MALARIA CONTROL INTERVENTIONS AMONG PREGNANT WOMEN IN HUYE DISTRICT, SOUTHERN PROVINCE, RWANDA

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DOCTOR OF PHILOSOPHY

(Public Health)

JOMO KENYATTA UNIVERSITY

OF

AGRICULTURE AND TECHNOLOGY

2022

Malaria Control Interventions Among Pregnant Women in Huye District, Southern Province, Rwanda

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A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Philosophy in Public Health of the Jomo Kenyatta University of Agriculture and Technology

2022

DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Signature…… Date ……..

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This thesis has been submitted for examination with our approval as the university supervisors

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DEDICATION

I sincerely owe my work to God Almighty and to my beloved parent and my wife for their constant support and encouragement all through the program.

ACKNOWLEDGEMENTS

Initially, I thank God Almighty, for His benedictions, to make this Ph.D. project possible and fruitful, all the study results have been presented through my weak reasoning process and hands. I wrote, but then again I have to be directed by the power, which is beyond my capacity of understanding as a human being. My many thanks are conveyed to pregnant women of the community of Tumba sector and its local leaders who have participated in this study and who stopped their daily duties for this study topic interviewing and their contribution to sharing the information that can help in improving the Rwandan health system. Furthermore, I highly appreciated my supervisors namely Prof. Joseph GIKUNJU and Dr. Dennis MAGU of this Ph.D. project, and other academic staff of Jomo Kenyatta University of Agriculture and Technology(JKUAT) who made this happen. Their productive and tangible feedback on this Ph.D. project during the presentation, seminars, and writing up phase, and I felt much motivated by all my class lecturers for their great support through the open discussions. My sincere thanks go to my beloved wife TWARACUNGUWE. Asile and other family members, for the encouragement and continuous support in various ways, may God bless and reward you all abundantly.

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ABBREVIATIONS AND ACRONYMS

ACT Artemisinin-based Combination Therapy

ALMA African Leaders Malaria Alliance

AQ Amodiaquine

AUSAID Australian Aid

BCC Community mobilization for behavior change using modified care groups

CD Community Development

CHD Community Health Desk

CHIS Community Health Information System

CHWs Community Health Worker

DDT Dichlorodiphenyltrichloroethane

DOH Department of Health-Papua New Guinea

HBM Home Based Management of Malaria

HP Health Promotion

ICCBM Integrated Community Case Management of childhood illness

IRS Indoor Residual Spraying

ITNs Insecticide Treated Nets

KBAP Knowledge, Attitude and Practice

LLINs Long Lasting Insecticide Nets

MOH Ministry of Health

MOPDD Malaria and Other Parasitic Diseases Division

OPD	Other Parasitic Diseases
PHC	Primary Health Care
PCR	Polymerase Chain Reaction
RDTs	Rapid Diagnostic Tests
RNC	Report of the National Census
Rwf	Rwanda francs
SP	Sulphadoxine-pyrimethamine
WHO	World Health Organization

DEFINITIONS OF OPERATIONAL OF TERMS

Pregnant women: refers to the time during which one or more offspring develops inside a woman

Under- five children: Children who are aged less than five years

Malaria: is a disease transmitted by the mosquito vector, and parasites of the genus called Plasmodium and transmitted by anopheles moquisto bite person to another one with clinical manifestation of chills and fever (WHO, 2019).

Malaria control: is a process that requires eradicating the carrier mosquito or reducing man-vector contact so as to break down the life-cycle of the parasite (WHO, 2013a).

Malaria management refers to the whole process of recognition of the causes, symptoms and transmission of malaria and seeking health care for its treatment promptly (WHO, 2012).

Knowledge of malaria person's capacity to recognize correctly the malaria disease in relations to contributing cause, transmission mode, and symptoms, cure and malaria disease management.

Attitudes towards malaria Opinions on malaria disease vulnerability, gravity and threat

Malaria prevention Practice Interventions towards malaria control among individual or group for malaria prevention and management. like use bed nets, insecticides and cutting bushes around the houses.

Community Health Workers Are persons, both men and women who work together with the professional health care providers to improve the health outcomes, and to promote the community health status of their fellow members.

Community Individuals' group living in a specific zone/area with common values, traditional/ cultural patterns, and social/ economic problems or difficulties

Malaria elimination "Interrupting local mosquito-borne malaria transmission in a defined geographical area, for instance zero incidences of local malaria case (WHO, 2017).

Long-lasting insecticide nets (LLINs)/ Insecticide Treated Nets (ITNs) Are mosquito nets that are impregnated with insecticides to kill the vector mosquitoes that can transmit malaria and prevent the mosquito's bites. LLINs or ITNs are consequently, an intervention strategy that provides vital defense from mosquitoes bites and malaria disease (WHO, 2013c).

Indoor Residual Spraying (IRS) Insecticide spray that can kill the malaria mosquito vectors and considered as an effective malaria control strategy that involves the coordinated, timely spraying of the inside house walls and protects the house between four and ten months with insecticides to kill mosquitoes (WHO, 2006).

Artemisinin-Based Combination Therapy (ACT) Antimalarial drugs. It consists of two medications, a combination of one artemisinin derivative and added antimalarial drug from another class. For instance Artemether+Lumefantrine (WHO, 2010)

Case Management (Home Management of Malaria - HMM) One of the strategies being used in malaria control. It is the procedure by which antimalarial drugs are administered to children of under five years old who presented the clinical signs of malaria like a fever after are being diagnosed at home by care givers and or community health workers (WHO, 2004).

Intermittent-Preventive Treatment in pregnancy (IPTp) Anti-malaria treatment that is being given to pregnant women from the second trimester of pregnancy. It involves two drugs that are currently being administered like sulfadoxine and primethamine (WHO,2013a).

ABSTRACT

Despite the fact, that malaria is a controllable disease, in sub-Saharan Africa, including Rwanda, it is still killing pregnant mothers and their children aged less than five years. Due to their low immunity, those two groups are most vulnerable to malaria disease, in areas with high to moderate malaria transmission. With 11 years left to the Global Technical Strategy for malaria target of reducing 90% of malaria case incidence and mortality rates, and elimination in 35 countries by 2030, there is limited evidence and a paucity of studies done on malaria knowledge, access, awareness, and use of malaria control interventions among a high-risk group to reduce the maternal and child death caused by malaria disease in Huye district, Rwanda. The main objective of the study was to explore malaria knowledge, preventive practices, and current ownership and utilization levels of LLINs, as well as factors that are associated with the use of these among pregnant women in the Huye district in the southern province of Rwanda. This study used a cross-sectional observation design on knowledge, ownership, and utilization of malaria control interventions. The sample included pregnant women who were interviewed using a semi-structured questionnaire. The study participants were those living in the Tumba sector, Huye district. A questionnaire developed by the research staff of the Rwanda Biomedical Center research team was adapted to collect data on demographic characteristics; knowledge and awareness, guideline compliance, and utilization of malaria intervention strategies. The study was done within the period of three months from May to July 2019. This study used descriptive and logistic regression analysis. Of the 384 respondents, 340 (88.5%) were married and the mean age was 29.5±6.8 years with 172 (44.8%) aged between 25 and 29 years. The majority 224 (58.4%) had a primary level of education and 147(27.9%) were farmers. Of the 384 respondents who had low knowledge 96 (25%) whereas 42 (14.9%) had high knowledge and 246 (64.1%) had moderate knowledge. 298 (77.6%) were aware and knew that malaria is transmitted by female anopheles and the majority of respondents 323 (84.1%) were using LLINs. Education level, marital status, and occupation were associated with malaria knowledge on preventive practices and LLIN utilization (p=0.001). All study participants demonstrated high knowledge and mentioned that using and sleeping under LLINs helps to avoid mosquito bites however 381 (99.2%) knew that LLIN use, helps to fight against the malaria burden. LLIN ownership was 323 (84.1%) while LLIN utilization was 283 (87.6%) among LLIN owners. Level of education

(p=0.001) and LLIN utilization (p=0.001) were significantly associated with LLIN ownership. Even though LLINs coverage was high, its utilization was still low across the country. Sixty-one respondents (15.9 %) did not have LLINs and 84 (22%) of respondents had low knowledge of LLINs utilization and its manipulation. This study reported the factors for not using LLINs among 384 study participants, 61 (15.9%) reported not using LLINs. Observed frequent factors that affect LLIN use among the respondents included: high temperature/heat 56 (94.9%), no access to LLIN 52 (88.1%), and used mosquito coil/spray 8 (13.6 %). Generally, formal education is strongly associated with LLIN utilization. Pregnant women who had high education levels were more expected to be LLIN users than those without formal education (OR 3.4 (95% CI 2.3–4.9). Also, pregnant women aged less than 29 years were less likely to utilize LLINs compared to older pregnant women (OR 0.7; 95% CI 0.5–0.9, p = 0.001). Finally, the overall mean score ±SD for the compliance index was 13.71 (5.4). Compliance index level of malaria control strategies, the model was, R2 = .131, F (5,486) = 13.18, p < .001. Two predictors, both age and education variables have significantly predicted the compliance towards malaria control measures with p < .03. Regression results on the impact of the maternal status on compliance index showed that pregnant women with under-five children were more likely to comply with policy guidelines on the malaria intervention strategies compared to those without under-five children. The study results have shown that the education level variable has an impact on the compliance index of malaria control interventions indicating that as the education level rises, the compliance index also raises. Therefore, this study revealed satisfactory knowledge of malaria control and prevention among pregnant women in southern Rwanda despite the poor implementation of current malaria control strategies. Malaria control policies were reported to be poorly implemented in the study area regardless of efforts made in malaria control and prevention. Yet there is a long journey in behavioral changes and communication among community members, lack of transportation means for referring malaria patients, and lack of feedback and decentralized supervision of health professionals were identified as possible challenges in malaria control policies execution in the study area. Forthcoming efforts need to emphasize behavioral changes and communication built on further research findings and regular national malaria control surveillance.

CHAPTER ONE

INTRODUCTION

1.1 Background information

Even though malaria is entirely preventable and curable disease; yet, worldwide 3.4 billion of people are at risk and prone to acquire malaria infection, and 1.2 billion of them are at high risk of malaria (WHO, 2013b). In 2012, an estimated number 482,000 of children aged less than five years were killed by malaria disease and its complications. although tangible malaria control interventions that are currently in place, like distribution of 136 million Insecticide Treated Nets (ITNs) in malaria endemic countries the same year as recommended by world health organization (WHO, 2013b). In areas with high to moderate malaria transmission, due to their immunity, the most vulnerable groups to malaria infection are both children below 5 years and pregnant women. Malaria causes 10% of all deaths of children in the Sub-Saharan African (SSA) region, in 2015 and 15% of the mortality rate in those aged under-five years old (WHO & GMP *et al.*, 2015).

Annually, an estimated number of 25 million of pregnant women from SSA are at risk for malaria infection (Anna M. van Eijk et al., 2015). For instance, in Ethiopia, malaria burden, and its complication is still a big challenge in pregnancies for new-borns and mothers in general. Studies were done in southern Ethiopian and north-western Ethiopia revealed that the prevalence of malaria among pregnant women was 9.7% and 10.4% respectively (Nega et al., 2015).

Further studies done in SSA have shown that women's malaria knowledge regarding contributing factors malaria remains low. Those done in Nigeria, Burkin Faso, and Sudan revealed that 64.9%, 56.1%, and 55.9% of study participants demonstrated good knowledge level of malaria causes respectively (Goshu & Yitayew, 2019). Moreover, it was argued by another study conducted in Nigeria has shown that the malaria knowledge

and preventive practices are still low and problematic in pregnancies from rural Southwest Nigeria, unfortunately several current malaria control measures in place. In that case, public health education on LLINs /ITNs use and malaria preventive measures might be a tangible approach to increase the knowledge level of those from rural areas concerning malaria control and prevention.

In years ago malaria incidence was reduced by intensified and combined control strategies in SSA countries (Assembly et al., 2011). Additionally, WHO targets the 90% reduction by 2030 in 35 countries within the new global strategic plan (Patouillard et al., 2017).

This strategy is focusing on people at risk of malaria and helping them to ha have access to malaria control services like free distribution of ITNs/LLINs and use IRS in malaria endemic regions, and prompt malaria diagnosis and treatment and malaria surveillance to know where to put much effort for malaria elimination. (WHO & G MP, 2015).

Major progress has been made in the fight against malaria, particularly in the scale-up of ITNs in endemic regions. Rwanda supports also two out of the three prongs of the WHO-recommended strategy to reduce malaria in pregnancy (President's Malaria Initiative, 2018). In 2008, due to significant parasite resistance to sulfadoxine-pyrimethamine (SP), the intermittent preventive treatment of malaria for pregnant women (IPTp) has been removed at Rwandan market by Malaria and other parasitic.

In Rwanda, 95% of the inhabitants were expected to demonstrate good knowledge of malaria control strategies (USAID & CDC, 2017). RDHS, 2014/15 has reported that long-lasting insecticidal nets (LLIN) are an important preventive measure along with indoor residual spraying (IRS), environmental management, and larval control. With free ITNs/LLINs distribution in SSA countries including Rwanda, universal coverage might be assumed to be achievable. Nevertheless, there is a large gap both in terms of ownership and utilization, predominantly in SSA where 90% of the malaria burden exists. Ownership of LLIN/ITN ranges between 34 and 98.4% of households at risk of

malaria in SSA (Moon et al., 2016). Among households that claim to own at least one LLIN/ITN, the utilization rate of LLIN was reported to be from 33.5 to 69% in SSA (Loha et al., 2013). In addition, a significant proportion of LLINs in use has been reported to be poor among LLIN owners (Quive et al., 2015).

Several factors have been reported to influence the ownership and use of LLIN/ITN, given that the intervention is effective in prevention of mosquitos bites. LLINs/ ITNs Ownership has been found to be associated to the socio-economic status of a household, the household head's age, mothers' malaria knowledge, and the presence of a pregnant woman or children aged less than five years (Quive et al., 2015)

1.2 Global and regional malaria control strategies

Even though more than700 millions of mosquito nets were distributed in SSA, only 36% of the population from different endemic regional of malaria disease were using/ sleeping under ITNs/LLINs/ in the middle of 2004 and 2013 (WHO, 2017). In Rwanda, no big change in LLINs/ITNs utilization, as reported in 2010 RDHS ,with 73% of pregnant women who slept under bed nets (National Institute of Statistics of Rwanda, 2016a). Recently, another study reported a 38.5% prevalence of malaria prevalence in the villages in the Southern province of Rwanda, while a 21.4% of malaria prevalence rate in the health center and 14.9 % in the hospital, and a high prevalence of malaria (22.8%) among health center attendees and 5.1% within the members of the household in Bugesera district (Rulisa et al., 2013).

Several studies elsewhere in Tanzania, Kenya, Uganda, and other SSA countries have reported the long waiting, service times, low malaria knowledge, lack of awareness of malaria control interventions, poor health worker behaviour, stock-outs, and lack of health policy as possible explanations for low LLIN use and coverage rate (Jenny. et al., 2013). Malaria knowledge, attitude, and practices studies among pregnant, have revealed that they consider malaria as a threat and serious disease, but also their weakness in malaria prevention (Obol et al., 2011). Multiple combination of malaria control approach, like earlier diagnosis, treatment, use of ITNs/LLINs, IRS and IPT in pregnancies. is key to stop and eliminate malaria in malaria endemic zones(White et al.,

2011). Even though several interventions have been put in place in Rwanda to control malaria through an intensification phase done between 2005 and 2012, with the 86% of malaria incidence reduction and 87% reduction in malaria morbidity, 74% reduction in malaria mortality, and a 71% reduction in malaria test positivity rate. In addition, Health Management Information System (HMIS) also shows how fragile gains in malaria control, and interventions can be as significant upsurges have been identified and responded to in 2009, 2012, and 2013. Weak health systems are likely to lead to scarce monitoring of stock-outs of LLINs/ITNs, ACTs, and RDTs in the local market (Mikkelsen-Lopez et al., 2013). Several studies have reported the high burden of malaria across the SSA region, and low malaria knowledge among community members, as well as some studies, have reported a large gap in terms of both LLINs ownership and utilization in the region (Tassew et al., 2017). With sustained efforts to improve LLIN usage and, to investigate the factors influencing the ownership, and usage of LLIN to respond to local malaria control policy.

Therefore, the current study has examined the level of malaria knowledge, awareness, ownership and use of LLINs along with the identification of associated factors at the household level among pregnant women in the Huye district.

1.3 Statement of the problem:

Globally, 11 million pregnant from 38 countries of SSA women were infected with malaria disease, those living in malaria endemic zones, including Rwanda. This caused around 900 000 children born under birth weight, and 70% of their deaths were related to malaria among them (WHO, 2018). In Rwanda, from 2012-2016 health system information management (HSIM) reported malaria in first place with a 25% morbidity rate; malaria is also included in the topmost ten causes of illness across the country. In addition, the calculated mortality rate in pregnancy is currently 210 deaths per 100,000 live births (NISR, 2015), and it contributes to a large proportion of deaths, with a 7.5% disease-specific prevalence rate (Sayinzoga et al., 2016).

Due to their low immunity, pregnant women and children aged less than five years are the most susceptible groups to the malaria disease and those living in the holoendemic

areas of malaria. (De Beaudrap et al., 2013). Although, Rwanda has made a big step in scaling up malaria control interventions and some non-governmental organizations promote malaria control interventions in the Huye district, the morbidity and mortality rate for malaria remains high and is currently a major cause of illness and death in this area. Particularly among children and pregnant women, malaria continues to be the leading cause of Outpatient Department (OPD) attendance, admissions, and even death in the District. To undertake malaria transmission, pregnant women must understand and implement malaria control measures.

Knowledge level was identified as a related factor to the practice of malaria control and prevention and health-seeking behavior of the community. Having good malaria knowledge about the cause, mode of transmission, signs, and symptoms, the effect of malaria on pregnancy, and prevention of malaria were linked to the use of malaria preventive practices and increased health-seeking behavior (Akaba et al., 2013). The study on pregnant women's level of practice on malaria preventive measures is limited in Rwanda. Therefore, determining pregnant women's malaria knowledge is an important key to addressing malaria control issues among them.

However very little is known about what specific knowledge of pregnant women in the Huye district, have; what control measures they already have been implementing to control malaria; and what factors they are experiencing at the household level that hinders the control of malaria, especially LLINs utilization. This requires a study so that correct and acceptable malaria control strategies could be planned to control malaria in this vulnerable group at the household level as supported by (Nyirakanani et al., 2018)

1.4 Justification for study

Data from the 2010 Rwanda HMIS indicate that 0.9 % of women have malaria in the South Province of Rwanda compared to 0.6 % at the national level. Huye district is of

one the three districts of this province, where the proportions of women with malaria were higher at 1.4% as compared to other districts in the South Province with 66% of LLINs utilization (RDHS, 2016). Malaria infection causes several health problem, including the high risks of losing life for the mother, and their children aged less than five years, which can also result in stillbirths and even death, and it causes about 10 000 maternal deaths, and 200 000 fetal deaths (Garrison et al., 2022). Malaria is closely associated with poverty and underdevelopment.

This study has investigated the malaria control interventions being used and factors that affect malaria knowledge, attitude and preventive practices among pregnant women residing in the Huye district. Since malaria prevalence cannot be explained from only a medical point of view, it is essential to consider other factors, such as economic and socio-cultural beliefs, precisely pregnant women, who still utilize herbal medicine due to the mentioned factors.

Treatment of uncomplicated malaria can prevent complicated malaria which is the cause of the high death rate of under-five children (Falade et al., 2010). Pregnant women residing in countryside areas may be at more risk of malaria infection than their urban counterparts because of the prevalence of mosquito breeding spots in these communities, lack of knowledge on malaria control strategies, and poverty. This is of particular concern because more than one billion people or about 83% of the total Rwandan population live in rural areas according to the Rwanda National Institute of statistics report of 2015.

In Rwanda, LLIN/ITN utilization has played a paramount role in the reduction of malaria incidence. Therefore this study was designed and crucial to determine the level of LLIN ownership and utilization among the people at risk (Tassew et al., 2017). The current study determines some of the factors which influence LLIN ownership and utilization at the household level among pregnant women in the Huye district as one of the highly malarious regions of Rwanda. Therefore, this study can be used to improve the design of community-based malaria control programs, and health indicators for malaria elimination.

Additionally, the significance of this study is to reduce the cost spent on malaria diseases and improve malaria knowledge and its control interventions among pregnant women in Rwanda. Hence, this generated a positive impact and more benefits in increasing awareness and behavior change toward malaria risk factors. Therefore, a reduction of the direct cost due to malaria treatment and indirect cost due to low productivity at the worksite. Furthermore, this study's significance is to help reduce maternal deaths, disabilities, and dependencies due to malaria disease.

1.5 Objectives

1.5.1 General objective

The main objective of this study is to determine the knowledge, accessibility, and use of malaria control interventions, as well as associated factors among pregnant women in Huye district in southern province, Rwanda.

1.5.2 Specific objectives

1. To determine the malaria knowledge among pregnant women in Huye district in southern province, Rwanda.
2. To assess the attitude toward malaria prevention and control among pregnant women in Huye district in southern province, Rwanda.
3. To determine the practices towards malaria control among pregnant women in Huye district in southern province, Rwanda.
4. To determine the current ownership and utilization levels of LLINs among the pregnant women in Huye district in southern province, Rwanda.
5. To investigate the factors influencing the knowledge of malaria among pregnant women in Huye district in southern province, Rwanda.
6. To investigate the factors influencing the practices of malaria control and compliance with malaria prevention among pregnant women in Huye district in southern province, Rwanda.

1.6. Research questions

1. What are the knowledge of malaria among pregnant women in Huye district in southern province, Rwanda?

2. What are the attitude towards malaria prevention and control among pregnant women in Huye district in southern province, Rwanda?
3. What are the practices towards malaria control among pregnant women in Huye district in southern province, Rwanda?
4. What are the current ownership and utilization levels of LLINs among the pregnant women in Huye district in southern province, Rwanda?
5. What are the factors that affect knowledge of malaria among pregnant women in Huye district in southern province, Rwanda?
6. What are the factors affecting practices, LLIN ownership and utilization and compliance with malaria prevention among pregnant women in Huye district in southern province, Rwanda?

1.7 Scope of the study

Cross sectional descriptive studies were used to describe what is happening at the present moment. This type of study was frequently used to determine the main characteristics in a population at a certain point in time and they were highly focused

Measuring the knowledge, attitude and practices within human being towards any interventions was usually used worldwide in public health sciences, including family planning, education, water sanitation and hygiene. This study told us what respondents know about malaria control interventions, how they perceive and how they perform. It was unique cross sectional study designed for malaria control interventions among pregnant living in Huye district. Additionally, it focused specifically on factors that can influence the malaria knowledge, attitude and practice among pregnant. Understanding the measurements certified the study to path variations in them over period (Spector, 2019). This study has been carried out in Tumba sector of Huye District which is located in Southern Province; Huye district has 14 sectors, one District hospital, one university teaching hospital, and 17 health centers with 314,022 inhabitants.

CHAPTER TWO

LITERATURE REVIEW

2.1 Description of Malaria

Malaria is a disease caused by a protozoan parasite and infectious disease that affects humans, fitting to the genus Plasmodium. Four species that cause malaria infection, on the other hand, the species called Plasmodium falciparum is the most causes of malaria cases in Africa, and is responsible for all severe malaria cases with the highest morbidity and mortality rate. Once a person is bitten by an infected mosquito consequently, it injects the new parasite from its saliva into the human body's bloodstream (CDC, 2015). Mostly malaria is transmitted from one person to another in this indirect mode. Every species has its life cycle, length, and preferred habitation and feeding. In Africa, the long lifetime and strong human-biting habit of the species are the influencing factors

of the high malaria incidence rate in the SSA region. Even though malaria is a manageable disease, it is still causing and affecting people's health and the decline the economy across the region (WHO, 2016).

The incubation period of malaria infection is from 8 to 25 days and is typically flu-and the most clinically presented symptoms are headaches, shakings. fever, chills, pain in joints, nausea, jaundice, retinopathy, feeling too cold, and intense shivering followed by fever and sweating, and the one mostly caused by P. falciparum. People might usually present abnormal posture, inability to turn their eyes in the same direction, seizures, or even falling into a coma (WHO, 2016). It was reported that when untimely treated malaria diseases become severe and affect the human vital organs, causing organ failure and even death. During pregnancy, malaria can cause many complications like being underweight, new infant mortality, and abortions (Dombrowski et al., 2018). The better management of malaria is to treat and control it timely for preventing it as earlier as possible. The two main combined methods of malaria control are recommended by WHO which ITNs use and IRS for the people living in endemic areas of malaria. When people are using and sleeping under bed nets regularly between dusk and dawn time, when the mosquitoes starts to feed by biting persons, this approach can form a strong barrier between human and mosquito bites. There many the majority of Africans can benefit from using ITNs. Presently, more than 50% of those at risk from malaria infection use ITNs, compared to 29% of those sleeping under ITNs in 2010. Due to the increased resistance of mosquitoes to insecticides, seasonal fumigation for preventing malaria transmission is still low in Sub-Saharan Africa for the region. This is because mosquitos are increasingly resistant to earlier, less expensive forms of insecticide, and for some people, the newer, more effective forms are prohibitively expensive (WHO, 2016)

WHO recommends that anti-malaria drugs such sulfadoxine-pyrimethamine could help much in malaria prevention for at-risk groups like pregnant women, children aged less than five years, and travelers who need to build up against because they come from free malaria areas, an estimated proportion of 22% of pregnant women are eligible to

receive the three doses recommended by WHO versa 0% in 2010 and 17% in 2015 in SSA countries. Additionally, many 15.7 million African children were In 2017, a total of 15.7 million children in 12 countries in Africa's Sahel region were sheltered during seasonal fumigation. Yet, around 13.6 million children were not protected, because of few funds and financial constraints (WHO, 2016).

In sub-Saharan Africa, around 61% of pregnant women and children have been reported to sleep under LLINs/ITNs in 2018 paralleled with 26% in 2010 and an increase of 22% ANC service delivery in 2017 to 31% in 2018 and given 3 or more doses of IPTp, as recommended by WHO to use LLINs and IRS in an effective way expanding the access to ANC services as the main key to attain the goals of the Global technical strategy for malaria elimination in 2016-2030 (World malaria report 2019, 2019). Still, too many women do not receive the recommended number of IPTp doses or none at all. seasonal malaria chemoprevention of malaria is also recommended during the season of heavy rain (World malaria report 2019, 2019).

Malaria vectors bite and collect the blood from the human body and using it like protein stock in their life cycle. They then lay eggs for their life phase and in the sequence of injecting the malaria parasites that cause ill-health to human beings (CDC, 2016). Moreover, it has been reported that the human being is more exposed to mosquitoes bites due to carbon dioxide and lactic acid as one of his body chemical components, since the parasites of malaria are introduced in the human body, they immediately reach into the bloodstream of infected people and they travel to the liver where they produce and grow. Within the period of six to nine days they escape the liver and reach the blood flow for also growing and multiplying. Finally, the person will clinically present fever, feeling headache and chills, when after the parasites were released by the busted red blood cells into the bloodstream (CDC, 2016). The researcher's observation is that pregnant women should acquire basic knowledge about current malaria control strategies in order to stop malaria transmission.

2.2 Diagnosis of malaria and challenges

In April 2008, the related tools and focal person was designated national wide and RDTs were introduced in two districts and extend in more districts after its implementation evaluation within the first two districts. a combined and mix of malaria prevention, treatment, and mosquito vector control strategies, with capacity building of health care providers and strengthened health system could be the key of success in malaria elimination to several countries. In all concerned CHWs have been trained in their respective minimum packages of activities including RTDs use in their communities and the success comes from the Rwandan political commitment, and vision (National Institute of Statistics of Rwanda, 2010).

2.3 Malaria prevention control policies

Currently, the Rwanda has new strategic plan 2013-20 for malaria control and prevention whereby it recommends the use of microscopy for prompt parasitological confirmation, RDTs use for all suspected malaria cases before prescribing any anti malaria drug (President's Malaria Initiative, 2014). Historically, in the 1990s, Rwanda began the targeted distribution of ITNs to mothers of under-five children through antenatal clinics and vaccination campaigns. Long-lasting ITNs were introduced in 2006 and non-insecticidal nets banned in 2008. IRS began in Rwanda in the 1940s and continued through the 1960s. In 2007, Rwanda resumed implementation of IRS targeted to priority high-burden districts, using pyrethroid insecticides. In 2008, decreasing malaria disease led to a change in policy from district-wide coverage of IRS to targeted focal spraying where spraying was only in subsectors with the highest malaria burden instead of blanket an entire district (Eckert et al., 2017) . Since 1192 there were several malaria control interventions and strategies taken by the government of Rwanda in combating with malaria burden, and the table presented the mass distribution of LLINs between 2009 and 2010 and in 2011 the government has deployed at the health facility and community level the trained community health workers countrywide who can perform RDTs for earlier malaria diagnosis and treatment.

Table 2.1: Timeline of data sources and malaria control interventions, 1992–2010

Timeline of data sources	Introduced malaria control interventions	Reports and year of publication
2000-2001	Use of chloroquine	**RDHS 2000 &SPA 2001**
2002-2003	Adoption of AQ+SP as first line treatment	**RDHS 2002**
2004-2005	Home management of malaria using AQ+SP	**RDHS 2005**
2006-2007	-IPTp implemented -Shift from AQ+SP to ACT -ITNs mass distribution targeting Pregnant women and under five children -IRS started and adoption of ACTs for the community treatment	**RDHS 2008**
2007-2008	-IPTp discontinued Adoption of ACTs in the private sectors -Move from district wide to target focal spraying	**RDHS 2007/8 & SPA 2007**
2009-2010	-Implementation of national wide Community case management of malaria -Targeted IRS in 5 district Implementation of universal testing before treatment -Mass LLINs distribution	**RDHS 2010**
2011-2014	-Early malaria diagnosis and treatment -30,000 trained CHWs at community and health facility level	**RDHS2014/15**

Since 1990s, Rwanda has been using chloroquine (CQ) in pregnancies, with a weekly dose to protect the mothers and their newborns from malaria infection, in the following years, from 2004 WHO has recommended the use of IPTp-SP in pregnancies (Van Eijk et al., 2011). Yet, in 2008, due to failure of SP use, the ANC services, and ITN use, were strengthened and promoted to protect the mothers (A M van Eijk et al., 2011). Following, the randomized trial done in African countries, including Rwanda in 2010 artesunate was reported to reduce mortality in children with severe malaria. All trials done to compare artesunate and quinine, have strongly advised replacing quinine with parenteral artesunate as the treatment of choice for severe malaria caused by *P. falciparum* globally.

With these findings, the National Malaria Control Program (NMCP) in 2011 has adopted the parenteral artesunate as the first-line treatment for severe malaria caused p. falciparum instead of using quinine drugs.

There was another NMCP's policy towards LLINs universal coverage, where the olds and expired LLINs should be replaced every three years through the rolling mass campaigns, referring to the malaria incidence trends to target high-risk districts. In this policy, the high-risk groups, vulnerable and new populations were prioritized during LLINs distribution. For instance, in January 2013, there was LLINs distribution to children under five in Nyagatare district (President's Malaria Initiative, 2014). There was also the universal parasitological diagnosis policy in RDT use implemented by the community health workers at the community level (Eckert et al., 2017).

In 2001, Rwandan health policy has changed chloroquine to Amodiaquine + Sulphadoxine-Pyrimethamine (AQ+SP), as the first-line of anti-malarial drugs which was started in 2002 to 2005 and 2006 nationwide, and also the country has decided to shift from AQ+ SP to ACTs treatment and artemether-lumefantrine. Additionally, the new national plan of malaria management for the period of five years (from 2005 to 2010) was developed in Rwanda. Likewise, to treat and control malaria disease different anti-malarial drugs have been used across the country. Nevertheless, in the study conducted by Schoepflin et al., (2010) for the drug-resistant, malaria disease was reported to reduce the effectiveness of antimalarial drugs and their treatments. Furthermore, a strategy of effective drugs supply, regular local compliance, and accurate tests and management of malaria disease have further made the use of anti-malarial drugs effective, and for instance the use of chloroquine or AQ+SP, combination therapy since 2000 to treat simple malaria (Schoepflin et al., 2010). Besides Wong et al., (2011) in their study findings, due to chloroquine-resistant malaria, the mentioned malaria treatments were reported to be no longer effective due and there was several many factors have made the use of anti-malarial drugs unsuccessful, such as drug resistance, low knowledge in some patients about treatment's interpretations, or ignoring to take the whole prescribed doses of drugs due to anti-malarial's bitter taste. In the other study conducted by (Kassam et al., 2015).

The locals‟ attitude of irregularities of oral medicines/ drugs was reported as common malpractice, and chloroquine-resistant falciparum was also reported main factors in three out of every four patients.

2.4. Accessibility and availability of malaria control interventions

According to (Rumisha et al., 2014) in their study, every people living in high-risk zones of malaria transmission should have sleep under the ITN/LLIN, as universal access policy to malaria control interventions . and administration of least two doses of SP to any pregnant during ANC visit. Additionally, in 2007, Rwanda has started the program of malaria/fever home based management, by using the CHWs to rapid malaria diagnosis and treatment, including ACT use. According to the MOPDD, by 2010, CHWs were trained and able to perform the RDTs, and 94% of all suspected malaria cases were diagnosed and confirmed.

2.5. Malaria knowledge and its preventive practices

The community members' knowledge about malaria is an essential prior factor for the acceptance and ITNs/LLINs usage for malaria control and prevention. The low knowledge level of malaria control and prevention was reported in several studies among pregnant women in rural Southwest Nigeria even though current malaria controls interventions. A concerted public health education sessions is needed to improve the malaria knowledge and its prevention among those who are living in rural areas, including the LLINs use in rural regions (Adebayo et al., 2015).

Furthermore, in the rural areas of southwest in Nigeria, pregnant women were reported to be knowledgeable on the antimalarial prophylaxis given during pregnancy, and they mentioned that cutting down the bushes nearby the houses and clean environment as the important measures of controlling malaria vectors. The malaria prevention knowledge of the antimalarial prophylaxis among them is the fact that they had benefited from (IPT) during previous pregnancies and through the health education on malaria treatment, they have got during antenatal care services. However, other studies from Nigeria reported the gaps in knowledge among those living in rural areas concerning the causation and treatment of malaria (Yusuf et al., 2008)

There was a need for the correct malaria control strategies to reduce mosquito's vectors and their propagation and to prevent the bites of mosquitoes and malaria transmission, many studies have suggested the empowerment of malaria knowledge of community members and it is reported as an important item used to change the peoples' behaviors and attitudes. For enhancing the peoples' self-awareness towards malaria control and prevention, they have to learn and it is crucial to understand the path of mosquito bites and their parasitic inoculation. According to the study conducted by (Mathania et al., 2016), the female anopheles mosquitoes was mentioned as the major vector to transmit malaria disease.

Additionally, the pyrimethamine dose was weekly recommended for pregnant women as an antimalarial drug to prevent malaria effects in pregnancies (Ntonifor & Veyufambom, 2016). Apart from the malaria case management by using chloroquine, the deprived compliance towards malaria control practices and antimalarial drugs resistant to *Plasmodium falciparum* has been reported to compromise the efficacy of antimalarial treatments IPTp treatment utilization has been demonstrated to be effective in malaria control and in improved pregnancy outcomes among the pregnant women, in addition, the IPTp with sulphadoxine-pyrimethamine was adopted by WHO as the gold standard for malaria prevention during pregnancy(WHO, 2018a).

Of 11 years' analysis of malaria prevalence among pregnant women in SSA, a 25.5% of pregnant women who attended the antenatal care services were positively diagnosed with malaria infection in East and Southern Africa whereas 35.1% infected with malaria were from the West and Central Africa(Emmanuel et al., 2016). Among the women in reproductive ages ,a 25 million of them become yearly pregnant and at same time risk at malaria infection due to their immunity caused by pregnancy (Cisse et al., 2014). The researcher's observation is that malaria disease is one the major condition that causes the low weight, anemia, and death of newborns during pregnancy in African countries.

2.6 Malaria control interventions in pregnancy

According to (Muhumuza et al., 2016), in malaria-endemic regions of Africa, WHO has recommended the use of IPTp with SP package and ITNs/LLINs utilization and to be

accessible at ANC services, together with anemic and malaria case management and due to lack of health policy that can support IPTp use, it has been stooped. Additionally, Rollback malaria was recommended at least two doses of IPTp to be received by pregnant women by 2010 and to ensure 80.0 % of those who are at risk of malaria infection to effectively use and sleep under ITNs/LLINs at night (Assembly et al., 2011).

According to Nevertheless (Hill et al., 2013) malaria control and preventive interventions are still low in pregnancies in SSA. in their study findings done within 27 African countries, the two doses of SP recommended by WHO and Rollback malaria was 24.5 % of ANC attendees among 80 % of the pregnant women attending at least two ANC visits according. Generally, the previous survey findings may be an indication of missing the opportunities to attend the health education sessions given during ANC in terms of malaria control and prevention. Furthermore, 35.3 % of pregnant women were only reported to sleep under ITNs/LLINs in the same survey compared to 73 % of pregnant women who slept under ITNs as reported by (NISR, 2015)

2.7 Ownership and Use of long lasting insecticidal nets/ITNs

Since the Sixth Century Before Christ (B.C), the bed nets have been used as a physical barrier to prevent the bites of mosquitoes; however, they were not used extensively for malaria control until bed nets have been impregnated with parathyroid insecticides and applied to net material in the mid-1980s. The malaria vector density, sporozoite rates, parasite occurrences, and all-cause child mortality have been reduced by the bed net usage, insecticidal and irritant effect of the pyrethroids combination usage Lindblade et al., (2015) have also demonstrated that the malaria mosquitoes bite indoor whereas they are resting in outdoor, such that the use of ITNs /LLINs is currently considered as the keystone of malaria control and prevention in Africa (Eisele & Steketee, 2011). Moreover, according to (World Health Organization, 2013b) an estimated 300 million ITNs/LLINs were distributed in Africa between 2010 and 2012, at a price of more than US$1 billion. In addition, ITNs' cost, uneven distribution, and little information towards malaria prevention and control, are some of the contributory factors to render the usage of physical barrier of bed nets ineffective in high-risk zones. Also, there was a need for

effective and quality delivery of service and motivation that can be proficiently given by the community health workers based on the researcher's observation of the ineffective ITNs/LLINs utilization, health education about malaria control and prevention.

In combatting and control malaria transmission, the ITNs/LLINs utilization were proved as an effective and cheap method in the journey of malaria elimination, in sub-Saharan Africa. In addition, ITNs use can significantly stop and reduce malaria infection. A systematic review study conducted by Lindblade et al., (2015) has revealed that ITNs use among pregnant women has a valuable impact on pregnancy outcome in malaria-endemic regions mostly in Africa. Twenty years ago, scaling up the malaria control interventions was reported to decrease the deaths of 842,800 children under five years of age in Malawi (Lindblade et al., 2015).

Another study done in Kenya has reported wide ITNs utilization and its acceptance, but some of the individuals have demonstrated ignorance towards ITNs maintenance and usage. Furthermore (Musoke et al., 2015) in their study, showed that the majority of women who had low malaria knowledge level in terms of malaria control and management in Uganda and even their of use of ITNs was not fair and ineffective.

Even though the ITNs/LLINs and curtains have been promoted and introduced many years ago as promising and effective malaria control tools, their usage is still problematic and limited across the SSA countries. Several studies done about malaria control interventions have reported the utilization of ITNs/LLINs as an effective malaria control strategy in pregnancies. In addition, ITNs usage has been reported by (Gerstl et al., 2010) to reduce the number of malaria cases in pregnancies. Moreover, the reduction of preterm deliveries and newborn low birth weights were also reported to those who use ITNs/LLINs.

2.8 Summary review

Malaria in pregnancy is one of the significant concerns in developing countries, with substantial risks to guardians and their unborn babies. A compromised a pregnant woman's immune response to malaria attacks, likely expose them at risk for infection,

severe anemia, spontaneous abortion, premature delivery or death while subjecting the fetus to the risk of low birth weight or stillbirth, in the study conducted by (Asundep, 2014) malaria disease was reported as a dangerous health problem among the pregnant women living in endemic countries. According to (Takem & D'Alessandro, 2013) due to the body's immune system, hormonal changes or other factors happening during pregnancy. Besides the malaria disease's menace and complications is high in pregnancies.

Different researches are done in Rwanda, including the one which was conducted by (Habtai et al., 2009) in their studies malaria disease was reported as a serious infection that can have a negative impact on an individual's health and entirely to family' income status, both in long term and short term with both short and long term, but also the country is concerned as a nation. Annually around 500 million persons are severely suffering from malaria among them, the children and pregnant women which equals one million and are vulnerable groups due to low immunity in Africa, malaria diseases are the cause of underweights in newborn, from the researcher's clinical experience, malaria infection in the pregnancies is a major determinant of high infant mortality usually caused by a lower hemoglobin level. This means the loss of blood during delivery can simply end up in hypovolemic shock and it is one of the factors that contribute to deaths of both mothers and their children in Rwanda (National Institute of Statistics of Rwanda, 2016b).

In the 1950s, there was a developed model namely the health belief model and it was designed to evaluate the use of health services and also to assess human behaviors, like towards tuberculosis testing. In that case, it is one of the models being used in health science research (Gorin 2006:56). By using the checklist this model highlights the areas to focus on in providing health information and effective interventions for guiding the people to perform health interventions, the use HBM has been efficiently changed the people's behaviors and their use of health services like vaccination and immunization services (Day, Dort & Tay-Teo 2010:60).

2.8.1 Conceptual framework: Health Belief Model (HBM)

In this study, HBM was applied because it provides the behavioral component which can be influenced by several social factors, comprising belief systems. The conceptual framework shows the relationship between the variables (independent moderating and dependent) that are being measured in the present study (Figures 1 and 2). The epidemiologic information about malaria transmission showed that many people are at high risk owing to several factors like climate, demographic, and socioeconomic status. A strengthened health system, including early malaria diagnosis and treatment, and available malaria control strategies with the effective antimalarial drug have a significant effect on the reduction of malaria prevalence rate. Malaria preventive measures impede and suppress the progression of malaria transmission. The present study explored the knowledge and awareness of pregnant women about what causes malaria, LLINs ownership, and utilization of personal choice on malaria preventive methods and use of antimalarial drugs.

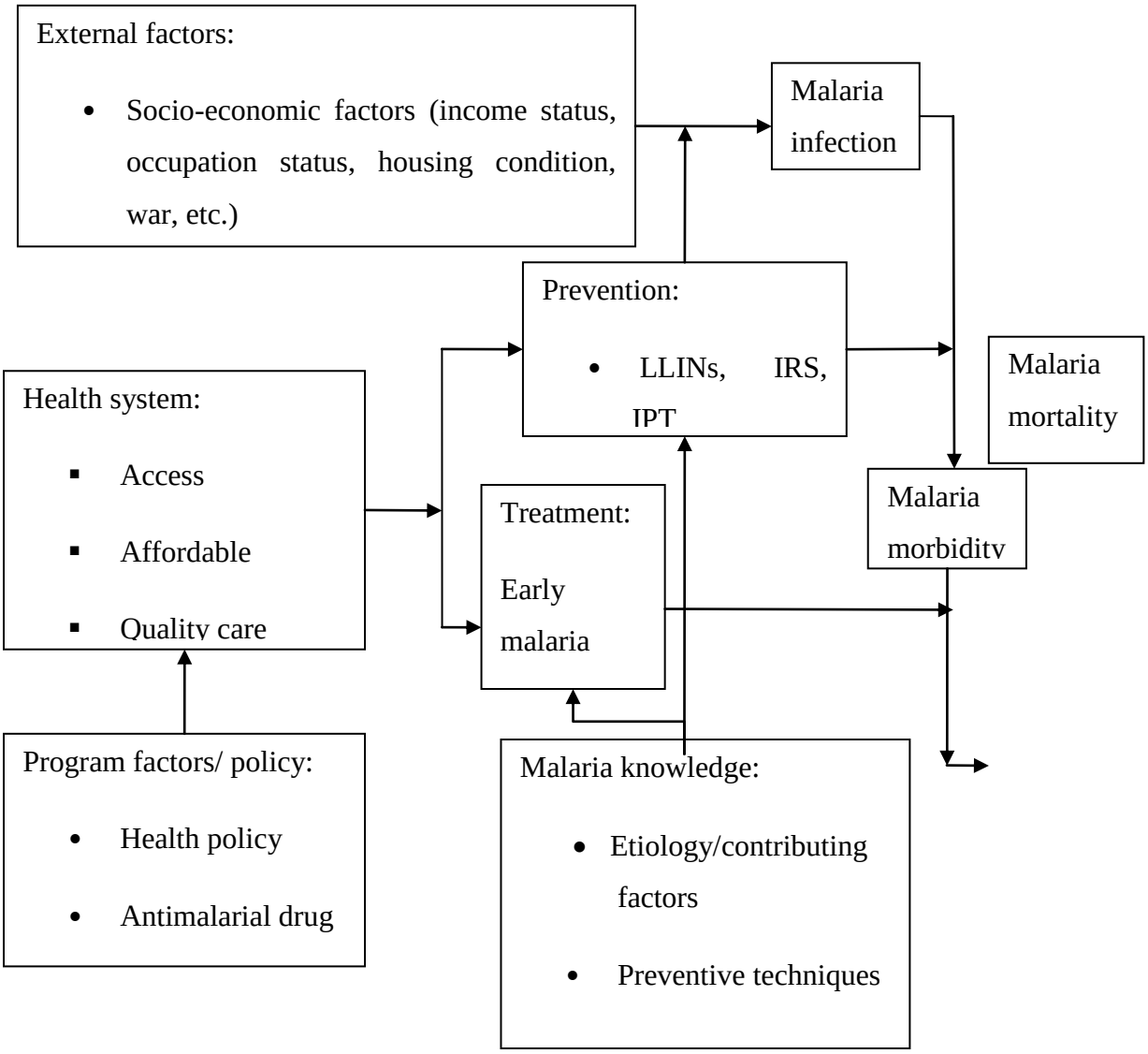

Figure 2. 1: Conceptual framework: Health Belief Model (Source: WHO, 2010)

To figure out the relationship between the independent, moderating and dependent variables, the study conceptual framework adopted the concept of the health belief model (**Figure 2.1).** The framework shows the interplay between, socio-demographic characteristics such as, education levels, presence and malaria knowledge, attitude and preventive practices like the use of personal vector protection strategies.

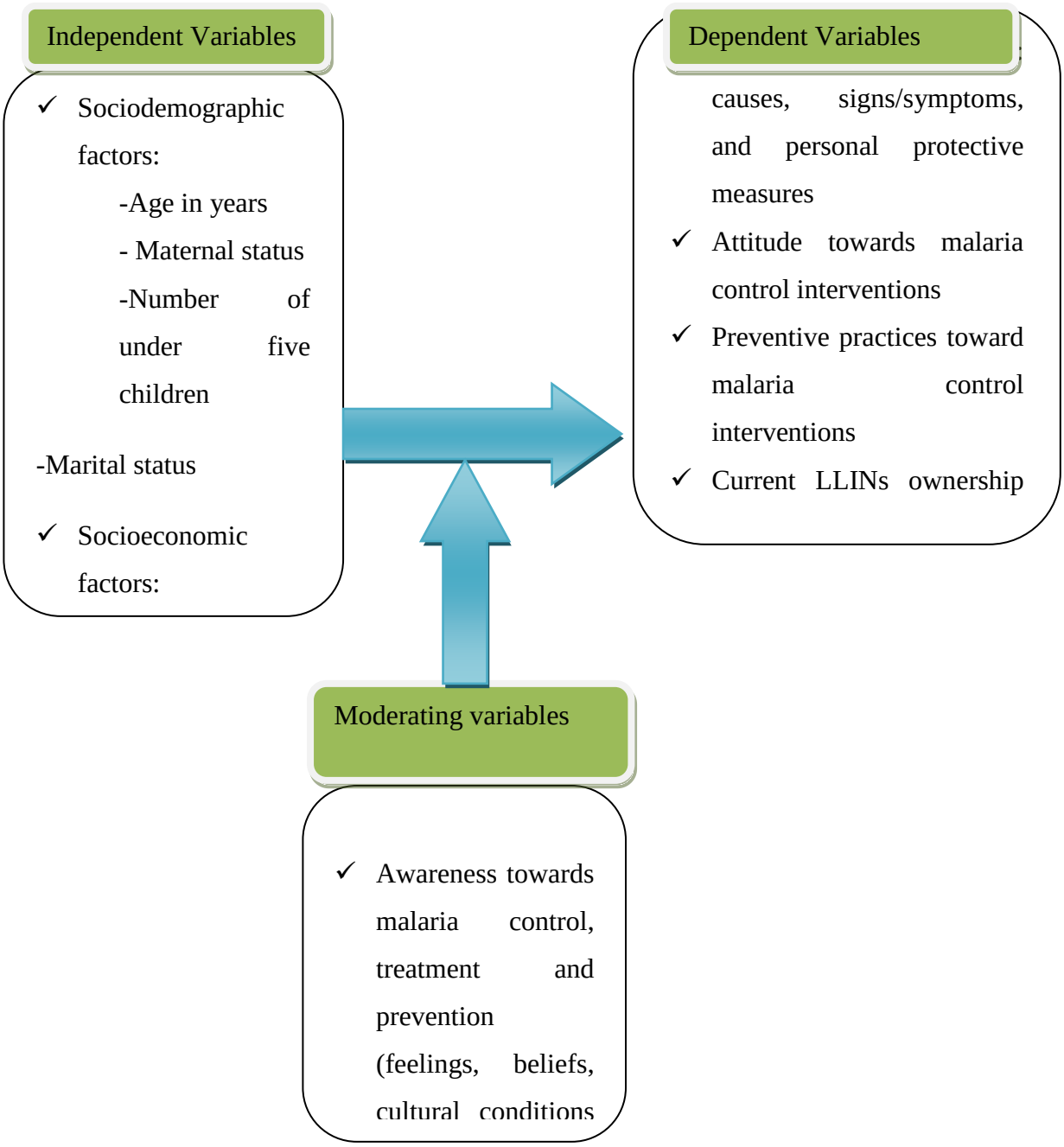

Figure 2.2: Conceptual framework of malaria control adapted from the Health Belief Model **(Source: WHO, 2010)**

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study area

Huye district is among eight districts of Rwanda's Southern Province. It is on 581.5 square Kilometers of the surface area with 314,022 inhabitants, where an average of 540 inhabitants is living on square kilometer. This district is composed of 14 sectors and 77 Cells with a total of 509 villages. Huye District shares the borders with Nyanza district in the North, Gisagara in the east and south, Nyaruguru in the South West, and Nyamagabe in the North West (NISR, 2012), on the latitude of **-2.586166**, and the longitude of **29.689026**. There is a famous Huye Mountain in the western part of the district and it has high undulated mountains with a rain of 1.200 mm and an average temperature of 19°C. in addition, it is divided into **14 sectors** namely: Gishamvu, Karama, Kigoma, Kinazi, Maraba, Mbazi, Mukura, Ngoma, Ruhashya, Huye, Rusatira, Rwaniro, Simbi, and Tumba. Huye district has been selected due to the high number of malaria cases compared to the rest of the districts of southern province and sharing the geographical limits with Gisagara district as a fellow citizen district is on second place in high prevalence of malaria in southern of Rwanda and in which the present study showed that 11% and 16% of community children were infected with P. falciparum based on microscopy and PCR, respectively and data from the ([Rwanda] MOH, 2009) indicate that 13.4% of patients attending health facilities in the Huye district had microscopically confirmed malaria (Gahutu et al., 2011). Besides, the people living in these sectors are neighbored and are sharing and crossing the limits for several activities and events from one sector to another like ceremonies housing, farming, and trading foods and goods. In that case, all these factors were taken into consideration to select the study area.

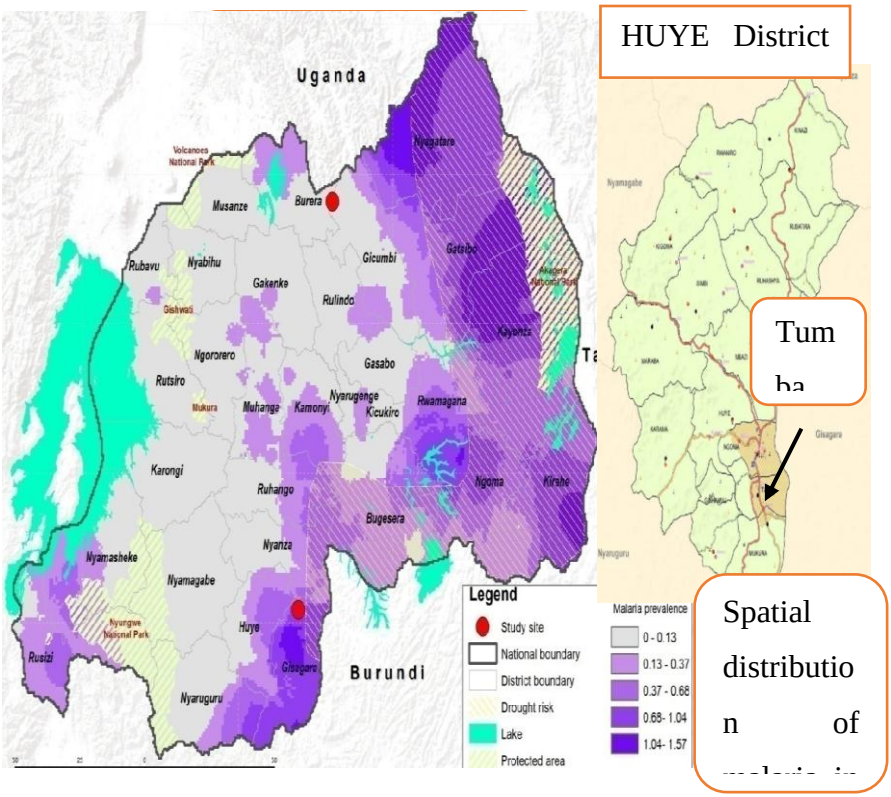

Figure 3.1: Map of Rwanda indicating Tumba sector as a study site and where malaria control interventions among pregnant women was implemented,2019

3.2 Study design

A cross-sectional study design was used in this study (Omair, 2015). The research design uses a quantitative approach to primary data from pregnant women in selected sectors. Data was collected on knowledge, attitude, and practices of malaria control among pregnant women living in the Huye district. Additionally, this study was, a household-based survey, and a random selection was used to reach the study participants from their houses, and gathering of data on LLINs ownership and utilization and their effect on malaria vectors and malaria transmission, other data collected was socio-demographic and socio-economic data among the pregnant in selected sectors.

3.3 Study population

The study population was the pregnant women who tested positive to pregnancy and attended ANC at Rango health center, Tumba sector, Huye district.

3.3.1 Inclusion criteria.

a) Pregnant women living in the catchment area of Tumba sector, Huye district.
b) Pregnant women who visited Rango Health center and get registered and has been confirmed to be pregnant by pregnancy test
c) Pregnant women aged more than 18 years
d) Pregnant women willing to be a study participant

3.3.2 Exclusion criteria

a) Pregnant women who decline to participate
b) Non pregnant women
c) Pregnant women aged less than 18 years
d) Any pregnant women who were not permanent living in selected villages, like the guests
e) Mentally disabled pregnant women, and those who were ill and unable to speak

3.4 Sample size determination

The study sample size (n) was computed based on the following formula of Cochran once the study population is vast: In 1977, the same formula was developed by Cochran to estimate a sample size that can represent the target population. In addition, according to (Lwanga & Lemeshow, 1991) in their study, the following equation was used in sample size calculation:

$$n = \frac{Z^2\ [p(1-p)]}{d^2}$$

Where **n** = sample size;

Z = the reliability coefficient at 95% confidence interval (1.96)

P = Estimated proportion was 50%. Meanwhile no estimate was available by Fisher *et al* (2008). No similar study has been conducted in Huye district to estimate the level of malaria Knowledge, Attitude, Practices, LLINs ownership

and utilization among the pregnant women towards malaria control and elimination

q = 1- p = (0.5);

d = margin error or level of precision (5%).

Due to the deficient of studies done in this topic in Huye district. Then the following formula is applied:

n = Z * Z [p (1-p)/ (d*d)] =1.960 * 1.960 [0.50(1 - 0.50) / (0.05 * 0.05)] =384.16≈384

So, 384 participants were recruited as sample size, and representing the target population, where the required minimum sample size of **384** pregnant women who visit Rango Health Center of Tumba sector in Huye district for antenatal care was determined

3.5 Sampling techniques

By adopting the balloting approach, the names of the sectors of Huye district were typed on smaller papers, retained in a container, and shuffled the first stage involved a random selection of one sector (Tumba) from the list of 14 sectors in Huye district. The one of Tumba sector was selected at random from the container by simple random sampling technique. Second stage a list of names of all five villages and number of households of each village in Tumba sector based on the 2012 Rwanda Population and Housing Census was found. Third stage, within the villages, a simple random selection of streets was done, then after with systematic random sampling methods used, the houses were arranged in order and selected from the streets: by dividing 820 houses by 384 houses required in the sample size. In this case, the sampling interval was 2. The second sampling interval, was counted down and started with simple random selection of household number 1 and selected each 2^{nd} household. In the selected houses women who were pregnant were also selected and interviewed. In a condition where a qualified pregnant woman is not available in a selected house, the following house to the right side was retained on behalf of the missed one. To be consistent the number of study

participants was also under estimated proportionally to each village based on number of pregnant women visiting antenatal care services per year at Rango health center (table 4.2).

3.6 Recruitment and training research assistants

A researcher recruited four professional nurses; two males and two females were recruited for the study data collection and given one-day intensive training and then deployed to the selected sector. The research assistants were four registered nurses with advanced diplomas in nursing, to certify the quality of the data collection process, the principal investigator carried out day-to-day supervision and ensured whether the participant has agreed to sign the written consent form (appendix I) at the opening of each interview. A researcher has identified potential four data collectors that fulfilled the following criteria before data took place:

- Those who at least completed high learning institution/college
- Those who had no permanent job
- Those who are familiar with villages ‘places
- Those experienced in data collection process

It was key to use those who understand and interpret the local cultural beliefs during data collection easier to track participants in their local places. Nurses with an advanced diploma in nursing sciences who had completed A1 level and not having permanent jobs or were employed somewhere else were primarily recruited. At this level of education, the Data collectors were able to easily read and understand the questionnaire tool during the training. Moreover, emails, number phones, and messages were initially used to reach all data collectors during the field study visits. There were two days of training on the instruments being used for data collection in the study area. Therefore, the following were concerned and addressed, first of all, the summary of the study including the study objectives, methods the purpose the study, and to conduct the interviews with face to face approach and techniques of interviewing, the role play was physically exercised between the selected data collectors. The ethical consideration issue was also addressed in this exercise. Telling them that no names, tags, and numbers were allowed to identify

the participants on the questionnaire before submitting them to the principal investigator. Entirely the questionnaire was debated step by step. That was followed by interviews conducted among the trainees during role-play sessions facilitated by the researcher. At the end of the day, the instrument was piloted in neighboring sectors of Huye districts which were not included in the study area every participant has confidentially signed the consent and agreement with the researcher and ensured that no given information will be disclosed to someone else except the researcher.

3.7 Operationalization of key variables

In this study the following were independent variables such as: income status, age, marital status, maternal status occupation, and housing type), moderating variables (awareness toward malaria preventive measures) and dependent variables in this study (Knowledge, attitude, practices and LLIN ownership and utilization levels): LLINs ownership and utilization was measured using the question "Do you own a treated bed net?" The answer categories are "Yes" or "No." Actual usage of LLINs was verified and collected as whether she slept under LLINs in previous night of the study or not (Yes/No). While awareness towards malaria control and preventive measures were considered as moderating variables of the study.

Furthermore, to assess the malaria knowledge there was another asked question, "What are the most common cause of malaria transmission?" The right answers to this question are bites of mosquitoes, immobile water, and poor environmental hygiene. Those who appropriately mentioned those three factors were considered as having a high knowledge level about malaria causes. Whereas those who mentioned two over three factors were recorded as moderate knowledge level for malaria causes. Lastly, the study participants who appropriately recognized one or unable to identify one of the three malaria contributing factors none were classified in the category of low knowledge level. In addition, an index was generated and construed with the aggregate score of 22 "malaria control and prevention Compliance Index", to evaluate the compliance with malaria control measures (Neuman, 1997). And possible items were used to assess malaria protective measures.

For practice levels, one question was posed. How do you protect yourself and your household against malaria?" one score was added, when the response was "yes" to burning grass and/ or closing the windows in the evening. When the response was "yes" to cleaning sewers and regular sleeping under bed nets two scores were added. Three scores were added when the answer was "yes" to removing stagnant water, cleaning and cutting bushes/grasses sideways of houses, windows wired nets gauzes, sleeping under LLINs and using insecticidal splays. "LLINs status was physically observed: torn or not torn; deprived of access to observe LLINs immediately was reflected to not intact bed nets. Two scores were added to any present intact LLINs; one score was assigned to not intact one. Surveillance on the actual use of LLINs: two scores were added to the one that was showed and hanged over bed areas and were considered is properly demonstrated.

Table 3. 1: Variable category and its total score

Variable category	Number of items	Total scores set
Knowledge	10	Combination of correct items: 3 correct items= 3scores =>High knowledge 2 correct items= 2scores=>Moderate Knowledge 1correct item =1 score=>Low Knowledge Total score=3 scores
Attitude	15	Each item, each right answer=> 4scores=>60 scores Each item, each wrong answer=>1 score Positive (score => 50) Neutral (score 40-49) Negative (score <=39) Total score:60 scores
Practices	10	Good (=> 14) Fair (=10-13) Poor (<=9) Total score:22 scores
Compliance index	3	Many items were combined in a single construct to measure an index into one score=>**22 total scores**

3.8. Data collection tool

A questionnaire which is adapted from the core questionnaires available from the RBM-RWANDA Malaria Indicator Survey of 2017 was used for reflecting to the population

and health issues relevant to Rwanda (see Appendix II). To collect the data, a semi-structured questionnaire was prepared in English and then translated into Kinyarwanda, the local language.

3.8.1 Parts of the questionnaire tool (I, II, III, IV, V)

I. Demographics pregnant women in Huye district in southern province, Rwanda
II. Basic knowledge and awareness toward malaria preventive practices among pregnant women in Huye district in southern province, Rwanda
III. Attitude towards malaria prevention and control among pregnant women in Huye district in southern province, Rwanda
IV. The current ownership and utilization levels of LLINs among the pregnant women in Huye district in southern province, Rwanda
V. Malaria prevention practices among pregnant women in Huye district in southern province, Rwanda

3.8.2 Pre-Test

To pretest the questionnaire tool, the pilot study was conducted in the same people from different and neighboring sectors (Huye and Ngoma) for addressing the issues of spelling grammar wording, and difficulties in answering questions while completing the distributed forms. Enough time was provided for the participant to question the nature of the study as the real study respondents, and they were given room to challenge the data collectors and comment on hindering obstacles to a deep understanding of the asked questions. Study participants were allowed to ask and comment on any item difficult to understand during the interviewing. It has taken 30 minutes for them to complete the questionnaire

3.9 Validity of the data

In this study the samples size was large for ensuring the study representive and ten pregnant women from neighboring sectors (Ngoma and Huye) were used in this study, some items throughout the instrument were amended to fit the participant's understanding level and to ensure the face study validity .and some edition were made following the pre-test. At the time of responding Likert scales options the research

assistants were so care full to guide the respondents by repeating the questions and clearly and loudly read the question, because some of them were confused and not easily differentiating those options. Every respondent was allowed to pose any question regarding the research tools and instructed to feel at home.

By reviewing much literature concerning similar research done the study content validity of the interview schedule was determined and used during data collection. Furthermore, two experts from the Rwanda Biomedical Center and two specialists in public health from the University of Rwanda were consulted during the instrument preparation and evaluation to ensure that the tool satisfactorily measured the concerning malaria prevention and control aspects and to certify its content validity. Additionally, after meeting with the team of experts from RBC and MOPDD some amendments were done throughout the instrument for their approval. However, both experts and my supervisors have recommended to complimenting the interview schedule with an observation approach to avoid bias in some responses. For example, the number of LLINs and house rooms can be observed throughout the interview. The tool was also adapted from similar studies done, elsewhere to ensure criterion validity, the use of a random sample of 384 pregnant women in the study has increased and improved the external validity of study findings.

3.10 Reliability of the data

Throughout the instrument, the technical terms were clearly explained and delineated to interviewees during the interview schedule for improving the study reliability, and SPSS software was used to enter and codding the collected data, and errors were verified and audited to ensure the reliability of the study instrument because it is affected the random errors. Every day the data completeness and consistency were checked and doubly entered in SPSS 21 version to find and address any like hood typing errors done during entering data.

To reduce instrument and selection bias; the research assistants were required to use the pretested and translated tool in the Kinyarwanda language; via the inclusive literature

review conducted, and the use of the Cochran formula to compute the study sample size; and guided by the adopted study conceptual framework namely Health Believe Model.

3.11 Data collection

In this study, the data collection process was carried out within three months, from March to June 2019 in the Tumba sector, Huye district. The data included, the villages of respondents, socio-demographic and economic characteristics. Furthermore, the study assessed the respondent's malaria knowledge, attitude, and practices. Every study participant was reached at home by the trained researcher assistants , who went house by house in the selected villages of the Tumba sector, in the afternoon hours where, most the respondent were available at home and free from their daily work from noon local time, And once the data collectors got the pregnant women, they begin with greetings and introduction and they explain to study participants the aim of the present study , what the participant can benefit from the same study and the allocated time of interview which was 30 minutes as it is mentioned in the consent form (see Appendix I);

- The data collector asked the participant if she was ready and accept to participate in the research;
- The household was jumped to those who were not ready to participate, data collector thanked them and go to the next household
- The household was maintained for those who accepted and were ready to participate in the study, research assistant chose a conducive place for the interview
- All items were listed and read clearly and loudly by the data collector at the same time ticking the given response under the supervision of the investigator, who was around to address any challenge and query

3.12 Analysis to address specific objectives

i. Knowledge levels

A list of items concerning malaria causes, and signs/symptoms was developed and respondents have ticked as many as possible and ranked as high, moderate, and low

knowledge level. To assess the knowledge of study participants, all statistical test was performed at a 95 % confidence interval, including the proportions of responses within three categories of knowledge levels. Additionally, the associations between those categories were calculated by chi-square and odds ratio under corresponding P-value <0.05.

ii. Attitude levels

A Likert's scale of 5 scores was used to assess the attitude of study participants, and they were required to answer the all negative and positive items related to malaria control and prevention, the combined 15 items were listed in table 4.6 and the point were assigned to them from strong disagree with one score to strongly agree with 5 scores.

iii. Practices levels

To determine the level of personal protective practice towards malaria control, there was a list of nine items listed in table 4.10, and one score was assigned when respondent mentioned that she sometimes performed good practice, a score of two once she always performed good practice of malaria control, and zero once she never performed good practice.

iv. Awareness to malaria preventive measures

Several items were used to assess the levels of awareness, ACT use as antimalarial drug, complications of malaria disease. Direct observation on LLIN status (ton, untorn and denied access to observe it) and its utilization was made, all these items were coded as Yes once LLI was presented and in use) and No when LLIN was not presented and not in use, relationship between demographic characteristics of respondents and LLIN ownership and utilization was assessed with statistical test (chi square and logistic test).

3.13 Data management and analysis

The data analysis process was performed in different steps, such as recording, sorting, and merging cases because data were entered in SPSS with different data recorders, and all codes of every variable were checked and verified during data entry in SPSS 21

version, any missing value was checked and cleaned through descriptive statistics by running the frequency distribution table of nominal variables, and missing values were excluded the data analysis, to observe the maximum and minimum values of every variable, the frequency distribution table of ordinal and nominal variables was run and give summarized data.

For quantitative variables discrete and continuous values were verified during data entry to find out any wrongly recorded values and outliers were checked for any presence of it that can affect the analysis process, the following variables were checked, age, income status, number of family members, number of LLINs, number of rooms, number of people who slept under the bed net, etc. In addition, the arithmetic mean and standard deviation were computed to provide the numerical values that can explain the nature of the distribution in numbers, and a histogram was plotted to test the normality and to ensure whether parametric tests are required during data analysis, box plots and histogram were used to also to determine if the assumptions of inferential statistics were satisfied ahead data analysis, and all socio-demographic data were manipulated with descriptive analysis, and to measure the association between categorical data ,the Chi-square test was used. Additionally, a logistic regression test was used to measure the likelihood of occurrence of the outcome variable for instance, high against low knowledge, good against the poor practice as binary variables, and all statistical test was considered to significance level of $p< 0.05$. Two or more independent variables were used to predict the dependent variable. To predict the compliance index of malaria control interventions, linear regression was used as a utility of predictors: Age category, marital status, maternal status, and education (Mertler & Vannatta Reinhart, 2016). The study has generated the primary data from interviews that were carried out in the Huye district, Tumba Sector. Quantitative data analysis has included descriptive statistics, like frequencies, means, and standard deviations.

3.14 Ethical considerations

Ethically this study was approved by the Institutional Review Board (IRB) of Jomo Kenyatta University of Agriculture and Technology (JKUAT), before the

commencement of the study data collection the administrative approvals were given by the head of Rango health center in the Huye district. Informed consent was obtained and filled in out with all study participants in the printed document (appendix I). Study participants were explained the potential benefits and worries/inconveniences involved with sharing or participating in the study. Potential participants were informed that participation in the study is completely voluntary and not paid. Informed consent forms were translated from English to Kinyarwanda as a local language for easier communication with study participants, when necessary and a participant information leaflet was distributed where applicable. Individual interviews were done with permission. Received data were treated carefully and privately with no name tag to it. The three principles which need to be followed in any research namely beneficence; respect for human dignity and justice was upheld in this study. Confidentiality was maintained and the obtained information has also been carefully treated and kept. All study participant's records were kept carefully and only known confidentially by the research team members

As this study was done house by the house there was no harm act and any stigmatizing message during the interview and grating that the environment was conducive and confidential , every participants was given a free time and freedom to decide to participate in the study or not , and the consent form (see appendix I) was distributed to those who accepted to participate and they signed the consent or put a thumbprint, every respondent was allowed to address any concern before the interview, through or after the interview. Throughout the research process, the researcher has maintained his scientific honesty based on his experience in this domain of malaria control and prevention. Despite malaria being a vast topic, no vulnerable people were involved in this study. All given information were kept in a locked cabinet and a soft copy was kept in a personal computer locked by a personal pass ward.

3.15 Limitations of the study

As this study has been conducted in one sector of Huye district, and used the across sectional descriptive design which cannot generalize reflect the study findings to the rest

populations separate the study respondents. In addition, there is generally no evidence of a chronological relationship between exposure and outcome. Therefore, it is not easier and likely impossible to establish a real cause and outcome relationship in short of longitudinal data(Solem, 2015).

Both malaria knowledge, and the compliance index of malaria control interventions was assessed among the study participants. With some study limitations in this used study methodology and scope. Firstly, the denied access to physically observe the LLINs utilization and its demonstration may have hidden the truth on LLINs utilization among the respondents and bring an effect on the study results and conclusions. Additionally, a cross-sectional survey, may influence the study results and left unmeasured factors and unable to compute or draw the causal inferences, and which is ineffective to demonstrate in what way LLINs ownership and utilization might change over a period of time. In reporting, there might be a potential social attraction unfairness that may affect the reported LLINs ownership and utilization among the study participants. In addition, study results may not represent the areas with low malaria endemic and low LLINs ownership and low knowledge of LLINs utilization and even to the entire country. There also were allowed study limitations of this study, due to its design, which was cross-sectional survey in nature and this means that the collected data were done at a single point in time, where its analysis could not generate and determine the association's direction and causal inference. In a few words, when other time intervals were chosen these circumstances may generate different outcomes and results.

Again, these findings could not be representing the entire population, because the men were not being represented in the present study; the pregnant women were only the study participants. Additionally, the location variable was not collected and considered in this study, it was only carried out in the southern province of the country, and there were other malaria-endemic areas in the eastern province of the country which were left behind and need to be surveyed in terms of malaria control interventions. The used study design of a cross-sectional descriptive study in exploration of the malaria knowledge and factors associated with LLINs utilization among pregnant women may affect the

representativeness of the study results to the left groups of people. As malaria disease is an essential topic, many areas were not incorporated in the survey form leaving numerous facts not being discovered. Even though a lot in literature were observed and quoted in the present study; henceforth the observed information may presently be transformed or improved. Due to the facts that some field data collectors were not allowed to enter and observe whether they really had the LLINs or not and to see if they were hung, therefore the findings were mainly grounded on self-reporters of LLINs owners and utilizers, even if 94% of the respondents were reached at homes. Additionally, there might be a misclassification and selection bias where the study participants used LLINs in their pregnancies 'period but did not use it at the night before the study took place. And also, the females who got pregnant within the study period were not comprised in the data collection process and the results may not entirely represent the population of pregnant women in Rwanda.

CHAPTER FOUR

RESULTS

4.1 Introduction

In this section, the socio-demographic and economic characteristics of the study participants are described and summarized in frequency distribution tables, the results from the questionnaires were analyzed and descriptively presented in tables and figures, and the three research questions were addressed: pregnant women's malaria knowledge and the factors that influence their malaria knowledge and preventive practices including the LLINs ownership and utilization, HMM and malaria treatments.

4.2 Sociodemographic information

A number of 384 study participants were recruited and completed the questionnaire, in Huye district, Southern Province, Rwanda,2019. Their mean age was 29.5 years ranging from 19 to 48 years. Most 172 (44.8%) were aged between 26-35 years. and 215 (56%) of the respondents were married. For educational status, most of the study participants 334 (87%) had varying forms of education ranging from primary to tertiary/high learning education while 50 (13%) had no formal education.

Most of the study participants 233 (60.7%) are living in households of three and less children aged under 15 years old and proceeded by 139 (36.2%) the ones living in families of four to six children. More than half 294 (76%) of the respondents were employed by others, 91 (and 76 (20%) were unemployed, and also the majority of 228 (59.4%) respondents their income status in terms of money ranging from 500-1000 Rwf per day from different business and professions.

The majority 147 (27.9%) of respondents were farmers followed by 90 (17.1%) of respondents were trades and the least 35 (6.6%) were civil/ public servants. In addition, the living house characteristics were surveyed and the majority 230 (59.9%) of respondents were living in a single room domestic house and followed by 83 (21.6%) of study participants who were living in the house of single bedroom and salon and 42(10.9%) were ling in duplex house or in a multi-family home with two or more

separate entrances.

Table 4.1: Socio-demographic information of respondents, Huye District, Rwanda, 2019

		Number (n=384)	Percentage
Age group(Years)			
under 24		131	34.1
25-29		172	44.8
30-34		76	19.8
More than 34		5	1.3
Mean age=29.5	**Sd=6.8**	**Minimum=19**	**Maximum = 44**
Marital status			
Single pregnant women		38	9.9
Married pregnant women		340	88.5
Widowed pregnant women		2	0.5
Divorced pregnant women		4	1.1
Total		**384**	**100**
Number of children ≤15years			
≤ 3		233	60.7
Between 4-6		139	36.2
≥ 7		12	3.1
Total		**384**	**100.0**
Education level			
No formal education		50	13
Primary		224	58.4
Secondary		100	26
HLI/ College		10	2.6
Total		**384**	**100**
Occupation			
Craftsperson		46	8.7
Trader		90	17.1
Farmer		147	27.9
Public servant		35	6.6
Total		**384**	**100**
Income status/day			
None (0Rwf)		76	19.6
500.5-1000.5 Rwf		228	59.4
1000.5-1500.5 Rwf		65	17
Above 1500.5 Rwf		15	4
Total		**384**	**100**
Living house types			
Duplex house		42	10.9
Single bedroom and salon		83	21.6
Single domestic house		230	59.9
Small and rondavel house		29	7.3
Total		**384**	**100**

Rwf: Rwanda francs
HLI: High Learning Institution

Table 4.2: Distribution of respondents by village, Huye District, Rwanda, 2019

No	Villages of Tumba sector	**Population (expected /Year)**	**Sample size***
1	Cyarwa	160	75
2	Cyimana	140	65
3	Gitwa	155	73
4	Mpare	175	82
5	Rango B	190	89
Total population/ sample size		820	384

4.3 Sources of information about malaria home management

Through several sources of malaria control information, all respondents 384(100%) have mentioned to have receive regarding malaria disease. Study respondents were permitted to make multiple selection during completing questionnaire. Of 384 respondents 325 (84.6%) received the information, from the health facility and 375 (97.7%) from Radio, 298 (77.6%) were from community meetings/CHWs, 135 (35.2%) from T.V and other sources73 (19%). According to the Figure 4.1. few respondents have got the malaria information from fiends/ relatives, reading magazines, newspapers, including internet source, and others, because one of their family members has suffered from malaria infection.

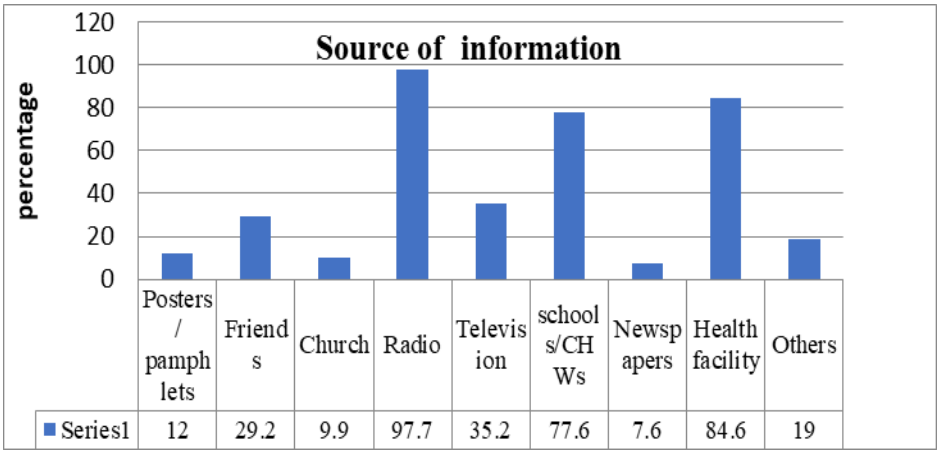

Figure 4.1: **Sources of information about malaria home management,** Huye District, Rwanda, 2019

4.4 Respondents' malaria knowledge on causes

Respondents 'malaria knowledge level was explored in this study, about the malaria signs and symptoms. Most of the respondents 361 (94%) knew the bites of mosquitoes as a related factor to malaria transmission. Nevertheless, 249 (64.8%) of respondents recognized stagnant water as a contributing factor, while 217 (56.5%) identified poor environmental hygiene as being a causative factor of malaria spread like the presence of bushes/grasses nearby home/ house, poor drainages of stagnant water. study participants were classified as having a high 57 (14.8%) moderate 243 (63.3%) low 84 (21.9%), knowledge level on the causes of malaria transmission, and 111 (28.9%) of respondents incorrectly identified the vector that can transmit malaria where they mentioned male anopheles as a cause of malaria transmission and 298 (77.6%) of respondents have correctly identified female anopheles as a real vector of malaria transmission. The majority of study participants 356(92.7%) mentioned malaria disease as a very serious problem and it can kill when not treated timely. The majority 366 (95.3%) of respondents were able to identify fever as the common symptoms/signs, 282 (73.4%) respondents for body pain, and 264 (68.8%) for headache. For antimalarial drugs, the majority 349 (90.9%) of the respondents pointed out ACT (coartem), while 182 (47.4%) of respondents also mentioned quinine. And the last was 86 (22.4%) of respondents who stated the other drugs as malaria treatments like chloroquine, amodiaquine, artesunate,

among others. Another 381 (99.2) have mentioned that pregnant women should be more protected from malaria than the group of adult people and supported by 297 (77.3) who mentioned that an infected pregnant woman should be treated in particular away from others. Additionally, 219 (57%) of respondents were aware of LLINs ownership and utilization.

Table 4.3: Respondents' knowledge and awareness on malaria, Huye District, Rwanda, 2019

Variables	Number (n=384)	Percentage
Vector that transmits malaria		
Female anopheles*	298	77.6
Male anopheles	111	28.9
Uncertain	59	15.4
Malaria causal /related factors		
Cold weather	47	12.2
Bites of mosquito *	361	94.0
Being rained	92	24.0
Stagnant water*	249	64.8
Eating sugar cane	68	17.7
Poor environmental hygiene*	217	56.5
Eating poor diet/bad food	52	13.5
Malaria as a serious problem		
Very serious problem	356	92.7
Serious problem	314	81.8
Moderate problem	280	72.9
Small problem	120	31.3
Among the following who should be mostly protected from malaria incfection than others?		
Children younger than five years	371	96.6
Pregnant women	381	99.2
Adults	113	29.4
Is a pregnant women who infected malaria, be treated in particular way than others?		
Yes	297	77.3
No	32	8.3
Not sure	55	14.4
***indicate the correct answer**		

Table 4.4: Respondents' knowledge and awareness on malaria, Huye District, Rwanda, 2019

Malaria signs/symptoms		
Headache	264	68.8
High body temperature/ fever	366	95.3
Chills /convulsion	215	56.0
Vomiting	163	42.4
Body pains	282	73.4
Loss of energy and appetite	235	61.2
Bad dreams/Hallucinations	114	29.7
Urine color change	205	53.4
Sweating	95	24.7
Eye color change	169	44.0
Awareness towards anti-malarial drugs		
ACT	182	47.4
Artemether/lumefantrine(Coartem)	349	90.9
Quinine	171	44.5
Chloroquine, Primaquine phosphate..	86	22.4
Awareness of government health policy change on LLINs utilization		
Yes	219	57.0
No	117	30.5
Uncertain	48	12.5

Table 4.5: Overall score of malaria knowledge amongst respondents in Huye district, 2019

Knowledge Levels	Number	Percentage
High (= 3scores)	42	14.9
Moderate (=2 scores)	246	64.1
Low (=1score)	96	25
Total	384	100

4.5 Respondents 'attitude concerning malaria control interventions

Both negative and positive statements were used in scaling the respondents 'attitudes towards malaria control and prevention with five points on Likert's scale a strongly disagree was scored one while a strongly agree was scored five points , and 15 questions regarding the respondents 'attitudes were summarized and tabulated in table 4.6 , On the whole, majority 315(82%) of respondents do recognize that controlling and checking the presence of possible breeding sites of mosquitoes should be conducted in everyday life , and a number of 299(77.9%) of study participants agreed that I can remove the water drainage around the house. While 276 (71.9%) of respondents agreed that they are important people in preventing malaria transmission. On the other hand, many respondents 100(26%) thought, that it is useless and time wasting to fight malaria meanwhile persons get it any time, and 180 (46.9%) of respondents who agreed that sleeping under bed nets doesn't give the assurance of malaria control and prevention. A proportion of the respondents 67 (17.4%) have been agreed that the LLIN use is similar to window/door net use compared to the majority 317 (82.6%) of respondents who disagreed with this previous statements, and 73 (19.1%) of study participants confirmed that the LLIN is not freely available whereas 311 (80.9%) of respondents have contrary reported the free charges of LLIN distribution and accessibility.

In the same vein, 45 (11.7%) of respondents stated that LLIN is expensive while 339 (88.3%) of study participants expressed differently and strongly disagreed that LLIN is expensive. Additionally, 318 (82.8%) of respondents agreed and stated that those who will have malaria will still have it, whether using LLIN or not while 54 (14.1%) of respondents were strongly disagreed with this statement and 64 (16.6%) of respondents were agreed that the substance in LLIN can kill under five-children compared to 320 (83.4%) of respondents who disagreed.

Table 4.6: Respondents' attitudes towards malaria control and prevention

Items	Strongly agree/ Agree	Strongly disagree/ Disagree

	n	%	n	%
1. I can use my money to buy control malaria equipment	38	9.9	346	90.1
2. I used to splay my house with IRS	96	25.0	288	75.0
3. I am strong enough to spray my house	53	13.8	331	86.2
4. I have all means to spray my home.	31	8.1	353	91.9
5. I have means to buy the new for replacing broken gauze screens.	115	29.9	269	70.1
6. I can remove any drainage water around my house.	299	77.9	85	22.1
7. Restricting and checking availability of possible breeding behaviors should be conducted daily.	315	82.0	69	18.0
8. The substance in LLIN can kill under five children	173	45.1	211	54.9
9. All kind of bed nets are available at home	61	15.9	323	84.1
10. I it is time wasting to combat malaria meanwhile people get it anytime.	100	26.0	284	74.0
11. using a bed net doesn't give the guarantee of malaria prevention	180	46.9	204	53.1
12. Your contribution in malaria prevention is paramount	276	71.9	108	28.1
13. LLIN is expensive	45	11.7	339	88.3
14. LLIN is not freely available	73	19.1	311	80.9
15. LLIN use is similar as window/door net use	67	17.4	317	82.6

4.6 The overall score of malaria control attitudes among respondents

The computed overall scores of malaria control attitudes among the respondents have 111(28%) of respondents have shown the positive attitude towards malaria control and prevention while 116(30.2%) have demonstrated negative attitudes about malaria control and prevention and surprisingly 157(41.8%) were not sure to the asked questions with non- opinions. By summing up the scores of 15 stated items regarding respondents 'attitude towards malaria control and prevention, the overall attitude score was computed out of the total 60 points as summarized in table 4.15.

Table 4.7: Overall score of malaria attitudes amongst respondents in Huye district, 2019

Attitude Levels	Number	Percentage

Positive(=>50)	111	28
Neutral(40-49)	157	41.8
Negative(<=39)	116	30.2
Total score	384	100

4.7 Respondents' practice towards malaria control and prevention

The majority 359 (93.5%) of respondents reported that one of their family members has ever got malaria compared to 16 (4.2%) who mentioned none of their households has infected with malaria disease and 9 (2.3%) expressed that they don't remember. 273 (71.1%) of respondents have gone to the nearest health facility when one of the family got sick and present the malaria signs and symptoms and this gives the of respondents' experience on malaria management and prevention. On the extent to which pregnant women are engaged in the home management of malaria program, 122 (31.8%) of respondents reported taking action in 24 hours when one of their family members show or present the signs /symptoms of malaria and 3165 (82.3%) look for treatment between 24 and 48 hours, while 41 (10.7%) of respondents reported searching for healthcare after 48 hours. Most of the respondents 324 (84.4%) of study participants had heard about ACT whereas 48 (12.5%) had never heard about ACT and 12 (3.1%) were not sure. The majority 223 (58.3%) of respondents preferred the ACT as an antimalarial drug due to its effectiveness and efficacy and the majority 346 (90.1%) of respondents mentioned the professional registered nurses as the ACT anti-malarial drug prescribers. 341(88.8%) of respondents cut bushes and grass alongside their houses and 316 (82.3%) were challenged by the lack of time in their malaria home management activities.

Table 4.8: Respondent's awareness toward malaria control and prevention, Huye District, Rwanda, 2019

Variables	Number (n=384)	Percentage
Anyone in household had malaria?		
Yes	359	93.5
No	16	4.2
Don't remember	9	2.3
What measure do you take once a family member get malaria disease?		
Use nearer health care facility	273	71.1
Went to the CHW	185	48.2
Went to the local shop of drugs	119	31.0
Did not do anything	14	3.6
When do you react once you manifest signs and symptoms of malaria?		
In 24 Hours	122	31.8
1-2 Days	316	82.3
3 Days or more	41	10.7
Preferred antimalarial drugs		
Multivitamins	31	8.1
Antibiotics	28	7.3
ACT	293	76.3
Analgesics	25	6.5
Have you ever heard of ACT?		
Yes	324	84.4
No	48	12.5
uncertain	12	3.1
Who prescribed the ACT and other anti-malarial drugs for you?		
Registered Nurse	346	90.1
Medical Doctor	63	16.4
Relatives /Friends neighbor	31	8.1
Self-prescribed	11	2.9
Registered Pharmacist	72	18.8
CHW	99	25.8
Why ACT as your choice of anti-malaria treatment?		
Fewer tablets	16	4.2
Does not have unpleasant taste	56	14.6
Inexpensiveness.	37	9.6
No undesirable side effects	23	6.0
Available	49	12.8
Efficacy/Effectiveness	223	58.1

CHW: Community Health Workers
ACT: Aritesinante based Combination Therapy

Table 4.9: Respondent's awareness toward malaria control and prevention, Huye District, Rwanda, 2019

Variables	Number(n=384)	Percentage (%)
What do you do to impede mosquito breeding at home?		
Water drainage.	319	83.1
Cut grass sideways the houses.	341	88.8
Remove all water containers around house	221	57.6
What are the obstacles do you face in your households during malaria control and prevention?		
Few equipment/medicines	18	4.7
Lack of means and money	243	63.3
Time constraint	316	82.3
Low malaria knowledge	116	30.2
Illiterate people	97	25.3
No incentive	23	6.0
Endemic region	249	64.8

4.8 Personal protective measures against mosquito bites taken by respondents

In the table 4.10, those using LLINs 232(60.4%) were using them every day/night while 61(15.9%) have never used LLIN, and 189(49.2%) were reported to cover their body every day/ night in prevention of mosquito bites while 28(7.3%) were applying mosquito repellent on the skin and 11(2.8%) used to cut bushes /grasses nearby home and clearing the drainages daily for mosquitoes spread around their houses.

Table 4.10: Personal protective measures against mosquito bites taken by respondents, Huye District, Rwanda, 2019

No	Personal protective measures against mosquito bites	Always [n(%)]	Sometimes [n (%)]	Never [n (%)]
1	Spray an insecticide in the outside and inside of the house	2(0.5)	10(2.6)	372(96.8)
2	Use mosquito nets/LLINs/ITNs at night	232(60.4)	39(10.2)	113(29.4)
3	Use of antimalarial medicine	5(1.3)	38(9.9)	341(88.8)
4	Cover my body with long clothes and blankets during night	189(49.2)	74(19.3)	121(31.5)
5	Rub on skin mosquito repellent	28(7.3)	59(15.4)	297(77.3)
6	Cutting bushes/grasses nearby home and clearing drainages	11(2.8)	123(32.1)	250(65.1)
7	Use of smoky fires at sunset to keep away mosquitoes	3(0.8)	5(1.3)	376(97.9)
8	Close windows & doors	216(56.2)	100(26.1)	68(17.7)
9	Use of gauze wires in house openings	91(23.6)	43(11.3)	250(65.1)

4.8.1 Overall score of malaria preventive practices

In this study, nine items were used to measure the preventive practices of malaria disease, each item was scored, and later the summation for all overall scores, for instance, once the respondent mentioned using to sleep always under the bed net, two scores were given, if she indicated to implement a sometimes good practice of malaria control, the score of one was given. Finally, a zero score was given to those mentioned never performing good practices towards malaria control and prevention. A proportion of 14.3% (55) of study participants demonstrated fair practices towards malaria control, while 22.14% (87) of them had good practices, and amazingly the majority 63.1% of respondents demonstrated poor malaria preventive practices concerning to malaria elimination. The distribution of malaria preventive practices across all study participants in Huye, 2019 is summarized in Table 4. 11.

Table 4.11: Distribution of respondents 'malaria preventive practices

Practice level	Number	Percentage
Good (=> 14)	87	22.6
Fair (=10-13)	55	14.3
Poor (<=9)	242	63.1
Total	**384**	**100**
Minimum=0		
Maximum=18		

=>: More than

<=: Less than

Sd=Standard deviation

4.9 Current LLINs ownership and utilization levels among the respondents

The study results presented the preventive strategies against malaria transmission and especially LLIN utilization. The greatest important malaria control strategy identified were LLINs ownership and utilization, IRS spraying the home with insecticide, avoiding stagnant water, and clearing and cutting bushes. The respondents have reported several malaria control measures such as: Use repellent lotion 71 (18.5%), use mosquito coils/use mortein doom 41 (10.7%) use repellent sprays 57 (14.8%) burn cow dung/ leaves, and avoid stagnant water 209(54.4%), use mosquito bed nets/LLIN 323 (81.4%), close windows & doors 216 (56.3%), gauze wires in house openings 91 (23.7%), and 13 (3.4%) do nothing, others 68 (17.7%).

Out of 384 respondents, 305 (79.4%) said they sent one of their family members to a health center when he or she is presenting signs of malaria, 271 (70.6%) used to consult the community health workers, 71(18.5%) used the cold application to bring down the body temperature herbal remedies, 69 (18%) went to seek pharmacist assistance and 13 (3.4%) seek the traditional healers in their home, 48 (12.5%) Give more drinks/ Give treatment.

In the study findings, 323 (84.1%) of respondents were reported as the LLINs owners and 283(87.6%) of them were only LLIN utilizers, while 40(12.4%) of respondents did not use LLIN the night before the survey. Among respondents who own a LLIN, more

than half 264(81.7) of them used it. All respondents knew that use of LLIN helps to prevent mosquito bites. Out of the 384 respondents, majority 381(99.2%) mentioned the LLINs utilization as the preventive measure of malaria burden and 378(98.4%) stated that the pregnant women should sleep under ITNs/LLINs. Shockingly, about 122(31.8%) of the respondents have mentioned that LLINs were factory-made with insecticides to last four to five years and 110 (28.6%) identified that the LLINs should not be washed repeatedly.

This study reported LLINs distribution among 384 study participants, 61 (15.9%) were reported not using LLIN. Observed frequent factors that affect LLIN use among the respondents were included: high temperature/heat 56 (94.9%), no access to LLIN 52 (88.1%), and used mosquito coil/spray 8 (13.6 %). Other factors were included: the absence of mosquitoes 15 (25.4%), feel uncomfortable sleeping under LLIN 20 (33.9%) and the rest use mosquito coil/spray 8 (13.6%) causes the skin rashes/ itch 42 (71.2%) reduces ventilation /asphyxia 45 (76.3%), among those who LLINs users 242(79.4%) had the untorn /unbroken LLINs while.

Table 4.12: LLIN ownership and utilization levels among respondents, Huye District, Rwanda, 2019

Variables	Number (n=384)	Percentage
Do you have LLINs?		
Yes	323	84.1
No	61	15.9
If yes do you use it?		
Yes	283	87.6
No	40	12.4
If No LLINs use, Why?		
No access to LLINs	338	88.0
Reduces ventilation /asphyxia	293	76.3
Feel uncomfortable sleeping in LLIN	130	33.9
Causes skin rashes/ itch	273	71.1
Absence of mosquitoes	98	25.5
Makes environment hot	364	94.8
Use of mosquito coils/spray	52	13.5
Dry season	108	28.1

Too old, no place to hang it on, feel discomfort with it	57	14.8

Table 4. 13: LLINs utilization amongst respondents, Huye District, Rwanda, 2019

Variable	n	%
Why bed nets /LLIN use?		
For privacy	60	15.6
To prevent bites of mosquitoes	384	100.0
To prevent malaria burden	381	99.2
To prevent bites from other insects	214	55.7
Who used under ITNs/LLINs last night?		
Children aged more than 5 years	217	56.5
Husband	186	48.4
Pregnant wife	307	79.9
Under five children	249	64.8
LLINs Physical condition observation		
unobserved	57	17.6
Unbroken	242	74.9
broken	178	55.1
LLIN utilization observation		
Not allowed	11	3.4
Not displayed LLINs	131	40.6
Displayed LLINs	243	75.2
If LLINs not displayed, Why?		
Keep the environment hygiene/cutting bush	152	47.1
Use of door and window curtains/nets	78	24.1
No need for it	43	13.3
Use of IRS is my choice	27	8.4
Not washed	53	16.4
It causes heat	172	53.3
No malaria , too old..	109	33.7
Have you ever been washed your LLINs?		
Yes	247	76.5
No	137	42.4
If yes what did you use?		
Rinse in water only	49	15.2
Bar soap with water	148	45.8
Detergents in water	89	27.6
Water and liquid soap	37	11.5
How do you dry your LLINS?		
Dry under the sun shining	231	71.5
Dry under the shade	117	36.2
Squeeze and hang it indoor..	43	13.3

4.9.1 LLINs and mosquito screens availability

The majority 273 (76.5%) of respondents expressed that the public health clinics/facilities were the most suitable place to buy the ITNs/LLINs. More than 364 (112.7%) of respondents stated that they used the bed nets to prevent mosquito bites as the main reason while 103 (31.9%) gave the reason of using LLINs for the prevention of insect bites.

Of the 323 who owned LLINs 219 (67.8%) were having between one and three LLINs, while 104 (32.2%) were having more than four LLINs. 247 (64.3%) of respondents stated that they had used the mosquito gauzes in the house openings (windows and doors). A total number of 326 (100.9%), of respondents identified children and pregnant women to sleep under LLINs regularly. Additionally, 301 (93.2%) had received a LLIN free of charge while 22 (6.8%) have paid for it. The study participants were willingly able to pay 3000 Rwf rather than 10000 Rwf for bed nets/LLINs. The majority 307 (95%) of respondents reported to treat their bed nets once a year and 361 (111.8%) of respondents have claimed the pregnant women to be regularly using or sleeping under bed nets. The most of respondents 371 (114.9%) mentioned free LLINs distribution as the main way of promoting LIINs ownership and utilization.

Table 4.14: LLINs and mosquito screens availability, Huye District, Rwanda, 2019

Variables	n	%
Where did you get LLINs?		
Market vendor /Retail shop	44	13.6
Private health facility	2	0.6
Pharmacy shop	23	7.1
During campaign	247	76.5
Public health facility	273	84.5
Others	37	11.5
Who is the best selective person to use LLINs in your family?		
Children aged more than 5 years	317	98.1
Pregnant women	361	111.8
Mothers and children aged less than 5 years	326	100.9
Spouse	215	66.6
Number of LLINs in household		
≤3	219	67.8
≥4	104	32.2
At free of charge, have got LLINs?		
Yes	301	93.2
No	22	6.8
Give reasons among the following for using LLIN:		
To avoid mosquito bites	364	112.7
For privacy	79	24.5
To avoid other insects bites	103	31.9
Others	114	35.3
How many times a year do you wash and treat your bed nets?		
From 2 to 4 months	31	9.6
From 5 to 9 months	113	35.0
Once a year	307	95.0
Never	69	21.4
Are ready to purchase LLINs for 10,000 Rwf?		
Yes	243	75.2
No	147	45.5

Table 4. 15: LLINs and mosquito screens availability, Huye District, Rwanda, 2019

Variables	n	%
The most convenient place for you to buy LLINs?		
Retail shop /market	19	5.9
Private health facility	21	6.5
Pharmacy shop	217	67.2
During campaign	164	50.8
Public health facility	311	96.3
Other	114	35.3
How can LLINs and HMM be promoted?		
Through health education at clinics and community meetings	353	109.3
Free LLINs distribution	371	114.9
Through mass media campaign	251	77.7
Others	119	36.8
Are your house's openings sheltered with mosquito screens?		
Yes, all of them	102	26.6
Only some of them	125	32.6
None of them	247	64.3

HMM: Home Management of Malaria

4.10 Factors affecting malaria knowledge

In this study, 23 (34.3%) of the respondents aged between 30 and 34 years were reported to have a high knowledge level compared to 60 (45.8%) of those aged under 24 years and who had low knowledge level on malaria burden. More respondents who qualified in high learning institution or college are more knowledgeable on malaria preventive measure than those who qualified in primary, secondary (level and none formal education category have had low knowledge towards malaria causes however, the association between education level and malaria knowledge levels was statistically significant (p=0.001). Respondents who were tertiary educated were also the ones who had high knowledge levels compared to the rest. None uneducated had high knowledge of malaria preventive measures. The marital status was not associated with malaria knowledge levels, which is not statistically significant. Furthermore, the study findings have shown a strong association (p=0.001) between occupation and malaria knowledge on preventive practices which is statistically significant.

Table 4.16: Association between selected demographic characteristics of respondents and malaria knowledge, in Huye district ,2019

Malaria knowledge levels					
Variables	High n (%)	Moderate n (%)	Low n (%)	Chi-square	p-value
Age groups					
under 24	26(19.8)	45(34.4)	60(45.8)		
25-29	36 (20.9)	83(48.3)	53(30.8)	17.851	0.001
30-34	23 (34.3)	29(43.3)	15(22.4)		
More than 34	3(21.4)	8(57.2)	3(21.4)		
Education					
No formal education l.	0(0.0)	19(38.0)	31(62.0)		
Primary level	50(22.3)	104(46.4)	70(31.3)		
Secondary level	31(31.0)	40(40.0)	29(29.0)	38.492	0.001
HLI/ College level	7(70.0)	2(20.0)	1(10.0)		
Marital status					
Single women	6(15.8)	28(73.7)	4(10.5.)		
Married women	32(9.4)	218(64.1)	90(26.5)	8.644	0.194
Widowed women	0(0.0)	1(50.0)	1(50.0)		
Divorced women	1(25.0)	2(50.0)	1(25.0)		
Number of children					
≤ 3	48(20.6)	104(44.6)	81(34.8)		
4-6	36(25.9)	57(41.0)	46(33.1)	2.260	0.687
≥ 7	4(33.3)	4(33.3)	4(33.3)		
Occupation					
Craftsperson	11(23.9)	21(45.7)	14(30.4)		
Trader	22(24.4)	46(51.1)	22(24.4)		
Agriculturer	25(17.0)	61(41.5)	61(41.5)	26.756	0.001
Public servant	18(51.4)	7(20.0)	10(28.6)		
Others	12(18.2)	30(45.5)	24(36.4)		
Income					
None	17(22.4)	32(42.1)	27(35.5)		
500-1000Rwf	48(21.1)	99(43.4)	81(35.5)	3.229	0.779
1000-1500Rwf	20(30.8)	27(41.5)	18(27.7)		
above 1501Rwf	3(20.0)	7(46.7)	5(33.3)		

4.11 Factors affecting malaria preventive practices

Considering the relationship between the socio-demographic characteristic and malaria practice scores, age, educational level, and income status, some of them were reported to be associated with malaria preventive practices, and the association was statically significant as indicated by the computed chi-square test. For instance, the respondent's education level ($p = 0.001$. Table 4.17). This is to mean that those who implemented good malaria preventive practices compared were more educated than the rest education categories, another association was between malaria practices and the respondent's income status and occupation ($p = 0.001$. Table 4.17). Furthermore, the study participants who demonstrated poor malaria preventive practices were those from the low-income category versus those with high-income status who performed good malaria preventive practices. Additionally, there was no relationship between malaria preventive practices and the respondent's age ($p = 0.279$. Table 4.17)

Table 4. 17: Association between selected respondent characteristics and malaria preventive practices

Malaria preventive practice levels					
Variables	Good n (%)	Fair n (%)	Poor n (%)	Chi-square	p-value
Age groups					
under 24	29 (22.3)	47(35.8)	55 (41.9)		
25-29	39 (22.6)	77 (44.7)	56 (32.7)		
30-34	18 (26.8)	32 (47.7)	17 (25.5)	7.476	0.279
More than 34	4 (28.6)	7 (50)	3 (21.4)		
Education					
No formal education l.	2 (4)	16 (32)	32 (64)		
Primary level	46 (20.6)	106 (47.3)	72 (32.1)		
Secondary level	34 (34)	35 (35)	31 (31)		
HLI/ College level	5 (50)	4 (40)	1 (10)	35.575	0.001
Marital status					
Single women	9 (23.7)	23 (60.6)	6 (15.7)		
Married women	36 (10.6)	213 (62.7)	91 (26.7)		
Widowed women	0 (0)	1 (50)	1 (50)	9.052	0.171
Divorced women	1 (25)	2 (50)	1 (25)		
Number of children					
≤ 3	44 (18.8)	112 (48.1)	77 (33.1)		
4-6	40 (28.8)	52 (37.4)	47 (33.8)	6.376	0.173
≥ 7	3 (25)	6 (50)	3 (25)		
Occupation					
Craftsperson	13 (28.3)	24 (52.2)	9 (19.5)		
Trader	18 (20)	49 (54.4)	23 (25.5)		
Agriculturer	25 (17.0)	61 (41.5)	61 (41.5)		
Public servant	18 (51.4)	7 (20)	10 (28.6)	34.172	0.001
Other jobs	15 (22.7)	22 (33.4)	29 (43.9)		
Income					
None	21 (27.6)	28 (36.8)	27 (35.6)		
500-1000Rwf	42 (18.3)	103 (45.2)	83 (36.5)		
1000-1500Rwf	24 (36.9)	25 (38.4)	16 (24.7)	34.887	0.001
above 1501Rwf	12 (80)	1 (6.6)	2 (13.4)		

4.12 Relationship between selected respondent's characteristics and LLIN ownership in Huye district, 2019

In table 4.18, some respondents'socio-demographic characteristics were associated with LLIN possession. Study respondents who demonstrated good malaria knowledge were 3.6 times more possible to own LLINs paralleled to participants who demonstrated poor knowledge (OR 3.6; CI 2.14–6.25; $p < 0.001$). respondents aged less than 29 years were

more expected to own LLINs paralleled to those aged more than 29 years (OR 2.84; CI 1.69-4.77; p = 0.001). In Table 4.18, on the other hand, the respondent's formal education was also associated with LLIN ownership (OR 6.7; CI 3.51-12.7, p = 0.001), being pregnant at the first time, and having a house with less than three sleeping rooms (OR 3.5; CI 2.1-5.8, p = 0.001) were less expected to be associated with LLIN ownership. The respondents who were earning more than 1501 Rwf per day were more expected to own LLIN paralleled to others with below 1000 Rwf, but it was not significant (OR 2.6; CI 1.49-4.71, p = 0.001).in this study the formal education was the core predictor of LLIN ownership were more likely to own LLINs compared to none educated respondents.

Table 4.18: Relationship between selected respondent's characteristics and LLIN ownership in Huye district,2019

Variables	LLIN Ownership					
	Yes (n)	%	No(n)	%	OR /95%CI	P-value
Knowledge of malaria cause						
Good	253	73.7	47	1.3	1	0.001
Poor	50	4.2	34	20.8	3.6(2.14–6.25)*	
Marital status						
Married	315	82.1	25	6.5	2.1(1.1-4.2)*	0.001
Non married/others	8	2.0	36	9.4	1	
Education level						
No formal education	22	5.7	28	7.3	6.7(3.51-12.7)*	0.001
Primary/Secondary/college	281	73.1	53	13.8	1	
Pregnancy status						
First pregnancy	74	19.2	43	11.	3.5(2.1-5.8)*	0.004

				2			
More than one pregnancy	229	59.6	38	9.9	1		
Number of rooms							
>3	112	29.2	28	7.3	1.54	(0.89-2.68)	0.694
<=3	210	54.7	34	8.9	1		
Age groups							
<29	239	62.2	64	16.6	1		0.968
=>29	46	12	35	9.1	2.84 (1.69-4.77)		
Occupation							
Public servants	23	6.0	12	3.1	1.97(0.94-4.15)		0.397
Others	276	71.9	73	19.0	1		
Income status							
<=1000Rwf	246	64.1	58	15.1	1		
1000-1500Rwf	40	10.4	25	6.5	2.6 (1.49-4.71)		
=>1501Rwf	13	3.4	2	0.5	0.6 (0.14-2.97)		
1= >reference group							
*=>p -value=0.001							
OR= odds ratio							

4.13 Relationship between respondent's characteristics and LLIN utilization in the study area

Table 4.19. shows the Logistic regression between LLIN Utilization and demographic information including knowledge levels of study participants. Those form good knowledge category concerning malaria causes were more expected use LLIN than those with poor knowledge on malaria cause [OR=1.71 (95% CI: 1.3-3.9); p-value=: 0.001]. The LLINs utilization level among married pregnant women was found to be very good

compared to non-married pregnant women and others [OR=2.1(95% CI: 1.1-4.2); p-value= 0.001] and also there was an association between the pregnancy status and sleeping under bed nets with [OR=3.2(95% CI: 2.1-5.6); p-value= 0.001] which is statistically significant. There was a positive association between the respondent's educational level with knowledge of malaria cause [OR=0.5(95% CI: 1.1-2.9); p-value= 0.001], which was statistically significant, and LLINs utilization with [OR=1.7(95% CI: 1.3-3.9); p-value= 0.001]. The other demographic characteristics like occupation, age category, and number of children did not have any association with LLINs utilization as observed in the logistic regression test; the most LLINs users were parous women compared to none nulliparous. Due the fact that this group of parous women had much exposure to ANC services than the rest with much package in health education session concerning malaria control and prevention.

Generally, formal education is positively associated with LLIN use among respondents. Study participants who had high education level were more expected to use LLINs than those without formal education (OR 3.4 (95% CI 2.3–4.9) (Table 4.19). Also, pregnant women aged less than 29 years were less likely to utilize LLINs compared to older pregnant women (OR 0.7; 95% CI 0.5–0.9, $p = 0.001$). Also, the number of house sleeping rooms was also positively effects the use of LLINs. Study participants who lived in a house with three or more sleeping rooms were more expected to use LLIN paralleled to those living in less than three rooms (OR 1.6, CI 1.1–2.4, $p = 0.001$).

Table 4. 19: Association between selected respondent's characteristics and LLIN utilization in Huye district,2019

Variables	LLIN utilization					
	Yes (n)	%	No(n)	%	OR /95%CI	P-value
Knowledge of malaria cause						
Good	248	64.5	52	13.5	1	0.001
Poor	55	14.3	29	7.5	3.2 (2.24–5.75)*	
Marital status						
Married	313	81.5	28	7.3	2.3(1.4-4.5)*	0.001
Non married/others	10	2.6	33	8.6	1	
Education level						
No formal education	20	5.2	30	7.8	6.3(3.1-12.4)*	0.001

Primary/Secondary/college	279	72.6	55	13.8	1	
Pregnancy status						
First pregnancy	77	20.1	40	10.4	3.3(2.4-5.6)*	0.001
More than one pregnancy	226	58.8	41	10.6	1	
Number of rooms						
>3	117	30.4	30	7.8	1.54 (0.89-2.68)	0.694
<=3	205	53.4	32	8.3	1	
Age groups						
<29	234	60.9	69	17.9	1	0.968
=>29	51	13.3	30	7.8	2.64 (1.39-4.57)	
Occupation						
Public servants	26	6.7	15	3.9	1.87(0.74-4.45)	0.397
Others	273	71.1	70	18.2	1	
Income status						
<=1000Rwf	240	62.5	58	15.1	1	
1000-1500Rwf	46	11.9	25	6.5	2.8 (1.39-4.81)	
=>1501Rwf	11	2.8	4	1.1	0.7 (0.13-2.87)	
1= >reference group						
*=>p -value=0.001						
OR= odds ratio						

4.14 Logistic regression of contributing factors of LLINs utilization among pregnant women (n = 384) who owns at least a LLIN in households

Sleeping under LLINs was higher 3 times associated among LLIN owners (95 % CI: 1.64–4.11) paralleled to not using LLINs, the number of sleeping rooms in house was the predictor of LLINs use with (p-value=0.001). Two and more sleeping rooms were positively associated with LLIN use paralleled to one room with 1.41 (95%CI: 1.13–1.83). With the multivariate analysis the study results shown that the income status was also associated with LLLIN utilization with 2.92 (95%CI: 1.31– 6.46), house or building characteristics like the number of windows and doors were not associated with the LLIN utilization, including the number of the rooms in the house, in multivariate analysis, the education level was also left behind as not associated with the LLINs utilization among the pregnant women. Sleeping under ITNs/LLINs was associated with LLINs ownership (p-value =0.001) compared to not sleeping under the mosquito nets.

Table 4.20: Logistic regression of contributing factors of LLINs utilization among pregnant women (n = 384) who owns at least a LLIN in households

Age group	Univariate OR (95 % CI)	P-value	Multivariate OR (95 % CI)	P-value
≤24	1			
25-34	0.72 (0.32–2.11),	0.652	-	
≥34	0.43 (0.22–0.98),	0.059	-	
Education level				
Any vs. None (reference)	2.12 (1.30–3.86),	0.005	0.44 (0.38–1.89),	0.640
Income status/ day				
0-999	1			
1000-1500rwf	2.11 (0.65–4.44),	0.087	2.23 (1.13–3.34),	0.000
≥1501	1.06 (0.48–3.57),	0.034	2.92 (1.31– 6.46),	0.000
Number of family members				
≤3	1			
4-6	0.25 (0.13–0.58),	0.009	0.52 (0.33–1.78),	0.478
≥7	0.48 (0.20–2.11),	0.452	1.12 (0.34–4.29),	0.621
Slept under LLIN last night?				
Yes vs. No (reference)	4.34 (3.23–7.68),	0.000	3.15 (1.64–4.11),	0.000
Number of sleeping rooms used				
1	1			
2	1.22 (0.45–1.78),	0.568	0.23 (0.18–0.87),	0.034
3+	1.41 (1.13–1.83),	0.001	0.18 (0.11–0.62),	0.001
Does LLIN have any holes?				
Yes vs. no (reference)	0.15 (0.08–0.75),	0.001	0.33 (0.18–1.26),	0.134
Number of rooms				
1	1		-	
2	12.01 (4.01–53.03),		1.42 (0.51–8.63),	0.312
3+	19.42 (4.36–73.04),		2.22 (0.54–8.42),	0.568
Number of doors				
1	1		-	
2	4.23 (2.32–10.33),	0.000	1.45 (0.69–5.34),	0.254
3+	7.34 (1.35–29.08),	0.001	1.56 (0.34–6.57),	0.375
Number of windows				
1	1			
2	4.21 (0.51–14.45),	0.432	2.34(0.87–12.23),	0.054
3	9.34 (1.51–43.55),	0.001	1.37 (0.22–5.99),	0.536
4+	5.57 (1.37–28.45),	0.017	1.09 (0.21–5.78),	0.807
Number of LLIN used				
1	1			
2	6.22 (3.11–11.64),	0.000	3.35 (1.19–11.43),	0.000
3	11.21 (3.45–19.14),	0.000	13.34 (4.12–45.24),	0.000
4+	38.01 (13.42–115.13),	0.000	89.23 (19.03–987.03),	0.000

4.15 Multinomial logistic regression analysis of factors associated with LLINs utilization among respondents in the study area

The table 4.16 reports the socio-demographic variables that were assessed, where the marital status and being heard to malaria control strategies from different sources of information were strongly and associated with reliable and uneven use comparative to rarely or never using LLINs in relation to being non married, being a married has significantly increased the likelihoods of steady LLINs utilization by 43.2% (OR = 0.432, CI = 0.216, 0.619) and that of utilizing the LLINs some nights by 81.7% (OR = 0.817, CI = 0.489, 1.012) comparative to not ever or rarely utilizing LLINs.

Study participants who heard on malaria control interventions were 52.5% (OR = 1.525, CI = 1.399, 2.848) more likely to report regular LLINs use and about 78.9% (OR = 1.789, CI = 1.719, 2.872) more likely to report uneven LLINs use comparative to hardly/never utilizing LLINs. There was a positive association with education: the likelihood of using nets every night and of using LLINs some nights compared to never or rarely using it increased with level of education. Whereas, age, and income status were negatively associated with steady LLINs utilization but made no significant difference for unreliable LLINS use. There was a negative association with age such that one-unit increase in age reduces the odds of regularly using LLINs with 73.1% (OR = 0.731, CI = 0.757, 0.866) compared with 91.7% (OR=0.917, CI=0.917, 1.010) comparative to never or rarely Utilizing LLINs. The chance of regular LLINs use was lower for those who have more than four sleeping rooms compared to those who less than three sleeping rooms. Several variables/predictors were positively associated with both regular and uneven LLINs utilization rather than rarely or never using, comprising readiness to pay for LLINs and positive attitudes towards LLINs utilization. In addition, there were the positive association with steady and unreliable LLINs utilization rather than rarely/never using include LLINs status (torned/untorned), and knowing where to buy the LLINs.

For instance, in relation to utilizing LLINs rarely or never, those who were eager to pay for LLINs had 48.5% (OR = 1.485, CI = 1.219, 2.009) higher odds of reporting regular use of LLINs and 73.4% (OR = 1.734, CI = 1.313, 2.197) higher odds ratio of reporting uneven use compared to those who were not ready to buy LLINs. In addition, the possibility for stable LLINs utilization was 73.5% (OR = 0.735, CI = 0.689, 0.992) higher and odds ratio for inconsistent use was 87.5% (OR = 0.875, CI = 0.816, 1.184) greater for those who perceived the severity of malaria burden. Respondents 'awareness towards mosquitoes bites as the cause of malaria transmission was not strongly associated with consistent LLINs use however significantly distinguished between uneven LLINs utilization and using LLINs rarely or not ever (OR = 1.517, CI = 1.214, 1.873). Respondents who had high scores of positive attitude on LLINs utilization were 52.7% (OR = 1.527, CI = 1.360, 1.894) more likely to use LLINs regularly and about 63.1% (OR = 1.631, CI = 1.415, 1.979) more likely to report uneven LLINs use comparative to hardly/never utilizing LLINs to those who had low scores of positive attitude towards LLINs use.

Table 4.21: Multinomial logistic regression analysis of factors associated with variations in LLINs utilization among pregnant women

Variables /predictors	LLIN use Every night vs. None/rarely		LLIN use some nights vs. None/rarely	
	OR	95%CI	OR	95%CI
Age in years	0.731*	0.757, 0.866	0.917	0.943, 1.010
Marital status				
Non-married	1			
Married	0.432*	0.216, 0.619	0.817	0.489, 1.012
Education level				
None	1			
Primary	0.890	0.640, 1.083	0.730	0.580, 0.862
Secondary/ tertiary	0.820	0.691, 1.046	0.638	0.373, 1.618
Heard about malaria control				
No	1			
Yes	1.525*	1.399, 2.848	1.789*	1.719, 2.872
Perceived severity of malaria				
No	1			
Yes	0.735	0.689, 0.992	0.875	0.816, 1.184
Knew malaria is caused by the bite of female anopheles				
No	1			
Yes	1.552*	1.211, 1.891	1.517*	1.214, 1.873
Positive attitude towards LLIN use				
Low score	1			
High score	1.527*	1.360, 1.894	1.631*	1.415, 1.979
Willing to pay for LLINs				
no	1			
Yes	1.485*	1.219, 2.009	1.734*	1.313, 2.197
Number of LLINs				
≤2	1			
≥3	1.737*	1.576, 2.111	1.331*	1.207, 1.575
Knew where to buy LLINs				
no	1			
Yes	2.634*	1.901, 3.724	2.110*	1.748, 2.961
Income status				
≤1000	1			
≥1001	0.391	0.232, 0.874	0.690	0.399, 1.170
LLINs status				
Torned LLINs	1			
Untorned LLINs	1.530	1.073,2.023	2.617*	1.835, 3.578
Number of sleeping rooms				
≤3	1			
≥4	0.682*	0.546, 0.839	0.771	0.639, 1.011

1= >reference group

*=>p -value=0.001

OR= odds ratio

4.16 Demographic summary of respondents who demonstrated compliance with malaria control interventions

In the present study, multiple regression analysis methods were used to reply to the research question. Hereby all independent variables were entered and analyzed into the analysis software instantaneously, and the significance level of every independent variable was tested to predict the dependent variable. Moreover, the data were selected for disappeared outlier's data, preceding to conducting the regression analysis as well as evaluated for test assumption.

By tolerance statistics, the multi-collinearity was explained for each independent variable. According (Stevens, 2007) any value near zero can be a sign of both a multi-collinearity and divergent problem. A phenomenon, in which there is a correlation between two or more predictor variables is called multicollinearity. This makes increases of standard errors which means that the constants for independent variables can c significantly be different and also it can make some variables less significant while they must be strongly significant (Daoud, 2018).

Based on the study variables the mean- standard deviation was computed: How many LLINs does your household have? Among the 384 study participants, the mean ± SD was 1.37 (0.72). How long ago (months) did utilize the LLINs? Of the 384 study respondents, the mean and SD was 8.2 (3.7) For the question, how often do you treat and wash the mosquito-net(s) in your house with insecticide? Of the 384 surveyed, the mean ±SD was 1.2 (0.7) a year. The observed children aged less than 5 years who were sleeping under LLINs versus the total children in the household, the total number was 132, with a mean ±SD was 1.2 (0.3). and 291pregnant women who used LLINs, with a mean ± SD was 1.8 (1.2). Finally, 13.71 (5.4) was calculated as the overall mean score ±SD for the compliance Index of malaria control and prevention.

The category of pregnant women without under-five children did not meet the hypothesis. However, because of its hypothetical meaning, this category was kept for

further statistical analysis. For the marital status variable, merely the category married pregnant women varied others were not sufficiently varying, thus the category of married pregnant women as compared to the rest categories. There were no outliers in univariate and multivariate variables ensuing, the data that were tested. Concerning standardized residual plots, the linear relationships were tested. Residual plots were also used to calculate the normality and homoscedasticity. With the prediction error line êi = 0. Compliance Index residual (CI) plots showed the abundant distribution of points and the normality was also examined. Inclusive, CI equals 13.71 (5.4). Generally, 48.6% of study participants had a reasonable to high knowledge level and 51.4% of respondents had a low knowledge level concerning malaria control interventions as shown in table 4.22.

Table 4.22 Regression statistical analysis

Variables	CI Mean ± SD	Malaria knowledge levels	
		High level	Low level
Marital status			
Married	12.33(5.25)	46.7	53.3
Others	7.32(3.75)	22.1	77.9
Maternal status			
Has other U5 children	11.2(4.68)	60.5	39.5
No other U5 children	10.1(4.62)	42.8	57.2
Education level			
No formal education	6.7(5.31)	35.3	64.7
Primary and secondary	14.5(6.01)	61.4	38.6
Tertiary	13.2(6.34)	52.9	47.1

CI =Compliance index
SD =Standard deviation

The mean age and standard deviation for respondents in the moderate/high were 32.48 (5.64), while the average age and standard deviation for those in the low knowledge value was 32.26 (7.14). In order to see if age, education level, marital status, and maternal status were the predictors of compliance with malaria control approaches, the Pearson Correlation was 0.19 and, a standard regression was computed in the table 4.23 compared to the calculated compliance Index regression analysis of malaria control

interventions. With regards to the general model of the independent variables considerably predicts the compliance index level of malaria control strategies, where, R^2 = .131, F (5,486) = 13.18, p < .001. Finally, the regression results have indicated the two predictors, which were age, and education variables, and they significantly predict compliance towards malaria control measures with p < .03. The previous indices are the important predictors of the compliance index of malaria control interventions. The model has demonstrated that both married and maternal status variables were not important predictors to malaria control strategies among the study participants. Moreover, the model R2 equals to .13 meaning that 13%, the total variance in compliance index is explained by marital status, education, age, and maternal status. And of course there was a lot of variability in the outcome variable that is not yet clarified. The associated p-value asks if each one of these predictors is significantly predicting compliance or not. What noticed here for age and education level variables is that they are significantly predicting the compliance index of malaria control interventions. And generally, the age variable has shown a positive relationship with the Compliance Index of malaria control interventions: the high as age category, the high compliance Index. Regression results on the impact of the maternal status to compliance index showed that pregnant women with under-five children were more likely to comply with policy guidelines on the malaria intervention strategies compared to those without under-five children. The study results have shown that the education level variable has an impact on the compliance index of malaria control interventions indicated that as the education level rises, the compliance index also raises.

Table 4.23: Standardized linear regression of compliance index level towards malaria control measures

Variable	B	SE B	β
Constant	-2.71	1.81	-
Maternal status			
PW without u5 children=0	-0.43	-0.77	-0.283
PW with U5 children=1			
Age categories*	0.22	0.51	0.21
≤30 age =0			
≥31 age =1			
Marital status			
Married =0	1.82	1.22	0,02
Others =1			
Education level*	2.12	0.36	0.19
No formal Education=0			
Others =1			
R^2 =0.14			
P*<0.001			
PW =Pregnant women			
U5=Under five			

CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATION

5.1 Discussion

The cross-sectional study was carried out in five villages of Tumba sector, Huye district, and southern province of Rwanda for exploring the malaria knowledge and its preventive practices and factors that affect knowledge and compliance with malaria prevention among pregnant women The study findings presented some demographic variables that were not correlated with the level of malaria knowledge and its preventive practice scores except for the variables of marital status, education level, and occupation. For the variable of marital status, this might be because it is believed in the population that adult women pregnant and who is also married and who should take care of their households have to be cautious and more responsible. The education level was an essential factor that contributes to apply knowledge into practice even though some confounding factors like age etc. One of the reasons could be that highly intellectual persons will be very knowledgeable, careful, and also taking the responsibility of preventing malaria transmission as a deadly disease. As well as the public/civil servants who were more exposed to the government health policy and its implementation.

Even though, the present study findings showed that the respondents were aware of implementing the right malaria control interventions. yet they were not willing to implement those malaria preventive practices and look after other duties. There was a relationship between occupation and malaria knowledge of respondents ($p = 0.001$), as shown in table 4.13. For the factors associated with LLINs utilization those who were knowledgeable about the causes of malaria transmission were more constantly using the LLINs with significant odds of 1.7(1.3-3.9).

Additionally, pregnancy status was strongly associated with the LLINs utilization, whereby those who had more than two pregnancies were more familiar and sleeping under LLINs than those with the first pregnancy with the odds of 3.1 (1.1-5.9. The observed differences might be associated with the knowledge acquired in antenatal care services during pregnancies, where pregnant women are frequently exposed to health

education about malaria transmission and its effects and complications on mothers and their newborns. There was also no association between the respondents 'attitudes towards the bites of mosquitoes and the regular LLINs use but significantly differentiated between uneven LLINs utilization and using LLLINs rarely or not ever (OR = 1.517, CI = 1.214, 1.873). Respondents who had high scores of positive attitude on LLINs utilization were 52.7% (OR = 1.527, CI = 1.360, 1.894) more likely to report regular LLINs use, while those who had low scores of positive attitude towards LLINs use were about 63.1% (OR = 1.631, CI = 1.415, 1.979) more likely to report uneven LLINs use comparative to hardly/never utilizing LLINs.

In collaboration with different non-governmental organizations (NGOs), the government of Rwanda has made a remarkable achievement in malaria control and prevention, for instance in scaling up LLINs universal coverage, with at least LLIN ownership/ household (NISR, 2015). It is also essential to recognize the extraordinary efforts of all donors /partners like RBM program, WHO, UNICEF, World Bank, Global funds, and the other non-governmental organizations that they have made in malaria control and elimination, especially among the children and pregnant women across the sub-Saharan Africa area including Rwanda. Nevertheless, there is still a big task.

In areas high transmission rate of malaria, WHO has suggested the following malaria control strategies, preventive treatment, like IPTps and SP in pregnancies, regular LLINs use, four visits of antenatal care services, and prompt diagnosis of malaria in pregnancies (WHO,2018b). Every year an estimated 35 million pregnant women might have an advantage from IPTp use. Conversely, a declined IPTp use in pregnancies were observed in African countries, and a low level of antenatal care visits among pregnant women (World Health Organization, 2013a).

According to (WHO, 2013), nearly 90% of Rwandese were reported to be at risk of malaria with an estimate of 443,000 pregnant women and 2.2 million children less than 5 years old per year (Eckert et al., 2017). Among 43 countries of Sub-Saharan Africa including Rwanda, malaria disease is endemic and a leading cause of morbidity and mortality rate especially in pregnancies. Yet Rwanda has made a big step in scaling up

malaria control interventions through the campaign of 15 months, the country has distributed over 6.1 million LLINs and Rwanda has reached in February 2011 the universal LLINs coverage among the first African countries (Mazigo et al., 2010a). The country has scaled up malaria control interventions successfully ten years ago and set an ambitious goal of achieving pre-elimination status with the test positivity rate of less than 5% and near-zero malaria deaths by 2018. However, an increased malaria prevalence rate has been recently reported in Rwanda and extensive funding, both internal and external, have been devoted to malaria control and elimination, there is a big demand from policy-makers, and different organs to review the effect of malaria control strategies on malaria morbidity and mortality especially among the pregnant women and under- five children. The MOPDD and all partners are eager to bridge the gaps between the strategic plan and malaria control and elimination strategies (President's Malaria Initiative, 2018). Pregnant women and children are vulnerable and at high groups of severe malaria, which results in anemia, abortion, and 11% of deaths of the newborn in areas of unstable P. falciparum malaria infection.

Efforts are needed to strengthening the malaria control and prevention program in pregnancy. In addition, the use of (IPTp) with (SP) and ITNs/LLINs in pregnancies were reported by (Eisele & Steketee, 2011) to be effective in reducing malaria mortality rate in newborns, mothers, and low birth weight, another study conducted by (Partnership, 2012), showed the protective role of IPTp-SP in reducing neonatal mortality. Even though the previously cited advantages of using IPTp and ITN /LLINs utilization to inhibit the malaria infection in pregnancy (Partnership, 2012). But IPTp was stopped in Rwanda in 2008, owing to increased parasite resistance to sulfadoxine-pyrimethamine countrywide, while, WHO has recommended the IPTp-SP to be given to in pregnancies in the early second trimester but not in the first in 2012 (WHO, 2018a).

Currently, an intermittent screen and treat (IST) approach to malaria control and prevention among pregnant women living in high transmission districts in Rwanda is being explored by Malaria and Other Parasitic Diseases Division (NISR, 2015). Rwanda Ministry of Health has trained over 60,000 CHWs across the country to help in home

malaria management and prevention especially treating the fever in under- five children with antimalarial drugs, however, they need to be adequately trained, supervised and supported in order to be effective (MoH, 2008).

In Rwanda, malaria is currently on 11th place and especially in Huye district, southern Rwanda where malaria is reported as the most community morbidity disease in adults including, pregnant women and under-five children (53%) among the leading causes of morbidity and mortality rate in Rwanda (Rwanda Ministry of Health, 2014). The present study is designed to assess malaria knowledge and its preventive practices among pregnant women in Huye district Southern province, Rwanda, the majority 246(64.1%) of respondents had moderate knowledge which is supported by (Mathania et al., 2016) in their study where 71.5 % of study participants have demonstrated knowledge level of malaria transmission during pregnancy. In this study, 298(77.6%) of respondents knew female anopheles as a malaria vector, which is an essential component in the prevention of malaria transmission. Similarly, (Iriemenam et al., 2011) in their study have found 78.9% of respondents mentioned infected mosquito bite as a vector of malaria transmission.

Elsewhere, the study has reported that pregnant women were aware and knowledgeable about causes, signs/symptoms of malaria and its control interventions, but this knowledge is not transformed into practice due to lack of access to LLINs and careless, sleeping discomforts and other logistical limitations (Manu et al., 2017). With regard to malaria treatment, 349(90.9%) of the respondents were found to use (ACT)/coartem and 171(44.5%) also used quinine. These study findings are in line with the antimalarial policy in Rwanda where it recommends the use of coated for uncomplicated malaria and quinine is given to the severe malaria case (NISR, 2015). Likewise, another study has stated that during the pregnancy, ACT drug is recommended in both second and third trimester for uncomplicated malaria, whereas quinine is for severe malaria cases during the first trimester of gestation (Agboghoroma, 2014). Normally the use of this ACT and quinine is in line with the malaria treatment guidelines of Rwanda, so far the high

coverage with ACT was reported as the most cost-effective antimalarial drug across the sub-Saharan African countries (Morel et al., 2005).

5.2 Knowledge of malaria among pregnant women in the study area

In this study, even though 100% of the respondents had heard/received malaria information through different channels of communication. The study findings have reported 96(25%) of respondents had low malaria knowledge in terms of malaria causes, contributory factors and prevention. Additionally, this low malaria knowledge among pregnant women might be linked with the poor interpretation of received malaria information as people may have different capacities of capturing and interpreting the received information and they incline to forget and missing the essentials elements in the received information. I addition lack of motivation and some benefits can matter here. Irrespective of accepting when people do not see the profit of an agreed behavior they cannot put it into practice. Insufficient health educational information on causal factors of malaria transmission looks like a big challenge that can hinder malaria control strategies. Out of 384 study participants, 243(63.3 %) of the respondents had adequate malaria knowledge while 57 (14.8%) of the respondents were highly knowledgeable in relation to malaria causes, and this seems that study participants might have previously faced with malaria history in their families, and having health education on malaria control and prevention. This is supported by (Fuge et al., 2015) in their study conducted in southern Ethiopia , shashogo district citizens were reported to have good malaria knowledge. Nevertheless, this respondent's knowledge was not completely transformed into practices for malaria control and elimination. Numerous research studies have reported the high knowledge level of malaria among the members of the community and it enables them to practice and implements correctly the malaria prevention and control strategies (Hlongwana et al., 2009).

5.2.1 Areas of high level of knowledge

In this study results, the majority 366(95.3%) of respondents have identified fever /high temperature as the common signs and symptoms of malaria this also was supported by (Kimbi et al., 2014) in their study results where 88% of respondents identified at least

one correct malaria's sign/symptom, and the most of study participants recognized fever as the most common malaria sign. The participants were aware vis-à-vis somewhere they would get antimalarial treatments when themselves or one of the family members have clinical manifestation of malaria disease with a high proportion 361 (94 %) of the study respondents identified mosquito bites as the most contributory factor of malaria transmission to this question was correct, while 298(77.6) of respondents have mentioned the anopheles' female mosquito as the vector that transmits malaria, in addition, the majority 297(77.3%) of study participants have agreed that the pregnant women who contracted malaria should be treated differently than adults ,likewise in the study conducted by (Obol et al., 2011) they reported the majority 91% of pregnant women who participated in their study to demonstrate the high knowledge in malaria causes ,by mentioning mosquito bite as associated with malaria infection. Additionally, study participants have correctly responded about the time that they can take antimalarial treatments where the majority 122(31.8%) of them have got the right answers by stating that they took an action within 24hours and 273(71.1%) of them they went to the nearest health facility for seeking health care or treatment as recommended by (World Health Organization, 2015) in its guideline of early diagnosis and treatment of malaria, and also 341(88.8%) of respondents have used to cut the bushes around the houses for malaria home management and prevention, similarly to the study done by (Oluwasanmi Amusan, 2017) the respondents have used to cut down the bushes around theirs houses as one of the malaria prevention procedures.

5.2.2 Areas of knowledge deficit

The present study showed that respondents are aware of their responsibilities; nevertheless, a low level of knowledge was found along with LLINs utilization and its manipulation among study participants who were not aware that insecticides are infused in LLINs and it is contraindicated to wash them frequently, so far training on LLINs are required to bond the break between LLINs ownership and its utilization. Furthermore, to know if pregnant women who contracted malaria should be treated differently than other adults, about this question, 32(8.3%) of respondents have said no and 55(14.4%) were not sure and non-opinion about this matter, and also 111(28.9%) of respondents have

failed to respond correctly on this question and they have mentioned male anopheles as the vector that can transmit malaria. about ACT whereas 48(12.5%) have never heard ACT and 12(3.1%) were not sure. Additionally, LLINs use was reported to be lower than bed net coverage in several studies done in different countries such as Ethiopia with 65.0 %, Togo (68.3 %), and Sierra Leone (76.5 %). In that case, the studies' results recommend increasing the coverage of LLINs distribution with appropriate effective approaches that encourage the utilization of bed net among the groups at high risk of malaria transmission (Wanzira et al., 2014). Future public health education has to stress LLIN utilization and its effectiveness in malaria control and prevention and to ensure that people could put into practice their good malaria knowledge.

The study results presented the high coverage of LLINs, but its utilization was low. Where 61(15.9 %) of respondents do not have LLINs and 84 (22%) of respondents had low knowledge on LLINs. As supported by (Adebayo et al., 2015) in their study , 30.6% of participants have demonstrated a low knowledge on ITNs utilization. According to LLINs status that are being frequently washed due to the low knowledge level of LLIN utilizers which can affect its efficacy (Axame et al., 2016). A majority of 298(77.6%) of respondents in this study have identified the female anopheles' mosquito as the malaria vector, and 215(56%) of respondents were able to identify correctly the signs/symptoms of severe malaria, such as chills and convulsion. The majority 217(56.7%) stated poor environmental hygiene or dirt and stagnant water as the contributing factors of malaria transmission.

5.3 Respondent's attitude towards malaria control

Based on the study results respondents demonstrated a positive attitude towards malaria control and elimination. Despite some factors that may hinder their practical behaviors towards malaria prevention and management such as being self-employed in agriculture 147 (27.9%) and also the 151(39.3%) of respondents has to care for more than 3 children under 5 years old in their households plus being pregnant , therefore they do not have time to implement the malaria control and preventive measures .Besides that, there might be any other social factors like lack of motivation, beliefs ,taboos, and

culture which could influence their skills and impede the malaria preventive practice. Moreover, another study done by (Adebayo et al., 2015) reported the majority (60.0%) of respondents who demonstrated poor and inappropriate attitude towards ITNs/LLINs utilization and malaria control and prevention in general. In this present study around 96 (25%) of the respondents have mentioned and felt the spraying as an enough malaria prevention strategy to stop the mosquito bites and breeding, and it looks as if they were not valuing other malaria control strategies. Additionally, 100 (26%) of respondents were strongly agreed that it is a waste of time to attempt to combat malaria since people get it in any case. In Nigeria, in a study conducted by (Ezire et al., 2015) a majority of 93.2% of respondents were reported to hear ITNs/LLINs, and 82.6% were self-confident of being ITNs/LLINs owners at the same time utilizers, being educated and living in location were reported to increase the confidence of using a bed net. It was those pregnant women who had the confidence to hang and utilize of ITNs/LLINs that were ten times more likely to utilize LLINs than those who were not confident. The majority of 341(88.8%) of respondents cut bushes, and grass alongside their houses and 316 (82.3%) were challenged by the lack of time in their malaria home management activities. Similar to another study done in eastern India, false impression, dishonesty and utilization of unverified malaria prevention procedures and traditional medicine were generally reported among pregnant women. Even though a portion of respondents have shown the willingness of taking prescribed antimalarial drugs and to attempt the new malaria prevention methods (Sabin et al., 2010).Study findings reported 45 (11.7%) respondents have mentioned LLIN as expensive tool, and 73 (19.1%) have mentioned that it is also no longer free available while 67 (17.4) reported LLIN use as same as using window and door net.

The available literature shows few studies on attitude towards malaria prevention have it as one of the factors directly influence the use of malaria preventive measures. Poor attitude towards malaria possibly influence the low use of preventive measures. However, most KAP (knowledge, attitude and practice) studies conducted in SSA lack the attitude component in detail; this is a gap to be filled in next researches in all

countries which are malaria infested. Again, in the context of Rwanda, the variable of attitude has never been studied in detailed way (Umwangange et al., 2018).

5.4 Malaria practices amongst respondents in the study area

In the table 4.10, those using LLINs 232(60.4%) were using them every day/night while 61(15.9%) have never used LLIN, and 189(49.2%) were reported to cover their body every day/ night in prevention of mosquito bites while 28(7.3%) were applying mosquito repellent on the skin and 11(2,8%) used to cut bushes /grasses nearby home and clearing the drainages daily for mosquitoes spread around their houses. Elsewhere, active participation of the community living in malaria endemic areas in the implementation of these malaria preventive measures is vital for the effectiveness of the program. In Rwanda, 73 % of pregnant women slept under LLINs in order to prevent mosquito bites and malaria complications (NISR, 2015); however, the government targets 100% of LLINs utilizers in households. The use of LLINs was reported as the most current malaria control intervention and they were regularly and freely given to pregnant women during antenatal care visits at health centers (Theiss-Nyland et al., 2016). According to RDHS 2014-15 LLINs ownership among pregnant women was 70%, but this study has reported the majority 323 (84.1%) of respondents as LLIN owners and this increase of LLINs utilization cannot reflect all pregnant women in Rwanda due to the study limitations in study methodology. This study reported more prevalence of malaria preventive practices than the one presented in Ethiopian's studies (Kibret et al., 2019). This inconsistency might be due to varied intense intervention implemented by the government health policy makers

5.5 Awareness, current ownership and utilization levels of LLINs among the pregnant women in the study area

This study presented that 169(52.2%) of respondents were demonstrated to sleep under the LLINs every night, while 103 (31.8%) of study participants were using the LLINs sometimes or some nights and 52(16%) of respondents were rarely or not using LLINs Additionally the majority 323 (84.1%) of respondents were the LLINs owners, even though the study results did not attain the WHO's target of 100% of maintaining LLINs universal coverage for all groups of age. However, improved LLIN ownership among

respondents was reported in study results as compared to the RDHS 2014-15 surveys, where 70% of pregnant women were reported as the overall LLINs owners whereas 68% of LLINs/ ITNs owners were the children less than five years. In addition, out of the 323(84.1%) LLINs owners in this study, only 59 (18.3%) were reported to sleep under the bed nets night before the survey. Study results indicate that 85% of LLINs utilization target set by the NMCP was not met (President's Malaria Initiative, 2014). Several studies have shown the significant differences between rural and urban settings in LLINs users, where among the 73% of pregnant women used LLINs, 72% of them were from rural areas while 78% of pregnant women were from urban areas (National Institute of Statistics of Rwanda, 2016b). With regards to this study results, 283(87.6 %) of respondents were LLINs utilizers, which is a great percentage compared to 73% of pregnant women who utilized LLINs, as reported in RDHS2014-15. Additionally, 66 % of children aged less than five years were reported to sleep under the bed nets/ ITNs in the southern province comprising Huye district, but no findings of ITNs/LLINs users were presented among the pregnant women. Likewise, there was a paucity of information among the pregnant women who slept under the LLINs, both in urban and rural areas in the southern province (RDHS, 2016). Historical background of ITNs/LLINs ownership and utilization in Rwanda was presented in increasing order where 17% of household ITNs ownerships was reported in 2005 RDHS ,62% in 2007/2008 interim RDHS and 72% in 2010 RDHS (President's Malaria Initiative, 2014). In a few words it is presently clear; those who used LLIN were more from urban than those from rural areas through different studies on malaria control and prevention in Rwanda.

The findings of this study reported 173(45.1%) respondents, who had high knowledge on LLINs as a major malaria preventive measure. To another place, (Axame et al., 2016) (73%) were presented with high knowledge on LLINs. Although knowledge and awareness on LLINs were as high as 70%, its utilization was as low as 3% among pregnant women. Additionally (Adebayo et al., 2015) in their study have reported (27%) of pregnant women who had adequate knowledge on ITNs/LLINs. However, it has been concluded that they do not actually put into practice their knowledge of malaria control

and prevention (Darko et al., 2019). In addition, some reasons for not using LLINs were reported among pregnant women, like discomfort related to heat, smell caused by bed net, and obstacles in hanging it (Manu et al., 2017).Similarly,(Axame et al., 2016), in their study have reported 81.4% of LLIN ownership while 42.5% was LLIN utilization. Another study has reported 87.9% of pregnant women were conscious of LLINs utilization in the prevention of malaria disease (Emmanuel et al., 2016). Amongst 64.8% of LLINs utilizers in pregnancy, 30% use it day by day, while 12.9% use it one time a week. In their study, pregnant women have demonstrated adequate knowledge about LLINs utilization. However, LLINs utilization level was low (Emmanuel et al., 2016).

The majority 375(97.7%) of respondents heard information about malaria from Radio and 325(84.6%) of respondents got it from health facility/ from health professionals these findings are supported by (Depina et al., 2019) in their study results revealed around 90% of the respondents who used media as a source of malaria information, predominantly the 83% were those who used TV and 43% were those who used the radio. (Manana et al., 2017) found that most of their study participants (75%) used the health facilities and consulting health care providers at clinics while (16%) of respondents heard the radio and (7%) of respondents during the community meetings as their sources of malaria information which is in line with these study findings which reported more than half of study participants to hear malaria information from health facilities and health community workers/community meetings 325(84.6%) and 298 (77.6) respectively .

Even though a big step has been taken in malaria control and elimination but the present study has revealed that study participants did not meet the goal set by RBM Rwanda. Rwanda has set the specific objective of the malaria control program which was to scale up the distribution of LLINs by targeting the entire population where all households own at least one LLIN for universal coverage. Beyond 83 % of households' ownership were reported to have at least one LLIN in RDHS 2014-15 while the RMIS 2013 has reported 84 % of LLINs ownership meanwhile 68% of children under five and 70 % of pregnant

women slept under the bed nets the night before the survey only, whereas 61.5 % of household population slept under a ITNs/LLINs, the target is not yet reached in Rwanda. Therefore, this study was conducted to find out malaria control interventions being in place among the pregnant women and assessing their knowledge LLINs utilization as the core important malaria control intervention in Tumba sector, Huye district southern province as one of the highly malarious region in Rwanda.

The study findings reported each and every study participant to have some form of knowledge on LLIN utilization, where the majority 219(57%) of respondents had high knowledge and the results showed that (99.2%) of them knew LLINs are used to prevent the bites of mosquitoes. Campaigns during free LLINs distribution ,ANCs and health education given by the CHWs might be the contributory factors of respondent's high knowledge as supported by (Habimana et al., 2016) in their study . This study has shown that the pregnant women were reported to be not aware of manufactured LLIN or its quality and manipulations, they were not even cautious whether LLINs are impregnated with insecticides or not and also did not know if LLIN should be washed or not and how often to wash it per month or yearly and this result into reduced LLIN effectiveness due to frequent washing of LLINs as argued by (Axame et al., 2016). Finally, this might confirm that the health information obtained during LLINs distribution campaigns and ANC services did not stress the fact that LLINs are manufactured and impregnated with insecticides as a result of not being washed frequently which influence the poor LLINs utilization in general.

5.5.1 Factors affecting LLINs ownership

In the study conducted by (Kateera et al., 2015), 92 % household LLINs ownerships was reported in their study and also similar studies have reported the high LLINs ownership and coverage rates in several countries such as (87.6 %) in Sierra Leone , (96.7 %) in Togo and (91.0 %) in Ethiopia but not ready to use LLIN during night for preventing the mosquitoes bites. According to (Wanzira et al., 2014) there was a major need of expending the LLINs distribution and improving the approaches used to encourage people to use bed nest especially the groups at high risk of malaria transmission like

pregnant women and under five children In the study done by (Auta, 2012) the mean difference between the number of family members (mean=4.7) and the mean number of existing mosquito nets (mean=2.1) was reported, which is inferior to the objective of having one ITNs per two family members. Consequently, a high access rate to ITNs/LLINs was considered as the determinant of mosquito net usage. Likewise in the study done by (Iwashita et al., 2010), showed the LLINs accessibility was the only determinant of ITNs utilization, in Uganda. Therefore, the efforts to increase LLINs access, mostly in families with many members, are essential in malaria control and elimination. In Togo, another study conducted by (Stevens et al., 2013) have reported the perception of malaria risk to be associated with the high LLINs utilization rate among the people from low income status, dissimilar to those from higher social economic status this might be related to the given public health education among those low social economic status. Moreover (Stevens et al., 2013) has reported in their study one ITN/LLIN ownership per household which was improved from 41.3% to 96.7% through the campaign and the LLINs ownership among the pregnant women was 77.5%. This study highlights the gap in LLIN ownership and its utilization. Similar to the study done by (Axame et al., 2016) LLINs Ownership was 81.4% while LLINs usage was 42.5%. LLIN ownership was influenced by the education Level with the strong association (p=0.003) and LLINs utilization (0.020). Additionally (Kateera et al., 2015) in their study , 92 % of households was reported to have at least one LLIN whereas LLINs utilization was 72 % of household members in Rwanda. The difference means between LLINs utilization and the house's sleeping spaces were 1.61 and 2.27 respectively. Furthermore, the majority 687(89.2%) of respondents understood that LLINs are used to prevent malaria transmission and avoiding the bites of mosquitoes and killing them.

5.5.2 Factors affecting LLINs utilization

In the study results, many factors that affect LLINs utilization among the LLINs owners were identified and makes respondents irregularly use the LLINs ,and 56 (94.9%) of respondents have reported irregular use of LLINs due to heat, for 52 (88.1%) of respondents it was due to the absence of LLINs ownership, 8 (13.6 %) of respondents

were reported to use of mosquito coil and spray no mosquitoes in place of residence 15 (25.4%), while 20(33.9%) of respondents feel uncomfortable when they slept under LLINs and the rest use mosquito coil/spray 8(13.6%) causes skin rashes/itch 42(71.2%) reduces ventilation /asphyxia 45(76.3%) Mainly this study reported the heat, lack of LLIN and unwashed or old LLINs as the main reasons of inconsistently use of LLINs or not use. Likewise in the study conducted by (Tassew et al., 2017) reported carelessness , poor memory, absence of ITNs/LLINs, net washed, weakness, sickness and being busy with work as reasons for not using ITNs/LLINs regularly (Muhumuza et al., 2016). Additionally (Axame et al., 2016) in their study reported heat as the main factor associated with poor LLINs utilization among pregnant women.

In the same vein, those who slept on the floor and in the small room in the house without a roof were almost fully associated with not using LLINs (Larson et al., 2014). Moreover, the lower compliance to ITNs/LLINs utilization was reported and related to some reasons like difficulty in spreading a be net over a sleeping mattress or other materials , lack of a suitable position/structure for hanging the ITNs, and troublesome that obscure the comfort of LLINs utilization among those who not sleeping on a bed (H. et al., 2010). .According to (Larson et al., 2014) it was revealed that sleeping on floor and in the slight house room without a roof was almost entirely linked with non-use of LLINs.

The house structure was also a possible reason for lower compliance to LLINs utilization among LLINs owners, which makes the difficulty to spread a bed net over the bed and mattress, bed net's structure can complicate the ease LLINs hanging and generally interrupt the bed net use (H. et al., 2010). Even if not studied here, it is likely seen difficult and irregular use of LLINs among those sleeping in larger spaces/rooms and not being ready to hang their LLINs and less willing to use bed nets. In the same study results, there were 93 % of the houses observed without a ceiling in their structures in the sake of easier LLINs hanging. Another study conducted by (Graves et al., 2011) has reported the lack of the appropriate space to hang nets as a possible reason of low odds of bed net usage and this study has concluded that the bed net

hanging increases the probability ITNs/LLINs utilization. To promote the LLINs use, the issue of hanging nets and their convenience should be addressed among the non-users of bed nets. Similar the findings from the done by (Graves et al., 2011) presented an association between the families who had more than two sleeping rooms and lower odds of LLINs use matched to a higher bed nets use in families with less than one ITN/LLIN per two family members in Ethiopia.

In spite of reasonable knowledge on LLINs utilization and malaria knowledge and its preventive methods, regular LLINs utilization was very low with 15.0% of respondents and it was the major reason for the high malaria transmission rate in the area and 14 % of study participants have identified pregnant women and children aged less than 5 years as the most vulnerable groups who should sleep in ITNs/ LLINs and regularly use them (Iwueze et al., 2015).

The issue of LLINs cost was raised during the survey where the study participants were questioned if they have been ready to pay 10,000 Rwf for LLINs in their village? And if not ready to pay 10000rwf, how much money would they be keen to buy a LLIN? In the compiled results, 39% of respondents reported their refusal to pay such an amount of money for LLINs. This amount might be too high, taking into consideration that most of these study participants were agricultures/ farmers, handcrafts, etc. The mean amount of money that respondents were ready to pay was 3000rwf. As it was recommended by the WHO for LLINs universal coverage, the governments and their partners should scale up LLINs and distribute them free of charge to the entire population during the campaigns. In collaboration with different partners like PMI, Global Fund (GF)etc., Rwanda has achieved ITNs universal coverage in 2011 for all categories of people Since then, and ITNS were distributed free of charge in routine distribution, during antenatal care and vaccination services, EPI program and schools. Additionally, in 2015, around 1,000,000 ITNs were distributed during the campaign as supported by PMI in the next year of 2016 there was an expectation of 6,000,000 ITNs would be distributed in the campaign under the Global Fund and PMI support. Moreover, the PMI was responsible for monitoring the ITNs' durability and insecticide resistance and promotion of Social and behavior

change communication by ensuring the consistency in ITNs utilization within the community members.

The following cost of $2.20 which is between $0.88 to $9.54 was assigned to the safeguard with ITNs/ LLINs utilization .furthermore the through the studies is done , a detailed interruption of costs was reported, whereby a mean percentage of 63% which was ranging from 12% to 92% of the total cost of ITNs/ LLINs distribution, and it was endorsed to bed nets and insect repellent and insecticides, and also 17% which is between 2% to 67% was allocated to the training of employees , and 7% which is between 1% to 17% was given to sessions of information education and communication(IEC) and transportation (USAID & CDC, 2017).

5.5.3 Factors that affect knowledge of malaria among pregnant women in the study area

In the study findings, those who were knowledgeable about malaria causes were more expected to perform good malaria preventive practices as paralleled to those low knowledge level. This is to mean that the more knowledge regarding malaria causes, risk factor, seriousness of the disease and personal preventive strategies, the more practicing preventive activities among study participants.

In this study, 23 (34.3%) of the respondents aged between 30 and 34 years were reported to have a high knowledge level compared to 60 (45.8%) of those aged under 24 years and who had low knowledge level on malaria burden. More respondents who qualified in high learning institution or college 7 (70%) are more knowledgeable on malaria preventive measure than those who qualified in primary (22.3%), secondary (31.0%) level and none formal education category 31 (62.0%); have had low knowledge towards malaria preventive practices however, the association between education level and malaria prevention knowledge levels was statistically significant (p=0.001). Those with tertiary education 7 (70%) were the ones who had high knowledge level compared to the rest. None uneducated had high knowledge of malaria preventive measures. In other studies, education level was shown to be associated with women's knowledge about

malaria, as women with lower education levels had lower odds of having complete malaria knowledge.

5.5.4 Factors affecting malaria prevention practices malaria among pregnant women in the study area

Accordingly, the study result revealed that the overall malaria prevention practice of the study participants is found to be good 87 (22.6%). Having children, formal education, and good malaria knowledge were positively associated with malaria prevention practices. The malaria practice level obtained in this study is lower than preceding study reports 53.5% in Tanzania (Rumisha et al., 2014) and 55% in Ethiopia (Asale et al., 2019). This may due to the African study participants had sharing different cultural believes in their daily living conditions and the implementation of the malaria preventive practices in their locations. Nevertheless, the result of this study is higher as compared with the prior studies report from Nigeria and Cameroon (Talipouo et al., 2019). additionally, the level of malaria practice found in this study is lower than previous studies conducted in Ethiopia (Kibret et al., 2019). This difference might have related to diverse intense malaria control intervention implemented by the government health specialists of the county. Among 384 study respondents 324 (84.4%) of them have heard about ACTs use and 223 (58.1%) it is their choice due to its efficacy and effectiveness and they used it to treat fever at home, since 2006, the artemether-lumefantrine (AL) was considered as the treatment of simple malaria and adopted by the national malaria control program(NMCP) as the first-line treatment and later alone in 2009 Rwanda has adopted the WHO recommendation of diagnosing the all fever cases for confirmation (RDHS, 2016).

On the other hand, the studies conducted by (Appiah-Darkwah & Badu-Nyarko, 2011). an association between demographic characteristics such as gender status, age status, education level, and income status, and level of practices towards malaria prevention and awareness was reported, vulnerability are said to have an effect on malaria control practices adopted by the members of the community (Appiah-Darkwah & Badu-Nyarko, 2011). Similarly, its impact on family, friends, or neighbors can also affect malaria

control practices. From these study findings, 67% of study participants were awake of the new government policy of malaria home management and LLINs ownership and utilization. Rwanda has initially implemented a program of distributing LLINs to each household as recommended by WHO in 2010 for universal access to LLIN use (A M van Eijk et al., 2011). promotion of ITN use.

5.5.5 Factors affecting malaria prevention compliance among pregnant women in the study area

In sub-Saharan Africa regions, there were inaccurate collected data or malaria information and poor reporting in the census, all the these have the implications on African public health sector whereby the imprecise figures on malaria control and prevention can cause poor budgeting concerning health finance and economy, provision of health facility services and health infrastructures, and it has the big impacts on malaria control interventions allocations , including the antimalarial drugs distributions supplies like as LLINs and ACTs. In the present study, it was reported the ACTs availability is still a problem and 223 (58.1%) of respondents have mentioned to choose ACTs use due to its availability when they were asked their choice about ACTs and the have demonstrated the limited access and availability of ACTs as big challenges that they currently faced with.

Also, in studies done by (Alonso & Tanner, 2013) 10 years ago there were some efforts to control malaria, like financial and political will and improved access and availability of new malaria control strategies and protocol /guidelines. But malaria disease is yet a major health problem in Africa as a continent. Vital challenges have been mentioned were the instability of many health systems, the increased resistance to insecticide and drugs, and decreased funds from donors, and failure to replace the oldest malaria control interventions in place as needed. Finally, it seems that Africa needs new and mutual approaches and strategies to quantity transmission for controlling and eliminating malaria, new, good knowledge of drugs and insecticide resistance.

Furthermore, many factors that are influencing the unavailability and access to malaria control interventions among the community members like ignorance and negligence of

people who used to go consult the traditional healers and self- medication, and also to get the ACTs to the diagnosed malaria case is still a big challenge, additionally, it was reported that current evidence the majority of those who need antimalarial treatments do not have them and in the same case those who are given anti-malarial they have not been diagnosed with malaria. Particularly the poorest are facing financial constraints and most of the ones who have malaria illness do not have access to healthcare, consequently the difficulties to deliver free malaria drugs. The ACT is currently highly costing and the frauds of it on the market. So there was an urgent need to address this issue of the forged drugs problems and finding sustainable solutions through different researches (Deye, N.,et al. (2016). For the LLIN utilization, this study has reported the mean of one LLIN use per household compared to, RBM targets of aiming 80% of households having one LLIN and access to LLINs (Assembly et al., 2011). With regards to RBM target and program on LLINs distribution and coverage, the governments and states need to revise their census and stress on LLINs utilization among the population, especially the pregnant women and under-five children those who are considered as a vulnerable group in the region for malaria control and elimination.

Different studies have identified the main gaps in malaria control and prevention like the poor implementation of health policy, weak regulatory board, funding and budgeting, and it is evidenced by many research that without sufficient funds the malaria disease cannot be controlled and eliminated, especially in Rwanda, the country was relying on the external funds from donors in last 20 years ago. Rwanda is one of the countries whereby they depend on the external resources to combat malaria diseases, referring to WHO 2013 country profile; while the economy of this country is mainly based on the trades of tea, coffee, and tourism, from this trading the country has started to think on how they can use this income in combating with health problems especially malaria disease in the context of self-reliance and entirely the countries in the region can do the same and be interested with their problems in the health sector and finding sustainable solutions for contributing to malaria control and elimination . In different nations malaria disease was reported as a major explanatory variable for national revenue like in

African countries ,including Rwanda, whereby, malaria has negatively impacted the total national output and their economic growth (Okorosobo,Mwabu, Orem, & Kirigia, 2011).

5.5.6 Further factors hindering malaria control and elimination

Big gaps towards the malaria prevention practices among pregnant women, the low knowledge and compliance were reported in the present study, additionally, the lack of health global policies and its poor formulation and implementation on malaria control and the logistics of implementation as they were initially conceived, the lack of adequate funding, and the implementation of uncoordinated strategy. Let us look at these issues separately for which a number of effective policy interventions could help in solving the problems, contributing financially to combat the malaria transmission (RDHS, 2016)

And also, the health policies were poorly prepared and applied. In Rwanda, for instance, some citizens are building all types of construction on drainage paths, with access to the drainage system living in high risk zones, and throwing the waste in water flow which affect environment and serves as breeding sites for mosquitoes. In Rwanda, there was support from global fund malaria of 6.6 million ITNs/LLINs to be distributed within 27 districts countrywide, in order to realize the 2018–2019 ITN/LLINs mass distribution; the GOR has also requested support from Global Fund and PMI to continue IRS in three districts with a high burden of malaria as an approach to cope with the insecticide resistance. Additionally, PMI has also supported the ITNs/ LLINs durability and quality control of IRS and provided 14.5 million RDTs across the country; there was an additional support request of 1 million RDTs for every year. Likewise, 8.4 million ACT doses were given by the Global Fund and around five million ACTs doses have been given by PMI. Rwanda's national malaria control is currently working hands in hands with PMI to make sure that there is no repetition of malaria control activities (RDHS, 2016).

Rwanda's national malaria control program has been funded by the Presidential Malaria Initiative in terms of communications strategy with the target of 95% of Rwandan at risk of malaria infection to have good malaria knowledge and its control strategies by 2020 the present study's findings have supported the previous target of Rwanda national

malaria control program, where it presented 288(75%) of respondents who had high to moderate malaria knowledge. In addition, the Rwanda ministry of health has established the center of behavior change communication activities, including malaria control and prevention activities (RDHS, 2016). Through this center, the health messages are harmonized and shared with the entire population across the private and public health sectors. Via different channels of communication like interpersonal communication ,mobile telephone, radio, print, and television, numerous malaria information and health messages have been funded by the presidential malaria initiative (PMI) , additionally, it is currently supporting the SBCC at community-level by focusing on mobilization and engagement of community members towards malaria control and prevention by means of interpersonal communication, using community radio, mobile telephone, cinema, and theaters (RDHS, 2016). The government of Rwanda will keep encouraging persons via SBCC messaging especially the pregnant women and mothers of under-five children to use LLINs and consulting the health care providers or CHWs for further management of malaria disease, including fever diagnostic and treatment in addition, the study conducted by (Koenker et al., 2014) has reported BCC as important tools in the journey of malaria control and elimination. And also, it can be considered as a useful tool to reach the populations at risk of malaria transmission in case people are dynamics to move, secondary it can help in the identification of cases with asymptomatic infections and their antimalarial treatments compliance, furthermore it is used to update the community members of the best programming of malaria control interventions, and informing them about the new malaria treatment guidelines and protocols.

In general, there were two main methods within malaria control interventions like prevention and case management. These two approaches can work together for malaria control and elimination; these strategies can work against the mosquito vector transmission to humans. The present study has reported the association between the moderating, independent, dependent variables and outcome variables; and also the following factors can affect the adoption of malaria control and preventive practices such as socio- economic and demographic features, malaria knowledge, and awareness of community members to malaria prevention.

5.6 Conclusion

1. This study found that pregnant women had moderate knowledge of malaria control interventions. Despite the poor implementation of current malaria control strategies and also, the majority of them used antimalarial treatment like ACT/ coartem, and quinine. The most malaria preventive strategies used by respondents were the LLINs, cleaning of houses, and removal of stagnant water. Radio and health facilities were identified as the most shared malarias 'sources of information among respondents. There is a need for sustaining and expanding the current LLINs ownership and utilization level and also improving public health education on malaria knowledge, preventive practices, and high health risk behaviors for the prevention of malaria. Study participants have reported several contributory factors of malaria transmission, such as the draining of water, bushes / poor environmental hygiene and sanitation can hinder the quality of malaria preventive practices whereas cutting bushes around the houses and cleanliness, removal of stagnated water, and advances in sanitation, like usage of glasses in windows and curtains in the house can stop the malaria transmission.

2. This study also found that some respondents are willing to use LLINs and other malaria prevention methods when the mosquito's vectors are probably being breeding or abundant. In addition, some study participants did not see malaria as a dangerous disease in their living areas; therefore, proper public health education is needed to modify their behavior and improving their awareness towards malaria control strategies. Improving the malaria knowledge and its preventive practice among the population at risk of malaria especially pregnant women and children aged less than five years old will remain the core approach of controlling and eliminating malaria disease. Lastly, monitoring and evaluation LLINs ownership and utilization should be improved to avoid the inconstancy and irregular use of LLINs

3. The present study found that people need to take into consideration carefully the present study's findings as long as the study presented the positive evidence of better using regularly the LLINs and pregnant women's training on LLIN ownership and utilization as required improving the identified low knowledge in the present study. The study findings showed that respondents were aware of their responsibilities; yet, low knowledge of LLINs utilization and its manipulation was reported among the respondents so, further training are essential to deal with the identified gaps in malaria knowledge. Despite having one or more than two LLINs, people who slept on the floor comparative to those who used beds were inconstantly using LLINs. Additional to LLIN scale-up campaigns, there was a needed to encourage people of living in houses with structural conditions that prevent indoor mosquito bites and sleeping on the bed not on the floor which can help in LLINs hanging among the groups at high risk. Regular training on LLINs may increase awareness of pregnant women on the benefits of LLIN utilization
4. This study found pregnant women aged more 29 years had meaningfully higher odds of having comprehensive malaria knowledge. The most pregnant women had some form of malaria knowledge, but gaps in comprehensive knowledge remained and still hindering the effective implementation of malaria control strategies. In order to increase knowledge, educational messages about malaria management should be more efficiently targeted to reach pregnant women as a group at high risks, less-educated pregnant women and in non-English speakers need to be approached in their mother language (Kinyarwanda).
5. This study found that partnership with the media and advocacy at health policy makers will enhance and promote primary prevention of malaria in communities especially children and pregnant women. Moreover, study results showed the income status was not associated with malaria preventive practice level except for marital status and education level. This might be related to most of the study participants were farmers and self-employed 147 (27.9%) and also a certain percentage of 139 (36.2%) respondents were to care about 4-6 children aged less

than 15 years, which makes them not having enough time of practicing malaria control interventions. There might be so many other hindering factors like taboos, culture; incentives, etc.as the behavior does not be subject to merely knowledge and attitude. A significant association was identified between malaria knowledge and LLINs utilization among the respondents. This means that people who had high malaria knowledge would have a good practice towards malaria control and elimination.

5.7 Recommendations

i. With regards to the study results, regular health education and trainings are required to improve malaria knowledge, preventive practices and management behavior against malaria among pregnant women. Therefore, established health education programs should be planned and carried out for improving and implementing the malaria control interventions and it should mainly focus on increasing the responsiveness and knowledge of the respondent vis-à-vis the causes of malaria transmission and the importance of implementing all malaria preventive measures and malaria effects /complications on pregnancy.

ii. Several public health educations, done face to face contact by CHWs and community health care providers and via social media to malaria control strategies are needed to make sure that people can develop a sense of positive attitude in relation malaria prevention and management for malaria elimination. In collaboration with the ministry of health, public and private organizations, the office of the health unit in every sector should yearly or when the higher incidence of malaria carry out the public health education about malaria control and elimination during campaigns across the country. Ministry of health has to provide a clear malaria management guideline and envoys lines that can guide the directors of health unit at the district and community level.

5.8 Suggestion for Further Study

Despite the good malaria knowledge among respondents, several studies highlighted the poor translation of this knowledge into good practice towards malaria control and elimination; in that case, further researches are needed to bridge the gap. Also, training and health education about malaria control and prevention is required to address the gaps in malaria knowledge as underlined in the present study. With regards to the study limitations, additional studies should be carried out in other districts with high malaria transmission rates across the country. Additionally, to determine the array of malaria knowledge, and LLINs utilization for malaria control and prevention among groups at high risks of malaria and also the future studies should also actively look for factors hampering the malaria control interventions due to the facts that besides the knowledge there were many influencing factors which affect the people's behavior like motivation, perceived benefits, etc.

Through the refreshment courses and training of health workers and community health workers, Rwanda Ministry of Health needs to make sure that these groups at high risk are aware of what is in the bed net and how it works. In general, there is a need for more researches to conclude why LLIN utilization is not good enough among respondents. In addition, the government and other partners should continue to distribute LLINs freely to those who are not able to buy LLINs and replacing the torn or old LLINs during the campaigns.

5.9 Contribution of the current study to learning

This study revealed major factors that can hinder or influence the pregnant women's malaria knowledge and preventive practices like poor involvement of women in malaria control programs and, carelessness, tiredness, forgetness, lack of time. Lack of motivation, perceived benefits, and negative behaviors towards malaria control and preventive practices

1. Emphasis on LLIN utilization effectiveness as a major tool of malaria control and prevention

2. Government health policy on malaria home management and pregnant women's contribution.

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APPENDICES

Appendix I: Individual Questionnaire (In English)

SECTIONI: SOCIO-DEMOGRAPHIC INFORMATION

1. What was your age in years at last birthday?

2. Marital status:

1.	Single	
2.	Married	
3.	Widowed	
4.	Divorced	

3. Education level :

1		Primary	
2		Secondary	
3		HLI/College	

4. Professional qualification:

1	Nursing	
2	Education	
3	Sociology	
4	Public health	
5	Other specify	

5. Employment status:

1	Employed by Others	
2	Self employed	
3	Unemployed	

6. Income/month:

1	None	
2	500-1000 Rwf	
3	1000-1500 Rwf	
4	Above 1501Rwf	

. How far are you along in your pregnancy?

1	First trimester	
2	Second trimester	
3	Third trimester	
4	Fourth trimester	

8. Number of family members……

SECTION II: Knowledge of the cause and signs/symptoms of malaria

8. What transmits malaria? (Tick as many as required)

1	Mosquito bites	
2	Use of stagnant water	
3	From forest	
4	Human-to- human	
5	From weather/sun	
6	Unclean house	
7	Use Traditional healers	
8	Eat sugar cane	
9	Other(specify):	

9. What do you think are the most common signs and symptoms in malaria infection? **(Tick as many as required)**

1	Headache	
2	High temperature/ fever	
3	Chills	
4	Vomiting	
5	Body pains	
6	Loss of energy	
7	Delirium	
8	Dizziness	
9	Loss of appetite	

11	Other specify	

10. Do you think you have enough information on malaria?

1	Yes	
2	No	
3	Don't know	

11. If no to question 14, what information would you like to get more about malaria?

(Tick as many as required)

1	Information on treatment	
2	Information on prevention	
3	Nature of the disease	
4	Signs and symptoms	
5	Information on control	
6	Any information	
7	Other (specify):	

12. Where would you like this information communicated to you? (Through what channels of communication) **(Tick as many as required)**

SECTION III: Knowledge and perception of malaria control programs

13. Have you heard of the government action (policy) on change in malaria prevention using long lasting, insecticide-treated bed nets (LLINs)?

1	Yes	
2	No	
3	Don't know	

14. If your answer to question 13 is **"Yes",** where did you get the information? **(Tick as many as required)**

1	Family member	
2	Posters/ pamphlets	
3	Friend	
4	Church	
5	Radio	
6	TV 10 Community meetings	
7	Newspapers	
8	Health facility	
9	Traditional healer	
11	Other (specify):	

15. What do you know about government policy on change prevention using long lasting, insecticide-treated bed nets (LLINs)?

16. Are you aware of the government action (policy) on home management of malaria for malaria prevention and treatment?

1	Yes	

2	No	
3	Uncertain	

17. If your answer to question 16 is **Yes** what do you know about government action?.....

18. From which source do you get most of your information on government action? **(Tick as many as required)**

1	Family member	
2	Posters/ pamphlets	
3	Friend	
4	Church	
5	Radio	
6	TV 10 Community meetings	
7	Newspapers	
8	Health facility	
9	Traditional healer	
11	Other (specify):	

19. Respondents' attitude towards LLINs and its utilization

Respondents' attitude towards LLINs and its utilization					
Items	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly desagree

LLIN use is similar as window/door net use					
LLIN doesn't make any difference in malaria control and prevention					
LLIN causes bad odors					
LLIN causes skin rashes					
LLIN causes heat					
LLIN causes sneezing and coughing					
LLIN causes hallucinations and bad dreams					
The substance in LLIN can kill under five children					
LLIN use can cause miscarriage among pregnant women					
LLIN can cause nausea during pregnancy					
LLIN cannot prevent and kill mosquitoes					
LLIN is not freely available					

LLIN is expensive					
Window nets/door nets are better than LLINs					
Bed net without insecticide is preferable					
Those who will have malaria will still have it, whether using LLIN or not					

SECTION IV: Ownership and Utilization of LLINs by respondents

20. Do you have insecticide-treated nets in your household? ……..

Yes	
No	

21. If your answer to question 20 is **NO** why?

22. If your answer to question 20 is **Yes** do you use the LLIN(s) in your household?

Yes	
No	

23. If no to question25, is because of the following: **(Tick as many as required)**

1	Makes environment hot	
2	Causes skin rashes/ itch	

3	Reduces ventilation /asphyxia	
4	Dry season	
5	No malaria outbreak	
6	Other (specify)	

24. Who slept under the mosquito nets last night in your household (the night before the survey)? **(Tick as many as required)**

Pregnant mothers	
Children under five years	
Children over five years	
Fathers	
Other(specify)	

25. Who is most likely to get a serious case of malaria?

OTE: Q28-30 ARE NOT ASKED, BUT SHOULD BE ANSWERED BY INTERVIEWER FOLLOWING OBSERVATIONS

26. Number of children under 5 years sleeping under treated net: ……

27. Number of pregnant women sleeping under treated net: ……..

28. Observation on the physical condition of the treated net:

Intact(not torn)	
Not intact (torn)	
Denied access to observe net	

29. Observation on the actual use of the treated net:

Displayed	
Not displayed	
Denied access to observe net	

30. Number of LLINs observed in house…..

31. How serious do you rate the malaria problem?

1	Very serious problem	
2	Serious problem	
3	Moderate problem	
4	Small problem	
5	Not a problem	

32. How many people do you know that are currently ill from malaria?

33. How many malaria cases occurred for each of the following age groups in your household during the past three months? **(Tick as many as required)**

1	Children younger than five years	
2	Children between the ages of 6 and 10 years	
3	Children between the ages of 11 and 15 years	
4	Children older than 16 years	
5	Pregnant women	
6	Adults	

34. Who should be protected the most against malaria? **(Tick as many as required)**

1	Children younger than five years	
2	Children between the ages of 6 and 10 years	
3	Children between the ages of 11 and 15 years	
4	Children of 16 years and older	
5	Pregnant women	
6	Adults	

35. Please provide a reason for your answer in question ……

36. Should a pregnant woman, who contracted malaria, be treated differently than other adults?

1	Yes	
2	No	
3	Uncertain	

37. If your answer to question 36 is **"Yes",** please indicate how you think a pregnant woman with malaria should be treated:

38. Respondents' attitudes towards malaria disease

Items	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I have enough money to spend on equipment to control malaria					
2. I have the time to consistently spray the home.					
3. I have the energy to spray the home so often.					
4. I have the equipment to spray the home.					
5. I can replace broken gauze screens for all the openings of my home.					
6. I can treat/drain any accumulation of water around the house.					
7. Restricting and checking availability of potential breeding habits should be conducted day by day.					

8. The equipment to spray homes is always available in my village.					
9. Mosquito bed nets and repellent are always available in my village.					
10. I feel it is a waste of time to attempt to combat malaria since people get it in any case.					
11. Sleeping in mosquito net doesn't give the guarantee of malaria prevention.					
12. You are one of the important people in preventing malaria transmission.					

SECTION V: PRACTICES REGARDING MALARIA COTROL

39. What do you do? If you or one of your family member present, some signs and symptoms of malaria. **(Tick as many as required)**

1	Cold application/unclothe	
2	Give treatment	
3	Give more drinks	
4	Transfer (**s/h**)to Health facility	
5	Use traditional medicines	
6	Transfer (**s/h)** to Pharmacy	
7	Other (specify):	

40. How soon after suspecting those signs and symptoms of malaria, would you give (s/h) treatment?

1	One day (within 24hours)	
2	2-3 days	
3	4-6 days	
4	7 days or more	

41. Do you think malaria can be prevented?

1	Yes	
2	No	
3	uncertain	

42. If yes to question 41, what are the personal protective measures against malaria? **(Tick as many as required)**

1	Use repellent lotion	
2	Use mosquito coils	
3	Use doom	
4	Use repellent sprays	
5	Burn cow dung/ leaves	
6	Use mosquito nets	
7	Close windows & doors	

8	Gauze wires in windows	
9	Other (specify):	
10	Do nothing	

43. What are the malaria preventive measures do you utilize? **(Tick as many as required)**

1	Avoid stagnant water in the yard	
2	Clinic	
3	Close windows	
4	Hygiene	
5	Proper disposal of tins	
6	Spraying	
7	Through continuous education	
8	Use bed nets	
9	Other (specify)	

44. What are the challenges do you face in your community in malaria control? **(Tick as many as required)**

1	Few equipments /Drugs	

2	Poverty	
3	Lack of time	
4	Low knowledge in domain	
5	Illiterate people	
6	Community accessibility	
7	No incentive	
8	Endemic region	
8	Other(specify):	

SECTION VI: Home management of malaria and the utilization of ACT

45. Have anyone in your household had malaria?

1	Yes	
2	No	

46. If **Yes** to question 45 what do you do when you or a member of your household contracted malaria? **(Tick as many as required)**

1	Went to the nearest health facility	
2	Bought drugs from the local shop	
3	Did not do anything	
4	Took other steps	

5	Others specify	

47. Have you ever heard of artemisinin-combination therapy (ACT)?

1	Yes	
2	No	

48. If Yes to question 47 have you or any member in your household ever used ACT for malaria treatment?

1	Yes	
2	No	
3	Cannot remember	

49. If Yes to question 48 who prescribed the ACT for you or any member in your household? **(Tick as many as required)**

1	Nurse	
2	Medical Doctor	
3	Relatives	
4	Self	
5	pharmacist	
6	Patent medicine seller	
7	Friends neighbor	
8	Other specify	

50. Did you consult a traditional healer before seeking medical help?

1	Yes	
2	No	

51. If **yes** to question 50, how many times have you consulted a traditional healer in the past six months for malaria?

52. What type of care did the traditional healer give you for malaria treatment?

53. How would you rate the effectiveness of the treatment provided by the traditional healer?

1	Very effective	
2	Effective	
3	Did help to some extent	
4	Had little effect	
5	Did not help at all	

54. Which medicines (both modern and traditional) do you commonly used for treating malaria?

55. What actions have you taken to inhibit mosquito breeding around the house? **(Tick as many as required)**

1	Drain any accumulation of water around the house.	
2	Clear bushes along water banks.	
3	Cut grass short along the house.	

4	Dispose of all containers likely to hold water	

56. How often have you taken the following actions to inhibit mosquito breeding around the house?

1	Every day	
2	At least once a week	
3	1-3 times a month	
4	Very seldom	
5	Have never done it	

57. How often do you take the following measures to control mosquito numbers?

Key: Every day = 1; At least once a week = 2 ;1 to 3 times a month = 3 ;Very seldom = 4 ;Never = 5

Items	Every day	At least once a week	1 to 3 times a month	Very seldom	Never
Spray the outside of the house					
Use mosquito coils					
Make use of traditional medicine (Leaves of certain plants)					
Dress the child with					

clothes that covers his/her arms and legs					
Apply mosquito repellent on the skin of your child					
Spray the inside of the house					
Make smoky fires at dusk to keep mosquitoes away					

58. Number of rooms in house observed

59. Number of sleeping rooms in house observed

60. Are the openings in your house covered with mosquito gauze?

1	Yes, all of the openings	
2	Only some of the openings	
3	None of the openings	

61. If **yes** to question 60, are the mosquito gauze screens intact? (Not torn or broken)

1	Yes, all of the screens	
2	Only some of the screens	
3	None of the screens	

62. Did you receive the mosquito-nets free of charge?

1	Yes	
2	No	

63. Please consider the following as a reason for using a mosquito-net: **(Tick as many as required)**

1	Prevent mosquitoes from biting	
2	For privacy	
3	To prevent bites from other insects	
4	Other reasons	
5	If "Other reasons", please specify	

64. How often do you treat the mosquito-net(s) in your house with insecticide?

1	Every 2 to 4 months	
2	Every 5 to 7 months	
3	Every 8 to 12 months	
4	Once a year	
5	Never	

64. How often do you use the mosquito-nets at night?.....

65. In your own opinion, where would you feel more convenient to go for the purchase of a treated net in your community? **(Tick as many as required)**

1	Government clinic	
2	Retail/Wholesale shop	
3	Private clinic	
4	Market vendors	
5	Pharmacy/chemist shop	
6	Other specify	

6. Awareness towards LLINs and its utilization

1.	LLIN use is similar as window/door net use
2.	LLIN doesn't make any difference in malaria control and prevention
3.	LLIN causes bad odors
4.	LLIN causes skin rashes
5.	LLIN causes heat
6.	LLIN causes sneezing and coughing
7.	LLIN causes hallucinations and bad dreams
8.	The substance in LLIN can kill under five children
9.	LLIN use can cause miscarriage among pregnant women
10.	LLIN can cause nausea during pregnancy
11.	LLIN cannot prevent and kill mosquitoes
12.	LLIN is not freely available

13.	LLIN is expensive
14.	Window nets/door nets are better than LLINs
15.	Bed net without insecticide is preferable
16.	Those who will have malaria will still have it, whether using LLIN or not

SECTION VII: HEALTH EDUCATION RECEIVED ON MALARIA

Have ever received a health education

67. When was the last time you received health education on malaria?

1	During the past month	
2	2-6 months ago	
3	7-12 months ago	
4	More than a year ago	
5	I cannot remember	
6	I have never received any health education	

68. How helpful was the health education you received?

1	Most helpful	
2	Helpful	

3	Somewhat helpful	
4	Not very helpful	
5	Not at all helpful	
6	I don't know	

69. Which of the following statements are appropriate to the health education you received? **(Tick as many as required)**

1	Malaria is a dangerous disease.	
2	How malaria could be prevented.	
3	The causes and symptoms of malaria.	
4	Children are more at risk of getting malaria	
5	How malaria is transmitted.	
6	How malaria is treated	
7	When you should seek medical help in suspected cases.	
8	How to know when the patient's condition is improving or deteriorating	
9	How to prevent mosquitoes from breeding.	

SECTION VIII: FACTORS PREVENTING THE IMPLEMENTATION OF PREVENTIVE MEASURES

70. Please indicates to which extent you agree or disagree with the following statements.

Key: Strongly agree = 1, Agree = 2, Neither agree nor disagree = 3, Disagree = 4, Strongly disagree = 5

Items	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. I have enough money to spend on equipment to control malaria					
2. I have the time to consistently spray the home.					
3. I have the energy to spray the home so often.					
4. I have the equipment to spray the home.					
5. I can replace broken gauze screens for all the openings of my home.					
6. I can treat/drain any accumulation of water around the house.					
7. The equipment to spray homes is always available in my village.					
8. Mosquito bed nets and repellent are always available in my village.					
9. I feel it is a waste of time to attempt to combat malaria					

since people get it in any case.					

We have concluded our interview which has took 45 minutes. Thank you very much for your hospitality and your valuable contribution.

UBWUMVIKANE BWA BURI MUNTU KU IBAZWA

Intangiriro

Amazina yange nitwa HABIMANA Amos,umunyeshuli mu kiciro cya kane cya kaminuza ya **Jomo Kenyattha University of Agriculture and Technology(JKUAT)** mu ishami ry'ubuzima rusange,nkaba ndigukorera ubushakashatsi ku, kubabyeyi batwite nabana bari munsi yimyaka itanu ku bwirinzi bwi ndwara ya malariya muri uyu murenge wa TUMBA Kubumenyi ,uburyo ndetse n'imikoreshereze yubwo buro mu kwirinda no kurwanya indwara ya malariya.

Impamvu y'ubu bushakashatsi:

Ubu bushakashatsi buzafasha porogamu ya malariya mu kumva neza amakuru akenewe bababyeyi batwite ndetse nabafite abana bato bari munsi yimyaka itanu mu rwego rwo kwirinda malariya no kuyivura.

Uko ubushakashatsi buzakorwa:

Niba wemeye impamvu y'ubu bushakashatsi ngiye kukubaza ibibazo bitandukanye ku ndwara ya malariya ,ibazwa rimara igihe cy'iminota 15.

INYUNGU UFITE MURI UBUBUSHAKASHATSI.

Nta nyungu ufite yahafi mukuboneka muri ububushakashatsi.Keretse ko bizafasha porogaramu ya malariya mu kongerera ababyeyi batwite nabafite abana bato ubumenyi n'ibindi byose nkenerwa mu kwirinda no kuvura indwara ya malariya.

Ubu mufite uburenganzira busesuye bwo kutaboneka cyangwa gusubiza mw'ububushakashatsi igihe mwumva mutanyuze nabwo ntazindi nkurikizi.Muramutse mwemeye kubazwa ibi bikurira bigenga amahame y'ubushakashatsi bizubahirizwa:

1.umushakashatsi ntazabwira undi muntu amakuru watanze

2.Izina ry'awe ntahantu ahariho hose rizigera rigaragara cyango ry'umvikane

Ukwisanzura n’ubunyangamugayo bwawe n’ingirakamaro mw’ubushakashatsi.usaba gusobanurirwa aho utumva neza

Waba wemera kuboneka mu ibazwa ry’ububushakashatsi?	Yego	Oya

Igihe igisubizo cyibaye Oya shimira hantuma ntumubaze ,ntacyo wandi k’urupapuro rwibibazo

Amazina y’ubazwa:…….

Amazina n’umukono by’umushakashatsi: HABIMANA Amos

Nimero yitumanaho y’umushakashatsi:0788650378/0728650378

Appendix II: Questionnaire in Ikinyarwanda

URUPAPURO RW'IBIBAZO RUGENEWE UMUGORE UTWITE

IGICE CYA MBERE : IBIBAZO KU IRANGAMIMERERE

2. Igihe cy'amavuko:

3. Irangamimerere

1	Ingaragu	
2	Ndubatse	
3	Ndapfakaye	
4	Natandukanye n'uwo twashakanye	

4. Ikiciro cy'amashuli ufite:

1	Abanza	
2	Ayisumbue	
3	Amakuru	

5. Ishami wize:

1	Ubuforomo	
2	Uburezi	
3	Imboneza mubano	
4	Ubuzima rusange	
5	Ibindi bivuge	

6. Ikiciro ukoramo

1	Gukorera abandi	
2	Kwikorera	
3	Ntakazi	

7. Mwaba mukorera amafaranga angahe ku munsi?

1	Ntayo	
2	500-1000Rwf	
3	1000-1500Rwf	
4	Hejuru 1501Rfw	

8. Uratwite?

1	Yego	
2	Oya	

9. Urumubyeyi cyangwa umurezi wabana bari munsi yimyaka itanu?

Icyitonderwa niba uteri umwe mubavuzwe ku 8 ni 9 turagushimiye umwanya wawe !

10. Niba kukibazo cya munani ari Yego inda igeze mugihembwe cyakangahe

1	Cya mbere	
2	cyakabiri	
3	cyagatatu	
4	cyakane	

IGICE CYA II: ubumenyi kugitera marariya nibimenyetso biyiranga

11.Niki gikwirakwiza malariya? Uburyo bwo gusubiza **(Hitamo ibisubizo bikwiye)**

1	Kurumwa numubu	
2	Gukoresha amazi yibizenga	
3	Mu ishyamba	
4	Umuntu kumuntu	
5	Ihindagurika ryibihe	
6	Inzu idasukuye	
7	Gukorana n'abavuzi bagihanga	
8	Kurya ibisheke	
9	Ibindi bivuge	

12. Utekereza ko marariya yica igihe itavuwe neza?

1	Yego	
2	Oya	
3	Ntabyo nzi	

13. Niki muribi bikurikira utekereza ko ari ibimenyetso simusiga cya marariya?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Headache	
2	High temperature/ fever	
3	Chills	
4	Vomiting	
5	Body pains	
6	Loss of energy	
7	Delirium	
8	Dizziness	
9	Loss of appetite	
11	Other specify	

14. Utekereza ko ufite amakuru ahagije kundwara ya marariya?

1	Yego	
2	Oya	
3	Simbizi	

15. Niba ataribyo kukibazo cya 14 niayahe makuru ukeneye byumwihariko kundwara ya marariya?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Amakuru kumiti	

2	Amakuru kubwirinzi	
3	Ubwoko bwindwara	
4	ibimenyetso	
5	Amakuru kukuyihashya	
6	ayariyose	
7	Ibindi bivuge	

16. nihe wifuza ko amakuru arebana ni ndwara yamarariya yajyaca kugirango akugereho!

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Mubanyamuryango	
2	Ibyapa	
3	inshuti	
4	urusengero	
5	Radiyo	
6	Televisiyo	
7	Ibinyamakuru byandika	
8	amavuriro	
9	Abavuzi gakondo	

11	Ahandi havuge	

Igice cya III: Ubumenyi nimyumvire kuri gahunda zo guhashya mararіya

17.waba warumvise amabwiriza mashya ya guverinoma kubirebana nikoreshwa ryinzitira mubu iteye umuti?

1	Yego	
2	Oya	
3	Simbizi	

18.Niba ari yego kukibazo cya 17 nihe wabyumive?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Mubanyamuryango	
2	Ibyapa	
3	inshuti	
4	urusengero	
5	Radiyo	
6	Televisiyo	
7	Ibinyamakuru byandika	
8	amavuriro	
9	Abavuzi gakondo	

11	Ahandi havuge	

9. Niki ubiziho?.....

20. uzi neza amahame ya guvernoma kuguhanga no guhashya marariya mu muryango

1	Yego	
2	Oya	
3	Simbizi	

21. niba ari yego kukibazo cya 20 ni ayahe mahame ya guverinoma waba uzi

22. Ayo mahame uyabona binyuze muwuhe muyoboro witumanaho?

1	Mubanyamuryango	
2	Ibyapa	
3	inshuti	
4	urusengero	
5	Radiyo	
6	Televisiyo	
7	Ibinyamakuru byandika	
8	amavuriro	

9	Abavuzi gakondo	
11	Ahandi havuge	

Igice cya IV: Imyumvire nikoreshwa ryinzitira mubu kubabazwa

23. ufite inzitira mubu murugo iwawe? ……..

1	Yego	
2	Oya	

24.Niba ari Oya kukibazo cya 23 kubera iki?

25. Niba ariYego kukibazo cya 23 urayikoresha?

1	Yego	
2	Oya	

26. Niba ariYego kukibazo cya 25 bya biterwa nizimpamvu zikurikira?

1	Ahantu hashyuha	
2	Uduheri kuruhu	
3	Igabanya umwuka duhumeka	
4	Igihe cyubushyuhe	
5	Ntacyorezo cya marariya	

6	Ibindi bibuge	

27. Ninde waraye munzitira mubu mwirijoro muri aba bakurikira:

Abagore batwite	
Abana munsi yimyaka itanu	
Abanabarengeje imyaka itanu	
abagabo	
Abandi bavuge	

28. Ninde ufite ibyago byisnhi mura bakurikira byo kuzahazwa nindwara ya marariya ?

Abagore batwite	
Abana munsi yimyaka itanu	
Abanabarengeje imyaka itanu	
abagabo	
Abandi bavuge	

Icyitonderwa : kuva kukibazo 28 kugeza 30 ntibizabazwa uhubwo biganirwaho hanarebwa uko ibintu byifashe

29. harebwa umubare wabana bari munsi yimyaka itanu barara munzitira mubu: ……

30. harebwa umure wabagore batwite byara muznitira mubu ……..

31. kugenzura ubuziranenge bwinzitira mubu:

Ntiyacitse	

yaracitse	
Ntibemeye kuyerekana	

32. Ubushishozi kwikoreshwa ryinzitira mubu:

Uko ikoreshwa	
Ntibirebye	
Ntaburenganzira bwo kubireba	

33. Ni ubuhe buremera uha icyorezo cya marararіya?

1	Nicyorezo giteye inkeke cyane	
2	nicyorezo	
3	Nikibazo	
4	Nakabazo gato	
5	sikibazo	

34. Ni abantu bangahe waba uzi ubu barwaye marariya?

35. muri aya mezi atatu ashize ni abantu bangahe uzi barwaye marariya muri ibi byiciro bikurikira?

1	Abana bari bari munsi yimyaka itanu	
2	Bana bari hagati yimyaka 6 ni 10	
3	Abna bari hagatyi yimwaka 11 na 15	
4	Abana bari hejuru yimyaka 16	
5	Abagore batwite	

6	abakuze	

36. Muri aba bakurikira ninde wakwitabwaho cyane mukumurinda mararriya

1	Abana bari bari munsi yimyaka itanu	
2	Bana bari hagati yimyaka 6 ni 10	
3	Abna bari hagatyi yimwaka 11 na 15	
4	Abana bari hejuru yimyaka 16	
5	Abagore batwite	
6	abakuze	

37. Gerageza unatange impamvu kukibazo cya 36:……

38. Byashoboka ko umugore utwite uvurwa marariya bitandukanye no kubandi?

1	Yego	
2	Oya	
3	Simbizi	

38. Niba igisubizo cyawe ari yego kukibazo cya38 garagaza uko avurwa

Igice cya V: ibikorwa birebana no kurwanya marariya

39. Niki ukora iyo mubo mumuryango agaragaje ibienyetso bya marariya

Key: Yes = 1 No = 2

1	Kumushyiraho ibikonje	

2	Kumuha imiti	
3	Kumuha ibyo kunnywa byinshi	
4	Kumujyana ku ivuriro	
5	Kumuha imiti gakondo	
6	Kumujyana kuri farumasi	
7	Ibindi bivuge	

40. Nimugihe kingana iki uha imiti uwagaragagaweho ibimanyetso bya malariya?

1	Mumasaha ma 24	
2	Hagati yiminsi 2 ni 3	
3	Hagati yiminsi 4ni 6	
4	Hejuru yiminsi 7	

41. Utekereza ko malariya yakwirindwa?

1	Yego	
2	Oya	
3	Simbizi	

42.Niba ari Yego ku kibazo cya 41 ni ubuhe bwirinzi wakoresha mu kurwanya malariya?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Uburyo bwo kwisiga amavuta	
2	Gukoresha inzitiramubu	
3	Gusenya indiri y'imibu	
4	Gutera umuti mu nzu	
5	Gutwika imyanda	
6	Gukinga amadirishya n'inzugi	
7	Gushyira utuyungiro mu madirishya	
8	Ibindi bivuge	
9	Ntacyo nkoro	

43. Nizihe ngamba ukoresha mukwirinda malariya?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Gusiba ibizenga by'amazi	
2	Kwivuza	
3	Gukinga amadirishya	
4	Kugira isuku	
5	Gushyira ibitabora ahabugenewe	
6	Gutera umuti munzu	
7	Gukomeza kwihugura kubirebana malariya	

8	Gukoresha inzitira	
9	Ibindi bivuge	

44. Nizihe mbogamizi waba uhura nazo mu kwirinda no kurwanya malariya ?

Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Ibikoresho n'imiti bike	
2	ubukene	
3	Kubura igihe	
4	Ubumenyi buke kuri malariya	
5	Kwita kubatazi gusoma no kwandika	
6	Kubageraho biragoye	
7	Agashimwe	
8	Agace kazahajwe n'indwara ya malariya	
9	Ibindi bivuge	

Igice cya VI: kuvura marariya murugo hifashijwe imitiyabugenewe

45.waba warigeze kugira umurwayi wamarariya murugo iwawe?

1	Yego	
2	Oya	

46.Niba ari yego kukibazo cya 45 niki ukora?
Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Kujya ku ivuriro rikwegereye	
2	Kugura imiti muri butike	
3	Ntacyo ukora	
4	Ukora ibindi	
5	Ibindi bivuge	

47. Waba warigeze kumva umuti witwa artemisini ihujwe?

1	Yego	
2	Oya	

48. Niba ari yego kucya 47 haruwo mumuryango wawukoresheje?

1	Yego	
2	Oya	
3	simbwibuka	

49. Niba ari yego ku cya 48 ninde wawumankdikiye muri aba bakurikira?

1	Umuforomo	
2	umuganga	
3	abavandimwe	
4	ubwange	
5	farumasiye	
6	Abacuruza imiti	
7	Inshuti duturanye	
8	Abandi bavuge	

50. Waba warigeze kujya kwivuza kumuganga gakondo?

1	Yego	
2	Oya	

51niba ari yego kukibazo cya 50 ninshuro zingahe wagiyeyo?

52. niyehe miti ivura marariya yaguhaye?

53. iyo miti yagufashije kukihe kigero muruburyo bukurikira?

1	Iravura cyane	
2	iravura	
3	Ntacyo yamariye	
4	Ifite ingaruka nke	

5	Ntacyo yamariye nagato	

54. Niyihe miti imenyerewe cyane nabavuzi gakondo mukuvura marariya?

55. niki ukora muguhangana nikwirakwira rya marariya?.....

1	Gukuraho ibizenga byamazi hafi yurugo	
2	Gutema ibihuru biri hafi yamariba yamazi	
3	Guconga urugo	
4	Kwikiza ibimene imyanda yose ifata amazi	

56. Nikangahe wibanda kuguhangana nikwirakira rya marariya ?

1	bumunsi	
2	Rimwe mu cyumweru	
3	Hagati ya 1 na 3 mukwezi	
4	Gake gashoboka	
5	ntanarimwe	

57. Nikangahe wita kukurwanya marariya ukoresheje ingamba zikurikira?

bumunsi =1,Rimwe mu cyumweru=2,Hagati ya 1 na 3 mukwezi=3 ,Gake gashoboka=4,Ntanarimwe=5

Ingingo	burimunsi	Rimwe mucyumweru	Hagati ya 1 na 3 mukwezi	Gake	ntibikorwa
Gutera umuti hanze yinzu					

Gukoresha inzitira mubu					
Gukoresha imiti gakondo					
Kwambika abana ibipfutse amaguru namaboko					
Gukoresha umuti bisgiga kuruhu					
Gutera umuti munzu					
Gutera imyotsi munzu					

58. Imiryango yamadirishya yawe ikingirijeho nutuyungiro?

1	Yego yose	
2	Imwe nimwe	
3	ntanumwe	

59. Niba ari yego kubazo cya 58 utwo tuyungiro ntago twacitse?

1	Yego twose nituzima	

2	Tumwe natumwe	
3	Twose twaracitse	

60. Waba warahawe inzitira mubu kubuntu?

1	Yego	
2	Oya	

61. Gerageza utange impamvu zogukoresha inzitiramubu murizi zikurikira: Uburyo bwo gusubiza : (Hitamo ibisubizo bikwiye)

1	Ituma umubu utakuruma	
2	Guhisha uburiri	
3	Irinda irumana ryudukoko	
4	Izindi mpamvu	
5	Ibindi bivuge	

62. Nikangahe ukarishya inzitiramubu yawe ukoresheje umuti?

1	Buri mezi 2 kugera kuri 4	
2	Buri mezi ari 5 kugera kuri 7	
3	Buri mezi ari 8 kugera kuri 12	
4	Rimwe mumwaka	
5	simbikora	

63. Mubwisanzure bwawe nihe wumva wagurira inzitira mubu muri aha hakurikira?

1	Amavuriri ya goverinoma	
2	abacuruzi	
3	Amavuriro yigenga	
4	Mu isoko	
5	Muri farumasi	
6	Ahandi havuge	

Igice cya VII: Inyigisho zubuzima kuri marariya

64. Niryari uheruka kubona amasomo kuri marariya?

1	Mukwezi gushize	
2	Hagati yamezi 2 na 6 ashize	
3	Hagati yamezi 7 na 12 ashize	
4	Hashize umwaka urenga	
5	sinibuka	
6	Ntanimwe nabonye	

65. Amasomo ku ndwara yamarariya wabonye yagufashishe kukihe kigero?

1	Yaramfashije cyane	

2	Yaramfashije	
3	Hato nahato	
4	Yamfashije gake	
5	Ntiyamfashije	
6	Simbizi	

66. Nibihe muribi bikurikira bihura neza namasomo wahawe kuri marariya?

Uburyo bwogusubiza: (Hitamo ibisubizo bikwiye)

++	Marariya nindwara mbi cyane.	
2	Nigute marariya yakwirindwa	
3	Igitera marariya nibimenyetso byayo	
4	Abana bafite ibyago byinshi byokwandura marariya	
5	Nigute marariya ya ndura	
6	Marariya ivurwa ite	
7	Niryari wareba wareba muganga igihe wumva ufite ibimenyetso bya marariya	
8	Gute wamenyako ubuzima bwumurwayi buri kuzahuka cyangwa buri mukaga	
9	Gute twarinda ikwirakwira byimibu itera marariya	

Igice cya VIII: impamvu zihungabanya ingamba zo kwirinda marariya

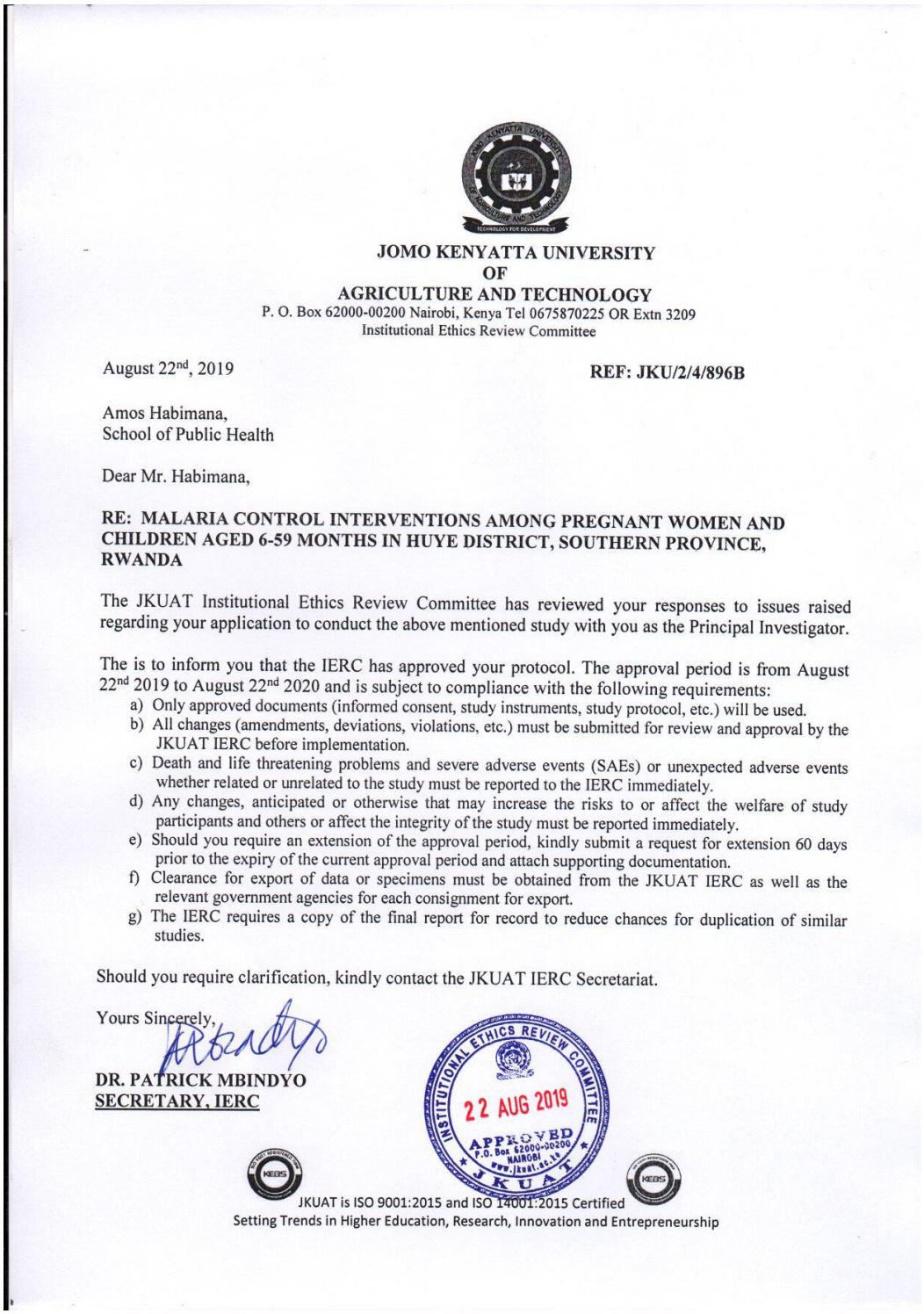
67. garagaza ubu waba wemera cyangwa utemera ibiri kuvugwa hasi

Uburyo bwo gusubiza: Key: nibyo cyane = 1, nibyo = 2, Ndifashe= 3, sibyo = 4, sibyo cyane = 5

Ingingo	Nibyo cyane	nibyo	ndifashe	sibyo	Sibyo cyane
1. mfite amafaranga ahagije yo kugura ibyo guhashya marariya					
2. mfite igihe cyo gutera umuti munzu					
3. mfite ingufu zo gutera umuti murugo					
4. mfite ibikoresho byo gutera umuti mu rugo					
5. mfite ubushobozi bwo guhindura utuyungiro twacitse mummadirishya					
6. shobora gusiba no gukurahaho ibizenga bya mazi hafi yurugo.					
7. ibikoresho byo gutera umuti birahari mugace ntuyemo					
8. inzitiramubu nimiti yo kwisiga kuruhu birabineka aho ntuye					
9. numva uruta uigihe mukurwanya marariya kuberako yandurira ahantu aharihohose					

Mbashimiyeko mwemeye kuboneka muri ubushakashatsi murakoze cyane!

Appendix III: JKUAT /BPS Ethical approval



JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
P. O. Box 62000-00200 Nairobi, Kenya Tel 0675870225 OR Extn 3209
Institutional Ethics Review Committee

August 22nd, 2019 **REF: JKU/2/4/896B**

Amos Habimana,
School of Public Health

Dear Mr. Habimana,

RE: MALARIA CONTROL INTERVENTIONS AMONG PREGNANT WOMEN AND CHILDREN AGED 6-59 MONTHS IN HUYE DISTRICT, SOUTHERN PROVINCE, RWANDA

The JKUAT Institutional Ethics Review Committee has reviewed your responses to issues raised regarding your application to conduct the above mentioned study with you as the Principal Investigator.

The is to inform you that the IERC has approved your protocol. The approval period is from August 22nd 2019 to August 22nd 2020 and is subject to compliance with the following requirements:

a) Only approved documents (informed consent, study instruments, study protocol, etc.) will be used.
b) All changes (amendments, deviations, violations, etc.) must be submitted for review and approval by the JKUAT IERC before implementation.
c) Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the IERC immediately.
d) Any changes, anticipated or otherwise that may increase the risks to or affect the welfare of study participants and others or affect the integrity of the study must be reported immediately.
e) Should you require an extension of the approval period, kindly submit a request for extension 60 days prior to the expiry of the current approval period and attach supporting documentation.
f) Clearance for export of data or specimens must be obtained from the JKUAT IERC as well as the relevant government agencies for each consignment for export.
g) The IERC requires a copy of the final report for record to reduce chances for duplication of similar studies.

Should you require clarification, kindly contact the JKUAT IERC Secretariat.

Yours Sincerely,

DR. PATRICK MBINDYO
SECRETARY, IERC

INSTITUTIONAL ETHICS REVIEW COMMITTEE
22 AUG 2019
APPROVED
P.O. Box 62000-00200 NAIROBI
www.jkuat.ac.ke
JKUAT

JKUAT is ISO 9001:2015 and ISO 14001:2015 Certified
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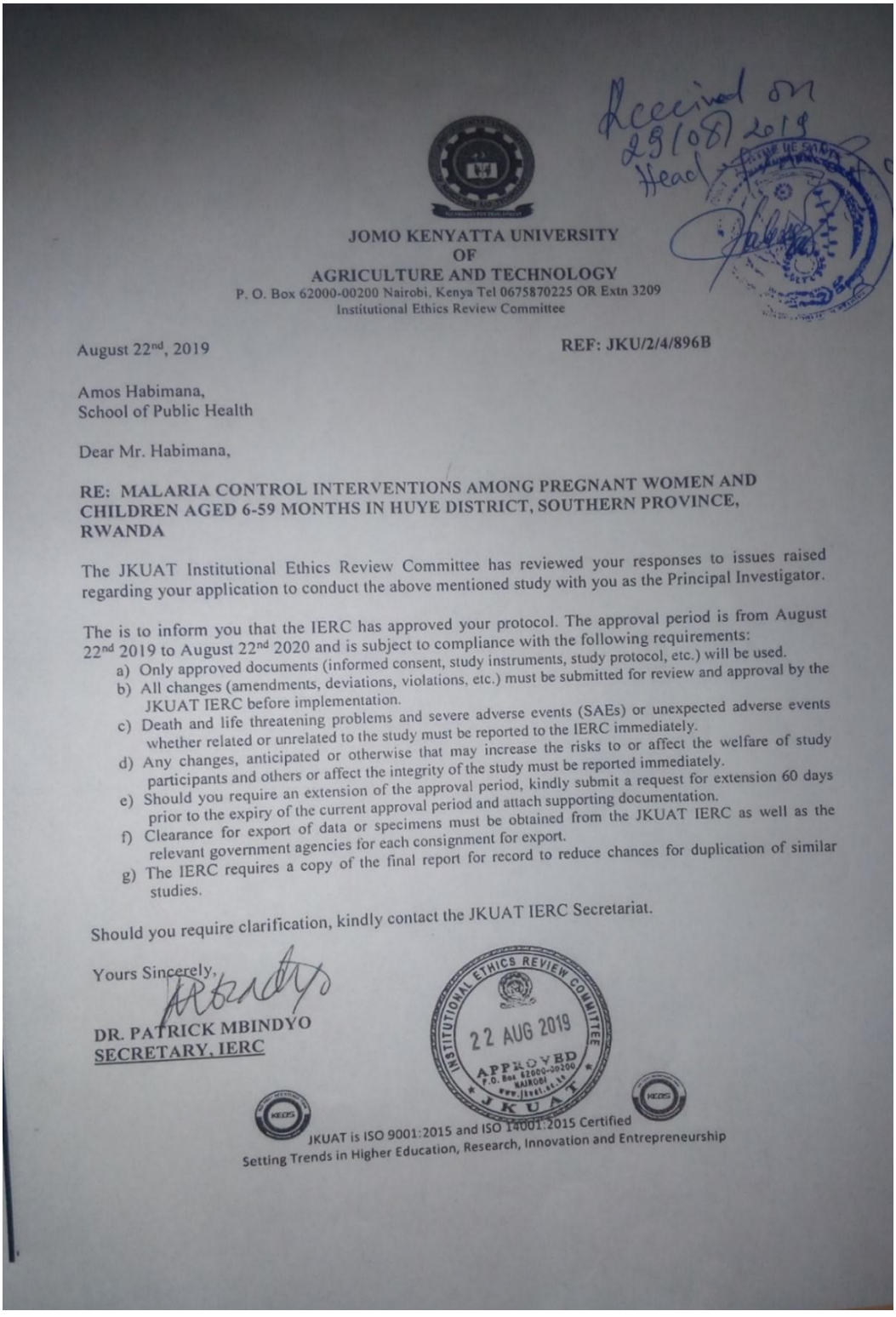
Appendix IV: Field data collection approval



JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY
P. O. Box 62000-00200 Nairobi, Kenya Tel 0675870225 OR Extn 3209
Institutional Ethics Review Committee

Received on 29/08/2019

August 22nd, 2019 REF: JKU/2/4/896B

Amos Habimana,
School of Public Health

Dear Mr. Habimana,

RE: MALARIA CONTROL INTERVENTIONS AMONG PREGNANT WOMEN AND CHILDREN AGED 6-59 MONTHS IN HUYE DISTRICT, SOUTHERN PROVINCE, RWANDA

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Appendix V: List of Publications

No	Year of Publication	Article tittle	Authors	Journal
1	2020	Assessing Knowledge and Factors Associated to Long Lasting Insecticide Nets use among pregnant women in southern Rwanda	**Amos Habimana,** Joseph Gikunju, Dennis Magu, Malachie Tuyizere	Rwanda Journal of Medicine and Health Sciences Vol.3 No.1, March 2020 **DOI:**//dx.doi.org/10.4314/rjmhs.v3i1.8
2	2020	Knowledge and preventive practices of malaria among pregnant women in Huye district Southern province, Rwanda	**Amos Habimana,** Joseph Gikunju, Dennis Magu,	International Journal of Community Medicine and Public Health **DOI:**http:dx.doi.org/10.18203/2394-6040.ijcmph20202450