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Association Between Malaria Educational Message Exposure and Malaria Prevalence Among Children in Nigeria

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This is to certify that the doctoral dissertation by

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Walden University
2024

Abstract

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MPH, Walden University, 2011

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Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

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Abstract

Malaria prevalence among children aged 6–59 months is a significant public health problem in Nigeria, which often relates to women's education about malaria. The purpose of this quantitative cross-sectional study was to examine the relationship between exposure to malaria education preventive messages, women's academic level, knowledge of malaria symptoms, mode of malaria information dissemination, and malaria prevalence among children aged 6–59 months in a single household in Nigeria. Lasswell's communication framework was used as the theoretical framework. A secondary data set for children at risk of malaria was obtained from the Nigeria Malaria Indicator Survey 2015 and the Demographic Health Survey 2015-2016 and was analyzed using a binary logistic regression. The findings indicated a significant association between women's education level, seeing malaria messages on TV, and malaria prevalence. An increase in education level decreased the likelihood of testing positive for malaria by 0.793 times (B = -0.231, $p < .001$, OR = 0.793), and women with no education had an increased likelihood of children in their household testing positive for malaria. Seeing a message about malaria on TV decreased the probability of testing positive for malaria (B = -0.431, $p = .027$, OR = 0.650) by 0.650 times. Findings may contribute to positive social change by providing supportive educational training through effective communication of malaria messages, knowledge of malaria symptoms, monitoring techniques, and encouraging malaria prevention practice.

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Dedication

This study is dedicated to Father Almighty, who gave me the strength, good health, and will succeed. I am grateful to all my family, especially my children, who added humor to challenging tasks. Indeed, I dedicate this study to all young and old Nigerians who are less fortunate to be reached with vital messages to educate them about how dangerous malaria is, and to parents who could not afford the tools to prevent, control, and treat children with malaria.

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This study would not have reached the proposal stage in my dissertation journey without consistent devotion, support, and guidance from the vastly experienced educators who stood with me to the final dissertation stage: Dr. W. Sumner “Bill Davis” (chair member), Dr. Jennifer Gadarowski (committee member), Jill Kaspszak (student advisor), and my family. I am grateful to my wife (Helen O. Ajiwe) and children who reluctantly cheered. I apologize to my family for social deprivation. I thank my Sunday school class group (the light bearers’ class), who prayed for this program. Also, I am grateful to the class leaders (Elders Bode Faleye and Ebi Comonibo) who prayed fervently on my behalf to complete the program successfully.

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Chapter 1: Introduction to the Study

Malaria is a significant cause of morbidity and mortality in Nigeria. The burden imposed by malaria among women of childbearing age and children continues to be a long-standing public health issue (Dawaki et al., 2016). Moreover, the disease creates nightmares for millions of lives globally. Particularly in Nigeria, the burden of malaria significantly impacts women of childbearing age, children 6–59 months, the weak, older people, and other vulnerable members of society (Dawaki et al., 2016; Sabina, K., 2017). Furthermore, the failed Nigerian health care system and the outdated/broken health care infrastructures compound the burden of malaria (Sadiq, 2015). Other contributors include mismanagement and environmental decay from poor roads to waste disposal mismanagement (Sadiq, 2015).

Malaria history contains centuries of reported malaria danger and counts for about 207 million disease cases and 627,000 deaths; 80.0% of the cases and 90.0% of the deaths occur in Africa (Ugwu, 2019; World Health Organization [WHO], 2018). Malaria is a vector-borne infection (mosquito) and the most prevalent endemic in 92 countries, including Nigeria (Ugwu, 2019; WHO, 2016). According to Ugwu the health education challenges and social and economic loss due to malaria can be preventable if individuals, communities, states, and nations practice proven, effective malaria control programs. Good malaria health education knowledge and awareness may lead to better malaria prevention. Regular practice of proper malaria prevention techniques may promote malaria infection reduction and elimination (Ugwu, 2019; WHO, 2018). The current

study may provide positive potential social change by helping to inform public health professionals and promote effective education programs.

There were limited studies on the relationship between women's household demographic characteristics and malaria prevalence among children 6–59 months in Nigeria using the Malaria Indicator Survey (MIS) 2015 secondary data. This study explored potential demographic factors associated with malaria prevalence of children 6-59 months and health prevention messages. I sought to determine whether these sensitive malaria messages may be related to malaria prevalence among children 6-59 months and malaria health education among women in Nigeria. Inadequate health education knowledge and poor exposure to malaria messages created a gap in the malaria preelimination program's inability to achieve the plan.

Background

Detailed literature describing the process of using education to impart knowledge and increase the regular use of malaria prevention and control tools constituted the frame of this research. The keywords searched included *communication strategies, women, childbearing women, malaria incidence, malaria prevalence in children, education, knowledge*, and *awareness*. Additional keywords I used were *malaria prevention, reduction, elimination, communication and dissemination techniques,* and *malaria messages*. I searched for peer-reviewed literature in the following health science databases: CINAHL Plus with Full Text, MEDLINE with Full Text, ProQuest Health and Medical Collection, ProQuest Nursing, Allied Health Sources, WHO, and SAGE Journal (Walden University Library, n.d.).

Raising awareness among malaria-endemic countries and globally was essential to WHO programs in 2015 to lower/eliminate malaria infection in 2020. WHO offered different methods and strategies to improve malaria health knowledge and awareness among malaria-endemic countries. To educate the countries, the organization formed the WHO Regional Action Framework for Malaria Control and Elimination in the Western Pacific from 2016 to 2020 (WHO, 2017a). The WHO's goal was to reduce malaria to a low level and eliminate it by raising health knowledge and awareness about the danger of malaria in the Western Pacific Region. This knowledge and awareness empowerment strategy requires health care professionals to know about patients' travel history to malaria-endemic areas and provide immediate treatment. The plan also requires leaders to attain a malaria-free Asian Pacific by 2030 (WHO, 2017a). Kilian et al. (2016) reported that different methods and strategies of malaria prevention tools improve knowledge and awareness of malaria control. In contrast, the occurrence of anemia in pregnant women with malaria in various malaria interventions indicates that the odds of pregnant women having anemia using two malaria prevention tools were lower than those using one malaria prevention measure (Anchang-Kimbi et al., 2016).

On the other hand, Apo and Kwankye (2015) reported that exposing study participants to malaria prevention messages increased their knowledge and awareness of the danger malaria poses to their health and the health of their loved ones. Apo and Kwankye found that malaria education encouraged parents of children under 5 years in Ghana to sleep under mosquito nets. Owusu Adejah and Panayiotou (2014) and Iwuafor et al. (2016) similarly found that the more households with males who acquired

knowledge and awareness about the importance of regular use of malaria prevention tools, the more likely their children were to sleep under a net. Owusu Adejah and Panayiotou stated that making the people of Ghana more aware of the importance of the consistent use of malaria prevention tools resulted in minor malaria infections. Having malaria health knowledge helped change their behavior and encouraged them to apply the best practice approach to seek treatment and use available malaria prevention tools. Iwuafor et al. and Owusu Adejah and Panayiotou provided valuable information about malaria prevention but failed to assess the prevalence of malaria among children.

Researchers have shown that providing campaign message techniques and media channels for information dissemination offered assessment strategies aligned with the study's methodology but did not address the impact on malaria prevalence among children 6–59 months (Apo & Kwankye, 2015; Iwuafor et al., 2016, Owusu Adejah & Panayiotou, 2014). The Nigeria Malaria Indicator Survey 2015 provided a valuable data set for women's exposure to vital malaria prevention messages and media communication channels in Nigeria. Lasswell's (1948) communication framework was used to guide the current study. The messages exchanged information between the source and the receiver (study participants). In this study, I applied Laswell's communication framework to represent how effective it is to consider whom to communicate with or make aware of concerning the pressing present malaria circumstances. The study framework described the need to create a process to perceive meaning and understanding between participants and malaria messages regarding the importance of malaria exposure risks.

The information, which is the relevant malaria messages, must flow from top to bottom and vice versa to reach the target population in the language they can understand. That means the information must be disseminated to each study participant at the right time through the right communication media channel. This study is stretching the strategy further to include those who bear the burden of malaria. The poor, women, and children suffer and die due to inadequate malaria health information education. This research was designed to determine the association between malaria-sensitive health messages of women aged 15–49 and children 6–59 months (about 5 years) and selected demographic characteristics and malaria prevalence among children 6–59 months in Nigeria.

The WHO and other health organizations have made progress in controlling malaria during the past decade and achieving some of their goals for malaria prevention. Encouraging progress has called for more global dialogue on reducing malaria to a low level and eradication. The new WHO vision for malaria elimination by 2030 increased the need for new malaria control tools to detect, treat, and prevent malaria. The new WHO vision also ushered in technologically advanced diagnostics, medicines, vaccines, vector control products, and improved surveillance techniques and responses to meet the program goals (Hemingway et al., 2016). Though there are many promising new malaria control measures, a gap exists in transforming innovative ideas to the target population that needs to acquire malaria health education and apply it to practice for malaria prevention. I evaluated some mass media channels that disseminate vital malaria information or messages to help foster the WHO's goal of malaria elimination globally,

particularly in Nigeria. This study may support future research on using mass media through information management strategies to reach targeted populations.

The malaria prevention tools the WHO prescribed may be wasted if malaria health education messages fail to reach those needing them most. Furthermore, the WHO will fail to achieve the new 2030 global malaria eradication goals if no active dissemination of malaria messages is included in the program. Finally, according to Hemingway et al. (2016), health care professionals, malaria-endemic target populations, and leaders must combine new approaches and tools for sustainable malaria control and prevention. Combining methods and research will be critical in advancing a malaria-free world (Hemingway et al., 2016). The current study, guided by the communication framework, may provide evidence to facilitate the actualization of the WHO's new goals for 2030 global malaria eradication. I used the Malaria Indicator Survey 2015 selected for demographic characteristics of women and children 6–59 months in Nigeria to determine whether a significant association exists between exposure to consistent malaria health messages and malaria prevalence among children 6–59 months.

Problem Statement

Malaria infection remains a significant health concern in sub-Saharan African countries despite efforts to eradicate this disease. According to the WHO (2016), about 3.4 billion people worldwide are at risk for malaria exposure. Also, the WHO (2016) reported an estimated 207 million malaria cases yearly. Irrespective of the efforts by health organizations to rid Africa of malarial disease, their goals remain unachievable in sub-Sahara African countries. Malaria parasite risk was over 30% and 40% in the

southeastern region of Nigeria, specifically the states of Abia and Edo. Adigun et al. (2015) reported that malaria was responsible for 300,000 childhood and 11% maternal deaths yearly. The Nigerian National Malaria Elimination Program aimed to significantly reduce malaria in Nigeria to preelimination status and malaria-related deaths to zero by 2020 (Nigeria Malaria Indicator Survey [NMIS], 2016). However, the WHO (date) realized that reducing malaria to a low level in readiness for eradication is not achievable and modified the plan. The WHO's (2021) new malaria goal is to reduce malaria mortality and incidence rates by 90%, eradicating the disease in at least 35 countries by 2030. The WHO World Malaria Report 2021 reported a call to action and investment combined with a global technical strategy to defeat malaria by 2030.

In Nigeria, malaria deaths, ill health, educational challenges, and economic loss caused by malaria may be preventable if the tools available and accessible to households are regularly used by those who need them most. However, many recent studies on the importance of malaria knowledge and awareness and malaria campaign messages on malaria control programs were poorly done. The impact of exposure to malaria educational messages and its association with malaria incidence and prevalence rate among Nigerian children households proved limited. Therefore, inadequate health education knowledge and poor exposure to malaria educational messages created a gap in the malaria preelimination program's inability to achieve the plan. Studies showed the harmful effects of poor malaria knowledge on malaria control programs (Ovadje & Nriagu, 2016). I evaluated exposure to malaria health information provided through the media using messages such as "malaria is dangerous," "malaria kills," "mosquitoes

spread malaria," and "sleeping inside mosquito nets helps prevent malaria." I sought to determine whether these sensitive malaria messages were associated with malaria prevalence among children 6–59 months and malaria health education among women in Nigeria.

About 214 million new malaria cases occurred in 2015, with nearly 90% of the cases in Africa (WHO, 2018). Malaria burdens and related morbidity and deaths and the resulting socioeconomic consequences and poor treatment of malaria impact Nigeria more than other sub-Saharan nations (Adigun et al., 2015; WHO, 2018). According to the Nigeria Center for Disease Control 2015, malaria causes 15% of maternal anemia and is the leading cause of neonatal deaths yearly in Nigeria. In Nigeria, the burden imposed by malaria includes the high cost of household health care and the inability to earn a reasonable income.

There is also the prohibitive cost of emergency care and delay in education completion (WHO, 2018). Some studies revealed that about 7% of Nigerian women 15-49 years of age have proper exposure to critical malaria educational campaign messages (Carlucci et al., 2017; NMIS, 2019; Nigeria Malaria Indicator Data Survey, 2015; Taremwa et al., 2017). The finding indicates a gap in the studies for the disease preeradication fight program that further promotes an increase in malaria prevalence to benefit the WHO program on malaria elimination in Africa (Carlucci et al., 2017; NMIS, 2019; Taremwa et al., 2017). I evaluated current exposure to malaria educational messages and malaria prevalence among children 6–59 months and malaria health knowledge among women age 15–49.

Purpose of the Study

The purpose of this study was to evaluate women's exposure to information on sensitive educational malaria campaign messages and malaria prevalence in children 6–59 months of age in a single household. I also sought to determine whether there were any associations between malaria educational messages and the best channel of information dissemination to encourage regular use of the most effective malaria prevention mechanism in Nigeria to decrease malaria prevalence in children. I used secondary data with variables that included messages and the most common mode of communication among women 15–49 years of age in Nigeria. This study addressed the association between exposure to malaria educational messages, information coverage, and malaria incidence/prevalence among women age 15–49. The study also addressed the message information dissemination effectiveness and the best media system to use as an essential medium to disseminate the message to significantly reduce the disease prevalence and support the malaria preelimination program (NMIS, 2016). The current study may help address the gap in health education among women through exposure to malaria campaign messages. The study may help encourage people to regularly use practical prevention tools available to control malaria (Malaria Fact Sheet, 2016).

Research Questions and Hypotheses

The following research questions and their corresponding null and alternative hypotheses provided the focus of this study:

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages among women age 15–49, women's academic level,

knowledge of malaria symptoms, and malaria prevalence among children 6–59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages among women age 15–49, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household in Nigeria.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages among women age 15–49, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household in Nigeria.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational prevention message, and malaria prevalence among children 6–59 months in a single household in Nigeria?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational message, and malaria prevalence among children 6–59 months in a single household in Nigeria.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational message, and malaria prevalence among children 6–59 months in a single household in Nigeria.

Theoretical Framework

I applied Lasswell's (1948) communication framework. The framework identified essential communication components in which the research is the sender of information, the message is the content of the communication, and the channel is the medium used to transmit the message. Furthermore, Lasswell identified the audience as the receiver who makes the communication meaningfully and effectively uses the information to measure outcomes. I considered mass media as one of the communication technology frameworks used in public health campaigns (see Glanz et al., 2008). Mass media includes many communication strategies; however, I focused on sensitive malaria messages via radio, television, billboards, posters, and printed materials (leaflet/fact sheet/brochure). In addition, I used these mass media to address four malaria exposure campaign messages (malaria is dangerous, malaria kills, mosquitoes spread malaria, and sleeping inside mosquito nets helps prevent malaria) (NMIS, 2015, 2018, 2019). The receivers of the malaria campaign messages included women age 1549 in Nigeria, and the outcome effect was the malaria prevalence among children 6–59 in a single household.

Nature of the Study

The nature of this study was quantitative and cross-sectional using de-identified secondary data. I compared women's age (15–49) and background characteristics (categorized groups). These groups included those exposed to malaria prevention messages 6 months before the survey. Also, their malaria health knowledge was based on exposure through hearing or seeing specific messages. The statements included malaria can kill and sleeping inside a mosquito net is essential. Also, how they differ between age

groups may be explored to determine age and education status (NMIS, 2016; Rudestam & Newton, 2015). I used secondary data survey sources from NMIS 2015 (NMIS, 2016) to determine whether a significant association exists between the medium of exposure (listening to the radio, watching television, and reading newspapers) and women age 15–49.

This research addressed the problem by examining the association between exposure to malaria educational prevention messages and women's academic level, malaria knowledge, the prevalence of malaria among children 6–59 months, and mothers age 15–49 in Nigeria. The independent variables were the malaria messages, selected mass media dissemination channels, women's ages, women's academic level, and women's malaria health knowledge. The dependent variable was malaria prevalence in children 6–59 months in Nigeria. Other moderating variables were controlled to prevent adverse outcome effects.

Definitions

I used independent variables identified by the sociodemographic characteristics survey NMIS 2015 (NMIS, 2016). These demographic characteristics included age and education level. My interest and level of importance drove me to select variables that may positively impact malaria prevalence among children 6–59 months in a single household in Nigeria. I used the independent variables identified by the sociodemographic characteristics survey NMIS 2015 (NMIS, 2016). The demographic characteristics (age and education level) may influence malaria prevalence among children 6–59 months in Nigeria.

Dependent variable: The prevalence of malaria among children 6–59 months in Nigeria. The dependent variable was dichotomous or binary for RQ1 and RQ2.

Malaria knowledge about symptoms: Malaria symptoms include fever, chills/shivering, headache, joint pain, poor appetite, vomiting, convulsion, cough, and nasal congestion, which measured how knowledgeable women are about malaria (NMIS, 2016).

Malaria preventive messages: An individual's ability to access available educational information dissemination through radio, television, billboards, leaflets, and printed or electronic materials among the population of interest.

Nigeria Malaria Indicator Survey 2015 (NMIS): The survey secondary data between October and November 2015 (NMIS 2016). The survey interview and questionnaires were collected based on the background characteristics of women aged 15–49 and children 6–59 months in households in Nigeria. Survey background characteristics included age, education, malaria knowledge, and media exposure performed by trained healthcare professionals (NMIS, 2016).

Rapid Diagnostic Test (RDT): A battery-operated portable HemoCue analyzer to measure the concentration of hemoglobin in the blood and SD Bio line Malaria Ag P.f (HRP-II) rapid diagnostic test (RDT) for detection of malaria through the detection of histidine-rich protein-2, manufactured by Standard Diagnostics, Inc., South Korea (Derjew, 2017; NMIS, 2016).

Women 15-49 age group: Nigerians who reported being exposed by seeing or hearing malaria preventive messages 6 months before the survey occurred.

Women's education level: A rank of education individuals attained. The Nigerian government's education record allows citizens to see and track their education when required throughout their lifetime. The level refers to an individual who can read, write, and understand the general language used in Nigeria. Also, the level indicates someone who attained or completed primary, secondary, or higher educational levels in Nigeria. The higher their educational attainment, the more knowledgeable they may be about health practice and health care services.

Women's knowledge of malaria symptoms: The ability of an individual to know or understand what malaria symptoms are, such as fever, chills, headache, and joint pains, to seek treatment and prevention.

Assumptions

I assumed the secondary health care data provided were void of random/systematic/instrumental errors using appropriate sampling methods. Also, I assumed all subjects who consented and participated in the study responded honestly to the survey questions. Another assumption of this study was that the characteristics of the data collected relied on a population sampled, and the subjects represented a cross-section of the people of interest. Lasswell's (1948) theoretical communication framework was assumed to be an appropriate framework for this cross-sectional study.

Scope and Delimitations

This study was limited to the population from which the original researchers had taken the sample. I was hopeful that the findings of this study would enhance existing efforts for a focused intervention in addressing risk factors that will have significant

outcomes for an improved product and add to the current knowledge. The results may influence future malaria intervention policy formulation and elimination strategies and may be generalizable to the rest of the population.

Limitations

The potential limitation of this study was that the survey questions depended on self-reporting by subjects; hence, recall and misreporting bias may not be ruled out. Also, the questionnaire used to compile the data has the benefit of mitigating the nonresponse bias but may not guarantee anonymity and truthfulness in sensitive questions.

Significance

This study may be relevant to public health concerning the study population. There is evidence in the reviewed documents of studies on the prevalence of maternal malaria in the study location and other areas. However, none of the studies determined the association between malaria's incidence or prevalence rate and exposure to effective malarial messaging. The current study may provide further evidence concerning the association between the prevalence of malaria and the structure and medium of health information messages.

Significance to Theory

This study's significance to theory is that a communication system may fail without the functional elements of information source, message, transmitter, channel, and destination. An excellent example of communication source failure is the COVID-19 multiple health information sources that confused many people (message receivers). Communication sources include individuals, groups, or organizations from where the

message originates. The theory can contribute to thinking, writing, drawing, and speech abilities. The framework is significant because it may provide learning about participants, subject situations, and background influences. The theory is influenced by the receiver of the message, socioeconomic status, education, or lack of knowledge of understanding the message. How well the malaria prevention message is received may affect the relationship between the message and the feedback or outcome result (malaria prevalence).

Significance to Practice

This study adds to current knowledge of the role of malaria education in prevention and public practice. The significance to public health practice is the inclusion of regular or frequent application of communication systems to strengthen malaria prevention programs. The positive impact of sensitive malaria messages on malaria prevalence among children 6–59 months may encourage practice and increase the pace of malaria elimination. Furthermore, good malaria knowledge could lead to effective prevention and health care. Research regarding women's knowledge of malaria, messages, mass media, and the relationship between malaria prevalence among children 6–59 months in Nigeria was limited. Therefore, this study aimed to assess the relationship between associated demographic characteristics and malaria prevalence among children 6–59 months in Nigeria (Nigeria Demographic Health Survey [NDHS], 2018). The outcome of this study may encourage future research interests in associations between health communication messages and malaria prevalence or incidence.

Significance to Social Change

The study may support educational training through effective communication messages to spread knowledge about malaria, monitoring techniques, and practicing malaria prevention methods. The study results may help establish a sustainable malaria education program and the importance of increased malaria knowledge among women. The results could inform programs that provide women's malaria knowledge of the cause, signs, and symptoms and compliance with the recommended preventive policies and treatment measures for malaria.

Summary and Transition

Malaria in sub-Saharan African countries, including Nigeria, is endemic and still a significant public health problem today. This study addressed the association between exposure to malaria messages and commonly available media channels to impart malaria health knowledge among women and malaria prevalence in children 6–59 months in a single household in Nigeria. Education about malaria control and related sensitive malaria messages and dissemination are needed to empower women to protect their families from the danger of malaria. I used relevant Nigeria MIS 2015 vital demographic characteristics of women as independent variables and malaria prevalence among children 6–59 months in a single household as the dependent variable.

The lack of clarity about malaria prevention messages and proper understanding of the relationship between malaria health knowledge and malaria prevalence in children 6–59 months is problematic in Nigeria. I examined the association between malaria educational messages, malaria knowledge, and the best channel of information

dissemination to promote regular use of practical malaria prevention tools in Nigeria to decrease malaria prevalence in children.

Chapter 1 covered this study's problem statement, background, study nature, limitation, purpose, theoretical framework, and potential positive contribution to social change. In Chapter 2, I discuss topics such as general information about malaria, current knowledge, history and cause of malaria, global malaria versus Africa, malaria epidemiology in Nigeria, climatic contribution and malaria in Nigeria, malaria risk factors, burden in Nigeria, and mass media role.

Chapter 2: Literature Review

Malaria health education lacks exposure to communication and disseminating sensitive malaria messages to a vital segment of the Nigerian population: reproductive-age women. The dissemination of valued information about malaria's nature is inadequate and creates consistent failure and public health challenges in promoting malaria prevention, reduction, and elimination. The result is a continued malaria transmission that poses significant health concerns in Nigeria and sub-Saharan Africa. The WHO (2015) reported that about 3.4 billion people globally might be at high risk of exposure to malaria. Of 300 million recorded cases, 600,000 die yearly, and 60% occur in Africa and 29% in Nigeria (Barofskya et al., 2015; NBS, & ICF International, 2016; WHO, 2015).

The current study's literature review includes relevant scholarly and peer-reviewed articles and books vital to this study's purpose. Also, I used literature to build the foundation of this research and focus on valuable malaria aspects that impact population health and malaria prevention initiatives, programs, and control. The key concepts in this research came from malaria intervention strategies and control programs instituted by national, institutional, and international bodies to eliminate malaria globally. The fight for malaria reduction and preelimination/eradication in malaria-endemic sub-Saharan African countries includes Nigeria. I limited the literature search to studies published within 5 years (from 2015 to 2020) based on malaria prevention programs, practice, and control. I extended the literature search 2 years back due to fewer peer-reviewed articles and the COVID-19 effect on the research.

Articles from 2014 and after were pertinent to this research. Many studies focus on malaria prevention practices and control, knowledge and awareness campaigns, and social determinants of health. However, my study addressed gaps in the literature regarding the association between malaria exposure to educational messages and disease prevalence. Research was unavailable about how exposure to Malaria educational messages impacts malaria prevalence, prevention, and control. Also, there was little peer-reviewed literature about the association between exposure to malaria health information dissemination through mass media and malaria prevalence among children 6–59 months in Nigeria. Other goals included determining the association between women aged 15–49 (including children's mothers) hearing malaria educational messages, women's education level attained, mode/type of malaria message dissemination, and malaria prevalence to promote prevention, control, and reduction.

Previous literature focused on malaria endemicity in sub-Saharan Africa, including Nigeria. These evidence-based articles supported the essential malaria themes and theories about the disease burden. Also reported were the effectiveness of insecticide-treated bed nets (ITN) and other tools in disease prevention, control, and the malaria burden. However, there were fewer articles on malaria messages exposure about the power of malaria information dissemination, mode of health education communication, impacts on knowledge and awareness, and malaria prevalence referenced to link and justify the current study's relevance.

Lasswell's (1948) communication approach provided a framework for comprehending Malaria in Nigeria, specifically for reproductive-age women (15–49).

The first section of this chapter discusses malaria's history, followed by variables and information analysis. I organized the study's literature review in a descriptive order including the strategy for the literature review search, causes of malaria, malaria epidemiology in Nigeria, global versus Africa, Malaria in Nigeria, the climatic contribution of malaria, and risk factors of Malaria in Nigeria. The communication framework was significant for this study because the information, which is the vital malaria messages, is distributed to reach the participants so they can understand better through appropriate communication channels.

Furthermore, the review revealed the gaps in the study population involving knowledge and awareness of malaria, mass media role, and women and malaria incidence rate in Nigeria. I sought to determine whether the consistent exposure of women to sensitive malaria educational messages and materials could positively impact the disease prevention and control programs to hasten the actualization of malaria preelimination and eradication. Constant reminders of malaria's burdens and debilitating effects on population health may change individual attitudes and behaviors toward malaria. The reports examined in this study demonstrated the relevance of malaria exposure to educational messages.

I applied the communication framework to demonstrate the importance of health information materials and malaria information dissemination among Nigerian women age 15–49 using mass media to improve malaria prevention and control to achieve and manage better malaria risks and prevention programs. The research was also consistent with public health promotion and prevention measures to improve population health. The

evidence showed how vulnerable members of society, such as infants, children, older adults, and reproductive-age women, are the most impacted. In this study, the approaches worked together to increase knowledge and awareness. I also sought to decrease malaria prevalence among children and help to achieve malaria preelimination/eradication by 2030 in Nigeria and globally.

Literature Review Search Strategy

I used information from the Walden University Library databases. Searches included electronic websites, databases, journals, and dissertations. Additional scholarly papers explored included theses available from the university website databases. ProQuest, EBSCOhost, Google Scholar, and Scholar Works were the search engines used. Other search engines through Walden University included CINAHL, MEDLINE, Nursing and Allied Health Sources, Sage Full-Text Collection, World Health Organization, CDC, and PubMed for literature published from 2015 to 2020. A few additional pieces of literature from earlier years, such as 2014 and 2013, were added due to scarce resources available for this study.

The literature review included search terms such as *history and causes of malaria*, *malaria epidemiology in Nigeria, global versus Africa*, *malaria in Nigeria*, the *climatic contribution of malaria*, and *risk factors of malaria in Nigeria*. Other search keywords were *health education* (*knowledge and awareness of malaria*), *mass media role*, and *women and malaria incidence rate in Nigeria*. I selected the most relevant and significant studies for review.

Theoretical Foundation

The burden of malaria infection activates individuals, groups, organizations, and public health professionals to determine the need to seek out the message as the receiver (Oyero, 2014). The communication model identifies various factors influencing the receiver, such as socioeconomic status and population demographic characteristics of the message receiver as the destination (Oyero, 2014). The receiver is the individual, the audience, or the research participants who get the message. At the receiver level, knowledge of the message varies from high, low, or less or no knowledge. The variation in ability determines how well the message is received and the resulting feedback results. For example, education, wealth level, age, and media channels affect the receivers' understanding of the message, influencing the relationship between the message source and receiver (Oyero, 2014).

Socioeconomic status variations may affect malaria prevention. Also, the complex nature of the socioeconomic status components in malaria interventions shows that no solution could eradicate Nigeria's malaria burden to the required level. According to Aragie and Baye (2020), the influence of socioeconomic status on malaria prevention measures is often not sufficiently addressed, denying society the needed access. The communication model connects education and knowledge to productivity, good wage earnings, and occupation opportunities (Aragie & Baye, 2020). Furthermore, knowledge could lead to better and more promising malaria prevention management practices. Education accounts for malaria health knowledge, sharpening skills, and individual ability to access information to promote malaria prevention and healthy living.

History and Cause of Malaria

Researchers believe malaria jumped from infected gorillas to humans around 10,000 years ago, originating in Africa (Loy et al., 2018; Malaria: History, n.d.). History reveals that the disease is still a health risk around some parts of the world to a lesser degree, for example, the Mediterranean shores, India, and Southeast Asia (Malaria: History, n.d.). Scholars over 4,000 years ago recorded malaria's ability to cause disease with fever symptoms, according to Nei Ching, a Chinese medical journal in 2700 BC (Azunie, 2017; Centers for Disease Control and Prevention [CDC], 2014; Davies, 2018). Greece recognized fever as a malaria symptom caused by insect bites in the fourth century BC (Davies, 2018; Zhang et al., 2014). In ancient Rome, mosquitos were common in the Palatine marsh, and the word malaria comes from the Italian name: ma-aria" or "bad air" or Roman fever (Davies, 2018; Malaria: History, n.d.; Zhang et al., 2014). French scientists Pierre Pelletier and Joseph Caventou discovered quinine by extracting the medicine from Cinchona tree bark in 1820 (Pam, 2020).

In the early 17th century, Indigenous Indians used tree bark (quinine) to treat fever, a malaria symptom (Davies, 2018; Pam, 2020). A 10% extraction improved quinine use, which significantly managed malaria in the first trimester of pregnancy (Ganger, 2020; Pam, 2020). Quinine became the best treatment for severe malaria during pregnancy until a safer alternative was available (Ganger, 2020). According to Ganger (2020), artemisinin-based combination therapy has become a better choice than quinine to treat uncomplicated malaria. Until recently, artesunate intravenous with quinine was the first line for uncomplicated malaria and a worldwide malaria treatment breakthrough

(Ganger, 2020). Malaria has become a common household name in sub-Saharan African countries and worldwide.

Malaria is a blood-borne infection caused by a parasitic protozoan of the genus *Plasmodium* and transmitted by the most common and dominant mosquito species, Anopheles. The female mosquito infected with the malaria parasite spreads the disease to mammals, including humans, by taking blood. Malaria is a disease that alters the condition between human and insect hosts (Ayanore et al., 2019; CDC, 2014; Fokunang et al., 2020; Malaria: History, n.d.; Chijioke-Nwauche et al., 2020). *Anopheles* species are *Anopheles funestus, gambie complex, arabiensis,* and *melas* (Chijioke-Nwauche et al., 2020). Malaria is a unique disease rooted in human history and other animals (CDC, 2014; Konlan et al., 2019; Yaya et al., 2019).

Malaria accounts for about 500 million infections globally, primarily in Africa, India, Southeast Asia, and South America. The disease causes an estimated 2.5 million deaths yearly, and 1 million are children (Malaria: History, n.d.). *Plasmodium falciparum* is responsible for 80%–90% of malaria among pregnant women and children under 5 (Ayanore et al., 2019; Malaria: History, n.d.). The five most common *Plasmodium* parasite species that cause malaria in humans are *Plasmodium* or *P. falciparum*, *P. malaria, P. vivax, P. ovale,* and *P. knowlesi* (Ayanore et al., 2019; CDC, 2014; Malaria: History, n.d.).

However, *Plasmodium falciparum* is the most common globally, particularly in sub-Saharan Africa and Nigeria (Ayanore et al., 2019; WHO, 2014). Malaria history consistently tells how deadly the disease is, suggesting malaria still wins the battle

despite tremendous progress. Therefore, associating sensitive and consistent malaria health education messages with material exposure was the objective of the current study to affect malaria incidence among women in Nigeria. The vicious nature of malaria was discovered in 1911 in blood transfusion, resulting in human-to-human malaria infection (Sabrina. K., 2017).

Global Malaria Versus Africa

The WHO determined in 2017 that the global response to malaria's unprecedented success in prevention and control eventually came to a crossroads (WHO, 2017). The WHO's achievement could not be possible without the help of control and prevention strategies such as the use of insecticide-treated mosquito nets (ITN), indoor spraying, and malaria treatment with artemisinin-based combination therapies (ACT) (WHO, 2017; White et al., 2014). However, the progress stalled because more than 5 million more malaria cases occurred in 2017 than in 2015, and when compared to the previous year, the death toll was similar at about 445,000 (WHO, 2017). Africa continues to carry about 90% of all malaria cases and deaths globally. Furthermore, of all the disease cases and deaths, 80% of the malaria burden occurred in SSA, including Nigeria, where malaria is endemic.

The WHO's global malaria strategy calls for 40% malaria incidence and death reduction by 2020 (WHO, 2017). However, the significant gains by WHO in the fight against malaria suffered drawbacks and missed the 2020 global malaria target. Therefore, it seems that WHO is not on track to achieving the mandate on malaria elimination, a critical milestone. The failure was due to significant gaps in their inability to meet

malaria prevention, control, and elimination goals. Malaria is endemic globally in more than 91 countries, with 40% of the population at risk and more than 3 million malaria deaths (Maduka, 2018; Oyekale, 2014; WHO, 2017a).

Although malaria morbidity and mortality have substantially reduced, the disease infects red blood cells (RBC) and kills over 2,000 people daily, particularly children in Africa (White et al., 2014). In addition, the goals of WHO faced many challenges, including the world economic downturn and the failure to eliminate malaria due to mosquitoes' resistance. According to White et al. (2014), some *anopheline* mosquitoes that harbor *Plasmodium falciparum* species treated with artemisinin develop artemisinin resistance. The report in Southeast Asia indicated the failure of the drug. Whereas, irrespective of the global efforts by WHO, United States Agency for International Development (USAID), United Nations International Children's Emergency Fund (UNICEF), and other world health stakeholders on malaria prevention and control, a significant gap consistently exists in Africa compared to developed regions of the globe.

According to Ugwu (2019), this gap indicated that malaria control and prevention inequality continued to account for the health disparity in malaria elimination in Africa (Cheng et al., 2016). WHO's success in malaria control is not valued due to economics (monetary funds), politics, and social and cultural issues (Mtenga et al., 2016; Ugwu, 2019). According to numerous reviewed articles and scholarly dissertations, there has been more progress in reducing the incidence rate of malaria (WHO, 2018, 2016, 2015; Zinyengere, 2018). Meanwhile, in Africa, millions of new cases continue to rise. Africa accounted for 90% of the malaria cases, while 2% and 7% occur in Eastern

Mediterranean and South-East Asia, respectively, including high morbidity and mortality rates (WHO, 2016; Zinyengere, 2018).

All efforts by WHO, USAID, UNICEF, and other global health stakeholders did not vanish because, between 2010 and 2015, WHO reported a reduction in malaria incidence rates (WHO, 2016). During this period, the world malaria incidence rate decreased by 21%, the death rate dropped by 29%, and children under five mortality rates reduced by 35% (WHO, 2016; Zinyengere, 2018). The WHO achieved these goals globally despite continued child deaths. WHO's achievements in malaria eradication globally may depend on effective prevention and control strategies requiring adequate funding and constant health education exposure to malaria messages and materials information dissemination.

Malaria Epidemiology in Nigeria

1990 marked the beginning of malaria epidemiology in Africa policy and decision-making based on disease elimination (Snow, 2015). The malaria global elimination strategy took center stage in 2000 and set investigation as an essential malaria vector species endemicity and risk factor mapping (Snow, 2015). This strategy started building a national understanding of the epidemiology of malaria transmission. Many studies reported malaria endemicity, particularly in SSA (Snow, 2015). Of the five malaria parasites in SSA, *Plasmodium falciparum* has the highest incidence in Nigeria. The parasite transmitted by the female *Anopheles* mosquito is prevalent among blood donors in Nigeria's deep south-south and southeast geopolitical zones, such as Port Harcourt (Dawaki et al., 2016; Wariso & Oboro, 2015).

According to Sadiq (2015) and Sabrina, K. (2017), malaria infection is minimally transmitted from person to person through blood transfusion. Educating the population about the danger of blood transfusion without adequate screening of the donor blood exposes recipients to malaria-infected blood, resulting in considerable morbidity and mortality. Transfusion of malaria-infected blood highlights the need for more efforts to prevent and control malaria transmission through effective malaria health education messages. Health education will reduce malaria prevalence and provide adequate knowledge of disease control and elimination in Nigeria.

Malaria, specifically *Plasmodium falciparum*, is endemic in Nigeria because mosquitoes efficiently transmit it as vectors. Malaria is a significant public health problem and accounts for more cases and deaths in Nigeria than in any other country globally (Depina et al., 2017; Wariso & Oboro, 2015). The 219 cases recorded in 2017 accounted for 451,000 deaths globally (Shretta, 2017; Wariso & Oboro, 2015). Of the incidences, Africa accounted for 90% of the cases and 93% of deaths (Depina et al., 2017; Shretta, 2017). However, according to Wariso and Oboro, 2015, Nigeria's population at risk of malaria is 90%, while 3% of the population habits malaria-free highlands (Wariso & Oboro, 2015). SSA accounts for 90% of malaria infections, of which Nigeria is responsible for 29%, whereas the Democratic Republic of Congo accounts for 11% of malaria infections (Depina et al., 2017; Shretta et al., 2017; Wariso & Oboro, 2015).

Malaria contributes most to morbidity and mortality rates in Nigeria, especially among reproductive-aged women, pregnant women, children, and older people (Sadiq,

2015). Irrespective of the sickness and deaths, the Nigerian population growth adds 0.7 percent (1.749 cases per 100,000 people) of malaria cases yearly (Dawaki et al., 2016). Sadiq (2015) found a monthly 9.0 percent cases per 100,000 people in some regions and parts of Nigeria. Furthermore, preventable malaria accounts for about 11% of maternal mortality (Sadiq, 2015).

The disease causes 60% of outpatient emergency room visits and 30% of hospitalizations for children under 5 in Nigeria (Sabrina, K., 2017; Sadiq, 2015). According to Sabrina, K. (2017), malaria infection is the second leading cause of death from infectious diseases in Africa and is second to HIV/AIDS. Malaria causes one in five deaths among children under five years in Africa (Sabrina, K., 2017; Sadiq, 2015). Global reports indicate that malaria is the third leading cause of death among children less than five years after pneumonia and diarrheal disease (Sabrina, K., 2017).

Climatic Contributions and Malaria in Nigeria

Nigeria is the largest nation in Africa, with a projected population of 198 million and a total landmass of 923,768 square kilometers (Adigun et al., 2015; Udenweze, 2019). Thirty-six states make up Nigeria. The country has a Federal Capital Territory in Abuja, with 774 local government areas. Furthermore, the Federal Government of Nigeria divided the country into six geopolitical zones (north-central, north-east, north-west, southeast, south-south, and southwest) for ruling reasons (NPC & ICF International, 2014; Udenweze, 2019). Nigeria is characterized by the rainy and dry (with cold and dusty Harmattan); the wet or rainy season seems to be dominated by heavy rainfall with a half-year circle from April through September.

Nigeria is a temperate country with temperatures between 25 ^{0}C and 40 ^{0}C. In comparison, the dry season occurs from October, extending into March. According to Adigun et al. (2015), the annual rainfall in the North is about 550mm around the Sahara Desert. In the South and coastal regions of the Niger Delta of Nigeria, the yearly measured rainfall is about 4,000mm. The tropical nature supports marshy mangrove lands in the South around the Niger Delta and Sahel Savannah in Northern Nigeria. Nigeria's tropical nature breeds *Anopheles* mosquitos, the vector for malaria infection. The landform is why malaria, including a dense population, is endemic in Nigeria. Malaria transmission is a year-round occurrence in most regions of the country.

The 2013 Nigeria Malaria Indicator Survey reported that malaria transmission is intense during the seasons and runs through Nigeria's six geopolitical zones (NPC & ICF International, 2014; Udenweze, 2019). Malaria takes three months or less in the northern regions of Nigeria, while in the south, malaria's duration is year-round (Udenweze, 2019). *Plasmodium falciparum* accounts for more than 95% of malaria infections and is the most severe, while *Plasmodium malaria* and *Plasmodium ovale* occur less in Nigeria (NPC & ICF International, 2014). Besides mapping the country's climatic season variations, the dry (temperature) and rainfall patterns impact malaria's positivity and negativity, including other common diseases in Nigeria. Earlier studies confirmed that climatic and non-climatic factors are essential in the incidence and prevalence of malaria in Nigeria and globally (Adeboyeji et al., 2020).

Furthermore, studies used climatic factors to develop a malaria risk map where the whole research applied Hotspot analysis to map different spatial clustering patterns.

The malaria risk map shows hot spots, high risk, and cold spots, indicating a strong relationship between climatic factors and malaria incidence, particularly maximum temperature, and relative humidity (Akinbolola & Ikiroma, 2018). The report also suggested that climate change was responsible for variations in the malaria incidence rate in Nigeria.

The intensity of clustering of a high hot spot and low cold spot varied, indicating a consistently significant increase in malaria hotspots, notably in Nigeria's south-eastern and south-western regions (Adeboyeji et al., 2020; Akinbolola & Ikiroma, 2018). On the other hand, the North remained a cold spot for malaria. Similarly, the rainy season report is the most effective malaria incidence rate compared to other climatic factors such as socio-cultural and socio-economic status and population behavior (Matthew, 2020). Further studies on climatic patterns show that malaria cases and transmissions follow seasonal climate variations, indicating an increase or decrease in disease cases/incidence rates (Abiodun, 2017; Matthew, 2020).

Both studies noted that rainfall, mean average, minimum and maximum temperature, and mean relative humidity significantly correlate positively with monthly malaria cases (Abiodun, 2017; Matthew, 2020). Similarly, Segun et al. (2020) concluded that rainfall positively influences Nigeria's malaria transmission and incidence rate. Therefore, they concluded that variations in climatic conditions and malaria cases are the key to understanding why malaria transmission is season-prone malaria-endemic in Nigeria (Abiodun, 2017; Adeboyeji et al., 2020; Matthew, 2020). Unfortunately, the varying climatic conditions in Nigeria continue to deter the increase in malaria control

and elimination efforts. However, the ecological and weather patterns are not slowing down, further driving malaria reduction and elimination.

Furthermore, many other vital factors account for malaria transmission, including vector availability (mosquitoes) and survivability, mosquito development and biting rates, and environmental factors. Some ecological factors include poor waste disposal, flawed drainage systems, poor sanitation, dense population, and population movement other than climatic variations. These climate conditions enhance malaria vector–Anopheles mosquito breeding activity and development rate. An increase in climatic temperature between 20 ^{0}C and 30 ^{0}C tends to increase malaria transmission, while a low temperature of about 16 ^{0}C negatively affects mosquito survival, decreasing the malaria incidence rate (Matthew, 2020). Simultaneously, the rainy season in Nigeria's eastern region is heavy and encourages aquatic life cycle maturation, increasing mosquito, mosquito biting, and malaria infection (Abiodun, 2017; Matthew, 2020; Ojeh & Aworinde, 2016).

Consequently, temperatures above 30 ^{0}C and below 16 ^{0}C negatively impact vector/malaria survival and account for decreased malaria cases or incidence rates (Abiodun, 2017; Matthew, 2020). Ojeh and Aworinde's (2016) findings on seasonal, monthly, and annual rainfall climatic differences in Nigeria showed an association between climatic variations in rainfall and malaria infection with seasonal cycles. Therefore, the continued lack of primary health education exposure to malaria associated with climatic variations in Nigeria undermines the disease's seriousness in prevention among women. In another study, public health professionals' and individuals' prior

education on effective malaria prevention and control contributes to their knowledge of associating malaria risk and climatic variations (Modu et al., 2017).

The direct experience to predict an increase in malaria incidence rate, specifically with high relative humidity occurring in the rainy season to about 74%, contributes to Nigeria's malaria incidence rate. Climatic conditions already contribute to the existing danger of malaria infection. However, further climatic factors exacerbate malaria morbidity and mortality, impacting pre-elimination/eradication. Any modification can create a relationship between climate factors and the urgency for educational interventions. Therefore, malaria health education messages will promote prevention and control to achieve the World Health Organization (WHO) 2030 pre-elimination/eradication program plan.

Malaria Risk Factors and Burdens in Nigeria

The temperate or tropical weather condition created a potential danger and predisposes it to the risks and burdens of malaria transmission. The WHO's World Malaria Report 2019 intended to not leave anyone behind in the fight to eradicate malaria to achieve a malaria-free world. However, the WHO Director-General reported that despite positive malaria control and prevention strategies, malaria continues to hit hardest the poor, pregnant women, and children in sub-Saharan Africa (WHO: World Malaria Report 2019, 2020). According to McGready (2020), 11 million pregnant women have malaria infection globally, and 900,000 babies were born prematurely with low birth weights. Malaria in pregnancy places an elevated risk on women and increases the risk of dying. Similar research by McGready (2020) and Chijioke-Nwauche et al. (2020)

reported that malaria during pregnancy causes fetal health complications and leads to premature delivery and low birth weight. The authors noted that malaria in pregnancy plays a vital role in infant morbidity and mortality. The impact of early delivery is a burden that reduces the mother's ability to care for the child, and she has difficulty living a healthy lifestyle (Gomez et al., 2017).

Malaria among women, particularly pregnant women receiving malaria treatment, creates an economic burden impacting their households and economic development. A cross-sectional study conducted in the Rivers State of Nigeria with 1,008 pregnant women found that diagnostic tests and treatment predispose women to direct financial burden (Chijioke-Nwauche et al., 2020). The study indicated a statistically significant association between malaria diagnosis and socioeconomic status among pregnant women. The study further reported that the poor and the vulnerable participants suffered the most from socioeconomic constraints (Chijioke-Nwauche et al., 2020; Nkegbe et al., 2017).

Olukosi et al. (2020) descriptive cross-sectional study of 113 pregnant women with malaria who received malaria combination therapy had a significant association with a lower risk of malaria infection. The research found that malaria care costs impose a substantial economic burden on the individual and the nation because of the out-of-pocket payment method. Also, nationally, pregnant women infected with malaria who receive intermittent preventive therapy resulted in a yearly national malaria care expenditure of about 22.8 naira or US $75.5 million (Onyia et al., 2020). Subsequently, the financial burden of malaria in Nigeria affects labor productivity and per capita income. In addition, reinfection is common and can cause an undue cycle of morbidity

and mortality. Therefore, access to malaria prevention messages with health education will make a better and healthier Nigerian society.

Similarly, Rolle and Omon (2018) agreed that malaria impacted Nigerian labor productivity poorly. The study concluded that public health expenditure and school enrollment rate had a substantial economic hold on labor productivity. Besides, the malaria burden affects everyone, not women, children, or pregnant women alone. Hence, various studies concluded that the message about the danger of malaria to the population requires intensive malaria health education (El-Houderi et al., 2019; Rolle & Omon, 2018).

A regression study conducted in the Upper West Region of Ghana, described as poverty-stricken and the worst affected by malaria burden, found a statistical association between poverty and malaria burden among Jirapa District's socio-economic deprivation region (Nkegbe et al., 2017). Furthermore, their findings recommended policy changes to increase income earnings to foster disease prevention and control and improve the region's economic condition (El-Houderi et al., 2019; Nkegbe et al., 2017; Rolle & Omon, 2018).

These mentioned studies demonstrated the extent of the damage caused by malaria risks and burdens when social and economic conditions failed to be addressed by global and national prevention/control efforts. To help us understand more, El-Houderi et al. (2019) conducted a peer-reviewed and systematic scholarly study on information about healthcare system costs. The authors also studied resource use and household management of children under five years impacted by malaria in sub-Saharan Africa. The

study coverage spans nine countries, including Nigeria in sub-Saharan Africa. In the study, the authors searched 1,846 scholarly articles to find only 17 met their criteria. The study showed severe malaria is associated with higher medical costs than mild/non-severe malaria. Hence, malaria's social and economic burdens weighed heavily on family income earnings.

The risk and burden of Malaria in Nigeria include the high cost of household healthcare and the inability to earn sufficient income. In addition, there is a high cost of emergency care and a delay in education completion (WHO: Fact Sheet, 2018). Few studies revealed that less than 7% of Nigerian women 15-49 did not know the benefit of proper malaria education. And malaria education can be available to them through exposure to sensitive malaria messages (Nigeria Malaria Indicator Survey [NMIS], 2019; Nigeria Malaria Indicator Data Survey [NMIDS], 2015; Taremwa et al., 2017, 2015). During pregnancy, *Plasmodium falciparum* infection caused about 50 thousand maternal deaths and 200 thousand stillbirths yearly (NMIS, 2019). Other adverse risks and burdens of malaria in pregnancy include neonatal morbidity, premature births, and a tiny baby for gestational age (McGready, 2020).

The reports stressed the importance of educating women with sensitive malaria messages about the danger of malaria. Also, information was vital to ensuring adequate dissemination coverage using the most common media channels. Therefore, this study assessed whether exposing women aged 15-45 to malaria messages compared to unexposed has a significant association with malaria prevalence. I also assessed the effects on malaria control, prevention, and reduction/pre-elimination based on the

variable outcome. This study fills the gap in inadequate malaria educational messages delivered by applying the most common media modes, radio, television, printed materials, and healthcare workers. This malaria control and prevention strategy may drive home the message to change how malaria is seen and viewed with appropriate knowledge about malaria's risks and burdens.

Malaria Health Education (Knowledge) and Prevention

Primary malaria health education among women of reproductive age (including female caregivers of children under five) is vital to understanding malaria transmission and prevention. A knowledge assessment study of malaria prevention conducted with ITN use among reproductive-age women in Southwest Nigeria found poorly practiced prevention strategies (Adebayo et al., 2015). The study suggested that lack of malaria health education exposure to sensitive malaria messages may account for low ITN utilization and an increase in malaria incidence rate among women in the 15-49 age group in Nigeria.

The study also attributed the lack of malaria health education messages to inappropriate information dissemination (communication and delivery of sensitive malaria messages) (Adebayo et al., 2015). Therefore, inadequate malaria health information, dissemination exposure, and poor education may contribute to poor malaria preventive controls, misconceptions about malaria, and a high incidence rate of malaria infection. This gap in relevant malaria educational messages and delivery was the basis for this research to bridge the gap needed to impact malaria prevention and control. Also,

to reduce malaria incidence among reproductive-age women and the general Nigerian public.

Scholars generally understand that malaria is endemic in Nigeria, with a consistently high prevalence rate of occurrence. However, Dawaki et al. (2016) reported that various Nigeria and communities vary in malaria transmission. The article estimated that disease infection happens between 20% and 72% of the prevalent malaria areas. Furthermore, the study attributes the variance between states to the difference in climatic changes. For instance, in Kano State, rainfall is less, with less surface waterlogging to serve as mosquito breeding sites than in the South, where there is torrential rainfall with extreme malaria vector breeding (Dawaki et al., 2016). Many researchers supported the notion that malaria is Nigeria's leading cause of morbidity and mortality. Similarly, some other studies consistently placed *Plasmodium falciparum* to cause between 58% to 64% malaria incidence rates among children under five, children 2-12 years of age, expectant women, and women 15-49 age group in Nigeria (Dawaki et al., 2016; Nmadu et al., 2015).

Every indication that Nigeria's war on malaria has a long road to travel. Dawaki et al. (2016) concluded that the malaria prevalence rate variance begs urgent technological control measures to reduce the incidence of malaria infection in Nigeria. Previous studies found that the Nigerian population had good knowledge about malaria transmission, symptoms, and preventive controls but could not apply preventive strategies (Dawaki et al., 2016). The findings may be due to a lack of focused health education on sensitive malaria messages based on consistent malaria information,

communication, and dissemination using mass media such as radio and television. This study aimed to close inadequate health education exposure to malaria messages and material information among women aged 15-49 and malaria prevalence in children 6–59 months in a single household in Nigeria.

This study focused on the importance of health education on malaria preventive measures. Many other preventive tools, such as long-term interventions, can improve education levels among women aged 15-49, reduce poverty, and improve the quality of life for vulnerable community members. The impact of malaria health education messages will go a long way to help Nigeria get a breakthrough in the war against malaria. Also, to achieve the new WHO program 2030 of zero malaria reduction or elimination.

Oyekale (2014), in a study conducted in North-West University Mafikeng Campus, Mmabatho, South Africa, on the use of mosquito nets with data from Malaria Indicator Survey (MIS) from 4,632 women of reproductive age, especially pregnant women who make up 13.19% of the women slept under mosquito nets. Also, 25.26% of the women who did not sleep under mosquito nets had malaria fever two weeks before the interview, while 78.28% knew mosquitoes are responsible for Malaria (Oyekale, 2014).

According to Oyekale (2014), adequate malaria prevention knowledge is low, with 55.70%, while only 14.93% of the population studied sleep under mosquito nets, ITN, and other preventive measures. The finding created the possibility for people to sleep under mosquito nets. Consequently, malaria prevention strategies significantly

increase knowledge of the methods to prevent malaria or mosquito bites. Furthermore, malaria health education exposure, knowledge, and awareness may increase the use of ITN and sleep under mosquito nets, indoor spraying, and other malaria preventive control measures (Oyekale, 2014; Tobin-West & Kanu, 2016).

Many scholars reported that malaria poses a critical challenge for women in Africa. The health challenge is severe, particularly for the vulnerable community members of the Nigerian society and SSA, such as people experiencing poverty, children under five, pregnant women, and older adults (Oyekale, 2014). Oyekale (2014) posits that peer education increases knowledge and awareness about malaria risk factors (Tobin-West & Kanu, 2016). In contrast, researchers reported that malaria preventive tools encountered positive results despite low use to prevent mosquito bites. An example is the effectiveness of ITN in preventing malaria. However, poor malaria health education among women in Nigeria indicates the Nigerian healthcare system's failure to associate the effectiveness of ITN with its use across the six geopolitical regions of Nigeria.

The healthcare system failure may be why the gap in achieving the world health organization's recommendation for malaria zero case reduction/elimination for 2020 shifted to 2030 (Tobin-West & Kanu, 2016). Unfortunately, few women in Nigeria correctly associate malaria morbidity and mortality with malaria or mosquito bites to date. However, this study may fill the gap by examining the association between exposure to malaria health education knowledge and malaria prevalence among children 6-59 months in a single household in Nigeria. Indeed, proper malaria knowledge acquisition can be vital to ensuring sufficient application of malaria intervention

programs and preventive strategies. Consequently, the study's outcome variable probability of malaria infection reduction may potentially increase the chance for more women sleeping inside mosquito nets.

Tobin-West and Kanu (2016) research followed the National Malaria Control set guidelines and investigated factors influencing malaria prevention among women of reproductive age to recruit 709 participants. The authors used descriptive and cross-sectional study design with cluster sampling techniques in this study. The participants had proper knowledge of malaria by knowing the cause and symptoms. The authors found that 89% had excellent malaria experience; therefore, the researchers associated their expertise with the educational level of knowing its cause and symptoms. The study also found some myths and misconceptions about Malaria (Tobin-West & Kanu, 2016).

In this study, 49.3% owned insecticide-treated bed nets (ITNs). However, 18.2% of the study participants consistently used mosquito nets, and 50% of the pregnant women received intermittent preventive treatment (IPTp). The authors concluded that malaria knowledge, ITN ownership, and female education were not significantly associated with ITN and IPTp usage (Tobin-West & Kanu, 2016). Although their conclusion was insignificant, this study evaluates different malaria health education messages and modes of information dissemination potential for malaria prevention and control.

Consequently, women knew that the most common disease in their environment was malaria, caused by mosquito bites. However, inadequate malaria health education redirects understanding to malaria myths. Myths cited as the cause of malaria include

sunlight, hard work, witchcraft, and past deeds. Therefore, this type of finding and the like are why this study will close the gap with adequate exposure to malaria health education messages with mass media to reach women across Nigeria. This study is not limited to women's education on malaria causes and symptoms. According to Tobin-West and Kanu (2016), Delta state women had correct malaria knowledge associated with their education and health information sources. For instance, they obtain health information from schools, family health centers, and clinics (Tobin-West & Kanu, 2016). The study described this as the first positive step towards recognizing malaria prevention and control strategies for care-seeking among reproductive-age women.

Malaria Incidence and Mass Media

By comparison, women's adequate knowledge and awareness of malaria prevention and control help strengthen health information communication challenges and promote effective mass media modes of information dissemination. Mass media's insufficient use in public health education messages is a significant drawback in fighting malaria prevention and reduction (Yaya et al., 2018). Similarly, according to Yaya et al. (2018), some mass media functions address the challenges of any public health intervention program. It also promotes malaria prevention programs and sensitizes pregnant women on the message benefits (Yaya et al., 2018). The study also reported that health literacy applicability as a form of communication and television, radio, and billboards promoted malaria prevention programs and control. The use of malaria educational materials served as a virtual drive for health knowledge transmission, while

public health researchers apply mass media as a tool for health behavior modification (Do et al., 2018; Sultana et al., 2017; Yaya et al., 2018).

Several researchers addressed the critical importance of mass media in health education information dissemination of malaria messages (Adjah & Panayiotou, 2014; Do et al., 2018; Malede et al. 2018; Sultana et al., 2017; Yaya et al., 2018; Zamawe et al., 2016; Zalisk et al., 2019). The researchers studied various aspects of mass media in health education. Almost all agreed that mass media's role in health education communication is vital for the public acquisition of a healthy lifestyle. Malede et al. (2018) affirmed that inadequate malaria health information and media application are among the predictors of malaria information dissemination through television, radio, posters, flyers, billboards, and the use of community healthcare workers. Malaria health education information for prevention and control received through mass media served to create an increase in mosquito bed net use among women in malaria-endemic sub-Saharan African countries (Yaya et al., 2018). Similarly, Malede et al. (2018) emphasized the need for more research to explore the limiting factors to accessing malaria information dissemination through mass media (Yaya et al., 2018).

The global effects of malaria infection and deaths sparked a strategic global game plan approach alliance for malaria prevention and elimination in malaria-endemic Africa. To this effect, the Nigerian National Malaria Strategic Plan (NNMSP) 2014–2020 goal focused on malaria elimination rather than control (Zalisk et al., 2019). As a result, the plan's goal to achieve pre-elimination status and reduce malaria deaths to zero by 2020 failed (Zalisk et al., 2019). Furthermore, the NNMSP did not materialize due to a lack of

knowledge and awareness, creating a significant drawback for the public health challenge (Yaya et al., 2018; Zalisk et al., 2020). However, there is a likelihood that the public health challenge would strengthen and promote health information and communication dissemination through mass media applications (Yaya et al., 2018).

Consequently, Yaya et al. (2018) demonstrated the power of mass media in delivering potential malaria health information. Thus, it was central to facilitating malaria infection and death reduction. Also, it can employ malaria prevention strategies toward achieving a pre-elimination program plan.

Providing adequate malaria health information is vital to fostering malaria prevention and elimination strategies. Malede et al. (2018), in a study of Lake Tana, Northwest Ethiopia, found that ineffective delivery of malaria messages accounted for inadequate health information on malaria risk factors and reduction. Also, inappropriate malaria message information delivery on seeking treatment, mosquito bed nets use, and other malaria preventive measures by the Local District Health Office accounted for inadequate health information on malaria risk factors and reduction. A similar study showed the positive effects of exposure to malaria health education messages. Zalisk et al. (2019) report that caregivers were exposed to malaria social and behavioral change messages (SBC) to improve mosquito bed net use among children under five in Nigeria, an endemic malaria country. The study used radio and television as the two most common mass media sources to disseminate information about malaria (Zalisk et al., 2019).

On the other hand, Adjah & Panayiotou (2014) reported the importance of delivering health information messages among women of reproductive age. The women recalled hearing news about mosquito bed nets (Adjah & Panayiotou, 2014). The survey data analysis of the research did not capture exposure frequency and intensity; therefore, it failed to test the level of exposure (Adjah & Panayiotou, 2014). Another limiting factor, according to Adjah & Panayiotou (2014), was the use of secondary data from the population that slept under ITN the night before the survey; statistical analyses used secondary data from the people who slept under ITN the night before the survey. Therefore, the study could not control the potential effects of confounding factors like malaria knowledge and other preventive measures.

The authors of the reviewed articles noted various limitations that impacted their studies. Zalisk et al. (2019) cited low malaria SBC messaging coverage in Nigeria, and a lack of variation in ITN recall messages. Also, the study could not establish a valid exposure to determine the dose-response relationship between SBC exposure and ITN use (Zalisk et al., 2019). Among the scholarly reviewed literature, none evaluated the association between the prevalence among children 6-59 months in Nigeria and the structure and the medium of health information messages.

Hearing malaria health education messages is essential to promoting malaria prevention and control strategies. Adjah and Panyiotou (2014) noted that hearing a malaria message from a community health care worker and or through a typical local radio station is associated with the chance of increasing mosquito bed net usage in the Ghana malaria prevention program. In Ghana, households exposed to malaria prevention

messages had more than twice the opportunity to use mosquito bed nets for malaria prevention, according to Apo (2015).

The impact of hearing malaria health education messages through various mass media outlets accounted for Ghana's adoption of malaria control measures for malaria reduction and perhaps elimination (Apo, 2015). According to Zamawe et al. (2016), mass media is critical for public health education improvement and changing health behaviors. In a similar study, to replicate the use of a short message service (SMS) that serves as a message to remind participants to increase treatment adherence in a distinct population of malaria diagnostic drug retailers, the SMS, a reminder message system, resulted in an advanced treatment adherence (Liu, 2016).

In contrast, the study found that expanded SMS only increased malaria treatment compliance in adults, not sick children (Liu & Modrek, 2016). The study concluded that SMS provided consistent positive results in every population studied but warned of the message content and length (Liu & Modrek, 2016). According to Liu and Modrek (2016), limiting message content and length reminds researchers to be mindful of the message, size, and range of health information campaigns.

Reviewed studies in general malaria knowledge, education, and awareness about malaria prevention, causes, symptoms, and prevalence in various study locations; indicated the need to intensify health education on malaria and the benefits of prevention and control (Apo, 2015, Liu and Modrek, 2016, Zamawe et al., 2016). However, none of the studies reviewed determined the association between malaria prevalence and exposure to sensitive malaria messaging.

This paper presents an association between exposure to malaria educational messages and malaria incidence among Nigerian women. This study used mass media such as television, radio, and other educational materials. According to Zamawe et al. (2016), community healthcare workers proved relevant in sustaining malaria prevention and control for malaria reduction and pre-elimination. This study captures the intensity of the malaria messages to fill the malaria prevention and elimination strategies and practice gap.

Summary

The literature review descriptively synthesized malaria health education exposure and the incidence rate through communication and information dissemination of malaria-sensitive messages among women age 15-49 in Nigeria. The study draws extensively from the value of information propagation by brochures, leaflets, radio, television, and printed/electronic materials (the most common mass media tools) to educate women on the dangers of malaria infection. Women's adequate education may include educational curriculums and sensitive malaria messages; despite being a multifaceted disease with multiple risk factors and socioeconomic burdens, half of the world's malaria suffering persists.

The review exhaustively connected women's inadequate malaria health education exposure with high infection risks and burdens, public health challenges, and continued failure to control, prevent, and reduce/eliminate malaria globally in SSA and Nigeria. A look at the historical origin and causes, the disease in the world versus Africa, the epidemiology in Nigeria, climatic contribution, and mass media role provided relevant

background scenarios for populations in endemic malaria countries. The problem statement presented extensively explored the concepts and variables influencing malaria.

The reviewed articles showed evidence concerning the study population's malaria prevalence in Nigeria and other sub-Saharan African countries. Still, none of the studies determines the association between the plurality of malaria and exposure to sensitive malaria messages. Therefore, the reviewed evidence supports the study's assertions and the research questions to fill the proposed gap. Scaling up malaria control measures through adequate health education may improve women's households' lives, enhance malaria reduction, and promote pre-elimination and the national economy.

I explained the relevant associations of selective health education exposure to malaria educational messages, malaria information materials, dissemination of malaria information through mass media, and their impact and association with malaria prevalence among children 6-59 months in a single household in Nigerian. However, women in Nigeria continue to suffer from inadequate malaria health education exposure. Malaria information dissemination through common media channels to reach women limits women's knowledge acquisition of malaria and its impact on healthy living, morbidity, and mortality.

Chapter 3: Research Method

IRB Proposal Approval Number: 11-10-22-0038374

In Chapter 2, I reviewed the recent literature and identified gaps that suggested the need for further research. In Chapter 3, I discuss the rationale for the study, methodology, variables, sampling process, data collection and analysis plan, the threat to validity, and ethical procedures. The purpose of this quantitative study was to evaluate the association between women's exposure to sensitive malaria information on educational prevention messages and their impact on the prevalence of malaria in children 6–59 months in Nigeria. The message's influence as an essential malaria prevention technique was explored and determined as the best information dissemination channel to promote malaria health education and prevention. I sought to determine whether any statistically significant relationship existed between women's demographic characteristics, exposure to malaria messages, and malaria prevalence in children 6–59 months in a single household. I conducted appropriate statistical analyses to determine a possible association between exposure to malaria educational messages, information coverage, and malaria in children 6–59 months.

This study may create new opportunities for researchers to explore. Given the identified variables for malaria prevention in Nigeria, the study offers a significant opportunity to enhance mother and child health and promote global efforts to reduce malaria infection and promote preelimination and eradication by 2030 (Winskill et al., 2017; Zinyengere, 2018). The WHO (2017b) emphasized the effects of the lack of malaria education, irrespective of decades of damage by malaria infection. In Chapter 3, I

discuss the study design and rationale. I also discuss the associated methodology implemented, including other vital components of the study such as threats to validity and the ethical issues specific to this study's secondary data use.

Research Design and Rationale

This quantitative cross-sectional study included secondary data sources from the NMIS 2015 malaria survey. I analyzed the relationship between the study variables without any attribute or suggestions to the study sampling and data collection; therefore, the study qualified as a cross-sectional design. A cross-sectional study examines the association between exposure and outcome variables of a defined population at one period (Creswell, 2013; Leedy & Ormrod, 2013). A cross-sectional quantitative design incorporated in the current study served as the framework to test two hypotheses and answer the research questions. The cross-sectional study design permits the comparison of groups and variables at a single point in time (Nsengimana, 2018).

This study addressed the problem by determining whether a significant statistical association existed between exposure to women's vulnerability to malaria educational prevention messages and women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household. The independent variables included exposure to malaria messages among women aged 15–49, selected dissemination channels, women's academic levels, and knowledge of malaria symptoms. The dependent variable was malaria prevalence in children 6–59 months in Nigeria.

The benefit of using a cross-sectional study includes the availability of large samples of participants, less time, robust risk-modifying variables, and lower cost to

conduct than case-control cohort studies (Derjew, 2017; Emebet, 2017; Nsengimana, 2018). Furthermore, a cross-sectional study provides an immediate direction for exposure predictor factors and outcome prevalence variables. A quantitative cross-sectional study is one of the typical study methods used in social and psychological disciplines (Rudestam & Newton, 2015). The nature of the design attributes the effect of interventions to the outcome and not some other acting variables (Frankfort-Nachmias & Nachmias, 2008; Rudestam & Newton, 2015). For example, a cross-sectional method measures the effects of public health interventions and disease prevalence (Frankfort-Nachmias & Nachmias, 2008).

A cross-sectional limitation is that it is hard to determine a temporal relationship between exposure and outcome because all variables are assessed simultaneously (Derjew, 2017; Emebet, 2017). The lack of a time element translates into nonrealization and understanding of the intensity and longevity of a risk modifier because of the single time dimension (Derjew, 2017; Emebet, 2017). Although data are readily available, the researcher requires permission to obtain and use the data. For the current study, experimental designs were not appropriate because I could not control the participants in a malaria intervention or prevention program to control the outcome and the prevalence of malaria (see Creswell, 2009; Nsengimana, 2018).

I did not seek to establish cause and effect; therefore, the study could not manipulate the risk factors. That means the risk factors occurred due to biological and sociological conditions, not physical manipulation (see Nsengimana, 2018). This study method differs from experimental research because it is less expensive, and the

researcher has the necessary resources for money and time. Lastly, the current study did not resemble ecological research, where observational data collection occurs at the individual level, not the population level (see Nsengimana, 2018). The current study's cross-sectional design could not capture changes over time, making it hard to follow trends. The study was constrained by selection bias because participants were assessed at one point in time, missing vital variables.

This study's cross-sectional design enabled me to test the two hypotheses and answer the research questions. This quantitative study included de-identified secondary data collected by applying a cross-sectional survey, a nationally representative sample of women aged 15–49 and children 6–59 months in Nigeria. According to Rudestam and Newton (2015) and Laureate Education (2010), quantitative analysis involves preexisting data to draw logical inferences. The current study delineated the study population so the results would represent the target population. This study's secondary data source collections were from the NMIS 2015, which was retrievable from the demographic health survey program website. Other data source collaborators included the Nigeria National Malaria Control Program (Dataset Records for National Malaria Control Program).

The agency collects and stores survey data on every aspect of the fight for malaria prevention and elimination. This data source was consistent with the current study's problem statement. A cross-sectional design addresses participants' response collection at a single point in time and not over numerous periods (Creswell, 2013; Emebet, 2017). The current study's basis for evaluating the hypotheses was the malaria indicator survey

(MIS) data. Other attributes included the survey questionnaires on population demographic characteristics, malaria health knowledge, women's educational levels, and media-type sources of malaria information. The survey questionnaires allowed participants to respond with multiple choices.

Research Questions and Hypotheses

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages among women age 15–49, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6–59 months in a single household.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational prevention message, and malaria prevalence among children 6–59 months in a single household?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational message, and malaria prevalence among children 6–59 months in a single household.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women age 15–49, the type of malaria educational message, and malaria prevalence among children 6–59 months in a single household.

Research Variables

The independent variable was sensitive malaria prevention educational messages based on the research questions. The campaign messages including "malaria can kill," "malaria is dangerous," "sleeping inside mosquito net is essential (net prevents malaria)," and "mosquito-spread malaria" represented demographic characteristic measuring instruments. The dependent variable was malaria prevalence among children 6–59 months in a single household. Increasing women's malaria education may be beneficial to encourage malaria prevention practices in their single homes. Other independent variables in this study included demographic characteristics such as education level and mother's age in Nigeria. The excluded urban and rural zones of the Northeast zones of Bornu State were not visited when samples were collected. Malaria message modes of information dissemination media of interest selected were radio, television, billboard, poster, and leaflets/fact sheets/brochures (electronic prints and printed materials). I used these mass media variables to measure the demographic characteristic variables.

Other demographic characteristics used in this study included women categorized age group (15–49), women's age, and women's education level as independent variables. Measuring instruments for women's education level included no schooling, primary education, secondary education, higher than secondary education, and malaria knowledge based on symptoms. I evaluated whether the variables would promote the use of malaria

prevention tools, malaria reduction, and preelimination/elimination status as other encouraging outcome benefits. The measurement scales for the variables were continuous, interval, ordinal, and nominal.

Methodology

According to Rudestam and Newton (2015) and Laureate Education (2010), my study's methodology involved quantitative analysis of preexisting data to draw logical inferences. The researcher draws inferences from the study population when the results are statistically significant and represent the population under study. I used secondary data from the NMIS 2015, retrievable from the demographic health survey program (DHS, 2016) for children at risk of malaria and the Nigeria National Malaria Control Program (Dataset Records for National Malaria Control Program). The agency collects and stores survey data on every aspect of the fight for malaria prevention and elimination. This secondary data source was consistent and satisfies the study's problem statement.

Analytical Strategies

I used the Statistical Package for Social Science (SPSS Version 27) for statistical analysis. I categorized some variables to determine a statistically significant association using Pearson's chi-square test. Categorical variables, such as women's age groups and exposure to sensitive malaria prevention campaign messages, required chi-square analysis to compare the effects of the campaign messages between the age groups of women age 15–49. I compared different age groups of women age 15–49 on exposure to educational malaria prevention messages using the most common modes of communication (radio, television, billboard, poster, and leaflets/fact sheets/brochure

(electronic prints and printed materials; see NMIS 2015, 2016). This study's messages and medium of information dissemination was examined to determine the channel's ability to reach women with malaria information and educational printed material coverage. The more common medium with the most acceptable communication dissemination may be valuable in reducing malaria prevalence and positively impacting preelimination programs and malaria prevention applications.

Multivariate regression determined the odds ratio at 95% confidence intervals (Daniel & Cross, 2010). This study used statistical regression analysis to predict malaria prevalence among children 6-59 months (malaria or no malaria – a binary outcome). More independent variables included age, messages, education level, malaria symptoms, and mass media to analyze the relationship between the dependent variables. I used regression analysis to estimate the probability of the outcomes.

Population

This study's target population participants were women age 15-49 and children 6-59 months in a single household drawn from the six geopolitical zones and urban and rural areas of the 36 states of Nigeria. The estimated nationally representative sample of more than eight households in 329 clusters received interviews. The identified eligible individual interviewed household respondents were 8,106 women, and the interview was completed with 8,034 women, with a response rate of 99 percent (NMIS 2015, 2016). The research participants were women age 15-49 and children 6-49 months. This study used data from women age 15-49 and children 6-59 months selected from each household for personal interviews and questionnaires about malaria and malaria/anemia testing.

Women aged 15-49 in a single household were surveyed based on their demographic background characteristics. The DHS-selected survey questionnaires followed the measured standard of the Nigeria malaria indicator survey set. A total sample size of 8,034 was used (NMIS, 2016). The 2015 NMIS questionnaires were adopted to reflect Nigeria's population and health issues.

Various stakeholders, such as international donors, e.g., WHO and USAID, NMEP, non-governmental agencies, and other government ministries, could access the survey questionnaires (NMIS, 2016). Donors collected more demographic information on individual women and children's participants, such as age, sex, malaria health literacy, knowledge, and malaria ITN use collected by DHS (dhsprogram.com, 2016; Emebet, 2017; NMIS, 2016). All women age 15-49 and children 6-59 months who slept in single households selected the night before the survey were eligible and included.

Sampling and Sampling Procedures

Sampling for this research was challenging. I could not include an entire population of interest to me. Since choosing the whole population is impossible, some parts of the targeted participants, like women age 15-49 in a single household in Nigeria, were selected. This study used these women to evaluate the effect of exposure to sensitive malaria prevention messages and the relationship with malaria prevalence among children under five years in the whole population. This process of choosing a unit of people for study defined my sampling. The sampling nature of my research permitted this study to select a specific branch of the target population to make conclusions and generalize to include the entire population of interest.

The 2015 NMIS sampling frame provided the survey indicators with representative sampling that included the six geopolitical zones and urban and rural areas of the 36 states of Nigeria. The sampling strategy used a two-stage sampling frame (State divided into local government areas (LGAs) and LGAs divided into localities) adopted in 2006 by the National Population and Housing Census (NPHC) of Nigeria (NMIS, 2016). Stage one used nine clusters from the 2006 enumeration areas (EAs) representing each state, including the Federal Capital Territory (FCT) (NMIS, 2016). The sampling selection technique resulted in 333 clusters nationally, meaning 138 urban and 195 rural areas (NMIS, 2016). However, the national indicators sampling excluded rural and urban groups from the Northeast zones of Bornu State.

Archival Data

This study used secondary data from the Nigeria Malaria Indicator Survey (NMIS) 2015 between October and November 2015. The field staff training was on survey methods and field procedures. From June 29 to July 10, 2015, the first level training for survey instruments and techniques and pretesting. This first stage of training involved senior officers from the implementing agencies (NMEP, NPopC, and NBS), including other stakeholders and laboratory scientists. The second training occurred in September 2015 and lasted three weeks, with 287 people for the fieldwork. These trained fieldwork staff served as supervisors, interviewers, nurses, laboratory scientists, quality control officers, information technology (IT) officers, etc. Thirty-seven trained supervisors, 111 interviewers, 37 laboratory scientists, and another field team of

professionals conducted the 2015 NMIS data collection. Each team had one supervisor, two interviewers (a nurse and a laboratory scientist), and a driver.

Instrumentation and Operationalization of Constructs

This research used secondary data retrievable from the Nigeria Malaria Indicator Survey (NMIS) 2015 between October and November 2015. the Nigeria Malaria Indicator Survey of women's questionnaires and individual surveys to obtain responses from women (including mothers of children under 59 months of age. I used the NMIS to procure respondents' demographic characteristics such as women and children's age, education, and wealth quantile. Tables 1 and 2 provide structured identification and descriptions of the independent and dependent variables and measurement scales applicable for the statistical testing of this study's research questions and hypotheses.

Table 1

Independent and Dependent Variables

Variable	RQ	Variable type	Level of measurement
Women's level of education	RQ1	Independent	Ordinal
Malaria knowledge of symptoms	RQ1	Independent	Categorical
Types of malaria messages	RQ1	Independent	Categorical/ordinal
Modes of communication	RQ2		
Malaria prevalence among children 6–59 months in Nigeria	RQ1, RQ2	Dependent	Dichotomous
RDT malaria diagnostics	RQ2	Dependent	Dichotomous

Table 2

Independent and Dependent Variable Description

Variable	Description
Women aged 15–49 exposed through specific communication channels (IV)	Women aged 15–49 exposed to specific malaria prevention messages through radio, television, billboards, posters, and leaflets/fact sheets/brochures (electronic printed materials)
Women aged 15–49 educational levels (IV)	Women's level of education attained (no education, primary, secondary, college, and higher)
Women aged 15–49 knowledge of malaria symptoms (IV)	Women aged 15–49 who have heard or know malaria symptoms such as fever, chills/shivering, headache, joint pain, poor appetite, vomiting, convulsion, cough, and nasal congestion. (categorical/ordinal)
Malaria prevalence among children 6–59 months in Nigeria (DV)	Children aged 6–59 months with positive malaria test by RDT (malaria rapid diagnostic test) (positive or negative) 2 weeks before the survey (dichotomous)
Media modes of communication	Malaria message dissemination channels (IV) (Tv, Radio, billboard, poster, and leaflets/fact sheets/brochures, (electronic materials)
Types of malaria educational messages (IV)	Malaria messages are malaria is dangerous, malaria can kill, mosquito-spread malaria, and sleeping inside a mosquito net is important (IV)

The study used secondary data provided or retrievable from the Nigeria Malaria Indicator Survey (NMIS) 2015 between October and November 2015. The dependent variable for this study instrumentation and construct operationalization is the prevalence of malaria among children 6-59 months in a single household. The malaria Rapid Diagnostic Test (RDT) instrument represents the dependent variable measure coding for malaria diagnosis where positive for malaria codes as one (1) and negative for no malaria codes as 0.as indicated in Table 3. Table 3 represents the measuring instrument description and coding of the dichotic nature of the dependent variable.

Table 3

Dependent Variable Instrument and Coding Description

Variable name	Description and coding	Variable type	Study code
Malaria prevalence among children 6–59 months (MPCG)	Is RDT positive for malaria or negative?	Dichotic/binary	1 = positive 0 = negative

Independent variables included women aged 15-49, exposure to malaria messages (Research Questions 1 and 2), academic levels, and knowledge of malaria symptoms (Research Question 1 Hypothesis only). Women aged 15-49 in this study analysis represent the single household population in Nigeria. Table 4 consists of the description and coding of independent variables. The other independent variables are malaria mode of communication and malaria prevention messages (Research Question 2 only).

Table 4

Independent Variable Descriptions and Coding

Variable	Description and coding	Variable type	Study code
Women Levels of Education-COD1 (RQ1)	Education	Ordinal	1 = No education 2 = primary education 3 = secondary education 4 = all other > secondary
Malaria Knowledge 4 (MKS4) RQ1	Malaria symptoms	Ordinal	1 = fever 2 = chills 3 = headache 4 = joint pain 5 = poor appetite 6 = vomiting 7 = convulsion 8 = cough 9 = nasal congestion
Malaria Prevention Messages (MLPM) RQ1 and 2	Exposure to sensitive malaria preventive messages	Ordinal	1 = malaria is dangerous 2 = malaria can kill 3 = mosquitoes spread malaria 4 = sleeping inside a net is important
Modes of Communication (MCCOD4) RQ2	Message dissemination channels	Ordinal	1 = television 2 = radio 3 = billboard 4 = poster 5 = leaflets/fact sheet/brochure

Table 4 shows coding for the categorical variables. This study used regression analysis, and I changed the categorical variables into yes vs. no dummy variables coded as 1 or 0. The background characteristics were measured by the malaria messages and media mode of malaria prevention message dissemination. Data collection was by NMIS-trained technical personnel and deemed appropriate, valid, and accurate (DHS, 2016). Malaria prevalence in children 6-56 (DV) was measured by the malaria rapid diagnostic test (RDT). This study will use available laboratory diagnostic data (SD Bioline Malaria Ag P. f HRP-II) from 2015 NMIS to determine whether children tested positive for malaria (RDT). RDT test uses blood samples obtained by finger or heel stick.

Data Collection Technique

My data came from the Nigeria Malaria Indicator Survey 2015, which was retrieved from the Demographic Health Survey (DHS) agency. I used the dataset for this study's statistical and descriptive analysis. Before conducting my study analyses, I emailed the DHS epidemiologist to request data access permission. The DHS data are public record. However, permission must be granted by the DHS and credited as the data source when the study is published. As a registered researcher with the DHS, I logged in with my username and password to www.dhsprograms.com to access and download the datasets of interest.

The results indicated patterns of association or no association with knowledge of exposure to malaria educational prevention messages to answer the first research question. Also, the women's health knowledge of malaria symptoms was measured based on malaria prevalence, diagnosis, and fever treatment in children under 59 months of age. Lastly, the results may show relational patterns with the knowledge of malaria measured by symptoms. The results of the second study question may reveal patterns of association with the sources of knowledge of malaria message exposure measured by mass media type.

I used criterion variables to evaluate the study hypotheses: the exposure to malaria educational prevention messages and malaria prevalence among children 6–59 months. Women aged 15-49 exposed to malaria messages such as malaria is dangerous, kills, spread by mosquitoes, and sleeping under a mosquito net is essential to determine the impact on malaria prevalence among children 6–59 months in a single household.

Malaria prevalence among children 6-59 is the dependent variable measured by the RDT and or microscopy examination of children's blood smear to diagnose malaria. A positive RDT or the presence of malaria parasite on blood smear examination indicates malaria infection. The rapid diagnosis would prompt quick treatment based on having a fever two weeks preceding the survey.

On the other hand, the criterion variables for the number one hypothesis included the women exposed to malaria messages, level of education, and knowledge of malaria symptoms. For the number two study hypothesis, the predictor variable is exposure to malaria educational prevention messages, and selected criterion variables represent the participants' demographic characteristics. The predictor variable is media exposure, which I measured with radio, tv, community health workers, and printed materials.

Data Analysis Plan

This study obtained sample size requirements using freely available online G*Power 3.0.10 software. The G*Power conventional standards and a priori research or theory used in my estimation were with the following G*Power components:

- alpha (α) level of standard error at .05 (or level of significance)
- 1-α (level of confidence at .95)
- desired power standard error
- estimated population effect size
- β (Beta) set at .2, and Power of Test (1-β) is .80

I used the generally accepted level of power of .80 (Cohen, 1988) and other standard levels to estimate the sample size, effect size, and strength for testing the study

hypotheses. My estimation using G*Power standards shows the most minuscule, medium, and extensive sample size appropriate for my research to detect the effect of a given test at the desired significance level. The predetermined statistical analysis assisted in the accurate assessment of the study hypotheses' error rates at $\rho < .05$ (5%) or more significant (Power and sample effect size). This prespecified statistical analysis gave the study clinically meaningful benefits at the conclusion. The figures below are examples of how I applied G*Power to estimate the smallest sample size suitable to detect the effect of a given test at the desired level of significance.

However, the determined statistical analysis method was a correlation, typical in various research areas. Statistical correlation analysis aims to determine how closely two numerical variables correlate (Bujan & Bharum, 2016). Therefore, correlation analysis requires one vital consideration of a large sample size. The large sample size allows results from the study analysis to meet the minimum correlation coefficient value required. Secondly, a large sample size ensured sufficient power and desired type 1 error or ρ-value. Lastly, sample size determination also depends on the study objectives and the research questions. The proper research, statistics, and type of power analysis guided me in resolving the effect size, including alpha (α), power, and degree of freedom.

The statistical power in this study is the probability of rejecting a false null hypothesis equal to one minus Beta (1-β). Beta (β) represents the probability of a type II error. The acceptable value of Power and Beta ranges between zero and one, where power is 0.80 or 0.90, and Beta is equal to 0.20 or 0.10. However, Alpha (α) is the probability of a type I error with a value between zero and one, but the preferred value of

$0.05(\rho < 0.05)$ is the standard value used in statistical analysis and this study (Bujan & Bharum, 2016).

In this study, the Baseline Correlation (B0) represents the value of the null hypothesis testing set point of zero (0), where the correlation value is between -1 and +1. However, the option for this study is to use the Baseline Correlation value set between 0.0 and 0.8. The Alternative Correlation (R1) value ranges between 0.1 and 0.9 for the alternative hypothesis testing. In this study, statistical correlation analysis for the null and alternative hypotheses will indicate the direction of the idea represented by the equation below:

Hypothesis Testing the null hypothesis: H_0: $\boldsymbol{\rho}_0 = \boldsymbol{\rho}_1$.

Hypothesis Testing the alternative hypothesis: H_a: $\boldsymbol{R}_0 \neq \boldsymbol{R}_1$

The study selected Chi-squared tests (χ^2) and goodness-of-fit tests as the statistical test: Contingency tables and a priori type of power analysis computed required me to use a sample size yielding α, power, and effect size. G*Power prescribed three sample size options: small (0.1), medium (0.3), and large (0.5). The enormous effect size is easily identifiable with a small sample size, while the little effect is not easily identifiable and serves minimal scientific purposes (Nsengimana, 2018; Suresh & Chandrashekara, 2012).

Sample Size Estimation and Power Analysis

Sample size effect estimation and power analysis are estimated measurements of the strength of the association between the variables and the probability of rejecting a false null hypothesis (Cohen, 1988; Derjew, 2017). The standard Power to reject a false null hypothesis is referred to as Alpha (α), a determinant of how confident you are when

leaving the null hypothesis that has a set point at Alpha (α) = .80 (Cohen, 1988). Researchers primarily determine the Power of their test using the standards for Power (π) = .80 and Alpha (α) =.05 for significance representing an adequate effect sample size.

Therefore, the two conventional values for sample size estimation and Power to know the benchmark for the risks – Beta (β) risk (the probability of a Type II error; Alpha (α) risk (the likelihood of a Type I error), at 0.2 and 0.05. Cohen (1988) characterized sample effect size as Cohen's *f:* small, medium, and large. Each Cohen's *f* denotes the association level with known effect size. Cohen's *f* for the effect size translates to values for effect size (ρ). Based on the assumption that the independent variables or predictors (age, educational levels, malaria knowledge, and wealth index) are random samples, I assume that the predictors predict the dependent variable verifiably by regression analysis.

This study used G*Power to calculate the small, medium, and large sample size required for this study at effect size (ρ) = .1; alpha error probability = 0.05; power (1-β error probability =0.90; total sample = 850 (large). The medium sample size at effect size (ρ) = .2; alpha error probability = 0.05; power (1-β error probability =0.90; total sample = 207. The small sample size at effect size (ρ) = .3; alpha error probability = 0.05; power (1-β error probability = 0.90; total sample = 88 (Cohen, 1988, Emebet, 2017). However, this study has 8,034 participants from the secondary data, enough to detect small, medium, and large sample size effects. The focus of the study's statistical data analysis plan is on the research following questions:

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages among women ages 15-49, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6-59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6-59 months in a single household.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6-59 months in a single household.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention messages, and malaria prevalence among children 6-59 months in a single household?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention messages, and malaria prevalence among children 6-59 months in a single household.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention messages, and malaria prevalence among children 6-59 months in a single household.

This study's questions and hypotheses were tested with (IBM SPSS) version 27. Statistical Package for Social Science (IBM SPSS) version 27. SPSS Pearson's Chi-Square ($\chi 2$) test evaluated the association between exposure to malaria educational prevention messages and demographic characteristics (the variables). Chi-Square was used in cases where the logistic regressions yielded invalid results in RQ1 and RQ2. The variables with a significant impact at 10% or greater in the analysis underwent further regression analysis if the variables were many.

I identified the predictor variables of malaria education prevention messages at a 5% significance level. This study performed a regression analysis to determine whether the predictor variables needed modification. The confounding variable effects did not specify how the study interpreted the statistical analysis result and added benefit to the study conclusion. The research applied Logistic Regression Analysis to determine the relationship between the single but dichotomous criterion variable and single or multiple study predictor variables.

Threats to Validity

External Validity

Internal and external threats to research validity and reliability signify whether study results are trustworthy and meaningful (Burkholder et al., 2020). However, the study's external validity refers to the design's quality that allows the results to be generalized from the original population sample, even by an extension (Burkholder et al., 2020; Dejew, 2017). External validity determines how well the study outcome-finding expectations apply to other study settings. External validity will benefit the quantitative

study conclusions outside of the study context in this study. Furthermore, the study's external validity relates to how the findings apply to the real world. Secondary data use may limit external validity by excluding women from rural and urban groups from the Northeast zone areas of Bornu State. Another limitation not controlled by this study include the primary study's external validity. Other external validity issues that I could not control may be in the preliminary study phase due to population characteristics, participant interaction, selection, independent variables description, study environment (researcher/experimenter effects), and time effects (Burkholder et al., 2020).

Internal Validity

This study's internal validity examines whether the study design, conduct, and analysis elements answer the research questions (Babbie, 2017; Burkholder et al., 2020; Fokunang et al., 2020). Internal validity refers to the quality of a due research design that permits study results to be associated with manipulating the independent variables (Babbie, 2017). The study could not correct the internal validity issue to the primary nature, limiting secondary data analysis. The study's internal validity refers to covariates or confounding variables that vary independent variables that change dependent variables. Confounding variables could be manipulatable by statistical analysis, instrumentation, selection bias, and other elements during the study (Dejew, 2017). I described the effects of specific internal validity elements in the next chapter.

Construct Validity

The study construct validity shows how inferences can accurately represent the Operationalization of the variables based on the theoretical constructs and relationship

with the study outcome. Construct validity is an essential concept in research that helps evaluate research findings (Burkholder et al., 2020). The idea represents the measures the study is trying to affect. The study construct validity assesses how well the research ideas or frameworks translate into fundamental actions (Babbie, 2017; Burkholder et al., 2020). This research recommendation shows that malaria health education messages will improve children's malaria prevalence. The study will open research opportunities for future malaria incidence studies among women in Nigeria. I ensured that the type of malaria message the study refers to-the same as what the study implemented and that the expected outcome was the type of the survey measured. The research may be misrepresented if the study does not measure what should be measured (Babbie, 2017; Brown, 1996; Shiken, 2000). Also, construct validity can identify with correct operationalization or failure. Furthermore, the construct relational definition rejects relying on operationalization (Babbie, 2017).

Ethical Procedures

This study used secondary data from the 2015-2018 Nigeria Demographic and Health Survey. The participants' ethical issues were resolved before the survey without mishandling respondents' confidentiality. The Nigeria Malaria Indicator Survey 2015 and Nigeria Demographic and Health Survey 2018 were reviewed and approved by the National Population Commission Abuja, Nigeria, the National Bureau of Statistics Abuja, Nigeria, the National Malaria Elimination Program (Federal Ministry of Health), the Demographic Health Survey Program and ICF International Rockville, Maryland, USA. Therefore, this study relies on the ethical recommendations of the survey stakeholders for

the 2015-2018 Nigeria DHS and Malaria Indicator Survey (NMIS, 2016; NDHS, 2019). The DHS and NMIS require this study not to share the dataset and be informed before publishing the research.

According to NMIS 2016 and NDHS 2019, interviewers for the data collection are trained healthcare professionals to manage and interact with the local leaders identifying the households selected for interviewing and answering the questionnaires. Before administering survey questionnaires, NMIS agents issued consent forms received from eligible women respondents in the selected households. Return of the consent forms shows that participation is voluntary and confidential. This study requested Walden University (Institutional) Review Board (IRB) approval before conducting this research. Hence, when the study was approved, I discussed ethical concerns about the data source, human participants, and Institutional Review Board (IRB) authorization.

Summary

Chapter 3 included a detailed description of research method components such as a short introduction of the methodology, the study design, population, instrumentation, and Operationalization of the study variables, study procedure, research questions and hypothesis, data source, data collection, and analysis techniques, possible study validity threats, and ethical guidelines using secondary data. This chapter described the secondary data sampling method the NMIS and DHS used and collected from the population. I also explained why I selected the statistical analysis for this study. The Nigeria 2015-2018 This study used the Malaria Indicator Survey as a cross-sectional study for relational regression to analyze the association between the criterion and predictor variables. The

approved permission to access the dataset and instrument is in the appendix section of this study. This study will discuss the statistical data analysis and results in Chapter 4.

Chapter 4: Results

The aim of this study was to evaluate women's exposure to information on sensitive malaria educational prevention messages and malaria prevalence in children 6–59 months of age. I sought to determine whether the occurrence of malaria was associated with women age 15–49 in education level, knowledge of the symptoms of malaria, and malaria messages and modes of communication. I addressed the following research questions and hypotheses in this study:

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6–59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6–59 months in a single household.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6–59 months in a single household.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women aged 15–49, the type of malaria educational prevention message, and malaria prevalence among children 6–59 months in a single household?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women aged 15–49, the type of malaria educational

prevention message, and malaria prevalence among children 6–59 months in a single household.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women aged 15–49, the type of malaria educational prevention message, and malaria prevalence among children 6–59 months in a single household.

Chapter 4 includes a discussion of the study's population and sample and a demographic description of the model. Demographic reports include frequencies and percentages for categorical (nominal) variables and mean and standard deviations measured at the interval level of measurement. Also presented are the testing of parametric assumptions for the statistical analysis and the results of statistical testing. This chapter concludes with a discussion of the results of this study.

Data Collection

I retrieved the data from the NMIS 2015. Upon IRB approval, I emailed the DHS epidemiologist to request data access permission. Although the DHS data are public, permission must be granted by the DHS and credited as the data source when the study is published. As a registered researcher with the DHS, I logged into www.dhsprograms.com to access and download the data sets of interest. The data set consisted of 8,034 cases for analysis, which included females from 15 to 49 years of age.

The participants exposed to malaria educational prevention messages were coded as 1 for yes exposure in SPSS, and women not exposed were coded as 0 for no exposure in SPSS, as shown in Table 5. To address RQ1 and the hypotheses, I used women aged

15–49 exposed to malaria educational prevention messages 6 months before the survey in the analysis, as outlined in Table 5. There were 2,812 (40.1%) participants exposed to malaria messages about malaria through any of the selected mass media channels in the last 6 months, and 4,207 (59.9%) were not exposed (see Table 5). The analysis did not include the study participants who were not exposed to any educational prevention messages about malaria within the 6 months before the survey.

Table 5

Exposure to Malaria Educational Messages

Response	Frequency	Percentage	Valid percentage	Cumulative percentage
No (0)	4,207	10.9	59.9	59.9
Yes (1)	2,812	7.3	40.1	100.0
Total	7,019	18.3	100.0	
Missing	31,423	81.7		
Total	38,442	100.0		

Five education levels were used for the study's statistical analyses. Women age 15–49 were analyzed as 2,982 (37.1%) participants with no education about malaria messages, primary education 1,273 (15.8%), secondary education 2,935 (36.5%), and higher education 844 (10.5%). The overall number of women participants was 8,034 (100%), as indicated in Table 6.

Table 6

Women's Education Level

Response	Frequency	Percentage	Valid percentage	Cumulative percentage
No education	2,982	7.8	37.1	37.1
Primary	1,273	3.3	15.8	53.0
Secondary	2,935	7.6	36.5	89.5
Higher	844	2.2	10.5	100.0
Total	8,034	20.9	100.0	
Missing	30,408	79.1		
Total	38,442	100.0		

Nine items measured knowledge of the symptoms of malaria, which consisted of fever, chills, headache, joint pain, poor appetite, vomiting, convulsion, cough, and nasal congestion. The highest knowledge was fever, with 4,794 (28.2%) correct responses. Other items included headache at 3,720 (21.9%), chills at 2,534 (14.9%), joint pain at 2,182 (12.8%), poor appetite at 1,316 (7.7%), vomiting at 922 (5.4%), convulsion at 146 (0.9%), cough at 392 (2.3%), and nasal congestion at 257 (1.5%), as indicated in Table 7.

Table 7

Malaria Symptoms Knowledge

Response	*n*	%
Fever	4,794	28.2
Chills/shivering	2,534	14.9
Headache	3,720	21.9
Joint pain	2,182	12.8
Poor appetite	1,316	7.7
Vomiting	922	5.4
Convulsion	146	0.9
Cough	392	2.3
Nasal congestion	257	1.5
Other	526	3.1
Don't know	214	1.3

Most people stated they heard messages about malaria through radio, 1,887 (60.0%). This report was followed by television, 969 (30.8%); billboard, 86 (2.7%); posters, 126 (4.0%); and brochures, 76 (2.4%). Table 8 provides this information.

Table 8

Mode of Malaria Information Dissemination

Response	*n*	%
Radio	1,887	60.0
Television	969	30.8
Billboard	86	2.7
Poster	126	4.0
Leaflet/fact sheet/brochure	76	2.4

Regarding the type of message heard, most women stated that malaria was dangerous, 1,313 (30.0%). The other messages re malaria can kill, 1,261 (28.8%);

mosquitoes spread malaria, 813 (18.5%); and sleeping inside a mosquito net is essential, 996 (22.7%), as shown in Table 9.

Table 9

Type of Messages

	n	*%*
Malaria is dangerous	1,313	30.0%
Malaria can kill	1,261	28.8%
Mosquitoes spread malaria	813	18.5%
Sleeping inside a mosquito net is important	996	22.7%

Regarding the malaria test results, 2,626 (6.8%) tested positive, and 3,399 (8.8%) tested negative for malaria. See Table 10.

Table 10

Malaria Prevalence Among Children 6–59 Months in a Single Household

Response	Frequency	Percentage	Valid percentage	Cumulative percentage
Negative	3,399	8.8	56.4	56.4
Positive	2,626	6.8	43.6	100.0
Total	6,025	15.7	100.0	
Missing	32,417	84.3		
Total	38,442	100.0		

Statistical Assumptions

This study's statistical analysis included binary logistic regression for the independent variables of exposure to malaria educational prevention messages (malaria is dangerous, malaria can kill, mosquitoes spread malaria, and sleeping inside a mosquito net is important), women's academic level, malaria knowledge (fever, chills, headache,

joint pain, poor appetite, vomiting, convulsion, cough, and nasal congestion), and mode of malaria information dissemination (radio, television, billboards, posters, leaflets/fact sheets/brochures), and an outcome variable malaria prevalence in children 6–59 months in a single household. Independent and dependent variables were categorized and recorded as required by the binary logistic regression principle, and I created reference categories for the independent and control variables. I reviewed the binary logistic regression analysis process about dichotomous or outcome-dependent variables and missing data, linearity, independent error, outliers, and multicollinearity of more than six cases in a variable category. Also, before performing binary regression analysis, I recoded the dependent variable malaria prevalence (outcome variable) as negative (0) and positive (1).

Testing of Parametric Assumptions

I conducted a binary logistic regression with SPSS to test the research hypotheses. This test was appropriate because the dependent variable (malaria test results) was dichotomous (negative coded as 0 or positive coded as 1). The independent variables were all categorical (nominal). These independent variables included exposure to malaria educational prevention messages, women's academic level, malaria knowledge, and mode of malaria information dissemination. Before conducting binary logistic regression, I verified six assumptions (see Field, 2018):

1. Assumption 1: There must be one dichotomous dependent variable.
2. Assumption 2: One or more independent variables measured must be on a categorical or continuous scale.

3. Assumption 3: There must be independence of observations and the categories of the dichotomous dependent variable, and all the nominal independent variables should be mutually exclusive and exhaustive.
4. Assumption 4: There must be a bare minimum of 15 cases per independent variable, although some recommend as high as 50 cases per independent variable.

Assumptions 1, 2, 3, and 4 met the requirement by choice of the study design. The dependent variable was dichotomous, there were independent variables (all nominal), observations were independent (per the assumption that there was no relationship between the statements in each category of the dependent variable or the reports in each category of any nominal independent variables), and the sample size met testing assumptions.

5. Assumption 5: Assumption 5 did not apply because the analysis had no continuous independent variables. However, the statistical analysis with the Cox and Snell *R* square and Nagelkerke *R* square used for the research questions showed that there was an association between women's education level and mode of malaria message dissemination (television) variables and the logit of the outcome variable malaria prevalence in children 6–59 months in a single household, a dichotomous variable (test positive or negative) for malaria parasite. The Hosmer and Lemeshow test I used for all the research questions indicated chi-square values that were not statistically significant ($p < .05$), meaning that the data used in this study were a good fit for the model.

6. Assumption 6: The data must not show multicollinearity.

Assumption 6 was tested by calculating variance inflation factors. There were none above 10; therefore, there was no evidence of multicollinearity.

Missing Data

After data analysis, there was some missing data. However, the missing data was excluded from the binary logistic regression analysis because of the large sample size used in this study. The outcome variable malaria prevalence in children 6-59 months in a single household did not show any outliers in this study's descriptive analysis.

Inferential Statistical Analyses

Logistic regression analysis was performed to investigate the extent to which independent variables and covariates predicted the odds of a child having malaria. I used logistic regression models to test the study research hypotheses and obtain a binomial distribution. For the outcome variable, malaria prevalence in children 6-59 months in a single household as derived from RDT (malaria rapid test) where 0 = Negative (no malaria parasite present) and where 1 = Positive (malaria parasite present). This study's odds ratio in the logistic regression model tables is represented in the column as Exp (β), the exponentiation of β coefficient. Wald test was used to test the predictor variables' significance.

The logistic regression does not have actual R^2 as in regular linear regression; therefore, the model's goodness of fit was tested using Hosmer and Lemeshow test (HLT) (Fagerland & Hosmer, 2016). To determine if there is any evidence of the model's poor fit or good fit, I used HLT to evaluate the fit of each model by how much variability in the dependent variable is explained by the independent variables. When the result of

HLT is significant ($p < .05$), it tells me there is evidence within the model of poor fit. However, if the HLT result is insignificant ($p > .05$), it means there is a good fit within the model. This study's conclusion was drawn from the premise explained by these inferential statistical analyses section.

Results

Binary logistic regression was performed with SPSS to address this first research question and hypotheses: This study's population characteristics were summarized by descriptive statistics. Binary logistic regression was performed with SPSS Version 27. The SPSS was used to analyze data frequency distribution and calculate percentages to address this study's research questions and hypotheses:

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6-59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6-59 months in a single household.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria symptoms knowledge, and malaria prevalence among children 6-59 months in a single household.

A binary logistic regression analysis was conducted to investigate [if exposure to malaria educational prevention messages, women's academic level, malaria symptoms knowledge, factors that predict if a child will have malaria or not?] That will affect

malaria prevalence among children 6-59 months in a single household. [The variable outcome of interest is the effect on malaria prevalence in children 6-59 months in a single household]. The possible predictor variables were: [exposure to malaria educational prevention messages, women's academic level, and malaria symptoms. Hosmer and Lemeshow's goodness-of-fit test was insignificant ($p > .05$), indicating the model is correctly specified. The logistic regression model was statistically significant, $\chi 2$ (3) = 24.490, p =. 001 shown .in Table 11.

Table 11

Model Fit (RQ1)

Step		X^2	*df*	*p*
Step 1	Step	24.490	3	.000
	Block	24.490	3	.000
	Model	24.490	3	.000

Additionally, the model summary of the binary logistic regression analysis of the demographic factor of women's educational level and malaria prevalence among children 6-59 months in a single household is represented in Table 12. The [-2log Likelihood = 1804.268] and the [Nagelkerke R squared = .024] of the model explained 2.4% (Nagelkerke R^2) of the variance in malaria prevalence in children and correctly classified 56.1% overall percentage of cases in Table 13.

Table 12

Model Summary Analysis of RQ1 Independent Variables and Dependent Variable

Step	-2 Log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	1804.268	.018	.024

[a] Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

The classification indicated in Table 13 correctly classified 56.1% overall percentage of cases for the binary regression analysis of women demographic factors and malaria prevalence in children 6-59 months in a single household The classification table also showed that the predictive variables predicted correctly 49.9%. for negative malaria result and 61.7% for positive malaria report.

Table 13

Classification Table (RQ1)

		Predicted		
		Malaria prevalence among children 6–59 months in a single household		Percentage
Observed		Negative	Positive	Correct
Malaria prevalence among children 6–59 months in a single household	Negative	312	313	49.9
	Positive	267	430	61.7
Overall percentage				56.1

The binary logistic regression model represented in Table 14 shows that most of the demographic factors (independent variables) like malaria educational prevention messages (with four category messages: malaria is dangerous, malaria can kill, mosquito-spread malaria, and sleeping inside a mosquito net is important), and malaria symptoms knowledge (with nine categories fever, chills, headache, joint pain, poor appetite, vomiting, convulsion, cough, and nasal congestion) failed to predict the odds of malaria prevalence in children 6-59 months in a single household were not statistically significant ($p > .05$), showing there was no association between these variables and outcome variable. Women's education level was found to be statistically significant ($p < .05$) at ($p < .001$).

The model resulted from the independent variables [exposure to malaria educational prevention messages and malaria symptoms knowledge], not significant ($p > .05$). However, one IV [women's education level] was found to be significant ($p < .05$). Controlling exposure to malaria educational prevention messages and malaria symptoms knowledge, the predictor variable, [women's education level], in the logistic regression analysis was found to contribute to the model.

Only women's education level showed to be the statistically significant predictor, B = [-.248], OR = [.780] shown in Table 14, could predict the odds of malaria prevalence in children 6-59 months. The variable women education level ($p < .001$) had statistically significant association with malaria prevalence for the study population. The coefficients of the RQ1 variables. The odds of testing negative for malaria in children were 0.780 times more likely in children living in the households of women with high level of

education than with no education. The odds ratios for the rest of independent variables were found not significant. Refer to Table 14.

Table 14

Variables in the Equation (RQ1)

							95% CI	
Variable	*B*	*S.E.*	Wald	*df*	*p*	*OR*	Lower	Upper
Malaria educational prevention	.076	.062	1.502	1	.220	1.079	.956	1.218
Women's academic level	-.248	.055	20.396	1	.001	.780	.701	.869
Malaria symptoms knowledge	-.043	.045	.922	1	.337	.958	.877	1.046
Constant	.457	.110	17.249	1	.000	1.579		

The binary regression coefficients for RQ1 shown in Table 15 represented the unstandardized B = [-.231], SE = [.056], Wald = [17.073], $p < .001$. The estimated odds ratio favored an [decrease] of nearly [3.6%], Exp (B) = [.793], 95% CI (.711, .885)] for every one-year increase in (education level). See the asterisk (*) at the bottom of Table 15. No other independent variables were found to be significant or contribute to the model. The model explained 3.6% (Nagelkerke R^2) of the variance in predicting the prevalence of malaria and correctly classified 56.9% of cases. The model significantly predicted malaria test results, $\chi 2$ (13) = 36.327, p =. 001, as shown in Table 15.

The women education level was one predictor variable significant ($p < .001$), indicating that the variable is independent of the dependent variable malaria prevalence in children 6-59 months in a single household ($p < .05$). Showing that a unit change in education level decreased the likelihood of children testing positive for malaria by 0.793

times (B = -0.231, $p < .001$, OR = 0.793) shown in Table 15. Since $p < .05$, the null hypothesis stating that there is no statistically significant association between women's education level and malaria prevalence in children 6-59 months in a single household was rejected by me for the women's education level. The remaining independent variables (malaria educational prevention messages and malaria symptoms knowledge) ($p > .05$) were not statistically significant in association, therefor, the null hypothesis was not rejected to predict malaria prevalence among children 6-59 months in a single household as indicated in Table 15.

Table 15

Coefficients Table (RQ1)

Response	*B*	*S.E.*	Wald	*df*	*p*	*OR*	95% CI for OR) Lower	Upper
Malaria message	-.082	.224	.135	1	.714	.921	.593	1.430
Education	-.231	.056	17.073	1	<.001	.793	.711	.885
Fever	-.029	.139	.043	1	.835	.971	.740	1.275
Chills	.202	.130	2.398	1	.121	1.224	.948	1.580
Headache	-.074	.126	.345	1	.557	.929	.725	1.189
Joint pain	.015	.131	.013	1	.910	1.015	.785	1.313
Poor appetite	-.239	.156	2.336	1	.126	.787	.579	1.070
Vomiting	-.058	.186	.097	1	.756	.944	.656	1.359
Convulsion	.380	.447	.724	1	.395	1.463	.609	3.514
Cough	.044	.317	.019	1	.890	1.045	.562	1.942
Nasal congestion	-.454	.372	1.493	1	.222	.635	.307	1.316
Other	-.407	.245	2.768	1	.096	.666	.412	1.075
Don’t know	-.580	.357	2.642	1	.104	.560	.278	1.127
Constant	.539	.159	11.437	1	.001	1.714		

* $\chi 2(13) = 36.327$, $p = .001$; Nagelkerke R2 = .036.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and malaria prevalence among children 6-59 months in a single household?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and malaria prevalence among children 6-59 months in a single household.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and malaria prevalence among children 6-59 months in a single household.

Binomial logistic regression was performed with SPSS to ascertain the effects of the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and the outcome variable malaria prevalence in children 6-59 months in a single household (RQ2). The logistic regression model was not statistically significant, $\chi 2$ (3) = 3.451, p = .178 shown in Table 16. The model showed the possible variables of the mode of malaria information dissemination (radio, billboards, posters, and leaflets/fact sheets, except television) and types of malaria educational prevention messages (malaria is dangerous, malaria can kill, mosquito-spread malaria, and sleeping inside a mosquito net is important) failed to predict the outcome variable malaria prevalence in children 6-59 months in a single household family.in

Nigeria, therefore, not statistically significant ($p > .05$) at $\rho = .18$. The model goodness-of-fit was not significant ($p > .05$) meaning the model is correctly specified. This result indicates a failure to reject the null hypothesis, stating no relationship between the mode of malaria messages dissemination except television, types of malaria educational prevention messages, and the odds of malaria prevalence among children 6-59 months in a single household in Nigeria.

Table 16

Model Fit Analysis of RQ2 Independent Variables and Dependent Variable

Step	X^2	*df*	*p*
Step	3.451	2	.178
Block	3.451	2	.178
Model	3.451	2	.178

Additionally, Table 17 is the model summary of the binary logistic regression analysis of the mode of malaria information dissemination except television, types of malaria educational prevention messages, and malaria prevalence among children 6-59 months in a single household. The [-2 log Likelihood = 1825.306] and the [Nagelkerke R squared = .003]. The model showed the IVs [the mode of malaria information dissemination types of malaria educational prevention messages] were not significant ($p > .05$); however, the IV [television] was found to be significant ($p < .05$). Therefore, controlling for radio, billboards, posters, and leaflets/fact sheets, and types of malaria educational prevention messages (malaria is dangerous, malaria can kill, mosquito-spread malaria, and sleeping inside a mosquito net is important, he predictor variable,

[television], in the binary logistic regression analysis was found to contribute to the model. The model explained 0.3% (Nagelkerke R^2) of the variance in malaria prevalence and correctly classified 53.1% of cases. Therefore, none of the predictors were found to be significant.

Table 17

Model Summary Analysis of RQ2 Independent Variables and Dependent Variable

Step	-2 Log likelihood	Cox & Snell *R* square	Nagelkerke *R* square
1	1825.306	.003	.003

[a] Estimation terminated at iteration number 3 because parameter estimates changed by less than .001.

Table 18 is the classification table for the binary logistic regression analysis of the mode of malaria information dissemination [television] and malaria prevalence in children 6-59 months in a single household. This result shows that the predictive category variable television correctly predicted 11.5% negative for malaria and 90.8% positive for malaria. Table 18 shows the overall correction prediction of 53.3%.

Table 18

Classification Table (RQ2) of the Outcome Variable Malaria Prevalence Among Children

		Predicted Malaria prevalence among children 6–59 months in a single household		
Observed		Negative	Positive	Percentage correct
Malaria prevalence among children 6-59 months in a single household	Negative	72	553	11.5
	Positive	64	633	90.8
Overall percentage				53.3

Table 19 indicates the association between all the modes of malaria educational prevention information dissemination, types of malaria messages, and malaria prevalence among children in a single household. The relationship between the categorical variables and the odds of testing positive or negative for malaria dichotomic variable was not a statistically significant variable ($p > .05$). This model, therefore, suggests that when considering the modes of malaria information dissemination and types of message possible categories, the variables proved to be a poor predictor of malaria prevalence in children 6-59 months in a single household in Nigeria.

Table 19

Variables in the Equation (RQ2)

							95% CI	
Variable	*B*	*S.E.*	Wald	*df*	*p*	*OR*	Lower	Upper
Malaria information dissemination	-.207	.112	3.403	1	.065	.813	.652	1.013
Types of Malaria Educational Prevention Message	.134	.089	2.283	1	.131	1.143	.961	1.361
Constant	.126	.065	3.770	1	.052	1.134		

Table 20 indicates the association between all the modes of malaria educational prevention information dissemination, types of malaria messages, and malaria prevalence among children in a single household. The relationship between the categorical variables and the odds of testing positive or negative for malaria dichotomic variable was not a statistically significant variable ($p > .05$). However, controlling for other categories of the modes of malaria information dissemination and types of classes of malaria message, the predictor variable [television], in the binary logistic regression analysis was found to contribute to the model. The unstandardized B = [-.431], SE = [.194], Wald = [4.915], $p < .027$. The estimated odd ratio favored a [decrease] of nearly [0.3%], Exp (B) = [.813], 95% CI (.652, 1.013)] for every one unit increase in malaria messages through television. This model suggests that when considering the modes of malaria information dissemination and type of message possible categories considered, the variables are poor predictors of malaria prevalence in children 6-59 months in a single household in Nigeria.

Table 20

Coefficients Table (RQ2)

Variable	*B*	*S. E.*	Wald	*df*	*p*	*OR*	95% CI for OR)	
							Lower	Upper
Dangerous	.276	.196	1.972	1	.160	1.317	.897	1.935
Kills	-.355	.192	3.426	1	.064	.701	.482	1.021
Mosquito spreads	.030	.220	.018	1	.892	1.030	.669	1.587
Sleep in net	.237	.195	1.479	1	.224	1.268	.865	1.859
Radio	.266	.177	2.263	1	.133	1.305	.922	1.847
TV	-.431	.194	4.915	1	.027	.650	.444	.951
Billboard	.097	.590	.027	1	.869	1.102	.347	3.506
Poster	-.688	.542	1.613	1	.204	.503	.174	1.453
Brochure	.084	.592	.020	1	.887	1.087	.341	3.469
Constant	.096	.066	2.134	1	.144	1.100		

Note. Variables entered on Step 1: Dangerous, Kills, Mosquito Spreads, Sleep in Net, Radio, TV, Billboard, Poster, Brochure.

The model explained 1.5% (Nagelkerke R2) of the variance in predicting the prevalence of malaria and correctly classified 54.6% of cases. The model was insignificant in predicting malaria test results, $\chi 2$ (9) =, p = .091. There was one significant predictor. Specifically, exposure to malaria education prevention messages on TV decreased the likelihood of testing positive for malaria (B = -0.431, p = .027, OR = 0.650). See Table 20. See Table 21.

Table 21

Variables in the Equation of the Binary Logistic Regression Analysis for RQ2

		Exp (B)	95% CI for Exp (B)	
Step			Lower	Upper
Step 1[a]	Modes of malaria information (malaria messages) dissemination	.813	.652	1.013
	Types of malaria educational prevention messages	1.143	.961	1.361
	Constant	1.134		

[a] Variable(s) entered on step 1: Modes of malaria information (malaria messages) dissemination, Types of malaria educational prevention message.

Summary

This study aimed to evaluate women's exposure to information on sensitive malaria educational prevention messages and malaria prevalence in children 6-59 months of age. Specifically, the study determined if the occurrence of malaria was associated with exposure to malaria educational prevention messages, women's academic level, malaria knowledge, mode of malaria information dissemination, and type of malaria

educational prevention message. I addressed the following research questions and hypotheses in this study:

RQ1: Is there a significant statistical association between exposure to malaria educational prevention messages, women's academic level, knowledge of malaria symptoms, and malaria prevalence among children 6-59 months in a single household?

H_o1: There is no significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria knowledge, and malaria prevalence among children 6-59 months in a single household.

H_a1: There is a significant statistical association between exposure to malaria educational prevention messages, women's academic level, malaria knowledge, and malaria prevalence among children 6-59 months in a single household.

RQ2: Is there a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and malaria prevalence among children 6-59 months in a single household?

H_o2: There is no statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational prevention message, and malaria prevalence among children 6-59 months in a single household.

H_a2: There is a statistically significant association between the mode of malaria information dissemination among women aged 15-49, the type of malaria educational

prevention message, and malaria prevalence among children 6-59 months in a single household.

Regarding the first research question, an increase in education level decreased the likelihood of testing positive for malaria by 0.793 times (B = -0.231, p < .001, OR = 0.793). No other predictors were significant. Regarding the second research question, seeing a message about malaria on TV decreased the likelihood of testing positive for malaria (B = -0.431, p = .027, OR = 0.650). What follows in Chapter 5 is a discussion of the results of this study's interpretation in the context of the theoretical framework. Any limitations of the study results are in the next chapter. Additionally, recommendations for future research are in the Chapter 5 discussion.

Chapter 5: Discussion, Conclusions, and Recommendations

Malaria infection remains a significant challenge in sub-Saharan African countries despite efforts to eradicate the disease. Past literature reviews revealed that Nigerian women had limited knowledge and awareness about malaria prevention. Limited education created a gap in the malaria preelimination program's ability to achieve eradication (Ovadje & Nriagu, 2016). I sought to evaluate the relationship between exposure to malaria educational prevention messages among Nigerian women aged 15–49, women's academic level, malaria symptoms knowledge, mode/type of malaria information dissemination, and malaria prevalence among children 6–59 months in a single household. I also sought to determine associations between exposure to malaria educational messages among women aged 15-49 through the best information dissemination channel to promote malaria prevalence reduction among children age 6–59 months in a single household in Nigeria.

This study included a cross-sectional quantitative design using de-identified secondary data. The Nigerian women aged 15–49 years included those trained in malaria prevention 6 months before the survey. I sought to address the problem by investigating the relationship between malaria prevention education exposure through malaria educational prevention messages provided through radio, television, billboard, posters, and factsheets, and Nigerian women's malaria symptoms knowledge, women's education level, and malaria's prevalence in children aged 6–59 months. The independent variables were women aged 15–49 exposed to malaria prevention messages, women's knowledge of malaria symptoms, selected mass media dissemination channels, and women's

academic levels. The dependent variable was the prevalence of malaria in children 6–59 months in Nigeria. The data set consisted of 8,034 cases for analysis, including females aged 15–49 as the filtering buffer. I performed binary logistic regression to answer the research questions.

Results indicated that increased education levels among Nigerian women decreased the likelihood of children aged 6-59 months testing positive for malaria. Also, compared to the highest education among Nigerian women, no education increased the likelihood of testing positive for malaria among children aged 6–59 months. The findings also demonstrated that seeing a message about malaria on television reduced the possibility of children aged 6-59 months testing positive for malaria. Chapter 5 includes the interpretation of the results in the context of the theoretical framework. I also present the limitations, implications, recommendations for future research, and a conclusion.

Interpretation of the Findings

The interpretation of findings is based on the research questions. The research questions that guided this study included the following: Is there a significant statistical association between exposure to malaria educational prevention messages among women aged 15–49, women's academic level, malaria symptoms knowledge, and the prevalence of malaria among children 6–59 months in a single household? Is there a statistically significant association between the mode/type of malaria information dissemination among women aged 15–49 and malaria prevalence among children 6–59 months in a single household?

Research Question 1

The findings indicated that compared to higher education, women with no schooling had an increased likelihood of children in their household testing positive for malaria by 0.793 times. The results revealed that increased education on malaria messages among women decreased the probability of children testing positive for malaria by 1.888 times. This outcome is nearly twice as much as children residing in households with uneducated women. This finding suggests that if more women are trained about the importance of malaria-sensitive messages exposure, there may be less malaria prevalence among children 6–59 months in a single household in Nigeria. Women with no academic education may not be well informed about malaria-sensitive messages, which may result in their children testing positive for malaria due to a lack of educational exposure to malaria messages and an understanding of malaria and its prevention mechanisms.

The findings are consistent with results from Ugwu (2019) in revealing that health education challenges and social and economic loss due to malaria are preventable if individuals, communities, states, and nations practice proven effective malaria control programs such as awareness education because high education leads to an understanding of malaria prevention mechanisms among Nigerian women. Education increases the uptake of malaria services, leading to improved malaria prevention among children in Nigeria (Ugwu, 2019). Regular practice of proper malaria prevention techniques may reduce malaria infection, reduce prevalence, and eliminate it (Ugwu, 2019).

The results from the current study indicated that mothers' increased education decreased the likelihood of their children testing positive for malaria. These findings are

consistent with Sadiq's (2015) results that focusing resources to educate Nigerian mothers reduces malaria infection among their children. Nigerian women exposed to malaria messages understand ways to prevent malaria, resulting in children experiencing low malaria infection and low malaria prevalence.

Focusing funds allocated for malaria education may be less effective than ensuring women have a good education and money to support their families. Furthermore, women can get educated academically and receive malaria education as well. Participatory health education interventions such as malaria awareness messages among Nigerian mothers would contribute to decreasing malaria prevalence among children in a single household family in Nigeria. Diverting funds meant for education to tackle the high poverty level would jeopardize the fight against malaria because there would be no education on malaria through messages and media such as radio and television, contributing to increased malaria prevalence.

Enhanced education among Nigerian women may reduce malaria prevalence and provide adequate knowledge of disease control and elimination in Nigeria. A high education level among women age 15-–49 is vital to understanding malaria prevention in Nigeria. A study of knowledge assessment of malaria prevention conducted with ITN use among reproductive-age women in Southwest Nigeria found limited prevention strategies are not adequately practiced (Adebayo et al., 2015). That study revealed that lack of malaria knowledge among women might account for low ITN utilization and increased malaria incidence among women in Nigeria's 15–49 age group.

According to Adebayo et al. (2015), the lack of malaria health education messages resulted from inappropriate information dissemination and a lack of education in a knowledge assessment with ITN among reproductive-age women in Southwest Nigeria. In agreement with previous literature, the current study's findings indicated that increased education level decreased the likelihood of children aged 6–59 months in a single household family testing positive for malaria infection in Nigeria. Limited training on malaria prevention through mass media messages may contribute to poor malaria prevention and control among children in Nigeria. As a result, mothers with modest education experience increased poverty, thereby resulting in increased malaria prevalence (Tobin-West & Kanu, 2016). However, mothers with higher education who are not poor are more likely to have the knowledge and resources to support their families in malaria prevention than mothers who are poor and with a low level of education.

Oyekale (2014) posited that peer education through mass media increases knowledge and awareness about malaria risk factors. However, poor education among women in Nigeria indicates the Nigerian health care system's failure to associate the effectiveness of ITN with its use across the six geopolitical regions of Nigeria (Tobin-West & Kanu, 2016). Limited education and low economic strength among Nigerian women indicate that more resource allocations go to supporting families than educating women, which increases malaria prevalence among children because these women lack knowledge about malaria prevention and control measures. According to Tobin-West and Kanu (2016), few women in Nigeria are educated with high incomes to support their families who can correctly associate malaria morbidity and mortality with mosquito bites.

Appropriate malaria symptoms knowledge acquisition is vital to ensuring sufficient application, malaria intervention programs, and preventive strategies among Nigerian women.

Compared to Nigerian women with higher education, those with limited education experienced high malaria prevalence among their children in Nigeria. The results were echoed in previous research by Tobin-West and Kanu (2016), who investigated factors influencing malaria prevention among women of reproductive age. The participants had proper knowledge of malaria by knowing the cause and symptoms. Tobin-West and Kanu found that 89% had excellent malaria experience and a high education level; therefore, Tobin-West and Kanu associated their expertise with the education level with low malaria prevalence. Tobin-West and Kanu evaluated different malaria health education and modes of information dissemination potential for malaria prevention and control and found that Nigerian women with higher education and stable economic strata were less likely to experience high malaria prevalence.

Women in Delta state (one of the 36 states of Nigeria) had correct malaria knowledge associated with the education received on malaria (Tobin-West & Kanu, 2016). The study described enhanced education among women as the first positive step toward recognizing malaria prevention and control strategies for care seeking among reproductive-age women in Nigeria. The current findings contributed to the previous literature by establishing that the education level on malaria among women in Nigeria significantly impacts malaria prevalence. A regression study conducted in the Upper West Region of Ghana, described as poverty-stricken and the worst affected by malaria,

found a statistical association between poverty and malaria burden among Jirapa District's socioeconomically deprived region (Nkegbe et al., 2017).

Rolle and Omon (2018) reported findings that were not consistent with the current study results. Rolle and Omon recommended policy changes to increase income earnings to foster disease prevention and control and improve the region's economic condition. Oyekale (2014) reported that adequate malaria prevention knowledge is low at 55.70%, while only 14.93% of the population studied sleep under mosquito nets, ITN, and other preventive measures. The findings provided insight into the need for people to sleep under mosquito nets despite being deprived of the opportunity due to lack of wealth and ability to afford malaria prevention measures. Malaria prevention strategies significantly increase with the understanding that the methods can prevent malaria or mosquito bites, which requires women to have a high level of education (Oyekale, 2014; Tobin-West & Kanu, 2016).

Research Question 2

The findings demonstrated that seeing a message about malaria on television decreased the likelihood of testing positive for malaria by $OR = 0.650$. The findings imply that the mode of malaria information dissemination, such as messages on television, predicted malaria infection among children in Nigeria. The results are consistent with those from Yaya et al. (2018), which revealed that the mode of information dissemination for malaria messages about the use of malaria bed nets to enhance education could lead to better and more promising malaria prevention management practices among women in sub-Saharan Africa.

Disseminating malaria messages through modes such as television and radios for education and awareness accounts for malaria symptoms knowledge, sharpening skills, and Nigerian women's ability to access information to promote malaria prevention strategies (Aragie & Baye, 2020). According to Modu et al. (2017), the persistent lack of primary health education about malaria in Nigeria undermines the seriousness of malaria prevention among women aged 15–49 in Nigeria. However, the current results contradict Modu et al., who found that the mode/type of dissemination of malaria information does not significantly impact malaria prevalence in individuals and public health officials in Mbaise, Nigeria.

Past literature somewhat contradicts current study results by indicating that access to modes of information dissemination is new, especially for health-related knowledge among Nigerian women that promotes malaria prevention and control measures to achieve the World Health Organization (WHO) 2030 pre-elimination/eradication program plan (Yaya et al., 2018). Ovadje and Nriagu (2016), an association assessment between caregivers' knowledge of malaria and ITN ownership and use by children, found that poor malaria knowledge adversely affects malaria prevention programs.

This study's findings contradict Ovadje and Nriagu (2016) by indicating that education level may significantly predict malaria prevalence because receiving messages through TV promotes education and awareness about the danger of malaria among children in a single household in Nigeria. Yaya et al. (2018) reported that effective mass media modes of information dissemination, such as TV, provided adequate malaria

prevention education between Nigerian caregivers' malaria knowledge and ITN ownership and use by children.

Mass media's insufficient use in public health education messages is a significant drawback in fighting malaria prevention and reduction (Yaya et al., 2018). Inconsistent with present study findings, past research indicates that through disseminating messages via TV and radio, social media training can address any public health intervention to promote malaria prevention programs and sensitize pregnant women to the message benefits (Yaya et al., 2018).

According to Sultana et al. (2017), health literacy applicability as a form of communication, television, radio, and health/community health workers promoted malaria prevention programs and control. Similarly, current study findings are consistent with previous literature by establishing that the mode or type of malaria information dissemination among women did predict malaria prevalence among children 6-59 months in Nigeria**.** Several of these researchers focused on women and female adolescents in rural Nigeria and addressed the critical importance of mass media exposure to health education information dissemination of family planning and malaria messages to Nigerian women (Aboagye et al., 2021; Abubakar et al., 2022; Chima & Alawode, 2019; Sultana et al., 2017).

Zamawe et al. (2016) and Adjah and Panayiotou (2014) studied various aspects of mass media in health education, agreeing that mass media's role in health education communication is vital for the public acquisition of a healthy lifestyle through malaria prevention. Malede et al. (2018) affirmed that inadequate malaria health information and

media application are among the predictors of malaria information dissemination through television, radio, posters, flyers, and billboards. The results above contradict current study findings indicating that messages on TV significantly predict malaria prevalence among children in Nigeria due to women being more economically stable to afford more television sets (Zalisk et al., 2019). Consistent with the present study findings, previous research revealed that educational information for preventing and controlling malaria received through mass media, such as TVs and radios, increased mosquito bed net use among women in malaria-endemic sub-Saharan African countries (Yaya et al., 2018). Zalisk et al. (2019) used radio and television as the two most common mass media sources to disseminate information about malaria (Zalisk et al., 2019). The findings have contributed to the previous empirical body of knowledge by revealing that seeing a message about malaria on TV decreased the likelihood of testing positive for malaria.

Limitations of the Study

The limitation of this study was that the survey questions depended on self-reporting by subjects; hence, recall and misreporting bias is not to be ruled out completely. Besides, the questionnaire used to compile the data had the benefit of mitigating the non-response bias but could not guarantee anonymity and truthfulness in sensitive questions. The study was limited to secondary data. Such secondary data may not answer the researcher's questions or provide specific information sought by the researcher. In addition, it is not difficult to ascertain the accuracy of the secondary day for the present research or project. The study was limited to Nigerian women aged 15-49

households, indicating that the findings may be limited to the families or homes of these women.

Recommendations

The results could assist in expanding knowledge regarding the use of educational messages. Therefore, there is a need for further research on how Nigerian women's education impacts their health and families. This study led to understanding various malaria prevention strategies and how malaria education is a vital prevention tool among Nigerian women. The limited scope of the results demonstrated that more research on this topic is still needed. Future research is required using other quantitative research designs to enable access to participants' perceptions and firsthand information regarding knowledge of malaria symptoms and information dissemination through messages and their impact on malaria prevalence.

There is a need for further research to investigate how malaria educational prevention messages can help prevent malaria prevalence in Nigeria and if such messages depend on women's education level. Future research should adopt a quantitative design to access firsthand information from participants rather than secondary data regarding mass media messages in educating Nigerian women households about malaria prevention and its impact on the prevalence of malaria in children 6-59 months in Nigeria. I recommend expanding the study scope in future research by examining the need for education about malaria prevention using other participants, such as children and healthcare professionals. There is a need for further research to investigate the association

between malaria incidence, the structure and mode of health information messages, and malaria prevalence in Nigeria.

Implications

Implications for Positive Social Change

The implication for social change is that this study's findings may positively support educational training through effective communication messages to spread knowledge about malaria, monitoring techniques, and practicing malaria prevention methods. The study results may help establish a sustainable malaria education program and help increase malaria knowledge among women. Other social change implications may include a decrease in malaria prevalence among children 6-59 months, increased treatment-seeking behaviors among mothers of the children, and increased use of available malaria prevention method resources. This study's results could inform healthcare providers, public health professionals, and researchers to comply with the recommended preventive policies and treatment measures for malaria.

This study indicates the need for educating women, in general, to help improve their family health conditions through learning preventive care strategies and when to seek care. As primary caregivers for the family, educated women provide excellent protection against malaria among children ages 6-59 months. Health education is essential for this region because many women surveyed had limited education about malaria. Health literacy, specifically about malaria among women through appropriate health education channels, provides the necessary information to engage in preventive health practices among Nigerian women.

Many Nigerian women are unaware of the risk of infectious diseases such as malaria. Thus, they are not practicing necessary preventive mechanisms and measures, making their children more susceptible to malaria infection. Educating women about malaria through various channels such as radio, TV, and posters about malaria and its preventive strategies can help reduce its prevalence in Nigeria.

The study findings are relevant to public health concerning the study population. There is evidence in the reviewed documents of studies on the prevalence of maternal malaria in the study location and other areas. Yet, none of the studies determined the association between malaria and exposure to effective malarial messaging. The result provides further evidence concerning the association between malaria and the structure and medium of health information messages.

Implications for Practice

The findings may add to current knowledge of the role of malaria education in public practice, including public health officers who may use these study findings to enhance malaria education among Nigerian women. The significance of public health practice is the inclusion of regular or frequent communication systems to strengthen malaria prevention programs (NDHS, 2018). The positive impact of sensitive malaria messages on malaria prevalence among children 6-59 months may encourage practice and increase the pace of malaria eradication. Another implication is that Nigerian women's households may use the findings to understand the need for education and resources such as funds to enhance effective malaria prevention and healthcare. Research regarding women's knowledge of malaria, messages, mass media, and the relationship

between malaria prevalence among children 6-59 months in Nigeria was limited. The research evaluated the association between associated demographic characteristics and malaria prevalence among children 6-59 months in Nigeria (NDHS, 2018). The outcome of this study may encourage future research interests in associations between health communication messages and malaria.

Theoretical Implications

I applied Laswell's (1948) communication framework in this study. The theory identified essential communication components where research is the sender of information, the message is the content of the communication, and the channel is the medium used to transmit the message. Furthermore, Laswell (1948) identified the audience as the receiver who makes the communication meaningfully and effectively uses the information to measure outcomes. I considered mass media one of the communication technology frameworks used in public health campaigns (Glanz et al., 2008).

The study's implication to theory was that a communication system might fail without the functional elements of information source, message, transmitter, channel, and destination as excellent communication sources. Communication sources include individuals, groups, or organizations from where the message originates. The theory can contribute to thinking, writing, drawing, and speech abilities. The framework was essential to this research because it provides learning about participants, subject situations, and background influences. The theory is influenced significantly by the receiver of the message, socioeconomic status, education, or lack of knowledge of

understanding the message. How well the malaria prevention message is received may affect the relationship between the message and the feedback or outcome result (malaria prevalence). The findings have added to the theory by establishing that education through social media messages may reduce malaria prevalence among children 6-59 months in Nigeria.

Conclusion

This study sought to determine if exposure to malaria messages among Nigerian women aged 15-49, education level, and knowledge of malaria symptoms affect malaria prevalence in children 6-59 months of age in a single household. The study also determined if there are any associations between malaria educational messages through radio, TV, billboard, flyers, and the best channel of information dissemination to enhance the use of the most effective malaria prevention affects malaria prevalence in children 6-59 months of age in a single household family. The findings demonstrated that increased education levels decreased the likelihood of testing positive for malaria. The results also revealed that seeing a message about malaria on TV reduced the probability of testing positive for malaria.

This study adds to the body of knowledge by establishing that education and mode of message dissemination among survey participants impact malaria prevention and prevalence among children 6-59 months old in a single-household family in Nigeria. More research is needed to get participant opinions and perceptions concerning wealth and malaria prevalence among children 6-59 months in Nigeria to understand how women aged 15-49 exposure to essential malaria educational messages, academic

education level, and malaria symptoms knowledge affect malaria prevalence in children 6-59 months (aged under five years) in Nigeria.

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