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Knowledge of Malaria Infection and Treatment-Seeking Behavior Among Tanzanian Pregnant Women

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Abstract

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MPH, Walden University, 2012

B.S., University of Central Missouri, 2002

Dissertation Submitted as Partial Fulfillment

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Abstract

Despite the availability of effective drugs to prevent malaria during pregnancy using intermittent preventive treatment with Sulfadoxine-Pyrimethamine or Fansidar and insecticide bed net, are still little used in Sub-Saharan Africa, including Tanzania. As a result, many pregnant women are at risk of malaria consequences such as maternal anemia and low birth weight babies, which increase the rate of infant mortality. Data from the Demographic Health Survey for Tanzania HIV/AIDs and the Malaria Indicator Survey 2011-2012 were used in a cross-sectional design guided by the health belief model. Logistic regression examined the association between preventive treatment-seeking behavior and SES, malaria media exposure, knowledge of malaria signs and symptoms, perceived seriousness of malaria, and knowledge of malaria preventive measures. After controlling for transportation, family responsibility, and age, significant associations ($p < 0.05$) were found between SES, malaria media exposure, knowledge of malaria signs and symptom, perceived seriousness of malaria, knowledge of malaria preventive measures, and treatment-seeking behavior. This study contributes to positive social change by helping design and implement policies and programs to improve the knowledge of Tanzanian pregnant women about the risk of malaria infection and the benefits of preventive treatments. Interventions to reduce malaria infection during pregnancy will reduce the associated morbidity and mortality of both mothers and infants; as a result, families and communities will be healthier and prevent unnecessary medical cost of malaria.

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Dedication

I dedicate this project to my grandparents who raised me and my other family members for their love and support. I am very grateful to my mother for enrolling me early in my wonderful journey of education. I am thankful for my father for bringing me to United States for increased opportunities in education.

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Chapter 1: Introduction to the Study

Introduction

Although preventable, malaria continues to be the major public health issue in developing countries, including the Sub-Saharan regions, where 90% of the world's malaria deaths occur (Kinney et al., 2010). Malaria is caused by a microparasite, of the genus *Plasmodium,* which infects red blood cells (Centers for Disease Control and Prevention [CDC], 2013). About 156 species of *Plasmodium* that infect many types of animals have been identified; however, only *P. falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowles* are known to infect humans (CDC, 2013).

Mosquitoes are the dominant vectors for transmitting infectious diseases, such as malaria, dengue fever, yellow fever, and filariasis; the major vector for malaria parasites in Sub-Saharan Africa is the *Anopheles* genus (Menger et al., 2014). Mosquitoes, such as *Anopheles gambie*, *A. arabiensis*, and *A. funestus* are the main vectors for malaria (Abeku et al., 2015). Other infectious diseases are transmitted by different species of mosquitoes; for instance, yellow fever and dengue fever are transmitted by *Aedes aegypti* Tome, Pascini, Dangelo, Guedes, & Martins (2014).

Symptoms of malaria include fever, profuse sweating, shivering, vomiting, severe headache, dehydration, nausea, diarrhea, convulsions, jaundice, myalgia, backache, and joint pain;, it can also be asymptomatic, while still causing anemia in some people who

live in high malaria transmission areas (Choge et al., 2014). *P. falciparum* is the major cause of malaria infection during pregnancy in Sub-Saharan Africa, which increases the risk of maternal anemia, LBW (LBW), premature birth, and neonatal mortality (Jackle et al., 2013; Webster et al., 2013).

In high malaria transmission area such as Tanzania, primigravida (first pregnancy) mothers are at greater risk for malaria infection and the consequences than multigravida (three or more pregnancies) mothers who have built immunity from repeated infection (Ouedraogo et al., 2012). Previous *P. falciparum* infection of placenta allows the development of antibodies, which quickly respond to malaria during a subsequent pregnancy to prevent the antigen of *P. falciparum* from binding to the placental cells; therefore, multigravida women are better protected, through immunity, than primigravida pregnant women (Fievet et al., 2002). As a result, intermittent preventive treatment in pregnancy is highly beneficial to primigravida women (Fievet et al., 2002).

In 2007, 125.2 million pregnancies occurred in areas with *P. falciparum* and/or *P. vivax* transmission, with 77.4 million in Southeast Asia and the Pacific region combined, 30.3 million in Africa, 13.1 million in the Eastern Mediterranean and European region, and 4.3 million in the South American region (Dellicour, Tatem, Guerra, Snow, & Kuile, 2010). Sub-Saharan countries are reported to have a higher prevalence of *P. falciparum*

infections in pregnancy, where 98.7% occur in African regions compared to none in European regions Dellicour et al. (2015).

As recommended by World Health Organization (WHO), the following combination has been shown to be effective in reducing the prevalence of LBW in first and second pregnancies (Mwandama et al., 2015): (a) intermittent preventive treatment for pregnancy with sulfadoxine-primethamine (IPTp-SP), (b) preventive methods using insecticide-treated bed nets (ITNs), and (c) insecticide residual spray (IRS). However, use of these treatment and preventive measures remains low; as a result, malaria during pregnancy is still a public health issue and causes 75,000 to 200,000 infant deaths annually in Sub-Saharan Africa (Esu et al., 2013). Even though it is mostly asymptomatic in high malaria transmission areas, the *P. falciparum* infection that occurs early in pregnancy is especially harmful for both mother and fetus as it causes maternal anemia and LBW outcome (Huynh, Cottrell, Cot, & Briand, 2015). Malaria infection at early pregnancy disrupts the normal placentation as the maternal placenta continues to develop, which, in turn, impairs and decreases the placenta's ability to transport nutrition to fetus and decreases maternal hemoglobin level (Huynh et al., 2015). Both placental and peripheral malaria infection at delivery are significantly associated with maternal and infant anemia (Accrombessi et al., 2015). The asymptomatic nature of *P. falciparum* in some pregnant women poses a challenge for malaria prevention efforts, which

necessitates screening for malaria because of the regular ANC protocol in malaria-endemic regions to reduce the malaria burden on pregnant women and infants (Agomo, Oyibo, Anorlu, & Agomo, 2009). This indicates the importance of early antenatal visits to begin intermittent preventive treatment for preventing malaria infection in pregnancy and early diagnosis if pregnant women are already infected so that they receive prompt treatment. Yet, many pregnant women do not take advantage of the available preventive and treatment measures.

This study sought to identify the barriers pregnant women face to using these measures. This chapter covers the following topics: background of the study, problem statement, purpose of the study, research questions and hypothesis, nature of the study, theoretical framework, assumptions and limitations of the study, delimitations, and significance.

Background

Malaria infection in pregnancy affects millions of women in developing countries; the pregnancy reduces women's immunity to malaria and puts them at risk of maternal anemia and LBW delivery (Tobin-West & Asuquo, 2013). Sub-Saharan Africa shares a greater burden of malaria infection, in that more than 70% of total global morbidity occurs in Africa (Snow & Marsh, 2010). Over 30 million women are exposed to malaria in pregnancy annually in Sub-Saharan Africa (Huynh et al., 2011). As a result, malaria is

a major public health issue and is the major cause of infant mortality in Sub-Saharan Africa (Falade, Tongo, Ogunkunle, & Orimadegun, 2010). Of the 35% of preventable LBW) outcomes in Sub-Saharan Africa, 20% are related to malaria in pregnancy, which results in 62,000 to 363,000 infant deaths per year (Falade et al., 2010).

Tanzania is one of the Sub-Saharan countries greatly affected by malaria, where 95% of the population (36.1 million people) is at risk, especially vulnerable individuals, such as pregnant women and children under 5 years of age (Mazigo et al., 2010). Malaria is the main health issue in mainland Tanzania, where 9.2% of population is infected. In Zanzibar, however, prevalence is only 0.8% according to the 2011/2012 HIV/Malaria Indicator Survey (WHO, 2014). As a result of low malaria prevalence in Zanzibar, the pre-elimination program is implemented by distributing ITNs and only treating pregnant women with positive malaria result at ANCs.. But because the prevalence of malaria is much higher in the mainland, malaria control program is implemented using SP, ITNs, and case management to promptly treat malaria in pregnancy (President's Malaria Initiative [PMI], 2015a; PMI, 2015b).

Eliminating malaria in pregnant women and the general population is challenging. Despite WHO's recommendations for effective intermittent drug treatment (sulfadoxine-pyrimethane or SP and chloroquine) and the use of insecticide bed nets and household insecticide spray, both the compliance rate and the medicine adherence rate are low

(WHO, 2013). To improve control, a program called Roll Back Malaria (RBM) was initiated in 1998 by the director of WHO and endorsed in 1999 after discussion with various [e.g. World Bank and UNICEF) partners (WHO, 1999). The aim of RBM was to increase interventions against malaria and to drastically reduce the malaria burden, especially among the poor who have less access to interventions (WHO, 1999). In 2005, RBM proposed the Scale-Up Malaria Control program to further increase the scope of malaria prevention and treatments and to dramatically reduce malaria (Yasuoka, Poudel, Ly, Nguon, Socheat, & Jimba, 2012).

Several agencies collaborated to fund and provide technical support for the Scale-Up Malaria Control program (rapidly increase access and use of malaria control interventions), including the Bill & Melinda Gates Foundation, World Bank, United States Agency for International Development (USAID), Program for Appropriate Technology in Health (PATH), the (PMI), and Japanese International Corporation Agency (Chizema-Kawesha, Miller, & Campbell, 2010). Some countries, such as Zambia, had already taken advantage of the program by using insecticide bed nets, indoor insecticide spray, and intermittent preventive treatment, and thus reducing maternal anemia by 68% and child paracitemia by 53% (Chizema-Kawesha et al., 2010). Between 2000 and 2012, the Scale-Up Malaria Control intervention saved an estimated 3.3 million lives, with 3 million saved in Sub-Saharan Africa (WHO, 2013).

In addition, the Millennium Development Goals (MDGs) adopted by 193 countries in the year 2000 included the aim of eliminating malaria by 2015 (Shretta, n. d.). As result of these programs, the malaria mortality rate was reduced by 42% in all age groups around the world by 2015. Yet, malaria still killed 627,000 people in 2012. Because malaria is still a problem, a revised global development framework, called Sustainable Development Goals (SDGs), was developed in 2015 to eliminate malaria by 2030 (Shretta, n.d.).

Eliminating malaria is a challenge because it greatly affects pregnant women—among the most vulnerable members of the population. Gross et al. (2011) discussed the effort to reduce malaria in pregnancy in stable malaria transmission areas, such as Tanzania, by using strategies recommended by the WHO: intermittent preventive treatment, ITNs, case management, and anemia testing at ANCs. Russell et al. (2010) examined a national-scale malaria program, which was started in 2006 in Tanzania and provided discounts to pregnant women and mothers of infants at ANCs to promote the use of ITNs. Although efforts have been made to increase the coverage of malaria prevention methods, many women lack adequate knowledge to use them. Similarly, Mutagonda, Kamuhabwa, Massawe, & Mpembeni (2012) found that most pregnant women (54.3%) in Tanzania did not know that SP is used as intermittent preventive therapy to prevent infection and that arthemether-lumefantrine (ALu) is used to treat

malaria infection in pregnancy. Mpogoro et al. (2014) discussed the fact that pregnant women in Tanzania who took SP had significantly reduced placental malaria infection rates, and as a result, reduced the risk of lower preterm and LBW delivery. Therefore, there is a need for further research to find improved strategies to help increase knowledge among pregnant women about the risk and prevention of malaria, and thus reduce malaria in pregnancy.

This study examined the link between pregnant women's knowledge of malaria and preventive measures against malaria, exposure to mass media about malaria risk, socioeconomic status (SES), perceived seriousness of malaria, and treatment-seeking behavior at an ANC. The results may help explain the barriers holding back pregnant women from using the already-implemented malaria prevention and treatment methods.

Problem Statement

Currently, IPTp-SP and ITNs, which are distributed at ANCs, are recommended by WHO to prevent *P. falciparum* infection in pregnancy. They are effective malaria prevention methods that can prevent maternal anemia and LBW deliveries (Webster et al., 2013). However, the use of SP and use of ITN by pregnant women is still low, in part due to mixed and unclear national-level malaria control program implementation/policy across Sub-Saharan African countries. As a result, there is lack of consistency in delivery of malaria prevention methods and education for pregnant women at ANCs (Gomez et

al., 2014). Given the problem of low coverage of IPTp-SP and ITN in pregnancy across Sub-Saharan Africa, the Global Call Action Seminar was held in 2014 to Scale-Up IPT-SP and ITN by updating the malaria control program's policy (Agarwal et al., 2015). The updated policy may increase knowledge of malaria risk among pregnant women, thereby increasing their willingness to attend ANCs and seek treatment.

How much pregnant women know about the risk of malaria infection and about treatment options affects their ability and willingness to use the available malaria control and treatment methods (Tobin-West & Asuquo, 2013). Despite the fact that malaria is still a serious problem, in some parts of Tanzania, many pregnant women are still not taking advantage of the available malaria prevention methods delivered by malaria intervention programs. While the prevalence of malaria in Zanzibar is only 0.2%, malaria accounts for more than 40% of all outpatient visits in the mainland resulting in 10-12 million malaria cases and 60,000 to 80,000 malaria deaths per year in all age groups. However, malaria control programs did not reach many residents in the mainland as evidenced by the fact that only 33% of pregnant women took the recommended minimum two doses of SP in 2012 (PMI, 2015b). The goal of this study was to improve understanding of the relationship between (a) women's knowledge of malaria, (b) their exposure to mass media about the risk of malaria, (c) SES, (d) perceived malaria infection risk, (e) knowledge of malaria prevention methods and pregnant women's

willingness to seek treatment at antenatal care clinic for malaria care in countries such as Tanzania, where formal malaria studies have yet to be conducted.

Purpose of the Study

The purpose of this research was to examine the relationship between self-efficacy (defined as knowledge of malaria) of Tanzania's pregnant women and treatment-seeking behavior.

Theoretical Framework since beliefs and value systems can influence treatment-seeking behavior, it is important to determine the barriers faced by pregnant women to using the available malaria prevention resources and seeking treatment. The theoretical framework for this study was the health belief model (HBM), which was developed in the 1950s by social psychologists Hochbaum, Kegel, and Rosenstock to study why people fail to participate in health intervention programs such as free tuberculosis (TB) screening programs (Resource Center for Adolescent Pregnancy Prevention [ReCAPP], 2016). They realized that perceived disease risk and perceived benefit of action (e.g., screening for TB) were important motivators (ReCAPP, 2016). As described by the Boston School of Public Health (2016), HBM is based on the belief that one's behavior is predicted by perceived susceptibility (the perceived risk of contracting malaria during pregnancy), perceived severity (the perceived level of injury of contracting malaria during pregnancy), perceived benefits (the perceived benefit of using malaria prevention and

treatment methods), perceived barriers (the perceived barriers to obtaining malaria treatment medicines, and using malaria prevention strategies during pregnancy, including the use of ITNs, insecticide spray, and IPTp), cue to action (pregnant women's behavior in the use of ITNs, insecticide spray and IPTp due to their perceived malaria threat and perceived benefit of malaria prevention methods.), and self-efficacy (the confidence of pregnant Tanzanian women to obtain and use malaria treatment and prevention methods (Roll Back Malaria, 2014).). It should be noted that the development of HBM was influenced by Kurt Lewin, Cognitive Theorist in 1940s, which states that a person's perception determines whether he or she will or will not participate in a given behavior (Poss, 2001).

HBM is useful for health education intervention and is used by various health educations' research; for instance, health intervention study was conducted to study folate (folic acid) intake in pregnant women to prevent neural tube defects or NTDs (Kloeblen & Batish, 1999). Koeblen & Batish indicated that perceived seriousness of NTDs and perceived benefit of folate in pregnant women were predicting factors for pregnant women's intention to permanently adhere to folate intake. HBM was also used for malaria intervention to study why bed net use, chemoprophylaxis, and antenatal care attendance to seek treatment were low in Uganda (Mbonye, Neema, & Magnussen, 2006). Researchers found that pregnant women perceived chemicals in insecticide-treated

bed net as dangerous for fetus when inhaling the chemical, had low perceived efficacy in obtaining bed net as men were the source of income, and a perceived barrier in attending antenatal care from belief that health care workers will mistreat them or will contract HIV from contamination (Mbonye et al., 2006).

To determine the general belief of pregnant women towards malaria risk and treatment, malaria household survey retrieved from agency Demographic Health Survey (DHS) was assessed. Creswell (2013) noted that surveys are valuable in collecting attitudes, opinions, and have ability to establish trends in populations. In this study, HBM was used to examine the motivation factors for Tanzanian pregnant women to seek treatment at antenatal care in order to obtain malaria screening, malaria prevention methods (e.g., bed nets), and malaria treatment. Specifically, HBM was used to evaluate the relationship of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action, and self-efficacy.

Research Questions

The overarching question is as follows: To what extent is the perceived self-efficacy of Tanzania's pregnant women (defined as SES, exposure to mass media regarding malaria risk, knowledge of malaria signs and symptoms, and knowledge of malaria prevention and treatment methods) related to treatment-seeking behavior (as

defined by the percentage of women who received two or more doses SP/Fansidar during antenatal clinic visit).

Research Question 1

Is the SES of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) associated with their malaria treatment-seeking behavior, after controlling for transportation and family responsibility?

H_{01}: There is no association between Tanzanian women's SES (age, educational level, residence, and wealth index) and treatment-seeking behavior, after controlling for transportation and family responsibility.

H_{1a}: There is an association between Tanzanian women's SES (age, educational level, residence and wealth index) and treatment-seeking behavior, after controlling for transportation and family responsibility.

Research Question 2

Is Tanzania pregnant women's malaria media exposure (as defined as exposure of malaria-related messages through radio, Television, billboard, community health workers, and other methods) related to their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{02} - There is no association between Tanzanian pregnant women's malaria-related messages media exposure and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a2} – There is an association between Tanzanian pregnant women's malaria media exposure and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Research Question 3

Is there a relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{03} - There is no relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a3} - There is a relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, transportation, family transportation, and age.

Research Question 4

Is there an association between Tanzanian pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, transportation, family responsibility, and age?

H_{04} – There is no association between Tanzanian pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a4} – There is an association between Tanzanian pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family transportation, and age.

Research Question 5

Is there a relationship between Tanzanian pregnant women's knowledge about malaria in pregnancy preventive methods (as defined as knowledge of ITNs, IPTp, and IRS) and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{05} – There is no relationship between Tanzanian pregnant women's knowledge about malaria prevention methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a5} – There is a relationship between Tanzanian pregnant women's knowledge about malaria prevention methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Nature of Study

This study is secondary data research; the data was obtained from Demographic Health Survey (DHS) for Tanzania HIV/AIDs and the Malaria Indicator Survey (THMIS) 2011-2012. This study examined the relationship between independent variables of (a) SES, (b) malaria media exposure, (c) knowledge of malaria signs and symptoms, (d) perceived seriousness of malaria, and (e) knowledge of malaria prevention methods (e.g. ITN) and dependent variable of treatment-seeking behavior for SP/Fansidar at ANC. Prior to data collection, data access permission was obtained from DHS, and Institutional Review Board (IRB) approval was obtained from Walden University. The primary survey was developed by National Bureau of Statistics (NBS), and sampling was taken from 2002 Population and Housing Census (PHC), which excluded nomadic and institutional population such as persons in prison, barracks, and hotels. The study was conducted between December 2011 and May 2012 in Mainland and Zanzibar Tanzania. Participants in the study were women and men age 15-49 and children less than 15 years of age.

This study used data only from Tanzanian women 15-49 years old Malaria Indicator Survey. This study was a cross-sectional survey of nationally representative

sample of women in Tanzania aged 15–49 years old. Two questionnaires, household and individual questionnaire, were based on MEASURE DHS standard Malaria Indicator Survey questionnaire. Samples were selected from 30 regions of Tanzania in two-stage. First stage included 58 cluster sample points from 2002 Population and Housing Census (PHC). Mainland has 25 regions, of which 30 samples points were taken from Dar es Salaam while 20 sample points were selected in each of the 24 regions. In Zanzibar, 15 sample points were selected in each of five regions. Second-stage used systematic sampling method of households selected. During the data collection process, there were no reported data collection discrepancies nor adverse events.

This study used the quantitative method, a deductive approach, to test an already developed hypothesis to see whether the study could be replicated in another study (Creswell, 2013). In this study, I analyzed the relationship between pregnant Tanzanian women's knowledge of malaria and their treatment-seeking behavior using SPSS version 23. Logistic regression method was used to analyze the data. I assessed the

- relationships between SES (age, educational level, residence, and wealth index) and treatment-seeking behavior;
- relationships between malaria-related messages exposure level and treatment-seeking behaviors;

- relationships between pregnant women's knowledge of malaria signs and symptoms and treatment-seeking behavior;
- relationships between pregnant women's perceived seriousness of malaria and treatment-seeking behavior; and
- relationships between pregnant women's knowledge of malaria in pregnancy preventive methods (ITNs, IPTp, and IRS) and treatment-seeking behavior.

Definitions

Intermittent preventive treatment in pregnancy with Sulfadoxine-Pyrimethamine (IPTp-SP): IPTp-SP is the only drug recommended for IPTp for pregnant women and one of the strategies to prevent the adverse effect of malaria in pregnancy such as maternal anemia and LBW (Andrews, Lynch, Eckert, & Gutman, 2015).

Insecticide-treated bed nets (ITNs) and long-lasting insecticide nets (LLINs): ITNs and LLINs are an important malaria control strategy in Sub-Saharan Africa and are recommended for all individuals at risk of malaria infection to optimize ITN effectiveness (Kateera et al., 2015).

Indoor residual spray (IRS): IRS is an effective insecticidal used to kill malaria's vector mosquitoes such as *A. gambiae* and plays an important role in preventing and controlling malaria in Africa (Haji et al., 2015).

Artemether-lumefantrine (AL): AL was recommended by the WHO because of the *P. falciparum* resistance problem with chloroquine and SP, and AL showed high level of efficacy and good tolerability. As a result, the Tanzania national treatment policy accepted to adopt AL in 2006 as the first-line of treatment for uncomplicated malaria (Kabanywanyi et al., 2010).

LBW: *P. falciparum* infection in pregnancy causes LBW (<2,500 g), which increases infant mortality risk (Walker, Kuile, Menendez, & Ghani, 2014). Maternal anemia and placental insufficiency caused by malaria restricts fetus growth (intrauterine growth retardation), thus LBW outcome occurs that affects development and health of infants at later life (Walther et al., 2010).

Rapid Detection Test (RDT): As global efforts to control malaria through vector control, diagnosis, and treatment, WHO recommended commercial molecular assay kit called Rapid Diagnostic Test (RDT) to detect *P. falciparum*, which is responsible for majority of morbidity and mortality (lower sensitivity to detect other *Plasmodium* sp.) and distinguish from other febrile illness, which prevents the overtreatment of malaria (Wilson, Reller, & Weinstein, 2012). Since WHO recommended testing people suspected of malaria before treatment, RDT use increased globally and millions of malaria cases were averted by year 2015; for instance, about 663 million malaria cases were averted in Sub-Saharan Africa by 2015 (WHO, 2015). Although a microscope is widely used to

detect malaria, the microscope has a few disadvantages such as low sensitivity to detect low malarial parasite load in peripheral blood smear and the need for skilled persons and infrastructure, which are not easily available in rural areas where most malaria cases occur; therefore, the RDT kit compensates for the limitations of the microscope as it can be taken in rural settings and is relatively simple to perform testing (Wilson et al., 2012).

Placental malaria and peripheral malaria: Placental malaria attacks the placenta and can be asymptomatic while still causing problems for both mother and fetus, whereas peripheral malaria is malaria infection that circulates in the blood and causes acute infection with fever (Ibanga et al., 2015). Even after malaria is cleared in peripheral blood, malaria still can reside in placental blood and is significantly associated with maternal anemia, fetal anemia, and LBW (Ibanga et al., 2015).

Febrile malaria: Fever with temperature >37°C in pregnant women is considered febrile malaria and can be detected by RDT, microscopic examination, and polymerase chain reaction (PCR) methods (Kashif et al., 2013).

Fansidar: Fansidar is a brand name for Sufadoxine-pyrimethamine (SP), which an effective and safe anti-malarial medicine when given as intermittent preventive treatment in pregnancy (IPTp) starting second trimester with one month apart; however, coverage remains low in malaria endemic regions of Sub-Saharan Africa (Rassi, Graham, King, Ssekitooleko, Mufubenga, & Gudoi, 2016).

SES: According to Clouston, Yukich, and Anglewicz (2015), social inequalities in malaria endemic countries such as Madagascar prevent poor women and children from acquiring adequate malaria knowledge and use of malaria prevention methods. Education, wealth, and health care access are among some of the socioeconomic factors in Madagascar that affect malaria infection risk. Clouston et al. (2015) found that both mother's education and household wealth strongly influence knowledge about and effort to prevent and treat malaria.

Treatment-seeking behavior: Perception of malaria's cause, symptoms, and treatment methods influence treatment-seeking behavior (Laar, Laar, & Dalinjong, 2013). Treatment-seeking behavior could depend on accessibility and availability of health centers, transportation, cost of treatment, and willingness to seek biomedical treatment versus traditional healing (O'Neill et al., 2015). Because malaria can be asymptomatic in high malaria transmission areas, signs and symptoms cannot predict malaria infection; therefore, screening all pregnant women in these area is important in order to detect early and treat (Tahita et al., 2013). Pregnant women's correct knowledge of malaria and access to health care enable them to seek treatment at health facility in order to receive services, such as malaria screening, uptake of intermittent preventive treatment, usage of insecticide treated bed net, malaria education, treatment if positive. Therefore, treatment-

seeking behavior is an important step for preventing malaria in pregnancy and the adverse outcome.

High malaria transmission area: In high malaria transmission area such as Tanzania and other tropical and sub-tropic regions of Sub-Saharan Africa, *P. falciparum* transmission occurs throughout the year with peak transmission occurring following long and short rainy seasons (Farnert et al., 2014).

Unstable malaria transmission area: In unstable malaria transmission area, *P. falciparum* occurs mainly during rainy season and post rainy season (Alim et al., 2015).

Asymptomatic malaria and anemia: Persons infected with *P. falciparum* in malaria endemic regions such as Tanzania usually show no symptom and thus do no seek treatment (Nzobo, Ngasala & Kihamia, 2015). This asymptomatic nature of *P. falciparum* leads to delay in treatment and allows the parasite to damage the red blood of infected persons, which leads to anemia (Nzobo et al., 2015).

Gravidity: Gravidity is a timing of pregnancy, where first time mothers or primigravid are at higher risk for malaria infection and anemia than multigravid mothers (had multiple pregnancies) who have immunity as result of repeated malaria infection (Ouedraogo et al., 2012); therefore, intermittent preventive treatment and screening pregnant women at ANC even without symptom will highly benefit primigravid women.

Premature birth and infant mortality: Premature birth that occurs before 37 weeks of gestation increases infant mortality risk and as a result about 1.1 million infants die annually in malaria endemic regions around the world (Vogel, Lee, & Souza, 2012).

Diagnostic stage: Detecting malaria at an early stage is necessary as it prevents consequences of malaria infection and further malaria transmission in the community (Golassa, Enweji, Erko, Aseffa, & Sedberg, 2013). Golassa et al. (2013) noted that eliminating malaria infection from a person stops mosquito from biting infected person and transferring it to others. Screening all pregnant women in region of endemic malaria, regardless of symptoms, is vital since not all women are symptomatic. In order to prevent the risk of malaria-related miscarriage, premature birth, maternal anemia, and maternal mortality, especially primigravida who have higher risk, early diagnosis through screening at first trimester is important since women are not given IPTp until the second trimester (Ouedraogo et al., 2012).

Assumptions

This study was based on the following assumptions:

- The theoretical foundation was accurate and reflected the study conducted by Demographic Health Survey;
- Interviews or survey questions accurately measured the construct;
- Participants were willing to participate and answer honestly;

- Sample size was sufficient;
- Statistical test was appropriate; and
- Researchers of primary data applied methods to reduce bias and confounding factors.

The HBM (theoretical framework) is assumed to be an accurate reflection of the cross-sectional study studied. Therefore, the results of this study are limited by the accuracy of the theoretical framework to reflect the pregnant women's perceived health risk towards malaria responding to closed-ended survey questions on malaria.

Scope and Delimitations

This study examined the relationship between knowledge level of malaria among pregnant women in Tanzania and their treatment-seeking behavior. Since characteristics of pregnant women in Tanzania may differ significantly from other African countries, generalization to populations outside of Tanzania may not be valid—even though the knowledge of, and attitudes toward, malaria risk may cross political boundaries. The study delimited to examination of malaria knowledge, respectively, rather than other variables. Only a quantitative perspective was undertaken given the nature of the study and sensitivity of information collected.

Limitations

This study was subject to the following limitations: which corresponded to the shortcomings of the secondary data analyses: (a) the data collected may not have been intended to test the same hypothesis or answer my research questions, (b) important variables for the study may have been missing, and (c) may not have control over what constructs that were measured or how they were measured (Cheng & Phillips, 2014; Greenhoot & Dowsett, 2012). Thus, the quality and reliability of the effect size and conclusions depended on the primary studies' reliability and methods of measurement.

Significance

This study sought to provide clarity about pregnant women's knowledge about malaria infection and preventive measures in Tanzania, and their treatment-seeking behavior, which could help public health workers design effective malaria infection prevention and treatment measures for this population. The results of the study could help establish sustainable malaria education, increase treatment-seeking behaviors among pregnant women, increase the use of available malaria prevention method resources, and spread knowledge about malaria and treatment modalities. The results could be used to enhance treatment-seeking behavior and compliance with the recommended preventive and treatment measures for pregnant women, such as SP, ITNs, and IRS.

This study has implications for social change. The findings could be used to inform policy, which could help increase the use of malaria infection treatment and prevention measures among pregnant women. The findings could help reduce the malaria infection rate and increase the treatment-seeking behavior of pregnant women. Reducing malaria infection rate in pregnancy would reduce the associated maternal anemia and mortality, and LBW, thereby reducing infant mortality risk, economic loss due to medical costs and lost productivity (CDC, 2016a).

Summary

Malaria in pregnancy is still a major public health issue in Sub-Saharan African countries, including Tanzania. The use of insecticide-treated bed nets and intermittent preventive treatment to prevent malaria among pregnant women is low. Barriers to using the available malaria prevention methods include lack of knowledge and misconceptions about malaria infection and methods for prevention and treatment. Other barriers include socioeconomic issues and lack of malaria-related messages to better educate pregnant women about the danger of malaria and prevention strategies. Several studies have been conducted to determine the association between pregnant women's knowledge and their likelihood of participating in malaria prevention practices and seeking treatment. However, clarity about implemented malaria practices and greater understanding about the relationship between knowledge, perceived malaria risk, and treatment-seeking

behavior are lacking in Sub-Saharan countries such as Tanzania. This study sought to determine the association between knowledge about malaria among pregnant women and their treatment-seeking behavior. This finding could help public health professionals implement appropriate and sustainable malaria education for pregnant women in order to prevent malaria infection and its consequences.

In Chapter 1, I covered the following topics: the background of the study, nature of the study, limitation, problem statement, purpose of the study, the theoretical framework, and the implications for social change. In Chapter 2, I will cover these topics: general information about malaria, an overview of malaria prevention strategies from past to present, adverse pregnancy outcomes with malaria infection in Sub-Saharan Africa, risk factors for malaria in pregnancy, malaria treatment for pregnant women, malaria diagnosing methods, and factors that influence pregnant women to seek treatment at antenatal care clinics to prevent and treat malaria. Methodology will be in chapter 3, results in chapter 4, and interpretation of findings in chapter 5.

Chapter 2: Literature Review

Introduction

Malaria is a preventable, mosquito-borne, parasitic disease. Despite its preventability, malaria is still not eliminated. More than 60% of world's population is at risk of malaria infection, making it a significant public health issue (Ndungu et al., 2015). Globally, malaria programs achieved a 17% incidence reduction between 2000 and 2010 by using ITNs) and indoor residual spray (IRS), early diagnosis with rapid diagnostic tests (RDTs), treatment with artemisinin-based combination therapies (ACT), and intermittent preventive treatment in pregnancy (IPTp). However, 174,000,000 fevers due to malaria infection still occurred in Africa alone in 2010 despite these efforts (West et al., 2013). According to West et al. (2013), poor households experienced a greater burden from malaria infection, and a better strategy for this population is needed. Sub-Saharan countries, including Tanzania, bear a greater burden from malaria in part due to the suitable environment for vector mosquitos in this tropical and subtropical climate, the lack of effective malaria treatment, and poor socioeconomic conditions (Korenromp, Hosseini, Newman, & Cibulskis, 2013).

In mainland Tanzania, malaria from *P. falciparum* infection is responsible for 125,000 deaths annually, of which 70,000–80,000 occur in children under 5 years of age, and; accounts for at least one-fifth of all maternal deaths (Mpogoro et al., 2014).

However, the island of Zanzibar has very low malaria prevalence as a result of scaled-up malaria intervention in this area; it is now one of the regions planning to eliminate malaria (Gosoniu, Msengwa, Lengeler, & Vounatsou, 2012). The low malaria prevalence rate in Zanzibar (<1%) is due to successful efforts in controlling *Anopheles gambiae s. s.* and *Anopheles funestus* through application of long-lasting insecticide-treated nets (LLINs) and IRS to 90% of dwellings (Hardy et al., 2015). The rate of coverage of malaria intervention methods in Zanzibar is much higher than that of mainland Tanzania, in that LLINs and IRS coverage was only 61.3% and 1.2%, respectively on the mainland between 2007 and 2008 compared to Zanzibar in the same year (Gosoniu et al., 2012).

Similarly, the coverage for (IPTp) using (SP), which is given after the first trimester to prevent *P. falciparum* in pregnancy, was low on the mainland. According to the HIV/AIDs/Malaria Indicator Survey of 2011/2012, coverage of one and two doses was only 60% and 32% respectively, and the uptake of three doses was only 6% in mainland Tanzania. Mpogoro et al. (2014) added that IPTp uptake was also low, even after a revised policy for SP was introduced in Tanzania in 2013. Because of confusion among health care workers about whether to give two doses or three doses of SP to pregnant women, WHO reviewed seven meta-analysis trials and found that pregnant women who took at least three doses of SP had less placental malaria and LBW than pregnant women who took two doses; there was no difference in serious adverse effect

between the two groups. As a result, WHO updated IPTP-SP in 2012 to at least three doses and recommended that African countries update the policy (WHO, 2014). WHO recommended that SP dose given at each antenatal visit; however, only 32% of pregnant women received at least two doses of SP in Tanzania, which is far less than the 80% coverage goal by 2015 set by Roll Back Malaria program (Mpogoro et al., 2014). Mpogoro et al. (2014) claimed that if a woman visited an ANC but did not receive SP, it was a missed opportunity. Pregnant women are among the most vulnerable for malaria infection.

The most vulnerable individuals are the poor, children under five, pregnant women, and those who live in highland areas, as they have low immunity to malaria (Castro & Fisher, 2012; Kienberger & Hangenlocher, 2014; West et al., 2013). Malaria is transmitted throughout the year in Tanzania, although peak transmission occurs after the two rainy seasons of October to December and March to May (West et al., 2013). Uncomplicated malaria infection from *P. falciparum* occurs in malaria-endemic regions such as Tanzania due to immunity development from repeated exposure; however, children under five who have not yet fully developed immunity and pregnant women who have compromised immunity from pregnancy are considered to be the highest-risk populations for malaria and bear the greatest burden of morbidity and mortality (Laishram et al., 2012). Other at-risk individuals include non-immune individuals

traveling from non-malaria-endemic areas to malaria-endemic areas, people who have immunosuppressed conditions, elderly travelers, and semi-immune travelers who lost some immunity from being away for six months or longer (WHO, 2016a).

The purpose of this study was to examine the association between knowledge of malaria and treatment-seeking behavior among Tanzanian pregnant women. This study examined whether or not pregnant women's knowledge about malaria is an influencing factor for their use of malaria prevention methods such as insecticide-treated bed nets, indoor residual spray, and intermittent preventive treatment. Measuring the association of pregnant women's knowledge and their treatment-seeking behavior for these malaria prevention methods may help provide a better picture of the current knowledge level, thereby helping to find a better strategy to sustain malaria education programs for this population. The following sections will discuss the strategies for conducting the literature review, theoretical framework, Tanzania's demographics and health system, background on malaria, malaria in pregnancy and adverse effect, and predicting factors for pregnant women to visit antenatal care for seeking treatment (e.g., SES).

Search Strategy

To gather literature that supports this study, the following databases were used: Walden University library databases, Google Scholar, PUBMED, PLOS ONE, Malaria Journal. The CDC), and WHO) were sources of critical data. The following keywords

were used: *knowledge of malaria and pregnant women, use of insecticide-treated nets and pregnant women, intermittent preventive treatment in pregnancy, women and perception of malaria, perception providers and intermittent preventive treatment, perception of malaria prevention methods and pregnant women, and adverse effect of malaria and pregnant women, and adverse effect of malaria and fetus.*

Excluded from these reviews was research that is related to malaria in pregnancy and underlying condition, such as HIV. HIV patients are at high risk of malaria infection and HIV and malaria intensify the severity of the disease in each other, in that malaria increases HIV viral load and HIV puts patients at risk of high malaria parasitaemia load and treatment failure (Maganda, Minzi, Kamuhabwa, Ngasala, & Sasi, 2014; Tay, Badu, Mensah, & Gbedema, 2015). Most articles included were published within 5 years and focused on Sub-Saharan Africa; however, articles older 5 five years and some malaria endemic regions from Asia were included if they were relevant and provided background and context for understanding the disease and its prevention. All articles were from peer-reviewed journals or government organizations.

Theoretical Framework

The theoretical framework for this study was HBM, which is guided by six constructs: (a) perceived susceptibility to particular disease, (b) perceived seriousness of disease, (c) perceived benefit to taking health action, (d) perceived barrier to taking

action, (e) cues to action (readiness to take action), and (f) self-efficacy (Glanz, Rimer, & Viswanth, 2008). HBM is a study of behavioral change that was originally developed in 1950s by social psychologists in the United States Public Health Services to explain why people fail to participate in programs to prevent and detect disease, and later included the study of people's response to symptoms by Kirscht in1974 and adherence of treatment by Becker in1974 (Glanz et al., 2008). Many disciplines showed that influencing behavioral change is difficult; as a result, programs such as health promotion programs improve the environment where people live to help enable behavioral change at an individual level (Shumaker, Ockene, & Riekert, 2009). HBM is widely used by different professions (e.g., nurses, dentist, public health) to study behavioral change and maintenance of behavior (Glanz et al., 2008).

Because HBM is based on the belief that people are more likely willing to avoid illness if they believe their specific action will prevent illness, HBM was applied to study perceived need for bed net use after malaria transmission was drastically reduced in Zanzibar, Tanzania through aggressive malaria intervention (Beer et al., 2012). Beer et al. (2012) indicated that most people had a positive attitude towards using bed net in Zanzibar; however, perceived low mosquito density and low malaria risk in dry season caused inconsistency in bed net use. Sustaining bed net use is important in order to maintain the currently low malaria transmission rate of Zanzibar (Beer et al., 2012).

HBM is also valuable for malaria research to study behavioral change towards malaria and its preventive measures and treatments, use of insecticide-treated bed nets (ITN), intermittent preventive treatment for pregnant women (IPTp), indoor residual spray (IRS), and timely malaria treatment for children under 5 years of age with fever (Roll Back Malaria, 2014). Similarly, HBM is useful for this study to find whether there is a relationship between Tanzanian women's SES, knowledge of malaria and preventive methods, malaria media exposure, perceived malaria risk, and treatment-seeking behavior at antenatal care clinics. Finding the predicting factors will assist malaria programs implement sustainable malaria education for pregnant women and find appropriate strategies to enable and motivate pregnant women to utilize malaria treatments and preventive methods. To determine the general attitude of pregnant women towards malaria risk and antenatal care visit for treatment, a malaria household survey retrieved from agency Demographic Health Survey (DHS) was utilized for this study. The next section will discuss demographic of Tanzania.

Demographic, Political, and Cultural Background of Tanzania

The United Republic of Tanzania (referred as Tanzania) is the largest country in the East Africa, with an average life expectancy of 51 and child fertility rate of 5.4% (Kruk et al., 2014). Tanzania is found between latitude 1° and 12° south and longitude 29° and 40° east, with an area of approximately 945,203 km^2, including bodies of water

(Hagenlocher & Castro, 2015). The United Republic of Tanzania is a union of two formally sovereign African states, the Republic of Tanganyika and the People's Republic of Zanzibar (Katunda & Kumburu, 2015). The United Republic of Tanzania formed in 1964 after Tanganyika, now known as mainland Tanzania, became independent in 1961, and the island Zanzibar became independent in 1963 (National Bureau of Statistics [NBS] and Office of Chief Government Statistician [OCGS], 2013). According to the population and housing census, as of 2012, the population of Tanzania is 44,928,923, of which 43,625,354 live on the mainland and 1,303,569 in Zanzibar (NBS & OCGS, 2013). Bimodal rains (the two rainy seasons) occur between October and December, and March and May over the northern coast, northeastern highlands, Lake Victoria basin, and the islands Unguja and Pemba of Zanzibar; whereas a unimodal rain occurs between November/December and April over southern, southwestern, central and western areas of the country (NBS, 2014).

Tanzania lies on the coast of the Indian Ocean, and neighboring countries include Uganda, Kenya, Rwanda, Burundi, Democratic Republic of Congo, Zambia, Malawi, and Mozambique (NBS & OCGS, 2013). Tanzania is the home to the famous Lake Victoria and Lake Tanganyika and the tallest mountain in Africa, Kilimanjaro (Otiso, 2013). The official languages are Kiswahili (also called Swahili) and English, but many also speak Arabic and several other indigenous languages (Constititutionnet.org, 2014). Agriculture

(70%) is central to the economy for Tanzania, as the majority of population lives in rural areas; agriculture produces 25% of the gross domestic product (GDP) (NBS, 2014). Swahili is the first official language of Tanzania and is used as a language of operation and in primary schools, whereas English is the second language and is used in higher courts as well as secondary and tertiary education (Reuter-Jahn, 2015). More than 130 indigenous ethnic groups live in Tanzania, and most people practice Christianity, Islam, and various African traditional religions; however, none of the ethnic groups are dominant, which explains why Tanzania is one of Africa's most politically stable countries (Otiso, 2013).

Tanzania has enjoyed political stability since independence and economic growth of 6.7% per year GDP increase, from US $277 in 2003 to US $414 in 2007, and is substantially invested in health reforms and decentralized the entire public sector (WHO, 2009). Because of this investment in health programs, Tanzania drastically reduced the child mortality rate after the first month of life, which has declined over 8% per year during the last decade, with most lives saved from programs around vaccines (12,500), malaria (9,300), and HIV/AIDS (5,800); as a result, Millennium Development Goal 4 (MDG4) of reducing child mortality was met (WHO, 2016b). However, maternal and neonatal mortality rate did not reduce significantly, and as a result 40% of newborn deaths annually and about 3,300 maternal deaths annually occur, mostly (70%) associated

with skilled care at birth (WHO, 2016b). Maternal mortality is high primarily because only 50% of women in the United Republic of Tanzania (UTR) deliver babies in health facilities, and only 13% of health facilities have the basic equipment and supplies for delivery (WHO, 2009).

About 56% of the 287,000 maternal deaths worldwide in 2010 occurred in Sub-Saharan Africa; Tanzania has a maternal mortality rate of 460 per 100,000 live births, which is similar to other Sub-Saharan African countries. Therefore, MDG5 of reducing maternal mortality by 75% between 1990 and 2015 was not met in Tanzania and other Sub-Saharan countries (Kruk et al., 2014). Therefore, a lot more work is required to improve medical infrastructure and health conditions, even though Tanzania has improved the health of its population through health reforms and a reduction of child mortality.

Background of Malaria

Malaria is from the Italian word meaning “bad air,” as malaria was believed to come from swampy areas in ancient Rome (Ferroni, Jefferson, & Gachelin, 2012). Although malaria was recognized and treated since ancient times, the contemporary understanding of malaria began with the discovery of the parasite in the blood of a patient by a French army surgeon named Charles Louis Alphones Laveran stationed in Algeria in

1880, and the discovery of the mosquito as transmitter of malaria by a British officer named Ronald Ross in 1897 (CDC, 2015a).

Malaria is caused by Apicomplexan parasite from *Plasmodium falciparum* (*P. falciparum*), which is the species responsible for most of the morbidity and mortality associated with the disease (Riglar et al., 2011). Apicomplexa parasites are obligate intracellular parasites that cause various serious diseases such as malaria and toxoplasmosis. They have the unique mechanism of host cell invasion through tight interaction between host cell and parasite surface called moving junction (Lamarque et al., 2011; Riglar et al., 2011). Malaria is transmitted through the bite of an infected female *Anopheles* mosquito, which occurs mainly between dusk and dawn and has an incubation period of seven days or longer before acute febrile malaria illness occurs (WHO, 2016a). Many *Plasmodium* species are identified that infect various vertebrates; however, only *P. falciparum, P. malariae, P. ovale, P. vivax, and P. knowlesi* are known to infect humans in tropical and subtropical parts of developing countries of the world (Nair et al., 2016). The temperature and rainfall in tropical and subtropical parts of the world provide a suitable environment for the spread of the malaria parasite (Karunaweera, Galappaththy, & Wirth, 2014).

P. falciparum is the most deadly form of malaria, especially to children under five years old (Chan, Fowkes, & Beeson, 2014). Pregnant women are also at increased risk of

P. falciparum infection. With 125,000,000 million pregnancies at risk of malaria worldwide, 32,000,000 are at risk of *P. falciparum*, and 40,000,000 are at risk of *P. vivax* infection; however, *P. falciparum* invades all stages of erythrocytes, causing heavy parasitimea and progressing to more severe malaria such as cerebral malaria, metabolic acidosis, respiratory distress, and severe anemia, as opposed to *P. vivax* which invades only young erythrocytes (McLean, Ataide, Simpson, Beenson, & Fowkes, 2015).

The malaria parasite goes through various stages of its life cycle from the mosquito vector to the human victim. Infected female Anopheles mosquitos, which do not suffer from the parasite, inject the sporozoite stage to humans when they bite. The sporozoite goes to the liver of humans to mature before entering the blood stream to infect red blood cells, where it matures to the merozoites stage, rupturing and destroying red blood cells (CDC, 2013). The gametocytes stage is picked up by mosquitos from humans during blood feeding and matures in the mosquitos' gut to the sporozoite stage, then travels to saliva of mosquito; the life cycle begins again when the mosquito bites a human (CDC, 2013).

Clinical symptoms occur during ongoing asexual multiplication of the parasite in red blood cells (Chan et al., 2014). Although it is not fully understood why a small portion (1-3%) of *P. falciparum* progresses to severe or fetal malaria while others lead to asymptomatic or uncomplicated malaria in high malaria transmission areas among local

residents, innate immune recognition of *P. falciparum* and release of cytokines in response to the infection are known to be the factors for both clearance and severity of the disease (Apinjoh et al., 2013). Symptoms of febrile malaria infection include fever, sweating, shivering, vomiting, and severe headache (Choge et al., 2014).

P. falciparum is the predominant species in the world, followed by *P. malaria,* which is found in South America, Asia, and Africa; *P. ovale* and *P. vivax* overlap and are found in Sub-Saharan Africa and other areas; and *P. knowlesi* is found in Southeast Asia (CDC, 2015b). The understanding of malaria parasite and its vector have led to malaria control efforts and research in the modern day.

Malaria Control Efforts in the Past

The malaria eradication program proposed by the World Health Organization in the 1950s (1955-1978) using dichloro-diphenyl-trichloroethane (DDT) as a household spray eliminated the Anopheles mosquito in temperate and seasonal malaria transmission areas and reduced mosquito in India, Sri Lanka, Afghanistan, Haiti, and Nicaragua; however, most Sub-Saharan African countries were excluded from the malaria eradication program project (CDC, 2016b). DDT was discovered in 1939 as potent insecticide agent (Karunaweera, Galappaththy, & Wirth, 2014). Malaria eradication efforts carried out by the Garki Project in Nigeria only, among Sub-Saharan countries, failed to eradicate malaria (Molineaux & Gramiccia, 1980). In Greece, the Anopheles

mosquito reappeared shortly after the application of DDT, showing that a time limit was important (with maximum of five years), as mosquitos develop resistance to DDT over time; thus, the World Health Organization national malaria eradication program of the 1950s was implemented in four phases: the preparation phase; the attack phase; the consolidation phase, for surveillance and mapping, to award the country as malaria-free if malaria did not reappear for three years; and the maintenance phase, to prevent malaria from reemerging (Karunaweera et al., 2014). Today, malaria is mainly found in tropical and sub-tropical areas and below 1,500 m altitude, although malaria was endemic in most of North America, Europe, and parts of Northern Asia (CDC, 2013). Unfortunately, the malaria eradication program in the 1950s was not able to eradicate malaria in all parts of the world, and malaria is still a major public health issue in tropical and sub-tropical areas of Asia, Africa, and Latin America.

Current Malaria Control Efforts

A great effort is needed to eradicate malaria worldwide and there is a long way to go to achieve malaria eradication. Recent success in malaria reduction showed some hope that malaria might be eliminated or at least minimized to low level. According to the World Malaria Report 2015, malaria intervention methods using insecticide-treated bed nets, indoor residual spray, and antimalarial treatments dramatically reduced malaria incidents by up to 18%, although many malaria cases are still reported, with most cases

being in the African region (88%), followed by 10 % in the Southeast Asian region, and 2% in Eastern Mediterranean region (WHO, 2015).

Currently, nine of 97 countries with malaria transmission are in the malaria elimination phase, 10 are in pre-elimination, seven are in prevention of re-introduction of malaria, and the rest are in the malaria control phase (WHO, 2016b). Of these 97 malaria transmission countries, 47 malaria-endemic countries are in Africa (Omumbo et al., 2013). Because 55 countries are on track for achieving 75% malaria reduction between 2000 and 2015 as a result of malaria intervention, the Global Technical Strategy (GTS) for malaria 2016-2030 was approved by the World Health Assembly in May 2015, and its implementation action frame work called Action and Investment to Defeat Malaria (AIM) was approved by Roll Back Malaria (RBM) in the same month to control malaria (Gueye et al., 2016). Gueye et al. noted that vector control is the main malaria programs' strategy of controlling and ultimately eliminating malaria using indoor residual spray (IRS) and long lasting insecticide-treated nets (LLITNs).

Malaria Diagnosis Methods

Malaria symptoms such as fever, weakness, sweating, shivering, vomiting, and diarrhea can resemble other illness; therefore, accurate diagnosis using detection methods is important to prevent misdiagnosis and overtreatment of malaria (Afrane, Zhou, Githeko, Yan, 2013; Choge et al., 2014; Ewing et al., 2015). In addition, prompt

treatment is highly essential, especially for acute infection with *P. falciparum,* as it could be deadly if not treated within 24 hours (WHO, 2015). Furthermore, asymptomatic *P. falciparum* infection in pregnancy, which occurs in stable malaria transmission areas such as Tanzania, can go unnoticed but still cause problem for both mother and fetus (Agomo & Oyibo, 2013). This indicates the benefits of screening and testing pregnant women as part of ANC visits.

Choge et al. (2014) noted that using fever as basis for therapeutic care leads to overestimation of malaria with fever presence and underestimation of anemia with fever absence; thus, accurate diagnosis is important. Quality-assured microscope examination of a Giemsa-stained blood smear detecting the malaria parasite is the gold standard in malaria diagnosis; however, it requires trained technicians, basic infrastructure, and quality equipment and reagent, which may not be readily available in rural settings (Visser et al., 2015). In addition, microscopes have limitations for detecting low parasitemia, especially in pregnant women with low-density parasite and *P. falciparum* infection of placenta that may be absent in peripheral blood (Mayor et al., 2012).

An antigenic test introduced in the 1990s called the rapid diagnostic test (RDT) does not require intensive training, can be taken to rural settings, is low-cost, and gives immediate results (15 to 30 minutes), unlike molecular testing with polymerase chain reaction (PCR) and a microscope (Visser et al., 2015). RDT is also a cost-effective

intervention method compared to microscopic and molecular testing in low-malaria transmission areas of Asian countries such as Afghanistan, where 90% of malaria infection are due to *P. vivax* and the rest are *P. falciparum,* since RDT detects both (Hansen et al., 2015). Although PCR has the highest sensitivity and specificity, and as result detects low parasite density, it is not readily available to low income countries because of its high cost (Mayor et al., 2012). Therefore, WHO recommended that all malaria-endemic countries use RDT for febrile patients to diagnosis first and treat if positive (Bisoffi et al., 2013; Visser et al., 2015).

Malaria Treatment Methods

Malaria has been recognized as a cause of fever and treated since ancient times. The ancient Chinese used Qinghao, now known as artemisinin, for fever, and it is still an effective antimalarial medicine; bark from the Cinchona tree, now known as quinine, was used for fever by indigenous Indian tribes in Peru and is still an effective anti-malaria medicine (CDC, 2016b). Other antimalarial medicines are developed based on the understanding of the malaria parasite life cycle, in that medicines target parasite stages such gametocyte and sporozote in the blood and liver (Delves et al., 2012). For instance, Delves et al. noted that artemisinin, artemisinin-combination therapies (ACT), methylene blue, and pimaquine work on reducing the gametocyte stage in the blood. Some antimalarials are administered singly while others work effectively in combination with

other medicines. These drugs include lumefantrine, dihydorartemisinin, sulphadoxine, pyrimethamine, piperaquine phosphate, and sulphamethoxypridaxine, among others (Chikowe, Osei-Safo, Harrisson, Konadu, & Addae-Mensah, 2015).

Although anti-malarial medicines reduced *P. falciparum* in Sub-Saharan Africa from 44% to 22%, an emerging strain of *P. falciparum* that is resistant to the previous first-line treatment with choloroquine or sulphadoxine-pyrimethamine (SP) caused challenges for malaria management efforts; as a result, the World Health Organization (WHO) recommended artemisinin-combination therapies (ACT) such as artemether-lumefantrine (AR-LU) as first line of treatment for uncomplicated *P. falciparum* malaria, and many countries including Tanzania and Ghana have already implemented this new policy (Abokyi et al., 2013). The benefit of malarial medicines must outweigh the side effects, especially for pregnant women and that of unborn child who are more vulnerable to adverse effect of medicine if malaria in pregnancy treatment guideline is not followed properly.

Anti-Malarial Medicines for Pregnant Women

SP is recommended for (IPTp) by the WHO, as it is effective to prevent malaria and safe and easy to administer (Onwujekwe et al., 2013). SP improves birth outcomes by helping prevent malaria infection in pregnancy and its consequences such as maternal anemia, stillbirth, preterm delivery, and maternal anemia (Mace et al., 2015). SP clears

submicroscopic (low parasitemia density) in asymptomatic women with *P. falciparum*; however, it does not protect from new infection during pregnancy since *P. falciparum* resistance to SP is documented (Cohee et al., 2014). Because of increasing *P. falciparum* resistance to SP, WHO guidelines recommended quinine for malaria treatment in the first trimester, and artemether-lumefantrine (ALu) in second and third trimesters (Kalilani-Phirl et al., 2013; Riley et al., 2016). Artemisinin is given as treatment for malaria in pregnancy; however, it must be administered after the first trimester Mutagonda, Kamuhabwa, Massawe, and Mpembeni (2012). Mutagonda et al. indicated that artemisinin interferes with the development of red blood cells in animal experiments and affects early fetal development if given in the first trimester. As a result, the risk of miscarriage increases when artemisinin given in the first trimester (Dellicour et al., 2015). A study conducted by Mutabingwa et al. (2009) supported these studies. Artemisinin did not increase adverse pregnancy outcomes if given after the first trimester (Mutabingwa et al., 2009).

Even when malaria case management is implemented, challenges arise for following the guidelines closely. In a study conducted by Riley et al. (2016), correct case management was observed only in 31% of women with no significant difference across healthcare provider types (health facilities and drug stores). In malaria-endemic regions, offering a pregnancy test to all child-bearing-aged women before prescribing malaria

medicine is important to make sure women in the first trimester are not exposed to AL, which is harmful to fetus at this stage, and to make sure SP is given for intermittent preventive treatment, not treatment of acute malaria. Riley et al. (2016) pointed out that the challenges are due in part to socio-cultural factors that influence both a woman's willingness to disclose pregnancy status and a provider's willingness to ask, and lack of adequate providers' awareness of the safety and appropriate medicines to prescribe in different gestational stages. This study stressed the importance of continuous provider training on the update of case management in pregnancy and outreach programs to educate women about the importance of sharing pregnancy status (Riley et al., 2016). Overall, these studies showed that effective malaria prevention and treatments for pregnant women are available; however, it is important to follow guidelines closely both to prevent malaria in pregnancy and prevent the adverse impact of anti-malarial medicines.

Epidemiology of Malaria in Tanzania

Mainland Tanzania

Malaria is a major public health issue with transmission occurring in all parts of Tanzania; it accounts for 39.4% of outpatients and 33.4% of hospital admissions among children under five years old, and 48% of outpatients and 42.1% of hospital admissions among children above five years old, as well as one third of deaths among all age groups

of children and one-fifth of deaths among pregnant women (Kinunghi et al., 2010). Most malaria cases and deaths occur in rural areas since effective diagnostic and treatment measures are located farther away in urban areas, and rural areas lack an appropriate channel for malaria education (Mazigo et al., 2010). A 25-year longitudinal study showed that malaria has declined in Tanzania and other African countries since 1980; however, malaria remains a major public health issue in Tanzania and other African countries (Farner et al., 2014).

Malaria occurs in all parts of Tanzania, although endemicity varies, and there are stable and unstable malaria transmission areas. Unstable malaria transmission areas, with a transmission rate of no more than three months of the year, are found in the northern and southern highlands and arid areas of central Tanzania with altitude up to 2000 meters above sea level, which accounts 25% of the Tanzanian population (Kinung'hi et al., 2010). Stable malaria transmission occurs throughout the year with peaks after the two rainy seasons of October to December and March to May in areas below 1,500 meters above sea level, such Mulebu district and Misungwi district of Kagera region, in northwest Tanzania (Mosha, Chilongola, Ndeserua, Mwingira, & Genton, 2014; West et al., 2013). However, both stable and unstable malaria transmission areas are prone to epidemics as a result of climate change, population movement, unusually heavy El Niño

rains, lack of anti-malarial drugs or effective drugs, low SES, changes in land use patterns, and vector dynamics (Kinung'hi et al., 2010).

Although both the mainland and Zanzibar are at risk for malaria, the prevalence rate differs. Malaria prevalence is still high on the mainland as discussed above. As a result, a malaria control program has been implemented on the mainland in collaboration with President's Malaria Initiative (PMI) using insecticide-treated bed nets (ITNs) distributed through ANCs, indoor residual spray (IRS), intermittent preventive treatment using sulfadoxine-pyrimethamine (IPTp-SP), prompt case management (diagnosis and treatment of pregnant women), epidemic surveillance and response, and monitoring and evaluation (President's Malaria Initiative [PMI], 2015).

Zanzibar Tanzania

Zanzibar Tanzania achieved dramatic malaria reduction, from >25% in 2005 to <1% in 2010, after a Scaled-Up Malaria intervention: a pre-elimination program implemented using indoor residual spray (IRS), distribution of long-lasting insecticide nets (LLINs), use of rapid diagnostic testing (RDT) and case management with artemisinin-based combination therapy (ACT), and rigorous malaria surveillance (Haji et al., 2015). Due to the low malaria prevalence, IPTp-SP is no longer part of the policy in Zanzibar; instead, diagnosis and treatment of pregnant women is recommended under the revised policy (President's Malaria Initiative [PMI], 2015). Before the Scaled-Up Malaria

intervention in Zanzibar, malaria accounted for more than 50% of inpatient cases and deaths, and about 40% of all outpatient cases, from 2004 to 2005 (Aragawi et al., 2011). Haji et al. noted that IRS efficacy was ≥80% on mosquito mortality after 24 hours of exposure on a sprayed surface. Despite these positive results, Zanzibar still has to maintain malaria intervention consistently since insecticide resistance has been documented, and the perception of low malaria risk may lead people to relax their use of bed nets (Haji et al., 2015).

Malaria in Pregnancy

Although adults in malaria-endemic regions are semi-immune to malaria from repeated exposure, pregnant women are at increased risk because they lose immunity due to pregnancy and malaria has new organ (the placenta) to which to bind; dangers include LBW (<2,500 g or <5.5 lb) delivery and maternal anemia (CDC, 2015c). Over 30,000,000 women are exposed to malaria in pregnancy annually in high malaria transmission areas of Africa (Huynh et al., 2011). Malaria infection causes 10,000 maternal deaths and 75,000 to 200,000 infant deaths per year occur in Sub-Saharan Africa (Scott et al., 2014). In Tanzania, about 1.7 million pregnant women are infected with malaria each year (Gross, Alba, Schellenberg, Kessy, Mayumanu, & Obrist, 2011).

Because of high malaria burden during pregnancy for women in stable malaria transmission areas such as Tanzania, the World Health Organization (WHO)

recommended at least two doses of sulfadoxine (500mg) and pyrimethamine (25mg) as intermittent preventive therapy in pregnancy (IPTp-SP) given during the second and third trimesters (Mutagonda, Kamuhabwa, Massawe, & Mpembeni, 2012). Tanzania adopted the standard of two doses of IPTp in 2000 to prevent malaria in pregnancy (Kibusi, Kimunai, & Hines, 2015). However, there is concern about increasing SP resistant *P. falciparum* (Bertin, Briand, & Deloron, 2011). Bertin et al. (2011) conducted research to compare SP and mefloquine (an alternative medicine for intermittent preventive treatment) to see whether SP is still effective to prevent malaria in pregnancy. This study showed that there was no difference between SP and mefloquine, and SP is still effective when given as intermittent preventive treatment (Bertin et al., 2011). Despite the availability of effective malaria prevention measures using IPTp-SP, insecticide-treated bed nets (ITNs), and indoor residual spray (IRS), many women are still not reached with these measures and bear the burden of LBW delivery and maternal anemia risks (WHO, 2013). The next section will examine the adverse outcome of malaria in pregnancy.

Outcome of Pregnancy with Malaria

Several studies reported the association between malaria in pregnancy and maternal anemia, LBW, abortion, intra-uterine growth retardation (IUGR), preterm delivery (<37 weeks), and stillbirth (Borgella et al., 2013; De Beaudrap et al., 2013; Huynh et al., 2011). A study conducted in Nigeria that included 330 pregnant women as

participants found that placental malaria was strongly associated with LBW (OR 1.01, 95% CI [1.001-1.02], $p = 0.04$) and fetal anemia (OR 1.02, 95% CI [1.01-1.03], $p < 001$); however, no association was found with preterm delivery and maternal anemia when adjusting for parity, maternal age, and use of IPT and ITN (Ibanga et al., 2015). Ibanga et al. indicated that most of participants (63.3%) had tertiary education, and the use of ITN and IPT was high in this study group.

Similarly, 703 women in Malawi were enrolled in a study to examine the effectiveness of IPTp-SP and ITN on birth outcomes (Gutman et al., 2013). In this study, LBW, placental infection, prenatal mortality, and anemia were more common in primigravid than multigravid. Placental infection was high in primigravid (62%, compared to 26% in secundigravid and 16% in multigravid); as result, primigravid had a lower level of hemoglobin than multigravid (10.7 mg/dL vs. 11.2 mg/dL) as well as lower birth weight outcomes (3154 g vs. 3293 g, $p < 0.0001$). The use of ITN was associated with a decreased risk of poor birth outcomes, and uptake of >=2 SP was associated with a reduction of LBW among both primigravid (adjusted PR, 0.67, 95% CI [0.14-3.16) and multigravid (adjusted PR, 0.20, 95% CI [0.06-0.64] (Gutman et al., 2013).

In addition, adverse birth outcomes are seen even in asymptomatic pregnant women with lower density malaria parasitaemia. A prospective cross-sectional study

conducted in Nigeria with 250 pregnant women attending an ANC found that 194 (77.6%) had asymptomatic malaria while 227 (90.8%) had placental parasitaemia (Nwali et al., 2014). LBW babies were born to both mothers with asymptomatic malaria and placental parasitaemic mothers ($X2 = 43.70$, $p < 0.001$); however, none of the neonates had anemia (Nwali et al., 2014). Thus, screening all pregnant women at ANCs is important regardless of symptoms.

The association between submicroscopic (low density malaria parasitaemia) was also observed in case-control study conducted in unstable malaria transmission area of central Sudan by Mohammed et al. (2013). In this study, cases involved women who delivered babies <2,500 g and controls were those who delivered >2,500 g babies. Submicroscopic (low density malaria) *P. falciparum* malaria from peripheral blood, placenta, and umbilical cord was detected by polymerase chain reaction (PCR) but not by microscopic slide examination. Significantly higher numbers of the cases than the controls had malaria infections from histological examination of placenta and submicroscopic infection detected by PCR (46 [53.0%] vs. 26 [30.0%], $p = 0.002$). The mean (SD) of birth weight was lower in cases than controls (2,387.2 g vs. 3,319.2 g, $p < 0.001$) (Mohammed et al., 2013). Thus, malaria in pregnancy was significantly associated with LBW outcomes even with submicroscopic malaria infection. The following section will discuss the possible risk factors for malaria infection in pregnancy.

Risk Factors for Malaria in Pregnancy

The risk of *P. falciparum* malaria infection in pregnancy rises with lower educational level, younger age, new mothers (primigravid and secundigravid), early gestational age (first trimester), low knowledge and awareness of malaria, long distance to clinic, and house type that provides easy access to mosquito (Campos et al., 2012; Jäckle et al., 2013; Cisse, Sangare, Louge, Bamba, Bayane, & Guiguemda, 2014; Yadav, Dhiman, Rabha, Saika, & Veer, 2014). A cross-sectional study conducted in Burkina Faso consisting of 579 pregnant women showed that low educational level, parity (primigravidAOR 5.0, 95% CI = [2.5-9.88] and secundigravid [AOR 2.1, 95% CI = [1.2-3.8]), and anemia (AOR 2.1, 95% CI = [1.3-3.5]) were significantly associated with *P. falciparum* malaria infection in pregnancy (Cisse et al., 2014).

Similarly, a study conducted in Gabon, Central Africa, consisting of 1,661 pregnant women showed that age, parity, gestational age, and season were significantly associated with risk of malaria (Jackle et al., 2013). There was a statistically significant difference between primigravid and multigravid (AOR 0.45, CI = [0.30-0.69], $p < 0.001$). Pregnant women attending an ANC in their first trimester had the highest risk of *P. falciparum* compared to the third trimester (AOR 0.66, CI = [0.45-0.97], $p = 0.035$). The younger age group (13-17) had higher risk of malaria compared to pregnant women above 17 in this study. Statistically higher malaria prevalence was also observed during

rainy seasons (September to November and February to May) compared to dry seasons (December to January and June to September) in high-risk groups of younger age, primigravid, and first trimester pregnancy (AOR 1.91, CI = [1.39-2.63], $p < 0.001$; Jackle et al., 2013).

A study conducted by Anchang-Kimbi et al. (2015) in the Mount Cameroon area in Africa supported the study of Jackle et al. Anchang-Kimbi et al. (2015) found that in addition to age and gravidity as risk factors, a rainy season with temperature of 18 to 20°C and 88% humidity, and presence of bush and/or standing water around the human population, provided a suitable climate for the mosquito *An. gambiae* to breed and survive; as result, the presence of bush and standing water were determined to be independent risk factors for *P. falciparum* parasitemia in pregnancy (OR 3.3, 95% CI = [1.6-7.0], $p = 0.002$).

Furthermore, a study by Yadav et al. (2014) conducted in Assam, India (northeast India) found that malaria infection prevalence was high among participants who had in low income, lived in bamboo houses (69.2%, compared to 25.5% in Kucha houses), low knowledge and awareness of malaria ($X^2 = 25.5$, $p < 0.0001$), and distance >3 km to health facility ($X^2 = 25.0$, $p < 0.0001$). Unlike the study conducted by Cisse et al. (2014), Yadav et al. (2014) found that education was not significantly associated with malaria occurrence even though low education may lead to low income ($X^2 = 0.008$, $p < 0.93$, RR

= 0.91, 95% CI = [0.57-1.48]). Yadav et al. indicated that improving SES, increasing malaria awareness, and building more clinics near rural area could help reduce the malaria infection rate. In general, these studies supported that low SES, low malaria knowledge and awareness, younger pregnancy age, early gestational age, rainy seasons, and long distance to clinics create higher risk of malaria infection in pregnancy. These risk factors could be the determinant or influencing factors for pregnant women to utilize malaria prevention methods through antenatal care visit, which is examined in the following section.

Treatment-Seeking Behavior at Antenatal Care Visit

Battle et al. (2016) stressed that treatment-seeking behavior is the most important step in obtaining proper treatment, and attendance of antenatal care (ANC) by pregnant women in malaria endemic regions was greater predictor of seeking treatment for malaria or other prenatal care. As a result, pregnant women are recommended to visit ANC in order to obtain vital malaria and other health issue interventions.

WHO recommended at least two doses of intermittent preventive treatment using SP (IPTp-SP), prompt case management malaria infection, and insecticide-treated bed nets (ITN) distribution through antenatal care (ANC) visit; thus, ANC visit may initiate the use of ITN and IPTp-SP and uptake of malaria treatment by pregnant women (Gross et al., 2011; Bouyou-Akotet, Mawili-Mboumba, & Kombila, 2013; Toure et al., 2014).

ANC is instrumental in distributing ITN to pregnant women and ITN is one of the major malaria prevention strategies. A 31% decline in malaria prevalence and 49% reduction in the number of malaria deaths from 2000-2012 were due to ITN use; as a result 39 of 44 malaria endemic-regions in Sub-Saharan Africa distributed free ITN and 34 of these countries distributed ITN through ANC (WHO, 2016c). Similarly, uptake of IPTp-SP was significantly associated with attendance of ANC, which in turn reduces malaria pregnancy (Tonga et al., 2013). These evidences support the importance of pregnant women's ANC visit for malaria prevention and other health issues.

WHO recommended at least four ANC visits during the pregnancy period to avert the estimated 800 maternal deaths daily worldwide due to pregnancy-related complications, where 90% of these deaths occur in Sub-Saharan Africa (Afulani, 2015). ANC visits improve the overall maternal and fetus well being through early intervention and monitoring of diseases and complications (Yeoh, Hornetz, & Dahlui, 2016). In research conducted by WHO, antenatal care visits showed beneficial to both mothers and newborns in reducing LBW, maternal anemia, and other complications with combinations of treatment and prevention of malaria and sexual transmitted infections (STI), management of anemia, vaccination, and nutritional support; however, attendance of at least four ANC is still low in Sub-Saharan Africa (WHO, 2003).

Tanzania adopted four or more ANC visits for pregnant women as recommend by World Health Organization to provide education, counseling, screening, and treatment, although achieving high quality ANC is still a working progress (Nyamtema, Jong, Urassa, Hagen, & Roosmalen, 2012). Visit to an ANC at least once is high across Sub-Saharan Africa, in that 71% of pregnant women visit an ANC at least once while the recommended four or more ANC visits are only 44% (Pell et al., 2013). Although pregnant women's ANC attendance rate is high for only one ANC visit in Sub-Saharan Africa including Tanzania, pregnant women with higher SES (wealth), education, and knowledge of the importance of ANC visit were more likely to attend at least four ANC (Afulani, 2015; Gupta et al., 2014; WHO, 2003). In order to obtain the recommended at least two doses of IPTp, treatment-seeking behavior of pregnant women is important. As such it is important to determine the influencing factors for treatment-seeking behavior, such as pregnant women's knowledge about malaria, knowledge of malaria prevention methods, SES, and malaria media exposures.

Influencing Factors for Treatment-Seeking Behavior

Knowledge About Malaria Among Pregnant Women

Most studies link pregnant women's knowledge of malaria and its preventive measures with a likelihood of using those preventive measures. However, few studies found a significant relationship between knowledge and use of preventive measures.

Iriemenan, Dosunmu, Oyibo, & Fagbenro-Beyioku (2011) found that women with education and knowledge of malaria were more likely to control malaria. Similarly, knowledge was associated with level of education, and low knowledge about malaria was associated with low use of IPTp-SP (Rumisha et al., 2014). Furthermore, Ankomah et al. (2012) conducted a study in Nigeria consisting of 2,348 pregnant women using a multi-stage probability sampling technique and found that only 28.8% (677 pregnant women) owned bed nets. In this study, pregnant women who visited ANCs, perceived malaria as harmful, had correct knowledge of how to prevent malaria, and knew that bed nets prevent malaria were more likely to own bed nets ($p < 0.0001$). However, residence (rural-urban), education, and age were not significantly related to bed net ownership ($p = 0.408$) (Ankomah et al., 2012).

Akaba, Otubu, Agida, and Onafowokan (2013) showed that the educational level of pregnant women was correlated with adequate malaria knowledge, which includes knowledge of asymptomatic nature of *P. falciparum* in some pregnant women; however, knowledge of malaria had no significance in use of malaria preventive method drug during pregnancy. The common finding of these studies is that women who have a strong educational background are more likely to have adequate malaria knowledge and more likely to utilize malaria prevention methods, even though not all women with this knowledge utilize malaria prevention methods. Educational programs to increase malaria

knowledge and awareness of malaria risk factors may help pregnant women utilize the available preventive measures and seek the appropriate treatment. For instance, Roll Back Malaria launched Global Call to Action to increase malaria coverage of intermittent preventive treatment during pregnancy throughout Sub-Saharan Africa by increasing awareness of malaria at every ANC visit (Roll Back Malaria, 2015).

Knowledge about Malaria Prevention Methods in Pregnancy

In a qualitative study conducted by Mutagonda et al. (2012), most pregnant women did not understand the benefit of taking SP although 53.3% of them reported of taking this preventive medicine at ANCs. In the study's interviews, pregnant women expressed that they were given SP by a nurse and asked to swallow it in front of the nurse, but they did not know why they were taking SP. Exavery et al. (2014) found that having been counseled on the danger of malaria in pregnancy early in the pregnancy was strongly associated with uptake of the optimal two doses of SP for IPT, and thus reduced risk of malaria in pregnancy.

A study conducted by Kibusi et al. (2015) showed that being in the age groups 30 to 34 and 35 to 39 and being married or living with a partner was associated with uptake of IPT-SP, compared to the age groups 15 to 29 and those not married or divorced. However, women pregnant for the first or second time were more likely to complete the recommended two doses of SP than those who already had two or more pregnancies

(Kibusi et al., 2015). In addition, most women did not know what drugs they were taking, even though they took SP for intermittent preventive treatment and artemisinin-combination therapy (ACT) for malaria treatment in pregnancy (Onwujkwe, Onwujekwe, & Soremekun, 2013). These studies stressed pregnant women's knowledge and awareness of SP and ACT influenced the uptake of medicines. However, the study by Mutagonda et al. (2012) and Exavery et al. (2014) highlighted that initiation and counseling by healthcare workers strongly influenced the uptake of SP and ACT by pregnant women.

Pregnant women who are better informed about intermittent preventive treatment with SP and treatment with ACT are more likely to uptake. There may be a need for similar research to examine the impact of knowledge of intermittent preventive treatment with SP among healthcare workers and implementation of continuing education for health workers. Also, there may be a need for ANCs to make counseling pregnant women part of routine ANC visits. These studies supported that knowledge about SP and ACT among pregnant women as well as healthcare workers may be an important factor to for initiating the use of intermittent preventive treatment with SP (IPTp-SP), insecticide-treated bed net (ITN), and indoor residual spray (IRS).

Perceived Seriousness of Malaria

Pregnant women who perceive malaria as serious illness are more likely to seek treatment at ANC for uptake of SP for IPTp than those who believe malaria as part of routine pregnancy illness (Kimbi et al., 2014; Onwujekwe, Onwujekwe, & Soremekun, 2013). A cross-sectional study conducted in Nigeria revealed that pregnant women's perceived seriousness of malaria in pregnancy along with social norms to care of malaria influenced treatment-seeking behavior at antenatal care clinics versus traditional medicine (Diala, Pennas, Marin, & Belay, 2013). In this study, Diala et al. (2013) indicated that pregnant women generally in the study area do not seek treatment when they are not feeling ill; as a result, pregnant women did not visit antenatal care to seek treatment for malaria in pregnancy. This could lead to undetected malaria in those with asymptomatic malaria. A similar study conducted in Uganda by Mbonye, Mohamud, & Bagonza (2016) also showed that one of the reasons for not taking SP for IPTp was pregnant women not feeling sick and not seeing the benefit of taking SP, although 96.1% of the 800 women interviewed believed malaria was a dangerous disease in pregnancy. This study indicates that lack of awareness of asymptomatic malaria could cause the low treatment-seeking behavior among pregnant women even though pregnant women perceive malaria as serious disease.

Similar to Mbonye et al. (2016) study, a mixed study conducted in rural area of Southern Mozambique by Boene et al. (2014) indicated that low awareness and perceived

malaria risk was not significantly associated with uptake of SP for IPTp; instead, perceived convenience, the delivery approach, and type of providers were the predicting factors. Boene et al. noted that 58% of the 85 pregnant women interviewed used insecticide-treated bed nets (ITN) and SP for IPTp and did not feel at risk of malaria. Of these 85 pregnant women, 54% of pregnant women perceived malaria in pregnancy as dangerous; however, the majority of women mentioned the adverse effect of malaria on pregnant women and few knew danger of malaria on fetus. The majority of women (76%) accepted SP for IPTp because it was given at health facility. Pregnant women reported that their first preferred malaria prevention method was ITN (62.6%) followed by IPTp (12.5%), and indoor residual spray (IRS) was the third choice. Most of pregnant women perceived malaria as dangerous. Those who did not use malaria prevention methods reported inconvenience to as a factor; for instance, difficulty of hanging ITN prevented some of the pregnant women from using ITN (Boene et al., 2014). Based on these studies, pregnant women's perceived danger of malaria is an important step for using malaria prevention methods and treatments; however, perceived seriousness of malaria alone is not always the predicting factor for using the available methods. In addition to perceived seriousness of malaria, accessibility of these preventive methods (perceived efficacy in accessing these methods) is also an important factor.

SES

The socioeconomic condition of the community has a direct effect on the vulnerability and prevention ability of malaria. Onabanjo & Nwokocha (2012) stated that SES, policy, education, and location (urban vs. rural) had an impact on treatment-seeking behavior among pregnant women, in that those who have access are more likely to utilize the available measure than those who do not have access. A study conducted in Madagascar confirmed this and revealed that women with higher SES were more likely to be tested for malaria and seek artemisinin-combination therapy (ACT) for malaria treatment than those with lower SES, and were also more likely to seek treatment for their child's fever (Clouston, Yukich, & Alglewicz, 2015).

Clouston et al. (2015) noted that poverty was common in Madagascar, and as a result, 20 to 25% of women age 15 to 49 enrolled in the study lack primary schooling. Poverty prevented women from obtaining education and healthcare. Even if healthcare was free, as Clouston et al. (2015) described, distance and funding cut greatly affects the poor. Education was associated with women using antimalarial prevention during pregnancy, however it was not associated with whether their child slept under an insecticide-treated bed net or they sought treatment for their child's fever (Clouston et al., 2015). This study showed that wealth was strongly associated with pregnant women's treatment-seeking behavior for both themselves and their child.

In addition, living in poor housing conditions also increases the susceptibility of the poor to malaria infection risk. For instance, a study conducted in Rwanda showed that families living poor housing such as that with mud walls, open eaves, and an absent ceiling were more likely to have children with malaria (Bizimana, Twarabamenye, & Kienberger, 2015). This indicates that poor housing conditions provide easy access for mosquitos to enter at night. Unfortunately, vulnerable populations in malaria-endemic zones are less likely to seek care as well and have less chance to accessing health facilities, which often have poor infrastructure (Bizimana et al., 2015). Furthermore, those with low SES in rural area may be forced to sell their crops or livestock to cover the cost of medical bill for malaria infection. It is reported that those with poor housing in rural areas could spend on average 25% of their income for malaria medical treatment and could harvest only 40% of crops harvested by a healthy family (Kiiza & Pederson, 2014). Spending a large percentage of their income for medical costs and not being able to harvest adequate amount puts poor households at risk of further shortage of food, and therefore the cycle of poverty, which puts them at further risk of malaria infection.

Moreover, poor households may be less likely to own insecticide-treated bed nets (ITNs) to protect themselves from malaria infection. Dickson, Randell, Kramer, and Shayo (2012) stated that Tanzania has been a leader in implementing policies for distributing ITNs throughout the country and vouchers (discount) for pregnant women in

2004, and later for children as well. However, poor households, especially in rural areas, did not own ITNs as regularly as wealthier households. Living in a large house and owning more land or large livestock in rural area were significantly associated with ownership of ITNs (Dickson et al., 2012). These findings show how poverty puts individuals at risk of malaria infection both directly and indirectly. This highlights the importance of assessing health needs so that resources are allocated to those who need the resources most. Malaria related media exposure could be another strategy to increase pregnant women's knowledge of malaria infection and the benefit of using malaria prevention methods, which is described in the following section.

Malaria Risk Media Exposure among Pregnant Women

Malaria risk media exposure is another useful factor for increasing knowledge and awareness of malaria and the importance of attending ANC for treatment. Social behavioral change communication (SBCC) programs in Tanzania called communication and malaria initiative in Tanzania (COMMIT), found by USAID under President's Malaria Initiative (PMI), launched in 2008 to the increase coverage and use of malaria prevention methods, such as insecticide-treated bed nets (ITN) and intermittent preventive treatment in pregnancy (Riccota et al., 2015). COMMIT included Community Change Agents or CCAs (group talks, public meeting, cultural shows or school events) and Mass Media and Community or M & C (radio, Television, and printed materials) as

communication strategy. In their study, Riccota et al. (2015) showed that CCAs and M & C significantly increased initiation of insecticide-treated bed nets (ITN) use and antenatal care (ANC) visit for IPTp-SP, especially with combination of CCAs and M & C. 2008-2009 survey showed that 77% of those exposed to malaria messages delivered by COMMIT used insecticide-treated bed nets (ITN) for their children the night before the survey compared to only 35% of those not exposed to malaria messages (The Daily Experience, 2014).

Malaria Haikubalki (malaria is not acceptable) campaign was also developed to change people's perception of malaria as part of norm, because of daily occurrence of malaria in Tanzania, to malaria is not acceptable (Vector-works, 2014). Case study showed that Malaria Haikubalki increased exposure of malaria-related messages using radio, films of testimonials about the danger of malaria, and logo and slogans; for instance, percentage of women who reported seeing or hearing the message increased from 10% in 2008 to 40% in 2009 and 60% in 2010 (Vector-works, 2014). As a result the malaria-related messages, women reported that they now perceive malaria as serious disease, not as common illness (Vector-works, 2014). These evidences demonstrated that mass media was significantly associated with increased malaria-related messages exposure in Tanzania and influence women to participate in malaria prevention practices.

Malaria risk media strategy increased awareness of malaria and use of malaria prevention methods in other Sub-Saharan countries as well. For instance, Ankomah et al. (2014) conducted cross-sectional study in Nigeria and found that exposure to mass media was significantly related to use of insecticide treated bed net (ITN) by pregnant women. In this study, listening to radio was significantly associated with use of bed net (OR = 1.56, 95% CI 1.07 to 2.28; $p = 0.02$). Pregnant women who heard of mass media campaign were two times more likely to sleep under bed nets (OR = 1.53, 95% CI 1.07 to 2.17, $p = 0.02$). Pregnant women who had correct knowledge on use of ITN were three times more likely to use be nets compared to those who did not know ITN prevents malaria (OR = 3.15; $p < 0.0001$). In addition, antenatal care (ANC) attendance had significant effect on use of ITN (Ankomah et al., 2014). Similarly, household survey conducted by Adjah and Payayiotou (2014) in Ghana showed that malaria related message through health workers or radio had significant effect on bed net use by children (OR = 1.65; 95% CI = 1.44 to 1.88 and OR = 1.26; 95% CI = 1.12 to 1.42). The findings in these studies indicate that media exposure is beneficial to increase malaria awareness and knowledge, thereby increase the use of malaria prevention methods such as ITN by pregnant women and children to prevent malaria infection.

Overall, behavioral change communication (BCC) to increase malaria-related messages and improve malaria prevention and treatment behavior is a good return on

investment since BCC increased the use of ITN, adherence of artemisinin combination therapy (ACT) for treatment and SP for IPTp, indoor residual spray (IRS) programs' reach of their target coverage levels, promote ANC attendance and IPTp uptake, and quality of care providers give to pregnant women (Koenker et al., 2014). Successful BCC program saves money by helping to decrease malaria transmission and progress to malaria elimination as seen in Zanzibar Tanzania's successful malaria control program that drastically reduced malaria to minimum and reached malaria elimination phase (Koenker et al., 2014). In this study, the influence of malaria media exposure on pregnant women's treatment-seeking behavior will be examined.

Potential Confounding Factors

Based on the previous research, confounding such as age, transportation, and family responsibility may affect the ability and willingness of women to attend ANC to seek malaria treatment. For instance, Anchang-Kimbi et al. (2014) study showed that pregnant women who were younger (≤20) and unmarried were significantly at higher risk for low ANC (ANC) attendance, thereby less likely to comply with the recommended at least four times ANC visit to uptake at least two doses of intermittent preventive treatment in pregnancy using sulphadoxine-pytimethamine (IPTp-SP) to prevent malaria in pregnancy. Similarly, younger than 20 years old pregnant women did not attend the recommended at least four times ANC visit compared to older pregnant women in Diala,

Pennas, Marin, and Belay (2013) study. Diala et al. (2013) also stated that pregnant women in rural area farther away from health facilities reported longer and expensive transportation as the reason for pregnant women's low ANC attendance. Not only the cost of transportation but also the scarcity of transportation service in their areas prevents pregnant women from attending ANC (Munguambe et al., 2016). Health care workers' lack of understanding of transportation issue makes pregnant women anxious when they are late to their appointment, which may farther cause pregnant women avoid ANC visit (Munguambe et al., 2016). Additionally, family and household responsibility causes pregnant women to delay ANC registration and visit (at 20 weeks gestation or later), which leads to missed scheduled ANC visits and prevents them from accessing ANC services that could have helped them prevent malaria in pregnancy and other illnesses (Mubyaz & Bloch, 2014). In order to remove their effect, these potential confounding factors (age, transportation, and family responsibility) found in the dataset are included in the analysis of chapter 4. The analysis is to show whether or not predictor variables still have effect on the criterion variable even after considering the potential confounding variables.

Summary

The research literature reviewed included results of studies conducted using various research paradigms such as quantitative and qualitative methods that are

published in peer-reviewed journals, reports from governmental and non-governmental agencies, and rigorously reviewed and published books. The literature review highlighted the most important factors that influence pregnant women's likelihood of seeking malaria treatment in poor sub-Saharan African countries such as Tanzania; however, some of studies included malaria-endemic regions in Asia. The epidemiology of malaria in pregnancy in Tanzania, risk factor for malaria in pregnancy, malaria prevention methods and diagnosis, and malaria treatment are also discussed. Influencing factors for treatment-seeking behavior at ANC discussed in this chapter are knowledge about malaria infection signs and symptoms and its prevention and treatment methods, perceived seriousness of malaria, malaria media exposure, and SES of pregnant women. Other issues discussed are inconsistencies in providers' delivery of malaria treatment and preventive measures due to mixed implementation of ANC policy and inadequate awareness of the new measures, and poor healthcare infrastructure. Lastly, potential confounding factors considered in the analysis of this study are also described. The following chapter will discuss the research method and design, population and sampling technique, data collection instrument and technique, statistical analysis method used in conducting this research, validity issue, and ethical consideration.

Chapter 3: Methodology

Introduction

The purpose of this quantitative study was to examine the relationship between Tanzania's pregnant women's self-efficacy beliefs (defined as knowledge of malaria) and treatment-seeking behavior. The research questions were formulated based on the HBM). The theory links pregnant women's knowledge of malaria with their treatment-seeking behavior. A component of the theory is the assertion that perceived susceptibility to malaria, which is assumed to include knowledge, potentiates pregnant women's intentions to adhere to malaria prevention methods, which in turn motivates behavior (treatment-seeking behavior). Accordingly, knowledge about malaria signs and symptoms and knowledge about malaria prevention methods may potentiate Tanzanian women's self-efficacy to protect themselves and their unborn children from malaria. The research question examined the relationship between Tanzanian pregnant women's SES, knowledge of malaria signs and symptoms, perceived seriousness of malaria, knowledge about malaria in pregnancy preventive methods, malaria media exposure, and their treatment-seeking behaviors. Five hypotheses were tested to answer research questions.

Research Method and Design

Method

In this study, the cross-sectional design that I incorporated was used as the framework to test the five hypotheses and attempt to answer the research question. Cross-sectional studies are studies that examine the relationships between exposure and outcome prevalence in a defined population at single point in time (Alreck & Settle, 2004; Creswell, 2013; Leedy & Omrod, 2013). Cross-sectional studies are useful for testing hypotheses since they often use the existing data sets collected at a point in time (Creswell, 2013). The advantage of the cross-sectional study is that it includes large number of people in the study and the large number of risk-modifying factors that can be examined. Furthermore, cross-sectional studies are less time-consuming than case-control or cohort studies, inexpensive to conduct, and provides a quick picture of prevalence of exposure and prevalence of the outcome variable. The limitation of cross-sectional study is that temporal relationship between exposure and outcome is difficult to determine since it lacks time element. This means that the intensity and longevity of a risk-modifier may not be fully realized or understood since time is reduced to single dimension.

In this study, a determination of cause and effect was not sought, since risk factors were not manipulated, that is, risk factors are a result of biological and sociological circumstances rather than artificial manipulation. The study was not an ecological study since observational data were defined at the individual level rather than at the population level.

The HBM that guided this study implies that an association is viable between the specified variables. Specifically, HBM suggests that there will be an association between pregnant women's perceived malaria threat to their health and that of their unborn child, their knowledge about malaria and its preventive methods, and their intent to engage in treatment-seeking behavior.

Design

This study used secondary data collected using a cross-sectional survey of nationally representative sample of women, aged 15–49 years, in Tanzania. The primary data was conducted between December 2011 and May 2012 by Demographic Health Survey (DHS) researchers. Cross-sectional refers to the fact that participant responses will be collected at a point in time rather than across multiple time periods (Creswell, 2013). Secondary data collected on the malaria indicator survey (MIS) from which hypothesis were evaluated, included demographic characteristics and closed-ended questions regarding knowledge of malaria and antenatal care behaviors. Closed-ended survey questions reflect the fact that participants were asked to select a response from a series of options (Baron, 1996).

Research Questions and Hypotheses

Research Question 1. Is the SES of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) associated with their malaria

treatment-seeking behavior (as defined by percentage of women who received two or more doses SP/Fansider during ANC visits), after controlling for transportation and family responsibility?

H_{01}*:* There is no association between Tanzanian women's SES (age, educational level, residence, and wealth index) and treatment-seeking behavior, after controlling for transportation and family responsibility.

H_{1a}*:* There is an association between Tanzanian women's SES (age, educational level, residence and wealth index) and treatment-seeking behavior, after controlling for transportation and family responsibility.

Research Question 2. Is pregnant women's malaria media exposure associated with treatment-seeking behavior, after controlling for transportation, family transportation, and age?

H_{02} - There is no association between pregnant women's malaria media exposure and treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a2} – There is an association between pregnant women's malaria media exposure and treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Research Question 3. Is there a relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{03} - There is no relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a3} - There is a relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Research Question 4. Is there an association between pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{04} – There is no association between pregnant women's perception of the seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a4} – There is an association between pregnant women's perception of the seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, and age.

Research Question 5. Is there a relationship between pregnant women's knowledge about malaria in pregnancy preventive methods (as defined as knowledge of mosquito nets, intermittent preventive treatment in pregnancy, and insecticide spray) and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{05} – There is no relationship between pregnant women's knowledge about malaria prevention methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a5} – There is a relationship between pregnant women's knowledge about malaria prevention methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Population and Sampling Technique

This study is secondary data research; the data was obtained from Demographic Health Survey (DHS) for Tanzania HIV/AIDs and the Malaria Indicator Survey (THMIS) 2011-2012. The survey of this study was developed by National Bureau of Statistics (NBS) and sampling was taken from 2002 Population and Housing Census (PHC), which excluded nomadic and institutional population such as persons in prison, barracks, and hotels. To collect data, 90 nurses (48 women and 32 men) were trained for three weeks based on MEASURE DHS training procedure. Trainers were senior staff from NBS and

Office of Chief Government Statistician-Zanzibar (OCGS), NMCP, Inner City Fund (ICF) International, and lab technicians from Muhimbili university of Health and Allied Science (MUHAS) and IFakara Health Institute (IHI). After completing training, data collection took place by 16 field teams, in which each team included one team leader, three female interviewers, two male interviewers, and one driver. Men interviewers interviewed men, and women interviewed women for cultural purpose. Five senior staff members from NBS coordinated and supervised the fieldwork activities. Data collection in Mainland took over five months (16 December 2011 to 24 May 2012), and data collection in Zanzibar took from 16 December 2011 to 10 April 2012.

Participants in the study were women and men age 15-49 and children under 15 years of age. My study only used data from women 15-49. Two questionnaires, household and individual questionnaire, were based on MEASURE DHS standard AIDS Indicator Survey and Malaria Indicator Survey questionnaire. Samples were selected from 30 regions of Tanzania in two-stages. The first stage included 58 cluster sample points from 2002 PHL. Mainland has 25 regions, of which 30 samples points were taken from Dar es Salaam while 20 sample points were selected in each other 24 regions. In Zanzibar, 15 sample points were selected in each of five regions. Second-stage used systematic sampling method of households selected. About 18 households were selected for survey from each sample points for total of sample size of 10,496. Samples were

weighted in data file to make results proportional at national level. All women were ages 15-49 and were either permanent resident or visitors who stayed in the house the night before.

Malaria Indicator Survey questionnaires were adopted to reflect the population and health issues of Tanzania. Questionnaires were written in English and then translated into Kiswahili (official language of Tanzania). Demographics of each person, such as age, sex, education, and relationship to household, household dwelling (e.g., water source, material for houses' floor and roof), and ownership of mosquito nets were collected. Individual questionnaires for eligible women age 15-49 included demographic information such as education, malaria exposure, and knowledge and awareness of malaria (dhsprogram.com, 2016).

From 10,496 households selected for sampling, in both mainland and Zanzibar, 10,226 were found occupied at the time of survey. Total of 10,040 households were successfully interviewed, which gave 98% response rate. From these households interviewed, 11,423 women were eligible for individual interview. A total of 10,967 women completed interviews, which gave 96% response rate (dhsprogram.com, 2016).

This secondary data was used to evaluate the research question, thus no sampling technique was used to extract a sample from the population. This secondary data

represented the population. Specifically, the population consisted of Tanzanian pregnant women age 15-49 between year of 2011 and 2012.

Data Collection

Instruments

Secondary data from the Tanzanian 2011-2012 Malaria Indicator Survey (MIS) were used to evaluate the research question. The Malaria Indicator Survey for Household survey, individual survey, and Women's Questionnaires were used to gather responses from women. Variable codes for questionnaires used to answer each of five research questions for this study are also found in appendix section. The MIS was used to capture participants' demographic characteristics, knowledge of malaria and antenatal care behaviors. The secondary data collected from the Tanzanian 2011-2012 MIS was assumed to be valid and accurate. Three demographic characteristics were used including age, education, and SES.

Data Collection Technique

Data from the Malaria Indicatory Survey 2011-2012 Tanzania, obtained from the Demographic Health Survey (DHS) agency, was used for statistical and descriptive analysis. After communicating with malaria epidemiologist of DHS and requesting permission to access the data, permission was granted. The data is a public domain; however, permission must be granted by DHS and interested person must mention DHS

as source for the research and notify DHS when publishing. Creating a username and pin number on www.dhsprograms.com is required to access data of interest.

After obtaining IRB approval from Walden University, data was extracted using a Mac (OS X 10.9.5) application, followed by SPSS version 23 (SPSS, Chicago) after the file was converted to SPSS data file format. IRB approval number from Walden University for my study is 10-14-16-0181307. DHS did not require IRB approval. It only required data agreement. Data agreement stated not share data with anyone else and to notify publication of the research I conducted with DHS.

Researchers of DHS conducted the primary data from the study participants using the designed questionnaire survey instrument Malaria Indicator Survey (MIS), specifically Malaria Indicator Survey (MIS) Household Survey (Malariasurveys.org, 2013). This secondary data was used for analytical purposes, and to add to the discussion of the established results, showing patterns of ANC attendance to seek malaria treatment, uptake intermittent preventive treatment in pregnancy, and use of insecticide treated bed nets and indoor residual spray. To test the research question and hypotheses, a logistic regression analysis was used. Logistic regression analysis is a statistical technique used to examine the relationship between a single dichotomous criterion variable and either single or multiple predictor variables. The criterion variable used to evaluate the five hypotheses is treatment-seeking behavior and was measured on a continuous scale

representing the number of IPTp-SP that participants received at antenatal care visit. The predictor variables for hypothesis one are age, educational level, residence, and wealth status. For hypothesis two, the predictor variable is malaria media exposure. For hypothesis three and four, the predictor variables are knowledge about malaria signs and symptoms, and perceived seriousness of malaria, respectively. Finally, the predictor variable for the fifth hypothesis is knowledge about malaria in pregnancy preventive methods.

Logistic Regression

The research question and five hypotheses were evaluated using one logistic regression analysis in case of criterion violates normality. Regression analysis is a categorical statistical technique used to examine the relationship between categorical criterion variable and from both continuous and categorical predictor variable (Preissor & Koch, 1997). Treatment-seeking behavior is determined by number of SP/Fansidar for IPTp uptake during ANC visit, which was categorized by low treatment-seeking behavior (0-1 SP/Fansidar) and high treatment-seeking behavior (two or moreSP/Fansidar). Both the predictor and criterion variable are scaled at the continuous level, meaning that a relationship between response options is assumed.

In addition to testing overall model fit with chi square goodness of fit tests and significance of individual predictors with the Wald test, odds ratios can be computed that

determine the odds of being in one of the categories of the criterion variable when a predictor variable score increases by one unit. An odds ratio above 1.0 indicates an increased chance and odds ratios below 1.0 indicate a decreased chance of being in a category of the criterion variable. Logistic regression is sensitive to outliers and multicollinearity between predictors; however, the assumption of normality does not have to be met (Peng & So, 2002).

The prediction equation for a logistic regression with four predictors and no interactions is: $Y' = (e^{A + B1X1 + B2X2 + B3X3 + B4X4})/(1 + e^{A + B1X1 + B2X2 + B2X3 + B4X4})$ (Peng & So, 2002). Significance of a model is determined using Wald's test by calculating a log-likelihood and comparing the model with predictors to the null model using chi square goodness of fit tests (Li, 2014).

Sample Size Estimation and Power Analysis

Study power is the probability of rejecting a false null hypothesis. Adequate power to reject a false null hypothesis is .80 (Keuhl, 2000). Alpha (referred to as α) is defined as how confident one is when rejecting the null hypothesis. There are no formal standards for power (π) or alpha (α). Commonly researchers assess power of their tests using $\pi = 0.80$ and significance using $\alpha = .05$ as a standard for adequacy. These two methods imply a four-to-one trade-off between β-risk and α-risk (β is the probability of a Type II error; α is the probability of a Type I error, 0.2 and 0.05 are conventional values

for β and α) (Ellis, 2010). Effect size, is an estimate measurement of the strength of the relationship between variables as described in Cohen (1988) study (University of Colorado Colorado Springs (UCCS), n. d.). The effect size was characterized by Cohen (1988) as Cohen's *f*: small, medium, and large where each level is associated with a specified effect size. Based on the assumption that the Logistic regression will have 4 predictors (age, educational level, residence, and wealth index), an alpha level of .05, and a power of .80, the minimum sample size for a medium effect (.15) is 85 and a small effect (.02) is 602. Therefore, the sample size of 10,967 from this secondary data is adequate enough to detect both a medium (.15) or a small (.02) sized effect, based on Cohen's *f* (1988) standards. G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) was used to calculate the sample size. The analysis procedure was conducted using the Statistical Package for the Social Sciences (SPSS) software program, Student Version 23.0.

Threats to Validity

External Validity

External validity refers to generalization of the study to population and selection of study design (Ferguson, 2004). This study generalized the results of the study to Tanzanian pregnant women. The data I am using may not have included pregnant women in all areas of Tanzania, which leads to external validity issue. The limitation of using secondary data may be that external validity in the primary study could not be controlled.

Internal Validity

The limitation of secondary data analysis is that internal validity issue from the primary study could not be corrected. Internal validity refers to the confounding factors that could manipulate the independent variable that changed dependent variable, such as selection bias, instrumentation, statistical analysis, and other factors during the study (Cook & Rumrill, 2005). Specific of internal validity detail was discussed in the next chapters.

Ethical Procedures

The 2011-12 Tanzania HIV/AIDS and Malaria Indicator Survey was reviewed and approved by Tanzania's National Institute for Medical Research (NIMR), the Zanzibar Medical Ethics and Research Committee (ZAMREC), the Centers for Disease Control and Prevention in Atlanta, Georgia, USA, and the Institutional Review Board (IRB) of Inner City Fund (ICF) International. The IRB of ICF International complied with the United States Department of Health and Human Services requirements for the "Protection of Human Subjects" (45 CFR 46). Consent forms were obtained from eligible women participants in the household before administering survey questionnaires to show that participation in the study was on voluntary basis and confidential.

Summary

Chapter 3 included the description of study design, research questions and hypothesis, data analysis methods, data source, possible threat to validity issues, and ethical consideration taken by the primary research data. This chapter described sampling method DHS researchers employed for the primary data and the population from which sample was drawn. The rational for selecting statistical analysis for my study were explained. Tanzania 2011-2012 Malaria Indicator Survey is a cross-sectional study. Logistic regression was used to analyze the relationship between the predictor variables and criterion. Permission to access data set and instruments (questionnaires) for the study are included below in appendix section.

Chapter 4 will discuss data analysis and results of the study.

Chapter 4: Results

Introduction

The purpose of this study was to examine the association between Tanzanian pregnant women's SES, malaria media exposure, knowledge of malaria signs and symptoms, perceived seriousness of malaria, and knowledge of malaria prevention methods and their treatment-seeking behavior to uptake the recommended at least two doses of SP/Fansidar at ANC (ANC) to prevent malaria in pregnancy. There were five research questions associated with this study. The research questions and associated null hypothesis are below.

Research Question 1: To what extent is SES of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) associated with their malaria treatment-seeking behavior, after controlling for family responsibility and transportation?

H_{01}: There is no association between Tanzanian women's SES (age, educational level, residence, and wealth index) and treatment-seeking behavior, after controlling for family responsibility and transportation.

H_{1a}: There is an association between Tanzanian women's SES (age, educational level, residence and wealth index) and treatment-seeking behavior, after controlling for transportation and family responsibility.

Research Question 2: To what extent is Tanzanian pregnant women's malaria media exposure related to their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{02} - There is no association between Tanzanian pregnant women's malaria media exposure and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a2} – There is an association between Tanzanian pregnant women's malaria media exposure and treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Research Question 3: Is there a relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{03} - There is no relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a3} - There is a relationship between Tanzanian pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Research Question 4: Is there an association between Tanzanian pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{04} – There is no association between Tanzanian pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a4} – There is an association between Tanzanian pregnant women's perception of the seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, and age.

Research Question 5: Is there a relationship between Tanzanian pregnant women's knowledge about malaria in pregnancy preventive methods (as defined as knowledge of mosquito nets, intermittent preventive treatment

in pregnancy and insecticide spray) and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

H_{05} – There is no relationship between Tanzanian pregnant women's knowledge about malaria preventive methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

H_{a5} – There is a relationship between Tanzanian pregnant women's knowledge about malaria prevention methods and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

In addition to the introduction, there are three sections in this chapter: data collection, results and summary. The data collection chapter will detail the data collection timeframe and a description of the sample. The results section describes the data cleaning and coding process, provides descriptive statistics of the demographic data, and evaluates the statistical assumptions of the statistical tests performed to answer the research questions, in addition to the statistical analysis findings organized by research question. The result of statistical analysis with predictor variables and outcome variable are presented first, then the analysis with addition of potential confounding factors followed to see if the predictor variables still have effect on outcome variable. Finally, the chapter

summary provides a summary of the answers to the research questions and transitions to chapter 5.

Results

Descriptive Statistics

There were 2,431 research participants in the study. Almost a quarter of respondents (23.85%) were between the ages 15-19. Thirty-three percent of respondents were between the ages of 20 and 29, 25.3% were between the ages of 30 and 39, and 17.7% were between the ages of 40 and 49. Most of the respondents lived in a rural setting (81.2%), were married (77.2%), and had a primary education (67.4%). However, respondents were relatively equally distributed across the five wealth categories. Table 2 shows the demographic information for the sample.

Data Preparation

There are three phases in the data analysis process, the data preparation phase, the preliminary analysis phase and the primary analysis phase. During the data preparation phase, the data is checked for error and missing values, and corrected if necessary. This is also the phase where variables are recoded, if necessary, and new variables are computed. In the preliminary analysis phase, tests of parametric assumptions are performed to determine if there are violations and if so, what other alternative analyses should be

conducted. Finally, in the primary analysis phase, statistical tests are performed that answer the research questions of the study.

In this study, descriptive statistics performed on the variables revealed no data errors. However, the variable used to calculate high and low dosages of SP/Fansidar had 16,888 missing values. Therefore, the total sample used for this study was reduced from 19,319 to 2,431. Next, the continuous variable SP/Fansidar dosage was recoded into a new variable, Dosage, where 0 to 1 was low and 2 and higher was high. See Table 1 for coding of variables. Next, total of malaria signs and symptoms that the respondents were aware of was calculated from 18 variables that each represented awareness of a malaria symptom. If the respondent indicated that they were aware of the symptom they received a 1 for that symptom variable. If they did not report awareness of this symptom, they received a 0 for that symptom variable. The 18 malaria symptom variables were then summed together to derive a total malaria signs value. Malaria seriousness was the dichotomous variable calculated from a question that asked, which disease is the most serious in your community. All those who stated malaria received a 1, while all those who stated something else, received a 0. Malaria avoidance was calculated from 25 variables that each captured one action or approach that could be used to prevent malaria. If a respondent noted the action as a means of preventing malaria, then they received a 1 for that variable. If they did not note the action, they received a 0. Malaria avoidance was

the sum of the 1s across each of the 25 variables. Potential confounding factor variables considered for this study (transportation and family responsibility) are also coded. Transportation was a dichotomous variable coded 0 and 1, where 1 was yes if they had either a car, truck, or motorcycle as a means of transportation, and 0 was no transportation. Family responsibility was also a dichotomous variable where 0 represented 0-1 child in the household and 1 represented two or more children in the household. Note that age was considered as potential confounding factor for research question two to five only as age was already the predictor factor in research question one. Table 1 contains the coding for all the variables.

Preliminary Analyses

Preliminary analyses were conducted to evaluate the assumptions of the logistic regression. The assumptions of the logistic regression are linearity and multicollinearity (Field, 2012; Pallant, 2016; Tabachnick & Fidell, 2012). To test for linearity scatterplots were produced for the standardized residuals and the standardized predicted values. If the scatterplot pattern is not curvilinear, then the assumption of linearity has not been violated (Field, 2012; Pallant, 2016; Tabachnick & Fidell, 2012). Results indicated that there was no violation in the assumption of linearity (see Figures 1-9). The variable inflation factor (VIF) values were examined to assess no perfect multicollinearity. According to Field (2012), if the VIF values for any independent variable are 10 or

above, then the assumption of no perfect multicollinearity has been violated. Results of the VIF for each of the independent variables were within the acceptable range, as none were above the numeric threshold of 10. See Table 3. Additionally, the scatterplots of the standardized residual and the standardized predicted values revealed no violation in linearity among any of the independent variables, as there were no curvilinear scatterplot shapes. See Figures one thru nine.

Table 1

Variable Coding

Variable name	Variable type	Variable coding
SP/Fansidar dosage	Categorical	= low, 2+ = high
SES		
Age	Continuous	Age 15-19 = 1, 20-24 = 2, 25-29 = 3, 30-34 = 4, 35-39 = 5, 40-44 = 6, 45-49 = 7
Education	Continuous	0 = no education, 1 = primary, 2 = secondary, 3 = higher
Residence	Categorical	0 = urban, 1 = rural
Wealth	Continuous	1 = poorest, 2 = poorer, 3 = middle, 4 = richer, 5 = richest
Total Awareness of Signs and Symptoms	Continuous	Know different symptoms of malaria, where higher scores = greater awareness 0 = No, 1 = Yes
Malaria Seriousness	Continuous	0 = Malaria not most serious disease 1 = Malaria most serious disease
Malaria Prevention Knowledge	Continuous	Know different ways to avoid malaria, where higher score = greater awareness 0 = No, 1 = Yes
Media Exposure – Prevention	Continuous	Saw/heard any messages about malaria prevention in the past year, where higher score = greater awareness 0 = No 1 = Yes
Media Exposure – Treatment	Continuous	Saw/heard any messages about malaria treatment in the past year, where higher score = greater awareness 0 = No 1 = Yes

Transportation	Dichotomous	0 = No transportation 1 = Yes if had car, truck or motorcycle
Family Responsibility	Dichotomous	0 = 0-1 child 1 = 2 or more children in household

Table 2

Frequencies: Sociodemographic characteristics of the participants included in the study

	N	%
Total number of women	2,431	100%
Age		
15-19	222	9.1%
20-24	541	22.3%
25-29	623	25.6%
30-34	471	19.4%
35-39	371	15.3%
40-44	161	6.6%
45-49	42	1.7%
Types of residence		
Urban	456	18.8%
Rural	1975	81.2%
Marital Status		
Single, never married	158	6.5%
Married	1876	77.2%
Living with partner	203	8.4%

Widowed	32	1.3%
Divorced	121	5.0%
Separated	41	1.7%
Highest Year of School Completed		
No education	452	18.6%
Primary	1638	67.4%
Secondary	336	13.8%
Higher	5	.2%
Wealth Index		
Poorest	426	17.6%
Poorer	492	20.2%
Middle	505	20.8%
Richer	560	23.0%
Richest	448	18.4%
Transportation		
No	2167	91.4%
Yes	203	8.6%
Family Responsibility (number of children)		
0-1	990	40.7%

2-10	1441	59.3%

Table 3

Variable Inflation Factor (VIF): Malaria Treatment-seeking behavior as the Dependent Variable

Independent Variable	VIF
Age	1.0
Residence	1.0
Education	1.0
Wealth	1.0
Media Exposure – Prevention	1.0
Media Exposure – Treatment	1.0
Malaria Signs and Symptoms	1.0
Perceived Seriousness of Malaria	1.0
Malaria Prevention Knowledge	1.0
Transportation	1.0
Family Responsibility	1.0

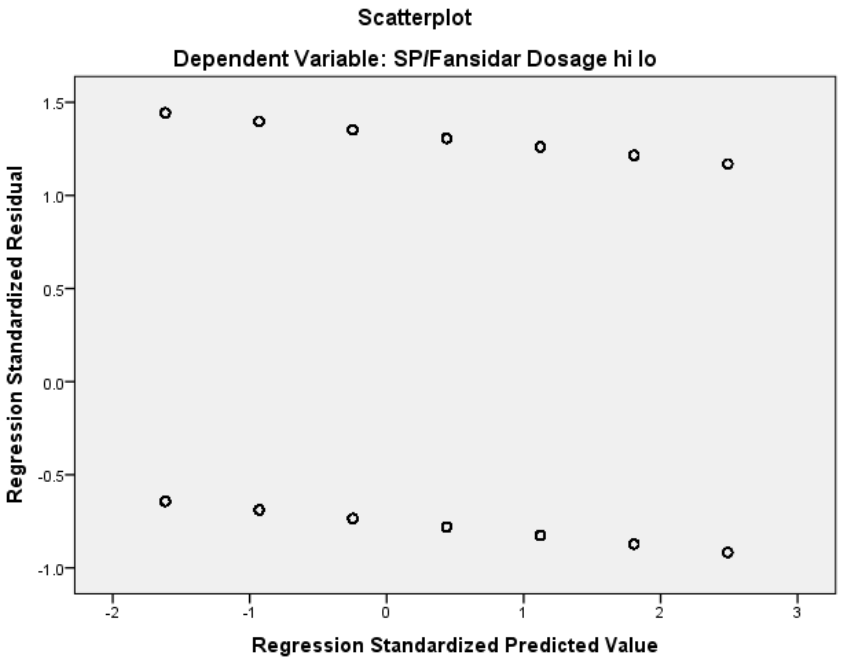

Figure 1: Age scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

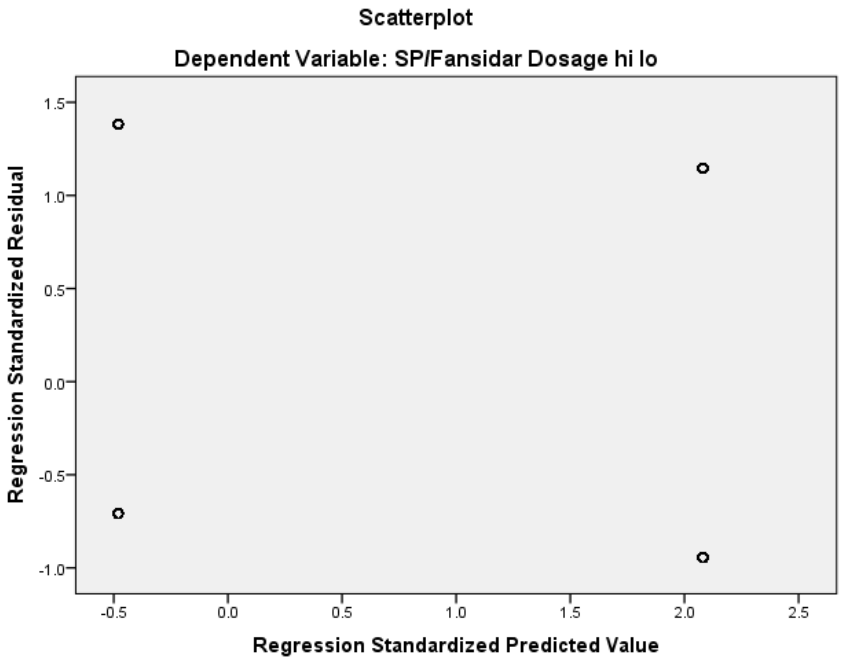

Figure 2: Residence scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

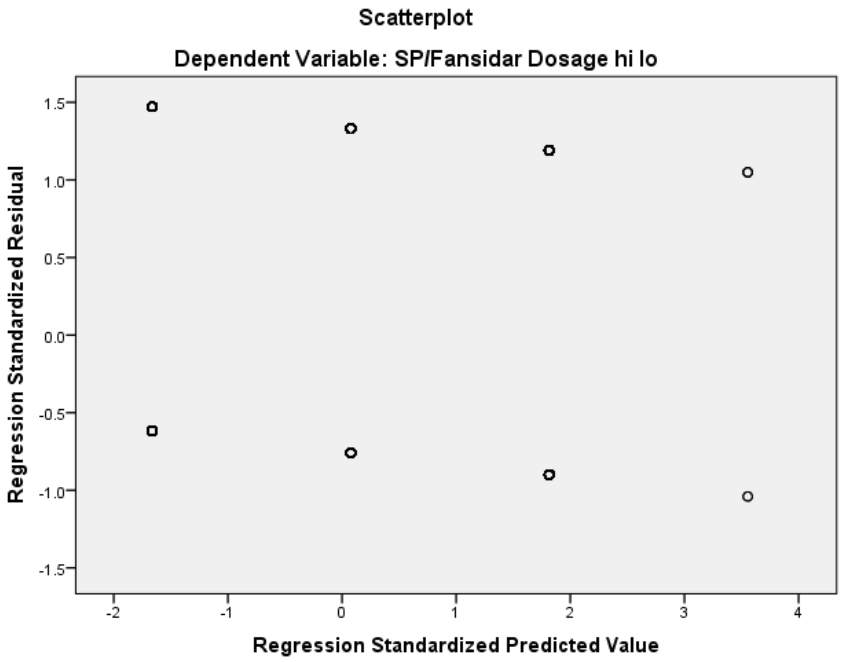

Figure 3: Education scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

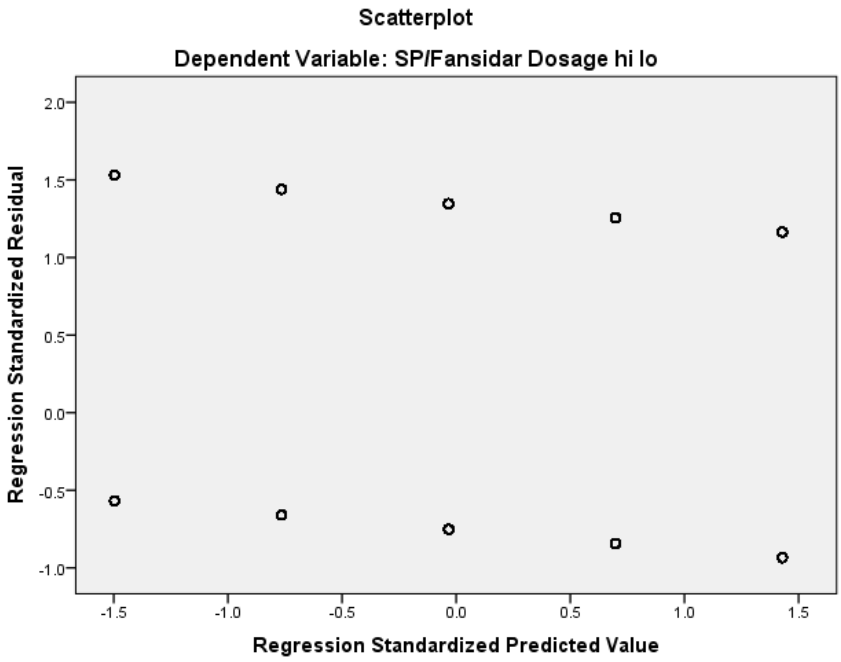

Figure 4: Wealth scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

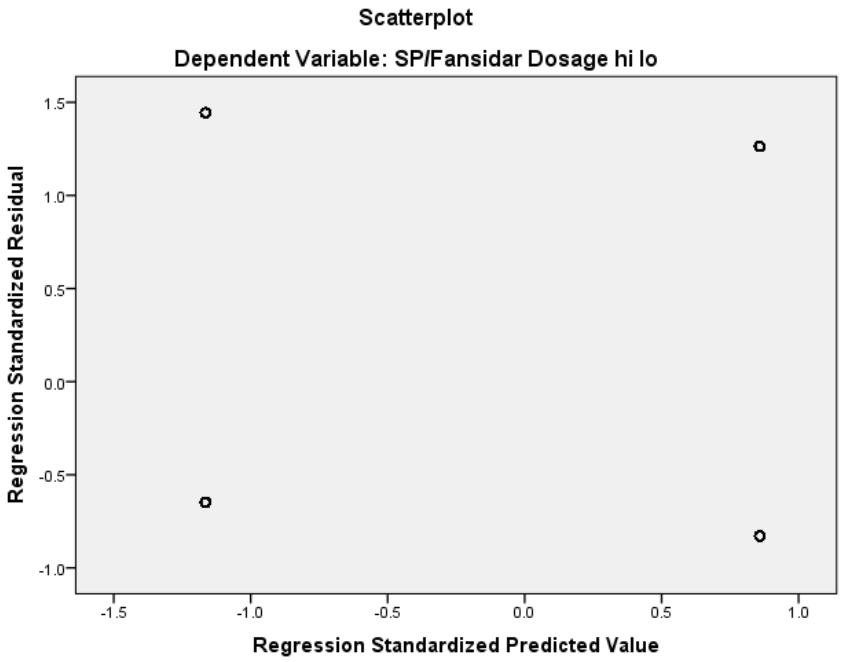

Figure 5: Media exposure prevention scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

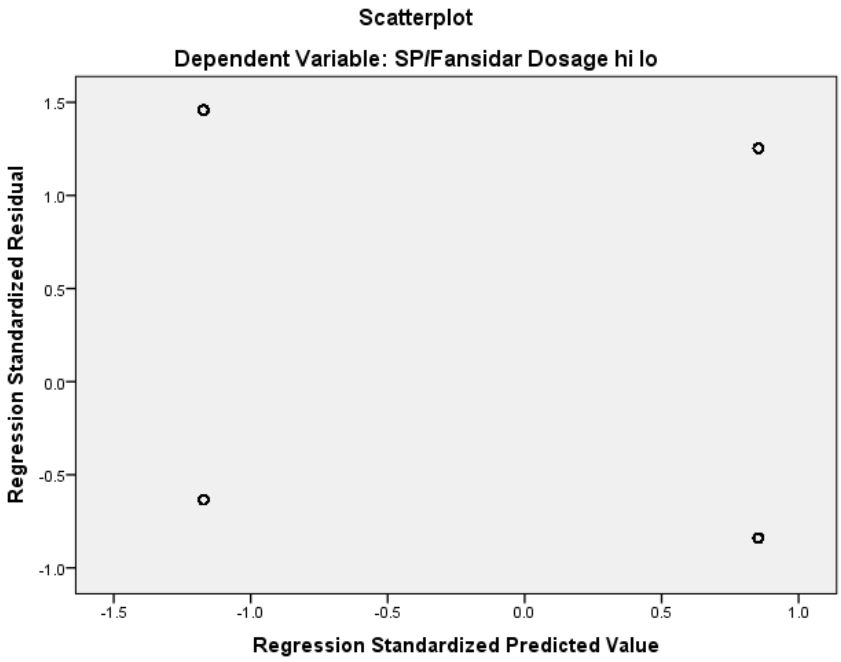

Figure 6: Media exposure treatment scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

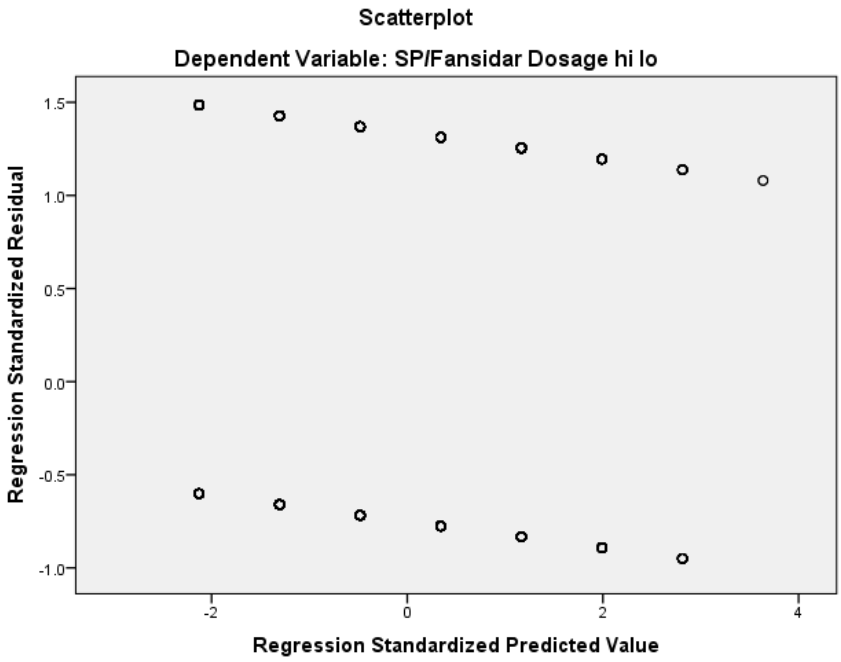

Figure 7: Knowledge of malaria signs and symptom scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

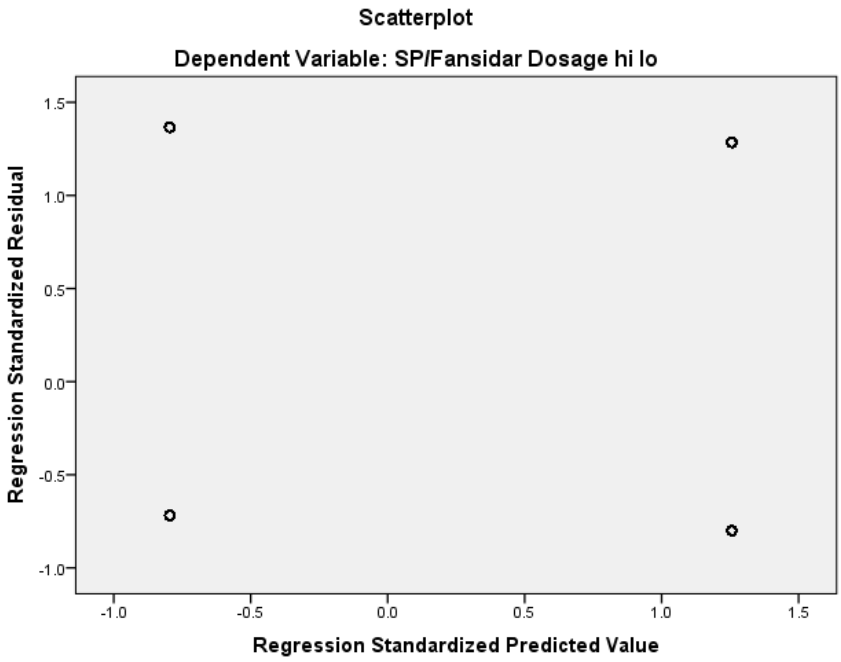

Figure 8: Perceived seriousness of malaria scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

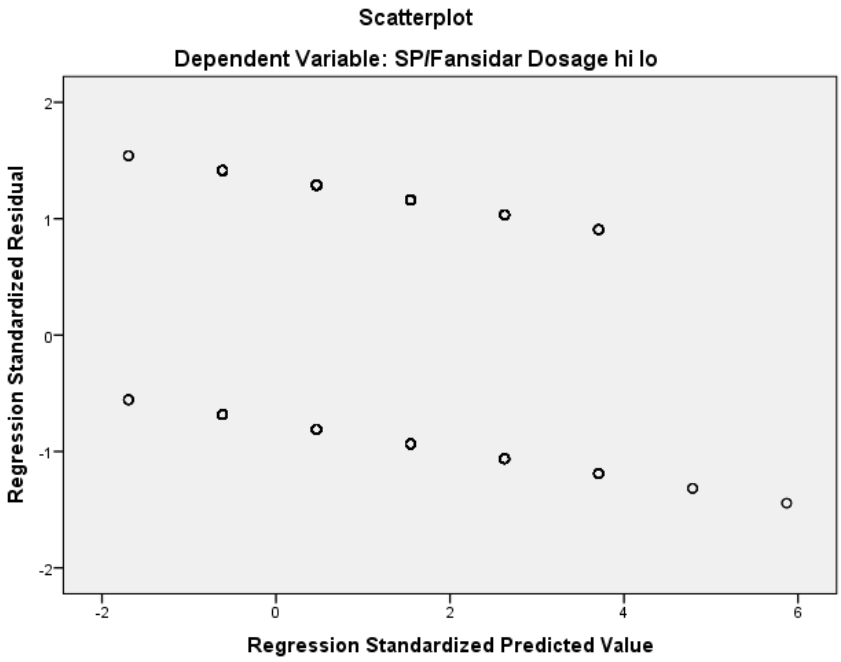

Figure 9: Malaria prevention knowledge scatterplot of the standardized predicted values and standardized residuals reveals no curvilinear pattern.

Primary Analyses

Research Question 1: Is the SES of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) associated with their malaria treatment-seeking behavior (as defined by percentage of women who received two or more doses SP/Fansider during ANC visits), after controlling for transportation and family responsibility?

Before the hierarchical logistic regression analyses were conducted, descriptive statistics were performed on the independent and dependent variables. The descriptive

statistics for the independent variable are found in Table 2. For the SP/Fansidar dosage, 64% of woman received high dosage and 36% received low dosage. See Table 4.

Table 4

Descriptive Statistics for High and Low Dosage of SP/Fansidar Dosage

	N	%
Low Dosage	1556	64.0
High Dosage	875	36.0
Total	2431	100.0

The first logistic regression for SES was conducted to determine if age predicted malaria treatment behavior. Age was the continuous independent variable where higher scores represented older respondents. Malaria preventive treatment (prophylaxis) for pregnant women was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that age was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was statistically significant, χ^2 (1, N = 2431) = 10.78, p = .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a

whole explained between .4% (Cox and Snell R square) to .6% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the results a one unit increase in age was associated with a 1.02 time greater likelihood of being in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 5.

Table 5

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	*Exp(B)*	Lower	Upper
Age	.095	.029	10.762	1	.001	1.099	1.039	1.164
Constant	-.897	.107	69.685	1	.000	.408		

The second logistic regression for SES was conducted to determine if residence predicted malaria treatment behavior. Residence was the categorical independent variable where 0 was urban and 1 was rural. Malaria was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that residence was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was statistically significant, χ^2 (1, N = 2431) = 20.08, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between .8% (Cox and Snell R square) to1.1% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the results, a person living in a rural residence was .622 less likely of being in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 6.

Table 6

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Residence	-.475	.1052	0.330	1	.000	.622	.506	.764
Constant	.282	.1942	.107	1	.147	1.325		

A third logistic regression for SES was conducted to determine if educational level predicted malaria treatment behavior. Educational level was the continuous independent variable where higher scores represented more education. Malaria was the dichotomous categorical variable where 0 represented those who took a low dose of

SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that educational level was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was statistically significant, χ^2 (1, N = 2431) = 15.89, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between .7% (Cox and Snell R square) to .9% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the result, a one unit increase in grade level was associated with a 1.34 time greater likelihood of being in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 7.

Table 7

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Education Level	.294	.07415	.730	1	.0001	.342	1.160	1.552
Constant	-.861	.084104	.183	1	.000	.423		

The fourth logistic regression for SES was conducted to determine if wealth level predicted malaria treatment behavior. Wealth level was the continuous independent variable where higher scores represented greater wealth. Malaria was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that wealth was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model for wealth index was statistically significant, χ^2 (1, N = 2431) = 37.97, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 1.5% (Cox and Snell R square) to 2.1% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the result of Table 8, a one unit increase in wealth level was associated with a 1.21 time greater likelihood of being in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 8.

Table 8

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	EXP(B)

							Lower	Upper
Wealth	.192	.031	37.327	1	.000	1.212	1.139	1.289
Constant	-1.171	.108	117.986	1	.000	.310		

A multiple hierarchical logistic regression was conducted that contained all of the independent variables, including wealth, education level, residence, and age, and the control variables of family responsibility and transportation. Results of the multiple hierarchical logistic regression indicated that the initial model containing transportation and family responsibility, was significant, χ^2 (2, N = 2431) = 25.58, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The initial model accounted for 1.1% (Cox and Snell R square) to 1.5% (Nagelkerke R squared) of the variance in malaria treatment behavior, and correctly classified 64.1% of the cases. The final model was also statistically significant, χ^2 (8, N = 2431) = 37.62, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 2.6% (Cox and Snell R square) to 3.6% (Nagelkerke R squared) of the variance in malaria treatment behavior, and correctly classified 64.2% of the cases. Table 8 reveals that wealth made a significant contribution to the model. Those with greater family responsibility (2 or more children) were less likely by a factor of.762 of being in the high

dosage group. For age, a one unit increase in age was associated with a 1.11 time greater likelihood of being in the high dosage group. Wealth was also significant, where a one unit increase in wealth was associated with a 1.12 times greater likelihood of being in the high dosage group. Residence and Education Level did not make a significant contribution to the model after controlling for transportation and family responsibility. Based on the results, the null hypothesis was rejected.

Table 9

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.137	.157	.763	1	.382	1.147	.843	1.561
Fam_Resposibility	-.272	.091	8.908	1	.003	.762	.637	.911
Age	.102	.030	11.576	1	.001	1.107	1.044	1.174
Residence	-.148	.127	1.358	1	.244	.862	.672	1.107
Education Level	.146	.084	3.037	1	.081	1.157	.982	1.364
Wealth	.117	.041	8.156	1	.004	1.124	1.037	1.219
Constant	-1.012	.328	9.526	1	.002	.363		

Research Question 2: To what extent is pregnant women's malaria media exposure related to their treatment-seeking behavior, when controlling for transportation, family responsibility, and age?

Descriptive statistics show that there were 42.4% of the women who saw/heard a prevention message in the past year. Additionally, 42.1% of women reported seeing/hearing about malaria treatment in the past year. See Tables 10 and 11.

Table 10

Descriptive Statistics for High and Low Dosage of SP/Fansidar Dosage

Media Message – Prevention	N	%
No	1030	42.4
Yes	1399	57.6

Table 11

Descriptive Statistics for High and Low Dosage of SP/Fansidar Dosage

Media Message – Treatment	N	%
No	1023	42.1
Yes	1406	57.9

To asses if pregnant women's media exposure predicted their treatment-seeking behavior, two logistic regressions were conducted, one examining the exposure to malaria prevention message and the second examining exposure to malaria treatment messages. For the first logistic regression, the dichotomous categorical independent variable was exposure to malaria prevention message in the media, where 0 was no and 1 was yes. Malaria treatment-seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that malaria media exposure was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression for malaria prevention messages exposure indicated that the model was statistically significant, χ^2 (1, N = 2431) = 19.33, $p < .001$, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between .8% (Cox and Snell R square) to 1.1% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.1% of the cases. Based on the results, those with media exposure to malaria prevention messages were 1.46 times more likely of being in the high -dosage group compared to those who had no exposure. Based on the overall results, the null hypothesis was rejected. See Table 12.

Table 12

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% C.I. for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Media Messages – Prevention	.379	.087	19.108	1	.000	1.461	1.233	1.732
Constant	-.801	.067	141.452	1	.000	.449		

For the second logistic regression, the dichotomous categorical independent variable was exposure to malaria treatment message in the media, where 0 was no and 1 was yes. Malaria treatment-seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that malaria media exposure was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression for malaria treatment messages exposure indicated that the model was statistically significant, χ^2 (1, N = 2431) = 24.96, p < .001, indicating that the model was able to distinguish between those who took low or high

dosages of SP/Fansidar. The model as a whole explained between 1.0% (Cox and Snell R square) to 1.4% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the result of Table 13, those with media exposure to malaria treatment messages were 1.54 time more likelihood of being in the high dosage high dosage group compared to those who had no exposure. Based on the overall results, the null hypothesis was rejected. See Table 13.

Table 13

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% C.I. for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Media Messages – Treatment	.432	.087	24.612	1	.000	1.541	1.299	1.827
Constant	-.833	.068	149.889	1	.000	.435		

The following described the relationship between malaria media exposure and treatment-seeking behavior after controlling for potential confounding factors of transportation, family responsibility, and age.

Results of the logistic regression for malaria prevention media exposure indicated that the final model was statistically significant even after controlling for transportation, family responsibility, and age as well, χ^2 (4, N = 2431) = 49.01, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 2.0% (Cox and Snell R square) to 2.8% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 63.8% of the cases. Based on the results, those with transportation were 1.4 times more likely to be in the high dosage group, while those with more family responsibility (2 or more children) were less likely to be in the high dosage group by a factor of .707. Those with media exposure to malaria prevention messages were 1.1 times more likelihood of being in the high dosage high dosage group as age increased compared to those who had no exposure. Based on the overall results, the null hypothesis was rejected. See Table 14.

Table 14

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.309	.150	4.218	1	.040	1.362	1.014	1.828

Fam_Resposibility	-.347	.088	15.400	1	.000	.707	.595	.841
Age	.095	.030	10.303	1	.001	1.100	1.038	1.165
Media Messages – Prevention	.330	.089	13.730	1	.000	1.392	1.168	1.657
Constant	-.921	.136	46.201	1	.000	.398		

For the second logistic regression, the dichotomous categorical independent variable was exposure to malaria treatment message in the media, where 0 was no and 1 was yes. Malaria treatment-seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The null hypothesis was that malaria media exposure was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression for malaria treatment message exposure indicated that the final model was statistically significant even after controlling for transportation, family responsibility, and age, χ^2 (1, N = 2431) = 53.56, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 2.2% (Cox and Snell R square) to 3.1% (Nagelkeke R squared) of the variance in malaria treatment behavior, and

correctly classified 63.8% of the cases. Based on the result of Table 15, those with transportation were 1.4 times more likely to be in the high dosage group. However, those with greater family responsibility were less likely to be in the high dosage group by a factor of .716. Additionally, older respondent were 1.1 times more likely to be in the high dosage group. Those with media exposure to malaria treatment messages were 1.46 time more likelihood of being in the high dosage high dosage group compared to those who had no exposure. Based on the overall results, the null hypothesis was rejected (see Table 15.

Table 15

Logistic Regression Predicting Malaria Treatment-Seeking Behavior

							95% C.I.for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.309	.150	4.225	1	.040	1.362	1.014	1.829
Fam_Resposibility	-.334	.089	14.236	1	.000	.716	.602	.852
Age	.095	.030	10.348	1	.001	1.100	1.038	1.165
Media Messages – Treatment	.378	.090	17.730	1	.000	1.459	1.224	1.739
Constant	-.957	.136	49.447	1	.000	.384		

Research Question 3: Is there a relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling transportation, family responsibility, and age?

A logistic regression was conducted to determine if pregnant women's knowledge about malaria signs and symptoms predicted treatment-seeking behavior. Malaria signs and symptoms was the continuous independent variable where higher scores represented greater knowledge of signs and symptoms of malaria. Malaria seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The mean number of signs and symptoms reported by women was 2.58 (SD = 1.21). The null hypothesis was that knowledge of signs and symptoms of malaria was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was statistically significant, χ^2 (1, N = 2431) = 11.98, p = .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between .5% (Cox and Snell R square) to .7% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the result of Table 16, a one unit increase in women's knowledge of malaria signs and symptoms was associated with a 1.13 time greater likelihood of being in the

high dosage group. Based on the overall results, the null hypothesis was rejected. See Tables 16.

Table 16

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% C.I. for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Malaria Signs_Total	.121	.035	11.897	1	.001	1.129	1.054	1.209
Constant	-.891	.102	76.834	1	.000	.410		

Results of the logistic regression indicated that the model was still statistically significant when controlling for transportation, family responsibility, and age, χ^2 (4, N = 2431) = 40.65, $p < .001$, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 1.7% (Cox and Snell R square) to.2.3% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the results of Table 17, older respondents were 1.1 times more likely to be in the high dosage group. Likewise, those with transportation were 1.4 times more likely to be in the high dosage

group. However, those with more family responsibilities were less likely to be in the high dosage group by a factor of .689. A one unit increase in women's knowledge of malaria signs and symptoms was associated with a 1.1 time greater likelihood of being in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Tables 17.

Table 17

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.327	.150	4.767	1	.029	1.387	1.034	1.860
Fam_Resposibility	-.372	.088	17.940	1	.000	.689	.580	.819
Age	.086	.030	8.281	1	.004	1.089	1.028	1.155
Signs_Total	.079	.037	4.729	1	.030	1.083	1.008	1.163
Constant	-.887	.148	35.867	1	.000	.412		

Research Question 4: Is there an association between pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

To assess if a pregnant women's perceived seriousness of malaria predicted their treatment-seeking behavior a logistic regression was conducted. Perceived seriousness was the dichotomous categorical independent variable reflecting the question, what is the most serious health problem in your community, where 0 was not malaria (something other than malaria) and 1 was malaria. Malaria treatment-seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). There were 61.2% of women who reported that Malaria was the most serious health problem in their community. The null hypothesis was that malaria media exposure was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was not statistically significant with malaria perceived seriousness alone, χ^2 (1, N = 2431) = 3.82, p =0.051, indicating that the model was not able to distinguish between those who took low or high dosages of SP/Fansidar. Based on the overall results seen in Table 19, the null hypothesis was accepted.

Table 18

Descriptive Statistics for High and Low Dosage of SP/Fansidar Dosage

Most Important Health Concern – Malaria	N	%
No	943	38.8

Yes	1488	61.2

Table 19

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% C.I. for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Malaria_Serious	-.169	.086	3.832	1	.051	.844	.713	1.000
Constant	-.473	.067	49.922	1	.000	.623		

Unlike the result above, results of the logistic regression indicated that the model perceived seriousness of malaria was statistically significant when controlling for transportation, family responsibility, and age, χ^2 (4, N = 2431) = 3.82, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 1.7% (Cox and Snell R square) to.2.4% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 63.9% of the cases. Based on the results of Table 20, older respondents were 1.1 times more likely to be in the high dosage group. Likewise, those with transportation were 1.4 times more likely to be in the high dosage group. However,

those with more family responsibilities were less likely to be in the high dosage group by a factor of .673. Those who believed that malaria is the most serious health concern were less likely to be in the high dosage group by .820, which is in contrast to the anticipated outcome of the more pregnant women perceive malaria as serious health concern the more likely they will be in high-dose group. Based on the overall results, the null hypothesis was rejected. See Table 20.

Table 20

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.341	.150	5.187	1	.023	1.406	1.049	1.886
Fam_Resposibility	-.397	.088	20.493	1	.000	.673	.567	.799
Age	.095	.029	10.509	1	.001	1.100	1.038	1.165
Malaria_Serious	-.198	.088	5.033	1	.025	.820	.690	.975
Constant	-.579	.133	19.012	1	.000	.560		

Research Question 5: Is there a relationship between pregnant women's knowledge about malaria preventive methods (as defined as knowledge of mosquito nets,

intermittent preventive treatment in pregnancy, and insecticide spray) and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?

A final logistic regression was conducted to determine if pregnant women's knowledge of malaria preventive methods predicted treatment-seeking behavior. Malaria preventive methods was the continuous independent variable where higher scores represented greater knowledge of preventive methods of malaria. Malaria seeking behavior was the dichotomous categorical variable where 0 represented those who took a low dose of SP/Fansidar Dosage (0-1) and 1 represented those who took a high dosage of SP/Fansidar Dosage (2 or more). The mean number of ways reported to avoid Malaria by women was 1.57 (SD = .93). The null hypothesis was that pregnant women's knowledge about malaria preventive methods was not a significant predictor of malaria treatment-seeking behavior.

Results of the logistic regression indicated that the model was statistically significant, χ^2 (1, N = 2431) = 32.24, $p < .001$, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 1.3% (Cox and Snell R square) to 1.8% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 63.6% of the cases. Based on the result of Table 21, a one unit increase in women's knowledge about malaria prevention methods was associated with a 1.29 time greater likelihood of being in the

high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 21.

Table 21

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% C.I. for EXP(B)	
	B	*S.E.*	Wald	*df*	*p*	Exp(B)	Lower	Upper
Malaria_Avoidance	.255	.045	32.125	1	.000	1.290	1.181	1.409
Constant	-.982	.084	136.719	1	.000	.375		

Results of the logistic regression for knowledge of malaria prevention methods indicated that the model was still statistically significant even after controlling for transportation, family responsibility, and age, χ^2 (4, N = 2431) = 56.44, p < .001, indicating that the model was able to distinguish between those who took low or high dosages of SP/Fansidar. The model as a whole explained between 2.4% (Cox and Snell R square) to 3.2% (Nagelkeke R squared) of the variance in malaria treatment behavior, and correctly classified 64.0% of the cases. Based on the result of Table 22, a one unit increase in women's knowledge about malaria preventive methods was associated with a 1.23 times greater likelihood of being in the high dosage group. Transportation did not

make a significant contribution to the model. However, those with higher family responsibility were less likely to be in the high dosage group by a factor of .713. Those who are older were 1.1 times more likely to be in the high dosage group. Based on the overall results, the null hypothesis was rejected. See Table 22.

Table 22

Logistic Regression Predicting Malaria Treatment-seeking behavior

							95% CI for EXP(B)	
	B	S.E.	Wald	*df*	*p*	Exp(B)	Lower	Upper
Transportation	.282	.151	3.473	1	.062	1.326	.986	1.783
Fam_Resposibility	-.338	.089	14.575	1	.000	.713	.599	.848
Age	.094	.030	10.046	1	.002	1.098	1.036	1.164
Malaria_Avoidance_Sum	.210	.046	20.327	1	.000	1.233	1.126	1.351
Constant	-1.056	.145	53.052	1	.000	.348		

Summary

In this study, there were five research questions. The first research question's results indicated that age was a significant predictor of malaria treatment behavior, where increases in age were associated with the increased likelihood of being in the high dosage malaria treatment group. However, residence was not a significant predictor of malaria treatment behavior, nor was educational level when controlling for transportation and family responsibility. Finally, wealth index was predictive of malaria treatment behavior,

where those who were wealthier were more likely to be in the high dosage malaria treatment group even after controlling for transportation and family responsibility.

The second research question's results indicated that media exposure to both treatment and preventive messages was predictive of malaria treatment behavior, such that those who were exposed to treatment or preventive messages were more likely to be in the high dosage malaria treatment group. Results of the study also found that, for research question three, pregnant women's knowledge about malaria predicted malaria treatment-seeking behavior, such that the greater the knowledge the more likely the respondent was to be in the high dosage malaria treatment group. Research question four results revealed that perceived seriousness of malaria alone was not a significant predictor of malaria treatment. When considering for transportation, family responsibility, and age, results indicated that perceived seriousness of malaria was a significant predictor of malaria treatment behavior; however, was counter to expectations, in that the greater the awareness of malaria as serious health threat, the less likely to be in the high dosage group. Finally, research question five showed a statistically significant association between predictor variable and outcome variable, where increases in women's knowledge about malaria preventive methods were associated with increased likelihood of being in the high dosage group.

In Chapter 5, an overview of the research study, along with interpretations of the results of data analyses in view of the stated hypotheses, the alignment between the findings of the current study and previous research results reported in the literature are provided. In addition, public health recommendations are made based on the findings of the current study along with suggestions for future research as pertains to the statement of the problem that was being addressed in the current study.

Chapter 5: Discussion

Overview

Malaria is a long-standing global health issue, and many efforts have been made to eliminate and control it. Around the world, 113 countries have eliminated malaria and 34 middle-income and some low-income countries are in the malaria elimination phase. However, most low-income countries in malaria-endemic regions of the world are still undergoing malaria control programs (Zelman, Kiszewski, Cotter, & Liu, 2014). Malaria disproportionately affects low-income countries, such as those of Sub-Saharan Africa, where 47 of 54 countries are malaria endemic and most are in malaria control programs (Omumbo, Noor, Fall, & Snow, 2013). Malaria infection in pregnancy has been, and still is, a public health problem, especially in Sub-Saharan Africa, despite implementation of (IPTp) with (SP) more than two decades ago to prevent *Plasmodium falciparum* infection in pregnancy (Braun et al., 2015). Of the 125,000,000 pregnant women at risk of malaria globally, 25–30 million pregnant women are in Sub-Saharan Africa; as a result, the region experiences annually 75,000 to 200,000 infant deaths, 900,000 LBW deliveries, and 10,000 maternal deaths (Cohee et al., 2016; Mayo-Alvarez, Abellana, & Cot, 2014; Scott et al., 2014). The high malaria rate in Sub-Saharan Africa, especially among vulnerable populations such as pregnant women and infants, is familiar to public health and global leaders. As a result, several studies have been conducted to examine the risk

factors for high prevalence of malaria morbidity and mortality among pregnant women and infants.

The purpose of this quantitative, descriptive, nonexperimental study was to investigate the association between Tanzanian pregnant women's (a) SES (as defined by age, educational level, residence, and wealth index), (b) malaria media exposure, (c) knowledge about malaria signs and symptoms, (d) perceived seriousness of malaria, and (e) knowledge about malaria in pregnancy preventive methods (knowledge of mosquito nets, intermittent preventive treatment in pregnancy, and insecticide spray) and their malaria treatment-seeking behavior (percentage of women who received the recommended two or more doses of SP/Fansidar (high dose) during ANC visits). All variables were significant predictors of being in high-dose group after controlling for transportation, family responsibility, and age. Malaria media exposure, knowledge about malaria signs and symptoms, and knowledge of malaria preventive measures were able to distinguish the likelihood of being in high SP/Fansidar dose group, in that the greater malaria media exposure and knowledge of malaria and its preventive measures the greater the likelihood of being in high-dose group. Perceived seriousness of malaria was also able to distinguish the likelihood of being in the high-dose group when controlling for transportation, family responsibility, and age. However, the result of perceived seriousness of malaria variable obtained is in contrast to the expected outcome, in that

pregnant women who perceived malaria as a serious health threat were less likely to be in the high-dose group as originally anticipated. In this chapter, I interpret the findings, discuss the limitations of the study, make recommendations for future research, suggest implications for social change, and offer a conclusion.

Interpretation of Findings

The findings of this quantitative, descriptive study are aligned with most of the previous studies conducted on malaria in pregnancy. However, some results differed.

Research Question 1

RQ1: Is the SES of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) associated with their malaria treatment-seeking behavior (as defined by percentage of women who received two or more doses SP/Fansidar or high dose during ANC visits), after controlling for transportation and family responsibility? The null hypothesis stated that SES (age, educational level, residence, and wealth level) was not a significant predictor of malaria treatment-seeking behavior, after controlling for transportation and family responsibility. This study expected all variables to be significant. The result of this study showed that all variables for SES were significant predictors for being in high-dose group without considering the potential confounding factors. When controlling for transportation and family responsibility, wealth and age were significant predictors of being in high SP/Fansidar

dose group, where the higher wealth status and older age increased the likelihood of being in high-dose group. However, residence and educational level were not significant predictors for being in high-dose group. The following will discuss the alignment of this study finding on SES to the previous studies.

In this study, the likelihood of being in high-dose group increased as age increased compared to those in younger age group. Note that the high-dose group represents those who took two or more dosages of SP/Fansidar (recommended dose) and the low dose group represents those who took 0-1 doses of SP/Fansidar for intermittent preventive treatment in pregnancy to prevent malaria. The result of this study is aligned with a study conducted by Kibusi et al. (2015) that found a statistically significant association between age and the likelihood of taking SP for intermittent preventive treatment (IPT-SP) in pregnancy. In Kibusi et al. (2015) study, being in the age group of 30 to 34 and 35 to 39 and being married or living with a partner was associated with uptake of IPT-SP, compared to the age groups 15 to 29 and those not married or divorced. Residence (rural vs. urban) was also a factor for likelihood of taking the recommended dosage amount to prevent malaria in pregnancy. Women living in rural areas were less likely to be in the high dosage group than those living in urban areas. However, residence was not a significant predictor in this study when controlling for transportation and family responsibility.

This study also showed a statistically significant association between wealth level and treatment-seeking behavior, in that as wealth level increase the likelihood of being in high-dose group increased compared to those with lower wealth. These findings are consistent with previous studies that showed poor households in rural areas are more vulnerable to malaria due to poor housing conditions and less financial access to health care, despite the availability of vouchers (discounts) in Tanzania at ANCs (Bizimana, Twarabamenye, & Kienberger, 2015; Dickson, Randell, Kramer, & Shayo (2012).

In addition, this study found that as educational attainment increased, the likelihood of being in the high dosage group increased compared to those with a lower educational level. This association is similar to the studies by Clouston, Yukich, & Alglewicz (2015) and Rumisha et al. (2014) that found an association between education and IPT-SP usage for malaria prevention during pregnancy. Clouston et al. (2015) indicated that pregnant women without education beyond primary school were more likely to be in poverty, which reduces their access to health care to prevent malaria. Thus, the result of this study confirms the research findings of previous studies. However, the result of this study showed that educational level was not a significant predictor of being in high-dose group when controlling for transportation and family responsibility.

Research Question 2

RQ2: Is pregnant women's malaria media exposure related to their treatment-seeking behavior, after controlling for transportation, family responsibility, and age? The null hypothesis was that malaria media exposure was not a significant predictor of malaria treatment-seeking behavior.

The findings of this study showed a statistically significant association between malaria media exposure and the likelihood of pregnant women taking the recommended dosage of SP/Fansidar for malaria in pregnancy prevention, even after controlling for transportation, family responsibility, and age. Those exposed to both malaria treatment messages and prevention messages were more likely to be in high SP/Fansidar dose group compared to those not exposed. The findings of my study are supported by study findings of Koenker et al. (2014) and Riccota et al. (2015), who that found a significant association between malaria media exposure and an increased attendance at antenatal visits to take SP for IPTp, adherence to artemisinin combination therapy (ACT) for malaria treatment, and usage of insecticide treated bed net (ITN). Koenker et al. (2014) indicated that malaria media exposure assists in increasing knowledge about the seriousness malaria infection and the methods to prevent it, thereby increasing the participation rate of pregnant women in malaria prevention programs.

Research Question 3

RQ3: Is there a relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age? The null hypothesis was that knowledge of malaria signs and symptoms was not a significant predictor of malaria treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

In this study, there was a statistically significant association between women's knowledge of malaria signs and symptoms and their likelihood of taking two or more SP/Fasindar doses, even after controlling for transportation, family responsibility, and age. Women with increased knowledge of the signs and symptoms of malaria were more likely to be in the high-dose group than those who had less knowledge of malaria signs and symptoms. This finding is in accordance with the study of Rumisha et al. (2014) that found an association between low knowledge about malaria and low use of IPTp-SP for malaria in pregnancy prevention. However, this finding is in contrast to a study by Akaba, Otubu, Agida, and Onafowokan (2013) that showed knowledge of malaria had no significant association with use of malaria prevention drugs during pregnancy. Although some studies from past found conflicting results regarding the association between malaria knowledge and treatment-seeking behavior, there is a strong association between knowledge of malaria and treatment-seeking behavior in this secondary data analysis.

Research Question 4

RQ4: Is there an association between pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age? The null hypothesis was that perceived seriousness of malaria was not a significant predictor of malaria treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

Perceived seriousness of malaria was not a factor that distinguished between women who took low or high doses of SP/Fansidar and did not have a significant effect, as initially expected when not controlling for potential confounding factors of transportation, family responsibility, and age. When controlling for these potential confounding factors, perceived seriousness of malaria was significant predictor of being in high-dose group; however, it is in contrary to the anticipated outcome, in that those who perceived malaria the most health concern were less likely to be in high-dose group. This is in contrast to findings of previous studies that linked pregnant women's perception of the seriousness of malaria and their willingness to seek treatment at ANCs for uptake of SP for IPTp (Kimbi et al., 2014; Onwujekwe, Onwujekwe, & Soremekun, 2013). However, the findings of my study are similar to the study conducted by Rassi et al. (2016) in Uganda, which found that adequate awareness of malaria as a danger to pregnant women and their children did not translate in high intake of IPTp by pregnant women. As Rassi et al. (2016) described, even though most women were aware of the

fact that pregnant women have a higher risk for malaria infection than nonpregnant women and that malaria harms their child, most reported being reluctant to take IPTp while pregnant. Many women reported that they were willing to take IPTp when prescribed by a health care worker, as they reported trusting the judgment of health care workers. Rassi et al. (2016) noted the importance of health care workers' assurance to pregnant women that IPTp is safe in order to increase pregnant women's uptake of IPTp, as the rate of IPTp remains low in Sub-Saharan Africa despite the relatively high ANC attendance rate. The result of my study is also similar to the study by Boene et al. (2014), which indicated that low awareness and perceived malaria risk were not significantly associated with uptake of SP for IPTp; instead, perceived convenience, the delivery approach, and type of providers were the predicting factors. Thus, this study showed that perception of the seriousness of malaria does not always predict treatment-seeking behavior among pregnant women.

Research Question 5

RQ5: Is there a relationship between pregnant women's knowledge about malaria prevention methods (as defined as knowledge of mosquito nets, intermittent preventive treatment in pregnancy, and insecticide spray) and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age? The null hypothesis was that pregnant women's knowledge about malaria prevention methods was not a

significant predictor of malaria treatment-seeking behavior, after controlling for transportation, family responsibility, and age.

In this study, there was a statistically significant association between women's knowledge of malaria prevention methods and their likelihood of being in the high-dose group compared to those who did not have adequate knowledge of malaria prevention methods, even after controlling for transportation, family responsibility, and age. This is in accordance with the study finding of Exavery et al. (2014), who found that having been counseled on the dangers of malaria in pregnancy early in the pregnancy was strongly associated with uptake of the optimal two doses of SP for intermittent preventive treatment in pregnancy (IPTp), and thus reduced risk of malaria in pregnancy. However, Mutagonda et al. (2012) showed that most pregnant women took SP when health care workers gave SP to them, but did not know the benefits of taking SP. Although some studies indicate pregnant women could still take SP with the guidance of health care workers even if they don't have adequate knowledge, my study showed that having adequate knowledge of malaria prevention methods such as SP among pregnant women is an important predictor for seeking treatment at ANC. Having the knowledge of malaria prevention helps pregnant women to initiate treatment-seeking behavior in case of a lack of health care workers to guide them.

Thus, the results of this cross-sectional study showed that socioeconomic factors, malaria media exposure, knowledge of malaria signs and symptoms, perceived seriousness of malaria, and knowledge of malaria prevention measures were significant predicting factors for Tanzanian pregnant women's treatment-seeking behavior of SP/Fansidar to prevent malaria in pregnancy at the time of study (year 2011-2012), after controlling transportation, family responsibility, and age. Even after controlling the potential confounding factors, the predictor variables still continued to have effect on the outcome variable. However, perceived seriousness of malaria had counter effect, in that those who perceived malaria as the most health concern in the community were less likely to be in high SP/Fansidar dose group rather than being in high-dose group.

Findings in the Context of the Theoretical Framework

HBM (HBM) was a framework used to examine the association of pregnant women's treatment-seeking behavior and the independent variables: SES (as defined as age, education, residence, and wealth), malaria media exposure, knowledge of malaria signs and symptoms, perceived seriousness of malaria, and knowledge of malaria prevention measures. All variables were significant predictors for pregnant women's likelihood of seeking treatment to take SP/Fansidar dose at ANC to prevent malaria in pregnancy, after controlling for transportation, family responsibility, and age. The HBM (HBM) is guided by six constructs: (a) perceived susceptibility to particular disease, (b)

perceived seriousness of disease, (c) perceived benefit to taking health action, (d) perceived barrier to taking action, (e) cues to action (readiness to take action), and (f) self-efficacy (Glanz, Rimer, & Viswanth, 2008). HBM is based on the belief that people are more likely willing to avoid illness if they believe their specific action will prevent illness.

In my study, HBM explains the behavior of pregnant women in regards to their treatment-seeking behavior to prevent malaria in pregnancy. My research findings aligned with most of HBM postulations. However, my findings showed that the perception of the seriousness of malaria did not automatically influence pregnant women to seek treatment at ANCs to prevent malaria in pregnancy, after controlling for transportation, family responsibility, and age. Instead, this study showed that those who perceived malaria as serious health issue were less likely to take the recommended high dose of 2+ SP/Fansidar. Other factors such as SES, and the availability of malaria related messages for increasing the awareness of malaria and prevention/treatment methods, contributed significantly to influencing pregnant women to seek treatment. Pregnant women's knowledge of malaria and its prevention/treatment methods helped them become better equipped to prevent malaria. As past studies showed, my study also revealed that knowledge of malaria infection among pregnant women was an important influencing factor for their willingness to seek malaria treatment and prevention.

Limitations of the Study

Threats to Validity

My study was limited to age groups of 15-49 among Tanzanian pregnant women. The analysis of data only provided quantitative measure of the participants' responses. The analysis did not provide an in depth qualitative phenomenon of the study. In addition, the secondary data analysis I conducted had threats to validity that may lead to incorrect inferences as the primary data may have omitted important information about participants for confidentiality purposes, which prevents the control of confounding factors that might be important in interpreting the results. Limitation of the study due to secondary data analysis was mentioned in Chapter 1. This study only looked at potential confounding factors of family responsibility, transportation, and age. There may be other potential confounding that could affect dependent variable of treatment-seeking behavior. Threats to validity include construct validity, internal validity, statistical conclusion validity, and external validity, which are described below.

Construct validity refers to the degree to which inferences can be made from a measurement instrument that was constructed based on theory (Trochim, 2006). Changing the meaning of a construct at an operational level by incorrectly specifying the measurement model compromises both construct validity and statistical conclusion validity (Petter, Rai, & Straub, n.d.). This study also has limitations because of internal

validity issues. Internal validity refers to the validity of inferences made about the relationship between predictor variables and outcome variables in the primary study (Trochim, 2006). The estimation of the association between variables in my study may not be a true association because of other covariate variables that may have existed, but have not been captured in the primary study. In addition, alternate variables or missing variables may have caused the observed outcome, which creates an internal validity issue (Trochim, 2006). The result of this secondary data analysis may be affected by internal validity.

Furthermore, this study may be affected by statistical conclusion validity. Statistical conclusion validity refers to the degree to which the relationship between the two variables is valid (Drost, 2011). The quality and reliability of this secondary data analysis depends on the quality of the statistical conclusions of the primary study, such as using statistical analysis to control confounding variables. Finally, this study is prone to external validity issues. External validity refers to the generalizability of the inferences made about the relationship between variables in given study to different setting and population (Shadish, Cook, & Campbell, 2002). My study generalized the results only to Tanzanian pregnant women ages 15–49. The result may not be generalizable to other countries as the rate of malaria risk and accessibility of malaria prevention methods may differ in different countries and settings.

Recommendations for Future Research

This study revealed some questions that could not be answered by existing research. Thus, future study is recommended to create greater understanding of the relationship between knowledge of malaria and treatment-seeking behavior. This study did not find that pregnant women's perceived seriousness of malaria increase their likelihood of taking the recommended high dose SP/Fansidar, as originally anticipated. Better understanding is needed regarding those who perceived malaria as serious health threat but did not seek treatment at ANCs. The second area that merits further study is the association between health education exposure from health care workers and pregnant women's treatment-seeking behavior. Health care workers' awareness of the dangers of malaria in pregnancy and their understanding of its prevention and treatment measures seems to play an important role in health workers' willingness to educate pregnant women, thereby influencing pregnant women to seek treatment.

Third, further research is recommended to find the relationship between spouses' malaria knowledge and pregnant women's treatment-seeking behavior. Spousal support may influence pregnant women's treatment-seeking behavior. Fourth, future research is recommended to find whether pregnant women's willingness to use insecticide treated bed net predicts their willingness to seek intermittent preventive treatment (SP/Fansidar) to prevent malaria in pregnancy. Better understanding is needed regarding whether

pregnant women who are willing to utilize one malaria prevention method are more likely to utilize other malaria prevention methods as well. Overall, this study revealed that the cooperation of health care workers, spouses, and even the community are important to help encourage pregnant women to participate in the available malaria prevention and treatment methods in order to prevent malaria in pregnancy. Pregnant women could benefit from all resources, human and material, to combat malaria.

Implications

This secondary data analysis provided a statistically significant estimate of associations between predictor variables and outcome variable to fill the gap in literature. Although several studies were conducted in previous years on malaria in pregnancy, there is still a need for greater understanding of the role of knowledge about malaria in influencing pregnant women's treatment-seeking behavior. Thus, filling the gap in literature is one aspect of this study aimed at creating social change. The other implication for positive social change from this secondary data analysis is that results can be disseminated to inform public health policy makers and local health care providers to enhance their understanding of the public health issue of malaria in pregnancy and increase their abilities to prevent and treat the disease. This understanding may help health care providers and policy makers establish sustainable malaria education, increase the treatment-seeking behavior of the uptake of Sulfadoxine-pyrimethane (SP) for

intermittent preventive treatment, and utilize other malaria prevention methods such as insecticide treated bed nets and insecticide spray to prevent malaria in pregnancy.

This study also showed the importance of the active involvement of health care workers and malaria researchers in reducing malaria in pregnancy as described below. First, health care workers can play a role in encouraging pregnant women through both community and ANCs. Almond et al. (2016) found out that pregnant women's likelihood of complying with repeat ANC visit depends on the quality of service and care they received. In this study, pregnant women who reported satisfaction with the service received at ANC for other prenatal testing were more likely to repeat ANC visits to receive testing for malaria (Almond et al., 2016). This research indicated that health care workers could assist pregnant women in making enough ANC visits to utilize the recommended malaria prevention methods. Adopting this health seeking behavior may reduce LBW outcomes, maternal anemia, and other adverse outcomes cause by malaria in pregnancy. Almond et al. (2016) stressed the importance of good communication and positive relationships between health care workers and pregnant women to achieve the goal of regular attendance at ANCs for malaria prevention services. Second, malaria researchers play an important role in helping implement effective malaria intervention by delivering evidence-based research to policy makers, public health workers, health care providers, and other stakeholders (Mwendera et al., 2016). These interventions will help

increase pregnant women's willingness to seek treatment and as a result, reduce malaria in pregnancy and the associated negative health outcomes for mothers and infants. Contributing to the malaria research effort to reduce malaria in pregnancy is thus one of the aspects of this study aimed to make social implication.

Conclusion

To prevent LBW outcomes (< 2,500 g), preterm delivery (< 37 weeks gestation), and maternal anemia, the World Health Organization (WHO) recommended at least two doses of Sulphadoxine-pyrimethamine (SP) for intermittent preventive treatment in pregnancy (IPTp) given at an ANC (ANC) one month apart, starting the second trimester, to prevent (not treat) *Plasmodium falciparum* in pregnancy since research showed SP as effective in clearing the infection. However, the rate of the recommended at least two doses of SP intake is still low in Sub-Saharan Africa including Tanzania. Pregnant women who attended an ANC at least four times more were likely to take the optimal two doses of IPTp-SP than those who made fewer than four ANC visits in past research. My research examined the treatment-seeking behavior of SP/Fansidar at ANC among Tanzanian pregnant women. The findings of my study were based on analysis of data on Tanzania HIV/AIDs and Malaria Indicator Survey (THMIS) 2011-2012. The results of this secondary data analysis showed a statistically significant association between SES (age, education, residence, and wealth), malaria media exposure, knowledge of malaria

signs and symptoms, perceived seriousness of malaria, and knowledge of malaria prevention methods and treatment-seeking behavior for SP/Fansidar used to prevent malaria in pregnancy, after controlling for transportation, family responsibility, and age. However, this study did not find a positive association between perceived seriousness of malaria and treatment-seeking behavior as originally hypothesized, in that those who perceived malaria as serious threat were less likely to take high SP/Fansidar dose.

Based on the result of this study, I recommended public health workers, health care providers, and policy makers help implement appropriate intervention strategy to create awareness of malaria in pregnancy as to increase treatment-seeking behavior of SP/Fansidar. Preventing malaria in pregnancy is crucial to prevent LBW outcome and maternal anemia, which in turn reduce infant and maternal morbidity and mortality rate. Preventing malaria in pregnancy will help the economy in general as it prevents medical treatment costs and lost productivity. In addition, giving infants a health start will help them to become productive adults in the future, which will benefit the society as a whole.

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Appendix A: Statistical Analysis Plan and Variables Code

Table 1. Summary of research questions, statistical tests to be used and variables to be included in each model

RQ	Variables	Statistical tests
To what extent is socioeconomic status (SES) of Tanzanian pregnant women (as defined by age, educational level, residence, and wealth index) is associated with their malaria treatment-seeking behavior (as defined by percentage of women who received 2+ doses SP/Fansidar during and ANC visit), after controlling for transportation and family responsibility?	Independent variables: age, educational level, residence, wealth status Dependent variable: Treatment-seeking behavior (treatment level = low or high)	Test of significance (OR; 95%CI) Logistic Regression
To what extent is pregnant women's malaria media exposure with treatment-seeking behavior, after controlling for transportation, family	Independent variable: Malaria risk media exposure (heard about malaria disease and prevention methods on media, e.g., via radio) Dependent variable: Treatment-	Test of significance (OR; 95%CI) Logistic Regression

responsibility, and age?	seeking behavior (treatment level = low or high)	
Is there a relationship between pregnant women's knowledge about malaria signs and symptoms and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?	Independent variable: Knowledge about malaria signs and symptoms Dependent variable: Treatment-seeking behavior (treatment level = low or high)	Test of significance (OR; 95%CI) Logistic Regression
Is there an association between pregnant women's perceived seriousness of malaria and their treatment-seeking behavior, after controlling for transportation, family responsibility, and age?	Independent variable: Perceived seriousness of malaria Dependent variable: Treatment-seeking behavior (treatment level = low or high)	Test of significance (OR; 95%CI) Logistic Regression
Is there a relationship between pregnant women's knowledge about malaria in pregnancy preventive methods (as defined as knowledge of mosquito nets, intermittent preventive treatment in pregnancy, and insecticide spray) and their treatment-	Independent variable: Knowledge about malaria in pregnancy preventive methods Dependent variable: Treatment-seeking behavior (treatment level = low or high)	Test of significance (OR; 95%CI) Logistic Regression

seeking behavior, after controlling for transportation, family responsibility, and age?		

Table 2 contains variable codes for dependent variable (treatment-seeking behavior) and independent variables.

Table 2

Variable Code

Variable Name	Variable Code
Treatment-seeking behavior (SP/Fansidar doses)	S312C$1
Socioeconomic status	
Age	V013
Education	V106

Residence Wealth	V102 V190
Total Awareness of Signs and Symptoms	S402A-S402R
Malaria media exposure	S406A-S406B
Perceived malaria Seriousness	S401
Malaria Prevention Knowledge Family Responsibility (number of children in household)	S404A-S404Y V137
Transportation (household has car, scooter or motorcycle)	V125

Appendix B: Data Access Permission Letter

August 11, 2015

Emebet Derjew Walden University United States Phone: 206-708-0867

Dear Emebet:

You are authorized to use the **Tanzania DHS/MIS datasets**, for your research project titled: **"**Knowledge about malaria risk and treatment-seeking behavior among Tanzania pregnant women**".**Interested users can register for a download account at: www.dhsprogram.com/data/new-user-registration.cfm. To download the data from your user account, please login at: www.dhsprogram.com/data/dataset_admin/login_main.cfm

- The user name is your registered email address: emebet.derjew@waldenu.edu
- The password is the one you selected during the registration process.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of

individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified. The DHS datasets must not be passed on to other researchers without the written consent of DHS. You are requested to submit an electronic or hard copy of any reports/publications resulting from using the DHS data files to our office. Sincerely, *Bridgette Wellington* Data Archivist The Demographic and Health Surveys (DHS) Program

11785 Beltsville Drive, Suite 300 ▪ Calverton, MD 20705 ▪ 301.572.0200 ▪ 301.572.0999 fax ▪ icfi.com

Appendix C: Tanzania HIV/AIDs & Malaria Indicator Survey (THMIS) Women's Questionnaire

INTRODUCTION AND CONSENT

Hello. My name is _____. I am working with the National Bureau of Statistics. We are conducting a survey about health all over Tanzania. The information we collect will help the government to plan health services. Your household was selected for the survey. The survey usually takes about 30 minutes. All of the answers you give will be confidential and will not be shared with anyone other than members of our survey team. You don't have to be in the survey, but we hope you will agree to answer the questions since your views are important. If I ask you any question you don't want to answer, just let me know and I will go on to the next question or you can stop the interview at any time.

In case you need more information about the survey, you may contact the person listed on the card that has already been given to your household.

Do you have any questions?

May I begin the interview now?

SIGNATURE OF INTERVIEWER:

DATE:

RESPONDENT AGREES TO BE INTERVIEWED 1

RESPONDENT DOES NOT AGREE TO BE INTERVIEWED 2

Questions and Coding Categories

Q101. RECORD THE TIME.

HOUR .

MINUTES . .

MORNING . 1

AFTERNOON . 2

EVENING/NIGHT . 3

102. In what month and year were you born?

MONTH .

DON'T KNOW

MONTH . 98

YEAR .

DON'T KNOW

YEAR . 9998

103. How old were you at your last birthday?

COMPARE AND CORRECT 102 AND/OR 103 IF INCONSISTENT.

AGE IN COMPLETED YEARS

104. Have you ever attended school?

YES .	1
NO .	2

105. What is the highest level of school you attended?

PRE-PRIMARY .	0
PRIMARY .	1
POST-PRIMARY TRAINING .	2
SECONDARY 'O'-LEVEL .	3
SECONDARY 'A'-LEVEL .	4
POST-SECOND TRAINING 'O' LEVEL	5
POST-SECOND TRAINING 'A' LEVEL	6
UNIVERSITY .	7

106. What is the highest grade you completed at that level?

IF COMPLETED LESS THAN ONE YEAR AT THAT LEVEL,

RECORD '00'.

GRADE . | | |

107. Do you read a newspaper or magazine, at least once a week, less than once a week or not at all?

AT LEAST ONCE A WEEK .	1
LESS THAN ONCE A WEEK .	2
NOT AT ALL .	3
CANNOT READ .	8

---

108. Do you listen to the radio, at least once a week, less than once a week or not at all?

AT LEAST ONCE A WEEK .	1
LESS THAN ONCE A WEEK .	2
NOT AT ALL .	3

---

109. Do you watch television, at least once a week, less than once a week or not at all?

AT LEAST ONCE A WEEK .	1
LESS THAN ONCE A WEEK .	2
NOT AT ALL .	3

109A. Do you have a mobile phone?

YES .	1
NO .	2

110.

FEMALE MALE

111. Aside from your own housework, have you done any work in the last seven days?

YES	.	1
NO	.	2

112. As you know, some women take up jobs for which they are paid in cash or kind. Others sell things, have a small business or work on the family farm or in the family business. In the last seven days, have you done any of these things or any other work?

YES	.	1
NO	.	2

113. Have you done any work in the last seven days?

YES	.	1
NO	.	2

---

114. Although you did not work in the last seven days, do you have any job or business from which you were absent for leave, illness, vacation or any other such reason?

YES	.	1
NO	.	2

115. Have you done any work in the last 12 months?

YES .	1
NO .	2

116. What is your occupation, that is, what kind of work do you mainly do?

INTERVIEWER: PROBE TO OBTAIN DETAILED

INFORMATION ON THE KIND OF WORK RESPONDENT DOES.

_____

_____

117. What have you been doing for most of the time over the last 12 months?

GOING TO SCHOOL/STUDYING .	01
LOOKING FOR WORK .	02
RETIRED .	03
TOO ILL TO WORK .	04
HANDICAPPED, CANNOT WORK .	05
HOUSEWORK/CHILD CARE .	06
OTHER _	96

(SPECIFY)

118. In the last 12 months, how many times have you been away from home for one or more nights?

NUMBER OF TIMES	.	
NONE	.	00

---

119. In the last 12 months, have you been away from home for more than one month at a time?

YES	.	1
NO	.	2

Household Own

How many of the following animals does this household own?

IF 95 OR MORE, ENTER '95'. IF UNKNOWN, ENTER '98'.

Cattle?

Milk cows or bulls? Horses or donkeys? Goats?

Sheep?

Pigs?

Chickens or other poultry?

CATTLE ..... COWS/BULLS ..... HORSES/DONKEYS ..... GOATS ..... SHEEP ..... PIGS ..... CHICKENS/POULTRY .....

Does any member of this household have a bank account?

YES..... 1 NO 2

How far is it to the nearest marketplace? IF LESS THAN ONE KM, ENTER '00'. IF MORE THAN 95 KM, ENTER '95'.

KILOMETRES .....

Now I would like to ask you about the food your household eats. How many meals does your household usually have per day?

MEALS .....

In the past week, on how many days did the household eat meat or fish?

DAYS .....

How often in the last year did you have problems in satisfying the food needs of the household?

NEVER ..... 1 SELDOM ..... 2 SOMETIMES ..... 3 OFTEN..... 4

ALWAYS 5

How far is it to the nearest health facility? IF LESS THAN ONE KM, ENTER '00'.

IF MORE THAN 95 KM, ENTER '95'.

KILOMETRES .....

If you were to go to (NAME OF HOSPITAL/HEALTH CENTRE/HEALTH POST), how would you go there?

CAR/MOTORCYCLE ..... 1 PUBLIC TRANSPORT (BUS,TAXI) 2

ANIMAL/ANIMALCART ..... 3 WALKING ..... 4 BICYCLE 5

OTHER

6

(SPECIFY)

At any time in the past 12 months, has anyone come into your dwelling to spray the interior walls against mosquitoes?

YES..... 1 NO ..... 2 DON'T KNOW 8

Who sprayed the dwelling?

GOVERNMENT WORKER/PROGRAM . . . . . A PRIVATE COMPANY . . . . . B NONGOVERNMENTAL

ORGANIZATION(NGO) ..... C OTHER X

(SPECIFY)

DON'TKNOW ..... Z

Does your household have any mosquito nets that can be used while sleeping?

YES..... 1 NO 2

How many mosquito nets does your household have? IF 7 OR MORE NETS, RECORD '7'.

NUMBER OF NETS .....

134. Did anyone sleep under this mosquito net last night?

Net #1

YES ..... 1 NO 2

(SKIP TO 135A)

NOTSURE ..... 8 (SKIP TO 136)

Net #2

YES ..... 1 NO 2

(SKIP TO 135A)

NOTSURE ..... 8 (SKIP TO 136)

Net #3

YES ..... 1 NO 2

(SKIP TO 135A)

NOTSURE ..... 8 (SKIP TO 136)

135. Who slept under this mosquito net last night?

RECORD THE PERSON'S NAME AND LINE NUMBER FROM THE HOUSEHOLD SCHEDULE.

NAME_____

LINE

NO. .....

NAME_____

LINE

NO. .....

NAME_____

LINE

NO. .....

NAME_____

LINE

NO. .....

GO BACK TO 128 FOR NEXT NET; OR, IF NO MORE NETS, GO TO 201

135A. Why not?

RECORD ALL MENTIONED

MALARIA NOW B TOOHOT ..... C DON'T LIKE SMELL D FEEL CLOSED IN/

AFRAID ..... E NET TOO OLD/TORN F NETTOODIRTY ... G NET NOT AVAILABLE

LAST NIGHT/NET

BEING WASHED H USUAL USER(S) DID NOT SLEEP HERE

LASTNIGHT ... I NETTOOSMALL... J SAVING NET FOR

LATER..... K NO LONGER KILLS/

REPELS MOSQ. L

OTHER X (SPECIFY)

DON'T KNOW ..... Z

136. GO BACK TO 128 FOR NEXT NET; OR, IF NO MORE NETS,

GO TO 201.

Reproduction

222. Have you had any live births since the birth of (NAME OF MOST RECENT BIRTH)? IF YES, RECORD BIRTH(S) IN TABLE.

YES	.	1
NO	.	2

223. COMPARE 210B WITH NUMBER OF BIRTHS IN HISTORY ABOVE AND MARK:

NUMBERS ARE SAME

NUMBERS ARE DIFFERENT

224. CHECK 215:

ENTER THE NUMBER OF BIRTHS IN 2006 OR LATER

NUMBER OF BIRTHS .....

NONE.....0

225. Are you pregnant now?

YES .	1
NO .	2
UNSURE .	8

---

226. How many months pregnant are you?

RECORD NUMBER OF COMPLETED MONTHS.

MONTHS ...

227.

CHECK

224:

ONE OR MORE BIRTHS IN 2006 OR LATER	NO BIRTHS IN 2006 OR LATER OR BLANK
301	

ANC and Children

301. CHECK 215: ENTER IN THE TABLE THE LINE NUMBER, NAME, AND SURVIVAL STATUS OF EACH BIRTH IN 2006 OR LATER. ASK THE QUESTIONS ABOUT ALL OF THESE BIRTHS. BEGIN WITH THE LAST BIRTH.

IF THERE ARE MORE THAN 3 BIRTHS, USE LAST 2 COLUMNS OF ADDITIONAL QUESTIONNAIRES.

Now I would like to ask you some questions about the health of all your children born since January 2006. We will talk about each separately.

302. LINE NUMBER FROM 212

LAST BIRTH	NEXT-TO-LAST BIRTH	SECOND-FROM-LAST BIRTH
	LINE NO.	LINE NO.

303. FROM 212 AND 216

_	NAME _	NAME _
DEAD	LIVING	LIVING
	DEAD	DEAD
	(GO TO NEXT COLUMN)	(SKIP TO

304. When you were pregnant with (NAME), did you see anyone for antenatal care for this pregnancy?

YES . 1

NO . 2

(SKIP TO 307)

305. Whom did you see?

Anyone else?

PROBE TO IDENTIFY EACH TYPE OF PERSON AND RECORD ALL MENTIONED.

HEALTH PROFESSIONAL

- DOCTOR/AMO . A
- CLINICAL OFFICER B
- ASST. CLINICAL OFFICER . C
- NURSE/MIDWIFE . D
- MCH AIDE . E

OTHER PERSON

- VILLAGE HEALTH WORKER . F
- TRAINED TBA/TBA G
- OTHER X _____

(SPECIFY)

306. Where did you receive antenatal care for this pregnancy?

Anywhere else?

PROBE TO IDENTIFY TYPE(S)

OF SOURCE(S) AND RECORD

ALL MENTIONED.

IF UNABLE TO DETERMINE IF

PUBLIC OR PRIVATE SECTOR,

WRITETHE NAME OF THE PLACE.

(NAME OF PLACE)

Where did you receive antenatal care for this pregnancy?	
Anywhere else?	
PROBE TO IDENTIFY TYPE(S) OF SOURCE(S) AND RECORD ALL MENTIONED.	

IF UNABLE TO DETERMINE IF
PUBLIC OR PRIVATE SECTOR,
WRITETHE NAME OF THE PLACE.

_____
(NAME OF PLACE)

J

_____
(SPECIFY)

RELIGIOUS/VOLUNTARY

REFERAL/SPEC.
HOSPITAL . K

DISTRICT HOSP. L

HEALTH CENTRE M

DISPENSARY . N

PRIVATE MED. SECTOR

SPECIALISED
HOSPITAL . O

HEALTH CENTRE. P

DISPENSARY . Q

OTHER PRIVATE
MED. SECTOR R

_____
(SPECIFY)

OTHER _ X
(SPECIFY)

306A. How many months pregnant were you when you first received antenatal care for this pregnancy?

MONTHS	.	
DON'T KNOW	.	98

307. During this pregnancy, did you take any drugs to prevent you from getting malaria?

YES	.	1
NO	.	2
		(SKIP TO 312A)
DON'T KNOW	.	8

308. What drugs did you take?

RECORD ALL MENTIONED.

IF TYPE OF DRUG IS NOT

DETERMINED, SHOW TYPICAL

ANTIMALARIAL DRUGS TO

RESPONDENT.

SP/FANSIDAR .	A
CHLOROQUINE .	B
OTHER _____ (SPECIFY)	X
DON'T KNOW	Z

309.

CHECK 308:

SP / FANSIDAR TAKEN FOR

MALARIA PREVENTION?

CODE A, B, C, D, OR E,

CIRCLED

OTHER

(SKIP TO

313)

310. How many times did you take SP during this pregnancy?

TIMES . | | |

311. CHECK 305:

ANTENATAL CARE FROM

HEALTH PERSONNEL

DURING THIS PREGNANCY

312. Did you get the SP during an antenatal care visit, during another visit to a health facility or from another source?

.

ANTENATAL VISIT . 1

ANOTHER FACILITY

VISIT . 2

OTHER SOURCE . 6

312A.

CHECK 304:

ANC RECEIVED?

NO ANC

ANC RECEIVED

(SKIP TO 313)

312B. Do you have an ANC card for the time you were pregnant with (NAME)?

IF YES: May I please see it?

YES, SEEN . 1

YES, NOT SEEN . 2

SKIP TO 313

NO CARD . 3

312C. CHECK ANC CARD AND RECORD NUMBER OF DOSES OF SP/FANSIDAR GIVEN.

DOSES . ___

NONE . 0

313. Who assisted with the delivery of (NAME)?

Anyone else?

PROBE FOR THE TYPE(S) OF

PERSON(S) AND RECORD

ALL MENTIONED.

IF RESPONDENT SAYS NO ONE

ASSISTED, PROBE TO DETERMINE

WHETHER ANY ADULTS WERE

PRESENT AT THE DELIVERY.

HEALTH PROFESSIONAL

DOCTOR/AMO .	A
CLINICAL OFFICER	B
ASST. CLINICAL OFFICER .	C
NURSE/MIDWIFE .	D
MCH AIDE .	E

OTHER PERSON

VILLAGE HEALTH WORKER . F

TRAINED TBA/TBA G

RELATIVE/FRIEND H

OTHER _____ X
(SPECIFY)

NO ONE ASSISTED Y

Malaria

401. In your opinion, what is the most serious health problem in your community?

HIV/AIDS .	01
TUBERCULOSIS .	02
MALARIA .	03
MALNUTRITION .	04
DIABETES .	05
CANCER .	06
FLU .	07
ROAD TRAFFIC ACCIDENTS .	08
DIARRHEA .	09
HEART DISEASE .	10

OTHER _____ (SPECIFY)	96
DON'T KNOW .	98

402. Can you tell me the signs or symptoms of malaria in a young child?

FEVER .	A
FEELING COLD .	B
CHILLS .	C
PERSPIRATION/SWEATING .	D
HEADACHE .	E
BODY ACHES .	F
POOR APPETITE .	G
VOMITING .	H
DIARRHEA .	I
WEAKNESS .	J
COUGHING .	K
CONVULSIONS .	L
OTHER _____ (SPECIFY)	X
DOES NOT KNOW ANY .	Z

403. Are there ways to avoid getting malaria?

YES .

NO .

Q404. What are the ways to avoid getting malaria?

SLEEP UNDER MOSQUITO NET .	A
USE MOSQUITO COILS .	B
USE INSECTICIDE SPRAY .	C
INDOOR RESIDUAL SPRAYING (IRS)	D
KEEP DOORS/WINDOWS CLOSED .	E
USE INSECT REPELLANT .	F
KEEP SURROUNDINGS CLEAN .	G
CUT THE GRASS .	H
REMOVE STANDING WATER .	I
INTERMITTENT PREVENTIVE TREATMENT (IPTP) .	J
HOUSE SCREENING .	K
OTHER _____ (SPECIFY)	X
DOES NOT KNOW ANY .	Z

405. Can ACTs be obtained at your nearest health facility or pharmacy (duka la dawa)?

YES .	1
NO .	2
DON'T KNOW .	8

406A. In the past year, have you seen or heard any messages about malaria prevention?

YES .	1
NO .	2

406B. In the past year, have you seen or heard any messages about malaria treatment?

YES .	1
NO .	2

407.

LOCATION OF INTERVIEW:

	408B.
MAINLAND TANZANIA	ZANZIBAR

408A. In the past year, have you ever heard or seen the phrase "Malaria Haikubaliki"?

Yes	1 Q409
NO	2

409. Where did you hear or see this phrase?

RECORD ALL MENTIONED.

RADIO .	A
BILLBOARD .	B

skip to 410

POSTER .	C
T-SHIRT .	D
LEAFLET/FACT SHEET/ BROCHURE	E
TELEVISION .	F
MOBILE VIDEO UNIT .	G
SCHOOL .	H
HEALTH CARE WORKER .	I
COMMUNITY EVENT/PRESENTATION	J
FRIEND/NEIGHBOR/FAMILY MEMBER	K
OTHER _____ (SPECIFY)	X
DON'T KNOW .	Z

410. In the past six months, were you visited by a health worker or volunteer who talked to you about malaria?

YES .	1	
NO .	2	

Q411.

LOCATION OF INTERVIEW:

	ZANZIBAR
MAINLAND	Q414
TANZANIA	

412. Have you heard of Hati Punguzo, the voucher programme for buying mosquito nets at a discount?

YES .	1

NO . 2

Q414

413. Where did you hear about Hati Punguzo?

RECORD ALL MENTIONED.

RADIO .	A
POSTER/BROCHURE .	B
NEWSPAPER .	C
TELEVISION .	D
MOBILE VIDEO UNIT .	E
COMMUNITY VOLUNTEER .	F
VILLAGE GOVERNMENT .	G
SHOP .	H
RCH/HEALTH FACILITY .	I
FRIEND/NEIGHBOR/FAMILY MEMBER	J
OTHER	X
_____ (SPECIFY)	
DON'T KNOW .	Z

414.

MALE Q501

FEMALE

415.

CHECK 224: Q501

ONE OR MORE BIRTH SINCE 2006

NO BIRTHS SINCE 2006 OR BLANK 501

416.

LOCATION OF INTERVIEW:

MAINLAND TANZANIA

ZANZIBAR 420

417.

CHECK 304:

ANC RECEIVED 304 = 1

NO ANC 304=2

418. When you received antenatal care for the pregnancy of (NAME OF YOUNGEST CHILD), did a health care provider give you a Hati Punguzo voucher for buying a mosquito net?

YES . 1

NO . 2

419. Did you get the Hati Punguzo for this pregancy at your first antenatal care visit or a later visit?

FIRST
VISIT . 1
SECOND VISIT OR LATER . 2

DON’T KNOW/DON'T REMEMBER . 8

420. Now I am going to read some statements and I would like you to tell me how much you agree or disagree with them. After I read each statement, please tell me whether you strongly agree with it, somewhat agree with it, somewhat disagree with it or strongly disagree with it.

421. I can easily protect myself and my children from malaria. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY
AGREE . 1
SOMEWHAT AGREE . 2
SOMEWHAT DISAGREE . 3
STRONGLY
DISAGREE . 4

422. I can ensure that my children sleep under a treated net every single night of the year. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY AGREE . 1
SOMEWHAT AGREE . 2
SOMEWHAT DISAGREE . 3
STRONGLY DISAGREE . 4

CHILDREN HAVE NO NETS . 5

423. I can easily hang my children's mosquito nets. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY AGREE	.	1
SOMEWHAT AGREE	.	2
SOMEWHAT DISAGREE	.	3
STRONGLY DISAGREE	.	4
CHILDREN HAVE NO NETS	.	5

424. It is important to sleep under a net every single night. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY AGREE	.	1
SOMEWHAT AGREE	.	2
SOMEWHAT DISAGREE	.	3
STRONGLY DISAGREE	.	4

425. Pregnant women are at high risk of getting malaria. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY AGREE	.	1
SOMEWHAT AGREE	.	2
SOMEWHAT DISAGREE	.	3
STRONGLY DISAGREE	.	4

426. Women should attend antenatal care early in their pregnancy. Do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree?

STRONGLY AGREE	.	1
SOMEWHAT AGREE	.	2
SOMEWHAT DISAGREE	.	3
STRONGLY DISAGREE	.	4