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DETERMINANTS OF UTILIZATION OF MALARIA PREVENTIVE MEASURES DURING PREGNANCY AMONG WOMEN AGED 15 TO 49 YEARS IN KENYA



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A research report submitted to the Faculty of Health Sciences, at the University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Epidemiology in the field of Implementation Science.

October 2021

Declaration

I, Beatrice Mkubwa, declare that except where specific reference is made to the work of others, the contents of this dissertation are original. The dissertation has not been submitted in whole or in part for consideration for any other degree or qualification in this or any other University. This study is unaided work, and it involves secondary data analysis of data initially collected by the Ministry of Health-Kenya as part of the 2015 Malaria Indicator Survey. It is being submitted for the degree of Master of Science in Epidemiology in the field of Implementation Science at the University of the Witwatersrand, Johannesburg.

Beatrice Mjumaa Mkubwa



14th October 2021

Dedication

I dedicate this research report to my loving parents and siblings. They have been instrumental in steering me toward my goals and supporting me throughout this journey.

Abstract

Background:

Malaria is a parasitic infection of public health concern. It is a significant cause of maternal and infant morbidity and mortality, especially in children under five years of age and pregnant women in Kenya and sub-Saharan Africa at large. This study aimed at identifying the determinants associated with the uptake of malaria preventive measures in pregnancy, hereon, Insecticide Treated Net and Intermittent Preventive Treatment with Sulfadoxine Pyrimethamine (ITN and IPTpSP).

Methods:

This is a cross-sectional study that involves secondary data analysis of the 2015 Kenya Malaria Indicator Survey (MIS) using a total of 2455 women between the ages of 15 to 49 years. To be included in this study, the women needed to have had a history of either being pregnant or having given birth within five years before the primary survey. The following methods of survey adjusted data analysis were used: descriptive analysis was used to determine the extent of the uptake of ITN and IPTpSP in pregnancy; multinomial logistic regression was used to identify the determinants of use of ITN and IPTpSP in pregnancy.

Results:

During pregnancy, ITN use was 60.5%. The use of at least one dose of IPTpSP was 56.6%, the use of three or more doses of IPTpSP was 24.8%, and only 37.1% of the study participants used both ITN and IPTpSP during pregnancy. The sex of the head of household (RRR 0.49, CI 0.29-0.84, p=0.010), the household-level head-level education (RRR 2.09, CI 1.17-3.72, p=0.013), and parity (RRR 0.48, CI 0.26-0.87, p=0.015) were significant determinants of ITN use. The number of Antenatal Care Clinic visits during pregnancy (RRR 52.91, CI 10.59-264.66, p=<0.001), whether the women live in an urban or rural place and

living in the different malaria endemicity (RRR 0.46, CI 0.28-0.76, p=0.003) were also significant predictors of IPTpSP uptake. The significant predictors of combined use of ITN and IPTpSP during pregnancy were the number of antenatal care visits (RRR 8.60, CI 2.18-33.87; p=0.002), the household head highest level of education (RR 2.06, CI 1.15-3.69; p=0.016), the household head sex (RRR 0.62, CI 0.41-0.93; p=0.023), and living in endemic (RRR 6.06, CI 3.10-11.83; p=<0.001) and low-risk (RRR 0.18, CI 0.10-0.34; p=<0.001) malaria endemicity areas.

Conclusion:

Despite the efforts put by the government and partners in the health sector in the fight towards malaria in pregnancy, the uptake of malaria preventive measures is still below 80% for both ITN and IPTpSP during pregnancy in Kenya. There is minimal available literature in this regard to guide policymakers to target ITN and IPT uptake, especially in moderate to high malaria risk areas. Further qualitative research needs to be geared towards understanding the influence of these factors in Kenya and other settings.

Keywords: *malaria in pregnancy, determinants, ITN, IPTpSP, multinomial logistic regression, Kenya*

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List of Abbreviations

ANC	Antenatal Care Clinic
DHS	Demographic Health Surveillance
DOT	Direct Observation Therapy
IPTpSP	Intermittent Preventive Treatment in pregnancy with Sulfadoxine Pyrimethamine
IPT	Intermittent Preventive Therapy
ITN	Insecticide Treated Net
MIS	Malaria Indicator Survey
MLR	Multinomial Logistic Regression
MOH	Ministry of Health
PAM	Pregnancy Associated Malaria
SP	Sulfadoxine Pyrimethamine
SSA	Sub-Saharan Africa
USAID	United States Agency for International Development
WHO	World Health Organization

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CHAPTER 1 INTRODUCTION

1.1 Background Information

Malaria is a parasitic infection transmitted through a bite of a female Anopheles mosquito (1). The most common malaria species infecting humans are *Plasmodium falciparum* and *Plasmodium vivax* (2). Other malaria-causing parasites are *Plasmodium ovale, Plasmodium malariae,* and *Plasmodium knowlesi* (3). Environmental factors such as bushes and stagnant water around homes, rainfall, low altitude, and high temperatures favour the breeding of mosquitoes, as well as *plasmodium* parasite reproduction (1).

Malaria is one of the most common parasitic infectious diseases globally. It is endemic in close to 100 countries in which 2400 million people reside (4). Approximately 228 million people globally get malaria infection annually (5). Twenty-five out of the twenty-nine countries that account for 95% of the malaria cases globally are in the World Health Organisation (WHO) sub-Saharan African countries (4). According to the 2020 World Malaria report, there has been a slow decline in malaria-related mortality rate from the year 2000 to 2019. In the year 2000, the mortality rate was 25 per 100,000 population at risk. In 2015, there was a further decline to 12 per 100,000, and in 2019 it was reported to be 10 per 100,000 population at risk globally. However, it has to be noted that the malaria burden is still high, especially among pregnant women and children (4).

Children below five years, pregnant women, and infants are the most vulnerable population in contracting malaria (5). A meta-analysis done in 2015 reported the prevalence of Pregnancy Associated Malaria (PAM) in sub-Saharan Africa to be between 10% and 20% (6). In 2018, a WHO report highlighted that 11 million pregnant mothers in moderate and high malaria transmission countries in sub-Saharan Africa had exposure to malaria infection. PAM can cause considerable dangers to the mother, the unborn and new-born child. Some of these dangers are foetal intrauterine growth retardation, premature births, anaemia, low birth weight, and

maternal death (7). As a result, approximately 872,000 children are born with low birth weight, and more than 40% of pregnant women develop anaemia (5). Additionally, each year, malaria in pregnancy contributes to up to 10,000 deaths globally (8).

In Kenya, malaria in pregnancy is among the leading infectious disease causes of maternal and infant morbidity and mortality. The country has four malaria endemicity ecozones. Namely; stable malaria zone (Nyanza, Coast, and Western Regions), seasonal malaria zone (Central, Eastern, and North -Regions), highlands prone to malaria epidemics (mainly in Rift Valley and some parts of Nyanza Regions), and the malaria-free zone (Nairobi Area and some parts of Central Region) (9).

It is estimated that 24 million individuals in Kenya are at risk of contracting malaria each year, and more than 30% of inpatient disease diagnoses in the country are related to malaria (10). In addition, approximately 1.5 million women become pregnant in Kenya each year (11). The majority of these women live in moderate to intense malaria transmission areas, putting them at a higher risk of contracting malaria. In 2019, the Kenya Ministry of Health (MOH) estimated PAM prevalence to be 6.3% among women attending their first Antenatal Care Clinic (ANC) visit (12). Therefore, pregnant women must be prevented from malaria infection to reduce this parasitic infection's substantial side effects and consequences.

To prevent PAM, the World Health Organization (WHO) advocates the use of Intermittent Preventive Treatment with a dose of Sulfadoxine-Pyrimethamine (IPTpSP) and sleeping under an Insecticide-Treated Net (ITN) (13). IPTpSP is first given early in the second trimester of pregnancy and every four weeks in the subsequent antenatal care (ANC) clinic visits until the mother delivers. It is administered using Direct Observation Therapy (DOT) by a qualified health worker, usually a nurse at the antenatal care clinic. In most countries, ITNs are given ITNs for free during their first ANC visit. The clinicians also emphasize the importance of consistent use of the ITNs before, during, and after pregnancy.

Determinants are the factors that affect the effective use of an intervention, and in this case, the uptake of malaria preventative measures during pregnancy (14). The success of the malaria prevention programs requires good knowledge of these determinants to improve the use of ITNs and IPTpSP during pregnancy (15). Therefore, it is important to identify individual and health system-level factors that affect women's decision to use ITNs and IPTpSP.

1.2 Problem statement

In 1998, Kenya adopted the two-malaria preventive interventions for all pregnant women, namely ITN and IPTpSP. It integrated the preventive measures with ANC care in all public hospitals. However, the burden of malaria amongst pregnant women is still high (16). Since introducing the free issue in public hospitals in Kenya, there has been a steady increase in ITN and IPTpSP use during pregnancy. Nevertheless, the uptake of these interventions is still low (10). Ideally, the target of the Kenyan government was to have a coverage of 80% of the usage of the ITN and IPTpSP amongst pregnant women (17). However, the Kenya Health Demographic Surveillance statistics show that between the years 2008 and 2009, 49.0% of pregnant women slept under an ITN, and only 33.3% used IPTpSP. In 2015, ITN and IPTpSP use was 57.8% and 50.0%, respectively (15,16).

1.3 Justification

Kenya is among the sub-Saharan countries reporting a high incidence of malaria. Additionally, pregnant women are among the most vulnerable population to malaria infection, putting pregnant women and unborn babies at risk of malaria-related complications. The use of ITNs and IPTpSP are proven effective measures for preventing malaria during pregnancy (20).

Despite Kenya's government's effort to reduce malaria cases, from the statistics above, the country still lags behind the 80% coverage target of ITN and IPTpSP set in the Kenya Malaria Strategy 2009-2018 report (17). Therefore, it is imperative to assess the factors affecting the use of malaria preventive interventions during pregnancy (10). Determining the factors that

influence the uptake of ITNs and IPTpSP during pregnancy may highlight critical gaps in the prevention programs. Malaria prevention measures in this context refer to both ITN and IPTpSP.

1.4 Research question

What are the determinants of utilization of ITN and IPTpSP during pregnancy among women aged between 15 and 49 years in Kenya in 2015?

1.5 Aim

To examine the use of ITN and IPTpSP and identify the key determinants of malaria preventive measures use during pregnancy among women aged between 15 and 49 years in Kenya in 2015.

1.6 Specific objectives

I. To describe the extent of use of ITNs during pregnancy among women aged between 15 and 49 years in Kenya.
II. To determine the extent of the use of Intermittent Preventive Treatment with IPTpSP during pregnancy among women aged between 15 and 49 years in Kenya.
III. To examine the role of individual and health system-related factors in determining the uptake of ITNs and IPTpSP among women aged between 15 and 49 years in Kenya.

1.7 Conceptual framework

The framework in Figure 1.1 captures the concepts related to the study objectives on the prevention of Pregnancy Associated Malaria (PAM). The concepts in the framework are; uptake of the PAM preventive measures, health system and individual-level determinants of the uptake of malaria preventive measures (9,14). The conceptual framework is based on the literature review and the Andersen's Behaviour Model (ABM). The ABM was initially developed in the 1960s to describe factors influencing the utilization of health care services. (21,22). The ABM model has also been used adopted in a study that was examining of predictors associated with

various health interventions, including medication use among individuals living with HIV (23). The figure of the conceptual framework below shows the causal pathway of the factors that lead to the uptake of ITN only, IPTpSP only, or both ITN and IPTpSP. The uptake of these measures individually or combined can lead to the prevention of PAM.

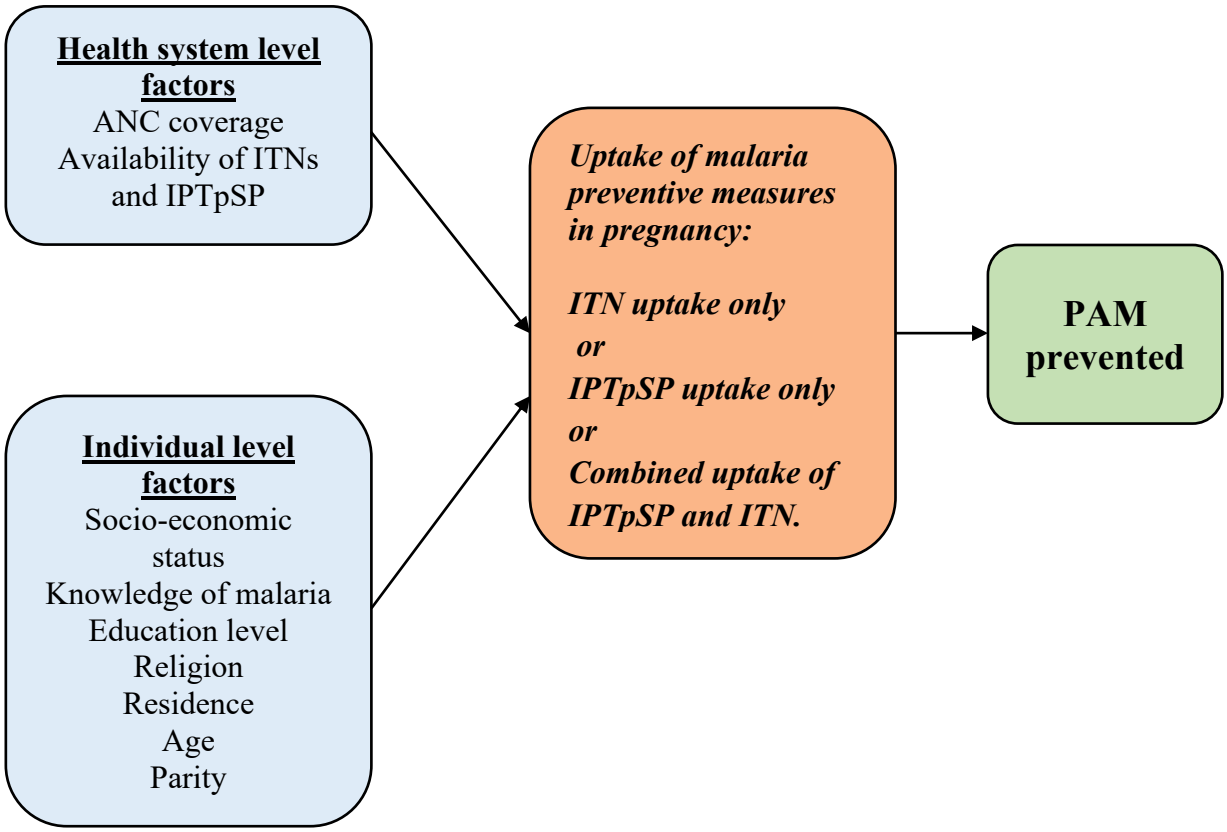


Figure 1.1 The conceptual framework showing factors associated with the uptake of preventive measures for Pregnancy Associated Malaria (PAM).

1.8 Literature review

This section reviews the literature on malaria in pregnancy, malaria preventive measures in pregnancy, the uptake of ITN and IPT in sub-Saharan Africa, the determinants of uptake of malaria preventive measures in pregnancy, and the implementation of malaria preventive measures during pregnancy. Only peer reviewed articles were synthesized in this literature review.

1.8.1 Malaria in pregnancy

Pregnant women are at a greater risk of symptomatic malaria infection. The physiological and hormonal changes that occur during pregnancy to create an environment for foetal development can cause maternal immunity suppression and put pregnant women at a greater risk of contracting malaria (24). Additionally, when a pregnant woman gets malaria, the malaria-infected red blood cells can sequester through the placenta (25). Consequently, if left untreated, malaria infection can result in a wide range of adverse effects for the pregnant woman, the developing foetus, and the new-born infant (26). The adverse effects range from negligible to severe depending on the pregnant woman immune response (10,20).

Malaria in pregnancy can cause severe anaemia. Severe anaemia during pregnancy can increase the risk of developing prepartum and postpartum haemorrhage, one of the leading causes of maternal death. Malaria infection can also lead to spontaneous abortion, stillbirth, foetal growth retardation and congenital infection for the foetus (28). Furthermore, it can cause premature birth, low birth weight, and neonatal mortality (25). The adverse effects can result in health complications, such as acute seizures, which can last well into adulthood (29). Fortunately, these adverse effects can be avoided.

1.8.2 Malaria preventive measures in pregnancy

The current study focuses on IPTpSP and ITN as malaria preventive measures in pregnancy. The WHO recommends effective case management of malaria infection (21). ITNs and IPTpSP

for the prevention and control of malaria during pregnancy (22, 23). The use of ITNs to prevent malaria dates back to the1980s after the Roll Back to Malaria Campaign.

By the 2000s, the use and access to ITNs received more attention as one way of fighting malaria (31). An ITN can either kill or repel mosquitoes that come into contact with it or repel them (32). In most sub-Saharan countries, ITNs are given for free through community mass distribution campaigns, at health care centres during ANC visits, as well as through the Expanded Programme of Childhood Immunization and are to be used throughout pregnancy and in the postpartum period for both mother and child (13, 29). ITN use during pregnancy has beneficial impacts on a pregnant woman, her foetus, and the new-born infant (34). In western Kenya, women who slept under an ITN every night in their first four pregnancies delivered approximately 28.0% fewer babies with low birth weight or premature babies. In addition, sleeping under an ITN reduced placental malaria by 35.0% (35).

IPTpSP has been a useful anti-malarial preventive drug given after 16 weeks of pregnancy (24). In 2012, the WHO updated its policy that all pregnant women in moderate and high transmission malaria areas should receive at least three doses of the IPTpSP. The more doses the pregnant woman received, the more effective the treatment. At 16 weeks of pregnancy, women are given IPTpSP in the first three or more regularly scheduled antenatal clinics (36).

In Malawi, the situation is similar. It was reported that receiving at least two or more IPTpSP doses significantly decreased the proportion of women with placental malaria infection at delivery (24). Moreover, a Randomised Clinical Trial in Kenya reported that IPTpSP reduced the risk of severe anaemia by up to 39.0% among pregnant women. It also gave up to 85.0% protection against malaria infection in primigravidae living in high-risk malaria areas of Kilifi (37). Delivery of IPTpSP doses is linked to routinely scheduled antenatal clinic visits. The WHO recommends an optimal schedule of four antenatal clinic visits, with three visits after 16

weeks of pregnancy (2)(38). As a result, repeated doses of IPTpSP with ITN use effectively reduces the risk of contracting malaria (2).

1.8.3 The prevalence of Malaria Preventive Measures during Pregnancy in sub-Saharan Africa

Underutilization of malaria preventive measures during pregnancy is a serious concern for malaria prevention and control programs run by health NGOs and national governments in sub-Saharan Africa. However, over the years, there has been a steady increase in the uptake of malaria preventive measures during pregnancy (16). For example, in 2011, Nigeria reported an ITN uptake of 20.0% (39); in 2020, the uptake use of ITN during pregnancy was 78.0% (40). The uptake of IPT and ITN varies, however, most sub-Saharan African countries' statistics are below the 80% utilization target set by the WHO (3, 34). Although studies done in Uganda, Ethiopia, and Nigeria that looked at the use of ITN in pregnancy reported the uptake of ITN to be 86.4%, 70.4% and 78.0, the. Uptake in Nigeria and Cameroon was 20.0% and 16.9%, respectively (38,33,40,39,42). In 2019, optimal uptake of IPT in Sierra Leone was 93.2% (43). In contrast, a study in Uganda recorded an uptake of 18.0% in the same year (44). In 2007, a study in Kilifi, Kenya, reported the uptake of IPT to be 70.5% (11). Table 1.1 summarizes the uptake of ITN and IPT from 15 studies conducted in sub-Saharan Africa from 2011 to 2021.

Table 1.1 Summary of uptake of malaria preventive measures in SSA

Year| Reference	Country	ITN uptake (%)	Any IPT uptake-at least one dose or more (%)	Optimal IPT uptake -three doses or more (%)	Combined uptake ITN and IPT (%)
2021 (38)	Uganda	86.4		14.7	
2020 (40)	Nigeria	78.0			
2020 (45)	Ghana			71.0	
2020 (46)	Malawi			42.0	
2019 (44)	Uganda			18.0	
2019 (47)	Tanzania			48.4	
2019 (43)	Sierra Leone		94.8	93.2	
2018 (33)	Ethiopia	70.8			
2017 (42)	Cameroon	16.9	61.6		
2017 (48)	Senegal	46.8	80.4		37.5
2016 (49)	Uganda	58.4	63.7		
2016 (50)	Cameroon	43.8	88.7		
2015 (10)	Kenya	52.0	38.5		
2013 (51)	Gabon		84.1	49.5	
2011 (39)	Nigeria	20.0	18.5		

1.8.4 The determinants of the use of malaria preventive measures during pregnancy

Several individual, social, economic, and community factors have been reported to influence the uptake of health interventions. Some factors include age, residence, education level, marital status, occupation, socioeconomic status, geographical area, access to the health intervention, community empowerment through education and creating awareness, and health facility service delivery (38,40,43,48). The following sub-sections synthesize some of the factors that have been highlighted in literature that influence the use of ITN and IPTpSP during pregnancy.

1.8.4.1 Availability of ITNs and IPTpSP drugs

Most countries in sub-Saharan Africa give free or subsidised ITNs and IPTpSP to all pregnant mothers visiting ANC clinics to prevent malaria (10). Availability of ITNs and IPTpSP drugs in ANC clinics is a determinant of the use of these two preventive measures (52). Irregular supply of IPTpSP drugs due to complex chain distribution procedures, insufficient funds, and poor government commitment to purchase the IPTpSP or ITNs contribute to the low uptake of the preventive measures (39). In some countries, including Kenya, ITNs are given at ANC clinics, and constant stock-outs of ITNs were reported to contribute to the low utilization (53). Additionally, a study that looked at factors associated with use of malaria control interventions by pregnant women in Bugiri in Uganda, highlighted that women with ease access to ITNs were most likely to sleep under an ITN (49).

1.8.4.2 ANC Coverage

Malaria preventive measures are primarily available to women who attend ANC clinics (51). Pregnant women at 16 weeks and above are expected to receive an ITN and the initial dose of IPTpSP during the first antenatal clinic visit. Therefore, low coverage of ANC visits can contribute to the low uptake of malaria preventative measures in pregnancy (54).

A study in Malawi reported that after controlling for other predictors such as age, education, and socio-economic status, the number of ANC visits was the only significant determinant in the uptake of malaria preventive measures in pregnancy. This finding could be attributed to the

late initiation of ANC visits only after the second trimester, instead of the first trimester (46). Pregnant women who attended the ANC clinic four or more times had a higher uptake of malaria preventive interventions (38). In Cameroon, the number of ANC visits was the only independent factor associated with IPT use. Pregnant women who visited the ANC clinic four and more times had a 7% higher chance of consistently sleeping under an ITN than those with lesser visits (50). Timely ANC visits also has been associated with completion of the three doses of the IPTpSP was associated with the timely visit to the ANC clinic (55).

Two studies in Senegal and Gabon reported a discrepancy between high ANC coverage and sub-optimal use of malaria preventive measures during pregnancy. In Senegal, although the ANC coverage was high, the uptake of malaria preventive measures was 38.8% (48). In Gabon, the use of malaria preventive interventions was not associated with ANC clinic attendance. Among the women with four or more ANC clinic visits, only 49.5% had three or more IPTpSP doses and used bed net the night before the survey (51).

In Senegal, the late start of ANC visits was a barrier to delivering the subsequent doses of IPTpSP. Women who start the ANC clinic late in pregnancy will receive fewer doses of IPTpSP. Additionally, pregnant women with easy access to healthcare are more likely to attend ANC clinics and were more likely to utilise malaria preventive measures than those who did not have easy access to healthcare services (48). In Gabon, 80.0% of women had four ANC visits, 97.4% received two doses of IPT under direct observation (51).

1.8.4.3 Knowledge and Education

Lack of knowledge about malaria can contribute to the inability of programs to achieve sustainable prevention and control of the disease. Pregnant mothers who were more knowledgeable regarding malaria and its risks in pregnancy were more likely to use malaria preventive measures than the less knowledgeable about malaria and its related complications

(35,21). Similarly, two studies done in Uganda reported that knowledge about IPTpSP was associated with the uptake of IPTpSP (53,44).

In Ghana and Cameroon, maternal literacy and higher education were associated with IPT and ITN uptake (42,45). However, in Sierra Leonne, women with a primary and higher level of education had lower odds of taking IPT (43).

1.8.4.4 Occupation and Socioeconomic status

Several studies have reported an association between socioeconomic status and the uptake of ITN and IPT in pregnancy. A study in Ethiopia reported that individuals from poorer households were less likely to use ITNs or IPT during pregnancy than women in a higher socio-economic standing (56). A survey done in Tanzania highlighted that some study participants lacked the money to top up the voucher amount given to get the ITN (7). Consequently, low uptake of PAM preventive measures in pregnancy was reported. A study on factors influencing the use of malaria preventive strategies in Senegal, Kenya, and Ethiopia reported that the higher level of income of the participants had a positive association with utilization of ITNs and IPTpSP (42,35,29). In Uganda, women in the fourth and fifth wealth quantile (higher wealth index) had a 1.08 more increased chance of using ITNs than those in the lowest wealth quantile (38).

In Uganda, optimal use of up to three or more doses of IPTpSP was positively associated with peasant farming as opposed to a housewife or businesswoman (38). However, in Tanzania and Ghana, self-employed participants had low uptake of IPTpSP (54,46). In Cameroon, occupation was the only factor associated with ITN use, while being a student or unemployed was negatively associated with ITN use during pregnancy (50). Another study in Nigeria reported that respondents who purchased the net had higher utilization of ITNs (40).

1.8.4.5 Maternal Age

Maternal age has been reported as a determinant of malaria preventive measures use in pregnancy. In Cameroon, older women were more likely to take up malaria preventive measures than younger women (50). Another study done in Sierra Leone reported that women aged between 25 and 29 years had higher uptake of at least three doses of IPT compared to the younger and the older women (43). This finding could be because older women have more experience with the use of ITN and IPT and are more likely to use these preventive measures in pregnancy (48). However, in Uganda, it was reported that women who were 34 years and above had lower odds of taking optimal doses of IPT (44).

1.8.4.6 Religion

In Kenya, religion was reported to play a role in the uptake of preventive measures. Muslims were more likely to use ITNs and IPT compared to non-Muslims (10). In Ghana, Christians and traditionalists had lower odds of using the recommended doses of IPTpSP compared to Muslims (45).

1.8.4.7 Other factors that influence IPT or ITN uptake

Other factors influencing the use of IPT or ITN amongst pregnant women include marital status, parity, and alternative malaria preventive methods. In Kenya, married women were likely to take up malaria preventive interventions than single mothers (10). Similarly to Kenya, single or never-married women in Ghana had a low uptake of three or more doses of IPT during pregnancy (45). Parity which is defined as the number of times one has given birth to a foetus with a gestational age of 24 weeks or more, regardless of whether the child was born alive or was stillborn has been can influence the uptake of IPT and ITN in subsequent pregnancies. In Tanzania, a study on predictors of early uptake of IPT among pregnant women reported that the participants with three or more children reported low uptake of IPT (55).

High malaria risk areas were also associated with increased uptake of IPT in Kenya compared to the low transmission regions (10). Some pregnant women did not like the smell of the ITNs and therefore did not sleep under an insecticide-treated net (53). Alternatives such as traditional herbs to prevent malaria during pregnancy were reported as a common practice in Nigeria (39). The availability of water at the clinic in Uganda was a vital determinant for the uptake of IPTpSP; 68.6% of the women were provided water and took SP under direct observation.

Other health system-related factors include inadequate dissemination of information by the health care workers to the community about malaria (39). The poor attitude of some healthcare workers towards patients in Ghana was highlighted as a barrier to achieving high IPTpSP uptake (52).

1.8.5 Implementation of malaria preventive measures during pregnancy

The literature illustrates that the availability of efficacious health interventions does not guarantee the usage of these interventions (41). Although ITN and IPTpSP are scientifically proven to be efficacious, the adoption of these preventive measures is still low, and the burden of malaria is still high (28). The uptake of these malaria preventive measures is influenced by individual, social, or structural factors, which play a vital role in the uptake of health interventions (29,35).

Individual factors such as change of perception, beliefs, attitude and knowledge of ITNs and IPTpSP in pregnancy are critical enablers or barriers to the uptake of efficacious interventions (57). Social factors such as creating community awareness of the intervention about the dangers of malaria in pregnancy, structural factors such as adopting new policies, and reduced health system bottlenecks play a role in utilizing these interventions (41)

CHAPTER 2 METHODOLOGY

This chapter presents the study design, study setting, study population, data management, data analysis, and ethical considerations of this study.

2.1 Study design

This study is a cross-sectional study that involves secondary analysis of the 2015 Kenya Malaria Indicator Survey (MIS). The primary data was collected from the 6th of July 2015 to the 15th of August 2015.

2.2 Study setting

Kenya is a low middle-income country located in Eastern Africa with an area of 580,367 km^2, bordering Ethiopia, Tanzania, Uganda, Sudan and Somalia. According to the 2020 UN statistics, it has been estimated that Kenya has a population of 53,771,296 (58). In sub-Saharan Africa, Kenya is one of the malaria-endemic countries with intense malaria transmission. It is considered a high malaria burden country, however, malaria prevalence varies across the country (59).

2.3 Study population

In the 2015 Kenya Malaria Indicator Survey, 5394 women aged between 15 to 49 years were selected from 7,313 households were consented and interviewed (59). In this secondary study, 2755 women with no pregnancy or no birth history five years before the primary survey, 131 who did not recall IPTpSP uptake and 53 who did not remember visiting the ANC clinic were excluded. After data cleaning, 2445 women (unweighted) were included in this study. Figure 2.1 shows the inclusion and exclusion criteria for the primary survey and this secondary study.

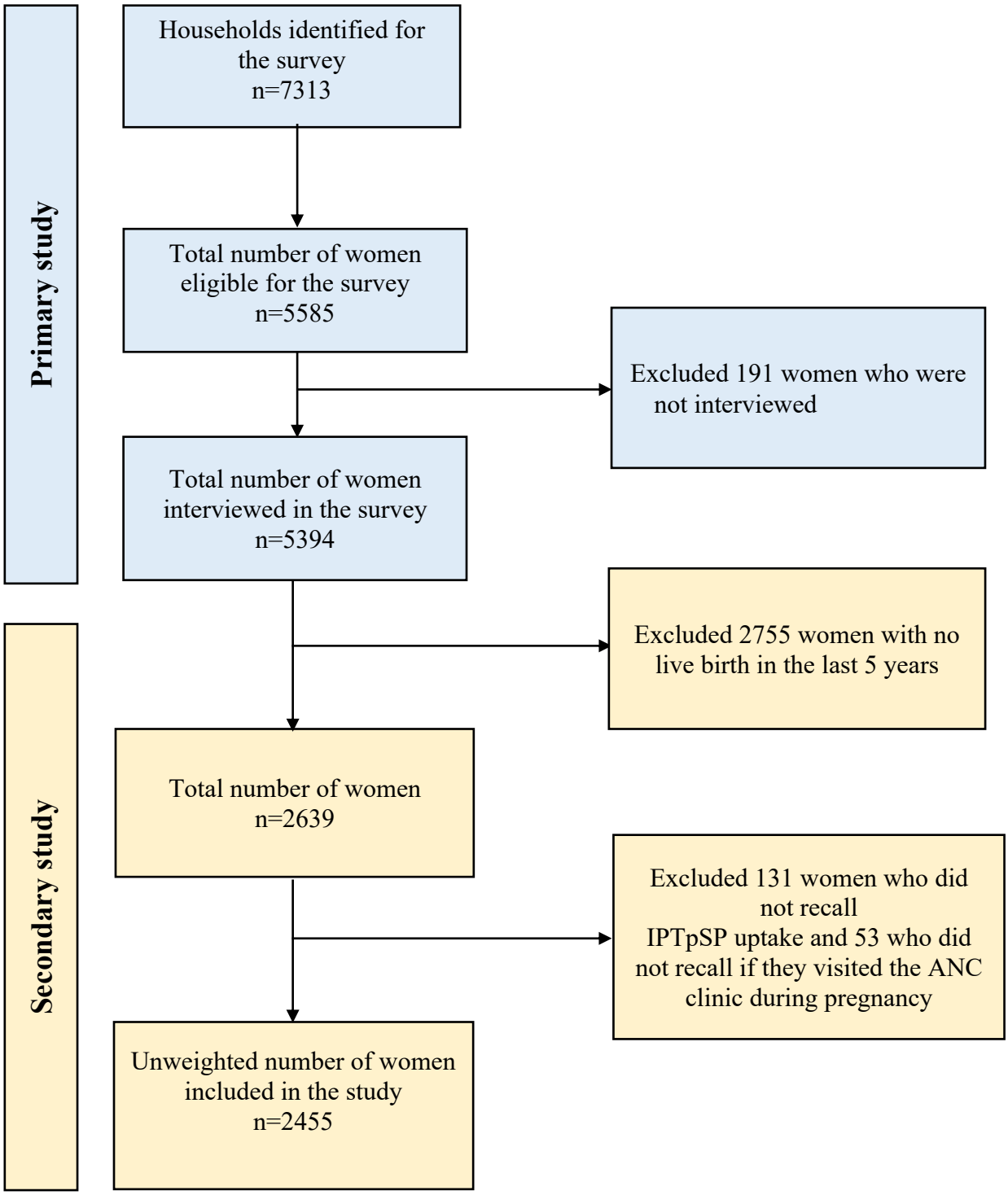


Figure 2.1 Flowchart diagram showing the selection of study participants included in the primary and secondary study

2.4 Sampling design

The primary survey included a nationally representative sample drawn from 7,313 households across the country. Sampling was conducted in two stages, namely, stratifies cluster sampling and systematic sampling. The stratified cluster sampling was used to identify 246 clusters, 131 from rural and 115 from urban areas. In the second step, systematic sampling was used to select 30 households from the 246 clusters (59). In this study, a convenient sampling strategy was used. After data cleaning, all the available data of the eligible participants were included in the analysis.

2.5 Data source and data collection

Primary data was collection was done by the Kenya Ministry of Health, Division of National Malaria Control Programme by trained fieldworkers using validated MIS questionnaires. The survey collected basic demographic information, reproductive health or birth history, the use of antenatal care services, the use of malaria preventive interventions and key malaria indicators, among other variables (59). The data sets of the 2015 Kenya MIS were downloaded from the USAID Demographic Health Surveillance Program website in the STATA compatible format.

2.6 Data management

Data management and cleaning were done using STATA Standard Edition (SE) version 16. The variables of interest were extracted from the household recode (data set for every household member), and the individual recode (data set for women aged between 15 to 49 years). Based on the literature review and the conceptual framework, the variables that could potentially influence the uptake of malaria preventive measures during pregnancy were identified from both recode datasets. All the other variables not included in the analysis were deleted. Participants with missing data for the outcomes variables of interest were excluded from the study. After data cleaning, the two data sets were merged using two unique identifiers common to the two datasets: the household number and cluster number. The study sample weight was

calculated by dividing the household sample weight by 1,000,000 to correct for unequal probabilities of selection that might have occurred during sampling and compensate for survey non-response in the primary survey (60).

2.7 Study variables

In this study, the primary outcomes of interest are Insecticide Treated Nets uptake, Intermittent Preventive Treatment with SP uptake, and combined uptake of Insecticide Treated Nets uptake and Intermittent Preventive Treatment with SP.

2.7.1 Outcome variable I: Insecticide Treated Nets uptake

In the 2015 MIS, women of reproductive age were asked if they had slept under a mosquito net the night before the survey. The possible responses included 'no bed-net', 'only a treated net', and 'only untreated nets'. ITN use was re-coded as follows: 'no bed-net' and 'untreated bed-net', which were merged to denote 'no ITN uptake' and 'only a treated net' to denote ITN uptake.

2.7.2 Outcome variable II: Intermittent Preventive Treatment with SP uptake

In this study, the optimal uptake of IPTpSP is defined as using at least three doses of SP to prevent malaria in pregnant women. IPTpSP uptake was categorized into a binary variable based on the response to the survey question, "During this pregnancy, did you take SP/Fansidar to prevent you from getting malaria?". Women who took less than three doses were categorized as 0, and those who took three or more were coded as 1 (44).

Any uptake of IPTpSP is defined as using at least one dose of SP to prevent malaria in pregnant women. In the survey, women of reproductive ages were asked if they were given IPTpSP during pregnancy. The responses to this question were categorized as 'yes', 'no', and 'don't know'. The variables with missing values and the 'don't know' category from the analysis were dropped from the analysis (38,58).

2.7.3 Outcome variable III: Combined uptake of ITN and IPT uptake

The third outcome variable of the study was the combined uptake of ITNs and IPTpSP during pregnancy. This variable was aimed at capturing women who make use of both these measures during pregnancy. However, there was no question in the 2015 MIS on the combined uptake of ITN and IPTpSP. Therefore, to generate the combined uptake of ITNs and IPTpSP variable, I merged the 'no' categories for ITN use and IPTpSP and the 'yes' categories of the ITN usage and IPTpSP uptake (42).

2.7.4 Explanatory variables

Based on the literature review and the conceptual framework, the explanatory variables included in the analysis were age, parity, marital status, residence, educational level, socioeconomic status, religion, malaria knowledge, malaria endemicity. We used some variables as they were in the original data set; we recoded some depending on the literature review and the research interests. The table in the Appendix A summarizes all the variables included in this study.

2.8 Data analysis

Data were analysed using STATA SE version 16. Before we started the analysis, the data was survey set using the primary sampling unit, sampling weight and stratification variables. The prefix **'svy:'** was used before each command throughout the analysis to account for the stratified cluster sampling used in the primary study.

Survey adjusted frequencies, proportions, and percentages were used to describe the variables and determine the extent of the use of ITN and IPTpSP against malaria in pregnancy. The Pearson's Chi-Squared test of independence was used to assess the statistical significance and the distribution frequencies of the outcome variables with the independent variables at 95% confidence intervals (0.05 alpha level). After that, the survey adjusted multinomial logistic

regression was carried out to identify the determinants of utilization of ITN, IPTpSP, and combined use of ITN and IPTpSP during pregnancy.

Initially, the survey-adjusted Pearson's Chi-Squared test of independence output was to be used to select the variables to be included in the multinomial logistic regression model. However, there were very few variables that had a significant p-value at the 5% alpha level. Therefore, explanatory variables were included based on the literature. The variables that were significant predictors of the uptake of malaria preventive measures in previous studies were included in the analyses. The baseline category for the multinomial logistic regression model was 'No ITN and IPTpSP use'. The potential interactions between variables such as age, maternal education and socioeconomic status, among other explanatory variables, were explored. There were no significant interactions as shown in the table in Appendix B. The multinomial logistic regression technique yielded relative risk ratios, which defined the association between predictor variables and each outcome variable. The multinomial logistic regression was used to identify the determinants of uptake of malaria preventive measures in pregnancy. The Hosmer Lemeshow goodness of fit test was done for the model with no interactions.

2.9 Ethical considerations and data privacy

The Kenyatta National Hospital, in collaboration with the University of Nairobi Scientific and Ethics Review Committee, approved the primary research protocol. Throughout the study, features that make the participants identifiable were anonymised, and confidentiality was maintained. In the primary survey, USAID and MOH Kenya sought a written informed consent from all participants and recruited only those who signed the informed consent.

Ethical approval for this secondary study was given by the University of the Witwatersrand Human Research Ethics Committee (HREC) - Medical (Protocol number M120247). Permission to use the 2015 Kenya Malaria Indicator Survey data for this study was requested from the Measure DHS database gatekeepers to access the data (Reference: 17/3/3). The data obtained were anonymised, and it is not possible to link it back to the survey participants.

CHAPTER 3 RESULTS

This chapter presents the study population's sociodemographic characteristics, the extent of use of insecticide-treated nets, and intermittent preventive treatment with SP. The first section highlights the descriptive analysis, followed by bivariate analysis results, and then the multinomial logistic regression output.

3.1 Sociodemographic characteristics of the study population

This section gives an overview of the sociodemographic characteristics of participants presented on Table 3.1. A weighted sample of 2270 participants were included in this study. The mean age was 28.37 years. The majority of the women (52.4%) were aged between 25 and 34 years. The women who had studied up to primary school were 49.7%, while only 12.2% had studied up to the tertiary education level. The pregnant women who attended the ANC 4 or more times were 64.1%, 31.0% visited the ANC 1, 2 or 3 times, and only 4.9% did not visit the ANC clinic throughout pregnancy.

3.2 Uptake of malaria preventive measures during pregnancy

The general uptake of ITN, IPTpSP as well as combined uptake was below 80% (Table 3.2). Out of the 2270 women included in this study, 60.5% of the women aged between 15 and 49 years slept under an insecticide-treated net, 56.6% took at least one or more doses of IPTpSP, and only 24.8% took up to three or more doses of IPTpSP which is the optimal uptake of IPTpSP. Only 37.1% slept under an insecticide treated net and took at least one dose of IPTpSP during pregnancy.

Table 3.1 Sociodemographic characteristics of the study participants

Explanatory variables	Frequency n =2270; weighted	Percentage %
Maternal age (years)		
15-24	678	29.9
25-34	1190	52.4
35-49	402	17.7
Residence		
Urban	769	33.9
Rural	1501	66.1
Maternal education		
No education	266	11.7
Primary education	1127	49.6
Secondary education	600	26.4
Tertiary education	277	12.2
Religion		
No religion or other	60	2.7
Roman Catholic	500	22.0
Protestant or other Christian	1538	67.8
Muslim	172	7.6
Wealth index		
Poor	974	42.9
Middle-class	417	18.4
Rich	879	38.7
Literacy		
Cannot read at all	413	18.2
Can read parts of a sentence	243	10.7
Can read a whole sentence	1614	71.1
Parity		
Para 2 or less	1106	48.8
Para 3 & 4	722	31.8
Para 5 & 6+	441	19.4
Media exposure		
No	865	38.1
Yes	1405	61.9
Number of ANC visits		
No ANC visit	112	4.9
1-3 ANC visits	703	31.0
4 or more ANC visits	1454	64.1
Head of household education		
Primary/ vocational	1029	52.5
Secondary	590	30.1
Tertiary	340	17.4
Household head sex		
Male	1556	68.5
Female	714	31.5
Head of household age (years)		
15-24	160	7.0

NB: Para is the number of completed pregnancies beyond 20 weeks' gestation

Table 3.2 Overall uptake of ITN and IPTpSP among Pregnant Women in Kenya – MIS 2015

Malaria Preventive measure		n (%)
ITN Uptake:	ITN Use	897 (60.5)
	No ITN Use	1373 (39.5)
IPTpSP Uptake:	Optimal Uptake (Three or more doses)	563 (24.8)
	Less than three doses (0, 1 and 2 doses)	1706 (75.2)
IPTpSP Uptake:	Any Uptake (at least one dose)	1285 (56.6)
	No IPTpSP	984 (43.4)
Combined uptake: ITN and IPTpSP		842 (37.1)

3.2.1 The association between the characteristics of respondents and the uptake of Insecticide Treated nets during pregnancy

During pregnancy, the use of ITNs was significantly associated with maternal education, wealth index, ANC clinic visits, the head of household sex, literacy level, and malaria endemicity of the participants' region, and media exposure to malaria messages as shown in Table 3.3. The use of ITNs was highest among the study participants living in the malaria-endemic areas and lowest in low-risk malaria areas where less than half of the women used ITNs in pregnancy. The uptake of ITN was higher by about 20.0% among women who attended the ANC clinic four or more times than women who did not visit the ANC during pregnancy. Middle-class women were more likely to sleep under ITN when pregnant than the women defined as poor or rich. The uptake of ITN during pregnancy was above 60% among women who were educated (primary, secondary or tertiary) compared women with no education (38%).

3.2.2 Association between the characteristics of participants and the use of three or more doses (optimal uptake) of IPTpSP during pregnancy

Table 3.4 shows the bivariate analysis results. The two factors significantly associated with the optimal uptake of the IPTpSP during pregnancy were the number of ANC clinic visits, and the endemicity of malaria in the area participants reside. The participants who did not visit the ANC clinics were less likely to take IPTpSP than those who had at least one or more visits. Women living in the malaria-endemic zones were more likely to use IPTpSP than those living in the low-risk and seasonal malaria zones.

Table 3.3 Bivariate analysis results of the association between characteristics of respondents and the uptake of ITN during pregnancy in Kenya – MIS 2015

Explanatory variables	ITN Uptake			
	ITN use n = 1373 n (%)	**No ITN use n = 897 n (%)**	**Chi Statistic χ^2**	**P-value**
Maternal age (years)				
15-24	405 (59.8)	272 (40.2)	1.09	0.730
25-34	731 (61.4)	459 (38.6)		
35-49	237 (58.9)	165 (41.1)		
Residence				
Urban	472 (61.4)	297 (38.6)	0.45	0.762
Rural	901 (60.0)	600 (40.0)		
Maternal education				
No education	101 (38.0)	165 (62.0)		
Primary education	715 (63.5)	412 (36.5)	69.43	**0.007***
Secondary education	375 (62.5)	225 (37.5)		
Tertiary education	182 (65.5)	96 (34.5)		
Religion				
No religion & other	19 (43.0)	34 (57.0)		
Roman catholic	1256 (60.5)	197 (39.5)	14.39	0.117
Protestant/other Christian	91 (62.0)	584 (38.0)		
Muslim	91 (52.9)	81 (47.1)		
Wealth index				
Poor	527 (54.2)	446 (45.8)	35.44	**0.009***
Middle-class	289 (69.2)	128 (30.8)		
Rich	557 (63.4)	322 (36.6)		
Literacy				
Cannot read at all	200 (48.4)	213 (51.6)	33.36	**0.004***
Can read parts of a sentence	152 (62.5)	91 (37.5)		
Can read a whole sentence	1021 (63.3)	593 (36.7)		
Parity				
Para 2 or less	685 (61.9)	422 (38.1)	3.73	0.390
Para 3 & 4	437 (60.6)	284 (39.4)		
Para 5 & 6+	251 (56.8)	191 (43.2)		
Media exposure				
No	454 (52.6)	410 (47.4)	39.60	**<0.001***
Yes	918 (60.5)	487 (34.6)		
Number of ANC visits				
No ANC visit	48 (42.4)	65 (57.6)	24.54	**0.008***
1-3 ANC visits	405 (57.6)	298 (42.4)		
4 or more ANC visits	920 (63.3)	534 (36.7)		
Head of household education				
Primary/vocational	628 (61.1)	400 (38.9)	6.28	0.465
Secondary	397 (67.2)	194 (32.8)		
Tertiary	212 (62.3)	128 (37.7)		
Household head sex				
Male	995 (63.9)	561 (36.1)	26.62	**<0.001***
Female	378 (53.0)	336 (47.0)		
Head of household age (years)				
15-24	95 (59.8)	64 (40.2)	0.058	0.982
25-34	546 (60.4)	358 (39.6)		
35 & above	731 (60.7)	474 (39.3)		
Malaria epidemiological zones				
Highland epidemic	334 (67.0)	165 (33.0)	238.82	**<0.001***
Endemic	520 (80.6)	125 (19.4)		
Seasonal	219 (50.5)	215 (49.5)		
Low risk	300 (43.4)	392 (56.6)		

NB: P-values are from chi-squared tests.
** p value less than 0.05*

Table 3.4 Bivariate analysis results of association between the characteristics of participants and the optimal uptake of IPTpSP during pregnancy in Kenya – MIS 2015

	Optimal IPTpSP Uptake			
Explanatory variables	**Three or more doses n=657 n (%)**	**Less than three doses n=1798 n (%)**	**Chi -Statistic χ^2**	**P-value**
Maternal age (years)				
15-24	185 (27.3)	492 (72.7)	3.74	0.247
25-34	286 (24.0)	904 (76.0)		
35-49	92 (22.9)	310 (77.1)		
Residence				
Urban	196 (25.5)	572 (74.5)	0.35	0.704
Rural	367 (24.4)	1134 (75.6)		
Maternal education				
No education	66 (24.8)	200 (75.2)		
Primary education	294 (26.1)	833 (73.9)	2.48	0.663
Secondary education	137 (22.8)	463 (77.2)		
Tertiary education	67 (24.1)	211 (75.9)		
Religion				
No religion/ Other religion	17 (29.0)	43 (71.0)		
Roman Catholic	124 (24.8)	375 (75.2)	0.77	0.887
Protestant/Other Christian	377 (24.5)	1161 (75.5)		
Muslim	44 (25.8)	127 (74.2)		
Wealth index				
Poor	238 (24.4)	736 (75.6)	2.43	0.539
Middle-class	115 (27.6)	302 (72.2)		
Rich	210 (23.9)	669 (76.1)		
Literacy				
Cannot read at all	103 (24.9)	310 (75.1)	0.95	0.735
Can read parts of a sentence	54 (22.4)	188 (77.6)		
Can read a whole sentence	406 (25.2)	1208 (74.8)		
Parity				
Para 2 or less	295 (26.6)	812 (73.4)	10.61	0.051
Para 3 & 4	184 (25.5)	538 (74.5)		
Para 5 & 6 and above	84 (19.1)	357 (80.9)		
Media exposure				
No	214 (24.7)	651 (75.3)	0.01	0.951
Yes	350 (24.9)	1056 (75.1)		
Number of ANC visits				
No ANC visit	9 (7.9)	104 (92.1)	42.85	**<0.001***
1-3 ANC visits	137 (19.5)	565 (80.5)		
4 or more ANC visits	417 (28.7)	1037 (71.3)		
Head of household education				
Primary/vocational	268 (26.1)	761 (73.9)	5.79	0.179
Secondary	127 (21.5)	463 (78.5)		
Tertiary	94 (27.6)	246 (72.4)		
Household head sex				
Male	402 (25.8)	1154 (74.2)	3.03	0.225
Female	161 (22.6)	553 (77.4)		
Head of household age (years)				
15-24	40 (25.2)	119 (74.8)	1.04	0.725
25-34	215 (23.7)	690 (76.3)		
35 and above	308 (25.6)	897 (74.4)		
Malaria epidemiological zones				
Highland epidemic	120 (23.9)	380 (76.1)	96.65	**<0.001***
Endemic	244 (37.9)	401 (62.1)		
Seasonal	80 (18.5)	353 (81.5)		
Low risk	119 (17.2)	573 (82.8)		

NB: Optimal IPTpSP is defined as 3 or more IPTpSP doses
*P-values are from the chi-squared tests. * p value less than 0.05*

3.2.3 Association between the characteristics of participants and the use of at least one dose of IPTpSP (any uptake) during pregnancy

According to the results in Table 3. 5, there was no significant relationship between maternal age, religion, and the participants' residence with the uptake of at least one dose of IPTpSP. However, there was a significant relationship between ANC visits with at least a dose uptake of the IPTpSP. The study participants who did not attend the ANC clinics were less likely to use IPTpSP than those who had one or more visits. The study participant's parity, level of education and the highest level of education of the head of the household were significant factors in the uptake of at least one dose of IPTpSP. Women living in the malaria-endemic zones were more likely to use IPTpSP during pregnancy than those living in the low-risk and seasonal malaria zones.

3.3 Determinants of the uptake of malaria preventive measures during pregnancy

This section presents the multinomial logistic regression model results (Table 3.6) of the factors predicting ITN and IPTpSP uptake during pregnancy.

3.3.1 Determinants of the use of Insecticide treated nets versus no malaria preventive measures use during pregnancy

The significant determinants of the ITN use during pregnancy versus not using any malaria preventive measures were parity, the level of education of the household head and living in the different malaria epidemiological zones in Kenya.

Participants who lived in a household where the head of the house was female were 51% less likely to use ITN during pregnancy than those whose household head was male (RRR 0.49; CI 0.29-0.84; p=0.010). The use of the ITNs in pregnancy was less than half among women who were para three and above. Women living in low-risk malaria zones were 79% less likely to use ITNs (RRR 0.21; CI 0.10 - 0.41; p=<0.001) but living in seasonal and endemic zones were not significant determinants of the uptake of ITN during pregnancy compared to living in the highland epidemic region.

Table 3. 5 Bivariate analysis of the association between the characteristics of participants and the uptake of one or more doses of the IPTpSP (any uptake) during pregnancy in Kenya – MIS 2015

Explanatory variables	Any IPTpSP Uptake			
	One or more doses n=1442 n (%)	**No IPTpSP n=1013 n (%)**	**Chi- Statistic χ^2**	**P-value**
Maternal age (years)				
15-24	385 (56.9)	292 (43.1)	2.26	0.510
25-34	660 (55.5)	530 (44.5)		
35-49	240 (59.6)	162 (40.4)		
Residence				
Urban	443 (57.6)	326 (56.1)	0.51	0.651
Rural	842 (56.1)	42.4 (659)		
Maternal education				
No education	133 (50.1)	132 (49.9)		
Primary education	690 (61.2)	437 (38.8)	28.55	**0.002***
Secondary education	334 (55.6)	266 (44.4)		
Tertiary education	129 (46.4)	149 (53.6)		
Religion				
No religion/ Other religion	32 (53.7)	28 (46.3)		
Roman Catholic	270 (54.1)	229 (45.9)	2.470	0.651
Protestant/Other Christian	887 (57.7)	651 (42.3)		
Muslim	95 (55.5)	76 (44.5)		
Wealth index				
Poor	560 (57.5)	413 (42.5)	3.163	0.516
Middle-class	246 (59.0)	171 (41.0)		
Rich	479 (54.5)	400 (45.5)		
Literacy				
Cannot read at all	224 (54.2)	189 (45.8)	1.72	0.598
Can read parts of a sentence	134 (55.3)	109 (44.7)		
Can read a whole sentence	927 (57.5)	687 (42.5)		
Parity				
Para 2 or less	588 (53.1)	518 (46.9)	15.19	**0.029***
Para 3 & 4	448 (62.0)	274 (38.0)		
Para 5 & 6 and above	249 (56.5)	192 (43.5)		
Media exposure				
No	467 (54.0)	398 (46.0)	4.25	0.150
Yes	819 (58.3)	587 (41.7)		
Number of ANC visits				
No ANC visit	13 (11.5)	100 (88.5)	117.19	**<0.001***
1-3 ANC visits	380 (54.1)	322 (45.9)		
4 or more ANC visits	892 (61.3)	562 (38.7)		
Head of household education				
Primary/vocational	622 (60.5)	407 (39.5)	17.28	**0.014***
Secondary	343 (58.2)	247 (41.2)		
Tertiary	162 (47.8)	178 (52.2)		
Household head sex				
Male	885 (56.9)	670 (43.1)	0.16	0.790
Female	400 (56.0)	314 (44.0)		
Head of household age (years)				
15-24	83 (51.9)	77 (48.1)	3.81	0.404
25-34	500 (55.3)	405 (44.7)		
35 and above	703 (58.3)	503 (41.7)		
Malaria epidemiological zones				
Highland epidemic	265 (53.0)	235 (47.0)	232.45	**<0.001***
Endemic	518 (80.3)	127 (19.7)		
Seasonal	194 (44.8)	239 (55.2)		
Low risk	309 (44.6)	383 (55.4)		

N.B. Any IPT is defined as uptake of at least one or more IPTpSP doses
*P-values are from the chi-squared tests. * p-value < 0.05*

3.3.2 Determinants of IPTpSP use versus no malaria preventive measure during pregnancy

The statistically significant determinants of the uptake of IPTpSP compared to not using any malaria measure during pregnancy were the participant's residence, number of ANC visits, and living in the different malaria endemicity zones.

The study participants who attended the ANC clinic 4 or more times during pregnancy and those living in malaria-endemic zones5 (RRR 3.25; CI 1.29-3.94; p=0.005) are more likely to use IPTpSP during pregnancy compared to those who did not visit the ANC and those living in those highland epidemic regions respectively. However, participants residing in the low-risk malaria zone (RRR 0.46; CI 0.28-0.76; p=0.003) and are from a rural residence are had a lower uptake of IPTpSP during pregnancy versus not using any malaria preventive measure than women living in the urban residence.

3.3.3 Determinants of malaria preventive measures of combined use of ITN and IPTpSP during pregnancy versus no malaria preventive measures use

Significant predictors of combined use of ITN and IPTpSP during pregnancy were the number of ANC clinic visits, the participants' residence, the highest level of education of the household head, the sex of the household head, and malaria endemicity of the area the participants reside. However, maternal age, maternal education, religion, and wealth index were not significant predictors of the combined use of ITN and IPTpSP during pregnancy.

The combined use of ITN and IPTpSP in pregnancy amongst women living in rural areas was almost 40% lower than women living in urban areas (RRR 0.60; CI 0.36-0.99; p=0.049). Women who completed four or more visits were eight times more likely to use malaria preventive measures than those who did not attend the ANC clinic (RRR 8.60; CI 2.18-33.87; p=0.002).

Table 3.6 Determinants of use of malaria preventive measures during pregnancy in Kenya – MIS 2015.

Variables	ITN use versus no use			IPTpSP uptake versus no use			Combined uptake - IPTpSP & ITN versus no use		
	Relative Risk Ratio (RRR)	95% Confidence Interval (CI)	P>[z]	Relative Risk Ratio (RRR)	95% Confidence Interval (CI)	P>[z]	Relative Risk Ratio (RRR)	95% Confidence Interval (CI)	P>[z]
Maternal age (years)									
15-24	Ref			Ref			Ref		
25-34	1.19	0.72 - 1.96	0.492	0.83	0.46 - 1.50	0.534	1.15	0.64 - 2.05	0.641
35-49	1.39	0.69 - 2.82	0.357	0.91	0.41 - 2.02	0.815	1.31	0.62 - 2.77	0.486
Residence									
Urban	Ref			Ref			Ref		
Rural	0.84	0.49 - 1.43	0.519	0.62	0.39 - 0.98	**0.042***	0.60	0.36 - 0.99	**0.049***
Maternal education									
No education	Ref			Ref			Ref		
Primary	1.72	0.61 - 4.90	0.306	0.81	0.30 - 2.18	0.673	1.48	0.43 - 5.05	0.529
Secondary	1.32	0.42 - 4.10	0.631	0.53	0.18 - 1.56	0.247	1.01	0.27 - 3.76	0.983
Tertiary	1.75	0.48 - 6.35	0.392	0.47	0.14 - 1.59	0.222	1.11	0.28 - 4.39	0.886
Religion									
No religion & other	Ref			Ref			Ref		
Roman Catholic	0.91	0.28 - 2.98	0.877	0.89	0.30 - 2.69	0.842	1.15	0.40 - 3.28	0.794
Protestant or other Christian	1.05	0.36 - 3.10	0.929	1.27	0.47 - 3.39	0.634	1.22	0.46 - 3.25	0.682
Muslim	0.54	0.14 - 2.19	0.389	1.00	0.26 - 3.84	0.999	0.82	0.20 - 3.35	0.775
Wealth index									
Poor	Ref			Ref			Ref		
Middle-class	1.12	0.65 - 1.93	0.694	0.66	0.38 - 1.14	0.135	1.25	0.77 - 2.02	0.371
Rich	1.09	0.62 - 1.91	0.762	0.78	0.44 - 1.38	0.387	1.03	0.63 - 1.70	0.909
Literacy									
Cannot read at all	Ref			Ref			Ref		
Can read parts of sentence	0.84	0.36 - 1.97	0.689	0.97	0.39 - 2.39	0.94	0.85	0.37 - 1.93	0.689
Can read whole sentence	0.94	0.44 - 1.99	0.861	1.42	0.67 - 3.00	0.357	1.42	0.69 - 2.90	0.339

Parity									
Para 2 or less	Ref			Ref			Ref		
Para 3 & 4	0.63	0.41 - 0.97	**0.037***	0.91	0.58 - 1.42	0.660	0.90	0.58 - 1.39	0.636
Para 5 & 6 above	0.48	0.26 -0.87	**0.015***	0.65	0.37 - 1.16	0.144	0.66	0.36 - 1.20	0.171
Media exposure									
No	Ref			Ref			Ref		
Yes	1.11	0.67 - 1.84	0.685	0.87	0.55 - 1.36	0.528	1.21	0.74 - 1.95	0.446
Number of ANC visits									
No ANC visit	Ref			Ref			Ref		
1 - 3 ANC visits	1.06	0.47 - 2.41	0.890	36.93	7.35 - 185.48	**<0.001***	5.06	1.27 - 20.17	**0.022***
4 or more ANC visits	1.43	0.63 - 3.26	0.396	52.91	10.58 - 264.66	**<0.001***	8.60	2.18 - 33.87	**0.002***
Head of household education									
Primary or Vocational	Ref			Ref			Ref		
Secondary or ‘a’ level	2.09	1.17 - 3.72	**0.013***	1.58	0.89 - 2.83	0.120	2.06	1.15 - 3.69	**0.016***
Tertiary	1.33	0.59 - 2.99	0.491	0.87	0.41 - 1.88	0.733	0.88	0.40 - 1.95	0.749
Household head sex									
Male	Ref			Ref			Ref		
Female	0.49	0.29 - 0.84	**0.010 ***	1.05	0.66 - 1.68	0.841	0.62	0.41 - 0.93	**0.023***
Head of household age (years)									
15-24	Ref			Ref			Ref		
25-34	0.72	0.28 - 1.82	0.482	1.11	0.40 - 3.10	0.838	0.99	0.38 - 2.58	0.989
35 & above	0.93	0.33 - 2.58	0.889	1.83	0.61 - 5.48	0.278	1.47	0.56 - 3.84	0.428
Malaria endemicity									
Highland epidemic	Ref			Ref			Ref		
Endemic	1.44	0.67 - 3.09	0.348	3.25	1.29 - 3.94	**0.005***	6.06	3.10 - 11.83	**<0.001***
Seasonal	0.75	0.29 - 1.92	0.544	0.67	0.32 - 1.39	0.279	0.51	0.25 - 1.05	0.068
Low risk	0.21	0.10 - 0.41	**<0.001***	0.46	0.28 - 0.76	**0.003***	0.18	0.10 - 0.34	**<0.001***

NB: Ref = Reference Category

** for significant p-values at 5% alpha level*

RRR = Relative Risk Rate

Participants exposed to malaria media messages were 21% more likely to use malaria preventive measures during pregnancy than those not exposed to any malaria messages through media, but the p-value for this finding was unsignificant (RRR 1.21; CI 0.74-1.95; p=0.446). The uptake of both ITN and IPTpSP during pregnancy was twice as much among women whose household head's highest level of education was secondary, or 'a' level (RRR 2.06; CI 1.15-3.69; p=0.016). Women living in endemic malaria zones were six times more likely to use both ITN and IPTpSP when pregnant than women living in the low-risk malaria zones than women living in the highland epidemic region. The participants who lived in a household where the head of the house is female were 38% less likely to use malaria preventive measures during pregnancy versus households headed by males (RRR 0.62; CI 0.41-0.93; p=0.023).

There were no significant interactions between age, maternal education level, marital and wealth index, and other explanatory variables. The results of the interactions tested are highlighted in Appendix B. The Hosmer Lemeshow goodness of fit test for the final multinomial logistic regression model chosen without the interaction term had a Chi-Square of 25.94 and a p-value of 0.356, indicating that the model is a good fit.

CHAPTER 4 DISCUSSION

This chapter presents a discussion of key study findings, as well as study limitations and conclusions. In this study, we investigated the uptake of ITN and IPTpSP and the determinants of the use of malaria preventive measures during pregnancy among women aged between 15 and 49 years in Kenya.

4.1 The extent of use of malaria preventive measures

The results show that the uptake of malaria preventive measures among pregnant women in Kenya is still below the 80% target as recommended by the WHO. However, the 60.5% uptake of ITN recorded in this study is higher than the 50.6% uptake reported in the 2014 Kenya Demographic Health Survey (KDHS) (59).

The study also revealed the uptake of three or more doses of the IPTpSP during pregnancy has increased steadily. In 2008-2009, KDHS reported a 6.9% uptake and 10.3% in 2014. In this study, approximately 24.8% took three or more doses of IPTpSP. However, the uptake of the recommended three doses or more of IPTpSP is still deficient. Uganda made similar observations, where the uptake of three or more doses of IPTpSP was 18% (38). The above findings are contrary to those reported in Sierra Leone, where the uptake of three or more doses of IPTpSP was 93.2% (49).

Only 37.1% of the participants slept under ITN and used IPTpSP during pregnancy in Kenya. A previous study using the Kenya DHS 2008-2009 data reported a combined uptake of ITN and IPTpSP to be 37.5% (35). These statistics show that the combined uptake of ITN and IPTpSP has remained stagnant in Kenya over the years. It has been reported using either ITN or IPTpSP only might not confer optimal protection against malaria in pregnancy as opposed to using both ITN and IPTpSP (62). A study in Cameroon reported that combining the use of ITN and IPT during pregnancy significantly reduces malaria related complications in

pregnancy than using either ITN alone or IPTpSP (2). There is a need to scale up national campaigns and creating community awareness on the use of malaria preventive measures during pregnancy by the MOH and health stakeholders to increase utilization.

4.2 Determinants of the use of malaria preventive measures during pregnancy

Previous literature argued that understanding the determinants of the use of malaria preventive measures during pregnancy is an essential aspect in the fight against malaria infection (35). Understanding these factors might inform early, frequent and appropriate delivery of ITN and IPTpSP during pregnancy. (59). Therefore, one of the primary objectives of this study was to identify factors that predict the use of ITN and IPTpSP during pregnancy.

The participants' number of ANC clinic visits in pregnancy and the residence (living in the rural or urban areas) were significantly associated with IPTpSP alone and combined use of ITN and IPTpSP use in pregnancy but not ITN use.

ANC clinics are crucial points of contact for all pregnant women. IPTpSP and a free issue ITN are given during ANC clinic visits, therefore visiting the ANC clinic offers the potential for implementing these interventions to prevent malaria in pregnancy (34,62). This study revealed that women who had four or more ANC clinic visits were likely to use IPTpSP and combined use of ITN and IPTpSP. This could indicate that the intervention was being administered at the ANC clinics. Similar findings been reported where IPTpSP use was associated with ANC visits but not ITN use during pregnancy (50). In Uganda, a study that looked at the determinants of utilization of ITN and IPTpSP reported that women who attended the ANC clinic had more than four times the uptake of malaria preventive measures (38). On the contrary, a study in that was looking at the uptake of ITN and IPT in Gabon did not find any association between ANC clinic attendance and the uptake of malaria preventive measures during pregnancy (51).

The literature has argued that women who go to the ANC clinic are educated about the dangers of malaria in pregnancy and therefore make informed health decisions about the uptake of the preventive measures (48). However, multiple ANC clinic visits do not guarantee high uptake of malaria preventive measures during pregnancy. This could be due to missed opportunities to administer IPT due to regular stock outs at the ANC clinics or late/infrequent visits to the clinic.

Lack of access to ITNs may be responsible for rural women reporting lower malaria preventive measures uptake during pregnancy than urban women (10). Rural women may lack access to well-equipped antenatal clinics, possibly explaining the low IPTpSP administration in the rural area compared to the urban area (48). The findings of this study show that rural women had a slightly lower IPTpSP uptake and the combined use of ITNs and IPTpSP during pregnancy than women in urban areas. Nonetheless, there was no association between the residence of the participants and ITN use during pregnancy. These findings differed from a study in Ethiopia that found an association between the type of residence and ITN use among pregnant women (67).

Head of household education level, head of household sex and parity were associated with ITN use but not IPTpSP use. The sex of the household head was also a significant determinant of the combined uptake of malaria preventive measures. Although a man headed the majority (68.5%) of the households, the households headed by women were less likely to use malaria preventive measures. In some communities in Kenya, women might not have the autonomy to make decisions, even regarding their health, without consulting the head of the household (64). This could be attributed to cultures and tribes' norms/practices. The uptake of the interventions could depend on whether the head of the family liked the idea of using the malaria preventive measures or not. Promoting the involvement of partners during especially during ANC visits

pregnancy could give them a deeper understanding of the importance of ITN and IPTpSP use and can improve the uptake of these two efficacious interventions in pregnancy.

ITN use during pregnancy was high where the households head had secondary or ‘a’ level education. A possible explanation could be that household heads with higher levels of education are better placed economically and can access these services, are knowledgeable about the effects of malaria in pregnancy, and tend to make healthcare decisions than those with a primary or vocational level of education.

This study demonstrated that parity is a significant predictor of ITN use but not IPTpSP or combined uptake. Women who had three children or more were less likely to sleep under an ITN than women with two or less children parity was two or less. The results are similar to what was reported in Tanzania (55). There may be a possibility that the women experienced discomfort associated with sleeping under an ITN or forgot information given in the previous pregnancy and therefore did not sleep under an ITN in subsequent pregnancies (66).

Malaria endemicity was a significant factor for ITN use, IPTpSP use and the combined use of ITN and IPTpSP. The results show that women living in Kenya's low-risk and seasonal-risk malaria regions are less likely to use malaria preventive measures during pregnancy than those living in the highland epidemic areas. Women living in the endemic areas are likely to sleep under an ITN or combined the use of ITN and IPTpSP. In seasonal malaria transmission areas in Kenya, the risk of getting malaria is less than 5%. In the low-risk malaria areas, it is 0.1% (10). Therefore, people living in low-risk malaria regions might not perceive malaria infection as life-threatening, and they might not sleep under an ITN or take IPTpSP while pregnant. Consequently, the uptake of malaria preventive measures is lower in areas with less malaria risk (10). Other studies have also found similar evidence for lower uptake of malaria preventive measures during pregnancy in the areas of lower risk of malaria (65).

Maternal education level, literacy, wealth index, religion and the head of the household age were not significant determinants of neither ITN nor IPTpSP in pregnancy.

Evidence of a possible link between maternal age and the uptake of malaria preventive measures in pregnancy has been reported in previous studies. Older women might be more knowledgeable about the risk of malaria and therefore display higher usage of ITN and IPTpSP during pregnancy (50). In this study, the relative risk ratio of maternal age was not a statistically significant determinant of ITN, IPTpSP, and combined uptake of ITN and IPTpSP during pregnancy.

This finding that maternal education and literacy were not significant predictors of ITN or IPTpSP uptake during pregnancy is contrary to other studies that have reported maternal education as an important determinant of malaria preventive measures utilization during pregnancy (40,46). An individual's education level has been linked to determinants of health such as health behaviours and uptake of health intervention, including preventative health services. However, education is not the sole predictor. Other factors such as income interact in many important ways with education and influence health interventions' uptake (68).

Previous studies have reported that women categorized as poor may have little or no access to the antenatal care clinic due to a lack of transport costs and payments at the clinic. Access to the freely administered IPTpSP and a free issue of ITN during pregnancy might not be possible. Also, it has been argued that wealthy women tend to be more knowledgeable and make better health decisions (38). In this study, wealth was not a significant predictor of the use of malaria preventive measures.

Religion has been said that it may impact the uptake of malaria preventive measures during pregnancy (45). Results from studies on factors affecting the use of ITN and IPTpSP in Kenya

and Ghana found a significant association between religion and ITNs utilization but not IPTpSP uptake (35,46). Future research may explore further examination of the impact of religion on the use of malaria preventive measures.

4.3 Study strengths and limitations

One of the strengths of this study is that the Malaria Indicator Survey is a standardized malaria surveillance tool, and the participants are representative of the national sample. However, this study had several limitations. First, this is a cross-sectional study; therefore, the study could not demonstrate a causal relationship between the outcome and the explanatory variables. Secondly, the data collected during the Kenya Malaria Indicator Survey was self-reported and therefore subject to recall bias.

Thirdly, this research relies on the quantitative approach only. Therefore, it was not possible to qualitatively understand the factors determining malaria preventive interventions during pregnancy, such as behavioural aspects and motivation. Additionally, this is a secondary data analysis study; therefore, the number of available variables in the Malaria Indicator Survey questionnaire was limited. Other factors that could contribute and apply to this study could not be explored. For example, the primary survey did not examine the health system-related factor such as the availability of ITNs and SP drugs in the ANC clinic and the participants' marital status and occupation.

In the primary study, women were queried if they slept under a mosquito bed net the night before the survey. Therefore, the women who were not pregnant at the time of the primary study but were aged between 15 and 49 years and had a pregnancy history in the last five years were used as a proxy for women's uptake of ITNs during pregnancy.

4.4 Conclusion

Despite the combined efforts by the government and the NGOs in the fight towards malaria in pregnancy, the uptake of malaria preventive measures is still below 80%. The study findings highlight that utilization of ITNs was higher compared to that of IPTpSP, and the combined uptake of IPTpSP was low (37.1%). Several factors were significantly associated with the utilization of malaria preventive measures in pregnancy. Parity, the head of household's sex, and the level of education of the head of the household were determinants of ITN use. Whether the women live in an urban or rural area, the number of ANC visits as well as living in the different malaria ecozones were also significant predictors of IPTpSP uptake. Significant predictors of combined use of ITN and IPTpSP during pregnancy were the number of ANC clinic visits, the participants' residence, the highest level of education of the household head, the sex of the household head, and malaria endemicity of the area the participants live. The findings of this study concur with results from most sub-Saharan Africa countries that there is a slight improvement in the uptake of IPTpSP during pregnancy, but we are still lagging behind the 80% uptake target. The study contributes to existing literature by exploring the determinants of utilization of malaria preventive measures in pregnancy in Kenya, which is scarce. These findings on the determinants of use of ITN and IPT can provide valuable information to the policymakers and implementers when planning interventions to promote uptake of ITN and IPTpSP during pregnancy.

4.5 Recommendations

It is vital to understand the determinants of ITN and IPTpSP use during pregnancy before designing strategies to improve the uptake of these measures. The Kenyan Government and development partners in the health sector such as the National Malaria control program should start or support existing malaria prevention programs where there are low malaria preventive measures use during pregnancy. In particular, malaria programs need to be directed towards

women who reside in the rural areas of Kenya, low and seasonal risk malaria zones. PAM prevention programs should pay attention to increase the uptake of ITN and IPTpSP among women living in households headed by females, including para three and above who had low relative risk ratios of using these preventive measures. Community sensitization on optimal ANC attendance (at least four visits) during pregnancy should be encouraged as it could potentially improve the uptake of ITN and IPTpSP. Finally, more qualitative studies need to be done to understand the factors influencing the uptake of malaria preventive measures in pregnancy in Kenya due to minimal available literature on the same.

REFERENCES

1. Zhou G, Afrane YA, Vardo-Zalik AM, Atieli H, Zhong D, Wamae P, et al. Changing Patterns of Malaria Epidemiology between 2002 and 2010 in Western Kenya: The Fall and Rise of Malaria. PLOS ONE. 2011 May 23;6(5):e20318. DOI: 10.1371/journal.pone.0020318

2. Fokam EB, Ngimuh L, Anchang-Kimbi JK, Wanji S. Assessment of the usage and effectiveness of intermittent preventive treatment and insecticide-treated nets on the indicators of malaria among pregnant women attending antenatal care in the Buea Health District, Cameroon. Malar J. 2016 Mar 17;15:172. DOI: 10.1186/s12936-016-1228-3

3. Chinweuba AU, Agbapuonwu NE, Onyiapat JE, Israel CE, Ilo CI, Arinze JC. Determinants of Malaria Prevention and Treatment Seeking Behaviours of Pregnant Undergraduates Resident in University Hostels, South-East Nigeria. J Pregnancy. 2017;2017:3653874. DOI: 10.1155/2017/3653874

4. WHO WHO. World Malaria Report 2020; Years of Global progress and Challenges. WHO; 2020. https://www.who.int/publications/i/item/9789240015791

5. WHO W. World malaria report. Geneva: World Health Organization. 2019; Available from: https://www.who.int/news-room/feature-stories/detail/world-malaria-report-2019

6. Van Eijk AM, Hill J, Noor AM, Snow RW, ter Kuile FO. Prevalence of malaria infection in pregnant women compared with children for tracking malaria transmission in sub-Saharan Africa: a systematic review and meta-analysis. Lancet Glob Health. 2015 Oct;3(10):e617-628. DOI: 10.1016/S2214-109X(15)00049-2

7. Protas J, Tarimo D, Moshiro C. Determinants of timely uptake of ITN and SP (IPT) and pregnancy time protected against malaria in Bukoba, Tanzania. BMC Res Notes. 2016 Jun 21;9:318. DOI: 10.1186/s13104-016-2122-3

8. Tegegne Y, Asmelash D, Ambachew S, Eshetie S, Addisu A, Jejaw Zeleke A. The prevalence of malaria among pregnant women in Ethiopia: A Systematic Review and Meta-Analysis. Silveira JF, editor. J Parasitol Res. 2019 May 2;2019:8396091. DOI: 10.1155/2019/8396091

9. Stephen AA-I, Wurapa F, Afari EA, Sackey SO, Malm KL, Nyarko KM. Factors influencing utilization of intermittent preventive treatment for pregnancy in the Gushegu district, Ghana, 2013. Pan Afr Med J. 2016;25(Suppl 1):4.

10. Choonara S, Odimegwu C, Elwange C. Factors influencing the usage of different types of malaria prevention methods during pregnancy in kenya. Afr Health Sci. 2015 Jun 1;15:413–9. DOI: 10.11604/pamj.supp.2016.25.1.6169

11. Njoroge FK, Kimani VN, Ongore D, Akwale WS. Use of insecticide treated bed nets among pregnant women in Kilifi district, Kenya. East Afr Med J. 2009;86(7):314–22. DOI: 10.4314/eamj.v86i7.54145

12. Nyamu GW, Kihara JH, Oyugi EO, Omballa V, El-Busaidy H, Jeza VT. Prevalence and risk factors associated with asymptomatic Plasmodium falciparum infection and anemia among pregnant women at the first antenatal care visit: A hospital based cross-sectional study in Kwale County, Kenya. PloS One. 2020;15(10):e0239578. DOI: 10.1371/journal.pone.0239578

13. Khan S. Factors affecting the uptake of malaria prevention strategies among pregnant women in Nigeria: evidence from 2013 Nigeria demographic and health survey. J Public Health. 2017 Dec 7;26. DOI: 1007/s10389-017-0877-1

14. Ankomah A, Adebayo SB, Arogundade ED, Anyanti J, Nwokolo E, Ladipo O, et al. Determinants of insecticide-treated net ownership and utilization among pregnant women in Nigeria. BMC Public Health [Internet]. 2012;12(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84856565029&doi=10.1186%2f1471-2458-12-105&partnerID=40&md5=2cb58875a74560f688da6ee21295893c. DOI: 10.1186/1471-2458-12-105

15. Sangaré LR, Weiss NS, Brentlinger PE, Richardson BA, Staedke SG, Kiwuwa MS, et al. Determinants of use of insecticide treated nets for the prevention of malaria in pregnancy: Jinja, Uganda. PLoS ONE [Internet]. 2012;7(6). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84862696393&doi=10.1371%2fjournal.pone.0039712&partnerID=40&md5=44532d7d22a2a83b345377c550d7e99f. DOI: 10.1371/journal.pone.0039712

16. Hill J, Kazembe P. Reaching the Abuja target for intermittent preventive treatment of malaria in pregnancy in African women: a review of progress and operational challenges. Trop Med Int Health TM IH. 2006 Apr;11(4):409–18. DOI: 10.1371/journal.pone.0039712

17. Kenya MOH. Kenya Malaria Strategy 2009-2018 report. Ministry of Health; 2015. https://www.measureevaluation.org/resources/publications/tr-19-319/at_download/document

18. USAID-DHS. Demographic Health Survey Statistics. USAID; 2008. https://dhsprogram.com/countries/Country-Main.cfm

19. USAID-DHS. Demographic Health Survey Statistics. USAID; 2015. https://dhsprogram.com/countries/Country-Main.cfm

20. Gamble C, Ekwaru PJ, Garner P, ter Kuile FO. Insecticide-treated nets for the prevention of malaria in pregnancy: a systematic review of randomised controlled trials. PLoS Med. 2007 Mar 27;4(3):e107. DOI: 10.1371/journal.pmed.0040107

21. Andersen R. A behavioral model of families' use of health services. Behav Model Fam Use Health Serv. 1968;(25). https://www.cabdirect.org/cabdirect/abstract/19702701913

22. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? J Health Soc Behav. 1995 Mar;36(1):1–10. https://www.jstor.org/stable/2137284

23. Andersen R, Bozzette S, Shapiro M, St Clair P, Morton S, Crystal S, et al. Access of vulnerable groups to antiretroviral therapy among persons in care for HIV disease in the

United States. HCSUS Consortium. HIV Cost and Services Utilization Study. Health Serv Res. 2000 Jun;35(2):389–416. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1089126/

24. Schultz LJ, Steketee RW, Macheso A, Kazembe P, Chitsulo L, Wirima JJ. The efficacy of antimalarial regimens containing sulfadoxine-pyrimethamine and/or chloroquine in preventing peripheral and placental Plasmodium falciparum infection among pregnant women in Malawi. Am J Trop Med Hyg. 1994 Nov;51(5):515–22. DOI: 10.4269/ajtmh.1994.51.515

25. Sharma L, Shukla G. Placental Malaria: A New Insight into the Pathophysiology. Front Med. 2017;4:117. DOI: 10.3389/fmed.2017.00117

26. Dellicour S, Hill J, Bruce J, Ouma P, Marwanga D, Otieno P, et al. Effectiveness of the delivery of interventions to prevent malaria in pregnancy in Kenya. Malar J. 2016 Apr 18;15(1):221. DOI: 10.1186/s12936-016-1261-2

27. Dosoo DK, Chandramohan D, Atibilla D, Oppong FB, Ankrah L, Kayan K, et al. Epidemiology of malaria among pregnant women during their first antenatal clinic visit in the middle belt of Ghana: a cross sectional study. Malar J. 2020 Oct 23;19(1):381. DOI: 10.1186/s12936-020-03457-5

28. Eisele TP, Larsen DA, Anglewicz PA, Keating J, Yukich J, Bennett A, et al. Malaria prevention in pregnancy, birthweight, and neonatal mortality: A meta-analysis of 32 national cross-sectional datasets in Africa. Lancet Infect Dis. 2012;12(12):942–9. DOI: 10.1016/S1473-3099(12)70222-0

29. Kariuki SM, Ikumi M, Ojal J, Sadarangani M, Idro R, Olotu A, et al. Acute seizures attributable to falciparum malaria in an endemic area on the Kenyan coast. Brain J Neurol. 2011/04/10 ed. 2011 May;134(Pt 5):1519–28. DOI: 10.1093/brain/awr051

30. Zhou G, Li JS, Ototo EN, Atieli HE, Githeko AK, Yan G. Evaluation of universal coverage of insecticide-treated nets in western Kenya: field surveys. Malar J. 2014 Sep 3;13(1):351. DOI: 10.1186/1475-2875-13-351

31. Feachem SR. Roll Back Malaria: an historical footnote. Malar J. 2018 Nov 19;17(1):433. DOI: 10.1186/s12936-018-2582-0

32. Larson PS, Minakawa N, Dida GO, Njenga SM, Ionides EL, Wilson ML. Insecticide-treated net use before and after mass distribution in a fishing community along Lake Victoria, Kenya: successes and unavoidable pitfalls. Malar J. 2014 Nov 28;13(1):466. DOI: 10.1186/1475-2875-13-466

33. Yitayew AE, Enyew HD, Goshu YA. Utilization and Associated Factors of Insecticide Treated Bed Net among Pregnant Women Attending Antenatal Clinic of Addis Zemen Hospital, North-Western Ethiopia: An Institutional Based Study. Malar Res Treat [Internet]. 2018;2018. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85083534071&doi=10.1155%2f2018%2f3647184&partnerID=40&md5=a289bdc04d2fe39258f37c5668e86208. DOI: 10.1155/2018/3647184

34. Nevill CG, Some ES, Mung'ala VO, Mutemi W, New L, Marsh K, et al. Insecticide-treated bednets reduce mortality and severe morbidity from malaria among children on the Kenyan coast. Trop Med Int Health TM IH. 1996 Apr;1(2):139–46. DOI: 10.1111/j.1365-3156.1996.tb00019.x

35. ter Kuile FO, Terlouw DJ, Phillips-Howard PA, Hawley WA, Friedman JF, Kariuki SK, et al. Reduction of malaria during pregnancy by permethrin-treated bed nets in an area of intense perennial malaria transmission in western Kenya. Am J Trop Med Hyg. 2003 Apr;68(4 Suppl):50–60. DOI: 10.4269/ajtmh.2003.68.50

36. Henry M, Florey L, Youll S, Gutman JR. An analysis of country adoption and implementation of the 2012 WHO recommendations for intermittent preventive treatment for pregnant women in sub-Saharan Africa. Malar J. 2018 Oct 16;17(1):364. DOI: 10.1186/s12936-018-2512-1

37. Shulman CE, Dorman EK, Cutts F, Kawuondo K, Bulmer JN, Peshu N, et al. Intermittent sulphadoxine-pyrimethamine to prevent severe anaemia secondary to malaria in pregnancy: a randomised placebo-controlled trial. Lancet Lond Engl. 1999 Feb 20;353(9153):632–6. DOI: 10.1016/s0140-6736(98)07318-8

38. Wafula ST, Mendoza H, Nalugya A, Musoke D, Waiswa P. Determinants of uptake of malaria preventive interventions among pregnant women in eastern Uganda. Malar J [Internet]. 2021;20(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85098557747&doi=10.1186%2fs12936-020-03558-1&partnerID=40&md5=ecdc676e2904931d2d8f1b22b791b74b. DOI: 10.1186/s12936-020-03558-1

39. Tongo OO, Orimadegun AE, Akinyinka OO. Utilisation of malaria preventive measures during pregnancy and birth outcomes in Ibadan, Nigeria. BMC Pregnancy Childbirth. 2011 Aug 18;11:60. DOI: 10.1186/1471-2393-11-60.

40. Ibegu MI, Hamza KL, Umeokonkwo CD, Numbere T-W, Ndoreraho A, Dahiru T. Use of long-lasting insecticidal nets among women attending antenatal clinic at a tertiary hospital in Bayelsa State, Nigeria 2019. Malar J [Internet]. 2020;19(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85098475576&doi=10.1186%2fs12936-020-03531-y&partnerID=40&md5=0b32b2d64691b0feefffd5da75967653. DOI: 10.1186/s12936-020-03531-y

41. Beiersmann C, Sanou A, Wladarsch E, De Allegri M, Kouyaté B, Müller O. Malaria in rural Burkina Faso: local illness concepts, patterns of traditional treatment and influence on health-seeking behaviour. Malar J. 2007 Aug 8;6:106. DOI: 10.1186/1475-2875-6-106

42. Dionne-Odom J, Westfall AO, Apinjoh TO, Anchang-Kimbi J, Achidi EA, Tita ATN. Predictors of the use of interventions to prevent malaria in pregnancy in Cameroon. Malar J [Internet]. 2017;16(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85016320179&doi=10.1186%2fs12936-017-1786-z&partnerID=40&md5=36b8ddee25baf6bbe4467b7994deb858. DOI: 10.1186/s12936-017-1786-z

43. Buh A, Kota K, Bishwajit G, Yaya S. Prevalence and Associated Factors of Taking Intermittent Preventive Treatment in Pregnancy in Sierra Leone. Trop Med Infect Dis. 2019 Feb 7;4(1). DOI: 10.3390/tropicalmed4010032

44. Okethwangu D, Opigo J, Atugonza S, Kizza CT, Nabatanzi M, Biribawa C, et al. Factors associated with uptake of optimal doses of intermittent preventive treatment for malaria among pregnant women in Uganda: analysis of data from the Uganda Demographic and Health Survey, 2016. Malar J. 2019 Jul 26;18(1):250. DOI: 10.1186/s12936-019-2883-y

45. Tackie V, Seidu A-A, Osei M. Factors influencing the uptake of intermittent preventive treatment of malaria among pregnant women: a cross-sectional study. J Public Health Ger [Internet]. 2020; Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85079740693&doi=10.1007%2fs10389-020-01234-x&partnerID=40&md5=7cf664f5148f90f9c4621fd05e92372f. DOI: 10.1007/s10389-020-01234-x

46. Azizi SC. Uptake of intermittent preventive treatment for malaria during pregnancy with Sulphadoxine-Pyrimethamine in Malawi after adoption of updated World Health Organization policy: an analysis of demographic and health survey 2015-2016. BMC Public Health. 2020 Mar 16;20(1):335. DOI: 10.1007/s10389-020-01234-x

47. Mchwampaka WM, Tarimo D, Chacky F, Mohamed A, Kishimba R, Samwel A. Factors affecting uptake of ≥ 3 doses of Sulfadoxine-Pyrimethamine for malaria prevention in pregnancy in selected health facilities, Arusha region, Tanzania. BMC Pregnancy Childbirth. 2019 Nov 27;19(1):440. DOI: 10.1186/s12884-019-2592-0

48. Mbengue MAS, Bei AK, Mboup A, Ahouidi A, Sarr M, Mboup S, et al. Factors influencing the use of malaria prevention strategies by women in Senegal: a cross-sectional study. Malar J. 2017 Nov 21;16(1):470. DOI: 10.1186/s12936-017-2095-2

49. Muhumuza E, Namuhani N, Balugaba BE, Namata J, Kiracho EE. Factors associated with use of malaria control interventions by pregnant women in Buwunga subcounty, Bugiri District. Malar J [Internet]. 2016;15(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85007614188&doi=10.1186%2fs12936-016-1407-2&partnerID=40&md5=09292d5b78ac6aea1a05988dd7c3c08d. DOI: 10.1186/s12936-016-1407-2

50. Leonard N, Eric FB, Judith A-KK, Samuel W. Factors associated to the use of insecticide treated nets and intermittent preventive treatment for malaria control during pregnancy in Cameroon. Arch Public Health Arch Belg Sante Publique. 2016;74:5. DOI: 10.1186/s13690-016-0116-1

51. Bouyou-Akotet MK, Mawili-Mboumba DP, Kombila M. Antenatal care visit attendance, intermittent preventive treatment and bed net use during pregnancy in Gabon. BMC Pregnancy Childbirth. 2013 Feb 26;13:52. DOI: 10.1186/1471-2393-13-52

52. Doku DT, Zankawah MM, Adu-Gyamfi AB. Factors influencing dropout rate of intermittent preventive treatment of malaria during pregnancy. BMC Res Notes. 2016 Oct 10;9(1):460. DOI: 10.1186/s13104-016-2265-2

53. Manu G, Boamah-Kaali EA, Febir LG, Ayipah E, Owusu-Agyei S, Asante KP. Low utilization of insecticide-treated bed net among pregnant women in the middle belt of Ghana. Malar Res Treat [Internet]. 2017;2017. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85060819767&doi=10.1155%2f2017%2f7481210&partnerID=40&md5=2f3229c6097ee51c437f0dfa5482b217. DOI: 10.1155/2017/7481210

54. Touré AA, Doumbouya A, Diallo A, Loua G, Cissé A, Sidibé S, et al. Malaria-associated factors among pregnant women in Guinea. Halasa-Rappel YA, editor. J Trop Med. 2019 Nov 15;2019:3925094. DOI: 10.1186/s13071-014-0495-5.

55. Kibusi SM, Kimunai E, Hines CS. Predictors for uptake of intermittent preventive treatment of malaria in pregnancy (IPTp) in Tanzania. BMC Public Health. 2015 Jun 7;15:540. DOI: 10.1186/s12889-015-1905-0

56. Ouedraogo M, Kurji J, Abebe L, Labonté R, Morankar S, Bedru KH, et al. Utilization of key preventive measures for pregnancy complications and malaria among women in Jimma Zone, Ethiopia. BMC Public Health. 2019 Nov 4;19(1):1443. DOI: 10.1186/s12889-019-7727-8

57. Nilsen P. Making sense of implementation theories, models and frameworks. Implement Sci IS. 2015 Apr 21;10:53. DOI: 10.1186/s13012-015-0242-0

58. Worldometer K. Kenya population statistics [Internet]. 2021. Available from: https://www.worldometers.info/world-population/kenya-population/

59. USAID/Kenya MOH/MIS. Kenya Demographic Kealth Survey (KDHS); 2015 Report. Kenya Ministry of Health/USAID; 2015. https://dhsprogram.com/pubs/pdf/fr308/fr308.pdf

60. Pfeffermann D. The Role of Sampling Weights When Modeling Survey Data. Int Stat Rev Rev Int Stat. 1993;61(2):317–37. DOI: 10.2307/1403631

61. Oppong FB, Gyaase S, Zandoh C, Nettey OEA, Amenga-Etego S, Anane EA, et al. Intermittent preventive treatment of pregnant women in Kintampo area of Ghana with sulphadoxine-pyrimethamine (SP): trends spanning 2011 and 2015. BMJ Open. 2019 Jun 22;9(6):e027946. DOI: 10.1136/bmjopen-2018-027946

62. Mwandama D, Gutman J, Wolkon A, Luka M, Jafali J, Ali D, et al. The use of intermittent preventive treatment in pregnancy and insecticide-treated bed nets for malaria prevention by women of child-bearing age in eight districts in Malawi. Malar J [Internet]. 2015;14(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-84939174185&doi=10.1186%2fs12936-015-0840-y&partnerID=40&md5=d67c57608d6df772726b506a06bb6496. DOI: 10.1186/s12936-015-0840-y

63. Bhalla D, Cleenewerck L, Okorafor Kalu S, Abubakar Gulma K. Malaria Prevention Measures among Pregnant Women: A Population-Based Survey in Nnewi, Nigeria. Sci World J [Internet]. 2019;2019. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-

85075735315&doi=10.1155%2f2019%2f6402947&partnerID=40&md5=5e900c79cab3c3e658dab67f1c8cdc52. DOI: 10.1155/2019/6402947

64. Fotso J-C, Ezeh AC, Essendi H. Maternal health in resource-poor urban settings: how does women's autonomy influence the utilization of obstetric care services? Reprod Health. 2009 Jun 16;6:9. DOI: 10.1186/1742-4755-6-9

65. Ouma PO, van Eijk AM, Hamel MJ, Sikuku ES, Odhiambo FO, Munguti KM, et al. Antenatal and delivery care in rural western Kenya: the effect of training health care workers to provide 'focused antenatal care'. Reprod Health. 2010 Apr 29;7(1):1. DOI: 10.1186/1742-4755-7-1

66. Babalola OJ, Sambo MN, Idris SH, Ajayi I-OO, Ajumobi O, Nguku P. Factors associated with utilization of LLINs among women of child-bearing age in Igabi, Kaduna State, Nigeria. Malar J [Internet]. 2019;18(1). Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-85076364570&doi=10.1186%2fs12936-019-3046-x&partnerID=40&md5=6dfec08b8f0405310fdff07ba45fe7f8. DOI: 10.1186/s12936-019-3046-x

67. Deressa W, Yihdego YY, Kebede Z, Batisso E, Tekalegne A. Individual and household factors associated with use of insecticide treated nets in southern Ethiopia. Trans R Soc Trop Med Hyg. 2014;108(10):616–24. DOI: 10.1093/trstmh/tru129

68. Desjardins R, Schuller T, Feinstein L, Campbell D, Lauglo J, Andersen J. Measuring the effects of education on health and civic engagement. 2006. https://www.researchgate.net/publication/293075137

APPENDICES

APPENDIX A: VARIABLE(S) AND VARIABLE DEFINITIONS

Variable	Definition and categories
Outcome measure/s:	
ITN Usage	Type of mosquito net slept under last night (0) No ITN use, (1) ITN use.
IPTpSP uptake	The administration of two or more doses of Sulfadoxine- Pyrimethamine (SP) during pregnancy. (0) No, (1) Yes.
Explanatory variables	
Age	Current age in 10-year groups. (0) 15-24, (1) 25-34, (2) 35+.
Education	Highest level of education (0) No education, (1) Primary, (2) Secondary, (3) Tertiary.
Literacy	Able to read and write (0) Cannot read (1) able to read part of the sentence (2) can read the whole sentence (4) blind/visually impaired
Malaria epidemiological zones	Region of residence categorized according to level of Malaria Transmission. (0) Endemic - Areas with 20 percent or higher risk of malaria; Coast, Western & Nyanza province. (1) Seasonal Risk -Areas with a malaria risk of less than five percent; North Eastern, Rift Valley and Eastern province. (2) Low Risk - areas with a malaria risk of 0.1 percent or less; Nairobi and Central province.
Residence	Type of place of residence (1) Urban , (2) Rural
Wealth index	Wealth index of households The wealth index is calculated using easy-to-collect data on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities. (0) Poor,(1) Middle Class, (2)Rich
Media exposure	Have you seen or heard any messages about malaria (0) No (1) Yes
Head of household age	Current age in 5-year groups (1) 15-24, (2) 25-34, (3) 35+.
Head of household sex	(0) male, (1) female
Parity	Birth history and current pregnancy (0) Para 3 or less (1) para 4 or more
Household head education	Household highest level of education (0) primary/vocational (1) Secondary/'a' level (2) tertiary
Number of ANC visits	Number of antenatal visits during pregnancy (0) no ANC visit, (1) 3 or less ANC visits, (2) 4 or more ANC visits
Religion	Religion of respondent (0) Christian, (1) Muslim, (2) Other, (3) No religion

APPENDIX B: MULTINOMIAL LOGISTIC REGRESSION MODEL INTERACTIONS RESULT

Variables	ITN use versus no use			IPTpSP uptake versus no use			Combined uptake - IPTpSP & ITN versus no use		
	Relative Risk Ratio (RRR)	95%Confidence Interval (CI)	P>[z]	Relative Risk Ratio (RRR)	95%Confidence Interval (CI)	P>[z]	Relative Risk Ratio (RRR)	95%Confidence Interval (CI)	P>[z]
Maternal age and wealth index									
25-34# middle class	1.97	0.70 - 5.52	0.195	0.67	0.26 - 1.72	0.406	1.03	0.40 - 2.66	0.954
25-34# rich	2.40	0.92 - 6.26	0.073	1.01	0.37 - 2.73	0.991	1.97	0.73 - 5.34	0.181
35-49#middle class	2.53	0.50 - 13.54	0.254	1.02	0.22 - 4.68	0.976	0.85	0.24 - 2.99	0.803
35-49#rich	2.59	0.67 - 9.57	0.171	1.18	0.32 - 4.36	0.803	1.18	0.33 - 4.15	0.798
Wealth index and maternal education									
Middle class#primary	0.61	0.10 - 3.86	0.598	1.18	0.24 - 5.86	0.838	6.03	0.70 - 51.74	0.101
Middle class#secondary	0.15	0.02 - 1.33	0.088	0.34	0.04 - 2.72	0.306	5.56	0.49 - 62.86	0.165
Middle class#tertiary	0.11	0.00 - 3.42	0.209	1.21	0.04 - 33.98	0.911	2.33	0.06 - 88.41	0.646
Rich#primary	1.37	0.23 - 8.08	0.724	0.75	0.08 - 7.33	0.804	0.18	0.02 - 2.06	0.166
Rich#secondary	0.54	0.08 - 3.70	0.529	0.42	0.05 - 3.76	0.435	0.21	0.02 - 2.35	0.203
Rich#tertiary	1.71	0.00 - 2.94	0.222	0.33	0.01 - 8.72	0.502	0.14	0.00 - 4.49	0.263
Maternal education and maternal age									
Primary education#25-34	5.50	0.76 - 39.89	0.091	6.62	0.88 - 50.02	0.067	7.80	0.71 - 85.59	0.092
Primary education#35-49	0.65	0.06 - 7.18	0.722	1.19	0.10 - 13.86	0.888	2.00	0.11 - 36.43	0.638
Secondary education#25-34	6.71	0.98 - 46.02	0.063	8.52	1.37 - 67.63	0.089	12.06	1.47 - 110.45	0.058
Secondary education#35-49	0.66	0.06 - 7.88	0.741	3.25	0.22 - 48.04	0.388	3.99	0.20 - 82.96	0.369
Tertiary education#25-34	7.56	0.84 - 67.97	0.071	10.61	0.65 - 272.67	0.096	8.11	1.06 - 75.48	0.065
Tertiary education#35-49	1.18	0.05 - 26.24	0.912	4.27	0.14 - 126.46	0.399	9.65	0.45 - 208.76	0.147
Parity and maternal age									
Para 3 &4#25-34	1.93	0.64 - 5.86	0.244	2.34	0.73 - 7.54	0.153	1.78	0.67 - 4.77	0.246
Para 3&4#35-49	3.50	0.43 - 27.99	0.236	2.73	0.42 - 17.59	0.288	2.70	0.38 - 19.05	0.318
Para 5 &6+#25-34	0.10	0.00 - 0.12	0.057	0.06	0.00 - 1.28	0.071	0.13	0.01 - 2.46	0.171
Para 5 &6+#35-49	0.12	0.00 - 4.60	0.063	0.09	0.00 - 2.66	0.160	0.16	0.01 - 4.25	0.270
Wealth index and media exposure									
Middle class and media exposure	2.31	0.79 - 6.68	0.123	1.00	0.34 - 2.98	0.995	1.44	0.59 - 3.55	0.423
Rich and media exposure	1.06	0.40 - 2.79	0.905	1.03	0.45 - 2.40	0.936	1.25	0.48 - 3.20	0.644
Number of ANC visits and wealth index									
3 or less ANC visits#middle class	2.72	0.43 - 17.34	0.288	0.31	0.01 - 7.22	0.461	0.15	0.01 - 1.89	0.141
4 or more ANC visits#rich	1.15	0.18 - 7.15	0881	0.49	0.02 - 13.89	0.675	0.38	0.01 - 12.38	0.587
3 or less ANC visits#middle class	1.66	0.31 - 8.80	0.551	0.50	0.03 - 9.43	0.638	0.15	0.05 - 1.53	0.109
4 or more ANC visits#rich	0.82	0.14 - 4.93	0.827	0.88	0.03 - 22.08	0.935	0.16	0.01 - 4.08	0.268

APPENDIX C: PLAGIARISM DECLARATION REPORT



PLAGIARISM DECLARATION TO BE SIGNED BY ALL HIGHER DEGREE STUDENTS

SENATE PLAGIARISM POLICY: APPENDIX ONE

I Beatrice Mkubwa (Student number: 2372048) am a student registered for the degree of MSc Epidemiology (Implementation Science) in the academic year 2021 .

I hereby declare the following:

- I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong.
- I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise.
- I have followed the required conventions in referencing the thoughts and ideas of others.
- I understand that the University of the Witwatersrand may take disciplinary action against me if there is a belief that this is not my own unaided work or that I have failed to acknowledge the source of the ideas or words in my writing.
- I have included as an appendix a report from "Turnitin" (or other approved plagiarism detection) software indicating the level of plagiarism in my research document.

Signature: Date: 14/10/2021

APPENDIX D: ETHICS CERTIFICATE

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG	HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

Office of the Deputy Vice-Chancellor (Research and Postgraduate Affairs

TO: Ms B Mkubwa
School of Public Health
Division of Epidemiology and Biostatistics
Medical School
University

E-mail: 2372048@students.wits.ac.za

CC: Supervisor: Dr J Kagura and Professor S Kinyanjui
<Juliana.Kagura@wits.ac.za>
and <HREC-Medical Research Office@wits.ac.za>

FROM: Mr Iain Burns
Human Research Ethics Committee (Medical)
Tel: 011 717 1252

E-mail: Iain.Burns@wits.ac.za

DATE: 2021/02/17

REF: R14/49

PROTOCOL NO: **M201164** (This is your ethics application reference number. Please quote it in all enquiries, oral or written, relating to this study.)

PROJECT TITLE: *Determinants of utilization of Malaria preventive measures during pregnancy among women aged 15-49 years in Kenya*

Please find attached the Clearance Certificate for the above project. I hope it goes well and that an article in a recognized publication comes out of it. This will reflect well on your professional standing and contribute to Government funding of the University.

MSWorks2000/Iain0007/Clearscan.wps

University of the Witwatersrand
OFFICE OF THE DEPUTY VICE CHANCELLOR RESEARCH
2021-03-03
RESEARCH OFFICE HREC (Medical) RECEIVED
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R49 Ms B Mkubwa

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M201164

NAME: (Principal Investigator)	Ms B Mkubwa
DEPARTMENT:	School of Public Health Division of Epidemiology and Biostatistics Medical School University
PROJECT TITLE:	*Determinants of utilization of Malaria preventive measures during pregnancy among women aged 15-49 years in Kenya*
DATE CONSIDERED:	2020/11/27
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr J Kagura and Professor S Kinyanjui
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2021/02/17

This Clearance Certificate is valid for 5 years from the date of approval. An extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office secretariat on the 3rd floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to submit details to the Committee. **I agree to submit a yearly progress report.** When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **«Missing mail merge field»** and therefore reports and re-certification will be due in the month of **«Missing mail merge field»** each year. Unreported changes to the study may invalidate the clearance given by the HREC (Medical).

Signature of Principal Investigator

03/03/2021
Date

APPENDIX E: DHS DATA PERMISSION LETTER



Jun 28, 2020

Beatrice Mkubwa
University of Witwatersrand
South Africa
Phone: +27604030593
Email: 2372048@students.wits.ac.za Request Date: 06/28/2020

Dear Beatrice Mkubwa:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Determinants of uptake of malaria preventive interventions among pregnant women in Kenya.":

Kenya

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

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 Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Please reference the complete terms of use at: https://dhsprogram.com/Data/terms -of-use.cfm.

The data must not be passed on to other researchers without the written consent of DHS. However, if you have coresearchers registered in your account for this research paper, you are authorized to share the data with them. All data users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: references@dhsprogram.com.

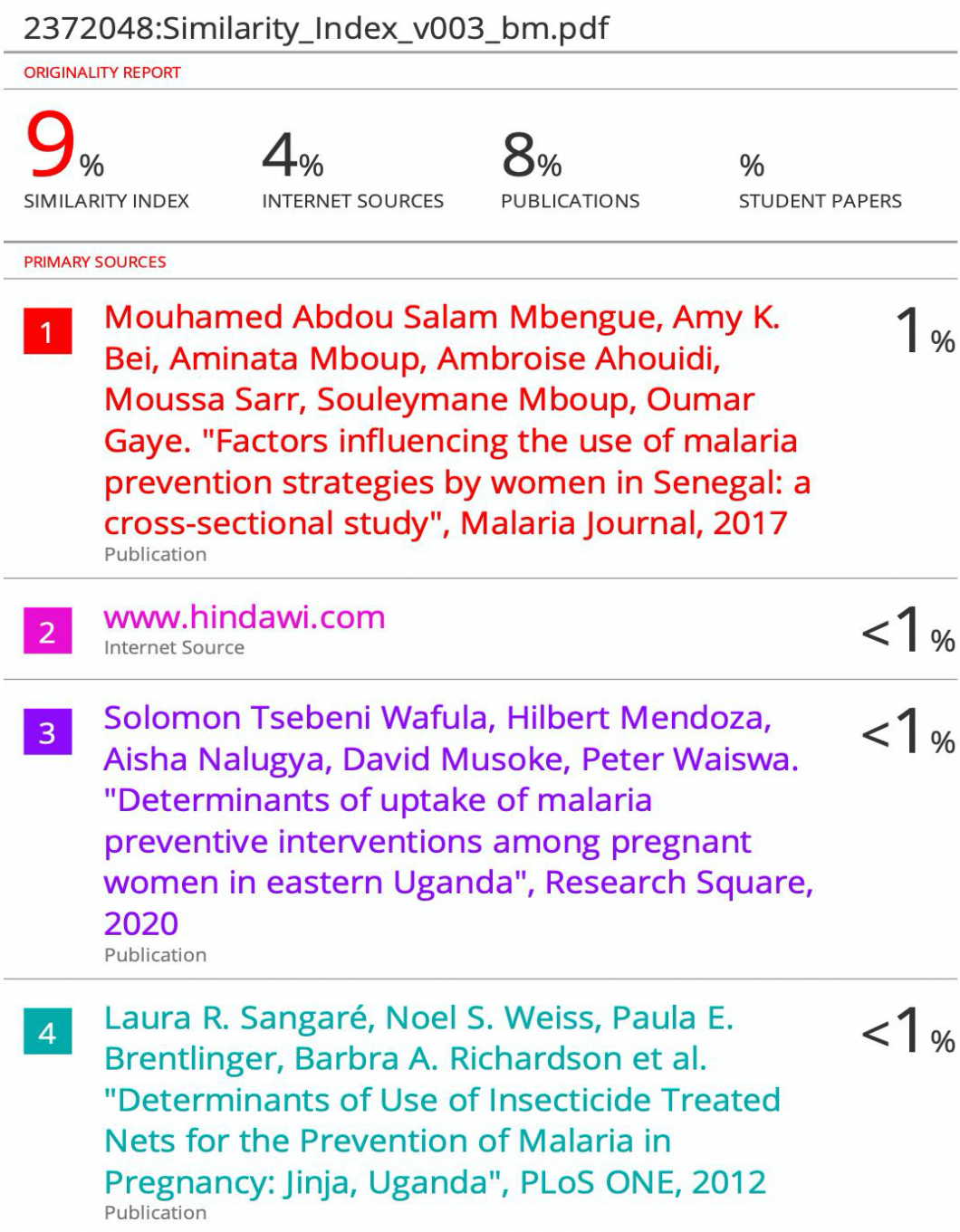
Sincerely,

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

Bridgette Wellington

530 Gaither Road, Suite 500, Rockville, MD 20850 USA +1.301.407.6500 +1.301.407.6501 fax icf.com

APPENDIX F: TURNITIN REPORT



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Supervisor signature

1. Dr Juliana Kagura

Signature: Date: 14/10/2021