RELATIONSHIP BETWEEN CURRICULUM BASED MALARIA KNOWLEDGE, ATTITUDE AND PRACTICES TOWARDS MALARIA PREVENTION AMONG SCHOOL CHILDREN: A STUDY OF ONE PUBLIC SCHOOL IN RWANDA

UMWANGANGE Marie Louise

COLLEGE OF MEDICINE AND HEALTH SCIENCES

SCHOOL OF NURSING AND MIDWIFERY

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DECLARATION

I do hereby declare that this ***dissertation*** submitted in partial fulfillment of the requirements for the degree of **MASTERS OF SCIENCE** in **NURSING**, at the University of Rwanda/College of Medicine and Health Sciences, is my original work and has not previously been submitted elsewhere. Also, I do declare that a complete list of references is provided indicating all the sources of information quoted or cited.

Date and Signature of the Student
11/06/2017

a. *Authority to Submit the dissertation*

Surname and First Name of the Supervisor: CHIRONDA Geldine, PhD

In my capacity as a Supervisor, I do hereby authorise the student to submit his/her **dissertation**.

Date and Signature of the Supervisor/Co-Supervisor
11/06/2017

DEDICATION

I dedicate this Dissertation to my husband Jean Bosco UWAMAHORO, to my children Gift MAHORO, Chris Regis MAHORO, Lis Raissa AMAHORO, to my parents, my sisters and brothers. You are the source of my achievement!

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ABSTRACT

Introduction: Malaria is among the top ten causes of morbidity and mortality in children in Rwanda. Despite the knowledge that school children got from school, the attitudes and health practice of school children towards malaria prevention are still questionable.

Aim: The study aimed at describing and examining the relationship between curriculum-based malaria knowledge, attitude and practices towards malaria prevention among school children in one public school in Rwanda.

Methods: Knowledge, attitude and practice and health belief models guided the study**.** A quantitative approach using a descriptive correlational study design was used. A stratified random sampling was used to obtain a sample of 160 school children aged 11-17 years studying in one public school. Data was collected using an instrument developed from in-depth literature in the form of a structured interview schedule with four sections namely the demographic data, level of knowledge, level of attitude and level of practice. Face to face interview was used to elicit information from the respondents. Descriptive statistics, the Pearson's correlation coefficient, linear regression and the Chi-square test as well as Fisher Exact test were used to analyse the data. SPSS version 21.0 was used in data analysis.

Results: Forty five (28.13%) have high knowledge, 108 (67.5%) and 7 (4.38%) have moderate and low knowledge respectively. Sixty four (40%) demonstrated positive attitude and 96 (60%) have negative attitude towards malaria prevention. One hundred and nineteen (74.38%) have good practice whilst 41 (25.63%) have poor practice towards malaria prevention. The study finds a significant weak positive correlation between knowledge and attitude ($r=0.162$, $p=0.041$), and between attitude and practice ($r=0.219$, $p=0.005$); and a weak negative non-significant correlation between knowledge and practices towards malaria prevention ($r=-0.010$, $p=0.898$). Knowledge contributes only 2.6% of increase in attitude ($R^2=0.026$). Furthermore, attitude had an impact of only 4.8% on practice ($R^2=0.048$).

Conclusion: The results predicted that as knowledge increases, attitude towards malaria also increases. Again, an increase in attitude predicted an increase in the level of practice towards malaria prevention among school children. Therefore, pediatric nurses should device and intensify individualized strategies to improve knowledge and correct attitudes, consequently good practice habits towards malaria among school children. Moreover, more contributory factors to poor attitude and practice habits should be identified.

Key words: knowledge, attitude, practice, malaria, school children

LIST OF ACRONYMS AND SYMBOLS

B: Beta

CDC: Center for Disease control and prevention

df: Degree of freedom

HBM: Health Belief Model

IRB: Institutional review Board

IRS: Indoor residual spraying

ITNs: Insecticide treated nets

F: Fisher test

JSI Research and Training Institute: John Snow Incorporated Research and Training Institute

KAP: Knowledge, attitude and Practice

MSP: Malaria Strategic Plan

N: Total number

NMCP: National malaria Control Program

OR: Odd Ratio

P: Probability value

Sign.: level of significance

SPSS: Statistical Package of Social Sciences

Std. Error: Standard Error

t: student test

X^2: Chi-squared

WHO: World Health Organization

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CHAPTER ONE: INTRODUCTION

1.1. INTRODUCTION

The World health organization (WHO, 2015, para.1) reported 214 millions of malaria cases with 88% counted in African countries and malaria deaths still high with estimated 438000 in 2015, which is mostly (90%) found in Africa, with 306000 in children aged less than 5 years old. In developed countries such as United Kingdom, malaria is imported by travellers from endemic countries and is considered as a disease of travellers with 1400 cases reported in 2015 (Public Health England, 2016).

Malaria was the fourth cause of child death in sub-Saharan Africa in 2015 and it remains the main killer of children which kills one child in every 2 minutes, whereas the prevalence of malaria in children aged between 2-10 years was 16% in 2015 (WHO, 2015, p. 12) with an estimated 6-9% of all malaria death in school children aged 5-14 years accounting for 70,000-110,000 malaria death per year globally (Murray *et al.*, 2012, p. 413).

School children are at risk of getting malaria; more than 500 million school children around the world are at risk of malaria infection and 200 million live in Sub Saharan Africa (Gething *et al.*, 2011, p. 378) where Rwanda is located. In Rwanda, Malaria is among the top ten causes of morbidity and mortality in children (Rwanda Ministry of Health, 2014, pp. 16–20). It is an endemic disease in Eastern province of Rwanda including Nyagatare, Bugesera, Gatsibo and Rwamagana district among others which occupy plain and prone regions (President's Malaria Initiative, 2015, p. 11).

The Rwanda Ministry of health (2014, pp. 67-68) reported that over 70% of malaria burden in Rwanda is found in Eastern and Southern province and malaria causes death of 496 people and 30% of them were children less than five years old. The prevalence of malaria in Eastern province of Rwanda was 22.8% among people who attended Ruhuha health centre and children who were in age-group 5-15 years have significant risk of getting malaria with 3 times greater odds compared to other population and older children had a higher risk of malaria parasite carriage compared to children less than 5 years old (Rulisa *et al.*, 2013, pp. 3–4). Gething and colleagues (2011, p. 378) further revealed the prevalence of asymptomatic malaria parasitemia in school-age children in Rwanda estimated between 5-19.9% with increased prevalence (20-39.9%) in high endemic area of Eastern region.

1.2. BACKGROUND OF THE STUDY

Malaria is a life-threatening parasitic disease caused by protozoa agent, genus "*Plasmodium"* transmitted to human through a bite of a female anopheles which is infected by Plasmodium (World Health Organization, 2016, para. 1). *Plasmodium falciparum* , the most severe and life-threatening species which kills approximately 1,000,000 people every year, is predominantly found in Africa (CDC, 2015, para. 2), and is the only species found in Rwanda in 2015 (WHO 2015, p. 153).

Malaria is a preventable and treatable disease when the appropriate interventions are well followed (World Health Organization, 2016, para. 1). The global efforts of preventing and controlling malaria were made by various international institutions such as United nations in the millennium development goal number 6 with achievement of reduction of 37% of global malaria incidence rate in 2015 and the sustainable development goal number 3 (United Nations, 2017) as well as Roll Back Malaria (2017) with the aim of malaria-free world by the year 2030.

In Rwanda, considerable efforts have been made to prevent malaria; this include health education to enhance population awareness of malaria cause, transmission, sign and symptoms, complications, treatment and preventive measures, distribution of insecticide treated nets (ITNs) and spraying insecticide in houses known as "indoor residual spraying (IRS)" and behaviour change communication for ITNs use compliance and IRS acceptance (President's Malaria Initiative, 2015, pp. 26–53).

Malaria control programs in Rwanda such as free distribution of long lasting insecticide net prioritize pregnant women and children less than five years (President's Malaria Initiative, 2015, p. 32), the same preferences were found in Malawi despite high malaria prevalence (60%) in school children (Mathanga *et al.*, 2015, p. 785). No special attention is addressed on school-age children as a group which needs particular protective measures against malaria, and this group is not routinely included in different surveys done in household, the reason why the prevalence of malaria in school-age children is not well defined, and the control measures are not addressed particularly to them (Brooker *et al.*, 2014, p. 321)

Rwanda established Malaria Strategic Plan (MSP) of achieving pre-elimination status with a test positivity rate less than five percent of all febrile illnesses and a near-zero malaria death by 2018 and the National malaria Control Program (NMCP) has among its objectives, the one of

achieving 95% of population with correct knowledge, behaviours and practice towards malaria prevention and control by 2018 (President's Malaria Initiative 2015).

Malaria information for behaviour change is delivered through drama on radio and television, health education by community health workers and other health professionals, distribution of printed materials such as leaflets and booklets; in addition school children get malaria information from the course content of their curriculum. A multi country content analysis of textbooks involving nine countries revealed that most of the textbooks highlight the mode of transmission (77.1%), methods of preventive (60%), epidemiology (57.1%) and cause of malaria (54.3%) and few of them have content on malaria signs and symptoms (37.1%) and treatment of malaria (22.9%); surprisingly, textbooks of only four countries (Laos, Cambodia, Ghana and Zambia) out of nine explain the importance of the use of insecticide treated bed nets in malaria prevention and 40% did not specifically mention the exact type of mosquito "anopheles mosquito" as the only type of mosquito which can transmit malaria whereas, only 11.4% present the danger signs of malaria like convulsions and unconsciousness (Nonaka *et al.*, 2012, pp. 1–2).

In Rwanda, malaria topic "avoiding malaria" is delivered in grade six, term three during the Social Studies course and is consisting of definition of malaria, the cause and mode of transmission, signs and symptoms, effect of malaria, treatment of malaria which is not specific and preventive measures (Kitooke and Oiko, 2010, pp. 139–140). The content is delivered in English the language used in public primary schools from grade four; and the relationship between knowledge gathered from this course and attitude and practice of school children regarding malaria prevention need to be determined.

1.3. PROBLEM STATEMENT

Malaria is responsible for nearly 25% of all child death in Sub-Saharan Africa; and severe falciparum malaria in children causes many complications including high fever, central nervous system problems like seizures and altered consciousness, respiratory distress, severe anemia, thrombocytopenia, hypoglycaemia, metabolic acidosis and hyperlactemia (Schumacher and Spinelli, 2012, p. 1). Furthermore, malaria is one of the most causes of school absenteeism (Brooker *et al.*, 2014, pp. 333–334; Nankabirwa *et al.*, 2014, p. 1298) as it accounts for 13-30% of the medical reasons of absenteeism from school; in addition, malaria affects the school

performance of children by reducing their test score; and this has been confirmed by numerous studies (Clarke *et al.*, 2013, p. 5; Nankabirwa *et al.*, 2013, p. 1102, 2014, p. 1298) which stated the consequences of malaria on cognitive function and capacity of school children. In Rwanda, Malaria cases increased dramatically from 934,484 cases in 2013 to 1,597,143 cases in 2014 as reported by Rwanda Ministry of Health (2014, p. 65) and the reported prevalence of malaria among school children was as high as 22.4% in Southern province (Sifft *et al.*, 2016) and 32.6% in Eastern province (Rulisa *et al.*, 2013).

In the neighbouring country, Tanzania, school children reported wrong causes of malaria including going to the toilet without shoes, touching malaria patient and eating dirty food and only 63% had knowledge on malaria transmission (Sumari *et al.*, 2016, p. 3) which showed a gap in malaria knowledge among school children. Mathanga and colleagues (2015, p. 779) found that only 32.4% of 2,667 school children in Malawi slept under a mosquito net the night before the survey, low use of Insecticide treated nets in school-aged children and adolescents has also been reported in Cameroon (Tchinda *et al.*, 2012, p. 114), Malawi (Hoshi *et al.*, 2013, p. 4), Nigeria (Garley *et al.*, 2013, p. 119) and recently in Liberia (Babalola *et al.*, 2016, p. 1), but no similar study has been conducted in Rwanda yet.

As school children are becoming self-determining on the use of preventive measures of malaria such as the use of mosquito nets when they are in bed; hence, they should have optimal knowledge on malaria to influence their practice towards malaria, this was confirmed by Brooker and colleagues (2014, p. 337) stipulating that as children become older, they become independent and their parents are less controlling them when they go to bed and whether they sleep under a net or not. Therefore, school-aged children and adolescents should be educated on malaria to increase the regular use of Insecticide treated nets (Tchinda *et al.*, 2012, p. 112; Brooker *et al.*, 2014, p. 337). In Rwanda, school children got malaria knowledge from the school through classroom curriculum content, despite the knowledge that they got from school, the attitudes and healthy practice of school children towards malaria prevention still questionable.

Studies (Ingabire *et al.*, 2014, p. 167; Asingizwe *et al.*, 2015, p. 53) have been conducted to assess knowledge and practices of the adult people towards malaria and no study has been done to assess knowledge, attitude and practice of malaria among school children in Rwanda. Moreover, previous studies have implicated distribution of malaria information as an important

correlate of knowledge, attitude and practice behaviours in other countries but no research has examined this concept in Rwandan school children. Again, previous studies showed the association between knowledge, attitude and practices towards malaria, but few studies show the direction and strength of that relationship. Therefore, the researcher sought to fill this gap by describing the level of curriculum-based malaria knowledge, attitude and practices towards malaria prevention among school children prior to examining the relationships between the three variables under study.

1.4. AIM OF THE STUDY

The aim of this study is to examine the relationship between curriculum-based malaria knowledge, attitude and practices towards malaria prevention among school children in one public school in Rwanda.

1.5. RESEARCH OBJECTIVES

The objectives of this study are:

1. To determine the level of knowledge towards malaria symptoms, transmission and prevention among school children in one public school in Rwanda.
2. To determine the level of attitude and health practices towards malaria prevention among school children in one public school in Rwanda.
3. To examine the relationship between curriculum-based malaria knowledge and attitude towards malaria prevention among school children in one public school in Rwanda.
4. To examine the relationship between curriculum-based malaria knowledge and health practices towards malaria prevention among school children in one public school in Rwanda.
5. To examine the relationship between attitude and health practices towards malaria prevention among school children in one public school in Rwanda.

1.6. RESEARCH QUESTIONS

The study findings answered the following research questions:

1. What is the level of knowledge towards malaria symptoms, transmission and prevention among school children in one public school in Rwanda?
2. What is the level of attitude and health practices towards malaria prevention among school children in one public school in Rwanda?

3. What is the relationship between curriculum-based malaria knowledge and attitude towards malaria prevention among school children in one public school in Rwanda?
4. What is the relationship between curriculum-based malaria knowledge and health practices towards malaria prevention among school children in one public school in Rwanda?
5. What is the relationship between attitude and health practices towards malaria prevention among school children in one public school in Rwanda?

1.7. SIGNIFICANCE OF THE STUDY

Significance to nursing practice

The study findings could show the need of the community i.e. school children towards malaria information. The level of knowledge, attitude and practice of malaria prevention among school children could enable the community health nursing to determine the need of this group and be able to establish a well designed health education tool appropriate for this age group.

Significance to nursing education

As education is research-based, this study could provide information of the community need as related to school health emphasis when organizing and implementing community nursing practice. The study could help in designing nursing curriculum based on evidence.

Significance to nursing research

The findings of this study provide information to other researchers in the same field and could provide recommendations for future area of research by establishing the means of generating hypothesis which should be tested in interventional studies. The results also add to the existing research based evidence about the topic in Rwanda.

Significance to nursing management

The findings of this study show the objective facts that there is a need for additional health education on malaria in school children that could influence their beliefs and behaviour change and could allow the nursing management committee to allocate human resources i.e. nurses and other resources to school health education program during community outreach of health centers.

1.8. CONCEPTUAL AND OPERATIONAL DEFINITION OF TERMS

1. Relationship: According to Oxford Dictionaries (2016), relationship is the way things are connected. In this study relationship means the association between two or more variables i.e. course-based malaria knowledge, attitude and practice.

2. Knowledge: The Cambridge Dictionaries online define knowledge as "the state of knowing about or being familiar with something" (Cambridge University Press 2016). In this study, knowledge is the level of understanding of school children towards malaria signs and symptoms, transmission and preventive measures.

3. Attitude: The Cambridge Dictionaries defines attitude as "a feeling or opinion about something or someone, or a way of behaving that is caused by this" (Cambridge University Press 2016). In this study, attitude means the intention of school children and their belief towards malaria prevention and treatment seeking in case of malaria.

4. Health practice: The Oxford Dictionaries defines Practice as the customary, habitual or expected procedure or way of doing of something (Oxford University Press, 2016). Health practice is good practice which has a positive impact on health of a person or community. In this study, the health practice means the use of malaria preventive measures and treatment seeking behaviour.

5. Knowledge, Attitude and Practice: A Knowledge, Attitude and Practices (KAP) survey is "a quantitative method (predefined questions formatted in standardized questionnaires) that provides access to quantitative and qualitative information". "KAP surveys reveal misconceptions or misunderstandings that may represent obstacles to the activities that we would like to implement, and potential barriers to behaviour change" (JSI Research and Training Institute, 2011).

6. **Baseline knowledge, attitude and practice:** Baseline means **"**information that is used as a starting point by which to compare other information" (Merriam-Webster's Learner's Dictionary, 2016). In this study, it is the knowledge, attitude and practice of school children after being exposed to malaria information.

7. Child: The United Nations convention on the rights of child (2010) defined a child as "every human being below age of eighteen years unless under the law applicable to the child, majority is attained earlier". In this study, a child is someone below age 18 years old.

8. School children: The dictionary.com (2016) defines schoolchild as "a child who attends school". In this study, school children refer to children attending either primary school or secondary school.

9. Malaria: The Center for disease control and prevention (2014, para. 1) defined malaria "a mosquito-borne disease caused by a parasite; intraerythrocytic protozoa of the genus Plasmodium (e.g., *P. falciparum, P. vivax, P. ovale,* and *P. malariae* among other species)". The World health organization (2016, para. 1) defines malaria as "a life-threatening disease caused by parasites (Plasmodium) that are transmitted to people through the bites of infected female *Anopheles* mosquitoes". In this study, the term malaria is used to mean the asymptomatic parasitemia for malaria and/or clinical malaria attack.

10. Information: The Dictionary.com (2016) defines information as knowledge gained through study, communication, research, instruction… In this study, information means malaria written content on printed leaflets, oral content of malaria health education given by health workers, media and specifically the information considered in this study is malaria information given to school children during classroom as part of the Primary school curriculum which is called "Curriculum-based malaria knowledge".

1.9. ORGANIZATION OF THE STUDY

This study is composed of five parts designed as chapters. The first chapter which has already been mentioned is highlighting the overview of the problem and its background, the aim, objectives and research questions. The significance of the study and the definition of the concepts used in the study are also discussed in chapter one. The following chapter is the literature review and discusses relevant theoretical and empirical literature done in relation to the study and identification of gaps in the literature as well as the theoretical frameworks which guide the study.

The chapter three describes the methodology which was used in the study; the design and setting of the study, the population and the sample are discussed in methodology chapter. It also discusses the data collection tool and procedure, data analysis and management and ethical consideration. The chapter four consists of the results and discussion and finally the chapter five discussing the conclusion and recommendations followed by reference and annexes.

CHAPTER TWO: LITERATURE REVIEW

2.1. INTRODUCTION

Literature review is the evaluation of previous studies or books written on a specific topic showing the brief collection of previous researches; it can be part of the research paper or be presented as a paper on its own showing similarities and difference in findings of studies done before across the globe and in a specific region, particularly, literature review helps in identification of the existing gap and therefore support in stating the research questions (Polit and Beck, 2010). This chapter discusses theoretical knowledge of malaria, numerous similar literatures done on knowledge, attitude and practice (KAP) towards malaria in Rwanda, Africa and around the World, and those showing the effect of health education on malaria KAP and their findings.

The Prevalence of malaria in children especially in school children and the consequences of malaria in school children are also discussed in this second chapter followed by the conceptual framework. The search engine which was used to obtain the literature include databases such as Pubmed, search in specific journal particularly malaria journal and other peer-reviewed journals, website of international health-related organizations such as World health organization, the center for disease control and prevention, report and guidelines of the Ministry of health. The key words used in searching are knowledge, attitude, practice, malaria, school children and the literature dated not later than 5 years back were mostly considered.

2.2. THEORETICAL LITERATURE

Malaria is defined by the Center for disease control and prevention (2014, para. 1) as " a mosquito-borne disease" which is caused by a parasite (protozoa) invading the erythrocytes of the human body. The causative agent of malaria is the Plasmodium and a many species of *Plasmodium* exist (100 species), however only five species can infect human being namely *Plasmodium falciparum* which is responsible for severe and fatal malaria, *Plasmodium vivax and Plasmodium ovale* which have dormant liver stage and can cause malaria relapse, *Plasmodium malariae* responsible for long-lasting chronic malaria infection and finally *Plasmodium knowlesi,* a recently found species responsible for zoonotic malaria in Southeast Asia (CDC, 2015, para. 4). Malaria is transmitted by a female anopheles mosquito infected by plasmodium which bites a person, the transmission via other routes such as transfusion of blood containing plasmodium is

extremely uncommon and rare and the transmission of malaria is mainly explained by its life cycle involving various stages such as mosquito stage with sporogonic cycle, human liver stage with extra-erythrocitic cycle and human blood stage with erythrocytic cycle (Herchline, 2015, sec. 1). The detailed life cycle of Plasmodium is illustrated below:

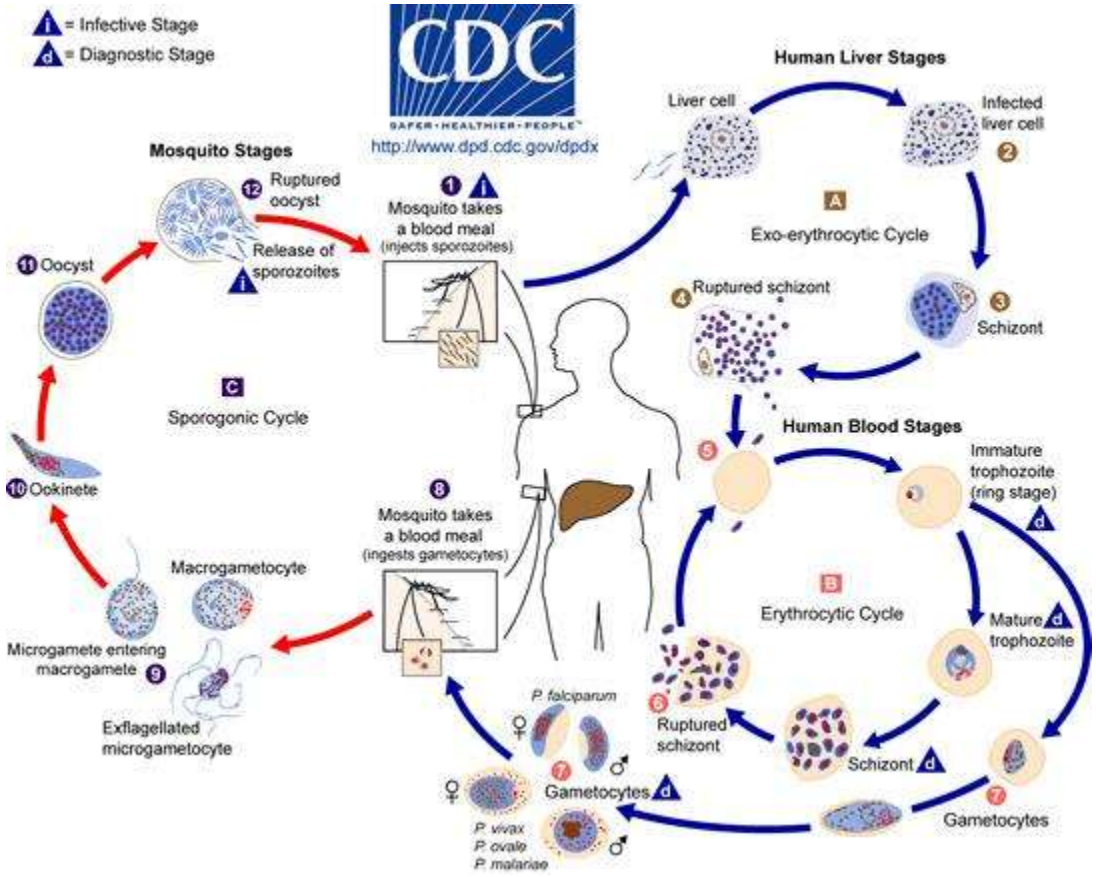

Figure 2.1 Malaria life cycle (CDC, 2015)

The signs and symptoms of malaria are similar to the manifestations of other diseases and are not specific; they include high body temperature (fever), headache, nausea and vomiting, muscle pain, feeling tired which can be found in other diseases like influenza showing the need for laboratory exams to detect malaria before treatment; besides the above signs and symptoms of simple malaria, the severe malaria (complicated malaria) which is usually caused by Plasmodium falciparum is manifested by neurological signs like confusion and coma (cerebral malaria), severe anemia which is due to erythrocytes lysis and respiratory problems (CDC, 2014, para. 2). Other clinical signs showing organ failure can be manifested in case of severe malaria and these include renal failure, generalized convulsions and coma, pulmonary edema and circulatory collapse; in this case, death may follow (WHO, 2016, para. 5). If diagnosed and treated early and

properly, plasmodium falciparum malaria has excellent prognosis, otherwise the poor prognosis with subsequent high mortality is associated with poorly treated and untreated falciparum malaria (Herchline, 2015, sec. 1).

Malaria is diagnosed using serological test such as rapid diagnostic test (RDT) detecting malaria antigen, the Polymerase chain reaction (PCR) is useful to detect specific species of plasmodium and the blood smear using microscopy is useful to detect plasmodium species and the percentage of red blood cells which is infected by plasmodium (CDC, 2014, para. 3). In Rwanda, malaria is even diagnosed by the community health workers using the rapid diagnostic test (RTD) to ensure early diagnosis of malaria in community especially in children who have fever.

The treatment of malaria uses different antimalarial drugs and various drugs have been used in Rwanda to treat malaria over the last decade including Quinine, Chloroquine, Sulfadoxine pyrimethamine known as Fansidar, Amodiaquine and recently Arthemisinin–based therapy has been introduced. The current treatment of simple malaria is based on Arthemisin combination therapy using Arthemeter+Lumefantrine known a Coartem and this is also available in community to be used by community health workers to treat children diagnosed with simple malaria and severe malaria is treated by Artesunate, which is an Artemisin derivative administered in parenteral route; if not available or in case of contraindication, Quinine is used in Dextrose 5% (Rwanda Ministry of Health, 2012). Plasmodium falciparum became resistant to Chloroquine in many countries and can be used to treat other species of plasmodium; and other combination of drugs such as Quinine+ Doxycycline is also effective (Herchline, 2015, sec. 5). Malaria can be prevented by education of the community about malaria, the use of insecticide treated net and in door residual spraying in addition to avoidance of breeding site of mosquitoes including drainage of stagnant water near the house, cutting bushes and cleaning the surrounding of the house (President's Malaria Initiative, 2015).

2.3. EMPIRICAL LITERATURE

2.3.1 Prevalence of Malaria in school children

School children have a high risk of getting malaria all over the world especially in sub-Saharan Africa (Gething *et al.*, 2011). Using a multivariate analysis, Dawaki and colleagues (2016) recently have found that being aged 12 years or older was significantly associated with malaria. Another current study (Pinchoff *et al.*, 2016) conducted in Zambia has revealed a high prevalence of malaria in children aged 5-17 years at a rate of 43% compared to children younger than 5 years (24%) and children aged 5-17 years had 8.83 higher odds compared with those aged 18 years and older.

In East Africa, The prevalence of the asymptomatic *Plasmodium falciparum* malaria parasitemia in school children in Rwanda as presented in World malaria map was between 5-19.9% with increased prevalence (20-39.9%) in high endemic area specifically in Eastern region of the country (Gething *et al.*, 2011). Similar findings have recently found in southern region of Rwanda with plasmodium infection in 22.4% of 1089 school children aged 6-10 years who were mostly asymptomatic (Sifft *et al.*, 2016). Furthermore, in Bugesera district of Eastern Rwanda (a malaria endemic area), the prevalence of malaria among children aged 6-15 years who attended health center was 32.6% (Rulisa *et al.*, 2013) and children in this age group had high risk of malaria parasitemia compared to children less than 5 years old (Rulisa *et al.*, 2013; Kateera *et al.*, 2015).

Similarly in Uganda, Nankabirwa and others (2013) found an estimated prevalence of 30% among school children aged 6-14 years old in high malaria transmission setting. Further findings in Kenya found the prevalence of 18%, 3%, 2% and less than 1% in school children aged 5-18 years old in high, moderate, seasonal and low transmission setting respectively (Gitonga *et al.*, 2012), and recently the prevalence of malaria in school children became high (48.7%) in Kenyan school children (Okoyo *et al.*, 2015) with age group 7-10 years was significantly associated with malaria infection ($p<0.001$). In Tanzania the prevalence was between 9-23% among school children in high malaria setting (West *et al.*, 2013)

In Central Africa, the prevalence of malaria in school children in high transmission setting was 42% in Equatorial Guinea (Rehman *et al.*, 2011), 34% in Cameroon (Kimbi *et al.*, 2013), and

16% in Democratic republic of Congo (Ibara-Okabande *et al.*, 2012). Different findings were found in West Africa with dramatic high prevalence of malaria in school children of high transmission setting: 83% in Mali (Clarke *et al.*, 2012), 66% in Ivory Cost (Assi *et al.*, 2013) and 54% in Senegal (Clarke *et al.*, 2012). In Nigeria the prevalence was 26% (Ojurongbe *et al.*, 2011) while the prevalence of 15% had been found in Ethiopia (Ashton *et al.*, 2011).

Current study done in Malawi (Mathanga *et al.*, 2015) revealed a high burden of Plasmodium falciparum malaria with a prevalence rate of 60% in a sample of 2,667 school children after screening of children with fever and this group was neglected by malaria control program where most interventions target children under 5 years old and pregnant women. No gender difference has been found in prevalence of malaria among girls and boys as reported by numerous authors (Midzi *et al.*, 2011; Mathanga *et al.*, 2015; Dawaki *et al.*, 2016), nevertheless, Kepha and others (2016) recently found high prevalence of Plasmodium falciparum among boys than girls. Using a multivariate analysis, Kepha and colleagues (2016) stated that being male was a risk factor for *Plasmodium falciparum* parasitemia while being a female was a risk factor for clinical malaria. Similar findings have been found in Rwanda (Kateera *et al.*, 2015) and in Kenya (Okoyo *et al.*, 2015) revealing that high malaria parasitemia was associated with male gender.

In their systematic review on malaria in school children in Africa, Nankabirwa and colleagues (2014) found that depending on the level of transmission and seasonality, the prevalence of malaria in school children varies within one country from one place to another; the prevalence rate also varies from country to country. Moreover, Nankabirwa and colleagues (2014) predicted that during the next years, malaria in school children will be increasing in incidence of its clinical attacks including severe malaria in school children who lived in previously highly endemic area; they added that there is a need to determine the best way to raise awareness of the importance of malaria in school-age children through operational research.

2.3.2 Consequences of malaria in school children

Severe falciparum malaria in children causes high fever, impaired consciousness, seizures, respiratory distress, severe anemia, thrombocytopenia, hypoglycaemia, metabolic acidosis and hyperlactemia and malaria is responsible for nearly 25% of all child death in Sub-Saharan Africa (Schumacher and Spinelli, 2012). Malaria is complicated in acute renal failure with a high

mortality rate; a study done in Democratic Republic of Congo (Aloni *et al.*, 2012, p. 514) highlighted that 25% of children who suffered from malaria with such renal complication died. Similarly, acute kidney injury was also found in Uganda as underrecognized complication of malaria in children aged 1-10 years and is associated with high mortality rate (Conroy *et al.*, 2016).

Malaria is one of the most causes of school absenteeism (Brooker *et al.*, 2014; Nankabirwa *et al.*, 2014) as it accounts for 13-30% of the medical reasons of absenteeism from school with greater impact in primary school children than in secondary school children (Nankabirwa *et al.*, 2014). Malaria affects the school performance of children by reducing their test score; this has been confirmed by numerous studies (Halliday *et al.*, 2012; Clarke *et al.*, 2013; Nankabirwa *et al.*, 2013, 2014) which stated the impact of malaria in cognitive function of school children. More specifically, Nankabirwa and others (2014) did a systematic review on malaria in school children in Africa and found that children who recovered from cerebral malaria may have cognitive impairment, speech and language problems and/or motor skills impairment which may be residual or persistent for at least 2 years. Persistent defect in language development has also been noted in children surviving cerebral malaria with confirmed retinopathy in Malawi (Boivin, Gladstone and Vokhiwa, 2011).

On the other hand, others studies (Clarke *et al.*, 2013; Nankabirwa *et al.*, 2013) found an association between asymptomatic malaria parasitaemia and decreased cognitive function and school performance. Another study done in Thailand in children aged 6-17 years who had an attack of uncomplicated malaria in two previous years found a reduction in children's score in mathematics and local language in relation to more malaria attacks in previous 2 years; nonetheless, no significant difference has been found compared to children without attack of uncomplicated malaria (Vorasan *et al.*, 2015). Therefore, Vorasan and others (2015) concluded that long-term effect of malaria on cognitive function of school children depends on severity of malaria.

In Mali, school children surviving malaria attack had problems in sustained attention (Clarke *et al.*, 2013), and in Uganda (Nankabirwa *et al.*, 2013), children aged between six and twelve years with asymptomatic parasitaemia had problems in reasoning and sustained attention. In recent study (Chen *et al.*, 2016), authors have suggested that the misnomer "asymptomatic malaria" should be replaced by " chronic malaria infection" as this is a debilitating condition associated

with impaired cognition and problems with schooling and it is the cause of chronic malaria. Previously, Lindblade and colleagues (2013) in their study " 'The silent threat': asymptomatic parasitemia and malaria transmission"they stated that when malaria is persistent in "its asymptomatic" nature, it is easily transmitted to others and negatively affect the attainment of malaria elimination.

2.3.3 Knowledge, attitude and practice of the community towards malaria

Community knowledge, attitude and practice on malaria in Tanzania revealed that 56% of respondents know the mode of transmission of malaria associating malaria with mosquito bite as the cause (Mazigo et al. 2010). In Uganda, the high percentage (89%) of study participants also recognized mosquito bite as a route of transmission of malaria; however, misconception of malaria transmission has been reported such as changing weather (cold), drinking non-boiled water and eating maize (Musoke et al. 2015).

Misconception of malaria cause and transmission has been reported in many studies (Abate et al. 2013; (Aderaw & Gedefaw 2013; Asingizwe et al. 2015; Chourasia et al. 2014; Ingabire et al. 2014; Mazigo et al. 2010; Mugao et al. 2014; Musoke et al. 2015; Regmi et al. 2016), some people still believe that malaria can be transmitted through being in contact with dirty object (Asingizwe et al. 2015; Chourasia et al. 2014), eating some food (Abate et al. 2013; (Aderaw & Gedefaw 2013; Chourasia et al. 2014; Ingabire et al. 2014; Musoke et al. 2015), drinking non-boiled water (Asingizwe et al. 2015; Musoke et al. 2015), being in cold weather (Abate et al. 2013; Aderaw & Gedefaw 2013; Musoke et al. 2015), hunger (Abate, Degarege and Berhanu, 2013; Aderaw and Gedefaw, 2013) and flies and respiratory route as ways of transmission of malaria (Abate, Degarege and Berhanu, 2013).

Sleeping with malaria patients and evil spirit were other misconception mentioned by the population (Aderaw and Gedefaw, 2013). In high endemic area of Rwanda, most adult people (90.7%) know that mosquito is the vector which transmit malaria and malaria is transmitted to humans by bites of mosquito infected with malaria (Asingizwe *et al.*, 2015), still, misconception about the cause of malaria and the mode of transmission exists among Rwandan population (Asingizwe *et al.*, 2015) (Ingabire *et al.*, 2014). In a study conducted by Habimana and others (2016), malaria knowledge was reasonably high among community health workers in Gicumbi district of Rwanda and 89.2% knew that the vector responsible for malaria transmission is

mosquito, 73.8% knew some signs and symptoms of malaria while all the participants (100%) reported to sleep under a mosquito net during night.

Abate and colleagues (2013) also found high knowledge about the cause, transmission and preventive methods of malaria among the community of Shewa Robit town of Ethiopia, but a considerable proportion who still had misconception on malaria cause and transmission with more than 20% stating other cause of malaria other than mosquito bite namely hunger, eating maize stalk, lack of personal hygiene, flies and body contact with malaria patient, similar misconceptions were found in another Ethiopian study (Aderaw and Gedefaw, 2013).
In terms of malaria prevention knowledge, Musoke and colleagues (2015) found low knowledge on malaria prevention methods (in 64.6% of study participants and among 376 participants (recognized only 1-3 malaria preventive measures among the 7 mentioned), none of them had high knowledge on malaria prevention methods.

Sleeping under a mosquito net is the most known method of malaria prevention by more than 93% of the population (Abate et al. 2013; Asingizwe et al. 2015; Musoke et al. 2015), followed by drainage of stagnant water: 84.2% (Abate, Degarege and Berhanu, 2013), 70.7% (Asingizwe *et al.*, 2015). Abate and colleagues (2013) found high percentage (78.9%) of community population who knew house spray with insecticide as a way of prevention of malaria which is not similar to other studies findings: only 28% mentioned house spray with insecticide as a method of prevention of malaria (Asingizwe *et al.*, 2015), only 5.3% accepted indoor residual spraying as malaria control and prevention method (Aderaw and Gedefaw, 2013). Other methods of prevention namely clear bushes and vegetation around the house are also known differently across studies: 71.3% (Asingizwe *et al.*, 2015), 45.8% (Abate, Degarege and Berhanu, 2013).
Misconception of malaria prevention using traditional healers has been found in Ethiopia with nearly 40% of study participants reporting eating garlic and green paper, drinking some juices, polishing the floor with ten jut and avoiding eating vegetables as the methods of prevention of malaria (Aderaw and Gedefaw, 2013)

Malaria knowledge was significantly associated with age, education and having heard a malaria message in the previous 12 months with a p-value < 0.01 (Musoke *et al.*, 2015). This was not the same as the study done in Rwanda (Asingizwe *et al.*, 2015, p. 56) which stated no association

between malaria practices and age (P value=0.7), but revealed an association of less education with poor malaria practices (p value=0.029).

The practice of malaria prevention among Tanzanian study population revealed that 64% of the participants slept under mosquito net the night before the survey (Mazigo *et al.*, 2010), which is far different from another study done in Uganda (Musoke *et al.*, 2015) where only 28.4% of the participants reported sleeping under mosquito net the night before the survey. However, another study conducted in Uganda (Mwanje, 2013) found 100% of the participants who reported to always use mosquito nets. Mazigo et al. (2010) further noted a gender difference on correct knowledge of malaria prevention (p value= 0.008) with 57.7% of female versus 30.9% of male reporting the use of insecticide treated nets, similarly to Garley and colleagues (2013) and Babalola and others (2016) who reported less usage of insecticide treated net in male compared to female.

Differently, Asingizwe and others (2015) stated no association between malaria practices and respondents' gender (p value=0.146) and by contrast, male gender was associated with good knowledge and practice in India (Naskar *et al.*, 2013, p. 43). In one Nigerian study conducted in Pregnant women, Ojong and colleagues (2013) found that pregnant women have good knowledge and practice of malaria prevention and further highlight a relationship between knowledge of malaria and practice of malaria prevention (r=0.62).

Regarding the knowledge of malaria signs and symptoms, most participants reported fever as a sign of malaria: 94.4% (Abate, Degarege and Berhanu, 2013), 93.3% (Asingizwe *et al.*, 2015). Aderaw & Gedefaw (2013) found different findings in community of Amahara National Regional state of Ethiopia stipulating that only 37.6% mentioned fever as a sign of malaria. Chills is also a well known symptom in one study done in Ethiopia (Abate, Degarege and Berhanu, 2013) reported by 93.3% of the Ethiopian urban community, which is far different from what Asingizwe and colleagues (2015) found in rural community of Rwanda that only 18.7% recognized chills as a symptom of malaria. In the other hand, in rural community of Eastern Rwanda, most of people (70.7%) recognized headache as a symptom of malaria, as opposite to 36.7% in Ethiopia (Aderaw and Gedefaw, 2013).

In one study done in Kenya showing the treatment seeking behaviour of the community in Tharatha Nithi county found 43% of people who preferred self medication as a way of treating malaria instead of hospital treatment and only 37.2% preferred hospital treatment (Mugao *et al.*, 2014). Furthermore, in Ethiopia, Aderaw & Gedefaw (2013) found that only 28.4% of febrile children were taken to modern health care for treatment the year before the study. In South Asia, Regmi and colleagues (2016) revealed that treatment seeking behaviour was found to be related to distance to health facility, cost of care, perception of health care among other factors.

Beyond Africa, a recent systematic review of malaria knowledge, attitude and beliefs about malaria among South Asia population was conducted and found lack of general knowledge, awareness of malaria, its transmission and control and preventative measures and misconception of malaria transmission still exist in South Asian population (Regmi, Kunwar and Ortega, 2016).

The relationship between knowledge, attitude and practice of the community towards malaria has also been determined. A study conducted in pregnant women in Nigeria (Atulomah, Farotimi and Atulomah, 2014) found a significant strong positive correlation between knowledge and attitude about malaria and its complication ($r=0.738$, $p<0001$). Another Nigerian study (Ojong *et al.*, 2013) conducted in pregnant women revealed a moderate positive correlation between malaria knowledge and practice ($r=0.62$). In other hand, a non-significant correlation between knowledge and practice of malaria was found in Zimbabwe (Chituku, 2013). The relationship between knowledge , attitude and practice regarding vector-borne diseases including malaria in Western Jamaica was determined by Alobuia and colleagues (2015, p.659) stipulating that knowledge and attitude scores were predictors of practice score; nevertheless knowledge score was not a predictor to practice score.

2.3.4 Knowledge, attitude and practice of school children towards Malaria

Children attending school have baseline knowledge of malaria that they got from the courses learned from the school. However, A multi country study on content analysis of textbooks used revealed that the content focused on mode of transmission, preventive measures, epidemiology and cause of malaria and left behind the signs and symptoms and treatment of malaria, and textbooks in 5 countries out of 9 countries failed to include the use of insecticide treated bed nets in recommended preventive measures (Nonaka *et al.,* 2012).In a study done in Nigeria (Eko

Jimmy, Osonwa Kalu and Offiong Dominic, 2013), a high percentage (85%) of school adolescents aged 11-20 years knew that malaria is caused by a mosquito bite, and malaria can be transmitted from one person to another through a mosquito bite.

Recently, Sumari and colleagues (2016) conducted a study in Tanzania using a quantitative-qualitative method and revealed that 63% of school children aged 6-14 years had knowledge on malaria transmission and most of the respondents recognized that female "anopheles" is the only mosquito that can transmit malaria. About 8% of school children did not understand the type of mosquito that transmit malaria and 5.6% had misconception about malaria transmission with some children believing that malaria is caused by eating dirty food, contact with malaria patients and going to the toilet without shoes (Sumari *et al.*, 2016). A study conducted in grade three school children aged 8-10 years in Zimbabwe, revealed a low knowledge of malaria cause, only 19.2% knew the cause of malaria and most of the children (75%) had no idea about malaria cause (Midzi *et al.*, 2011)

Misconception about malaria cause and transmission has also been found in school children in Ethiopia (Debela, 2014), in Cameroon (Makoge *et al.*, 2013) and in Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013). Some school children still believe that malaria can be caused by drinking dirty water (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013; Makoge *et al.*, 2013; Debela, 2014), others believe that eating dirty food can cause malaria and being in contact with malaria patient can also transmit malaria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013; Debela, 2014; Sumari *et al.*, 2016). Outside Africa, malaria misconception about the transmission of disease has also been noted in school adolescents in India revealing 32.8% of 1096 adolescents who believed that malaria is transmitted by houseflies and 57.7% who considered dirty water as the cause of malaria (Dambhare, Nimgade and Dudhe, 2012), likewise in Ethiopia, flies were mistaken by students to be involved in transmission of malaria (Debela, 2014). Furthermore, Dambhare and colleagues (2012) stipulated that there was a low knowledge of malaria transmission, treatment and prevention among adolescent with a mean age of 13 years old: in a sample of 1096 adolescents, only 8.6% were aware that anopheles mosquito bite is the cause of getting malaria and only 47.4% knew that malaria is a preventable disease, only 20.7% used mosquito net as preventive measure for malaria; and none of the respondents knew the insecticide treated bed nets as a new strategy to prevent malaria. Contrarily in Nigeria, 98.5% of school adolescents heard the information about the Insecticide treated net

from the health workers and 54.7% of them were still using the ITN at the time of the survey (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013) and in Kenya, 67.9% of school children slept under a long lasting treated net the night prior to the survey (Okoyo *et al.*, 2015)

The most known symptoms of malaria are fever and headache reported by more than a half of the respondents (Makoge *et al.*, 2013; Sumari *et al.*, 2016), different findings have been found in Ethiopia, whereby only around 30% of the participants reported fever as a symptom of malaria and the majority of them (75.7%) mentioning feeling cold as a symptom of malaria (Debela, 2014), and another study conducted in Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013)found that only 32% of school adolescents reported fever as a symptom of malaria while 26.3% reported yellow urine and 21.6% reported headache as the symptom of malaria.
Vomiting has been recognized as a symptom of malaria by 28% of the school children in Tanzania (Sumari *et al.*, 2016), the same findings has been reported in Ethiopia (Debela, 2014). In a study conducted in Cameroon (Makoge *et al.*, 2013), vomiting was reported by 37% of school children as a symptom of malaria.

Using mosquito net is the well known method of prevention of malaria mentioned by 92% of school children in Tanzania (Sumari *et al.*, 2016), 71% of students in Ethiopia (Debela, 2014) and 76% of school-going children in Cameroon (Makoge *et al.*, 2013). More specifically in Southern Nigeria, 41.9 % of school adolescents recognized that sleeping under insecticide treated bed nets (ITNs) is the strategy to prevent malaria and clearing bushes around the house was used by 14.5% of the adolescent at the time of the study (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013). Eko Jimmy and others (2013) further stated the attitude of school adolescents about malaria: 35% of school adolescents believed that malaria is a life-threatening condition that can kill somebody and 51.2% of the respondents strongly agreed that when they felt some symptoms of malaria, they should go to the nearest health facility for consultation and treatment instead of self-medication.
Mathanga and colleagues (2015) found that only 32.4% of 2,667 school children in Malawi slept under a mosquito net the night before the survey, and girls were more likely to use bed net compared to boys ($p=0.047$). Low use of Insecticide treated nets in school-aged children and adolescents compared to children less than 5 years (OR: 0.37) has also been reported in Cameroon (Tchinda *et al.*, 2012), Malawi (Hoshi *et al.*, 2013), Nigeria (Garley *et al.*, 2013) and recently in Liberia (Babalola *et al.*, 2016). Tchinda and others (2012) argued that older children

are usually sleeping in separate bedrooms from their parents which cause less usage of Insecticide treated net by this age- group, this is confirmed by Brooker and colleagues (2014) stipulating that as children become older, they become independent and their parents are less controlling them when they go to bed and whether they sleep under a net or not. Therefore, school-aged children and adolescents should be educated on malaria to increase the regular use of Insecticide treated nets (Tchinda *et al.*, 2012; Brooker *et al.*, 2014)

2.3.5 Effect of health education on malaria KAP in school children

Malaria information can be delivered by health workers, media as reported by Eko Jimmy and colleagues (2013) that health workers and media were the major source of malaria information and newspapers and magazines were also reported by 36.3% as the source of malaria information in Indian school going adolescent (Dambhare, Nimgade and Dudhe, 2012). In Zimbabwe, the school based health education including distribution of health education leaflets about malaria and other parasitic diseases in conjunction with other educational methods had an impact on increasing the knowledge of school children on malaria cause from 4.1% baseline knowledge to 55.8%, while the knowledge about malaria preventive measures increased from 19.2% at baseline to 66.3% after health education (Midzi *et al.*, 2014). Different findings have been found by Hoshi and others (2013) in a randomized trial done in Malawi revealing that no difference was found in the use of bed net among the intervention arm which received educational leaflets with mosquito picture (allowing indirect observation of mosquito) compared to control group, rather the difference has been noted in the arm which directly watched the mosquito compared to the control group.

In neighbouring country Uganda, the use of malaria information on posters, fliers and stickers as a behaviour change communication intervention increased the knowledge of school going children (aged 10-24 years) from 76.6% at baseline to 90% (Mugisa and Muzoora, 2012). Similarly, school-based education using picture charts and posters of malaria information increased significantly the knowledge of school children; specifically, children who knew that mango cannot cause malaria raised from 10.5% before health education to 79.8% after health education ($p < 0.001$) and other misconceptions about malaria cause and transmission had also been decreased namely heat and dirty water as the cause of malaria (Ayi *et al.*, 2010). In addition, Ayi and colleagues (2010) found that malaria health education reduced the prevalence of *Plasmodium falciparum* parasitemia in school children from 30.9% before to 10.3% after

health education, and school children used as health messengers had an impact on raising the community knowledge about malaria.

School-based health education also improved the knowledge of children about the transmission and prevention of malaria in Zimbabwe (Midzi *et al.*, 2014) and behaviour change communication messages increased the use of Insecticide treated nets among Zambian population including school children with 29% increase in Insecticide treated nets usage (Boulay, Lynch and Koenker, 2014), this was confirmed by Nankabirwa and others (2014) arguing that direct education of older children through malaria education in schools is the most effective way of increasing regular use of insecticide treated net nets in school children and the authors recommended that school aged children must recognize the nature of their illness for early diagnosis and effective treatment.

The interpersonal communication malaria campaign done by community health workers who provided information on malaria transmission and preventive measures including the use of mosquito net had an impact on the use of insecticide treated mosquito net in children aged 5-14 years from 37% before to 68% after the campaign (Keating *et al.*, 2012), and the campaign used house-to-house visit, community plays and printed leaflets and pictures showing how malaria is transmitted (Keating *et al.*, 2012).

2.4. CRITICAL REVIEW AND RESEARCH GAP IDENTIFICATION

After reviewing the literature on malaria, many studies showed the prevalence of malaria in its clinical forms or with asymptomatic parasitemia in school children across Africa and beyond. In addition, various literature were conducted in different countries in Africa and other continents assessing knowledge, attitude and practice of adult people towards malaria and few similar studies have been conducted in Rwanda. More specifically, some studies have been conducted in school children assessing their knowledge, attitude and practices towards malaria, including the one conducted in Tanzania, however, there is no study conducted in Rwanda assessing the knowledge, attitude and practice towards malaria among this specific group i.e. school children and few studies showed the strength and intensity of relationship between knowledge, attitude and practice towards malaria and no one has been conducted in school children in Rwanda.

The literature shows the effect of malaria health information on knowledge, attitude and practice of school children towards malaria and the content analysis of many textbooks used in school in nine countries has been conducted to analyze malaria content. Even though it is known that school children in Rwanda get malaria information in their "social studies" course, the relationship between course-based malaria knowledge and attitude and practice of school children towards malaria prevention is not known.

2.5. CONCEPTUAL FRAMEWORK

The conceptual framework is the abstract nature of the study that support it based on a specified conceptual model to show the intangible definition of the variables used in the study and allow the reader to know the study's structure and organization (Polit and Beck, 2010, p. 128). This conceptual framework discusses various concepts used in this study and illustrates the models used to demonstrate the relationship between variables i.e. course-based malaria knowledge, attitude and practice. This study will be guided by the two conceptual frameworks which are Knowledge, attitude and Practice (KAP) model (Ibrahim 1995) and Health belief model (Becker 1974).

2.5.1. Knowledge, attitude and practice (KAP) model

Knowledge influences attitude and then, attitude influences the practice of a certain action. Ibrahim (1995) identified knowledge, attitude and practice as "three pillars of excellence and wisdom" and noted that knowledge grows through public education. In KAP model, knowledge is "a set of understandings; attitude is a way of being, a position; and practice or behaviour is the observable actions of an individual in response to a stimulus" (Sybille 2011 in Dong 2015). Chien-yun and colleagues (2012) indicated how knowledge, attitude and practice are interrelated in general, stipulating that in the domain of education, attitude of the learners is directly affected by knowledge and concurrently, attitude is changed into practice or behaviour. This framework shows the influence of knowledge on attitude and practice as shown in the diagram below:

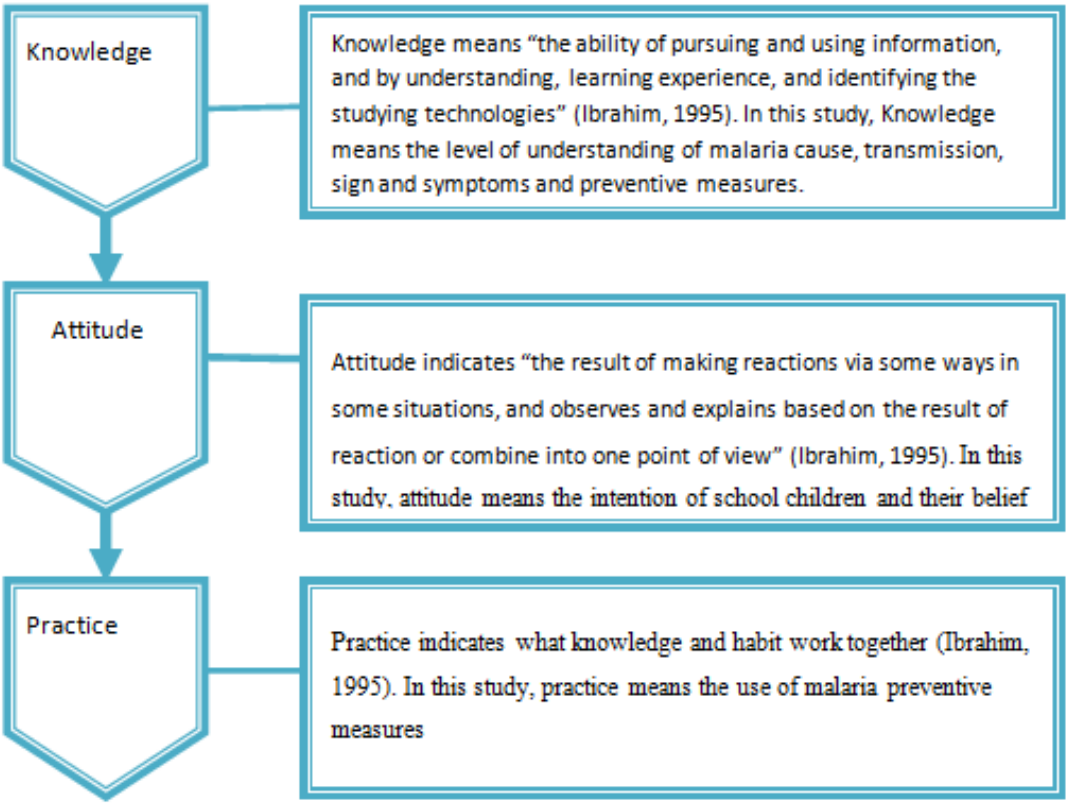

Figure 1 : 2.2 Framework showing the relationship and influence of knowledge, attitude and practice. Adapted from Dai et al. 2012

2.5.2. Health belief model (HBM)

HBM is the most commonly used theory in health education and health promotion and explains that health behaviour is determined by personal beliefs or perception about a disease and strategies available to decrease its occurrence (Becker, 1974). The main constructs of this model are perceived seriousness, perceived susceptibility, perceived benefit and perceived barriers which are modifiable variables, and the cues to action, motivating factors, and self-efficacy have been added to the previous constructs to expand the meaning of the model (Hayden, 2014).

The perceived seriousness concerns the individuals' beliefs about the seriousness or severity of a disease and it often depends on information or knowledge and the perceived susceptibility is the one of more powerful construct which provokes people to adopt healthier behaviours (Hayden, 2014); therefore, a health education based on health belief model is very important as individuals understand the severity of the disease and are able to change their behaviours.

The cues to action of health belief model are like mass media campaign, advice given by others, reminder post cards from a health care provider (Ali in Hayden 2014) or a health information in textbook which will be considered as a cue to action in this study **(Figure 2.3)**.

2.5.3 Research related to the conceptual framework

The use of KAP model

KAP model can be used to know much about a specific topic and it is usually used in health-related research subjects by establishing the baseline "knowledge, attitude and practice" taken as reference value which will be used in following researches and hence, it will help in measuring the effectiveness of the activities of health education in changing health behaviors (Sybille in Dong 2015). Moreover, some relevant studies found that knowledge will directly influence attitude and practice, similarly the attitude will have a direct impact on practice/ behavior or intentions (Chien-yun *et al.*, 2012).

In a study done in Rwanda on malaria elimination practices, Asingizwe and collaborators (2015) found that high knowledge of malaria was positively associated with malaria elimination practices (OR=1.82), another study done in India (Dambhare, Nimgade and Dudhe, 2012) stipulated that lack of knowledge of malaria cause and prevention was associated with poor practice of malaria preventive measures; this show the interrelationship between knowledge, attitude and practice.

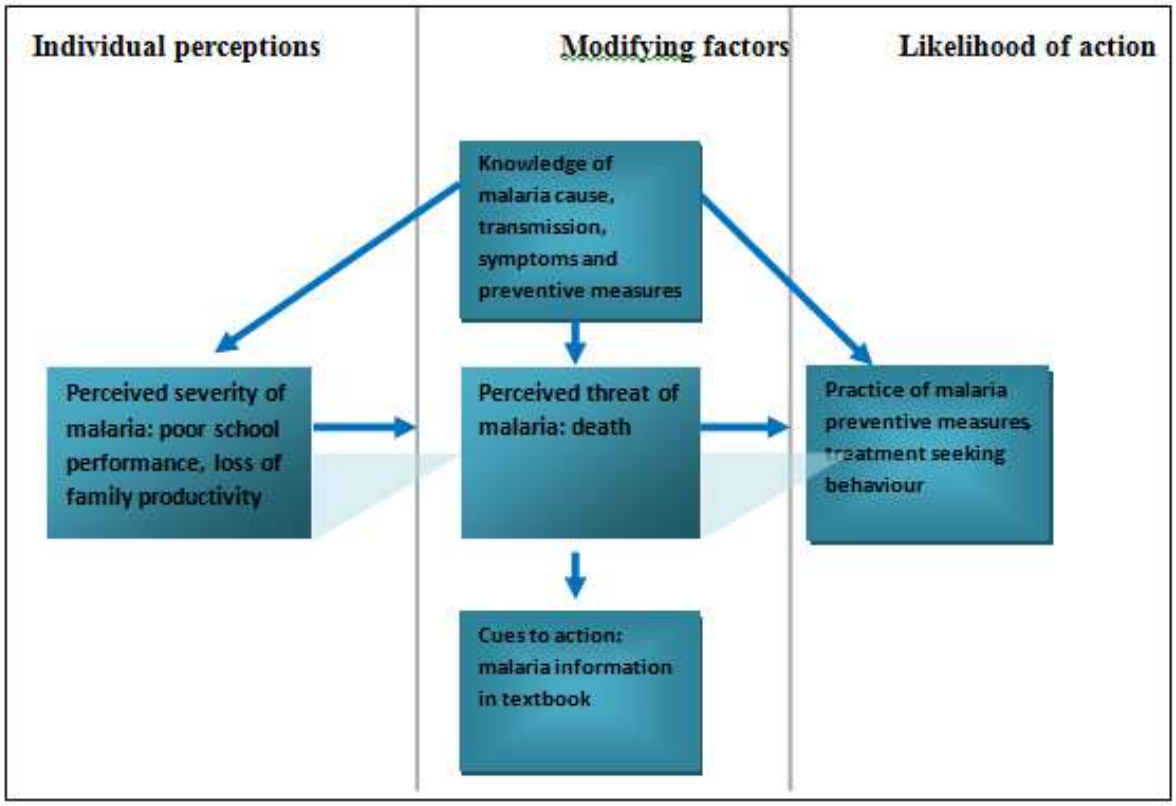

Figure 2 : 2.3 The Health Belief Model Framework. Adapted from Glanz, Rimer and Lewis (2002)

The use of Health belief model

Numerous current studies (Cao et al. 2014; Kim et al. 2012; Mulualem et al. 2016; Romano & Scott 2014) used health belief model in changing the behavior of people, including a systematic review (Jones, Smith and Llewellyn, 2014) assessing the effectiveness of health belief model interventions in improving adherence to health promoting advice. Cao and colleagues (2014) in their study called "health belief model based evaluation of school health education program for injury prevention among high school students in the community context" stated that health belief model improved the students awareness of the benefit of injury prevention action and students were aware of the consequences of injury and their susceptibility to those consequences after the study.

They further noted that the perceived benefit to take action and the perceived seriousness of injury were the most components of health belief model which have a strong impact of the students' belief, followed by the perceived susceptibility and cues to action and the health belief

score was significantly high after intervention ($p<0.001$) compared to the belief that students had before intervention (Cao, Chen and Wang, 2014). The health belief model also showed an effect in reduction of obesity and it should be used in preventive programs to ensure adherence of the community to the program and success of the preventive program (Romano and Scott, 2014)

Conclusion of the chapter

The chapter described various theoretical literatures about malaria and diverse studies conducted on prevalence and consequences of malaria, the studies on knowledge, attitude and practice towards malaria prevention among the adult community and among school children and finally the effect of malaria education on knowledge, attitude and practice of school children towards malaria. The prevalence of malaria among school children in various countries of East Africa and other African countries as well as beyond Africa was depicted. This chapter also highlighted the consequences of complicated malaria including the consequences of malaria on school performance. The conceptual frameworks guiding the study were also presented in this chapter as well as the researches related to those frameworks. The chapter also identified the research gap showing the lack of study conducted on knowledge, attitude and practice towards malaria among school children in Rwanda and few studies showed the degree of relationship between knowledge, attitude and practice towards malaria and no one has been conducted in school children in Rwanda.

CHAPTER THREE. METHODOLOGY

3.1. INTRODUCTION

The chapter three of this study talks about the methodology used in carrying out the study. Methods in research show which category of data were collected and the way of collecting those data and analyzing them, furthermore, methods state the study design and why it is chosen among other designs (Azevedoa *et al.*, 2011, p. 237; University of Southern California, 2016, para. 1). This chapter describes the study design, study area, the study population, the sample size used and the sampling strategies used to obtain the sample. It also discusses data collection procedure and tool used in data collection, data analysis, data management and dissemination and ethical consideration.

3.2. RESEARCH APPROACH

This study used a quantitative approach. A quantitative approach is the approach that is based on "post-positivism" paradigm examining different causes and their influences to the outcomes and the results of quantitative research approach are based on careful observation, correct measurement and interpretation of measured data (Sousa, Driessnack and Mendes, 2007, p. 503). In this study, malaria knowledge, attitude and practice were measured and their relationships were interpreted.

3.3. STUDY DESIGN

Study design shows the fundamental plans and strategies that are suitable to answer the research questions or to test hypotheses (Polit and Beck, 2010) This study used a descriptive correlational study design which is a type of non-experimental research which studies the interrelationship between two or more measured variables without much control of extraneous variables and without manipulating independent variable, thus it does not prove causation (Polit and Beck, 2010). The study determined and described the level of course-based malaria knowledge, attitude and practices towards malaria prevention among school children prior to examining the relationships between the three variables under study.

3.4. STUDY SETTING

Setting refers to location for conducting a research which maybe "natural, partially controlled or highly controlled" (Grove et al, 2013). The study was conducted in one Public school in

Rwamagana District, Muyumbu sector. Rwamagana District is located in Eastern Province of Rwanda, it has the area of 682 km^2 and altitude of 1556 m, 381,000 population; 53% aged 19 years and younger (Rwanda National institute of Statistics, 2012). Rwamagana is among the districts that are categorized by the Rwanda National Malaria Control Program as endemic for malaria (President's Malaria Initiative, 2015).

Figure 3 : 3.1 Map showing the study setting in Rwamagana District

3.5. STUDY POPULATION

Population is defined as "the entire aggregation of cases in which a researcher is interested in" (Polit and Beck, 2012). The study population consists of the entire population, target population and accessible population. The entire population for the study was all school children in Rwanda. Target population refers to groups of individuals who meet the sampling criteria and to which the study findings will be generalised (Grove et al, 2013). In this study, the target population was school children studying in grade seven in one public school at Muyumbu Sector of Rwamagana District.

The accessible population is "the population of people available for a particular study, often a non-random subset of the target population" (Polit & Beck, 2012). In this study, the accessible population is the school children studying and available in grade seven at one public school at Muyumbu sector of Rwamagana District at the time of the study.

3.6. SAMPLING

3.6.1. Sampling strategy

Sampling is "the process of selecting study subjects from the population to be included in the study sample and to represent the entire population" (Polit and Beck, 2010). Probability stratified random sampling was used to obtain the sample. Probability sampling uses random selection of elements so that each elements in the accessible population has an equal chance to be included in the sample and participate in the study (Polit and Beck, 2010). Disproportionate stratified sampling is the type of stratified sampling whereby the number of elements in the sample from one stratum is disproportional to the number of all elements present in the stratum or the size of the stratum (Oxford University Press, 2016, para. 1).

The total number of school children in grade seven was 220. Four strata: class A, B, C and D of grade seven were formed and a sampling frame of each stratum was developed so that children could be selected from the list randomly. Each stratum had 40 school children. The selected child was removed on the list by crossing the line over his/her name and the selection continued until appropriate sample size was reached. Randomly selected children with signed parental permission forms and assent forms were included in the sample. A total of 160 school children were sampled including 88 female and 72 male.

3.6.2. Sample size

According to Polit and Beck (2012), sample size is the number of people who participate in a study. The sample size for this study is 150 based on alpha of 0.05, power of 0.80 and effect size of 0.20 as shown in **figure 3.2**.Ten more subjects were added to cater for attrition to make a total sample of 160. A total of 160 school children including 88 female and 72 male formed the study sample. The level of significance used in this study is an index that the study findings are reliable as it shows that only 5 out of hundred, the results are unreliable. The results were correct 95 times out of hundred.

Effect size shows the magnitude of the relationships between two or more variables under study (Polit and Beck, 2012). The study used the medium effect size of 0.20 as the majority of nursing studies cannot expect effect sizes in excess of 0.20.

Power is the capacity of a design to detect differences or relationships that actually exists in the population (Burns and Grove, 1993). Power of 0.80 was used in this study and this is the minimum acceptable level of power for a study. The power results in 20% of a study failing to detect existing differences or relationships.

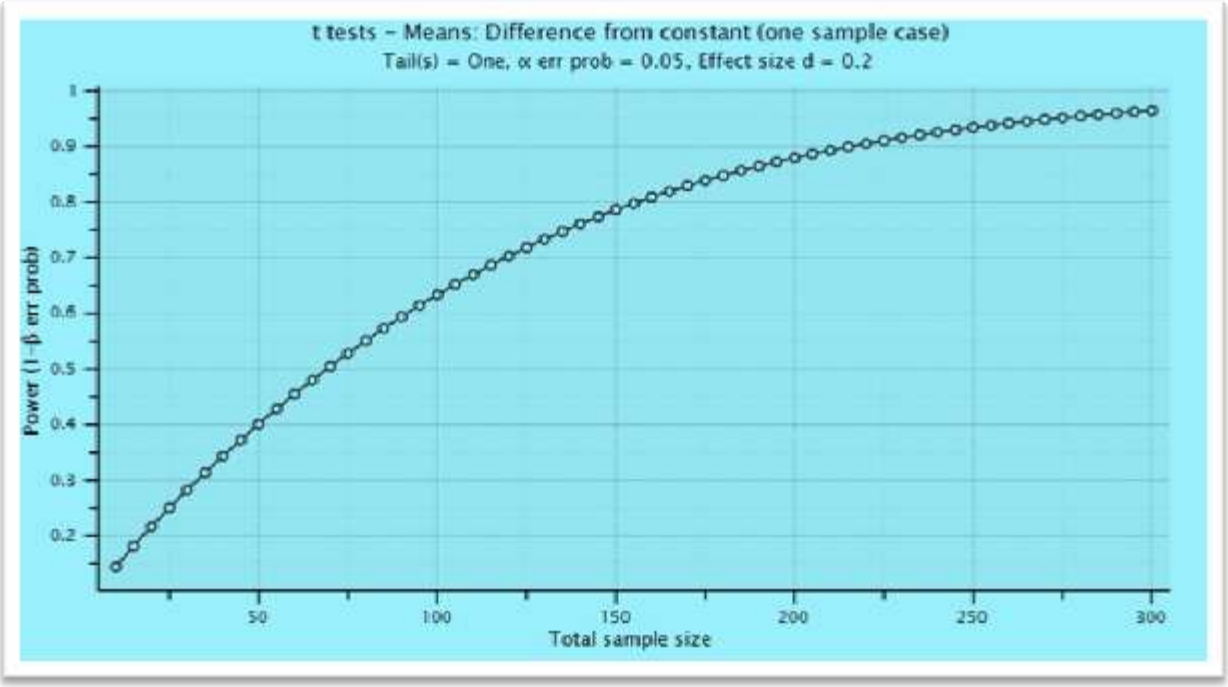

Figure 4 : 3.2 The graph showing the required sample size

3.7. INCLUSION AND EXCLUSION CRITERIA

3.7.1. Inclusion criteria

Children studying in grade seven (senior one) who attended the school during the time of data collection and who studied in grade six the previous year at the same school were included in the study. In this study, children studying in grade seven who have been taught malaria the previous year (in grade six) were assessed in order to measure the relationship between course-based malaria knowledge gained in the previous year of study (5 months ago) and their attitude and practice towards malaria prevention.

3.7.2. Exclusion criteria

Children studying in other grades other than grade seven were excluded in the study. Students of grade one, two, three, four, five and grade six were not included in the study as they are not yet studied malaria which is taught in grade six during the term three. School children studying in grade eight, nine and above grades did not participate in this study because this study will assess children who have been exposed to malaria content 5 months prior to the study. Students who did not get consent from their parents or guardians were excluded and those who were aged 18 years and more were excluded because there are not children.

3.8. DATA COLLECTION

3.8.1. Data collection instrument

The structured interview schedule was used to assess knowledge, attitude and practice of school children towards malaria prevention. The validated questionnaire by Atulomah, Farotimi and Atulomah (2014) was adapted with permission to assess Knowledge, attitude and practice of school children towards malaria **(Appendix 1)**. Various literature (Midzi et al., 2011; Sumari et al., 2016) done to assess knowledge, attitude and practice of school children towards malaria and the textbook for grade six social studies course (Kitooke and Oiko, 2010) were used to adapt the tool to school children.

Section A of the interview schedule was composed of socio-demographic information including age and gender, and source of malaria knowledge. The Section B of the tool was composed of questions to assess knowledge of school children towards malaria, cause, transmission, signs and symptoms, consequences and preventive measures. Questions to assess knowledge were answered in "Yes or No" format. The correct answer was 1 point and the wrong answer was 0. Maximum point of 25 (100%) was graded for knowledge assessment section. The score for knowledge was ranged as High knowledge: 90 -100%, moderate knowledge: 70- 89% and low knowledge: Below 70%.

The section C of the tool was composed of questions to assess the attitude of school children towards malaria, and questions were answered using the following key: Strongly agree, agree, disagree and strongly disagree. 3 point to the most appropriate attitude, 0 to the wrong attitude towards malaria prevention and treatment seeking behaviour.

Eight questions were in this format and a total of 24 (100%) maximum points were graded for attitude assessment section. The score for attitude was ranged as Positive attitude: 70 -100%, Negative attitude: Below 70%.

The section D of the tool was composed of questions to assess the practice of malaria prevention and treatment seeking behaviour in relation to symptoms of malaria. Eight questions asks how often school children use malaria prevention methods in previous three months and were answered using the following key: Very often (3), often (2), rarely (1) and Not at all (0), the reverse coding was applied for 2 of 8 statements: the right practice value 3 and the wrong practice value 0. Other three questions assessed the use of malaria prevention the previous day and were answered in "Yes or No" format. The assessment of whether they slept under insecticide treat net the previous night or closed the windows and doors at sunset the previous evening and wearing long protective clothes the previous evening was graded 2 point when the practice has been done or zero when they did not practice. A total of 30 (100%) maximum points was graded for practice assessment tool. The score for practice was ranged as Good practice: 70 - 100%, Poor practice: Below 70%. The tool was translated in Kinyarwanda and back translated into English to ensure the proper translation of the content.

3.8.2 Validity of the instrument

Validity is extent to which an instrument is measuring what is intended to measure (Polit and Beck, 2010). The validity of the research tool will be evaluated in terms of face, content and construct.

3.8.2.1 Face validity

The face validity measures the validity of a tool informally on its "face" by observation of the items (Polit and Beck, 2010). Two colleagues in paediatric area and one primary school teacher validate the face validity of this tool proving that questions are clear and do not cause ambiguity. Before conducting the study, the tool was pretested in 15 school children studying in grade seven at a nearby school at Muyumbu Sector to assess for clarity of words in the tools so that ambiguous words will be modified before collecting data; and this added value to the validity of the tool.

3.8.2.2 Content validity

The content validity measures carefully the construct of interest which is conceptually defined ensuring that relevant questions to assess the construct were asked. Because the tool was adapted from a validated questionnaire and questions from literature on knowledge, attitude and practice towards malaria in school children were used to adapt the tool, the content validity was ensured. The tool was also evaluated by experts in the area of community health related research as well as paediatrics.

3.8.2.3 Construct validity

The construct validity ensures that the tool is measuring the concept of interest (Polit and Beck, 2010; Creative commons, 2012). The tool was valid in its construct as the research questions were related to the conceptual framework and all the concepts i.e. knowledge, attitude and practice have been addressed in conceptual framework and in the tool **(Table 3.1).**

3.8.1.2 Reliability of the instrument

Reliability measures the consistency of a measuring tool. Reliability can measure the consistency of a tool over time or stability of a tool (test-retest reliability), it also measures consistency across different data collectors (inter-rater reliability) measuring the equivalence of the tool, and it also measures the consistency across items of the tool (internal consistency) and the internal consistency is the commonly used and it is measured using reliability coefficient analysis (Cronbach alpha) which should be between 0.65 and 0.80 to be acceptable; the more the coefficient, the more the tool is reliable (Polit and Beck, 2010; Creative commons, 2012). The instrument that was adapted and used in this study is reliable in its internal consistency (Cronbach alpha=0.74), and the modified instrument adapted to school children by adding and removing some items was also reliable in its internal consistency (Cronbach alpha=0.713) and SPSS version 21 was used to calculate the reliability coefficient of the new adapted instrument.

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Table 1: 3.1 Construct validity of the instrument

Objectives of the study	Components of the conceptual framework	Item in interview schedule
To determine the level of knowledge towards malaria symptoms, transmission and prevention among school children in one public school in Rwanda.	**KAP model:** Knowledge	Section B, all items
	HBM model: Modifying factors (knowledge of malaria cause, transmission, symptoms and preventive measures, cues to action: malaria information in textbook)	Section B, all items
To determine the level of attitude and health practices towards malaria prevention among school children in one public school in Rwanda.	**KAP model:** Attitude, practice	Section C, D all items
	HBM model: Perceived severity and perceived threat (death)	Section B, item 14, 17, 18, 19, 20, 21, 22 Section C, item 1, 4, 5, 6, Section D all items
To examine the relationship between course-based malaria knowledge and attitude towards malaria prevention among school children in one public school in Rwanda.	**KAP model:** Knowledge, attitude and practice	Section B, C, D , all items
	HBM model: Knowledge of malaria, perceived severity and threat and practice of malaria preventive measures	Section B, C, D , all items
To examine the relationship between course-based malaria knowledge and health practices towards malaria prevention among school children in one public school in Rwanda.	**KAP model:** Knowledge and practice	Section B, C, D , all items
	HBM model: Knowledge of malaria, perceived severity and threat and practice of malaria preventive measures	Section B, C, D , all items
To examine the relationship between attitude and health practices towards malaria prevention among school children in one public school in Rwanda.	**KAP model:** attitude and practice	Section B, C, D , all items
	HBM model: Knowledge of malaria, perceived severity and threat and practice of malaria preventive measures	Section B, C, D , all items

3.8.1.3 Variables

The independent variables

The independent variable is also called predictor or presumed cause. It is the variable which influence another variable (David and Sutton, 2004, p. 143; Polit and Beck, 2012, p. 65). In this study, the independent variables were course-based malaria knowledge, attitude. The attitude was used as independent variable when correlated to practice.

The outcome (dependent) variables

The outcome (dependent variable) is the also called presumed effect and is the variable which is influenced by the independent variable, therefore the variation in dependent variable is presumed to be caused by variation in independent variable (David and Sutton, 2004, p. 143; Polit and Beck, 2012). In this study, the dependent variables were: Attitude and practice of school children towards malaria prevention. The attitude was considered outcome variable when correlated to knowledge.

Control variables

The control variables are the variables that may influence the relationship between independent variable and dependent variable, the control variable may have direct influence on independent variable (David and Sutton, 2004, p. 143) . In this study, the control variables were other source of health information on malaria like media, malaria campaign, and health education sessions in health facility. Using homogenous sample and using random sampling helped to control such extraneous variables. Other variables which were considered are socio-demographic variables including age and sex.

3.8.2. Data collection Procedure

After obtaining the Institutional review board (IRB) approval, the researcher asked the school authority the appointment to contact children, then the school authority facilitated the sampling of school children by offering the list of all students studying in grade seven (Grade seven A, B, C and D). All students in grade seven where explained the purpose of the study and the sampling strategy used (random selection) to include some students in the study. After sampling, the children included in the sample were explained the purpose of the study and were given the letter

explaining the purpose and process of the study together with the consent form to be signed by the parents during parents meeting, so that their parents permit them to participate in the study. Then, after the parents sign the consent form for their children, the children also signed the assent form to voluntarily accept their participation in the study. Data were collected in February 2017 within 3 weeks and took almost 10 minutes to be completed for each child.

3.9. DATA ANALYSIS

Data were coded and entered in SPSS version 21.0 and double checked to remove errors. Analysis of data used first descriptive statistics in terms of frequencies and percentages which were presented in tables and graphs to describe the demographic variables, level of knowledge, level of attitude and level of practice towards malaria prevention among school children. Secondary, inferential statistics were used to analyze the relationship between variables: the Chi squared test and Fisher's Exact test were used to show the relationship between knowledge, attitude and practice and socio-demographic characteristics The correlation analysis was used in inferential analysis and the Pearson correction coefficient (r) showed the degree of relationship between knowledge, attitude and practice towards malaria prevention. The regression analysis was used when the correlation between variables was significant, and the coefficient of determination (R squared) determined how much contribution of independent variable (i.e. knowledge or attitude) to the dependent variables (i.e. attitude or practice). SPSS version 21.0 was used in data analysis.

3.10. DATA MANAGEMENT

Data were collected using paper and pen then coded and entered in a computer using SPSS version 21. Papers with the respondent's answers were transported by the researcher and kept protected in a locked room with respect to the confidentiality of collected data. After data analysis, data were stored in a computer locked with a personal password and the filled instrument used in data collection (interview schedule guide) were stored in a cupboard which is locked and will be kept there for five years, then will be destroyed.

3.11. DATA DISSEMINATION

The findings of this study will be communicated to the authority of the school and the participants, and will be presented in front of the panel during Dissertation oral presentation.

Additionally, the dissemination of the study findings will be done through oral presentation of an abstract in the conference and the submission of the full paper in a journal.

3.12. ETHICAL CONSIDERATIONS

3.12.1 Ethical review board approval

The study was approved by Institutional review board (IRB) of the College of Medicine and Health sciences, University of Rwanda **(Appendix 6)** after reviewing the research proposal and other applicable documents before starting the process of data collection.

3.12.2 Respect of participant right

3.12.2.1 Right to self-determination

The study participants were informed on the purpose of the study and voluntarily choose to participate in the study. As the autonomy of children is determined by their parents or guardians, the consent forms from their parents were signed before data collection and those whose parents did not sign the consent form were not blamed.

3.12.2.2 Right to privacy

During data collection using face to face interview, questions were asked with normal voice without shouting and school children were interviewed one by one without sharing individual answer.

3.12.2.3 Right to confidentiality and anonymity

The participant voluntarily participated in the study and no name of the participant appeared on the questionnaire and the participant's responses were kept confidential by privately keeping the questionnaires and storing the information from questionnaire in a password-protected computer. However, the participant's right to anonymity was partially violated because the researcher employed face-to-face interviews and the researcher filled the questionnaire according to participant's answer and help school children to understand the questions.

3.12.2.4 Right to fair treatment and justice

School children were fairly included in the study, they were randomly selected with respect to inclusion and exclusion criteria; and each child with inclusion criteria had equal chance to participate in the study.

All school children who participated in the study were asked the same questions. All school children in grade seven attended a health education on malaria after data collection period.

3.12.2.5 Right to protection from discomfort and harm

The study did not cause any harm to participants, and the answer to questions did not have any effect on classroom score of school children.

3.12.3 Parental (or guardian's) permission, assent and participant's authorization

After obtaining the permission from school authorities, a letter explaining the purpose of the study, study benefits and the procedure to be used in the study was given to parents together with the parental permission forms **(Appendix 2**) After the parent signed the consent form to allow the child to participate in the study, the school children signed the assent forms **(Appendix 3)** showing that they voluntarily accept to participate in the study.

Conclusion of the chapter

This study used a descriptive correlational design to determine the relationship between knowledge, attitude and practice towards malaria prevention in 160 school children, sampled using a stratified random sampling in one public school of Rwamagana district, Muyumbu sector. Using a pre-tested and validated interview schedule guide, data were collected using face-to-face interview. After data collection, data were coded and analyzed using SPSS version 21. Descriptive and inferential statistics were used including correlation and regression analysis, chi-squared and Fisher's Exact test. The study was approved by Institutional review board (IRB) of the college of Medicine and Health sciences of the University of Rwanda and the study was conducted with respect to participants' rights. The parents or guardian gave the permission to conduct the study and school children signed the assent forms to show that they voluntarily accept to participate in the study. Data management and data dissemination were also tackled in this chapter.

CHAPTER FOUR. RESULTS PRESENTATION

4.1. INTRODUCTION

This study was conducted at one public school in Muyumbu sector of Rwamagana District among 160 school children studying in grade 7 and descriptive correlational study design was used. The aim of this study was to examine the relationship between curriculum-based malaria knowledge, attitude and practices towards malaria prevention among school children in one public school in Rwanda. The objectives of this study were to determine the level of knowledge towards malaria symptoms, transmission and prevention among school children in one public school in Rwanda, to determine the level of attitude and health practices towards malaria prevention among school children in one public school in Rwanda, to examine the relationship between curriculum-based malaria knowledge and attitude towards malaria prevention among school children in one public school in Rwanda, to examine the relationship between attitude and health practices towards malaria prevention among school children in one public school in Rwanda, to examine the relationship between curriculum-based malaria knowledge, attitude and health practices towards malaria prevention among school children in one public school in Rwanda.

This chapter presents the findings which were obtained after data analysis. The results are presented in tables and graphs; frequencies and percentages are computed as well as statistical tests to show the relationship between variables. The results are presented in 8 subheadings including demographic characteristics of the participants, knowledge of school children towards malaria, attitude of school children towards malaria, practice of school children towards malaria, relationship between knowledge, attitude and practice of school children towards malaria and socio-demographic characteristics, relationship between knowledge and attitude about malaria, relationship between knowledge and practice about malaria, relationship between attitude and practice about malaria.

4.2 DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

The following bar chart in figure 4.1 summarizes the age of participants. The school children included in the study were 160 in total; 47 (29.38%) were 14 years old, 40 (25%), were 15 years old, 31 (19.38%) were 16 years old, 29 (18.13%) were 13 years old, 6 (3.75%) were 12 years old, 6 (3.75%) were 17 years old and only 1 (0.63%) was 11 years old. The minimum age of participants was 11 years and maximum age was 17 years. The mean age was 14.48 years ±1.239 Standard deviation with a variance of 1.534. The median and modal age were both 14 years.

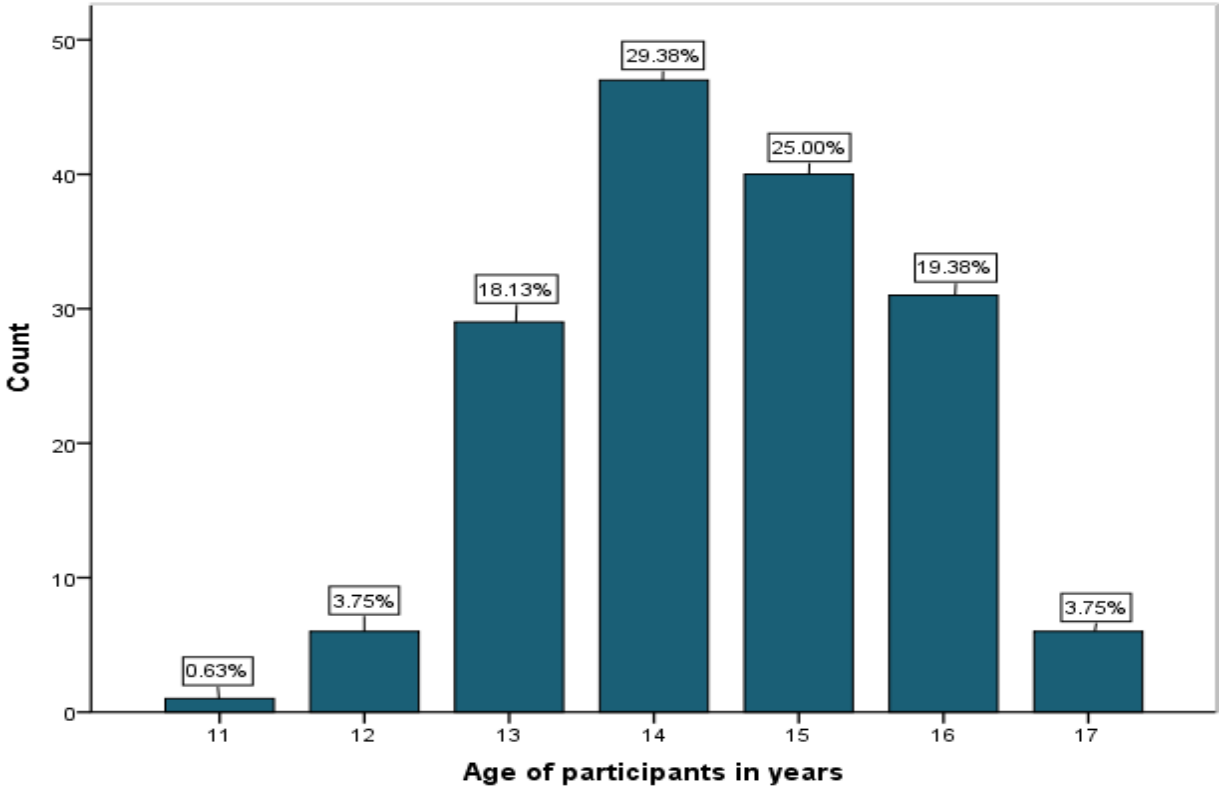

Figure 5 : 4.1. The frequency and percentage of age of participants (N= 160)

The Pie chart below shows the participants according to sex. Among 160 eligible school children, 88 (55%) were female and 72 (45%) were male.

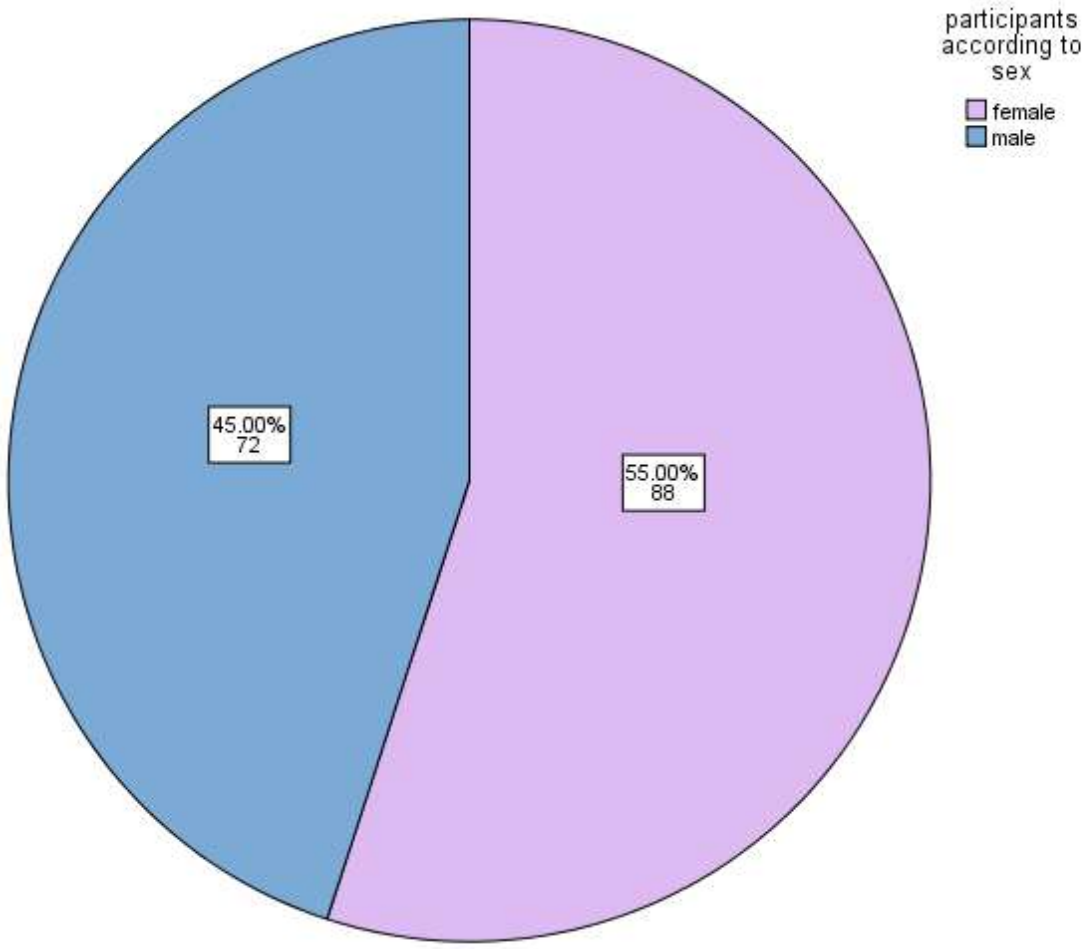

Figure 6 : 4.2. Frequency and percentage of the participant according to sex (N=160)

4.3. KNOWLEDGE OF SCHOOL CHILDREN ABOUT MALARIA

Knowledge of malaria was assessed on disease causes, transmission, symptoms and consequences and preventive measures. Table 4.1 reveals that among 160 school children, 86 (53.8%) responded that they retrieved malaria knowledge at school in class courses only, and the remaining 74 (46.3%) retrieved the knowledge at school in class courses and elsewhere; including information from media, community health workers, health facility and at home.

Almost all 159 (99.4%) school children know that malaria is a disease. Only 86 (53.8%) school children know that malaria is caused by plasmodium and 152 (95%) know that malaria is transmitted by the bites of mosquitoes. Less than a half 71 (44.4%) of school children know that only infected anopheles female mosquito bite can transmit malaria. Nearly a half 70 (43.8%) of school children know that malaria is caused by eating mangoes, while 50 (31.3%) affirm that malaria is caused by eating sugarcane. 20 (12.5%) and 16 (10%) of school children know that malaria is caused by eating maize and long stay under the sun respectively. All 160 (100%) school children know that stagnant water in gutters around the house transmit malaria and 98.8% know that bushes around the house transmit malaria. 19 (11.9%) affirms that malaria is more transmitted in places where refuse and wastes are properly disposed (Table 4.1)

Table 2 : 4.1. Knowledge of malaria, cause and transmission among school children (N=160)

Statements		Count	Percentage
Malaria is a disease	**No**	1	0.6%
	yes	159	99.4%
Malaria is caused by Plasmodium	**No**	74	46.3%
	yes	86	53.8%
Malaria is transmitted by the bites from mosquitoes	**No**	8	5.0%
	yes	152	95.0%
Only infected anopheles female mosquito bite can transmit malaria	**No**	89	55.6%
	yes	71	44.4%
Malaria is caused by long stay under the sun	**yes**	16	10.0%
	No	144	90.0%
Malaria is caused by eating sugarcane	**yes**	50	31.3%
	No	110	68.8%
Malaria is caused by eating maize	**yes**	20	12.5%
	No	140	87.5%
Malaria is caused by eating mangoes	**yes**	70	43.8%
	No	90	56.3%
Malaria transmission is more in places having stagnant water in gutters around the house	**No**	0	0.0%
	yes	160	100.0%
Malaria transmission is more in places having bushes around the house	**No**	2	1.3%
	yes	158	98.8%
Malaria transmission is more in places having properly disposed refuse and wastes	**yes**	19	11.9%
	No	141	88.1%

The table 4.2 continues to reveal knowledge of malaria with regards to disease causes, transmission. The results shows that only 72 (45%) school children have no misconception of malaria cause; the remaining have different misconceptions; some have single misconception; others have two and/or more misconceptions. 25 (15.6%) school children have a single misconception that malaria is caused by eating mangoes, and other 22 (13.8%) have two misconceptions including eating sugarcane and eating mangoes, 9 (5.6%) has a single misconception that malaria is caused by eating sugarcane. 6 (3.8%) have many misconceptions of causes of malaria including long stay under the sun, eating sugarcane, eating maize and eating mangoes and 6 (3.8%) affirms that malaria is caused by eating sugarcane, eating maize and eating mangoes. Other 5 (3.1%) affirms that eating maize and eating mangoes cause malaria.

Table 4.2. Misconception of school children about malaria cause (N=160)

Statements	Count	Percentage
Malaria is caused by long stay under the sun	4	2.5%
Malaria is caused by eating sugarcane	9	5.6%
Malaria is caused by eating maize	1	0.6%
Malaria is caused by eating mangoes	25	15.6%
Malaria is caused by long stay under the sun and eating mango	3	1.9%
Malaria is caused by eating sugarcane and eating maize	3	1.9%
Malaria is caused by eating sugarcane and eating mangoes	22	13.8%
Malaria is caused by eating maize and eating mangoes	5	3.1%
Malaria is caused by long stay under the sun, eating sugarcane and eating maize	1	0.6%
Malaria is caused by long stay under the sun, eating sugarcane and eating mangoes	3	1.9%
Malaria is caused by eating sugarcane, eating maize and eating mangoes	6	3.8%
Malaria is caused by long stay under the sun, eating sugarcane, eating maize and eating mangoes	6	3.8%
no misconception	72	45.0%

The knowledge of school children towards malaria signs and symptoms and consequences are presented in Table 4.3. Among 160 school children, 148 (92.5%) know that fever is an important symptom of malaria, 142 (88.8%) know that malaria reduces appetite and 156 (97.5%) know that malaria causes vomiting. 140 (87.5%) know that untreated malaria can cause death, 81.3% know that malaria can decrease the productivity of the family. 157 (98.1%) of school children know that malaria cause school absenteeism and 155 (96.9%) affirm that malaria reduces school performance. 144 (90%) know that malaria can be complicated to cerebral form and131 (81.9%) know that malaria kills children easily. 20 (12.5%) school children do not know that untreated malaria can cause death and 29 (18.1%) do not know that malaria kills children easily (Table 4.3).

Table 3 : 4.3. Knowledge of signs and symptoms and consequences of malaria (N=160)

Statements		Count	Percentage
Malaria causes fever as an important symptom	**No**	12	7.5%
	yes	148	92.5%
Untreated Malaria can cause death	**No**	20	12.5%
	yes	140	87.5%
The appetite of someone with malaria is usually poor.	**No**	18	11.3%
	yes	142	88.8%
Someone suffering from malaria can vomit	**No**	4	2.5%
	yes	156	97.5%
Malaria can decrease the productivity of the family	**No**	30	18.8%
	yes	130	81.3%
When the school child gets malaria, he/she is absent from school	**No**	3	1.9%
	yes	157	98.1%
The school child will perform well at school when he/she got malaria	**yes**	5	3.1%
	No	155	96.9%
Malaria can reduce the school performance of the school child	**No**	6	3.8%
	yes	154	96.3%
There may be serious complications including cerebral form of malaria	**No**	16	10.0%
	yes	144	90.0%
Malaria kills children easily	**No**	29	18.1%
	yes	131	81.9%

Table 4.4 shows the knowledge of school children towards malaria prevention methods: almost all school children 159 (99.4%) know that sleeping under bed nets protects one from mosquito bites, 148 (92.5% know that indoor residual spraying of insecticide can protects one from mosquito bites and 149 (93.1%) know that closing windows and doors at sunset is the way of prevention of malaria. Nearly a half of school children 79 (49.4%) affirm that covering with blankets when one is sleeping protect him/her from mosquito bite and help to prevent malaria.

Table 4 : 4.4. Knowledge of malaria prevention methods among school children (N=160)

Statements		**Count**	**Percentage**
Sleeping under bed nets protects one from mosquito bites	**no**	1	0.6%
	yes	159	99.4%
Indoor residual spraying of insecticide can protects one from mosquito bites	**no**	12	7.5%
	yes	148	92.5%
Closing windows and doors at sunset is the way of prevention of malaria	**no**	11	6.9%
	yes	149	93.1%
Covering with blankets when one is sleeping protect him/her from mosquito bite and help to prevent malaria	**yes**	79	49.4%
	no	81	50.6%

Table 4.5 presents the knowledge score. The total knowledge score was 25 (100%) including the score for knowledge of malaria, cause, transmission, signs and symptoms and consequences and prevention methods. Each correct question was scored 1 and the wrong answer was scored 0. The mean knowledge score is 21.27 ±1.996 (85.13%± 7.99%) standard deviation and variance of 3.984 (63.83%). The minimum score is 15 (60%) and the maximum score is 25 (100%). The quartile 1 is 20 (80%), the quartile 2 (median) is 22 (88%), the quartile 3 is 23 (92%) and mode is 22 (88%).

The level of knowledge was categorized in high knowledge (90-100%), moderate knowledge (70-89%), and low knowledge (below 70%). Among 160 school children, 45 (28.13%) have high knowledge, 108 (67.5%) have moderate knowledge and 7 (4.38%) have low knowledge (Figure 4.3).

Table 5 : 4.5 Knowledge score of school children

15	60	1	.6%	**Low Knowledge**
16	64	3	1.9%	
17	68	3	1.9%	
18	72	4	2.5%	**Moderate Knowledge**
19	76	20	12.5%	
20	80	23	14.4%	
21	84	23	14.4%	
22	88	38	23.8%	
23	92	23	14.4%	**High Knowledge**
24	96	19	11.9%	
25	100	3	1.9%	
Total		160	100.0	

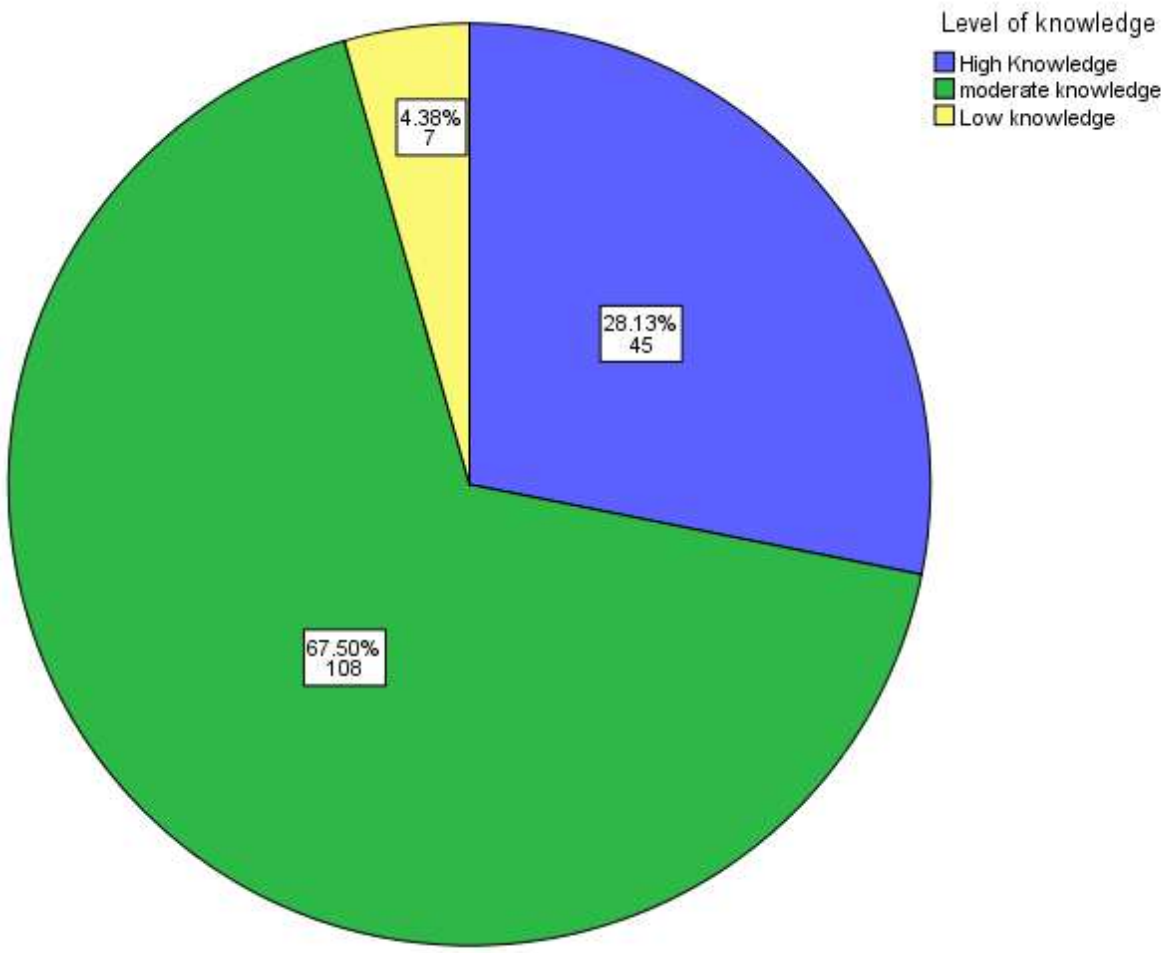

Figure 7 : 4.3. The level of knowledge of school children (N=160)

4.4. ATTITUDE OF SCHOOL CHILDREN ABOUT MALARIA

Table 4.6 shows the attitude of school children towards malaria; the attitude was assessed using 4 point Likert scale from strongly agree to strongly disagree. The results show that 22 (13.8%) strongly agree and 52 (32.5%) agree that they are not worried about getting malaria, 61 (38.1%) disagree and 25 (15.6%) strongly disagree that they are not worried about getting malaria. 81 (50.6%) school children strongly agree and 73 (45.6%) agree that sleeping under bed net protect them from getting malaria while 4of them (2.5%) disagree and 2 (1.3%) strongly disagree that sleeping under bed net protect them from getting malaria. 10 (6.3%) school children strongly agree and 18 (11.3%) agree that indoor residual spraying causes bedbugs and does not protect for malaria while the majority 99 (61.9%) disagree and 33 (20.6%) strongly disagree that indoor residual spraying causes bedbugs and does not protect for malaria.

7 (4.4%) school children strongly agree and 12 (7.5%) agree that malaria is common and merely an inconvenience, just like the common cold and not a problem. The majority of school children121 (75.6%) disagree and 20 (12.5%) strongly disagree that malaria is common and merely an inconvenience, just like the common cold and not a problem. 10 (6.3%) school children strongly agree and 25 (15.6%) agree that malaria it is not a problem because everybody gets malaria, 103 (64.4%) disagree and 22 (13.8%) strongly disagree to the statement.

8 (5%) school children strongly agree and 21 (13.1%) agree that if they have malaria as often as possible, there will be no consequences on their performance at school. 107 (66.9%) disagree and 24 (15%) strongly disagree to the statement.

Table 6 : 4.6. Attitude of school children about malaria severity, consequences and

Statement		Count	Percentage
From what I know about malaria, I am not worried about getting malaria.	strongly agree	22	13.8%
	agree	52	32.5%
	disagree	61	38.1%
	strongly disagree	25	15.6%
If I am sleeping under bed net, I believe that I will be protected from malaria.	strongly disagree	2	1.3%
	disagree	4	2.5%
	agree	73	45.6%
	strongly agree	81	50.6%
When using indoor residual spraying, I believe it causes bedbugs and does not protect for malaria	strongly agree	10	6.3%
	agree	18	11.3%
	disagree	99	61.9%
	strongly disagree	33	20.6%
Malaria is common and merely an inconvenience, just like the common cold and not a problem.	strongly agree	7	4.4%
	agree	12	7.5%
	disagree	121	75.6%
	strongly disagree	20	12.5%
Everybody gets malaria, I don't think it's a problem	strongly agree	10	6.3%
	agree	25	15.6%
	disagree	103	64.4%
	strongly disagree	22	13.8%
I believe if I have malaria as often as possible, there will be no consequences on my performance at school.	strongly agree	8	5.0%
	agree	21	13.1%
	disagree	107	66.9%
	strongly disagree	24	15.0%

Table 4.7 presents the attitude of school children about malaria treatment and shows that 4 (2.5%) school children strongly agree and 4 (2.5%) agree that traditional herbs are better for treating malaria. In other hand 121 (75.6%) disagree and 31 (19.4%) strongly disagree that traditional herbs are better for treating malaria. 76 (47.5%) school children strongly agree and 80 (50%) agree if antimalarial medications are given, they should be continued until finished; even when malaria symptoms disappeared; only 4 (2.5%) disagree to the statement

Table 7 : 4.7. Attitude of school children about malaria treatment (N=160)

Statements		**Count**	**Percentage**
I believe traditional herbs are better for treating malaria	**strongly agree**	4	2.5%
	agree	4	2.5%
	disagree	121	75.6%
	strongly disagree	31	19.4%
If antimalarial medications are given, I believe they should be continued until finished; even when malaria symptoms disappeared	**strongly disagree**	0	0.0%
	disagree	4	2.5%
	agree	80	50.0%
	strongly agree	76	47.5%

Table 4.8 presents the attitude score of school children. The attitude was assessed using 4 point Likert scale from strongly agree to strongly disagree; for most of the statements, strongly disagree was scored 3, disagree was scored 2, agree was scored 1 and strongly agree was scored 0 and the reverse coding score was applied in two statements. The total attitude score was 24 (100%). The mean attitude score is 16.29 ±2.569 (67.86%± 10.69%) standard deviation and variance of 114.29. The minimum score is 10 (41%) and the maximum score is 24 (100%). The quartile 1 is 15 (62.5%), the quartile 2 (The median) is 16 (66.66%), the quartile 3 is 17 (70.83%) and mode is 16 (66.66%).

The attitude of school children was categorized in positive attitude (70-100%), negative attitude (Below 70) according to their attitude score. 64 (40%) of school children have positive attitude and 96 (60%) have negative attitude towards malaria prevention. (Figure 4.4)

Table 8 : 4.8 Attitude of school children towards malaria prevention

Malaria attitude score out of 24	Percentage attitude score	Frequency	Percentage	Level of attitude
10	41.66	2	1.3%	
11	45.83	5	3.1%	
12	50	2	1.3%	
13	54.16	7	4.4%	**Negative attitude**
14	58.33	13	8.1%	
15	62.5	30	18.8%	
16	66.66	37	23.1%	
17	70.83	24	15.0%	
18	75	18	11.3%	
19	79.16	7	4.4%	
20	83.33	3	1.9%	
21	87.5	3	1.9%	**Positive attitude**
22	91.66	4	2.5%	
23	95.83	4	2.5%	
24	100	1	0.6%	
Total		160	100.0%	

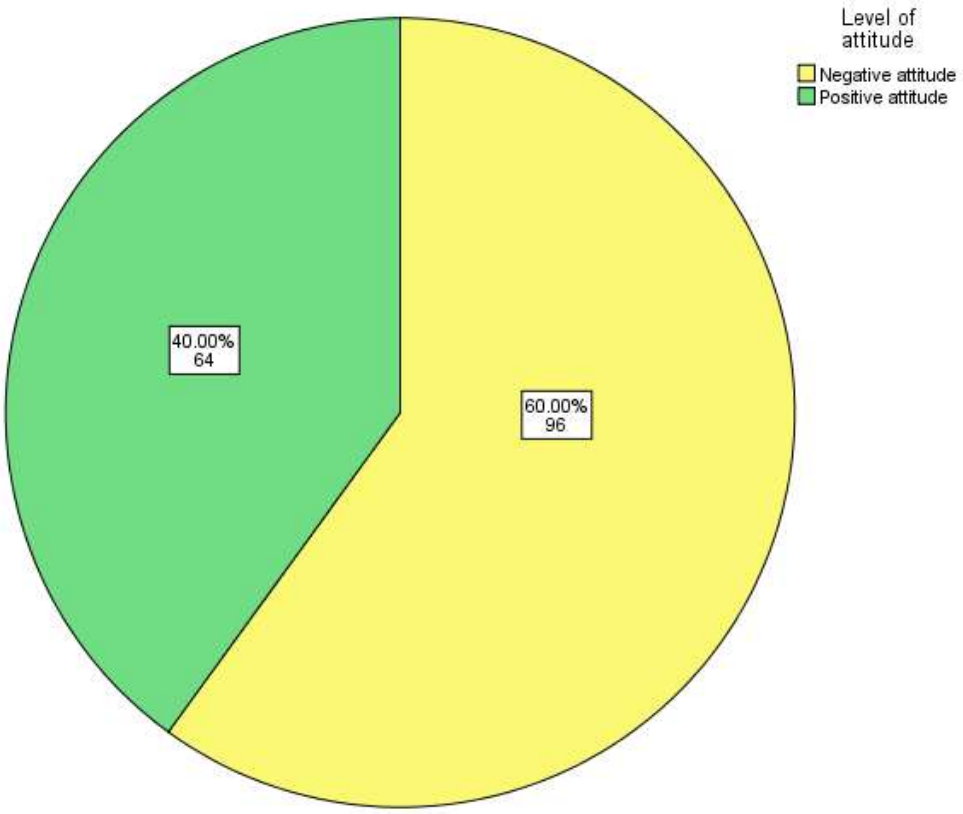

Figure 8 : 4.4. The level of attitude of school children towards malaria prevention and

4.5. PRACTICE OF SCHOOL CHILDREN ABOUT MALARIA PREVENTION

The table 4.9 reveals the results for health practices towards malaria among school children. School children were asked how often they do practice malaria prevention; they responded from not at all to very often.82 (51.3%) school children have closed door and windows at sunset very often, 53 (33.1%) occasionally, 17 (10.6%) rarely and 8 (5%) never close door and windows at sunset. 101 (63.1%) school children sleep under insecticide treated net very often, 41 (25.6%) occasionally sleep under insecticide treated net,11 (6.9%) rarely sleep under insecticide treated net and 7 (4.4%) never sleep under insecticide treated net in the last five months.

107 (66.9%) school children very often help in keeping the surrounding clean, 39 (24.4%) occasionally help in keeping the surrounding clean, 9 (5.6%) rarely help in keeping the surrounding clean and 5 (3.1%) never help in keeping the surrounding clean. 60 (37.5%) very often wear long protective clothing in the evening to prevent mosquito bites, 72 (45%) occasionally wear long protective clothing in the evening to prevent mosquito bites, 17 (10.6%) rarely wear long protective clothing in the evening to prevent mosquito bites and 11 (6.9%) never wear long protective clothing in the evening to prevent mosquito bites.

113 (70.6%) very often help in clearing the bushes in the surrounding and clear the gutters to prevent mosquito breeding, 39 (24.4%) occasionally help in clearing the bushes in the surrounding and clear the gutters to prevent mosquito breeding. 4 (2.5%) rarely and 4 (2.5%) never help in clearing the bushes in the surrounding and clear the gutters to prevent mosquito breeding. The school children were asked if they used the preventive measures of malaria during the last night or evening to assess the regularity in malaria prevention practice. 114 (71.3%) of 160 school children, slept under an insecticide treated net the previous night and 46 (28.8%) did not sleep under an insecticide treated net the previous night.

120 (75%) of 160 school children, closed doors and windows at sunset the previous evening and 40 (25%) of them did not close doors and windows at sunset the previous evening. 79 (49.4%) worn the long protective clothes the previous evening and 81 (50.6%) did not wear the protective clothes the previous evening.

Table 9 : 4.9. Practice of school children towards malaria prevention (N=160)

Statements		Count	Percentage %
I close door and windows at sunset	not at all	8	5.0%
	rarely	17	10.6%
	occasionally	53	33.1%
	very often	82	51.3%
I sleep under Insecticide treated net	not at all	7	4.4%
	rarely	11	6.9%
	occasionally	41	25.6%
	very often	101	63.1%
I Help in keeping the surrounding clean, removing bottles, pots	not at all	5	3.1%
	rarely	9	5.6%
	occasionally	39	24.4%
	very often	107	66.9%
I Wear long protective clothing in the evening to prevent mosquito bites.	not at all	11	6.9%
	rarely	17	10.6%
	occasionally	72	45.0%
	very often	60	37.5%
I help in clearing the bushes in my surrounding and clear the gutters to prevent mosquito breeding	not at all	4	2.5%
	rarely	4	2.5%
	occasionally	39	24.4%
	very often	113	70.6%
	no	46	28.8%
I Slept under an insecticide treated net last night	Yes	114	71.3%
	no	40	25.0%
I Closed doors and windows at sunset last evening	yes	120	75.0%
	no	81	50.6%
I Worn long protective clothes last evening	yes	79	49.4%

Table 4.10 continues to show the findings on practice.The findings of treatment seeking behavior of school children revealed 2 (1.3%) of 160 school children who very often use the traditional herbs for treating malaria, 30 (18.8%) use them occasionally, 24 (15%) rarely use them and 104 (65%) never use traditional herbs to treat malaria (table 4.10). 120 (75%) of 160 school children consult health center very often when they feel malaria symptoms, 29 (18.1%) occasionally consult health center when they feel malaria symptoms, 3 (1.9%) rarely and 8 (5%) never consult health center when they feel malaria symptoms. 5 (3.1%) of 160 school children very often forget to take medications when malaria symptoms disappear, 42 (26.3%) occasionally forget to take medications when malaria symptoms disappear. 16 (10%) rarely and 97 (60%) never forget to take medications when malaria symptoms disappear.

Table 10 : 4.10. Practice with regards to Malaria treatment seeking behavior among school children (N=160)

Statements		**Count**	**Percentage**
I use the traditional herbs for treating malaria.	**very often**	2	1.3%
	occasionally	30	18.8%
	rarely	24	15.0%
	not at all	104	65.0%
I consult health center when I feel malaria symptoms	**not at all**	8	5.0%
	rarely	3	1.9%
	occasionally	29	18.1%
	very often	120	75.0%
I Forget to take medications when malaria symptoms disappear	**very often**	5	3.1%
	occasionally	42	26.3%
	rarely	16	10.0%
	not at all	97	60.6%

Table 4.11 presents the overall practice score with regards to malaria prevention and treatment seeking behavior of school children. The total practice score was 30 (100%). The mean practice score is 23.36 ± 4.327 (77.85% ±14.44%) standard deviation and variance of 18.721 (208.58). The minimum score is 12 (40%) and the maximum score is 30 (100%). The quartile 1 is 20 (66.66%), the quartile 2 (median) is 24 (80%), the quartile 3 is 27(90%) and mode is 27 (90%) (table 4.11). The practice of school children is categorized in good practice (70-100%) and poor practice (0-69%) according to their practice score. Nearly three quarters: 119 (74.38%) of 160

school children have good practice, and one quarter: 41 (25.63%) have poor practice about malaria prevention (Figure 4.5)

Table 11 : 4.11. Practice score of school children towards malaria prevention (N=160)

Practice score	Percentage practice score	Frequency	Percentage	Level of practice
12	40	3	1.9%	**Poor practice**
13	43.33	1	0.6%	
14	46.66	2	1.3%	
15	50	2	1.3%	
16	53.33	4	2.5%	
17	56.66	3	1.9%	
18	60	8	5.0%	
19	63.33	6	3.8%	
20	66.66	12	7.5%	
21	70	10	6.3%	**Good practice**
22	73.33	13	8.1%	
23	76.66	11	6.9%	
24	80	15	9.4%	
25	83.33	16	10.0%	
26	86.66	6	3.8%	
27	90	23	14.4%	
28	93.33	6	3.8%	
29	96.66	7	4.4%	
30	100	12	7.5%	
Total		160	100.0%	

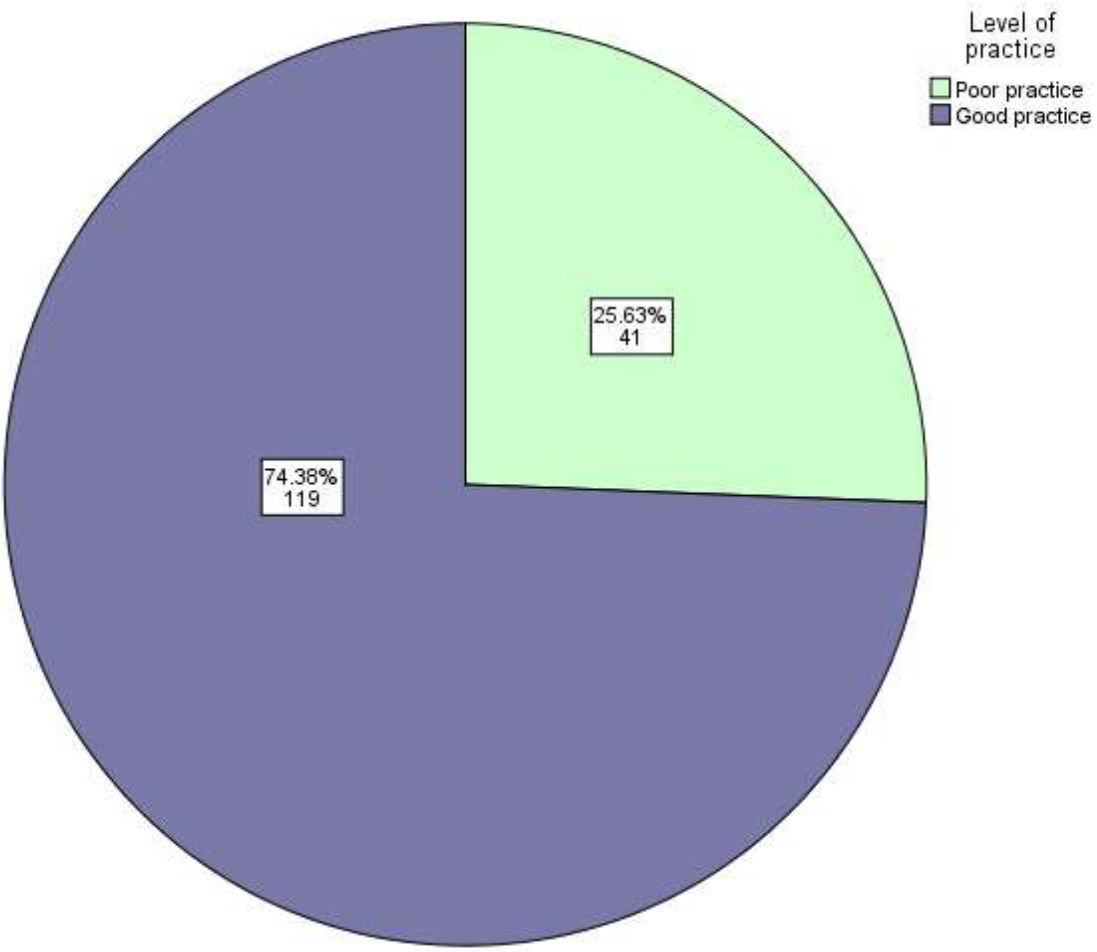

Figure 9 : 4.5. Level of practice of school children towards malaria prevention (N=160)

INFERENTIAL STATISTICS

4.6. RELATIONSHIP BETWEEN KNOWLEDGE AND ATTITUDE OF SCHOOL CHILDREN TOWARDS MALARIA PREVENTION

The relationship between knowledge and attitude of school children towards malaria is presented in table 4.12. The Pearson correlation coefficient (r) revealed a weak positive correlation between knowledge and attitude (r=0.162) which is statistically significant (p=0.041).The results show that when the level of knowledge of school children towards malaria increases, the level of attitude also increases and the results are correct 95 times out of a hundred.

Table 4.12. Pearson correction between knowledge and attitude of school children towards malaria (N=160)

		Knowledge score	**Attitude score**
Knowledge score	**Pearson Correlation**	1	.162*
	Sig. (2-tailed)		.041
	N	160	160
Attitude score	**Pearson Correlation**	.162*	1
	Sig. (2-tailed)	.041	
	N	160	160
*. Correlation is significant at the 0.05 level (2-tailed).			

Since the correlation was significant, the researcher wants to know how much variance the independent variable (knowledge) contributes to the dependent variable (attitude) using linear regression analysis. The scatter plot (figure 4.6) shows a correlation between knowledge and attitude score and the linear regression analysis shows that knowledge contributes only 2.6% of increase in attitude (R^2=0.026) and other 97.4% of change in attitude are not explained by knowledge.

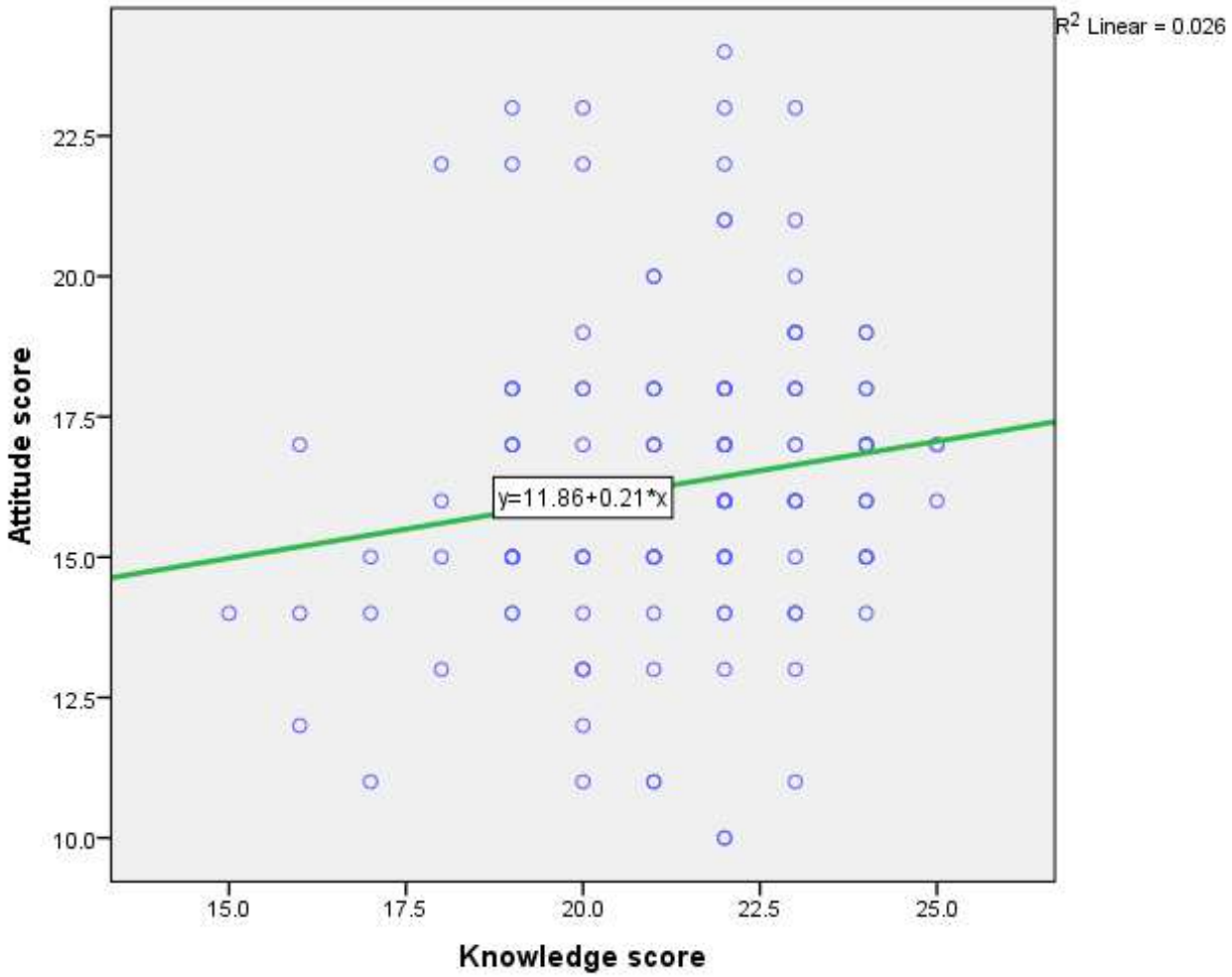

Figure 10: 4.6 Correlation between knowledge and attitude score (N=160)

The Regression analysis of attitude of school children towards malaria is presented in table 4.13. The results show that every unit change in knowledge, will increase by 0.208 (-0.21) of attitude. The findings also revealed that there is little contribution of knowledge of school children towards attitude of school children with regards to malaria prevention (Beta=0.162)

Table 12 : 4.13 Regression analysis of attitude of school children towards malaria (N=160)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	11.857	2.155		5.501	.000
	knowledge score	.208	.101	.162	2.064	.041
R^2= 0.026					F= 4.262	

4.7. RELATIONSHIP BETWEEN KNOWLEDGE AND PRACTICE SCORE

The table 4.14 shows the relationship between knowledge and practice score of school children. There is a very weak correlation (r=-0.01) which is not statistically significant (p= 0.898); the results revealed that more than 5% (8.9%) of the relationship is possibly due chance. Because the significance level was set at 0.05, therefore the relationship between knowledge and practice of school children towards malaria prevention is not statistically significant and regression analysis could not be performed.

Table 13 : 4.14. Pearson Correlation between knowledge and practice of school children towards malaria prevention (N=160)

		Knowledge score	Practice score
Knowledge score	**Pearson Correlation**	1	-.010
	Sig. (2-tailed)		.898
	N	160	160
Practice score	**Pearson Correlation**	-.010	1
	Sig. (2-tailed)	.898	
	N	160	160

4.8. RELATIONSHIP BETWEEN ATTITUDE AND PRACTICE SCORE

The Pearson correlation coefficient (r) revealed a weak positive correlation between attitude score and practice score (r=0.219) which is statistically significant (p=0.005) (Table 4.15). As the level of attitude of school children towards malaria prevention increases, the level of practice towards malaria prevention also increases. The relationship is significant at 0.01 level, showing that the results are correct 99 times out of a hundred and only 1% may be due to chance.

Table 14 : 4.15. Pearson Correlation between attitude and practice of school children towards malaria prevention (N=160)

		Attitude score	Practice score
Attitude score	Pearson Correlation	1	.219**
	Sig. (2-tailed)		.005
	N	160	160
Practice score	Pearson Correlation	.219**	1
	Sig. (2-tailed)	.005	
	N	160	160

**. Correlation is significant at the 0.01 level (2-tailed).

Since the correlation was significant, the researcher wants to know how much variance the independent variable (attitude) contributes to the dependent variable (practice) using linear regression analysis. The scatter plot (figure 4.7) shows a correlation between attitude and practice score and the linear regression analysis shows that attitude contributes only 4.8% of increase in practice (R^2=0.048) and other 95.2% of change in practice are not explained by attitude.

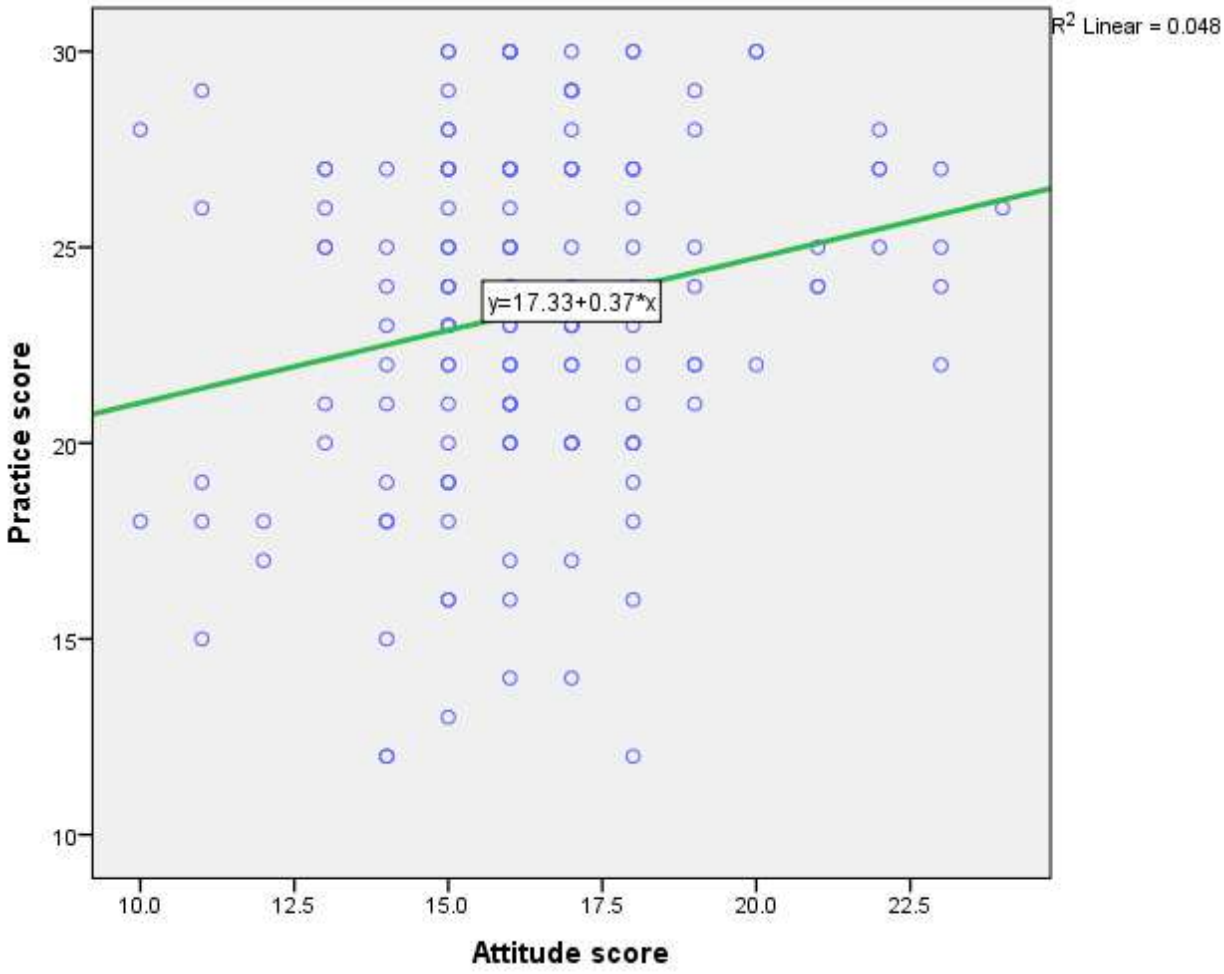

Figure 4.7 Correlation between attitude and practice score (N=160)

The Regression analysis of practice of school children towards malaria prevention is presented in table 4.16. The results show that every unit change in attitude will increase by 0.37 of practice. The findings also revealed that there is little contribution of attitude of school children towards practice of school children with regards to malaria prevention (Beta=0.219)

Table 15 : 4.16 Regression analysis of practice of school children towards malaria

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	17.325	2.161		8.017	.000
	Attitude score	.370	.131	.219	2.825	.005
R^2= 0.048					F=7.982 (p=0.005)	

4.9. CHI-SQUARED TEST AND FISHER'S EXACT TEST BETWEEN THE LEVEL OF KNOWLEDGE, ATTITUDE AND PRACTICE AND DEMOGRAPHIC CHARACTERISTICS

The Chi-squared test is used to test the association between two categorical variables. The Fisher's Exact test was used when more than 20% of the cells have expected count less than 5; in this case the Chi-squared test could not be valid.

The Fisher's Exact test reveals a non-significant statistical association between malaria knowledge and gender of participants (p=0.061) (Table 4.17).

Table 16 : 4.17. Fisher's Exact test of level of knowledge and participants gender

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	5.755[a]	2	.056	.058
Fisher's Exact Test	5.567			.061
N of Valid Cases	160			

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.15.

The table 4.18 shows the level of knowledge of female and male participants towards malaria; 23 (26.13%) of female participants have high knowledge, 64 (72.73%) have moderate knowledge and 1 (1.14%) has low knowledge. In other hand, 22 (30.55%) of male participants have high knowledge, 44 (61.11%) have moderate knowledge and 6 (8.33%) have low knowledge.

Table 17 : 4.18. Level of knowledge according to gender of participants (N=160)

participants according to sex * Level of knowledge Crosstabulation					
Count					
		Level of knowledge			Total
		High Knowledge	moderate knowledge	Low knowledge	
participants according to sex	female	23 (26.13%)	64 (72.73%)	1 (1.14%)	88 (100%)
	male	22 (30.55%)	44 (61.11%)	6 (8.33%)	72 (100%)
Total		45	108	7	160

The Pearson Chi square test reveals no significant association between malaria attitude and gender of participants (X^2=0.004, df= 1, p= 0.948). (Table 4.19)

Table 18 : 4.19. Chi-square test of level of attitude and participants gender (N=160)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.004[a]	1	.948	
Fisher's Exact Test				1.000
N of Valid Cases	160			

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 28.80

The table 4.20 shows the level of attitude of female and male participants; 53 (60.23%) of 88 female participants have positive attitude and 35 (39.77%) of them have negative attitude. Among 72 male participants, 43 (59.22%) of them have positive attitude and 29 (40.28%) have negative attitude.

Table 19 : 4.20. Level of attitude according to gender of participants (N=160)

Count				
		Level of attitude		Total
		Negative attitude	Positive attitude	
participants according to sex	female	53 (60.23%)	35 (39.77%)	88 (100%)
	male	43 (59.22%)	29 (40.28%)	72 (100%)
Total		96	64	160

The Pearson Chi square test reveals a statistical significant association between malaria practice and gender of participants (X^2, df= 7.553, p=0.007), showing that female are more likely to have good practice towards malaria prevention compared to male. (Table 4.21). Although the significance level for the results of this study was set at 0.05, the association between malaria practice and gender of participants was statistically significant at 0.01 level, proving that 99% of the results are correct and only 1% may be due to error/chance.

Table 20 : 4.21 Chi-square test of level of practice towards malaria prevention and participants age (N=160)

	Value	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**
Pearson Chi-Square	7.553[a]	1	.006	.007
Fisher's Exact Test				.007
N of Valid Cases	160			

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 18.45.

The table 4.22 shows the level of practice of female and male participants; 73 of 88 female participants have good practice and 15 have poor practice towards malaria prevention. 46 of 72 male participants have good practice and 26 have poor practice towards malaria prevention.

Table 21: 4.22. Level of practice according to gender of participants (N=160)

participants according to sex * Level of practice Crosstabulation

		Level of practice		**Total**
		Poor practice	**Good practice**	
participants according to sex	**Female**	15 (17.04%)	73 (83.95%)	88 (100%)
	Male	26 (36.11%)	46 (63.88%)	72(100%)
Total		41	119	160

The table 4.23 shows the association between level of knowledge and age of participants. The Fisher's Exact test revealed a non-significant association between level of knowledge of school children and age of participants. There is no statistically significant difference between children aged 11-14 years and children aged 15-17 years regarding malaria knowledge level (p=0.743, Fisher= 0.597).

Table 22 : 4.23 Fisher's Exact test of level of knowledge and participants age (N=160)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.533[a]	2	.766	.743
Fisher's Exact Test	.597			.743
N of Valid Cases	160			

a. 2 cells (33.3%) have expected count less than 5. The minimum expected count is 3.37.

The cross tabulation between knowledge level of school children and their age shows that 22 (26.5%) school children aged 11-14 years have high knowledge versus 23 (29.87%) school children aged 15-17 years who have high knowledge of malaria. 58 (68.87%) school children aged 11-14 years have moderate knowledge versus 50 (64.93%) aged 15-17 years who have moderate knowledge. 3 (3.61%) school children aged 11-14 years have low knowledge versus 4 (5.19%) aged 15-17 years with low knowledge of malaria (table 4.24).

Table 23 : 4.24. Level of knowledge of school children towards malaria according to age of participants (N=160)

		Level of knowledge			Total
		High Knowledge	moderate knowledge	Low knowledge	
Age group of participants	11-14 years	22 (26.5%)	58 (68.87%)	3(3.61%)	83 (100%)
	15-17 years	23 (29.87%)	50(64.93%)	4(5.19%)	77 (100%)
Total		45	108	7	160

The table 4.25 shows the association between level of attitude and age of participants. The Chi-square test revealed a non-significant association between level of attitude of school children and age of participants. There is no statistically significant difference between children aged 11-14 years and children aged 15-17 years regarding malaria attitude level (X^2=0.818, df=1, p= 0.366).

Table 24 : 4.25 Chi-square test of level of attitude and participants age (N=160)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	.818[a]	1	.366	.421
N of Valid Cases	160			

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 30.80

The cross tabulation between attitude level of school children and their age in Table 4.26 shows that 36 (43.37%) school children aged 11-14 years have positive attitude versus 28 (33.73%) school children aged 15-17 years who have positive attitude towards malaria prevention.
47 (56.62%) school children aged 11-14 years have negative attitude versus 49 (63.63%) aged 15-17 years who have negative attitude towards malaria prevention (table 4.26)

Table 25 : 4.26. Level of attitude of school children towards malaria according to age of participants (N=160)

Count				
		Level of attitude		Total
		Negative attitude	Positive attitude	
Age group of participants	11-14 years	47 (56.62%)	36 (43.37%)	83 (100%)
	15-17 years	49 (63.63%)	28 (33.73%)	77 (100%)
Total		96	64	160

The table 4.27 shows the association between level of practice and age of participants. The Chi-square test revealed a significant association between level of practice of school children towards malaria prevention and age of participants. There is a statistically significant difference between children aged 11-14 years and children aged 15-17 years regarding level of practice of malaria prevention (X^2=6.940, df=1, p= 0.008).

Table 26 : 4.27 Chi-square test of level of practice of school children towards malaria prevention and participants age (N=160)

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)
Pearson Chi-Square	6.940[a]	1	.008	.011
N of Valid Cases	160			

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 19.73.

The cross tabulation between the level of practice towards malaria prevention of school children and their age shows that 69 (83.13%) school children aged 11-14 years have good practice versus 50 (64.93%) school children aged 15-17 years who have good practice towards malaria prevention. 14 (16.86%) school children aged 11-14 years have poor practice versus 27 (35.06%) aged 15-17 years who have poor practice towards malaria prevention (table 4.28). Therefore the school children aged 11-14 years have good practice of malaria prevention more than those aged 15-17 years and the difference is significant at 0.01 level (p=0.008) even though the significance level was set at 0.05 level; showing that 99% of the results are correct and only 1% may be due to error/chance.

Table 27 : 4.28. Level of practice of school children towards malaria according to age of participants (N=160)

		Level of practice		Total
		Poor practice	Good practice	
Age group of participants	11-14 years	14(16.86%)	69 (83.13%)	83 (100%)
	15-17 years	27 (35.06%)	50 (64.93%)	77 (100%)
Total		41	119	160

Conclusion of the findings

The Demographic characteristics presented were age and gender. Many school children 47 (29.38) were aged 14 years old representing the modal age, and female were mostly represented 88 (55%). The level of knowledge of school children was presented and 45 (28.13%) have high knowledge about malaria, 108 (67.5%) have moderate knowledge and 7 (4.38%) have low knowledge; misconceptions of school children about malaria cause have also been found in 88 (55%). This is answering the first research question. The level of attitude of school children is presented and 64 (40%) have positive attitude and 96 (60%) have negative attitude towards malaria. The level of practice of school children was also presented and 119 (74.38%) have good practice and 41 (25.63%) have poor practice towards malaria. This is answering the second research question.

A weak positive correlation was found between knowledge and attitude of school children towards malaria as evidenced by the Pearson correlation coefficient (r= 0.162, p= 0.041). This is answering the third research question. There is a non-significant correlation between knowledge and practice of school children towards malaria. A very weak negative correlation was found which was not statistically significant (r= -0.010, p= 0.898). This is answering the fourth research question. To answer the last research question, the Pearson correlation coefficient (r) revealed a weak positive correlation between attitude score and practice score (r=0.219) which is statistically significant (p=0.005)

The association between the level of knowledge, attitude and practice and demographic characteristics of school children (gender and age) revealed that female are more likely to have good practice towards malaria prevention compared to male school children, and children aged 11-14 years have good practice more than those aged 15-17 years. The Chi-square test was used to statistically confirm that difference and the results were significant at 0.01 level. In other hand, the level of knowledge and attitude among female and male school children and for age group 11-14 years and 15-17 years was not statistically different. This gives detailed and further elaboration on the results of the study.

CHAPTER 5 DISCUSSION OF STUDY FINDINGS

5. 1 INTRODUCTION

This study determined and described the level of curriculum-based malaria knowledge, attitude and practices towards malaria prevention among school children prior to examining the relationships between the three variables under study. The study used the descriptive correlational study design. The findings of this study revealed that 45 (28.13%) of school children have high knowledge about malaria, 108 (67.5%) have moderate knowledge and 7 (4.38%) have low knowledge with more than a half (55%) of school children who have misconceptions about malaria cause. The level of attitude of school children was also presented and 64 (40%) have positive attitude and 96 (60%) have negative attitude towards malaria. Most of school children; 119 (74.38%) have good practice towards malaria prevention and 41 (25.63%) have poor practice towards malaria prevention. This study also determined the relationship between knowledge and attitude, knowledge and practice, and attitude and practice of school children towards malaria prevention.

A weak positive correlation was found between knowledge and attitude of school children towards malaria as evidenced by the Pearson correlation coefficient (r= 0.162, p= 0.041), in other hand a non-significant correlation between knowledge and practice of school children towards malaria was found with a very weak negative correlation which was not statistically significant (r= -0.010, p= 0.898). The Pearson correlation coefficient (r) revealed a weak positive correlation between attitude score and practice score (r=0.219) which is statistically significant (p=0.005)

The discussion section discusses the results of the study according to study objectives and provides discussion on sample size and demographics. The conclusion and recommendations come after the discussion section.

5.2. DISCUSSION OF THE SAMPLE SIZE

This study used the sample of 160 school children. The sample size was calculated according to statistical formula using power of 80%, alpha error of 0.05 and effect size of 0.2 and gives the

required sample size for the relationship study. One study conducted in Tanzania used a sample size of 125 school children (Sumari *et al.*, 2016), in other hand, other studies used large sample size varying from 172 to 432 participants (Midzi *et al.*, 2011; Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013; Makoge *et al.*, 2013; Debela, 2014). Another study conducted in adolescents in India used a large sample size of 1096 school –going adolescents (Dambhare, Nimgade and Dudhe, 2012). The sample size for this study was adequate for studies evaluating relationship between variables.

5.3. DISCUSSION OF DEMOGRAPHICS

The age of participants in this study ranged between 11 and 17 years; which is quite similar to the age range used in one study in Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013) and the mean age of school children was 14 years old; and is not far different from the mean age found in other studies (Dambhare, Nimgade and Dudhe, 2012). This was possibly due to that the participants were school children studying in grade 7 and most of them were in this age range and few of them aged 18 years and more were not included in the study as they are not considered children by the United Nations convention on the rights of child (2010).

The majority of participants were female, the same for other studies like the recent study conducted in Tanzania (Sumari *et al.*, 2016), Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013), Nigeria (Midzi *et al.*, 2011) however other study (Babalola *et al.*, 2016) used almost equal number of male (49.5%) and female (50.5%). Having many female participants in the sample was due to enrollment of many girls in secondary school.

5.4. LEVEL OF KNOWLEDGE OF SCHOOL CHILDREN TOWARDS MALARIA

High level of knowledge was found in 45 (28.13%) school children and 108 (67.5%) have moderate level of knowledge while 7 (4.38%) have low level of knowledge about malaria, cause, transmission, signs and symptoms, consequences and preventive measures. The same findings in other studies conducted in Tanzania (Sumari *et al.*, 2016), Ethiopia (Debela, 2014) and in Cameroon (Makoge *et al.*, 2013) found that high percentage of school children have correct knowledge about the cause, transmission, symptoms and prevention of malaria. However, the misconceptions of malaria cause exist in school children. Eating mangoes and sugarcane were the most stated causes of malaria, eating maize and long stay under the sun were also stated which is not different from the findings of other studies conducted in adult community in

Rwanda (Ingabire *et al.*, 2014; Asingizwe *et al.*, 2015) and different misconceptions were found in other studies conducted in school children in Tanzania (Sumari *et al.*, 2016) and many studies in adult community (Mazigo *et al.*, 2010; Aderaw and Gedefaw, 2013; Chourasia, Abraham and John, 2014, p.196; Mugao *et al.*, 2014; Musoke *et al.*, 2015; Regmi, Kunwar and Ortega, 2016). This may be due to the fact that in the community, the misconceptions exist; even though school children study malaria at school, they heard other information at home from their parents since childhood.

95% of school children know that malaria is transmitted by mosquito bite, similar findings were found in school adolescent (11-20 years) in Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013) with 85% who know that malaria can be transmitted via mosquito bite. The results of this study also revealed that 53.8% of school children know that malaria is caused by Plasmodium and 44.4% know that only infected anopheles female mosquito bite can transmit malaria; which is different from the findings in India (Dambhare, Nimgade and Dudhe, 2012, p. 76) where only 8.6% of school going adolescents recognize anopheles mosquito bite as the causative agent of malaria, and in Zimbabwe (Midzi *et al.*, 2014) only 19.2% of school children knew the cause of malaria.

In Tanzania, Sumari and others (2016) found 63% that female anopheles is the only mosquito that transmit malaria. High knowledge (90.7%) of malaria cause and transmission was also found in adult community in eastern region in Rwanda (Asingizwe *et al.*, 2015). Children in Public school in Rwanda study malaria as part of the classroom course content in grade six (Kitooke and Oiko, 2010); this may possibly be the reason why more than a half of participants know that malaria is caused by plasmodium, and having some misconceptions from the community possibly causes some of them (89/160; 55.6%) to state that not only the female anopheles may transmit malaria.

Vomiting was the mostly known symptom of malaria by 156 (97.5%) school children and 148 (92.5%) school children knows fever as an important symptom of malaria, lack of appetite is also know by most of the participants. These results corroborate with other studies' findings with more than 50% reporting fever as a symptom of malaria (Dambhare, Nimgade and Dudhe, 2012; Makoge *et al.*, 2013; Sumari *et al.*, 2016), However, in Nigeria only 32% of school adolescents

reported fever as a symptom of malaria and vomiting was reported by less than a half of school children (Makoge *et al.*, 2013; Sumari *et al.*, 2016) and in Cameroon, fever was the mostly known symptom of malaria among school-going children (Makoge *et al.*, 2013).High knowledge of malaria symptoms in school children is possibly due to significant increase in malaria cases in recent years in Rwanda and high malaria burden in Eastern province of Rwanda (Rwanda Ministry of Health, 2014) where these school children live and children may be able to observe the manifestations of malaria in the community, in addition, children may recall the symptoms of malaria that were taught at school in previous six months (Kitooke and Oiko, 2010)

Almost all (159/160; 99.4%) school children know that sleeping under bed nets is the way of protecting mosquito bite and is the mostly known method of malaria prevention followed by closing windows and doors at sunset known by 149 (93.1%), indoor residual spraying known by 148 (92.5%). Similar findings were found in school children in Tanzania with most of participants stating use of mosquito net as a way of preventing malaria (Sumari *et al.*, 2016). Other studies conducted in adult community in Rwanda (Asingizwe *et al.*, 2015), Uganda (Musoke *et al.*, 2015), and Ethiopia (Abate, Degarege and Berhanu, 2013) have similar findings whereby the most known method of prevention of malaria was sleeping under mosquito net. However, the studies conducted in Ruhuha sector of Eastern province of Rwanda (Asingizwe *et al.*, 2015) found only 28% of participants who knows indoor residual spraying as a method of malaria prevention.

Surprisingly, nearly a half (79/160; 49.4%) of school children in this study know that covering with blankets when one is sleeping protect him/her from mosquito bite and help to prevent malaria, similarly in Ethiopia misconception about malaria prevention exist (Aderaw and Gedefaw, 2013). The results of this study also found that 20 (12.5%) school children do not perceive the severity of malaria as a disease which can cause death if untreated and 29 (18.1%) do not perceive malaria as a disease which can easily kill children. 16 (10%) do not perceive the seriousness of malaria as a disease which may be complicated in cerebral form and 30 (18.8%) do not perceive that malaria can reduce the family's productivity. In other hand, almost all school children know that malaria can cause school absenteeism (157/160; 98.1%) and reduce the school performance (155/160; 96.3%). A study done in Liberia (Babalola *et al.*, 2016, p. 6)

also found certain percentage (32%) of participants who do not perceive the severity of malaria especially for older children.

The level of knowledge of school children was not statistically associated with the gender of participants (p=0.061), this is different from the findings of Mazigo et al. (2010) stipulating that there is gender difference on correct knowledge of preventive measures of malaria with more knowledge in female than male. School children; both female and male are taught the same content in class which is possibly the reason why there is no significant difference in their knowledge about malaria. The findings also revealed that no significant difference between level of knowledge and participants' age. Different findings have been found in Ugandan adult community stating significant association between malaria knowledge and age (Musoke *et al.*, 2015). This is not surprising, possibly because even though school children in this study are in different age groups (11-14 years, 15-17 years) they were exposed to the same curriculum content about malaria; their knowledge would not significantly differ.

5.5. LEVEL OF ATTITUDE AND PRACTICES OF SCHOOL CHILDREN TOWARDS MALARIA

Among 160 school children, 40% have positive attitude and 60% have negative attitude towards malaria prevention. This is also found in a study conducted in adult with positive attitude in few participants compared to negative attitude towards malaria prevention found in many participants (Mwanje, 2013). Nearly a half of school children are not worried about getting malaria and about 12% of school children perceive malaria as a common condition like common cold and about 22% believe that malaria is not a problem because everybody gets malaria. Similar findings were found in Nigeria where school-going adolescents do not believe that malaria is a disease that can cause death (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013, p. 249). Some school children do not perceive the seriousness of malaria which may influence their practice of malaria prevention.

Almost all (96.2%) school children believe that sleeping under bed net protect them from getting malaria; this corroborates with the findings of the study done in adult community in Rwanda (Asingizwe *et al.*, 2015, p. 56) and in Ethiopia (Abate, Degarege and Berhanu, 2013) who believe that sleeping under mosquito net is the best way of preventing malaria.

28 (17.6%) school children have negative attitude towards the use of indoor residual spraying; believing that it causes bedbugs and does not protect for malaria. Most of the school children 152 (95%) do not believe that traditional herbs are better to treat malaria; only 5% believe that traditional herbs are better to treat malaria; and almost all 156 (97.5%) school children believe that antimalarial drugs should not be discontinued even though the symptoms of malaria disappeared. The beliefs of school children towards the treatment of malaria may possibly influence their treatment seeking behavior. There was no relationship between attitude of school children towards malaria prevention and school children's age and gender.

Among 160 school children, 119 (74.38%) have good practice and 41 (25.63%) have poor practice towards malaria prevention. About two third 101 (63.1%) of school children sleep under mosquito net very often and nearly three quarters 114 (71.3%) slept under mosquito net the night prior to the study. This is not far different from the findings of a study conducted in Kenya (Okoyo *et al.*, 2015) with 67.9% of school children who slept under mosquito net the night prior to the study, however different findings have been found in Malawi (Mathanga *et al.*, 2015) with only 32.4% reporting to sleep under mosquito net the previous night. The free distribution of mosquito nets in the community in Rwanda may allow most of school children to sleep under mosquito net.

Wearing the long protective clothing in the evening was the least useful method of prevention of malaria prevention with 60 (37.5%) school children who very often wear protective clothing in the evening and 79 (49.4%) who wore the long protective clothes the evening prior to the study.

About a half of the school children close door and windows at sunset very often and three quarter of school children closed doors and windows at sunset the evening prior to the study. This is different from the findings in adult community with only 16% reporting to close door and window as a method of prevention of malaria (Mwanje, 2013). Helping in clearing bushes and keeping the surrounding clean were also practice by about 70% of school children, this was also reported in other studies conducted in adult (Abate, Degarege and Berhanu, 2013; Mwanje, 2013)

Most of school children consult the health center when they feel malaria symptoms, which was also found in school-going adolescents in Nigeria (Eko Jimmy, Osonwa Kalu and Offiong Dominic, 2013). Female school children were found to have better practice of malaria prevention compared to male school children ($p=0.007$); the same relationship between gender and malaria

practices have been found in numerous studies conducted in school children and adult community (Garley *et al.*, 2013; Mathanga *et al.*, 2015; Babalola *et al.*, 2016), however a study conducted in adult community in Rwanda found different findings reporting no significant association between malaria practices and respondents gender (Asingizwe *et al.*, 2015). Surprisingly, the school children aged between 11-14 years has good practice more than the older children aged 15-17 years.

5.7. RELATIONSHIP BETWEEN KNOWLEDGE AND ATTITUDE OF SCHOOL CHILDREN TOWARDS MALARIA PREVENTION

Many studies have assessed the relationship between knowledge, attitude and practice towards malaria; but few of them assessed the direction and intensity of that relationship. In this study, the knowledge of school children towards malaria is positively correlated with attitude of school children towards malaria; Pearson correlation coefficient revealed a weak positive correlation. This finding corroborates with what Chien-yun *et al.*, (2012) stated on the relationship between knowledge and attitude as related to education domain where attitude of the learners is directly affected by knowledge. This study also found that increase in knowledge of school children towards malaria has a little contribution to the increase in their attitude towards malaria prevention (B=0.21) and only 2.6% of attitude of school children towards malaria is explained by their knowledge (R^2 =0.026) while other 97.4% of attitude may be due to other factors which were not explained by the linear regression analysis.

A study conducted in adult in Nigeria found a significant correlation between knowledge and attitude about malaria and its complication r=0.738 (p<0001), however this was a strong positive correlation (Atulomah, Farotimi and Atulomah, 2014, p. 18) which is different from the findings of this study. These findings are also different from Alobuia *et al.* (2015, p. 659)' s findings stating that attitude score was not predictor of practice score of adult people towards vector borne diseases including malaria in Western Jamaica.

5.8. RELATIONSHIP BETWEEN KNOWLEDGE AND PRACTICE OF SCHOOL CHILDREN TOWARDS MALARIA PREVENTION

The results of this study revealed a very weak negative correlation between knowledge and practice; which is not statistically significant (r=-0.010, p=0.898). A non-significant correlation between knowledge and practice of malaria prevention was also found in Zimbabwe (Chituku,

2013). This finding is different from the Nigerian study (Ojong *et al.*, 2013, p. 75) conducted in adult (pregnant women), showing a moderate positive correlation between malaria knowledge and practice (r=0.62), and other studies showed an association between knowledge of malaria and practices of malaria preventive measures (Dambhare, Nimgade and Dudhe, 2012; Asingizwe *et al.*, 2015).

Different findings was also found in a Jamaican study conducted in adult community revealing that knowledge score was a significant predictor of practice score regarding vector-borne diseases including malaria (Alobuia *et al.*, 2015, p. 659). School children have good knowledge of malaria compared to their practices; this is possibly because malaria is taught as course content but some school children do not perceive malaria as a life-threatening disease which may prevent them to have good practice towards malaria prevention.

5.9. RELATIONSHIP BETWEEN ATTITUDE AND PRACTICE OF SCHOOL CHILDREN TOWARDS MALARIA PREVENTION

The results of this study suggest a weak positive correlation between attitude and practice of school children towards malaria prevention (r=0.219, p=0.005) showing that as the attitude of school children towards malaria prevention increases, their practice of malaria preventive measures also increase. The linear regression analysis revealed a little contribution of attitude to practice of school children towards malaria prevention (Beta=0.219) and at every unit of increase in attitude, there is only 0.37 increase in practice only 4.8% of practice of school children towards malaria is explained by their attitude (R^2 =0.048) while other 95.2% of practice may be due to other factors which were not explained by the linear regression analysis.

A study conducted in adult also found the positive correlation between attitude and practice of malaria risk-reduction (r=0.575) and the intensity of correlation was moderate. The findings of adult people in Western Jamaica (Alobuia *et al.*, 2015, p. 659) showed that attitude score was a significant predictor to practice score regarding vector-bone disease including malaria and for every unit of increase in attitude score, the practice increased by 0.17 which is somehow similar to the findings of this study.

5.10. STUDY LIMITATIONS AND CHALLENGES

This study has limitations and challenges and some mitigation factors helped the researcher to minimize the effect of those challenges.

1. The study was conducted in one public school in Eastern province, so the findings could not be generalized in all school children in Rwanda.
2. Data were collected using face to face interview which may cause the interviewer bias; to minimize this bias the researcher do not allow her knowledge to affect the interview.
3. Another challenge related to face to face interview is information bias whereby the respondents gave the information of what a researcher want to hear.
4. The selection bias may also be the challenge; so to minimize this type of bias like the students who could not attend the school during data collection ; the researcher used attendance list with random selection and extend the period of data collection to 3 weeks giving equal chance to all school children to participate in the study.
5. A recall bias could also be a challenge when collecting data; to minimize this type of bias, school children were required to recall the knowledge they acquired 5 months back and the practice they used in three previous months.
6. The study used a descriptive correlational study design, which cannot establish a cause-effect relationship.

CONCLUSION AND RECOMMENDATIONS

RECOMMENDATIONS

The results of this study inform the researcher to present recommendations in order to enhance the knowledge, attitude and practice of school children towards malaria; thus the researcher has recommendations to the nursing practice, education authority, and administration as well as future researchers.

Recommendations to nursing practice

1. School children should always be educated about malaria with special focus on the seriousness and severity of malaria which may influence their attitude towards malaria as a life-threatening disease.
2. Pediatric nurses should organize outreach at community level (schools) and household level to help maintaining and strengthening the knowledge acquired at school regarding malaria and monitor the utilization of malaria preventive measures in school children.

Recommendations to education authority

1. The education authority should collaborate with health sector and deploy nurses to give health education as regards to malaria apart from the curriculum content.
2. The seriousness and severity of malaria and vulnerability of children should be tackled in the curriculum and malaria should be taught from the early age such as grade 1 of primary school to influence the attitude of school children regarding malaria and be able to practice malaria preventive measures from the early age.

Recommendations to the administration

1. The ministry of education in collaboration with ministry of health should initiate the deployment of school nurses to ensure continuous health education to school children using behavior change communication methods specific for children highlighting the seriousness and severity of malaria such as drama, films among others. This would influence the attitude of school children in positive way and hence influence their practice towards malaria prevention.

Recommendations to other researchers

1. The researchers should do other studies in other schools from other regions of Rwanda since this study was conducted in one public school in Eastern province of Rwanda.

2. The researchers should do further inquiry to know other factors contributing to attitude of school children towards malaria since knowledge was contributing a little (2.6%) to the attitude of school children towards malaria prevention with 97.4% of change in attitude which could not be explained in this study, and thus need further research with possible different design.
3. The researcher should also do further investigation to know other factors contributing to practice of school children towards malaria prevention; as attitude was contributing a little (4.8%) to practice of school children towards malaria prevention; therefore, researchers should use different design to address other factors which could results in 95.2% of change in practice which were not explained in this study.

CONCLUSION

This study used the descriptive correlational design to assess the relationship between Curriculum-based malaria knowledge, attitude and practice towards malaria prevention among school children. The high level of knowledge towards malaria was found in 28.3% school children, 40% have positive attitude and 74% have good practice towards malaria prevention, therefore, the knowledge, attitude and practice of school children towards malaria need to be enhanced because it is below expected knowledge, attitude and practice of school children who were taught malaria as part of the curriculum. The results are in line with the conceptual framework and show the direction and strength of relationship between knowledge, attitude and practice of school children towards malaria prevention; showing that knowledge is positively correlated with attitude and attitude is positively correlated with the practice; and the strength of the relationship was weak. However no significant relationship has been found between knowledge and practice of school children towards malaria prevention.

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APPENDICES

APPENDIX 1. INTERVIEW SCHEDULE GUIDE

Interview schedule assessing course-based malaria Knowledge, attitude and practice towards malaria prevention among school children in one public school in Rwanda.

SECTION A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Age:
Sex: F/M
Where did you get malaria knowledge?

School ☐

Elsewhere: ☐ please specify:

SECTION B	ASSESSMENT OF MALARIA KNOWLEDGE. MAXIMUM POINTS= 25 MARKS		
	In this section, Answer the following questions by responding by "Yes" or "No"		
	Which one of the following statements apply to malaria; *(All the responses apply-choose Yes or No for each.*		
	1. Malaria is a disease	**(1)Yes [1]**	**(2)No [0]**
	2. Malaria is caused by Plasmodium	**(1)Yes [1]**	**(2)No [0]**
	3. Malaria is transmitted by the bites from mosquitoes,	**(1)Yes [1]**	**(2)No [0]**
	4. Only infected anopheles female mosquito bite can transmit malaria	**(1)Yes [1]**	**2)No [0]**
	5. Malaria is caused by long stay under the Sun,	**(1)Yes [0]**	**(2)No [1]**
	6. Malaria is caused by eating sugar cane	**(1)Yes [0]**	**(2)No [1]**
	7. Malaria is caused by eating maize	**(1)Yes [0]**	**(2)No [1]**
	8. Malaria is caused by eating mangoes	**(1)Yes [0]**	**(2)No [1]**
	9. Sleeping under bed nets protects one from mosquito bites,	**(1)Yes [1]**	**(2)No [0]**
	10. Indoor residual spraying of insecticide can protects one from mosquito bites	**(1)Yes [1]**	**(2)No [0]**
	11. Closing windows and doors at sunset is the way of prevention of malaria	**(1)Yes [1]**	**(2)No [0]**
	12. Covering with blankets when one is sleeping protect him/her from mosquito bite and help to prevent malaria	**(1)Yes [0]**	**(2)No [1]**
	The nature and consequences of malaria *(Yes or No);*		
	13. Malaria causes fever as an important symptom.	**(1)Yes [1]**	**(2)No [0]**
	14. Untreated Malaria can cause death	**(1)Yes [1]**	**(2)No [0]**
	15. The appetite of someone with malaria is usually poor.	**(1)Yes [1]**	**(2)No [0]**
	16. Someone suffering from malaria can vomit	**(1)Yes [1]**	**(2)No [0]**
	17. Malaria can decrease the productivity of the family	**(1)Yes [1]**	**(2)No [0]**

	A school child needs to be protected from having malaria because; (*Yes or No)*		
	18. When the school child gets malaria, he/she is absent from school	**(1)Yes [1]**	**(2) No [0]**
	19. The school child will perform well at school when he/she got malaria	**(1)Yes[0]**	**(2) No [1]**
	20. Malaria can reduce the school performance of the school child	**(1) Yes[1]**	**(2) No [0]**
	21. There may be serious complications including cerebral form of malaria	**(1)Yes[1]**	**(2) No[0]**
	22. Malaria kills children easily;	**(1)Yes [1]**	**(2)No[0]**
	Malaria transmission is more in places noted for *(Choose Yes or No);*		
	23. Having stagnant water in gutters around the house;	**(1)Yes [1]**	**(2)No [0]**
	24. Having bushes around the houses;	**(1)Yes [1]**	**(2)No [0]**
	25. Having properly disposed refuse and wastes;	**(1)Yes [0]**	**(2)No [1]**

SECTION C	**ATTITUDES OF SCHOOL CHILDREN TOWARDS MALARIA AND ITS PREVENTION: MAXIMUM POINTS= 24 MARKS**				
	Kindly answer using these response pattern in the following key: **SA**=Strongly Agree; **A**=Agree; **D**=Disagree and **SD**=Strongly Disagree				
	Statements for Consideration	**SA**	**A**	**D**	**SD**
1.	From what I know about malaria, I am not worried about getting malaria.	**0**	**1**	**2**	**3**
2.	If I am sleeping under bed net, I believe that I will be protected from malaria.	**3**	**2**	**1**	**0**
3.	When using indoor residual spraying, I believe it causes bedbugs and do not protect for malaria	**0**	**1**	**2**	**3**
4.	Malaria is common and merely an inconvenience, just like the common cold and not a problem.	**0**	**1**	**2**	**3**
5.	Everybody gets malaria, I don't think it's a problem	**0**	**1**	**2**	**3**
6.	I believe if I have malaria as often as possible, there will be no consequences on my performance at school.	**0**	**1**	**2**	**3**
7.	I believe traditional herbs are better for treating malaria	**0**	**1**	**2**	**3**
8.	If antimalarial medications are given, I believe they should be continued until finished; even when malaria symptoms disappeared	**3**	**2**	**1**	**0**

SECTION D	Malaria Prevention Practice and treatment seeking behaviour among school children MAX SCORE=30-Points				
	How did you use the following methods of malaria prevention during last 3 months? *Kindly answer using these response pattern in the following key: **NA**=Not at all; **R**=Rarely; **O**=Occasionally and **VO**=Very Often*				
	Statements for Consideration	**NA**	**R**	**O**	**VO**
1.	I Close doors and windows at sunset	0	1	2	3
2.	I sleep under an Insecticide Treated Bed Net.	0	1	2	3
3.	Helping in keeping the surrounding clean (removing open bottles, pots….)	0	1	2	3
4.	I use long protective clothing in the evening to prevent mosquito bites.	0	1	2	3
5.	I help in clearing the bushes in my surrounding and clear the gutters to prevent mosquito breeding.	0	1	2	3
6.	I use the traditional herbs for treating malaria.	3	2	1	0
7.	I use to consult the health center when I feel one of these symptoms like fever, headache, loss of appetite, vomiting, joint or muscle pain	0	1	2	3
8.	I forget to take my antimalarial medication given to me at the health center when malaria symptoms disappear	3	2	1	0

How did you use the following methods of malaria prevention yesterday?

Methods	**Yes**	**No**
9. Sleep under an insecticide treat net (last night)	2	0
10. Closing doors and windows at sunset (last evening)	2	0
11. Wearing long protective clothes (last evening)	2	0

Adapted from Atulomah, Farotimi and Atulomah (2014)

THANK YOU FOR TAKING TIME TO ANSWER THESE QUESTIONS

APPENDIX 2. PARENT LETTER AND PARENTAL PERMISSION FORM

Dear Parent,

Introduction

My name is **Marie Louise UMWANGANGE.** I am a Master Student in Nursing, Pediatric Track at University of Rwanda conducting my Master's research project. I am asking you to let your child participate in this project which will consist of assessment of relationship between malaria knowledge taught at school and attitude and practice of malaria prevention among school children.

Purpose of the study

The purpose of the project is to know if the knowledge of children gained at school during social studies course may influence their attitude and practice towards malaria prevention and be able to take decision on additional malaria information for school children.

Description of study procedures

The child is expected to be in the study for 20–40 minutes. There will be an interview asking the knowledge, attitude and practice of school children towards malaria prevention. The interview scores will not affect your child's classroom grades and your child's name will not be recorded on the test and will be therefore anonymous (not identifiable).

Confidentiality

Confidentiality will be assured as no names will appear on the interview scheduled guide at any stage of data collection as they will be coded. Signed consent forms will not be attached to instruments to ensure anonymity. If you are willing to let your child participate, a consent form will be signed to indicate acceptance. Data will be stored in a locked cabinet and not be accessible to any other person other than the investigator.

However, absolute confidentiality cannot be guaranteed and personal information may be disclosed if required by the law. The study staff will have access to all the information collected in this study. In addition, there are organizations that may inspect or copy your research records for quality assurance and data analysis and these include the institutional review board (IRB). Furthermore, all documents for the study will be destroyed after 5 years of study completion.

Right to refuse or withdraw from the study

Participants are allowed to refuse or withdraw at any stage of the study. Also, you will have the option of not letting your child in participating in any part or the full interview, without any adverse consequences on your treatment at the study facility.

Benefits of participating in the study

School children who will participate in this study will have additional education on malaria prevention.

Risks expected in the study

There are no risks to your child for participating in this project and the participation is voluntary.

Contact details

For further information or reporting of study related adverse events, contact me or my supervisor on the following address and numbers:

University of Rwanda

College of medicine and Health Sciences

School of Nursing and Midwifery

Kigali, Rwanda

Marie Louise UMWANGANGE: 0788773166

Dr Geldine Chironda – 0250 789924956.

For any concern about this project, please contact

College of Medicine and Health sciences

Institutional Review Board chairperson on 0788490522

Or Deputy Chairperson on 0783340040.

If you agree that your child could participate in this project, please sign the consent form attached.

Parental permission form

I……..give voluntary permission to my child…… to participate in the research project "Relationship between course based malaria knowledge, attitude and practices towards malaria prevention among school children: A study of one public school in Rwanda". I understand that the project will provide additional malaria information to school children depending on study findings and will improve my child's practice of malaria prevention.

……. Date: 2017

Parent or legal guardian signature

……

Date and signature of the researcher

APPENDIX 3. CHILD ASSENT FORM

I……..give voluntary permission to participate in the research project "Relationship between course- based malaria knowledge, attitude and practices towards malaria prevention among school children: A study of one public school in Rwanda". I understand that the project will help school children to have additional information on malaria depending on study findings and will help me to change my practice of malaria prevention. I understand that the scores of the interview will not affect the classroom grades and will be kept without names.

……

Child's signature and date

…….

Researcher's signature and date

APPENDIX 4. REQUEST TO CONDUCT THE STUDY

APPENDIX 5. PERMISSION TO CONDUCT THE STUDY

APPENDIX 6. INSTITUTIONAL REVIEW BOARD (IRB) APPROVAL