

**ASSESSMENT OF KNOWLEDGE, ATTITUDE AND USE
OF INSECTICIDE-TREATED NETS AMONG
STUDENTS IN BOARDING SECONDARY SCHOOLS
IN IGEMBE DISTRICT, KENYA**

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award of the Degree of Master of Public Health and Epidemiology in
the School of Public Health of Kenyatta University**

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Declarations

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

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Dedication

I dedicate this work to my mother Teresia, my wife Doris, and my children Daisy,
Ezra and Aaron.

Acknowledgement

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ABBREVIATIONS AND ACRONYMS

ACT	-	Artemisin-based Combination Therapy
AFRO	-	Regional Office for Africa
AIDS	-	Acquired Immunodeficiency Syndrome
CDC	-	Centre for Disease Control
HIV	-	Human immunodeficiency virus
IPT	-	Intermittent Preventive Treatment
ITNs	-	Insecticide-Treated Nets
KNMS	-	Kenya National Malaria Strategy
MoH	-	Ministry of Health
MoPHS	-	Ministry of Public Health and Sanitation
RBM	-	Roll Back Malaria
SAMC	-	Southern Africa Malaria Control
SP	-	Sulfadoxine-pyrimethamine
SPSS	-	Statistical Package for Social Sciences
TB	-	Tuberculosis
UNDP	-	United Nations Development Programme
WHO	-	World Health Organization

ABSTRACT

Malaria is a major public health problem causing immeasurable human suffering in many countries particularly in the sub-Saharan Africa, which account for about 90% of malaria cases in the world. Many people live in countries with high risk of contracting malaria and 300-500 million cases of malaria are estimated to occur annually. Malaria is transmitted to people of all ages and an estimate of 80% of human-mosquito transmission comes from over-fives with young adolescents forming the peak age group. Over the years malaria has emerged as serious threat to poverty reduction and a contributor to poor socio-economic development. In Kenya, malaria remains the leading cause of morbidity and mortality followed by AIDS and TB. Efforts to control malaria are being challenged by emergence of drug and insecticide resistance among other factors. Hence, there is a need to focus on interventions which prevent human contact with the mosquito vector such as the use of ITNs. However, studies have shown that ITN is an effective tool for malaria control. Although, a lot of campaign is being made to promote the use of ITNs WHO has reported low usage of ITNs among students in boarding secondary schools in Ghana, Nigeria, Sudan and Kenya, even in malaria endemic areas. The primary beneficiaries of the donor-driven free distribution of ITNs have been pregnant women and children below five years. Thus failing to target older children, it means malaria transmission is likely to continue. The objective of this study was to assess the students' knowledge on malaria transmission and the use of ITNs for malaria prevention among students in boarding secondary schools. This study was a descriptive cross-section survey and it was carried out in randomly selected boarding secondary schools in Igembe district, Meru County, Kenya. The study focused only on boarders who are admitted or resident of the area for at least one month because naturally acquired malaria has an incubation period of 12-28 days. Three hundred and eighty four students were randomly selected from 5170 learners in ten schools out of 37 secondary schools in Igembe district. Pre-tested, structured self-administered questionnaires, observation checklist and interview guide to guide focused group discussion was used to collect information on demographic characteristics, knowledge, use of ITNs and reasons for non-use of ITNs. Only respondents willing to participate in the study were recruited. Data was analyzed using SPSS. Chi-square test was used to compare differences in proportions between groups. Most respondents 303(79%) were aware that mosquitoes transmit malaria but only a few could identify the causative agent of malaria. Respondents reporting ITN use experienced significantly less episodes of malaria [8(16.6%)] relative to those reporting non-use of ITNs [205(61%)]. This was statistically significant ($p = 0.003$). Cost [172(44.7%)] and availability [81(21.2%)] were the main reasons cited

by most students for non-use of ITNs. Therefore, to protect our youth in boarding secondary schools from malaria attack, ITNs usage should be incorporated into the school health service. The result of this study was used to make recommendations to scale up ITNs usage among the students in boarding secondary schools. This would lead to reduced malaria morbidity and mortality and increase malaria prevention awareness among the students in boarding secondary schools.

CHAPTER 1: INTRODUCTION

1.1 Background

Malaria is an infection caused by coccidian protozoan parasite of the genus *Plasmodium* carried by female *Anopheles spp.* mosquito (Pasvol, 2004). Malaria was thought by Italian writers to be caused by the offensive vapours emanating from the Tiberian marshes (Cook and Zumia, 2003). Later it was found that swamps and pools of water are the breeding sites for the mosquito vector.

Malaria is one of the greatest threats to global health and stability. An estimate of 300-500 million people are infected annually worldwide (WHO, 2007). Malaria cases in Africa account for approximately 90% of all malaria cases in the world (WHO, 2007). Malaria costs Africa more than US\$12 billion every year (WHO, 2007).

In Kenya, malaria remains a major public health problem, a challenge to poverty reduction and a contributor to poor economic development (MOH, 2006). Over 80% of the population (approximately, 28 million people) is at risk of malaria infection (MOH, 2006). Pregnant women and children under five years are worst affected by the scourge, which claims about 34,000 persons every year (MOH, 2006). Further, malaria accounts for 30% of outpatients and 20% inpatients in Kenyan hospitals, both in rural and urban areas (CDC, 2007).

Malaria control has been increasingly recognized as an integral part of comprehensive development framework with a key role in poverty reduction. Following the Roll Back Malaria initiative in 1998 by the WHO, Kenya became a signatory of the Abuja Declaration signed by African Heads of State in April 2000 and committed itself to reduce the malaria burden by 50% by the year 2010. The country developed the National Malaria Strategy (2001-2010) and adopted four main strategic interventions. The components of the National Malaria Strategy include: use of insecticide-treated nets (ITNs), application of indoor residual spraying, early diagnosis of infection, treatment with effective ant-malarial drugs, intermittent preventive treatment of pregnant women, environmental managements, improved housing, increased health education and awareness, epidemic forecasting, improved monitoring and surveillance system and evaluation of programs implementation (KNMS 2001-2010). However, use of ITNs is one of the main strategies of malaria control in all malaria endemic areas (CDC, 2007). If these interventions were to be adapted at the county, district and institutional level, and implemented with sufficient integrity and coverage, and sustained on the national scale, they would greatly reduce malaria morbidity and mortality and promote economic growth and development (KNMS 2001-2010).

1.2 Problem Statement

In Kenya, malaria continues to be the leading cause of death followed HIV/AIDS and TB despite numerous preventive measures (CDC, 2007). However, students

from malaria free-zone are at risk of developing severe malaria because they have low immunity to malaria (Parry *et al.*, 2004). Malaria prevention is complicated by the fact that there are misconceptions regarding the cause and cure for malaria among the students (Elzubier *et al.*, 1997). This reduces the value of using ITNs among the students.

Among school adolescents, malaria is responsible for school absenteeism, poor performance in school, examination failures, school dropouts and even death (Ndifreke *et al.*, 2010). A study carried out in Sri-Lanka to investigate the effect of repeated malaria infections on school performance, it was found out that a child who experiences more than three attacks of malaria, scored approximately 15% less on languages and mathematics compared to a child who experiences less than three attacks of malaria, after controlling for parent's education, monthly family income, and house type (Fernando *et al.*, 2003).

Malaria related illness cause anaemia and impaired school performance. A study to investigate the impact of preventing malaria among school children carried out in Western Kenya, showed that preventing malaria in school children improves academic performance while reducing the rate of infection and anaemia (WHO, 2007).

Also, a study carried out in eighteen African countries by KEMRI/Welcome Trust Research Institute in 2009, revealed that while the ITNs prevented children from getting malaria before the age of five, the older children would not have developed immunity to the parasite and they continued to contribute to the transmission of the disease in the community. The results which are published in the Open Access Journal BMC of Public Health revealed that the primary beneficiaries of the donor-driven free distribution of ITNs have been pregnant women and children below five years. Also, the study revealed that failing to target older children (5-19 years) means that malaria transmission is likely to continue. This is an unintended consequence in the pursuit of the Abuja Declaration and Millennium Development Goals target.

Further, malaria and its health complications are responsible for high rates of absenteeism in the school system each year (Brooker *et al.*, 2000). Malaria infections have a tremendous social and economic impact in the community and they impact negatively on child survival and long term development (WHO, 2007). I, therefore, aimed to assess knowledge, attitude and use of ITNs among the students in boarding secondary schools in Igembe district, Meru County, Kenya.

1.3 Justification

Adults born and living all their lives in malaria-free zone have least immunity to malaria and are just as susceptible to severe malaria as young children below five years (Parry *et al.*, 2004). This is obvious in the case of students from malaria-free

zone schooling (boarding) in a malaria endemic zone.

Malaria causes severe illness and much suffering. Malaria infections range in their level of severity. During an infection with malaria, in addition to fever, a student can suffer from other symptoms such as convulsions, headache, pain in the extremities, anorexia, nausea and other gastrointestinal afflictions such as diarrhea and vomiting (WHO, 2007). The fact that malaria prevents the learners from attending school due to illness jeopardizes child's learning abilities.

There is low usage of ITNs among secondary school students. Past studies in Kenya have shown that less than 5% of students enrolled in boarding secondary schools use ITNs to protect them from mosquito bite even in malaria endemic areas (WHO, 2007).

High cost of malaria treatment and development of drug resistance by the malaria parasite calls for an effective method of malaria control. However, sleeping under ITNs has been identified as one of the most effective method of reducing malaria transmission (CDC, 2007). Thus, focusing on health education on ITNs use and the scaling-up the use of ITNs in boarding secondary schools may lead to reduction in malaria transmission.

Schools provide the most effective and efficient way to reach large portions of the population. Also, students can be reached at influential ages in their lives, during adolescence when lifelong behavioural patterns are formed (SAMC and WHO, 2007).

Furthermore, the government of Kenya has vision 2030, which aims at restructuring the health care delivery system to shift the emphasis from curative to promotive and preventive health care (MoPHS, 2007). This may lead to reduction in malaria transmission.

1.4 Research Questions

The study was guided by the following questions: -

- (a) What proportion of the students in boarding secondary schools in Igembe district know about etiology and transmission of malaria?
- (b) What proportion of the students in boarding secondary schools in Igembe district sleep under ITNs to prevent themselves from mosquito bite?
- (c) What are the main reasons for non-use of ITNs among students in boarding secondary schools in Igembe district?
- (d) What is the influence of schools nurses in promoting the use of ITNs among students in boarding secondary schools in Igembe district?

1.5 Hypotheses

- (a) Students in boarding secondary schools in Igembe district know about malaria

etiology and transmission.

- (b) Students in boarding secondary schools in Igembe sleep under ITNs to prevent themselves from mosquito bite.
- (c) There are no reasons for non-use of ITNs among students in boarding secondary schools in Igembe district.
- (d) School nurses do not influence the use of ITNs among students in boarding secondary schools in Igembe district.

1.6 Objectives

1.6.1 General Objective

To assess knowledge, attitude and the use of ITNs for malaria prevention among students in boarding secondary schools, in Igembe district of Meru County, Kenya.

1.6.2 Specific Objectives

- (a) To determine the knowledge levels of students in boarding secondary schools in Igembe district on the etiology, transmission and prevention of malaria.
- (b) To establish the proportion of students in boarding secondary schools in Igembe district sleeping under ITNs to prevent themselves from mosquito bite.
- (c) To identify reasons for non-use of ITNs among the students in boarding secondary schools in Igembe district.
- (d) To determine whether school nurses promote the use of ITNs among the

students in boarding secondary schools in Igembe district.

1.7 Significance and Anticipated Output

If the findings of this study are implemented there will be increased malaria prevention awareness among students in boarding secondary schools. Increased and sustained use of ITNs will reduce the rate of malaria infection; reduce malaria morbidity among the students and increase school performance. Also, increased use of ITNs will also improve the quality of blood donated by the students (MoH, 2006).

CHAPTER 2: LITERATURE REVIEW

2.1 Etiology and Epidemiology of Malaria

Malaria is a parasitic disease transmitted to humans through a bite of an infected female *Anopheles spp.* mosquito (CDC, 2007). Infection usually results from the bite of infected female *Anopheles* mosquito though it can also be transmitted by the transfusion of infected blood (Parry *et al*, 2004). Malaria in humans is due to infection by one of the four protozoan species belonging to genus *Plasmodium*, namely: *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae* (Roy and May, 1992). *P. falciparum* is the most virulent and the most likely to cause death (WB, 2001). Where temperatures are favorable and humans and mosquitoes co-exist there is the potential for malarial transmission (CDC, 2007). Factors favoring mosquitoes include bushes, garbage heaps, swamps and pools of water that surround residential houses since they are breeding sites for the mosquito vector. Seasonal rainfall dramatically increases the breeding sites for the mosquitoes (Nkuo, 2006).

2.1.1 Global Malaria Distribution

Malaria occurs throughout the tropics and sub-tropics (*Appendix 7*). However, malaria transmission is low at temperatures below 16°C or above 33°C and at altitudes greater than 2000m above sea level because development of the mosquito (*sporogony*) cannot take place. As the temperature rises, the time taken to complete

the parasite's life cycle in the vector shortens. At low temperatures of about 18°C this process takes longer than the average lifespan of the mosquitoes and too few mosquitoes can survive to transmit the disease (Parry *et al.*, 2004). The optimum conditions for transmission are high humidity and ambient temperature between 20° and 30°C (Cook and Zumia, 2003).

The four species of malaria parasite that affect humans differ in the geographic distribution: *Plasmodium falciparum* is most common in Sub-Saharan Africa; *P. vivax* is found mainly in Central and South America, North Africa, the Middle East and within the Indian Sub-continent, *P. ovale* is found predominantly in West Africa but also in Asia, and *P. malariae* occurs worldwide, although most cases occur in Africa (Pasvol, 2004). Each year more than 500 million people are infected with malaria worldwide (WHO, 2007).

2.1.2 Malaria Situation in Africa

Malaria cases in Africa account for approximately 90% of malaria cases in the world. An estimate of 4 million people die of malaria each year with 85% of them being children below five years. Malaria constitutes 10% of the continent's disease burden. It accounts for 40% of public health expenditure, 30-50% of inpatient admission and up to 50% of outpatients visits in areas with high malaria transmission (WHO, 2007). One of the greatest challenges facing Africa in the fight against malaria is that *Plasmodium* has developed resistance to common anti-malarial drugs.

2.1.3 Malaria Situation in Kenya

Malaria remains the leading cause of death followed by HIV/AIDS and TB. The limited amount of resources spent on HIV/AIDS, malaria and TB intervention programmes constraints the quality and the range of social services including education, health care, law and order, water and sanitation, which are often seen as basic rights and essential for human development (CDC, 2007).

2.2 Pathogenesis

Naturally acquired malaria has an incubation period of 13-28 days in case of *P. falciparum* (Cook and Zumia, 2003). The common first symptoms are fever, headache, chills, and vomiting, which appear 10 to 15 days after a person is infected. The clinical symptoms and signs are produced by the asexual forms of the parasite which invade and destroy red blood cells and release many pro-inflammatory cytokines of which TNF- α is thought to be the most important. Production and release of TNF- α could account for the fever leucocytosis, hypoglycemia, acidosis, dyserythropoiesis and even the impaired consciousness observed in malaria (Pasvol, 2004). If not treated promptly with effective medicines, malaria can cause severe illness that is often fatal (WHO, 2007).

2.3 Diagnosis of Malaria

The common definitive diagnosis of malaria is made by prompt microscopic examination of thick and thin blood films. Malarial chemoprophylaxis should be withheld during investigation for malaria because antimalarial drugs can suppress peripheral parasitemia (Pasvol, 2004).

2.4 Therapeutic Modalities

Drug resistance remains the greatest challenge facing Africa in its fight against malaria, as most popular drugs such as *Chloroquine* and *Sulfadoxine-pyrimethamine (SP)* are no longer clinically effective. Recent WHO reports suggest that combination therapy using *Artemisinin* derivatives are the fastest acting fixed-dose combination antimalarial with more than 95% cure rates particularly in multi-drug resistant cases (WHO, 2007).

2.5 Prevention of Malaria

Malaria can be prevented by simple interventions such as continuous use of ITN, indoor spraying and use of mosquito repellants (WHO, 2007). In endemic areas, anti-malaria measures may include: sleeping in properly screened rooms; use of insecticide-treated mosquito nets without holes; wearing of long sleeved clothing and long trousers when outdoor after sunset; use of mosquito repellants; destroying breeding sites for mosquitoes; as well as killing mosquitoes directly by spraying them with insecticide (CDC, 2007). Currently, there are concerted efforts to promote and scale-up three-core malaria control intervention; use of insecticide-treated nets

(ITNs), intermitted preventive treatment (IPT) during pregnancy and in infants, and prompt and effective treatment of clinical cases with ACTs (WHO/AFRO, 2006).

2.6 Insecticide-Treated Bed Nets

A record on the use of mosquito nets dates back to the sixth century B.C. They have been used for decades as protection against nuisance/harmful insects, dust and roof debris falling on sleepers as well as for privacy. However, the application of insecticides to bed nets (mosquito nets) was first used by Russian troops during the Second World War. Insecticide-treated bed nets (ITNs) are now one of the main strategies of malaria control in all endemic areas (Parry *et al.*, 2004). In community wide trials in several African settings, ITNs have been shown to reduce all cause mortality by about 20% (CDC, 2007). The effectiveness of bed nets is greatly enhanced by impregnation with pyrethroid (Abram, 1995).

Currently, only pyrethroid-insecticides are approved for use on ITNs. These insecticides have very low mammalian toxicity. To maintain the efficacy of ITNs, the nets must be retreated at intervals of 6-12 months and more frequently if the nets are washed. Mosquitoes can feed on people through untreated bed nets and nets with even a few small holes provide little, if any protection (CDC, 2007). Constraints on the use of ITNs remain the relatively high cost of the nets and the need to re-impregnate the nets at intervals (Parry *et al.*, 2004).

2.7 Long-lasting ITNs

The need for frequent re-treatment is one of the most difficult barriers to full implementation of ITN use in endemic areas. The additional cost of the insecticide and the lack of understanding of its importance results in very low re-treatment rates. In response, several companies have developed long-lasting ITNs such as Olyset, Permanet and Interceptor that theoretically retain lethal concentrations of the insecticide for 3-5 years (CDC, 2007).

CHAPTER 3: METHODOLOGY

3.1 Study Area

The study was conducted in Igembe district, Meru county, Kenya (Figure 3.1). In 2008, Igembe district was split from Meru-North (Nyambene) district along with Tigania district. The district lies within latitude 0°00' and 0°40' North and longitudes 37°50' and 38°50' East with the Southern boundary lying along the Equator. Administratively, Igembe district comprises of nine (9) divisions which are further subdivided into thirty five (35) locations. It covers an area of 3,942.3 Km² and according to the 1999 population census it had a population of 395,612 persons. The district headquarter is Maua (DPHO, 2007).

IGEMBE DISTRICT

Source: www.kmis.org/epidem.htm
Malaria Endemic Areas in Kenya
K E N Y A

Figure 3.1: Map of the Study Area (Igembe District)

The highest altitude is 1,067m above sea level and the lowest altitude is 610m above sea level which is Eastern side towards Meru National Park. This area has pockets of swamps (120.3Km²) which offer breeding sites for the mosquitoes that transmit malaria. The annual mean temperature is 24.7°C for low altitude (610-700m) and 13.7°C for high altitude especially on the Western slopes of the Nyambene ranges. The rainfall pattern is bi-modal with long rains coming from March to May and short rains in October to December. The lowlands receive leeward rainfall (380-1000mm) annually. This is probably why the prevalence of malaria is so high in the area.

The people of Igembe district are predominantly Bantus (Ameru). Other minority

ethnic groups found mainly in trading centres include Agikuyu, Akamba and Somali.

The main cash crop is miraa (*Catha edulis*) also known as Khat. Trading in this commodity is a boom. This is particularly seen in the sale of banana leaves by the vendors to miraa traders who use the leaves to cover and protect miraa from drying.

There are cases of poverty levels in the district. This includes the landless mostly found in areas with high population density (Laare, Ndoleli and Mutuati divisions) and settlement schemes where they live as squatters. Child labour is common in *miraa* growing areas or in trading centres (Laare, Maua, Kiutine). This means such parents cannot afford to buy mosquito net for their secondary school going children because they are already burdened with high school fees.

In health sector, the most common diseases in order of prevalence are malaria, respiratory tract infections, intestinal worms, rheumatism/joint pains, skin diseases and diarrheal diseases (DPHO, 2007). The doctor-patient ratio is 1:65,620. There are few government health centers thus creating an opportunity for mushrooming of private health clinics in almost every trading centre.

Some of the key health indicators of the district are: crude birth rate 47/1000, crude death rate 26/1000, infant mortality rate 16/1000, literacy level 67%, and poverty level 47%. In terms of health problems, malaria is one of the main health problems

and the leading cause of hospital admissions (DPHO, 2007). The district registers the lowest (16%) ITNs use in the Eastern province (DPHO, 2007).

3.2 The Study Design

This was a cross-sectional descriptive survey of malaria knowledge and prevention practices (especially use of ITN) among students in boarding secondary schools in Igembe district, Meru County, Kenya.

3.3 Target Population

The target population was all the students in boarding secondary schools in Igembe District who have been in the study area at least for the last twelve months.

3.4 Study Population

The study population was randomly selected students from the sampled boarding secondary schools in Igembe District of Meru County, Kenya.

3.4.1 Inclusion Criteria

Only students from randomly selected boarding secondary schools within the study area who have been boarding in the study area at least for the last twelve months and gave consent to participate in the study were recruited.

3.4.2 Exclusion Criteria

Day scholars (if any) and students who did not consent to fill the questionnaire were excluded in the study. Also, newly admitted students with less than two terms were excluded from the study.

3.5 Sample Size Determination

The sample size was determined using Fisher *et al* (1998) formular:

$$n = Z^2 pqD/d^2;$$

Where:

n = desired sample size (for population >10,000),

Z = standard normal deviate (set at 1.96) at 95% CI,

p = expected proportion of students using ITNs (0.5),

$q = 1-p = 0.5$,

d = degree of accuracy desired, in this case 0.05,

D = design effect = 1

$$\rightarrow n = \frac{1.96^2 \times 0.5 \times 0.5}{(0.05)^2} = 384 \text{ respondents.}$$

Therefore, a minimum of 384 respondents were recruited to participate in this study.

3.6 Sampling Procedure

A combination of sampling methods was used in order to select a representative sample. Purposive sampling was used to select the study area. Because Igembe district is malaria endemic zone and malaria cases leads the top-ten health problems

in the district (DPHO, 2007). In addition, a study focusing on mosquito net acquisition, treatment and use by students in boarding secondary schools has not been done in this area.

Using stratified sampling technique, ten boarding secondary schools were randomly selected from all 37 government and privately owned secondary schools in Igembe district with student's population of 13,210. Information about the schools was obtained from the district education office. The ten secondary schools were randomly selected, based on their status as a single-sex school or a mixed school. The schools were grouped into boys-only schools, girl-only schools and mixed secondary schools. For this study, four schools were selected randomly from each of the former two categories, while two were selected from the latter.

Quota-sampling technique (probability proportional to size) was used to get samples from each school and form. Three hundred and eighty four learners were selected randomly to participate in the study. Since the population of each of the ten schools was different, a proportionately representative sample was randomly selected from each of them to reflect their numerical strength. Permission was obtained from the headteachers before embarking on data collection. Five learners were drawn by a systematic random sampling method from each class (80 classes). Informed verbal consent was obtained from the selected learners before participating in the study.

3.7 Data Collection

Data collection was carried out between September and October 2010 using semi-structured questionnaires. The questionnaire included socio-demographic data on the learners and knowledge on malaria and prevention practices. Interview guides and observation check-list were used to verify information given in the questionnaire.

3.7.1 Questionnaires

Pre-tested questionnaires were administered, with the help of the teacher on duty and two research assistants, to the sample population to fill and then collected. Semi-structured questionnaires having both open and closed ended questions were used. The survey questions were structured in open manner, with all possible options provided, including no option. This was to ensure there was no bias at all with the way questions were asked. In total, at least four hundred questionnaires were developed to cater for any extra questionnaire that may be needed. Data collected using questionnaires included gender and class of the respondent, net acquisition/ownership, net use, rate of net treatment, reasons for non-use of ITNs and whether school nurse influence use of ITNs among the students.

3.7.2 Interview Guide

Pre-tested interview guide was used to seek relevant information from school heads and school nurses. The interview lasted for about 10-15 minutes.

3.7.3 Observation Check-list

Pre-tested observation check-list was used to verify the information given in questionnaires such as presence of bed nets, number of dormitories with screened windows, presence of bush or grass around the dormitories and other relevant information.

3.7.4 Data Quality Control

Data quality control was ensured through pretesting of study instruments, self-correcting of obvious errors, and training of the two research assistants involved in data collection as well as briefing the respondents on how to fill the questionnaires. Piloting was also carried out to determine the validity and reliability of the research instruments.

3.8 Data Analysis and Presentation

After data collection, completed questionnaires were checked for obvious errors and raw data from the questionnaires were coded. Ms Excel was used for data entry. Raw data was then summarized in compact form using statistical tables and SPSS was used to analyze the data. Data presentation was done using proportions, percentages, bar-charts and pie charts. Measures of central tendency (mean, median and mode) and standard deviation were calculated. 2 x 2 contingency tables and Chi-square test were used to test the hypotheses. Chi-square test is appropriate for analyzing categorical data because no assumptions are made about the distribution of the scores.

3.9 Variables

Independent Variables in this study include: type of the school (public/private), gender of the respondent (boy/girl), class of the respondent and factors that affect the net use among the students in boarding secondary schools. Dependent variables include number of students sleeping under ITNs, rate of net treatment and factors affecting the use of ITNs.

3.10 Logistical and Ethical Consideration

Data was collected during third term in the month of September and October, 2010. Permission was sought from the Department of Public Health, Kenyatta University; Igembe District Education Office and from the heads of school where samples were obtained. Participation of students was voluntary; no student was forced to participate in the study. Confidentiality of the information provided by informants was guaranteed.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Demographic and Socio-economic Characteristics of the Study Population

A total of 384 administered questionnaires were returned, giving a response rate of 100%. Of the respondents, 212 (55.2%) were males while 172 (44.8%) were females. The age of respondents ranged from 13 to 20 years, while the mean age was 14.4 (s.d.±4.6) years. Low net use was noted among the students whose parent/guardian was unemployed. Only 8.0% of students whose parent(s)/guardian was unemployed had ITNs compared with students whose parent(s)/guardian had either formal employment 21 (15.1%) or business 13 (18.6%). Default from the net use was more frequent among the male students at 192 (90.6%) as opposed to the female students

at 144 (83.7%) (Table 4.1).

Table 4.1: Demographic and Socio-economic Characteristics of the Study Population

VARIABLE	ITN USAGE,	ITN NON-USAGE,	<i>p</i> = 0.003
	48 (12.5%) NUMBER (%)	336 (87.5%) NUMBER (%)	
Age (yrs):			
12-14	10 (7.8 %)	118 (92.1 %)	<i>p</i> = 0.007
15-17	17 (12.5 %)	119 (87.5 %)	
18 - 20	21 (17.5 %)	99 (82.5 %)	

Gender:			
Male	20 (9.4 %)	192 (90.6 %)	$p = 0.006$
Female	28 (16.4 %)	144 (83.7 %)	
Parent/guardian's			
Occupation :			
Unemployed	14 (8.0 %)	161 (92.0 %)	$p = 0.004$
Formal employment	21 (15.1 %)	118 (84.9 %)	
Business	13 (8.6 %)	57 (81.4 %)	

4.2 Knowledge of Malaria Causation and Transmission

There is a misconception regarding the cause and transmission of malaria among the students in boarding secondary schools. According to the survey, 91 % of the respondents confused causative agent for malaria with the mode of transmission (Figure 4.1). Only 12 (3.1 %) of the surveyed students identified the malaria causative agent (*Plasmodium spp.*). Other respondents mentioned mosquitoes 253 (65.9 %), bacteria 54 (14.1 %), virus 19 (4.9 %), witchcraft 9 (2.3 %), and 37 (9.6 %) did not know the causative agent for malaria (Figure 4.1). This misconception affected health seeking behavior as most victims are likely to aim to avoid mosquito-contact yet the parasite is causing more harm in their bodies.

Figure 4.1: Students' Knowledge on Causation of Malaria

Table 4.2: Students' Knowledge on Cause, Transmission and Prevention of Malaria

VARIABLE	CATEGORY	FREQUENCY (%)
CAUSATIVE AGENT	Mosquitoes	253 (65.9 %)
	Plasmodium	12 (3.1 %)
	Bacteria	54 (14.1 %)
	Virus	19 (4.9 %)
	Witchcraft	9 (2.3 %)
	Do not know	39 (9.6 %)
MALARIA TRANSMISSION	Mosquito bite	303 (79.0 %)
	Dirty Water	27 (7.0 %)
	Eating Sheep Meat	38 (10.0 %)
	Do not know	15 (4.0 %)
METHODS USED TO PREVENT MALARIA	Use local herbs	23 (6.0 %)
	Use mosquito repellants	58 (15.0 %)
	Wear long sleeved clothing	84 (22.0 %)
	Take No Action	219 (57.0 %)

Concerning the mode of transmission of malaria, 303 (79 %) of the respondents were aware that malaria is transmitted through mosquito bite (Figure 4.2). Other modes of transmission mentioned by the respondents were drinking dirty water 27 (7 %), eating sheep meat 38 (10 %) and 15 (4 %) of the respondents did not know how malaria is transmitted.

Figure 4.2 Students' Knowledge on Malaria Transmission

Regarding the common symptoms, information was scanty. Only 24 % of the students could identify all the common signs and symptoms of malaria. Thirty per cent of the students mentioned sweating at night, joint pains (15.7 %), vomiting (14 %), fever (12.5 %), and do not know (4 %).

Four in every ten respondents (44 %) said they have suffered from malaria more than three times in the last 12 months before the survey, 3 times (36 %), 2 times (15 %), and once (4 %). Majority of the respondents obtained treatment in private clinics (66 %), government health facility (24.6 %), school dispensary (16.4 %), and used local herbs (9 %). The mean cost for treatment at a private clinic was Kshs.760.00 compared with Kshs. 160.00 that it would cost to be treated in government health facility.

Respondents differed greatly on the main source of their knowledge of malaria prevention. In total, 132 (34.4 %) had heard about it over the radio, 81 (21.1 %) through the television, 27 (7.1 %) from health care providers such as nurses and doctors, 40 (10.4 %) from newspapers, 30 (8.6 %) from teachers and friends, while 74 (19.3 %) had heard about malaria from their parents.

The finding from this study reveals that there are gaps in knowledge of malaria etiology. Although most respondents 303 (79 %) were aware that malaria is transmitted through a bite of infected female *Anopheles spp.* mosquito, only a few 12 (3.1 %) of the respondents identified the acceptable causative agent of malaria as *Plasmodium spp.* (protozoan parasite of red blood cells). Other respondents were of the opinion that the disease is caused by viruses and bacteria. This is a serious knowledge gap and is similar to the findings of Ndifreke and Abraham (2010) which

also revealed a lack of or poor knowledge on the cause and transmission of malaria. among school adolescents of coastal community in Calabar, Nigeria.

In a fairly literate population such as the one used for this study, the findings that only 12 (3.1 %) respondents were able to identify causative agent of malaria as *Plasmodium spp.* shows a wide knowledge gap that need to be filled. The reason for the absence of this knowledge in this study is probably because of low capacity of teachers informed about malaria causation or an inadequate content of health education in the curriculum for teaching of primary and secondary school children.

The radio, television and parents constituted the main sources of information on malaria prevention. Teachers were a source of information on malaria prevention for only about one-tenth of the adolescents. This very low percentage of representation of teachers is in contrast to the 47.4 % found among school children in Tanzania. These findings suggest the need to empower school teachers with health information so that such information could be passed on to the learners.

4.3 Use of ITNs for Malaria Prevention and Control

Overall, 336 (87.5 %) of the respondents did not have mosquito net (Figure 4.3) and only 18 (37.5 %) of the students having ITNs slept under the net to protect themselves from mosquito bite. Gender analysis showed that boys 192 (50.0 %)

compared to girls 144 (37.5 %) did not have ITNs (Table 4.3). Twenty six (54.0 %) of the students having the net, did not know whether the net is treated with insecticide or not although some students were using well known insecticide treated bed nets such as *Olyset* which had labels.

Table 4.3: Use of ITNs for Malaria Prevention and Control

Variable	Use ITN	Do Not Use ITN	Totals (%)
	Frequency (%)	Frequency (%)	
Boys	20 (5.2)	192 (50.0)	212 (55.2)
Girls	28 (7.3)	144 (37.5)	172 (44.8)
Totals	48 (12.5)	336 (87.5)	384 (100.0)

Figure 4.3: Students' Overall Use of ITNs

Although 54 (14 %) of the respondents use of ITNs at home to prevent mosquito bite, only 48 (12.5 %) and 50 (13 %) use ITNs in school and both at home and in school respectively. Only 27 (7 %) of the survey students consistently use the ITNs every night to prevent mosquito bite, and the remaining 15 (4 %) of the respondents were just keeping the net in the box either due to lack of support to hang the net 12 (3 %) or fear of losing the net to other students 4 (1 %). Therefore, the number of students in boarding secondary schools sleeping under ITNs to prevent mosquito bite is very insignificant ($X^2 = 3.84$; $df = 1$; $p = 4.068$).

It was evident that class of the student did not show any significant relationship with

ITNs use. This implies that knowledge on malaria among the students is almost the same. This is in line with the study carried out in western Kenya by Odenyo T. O (2005) to assess the knowledge, attitude and practices towards malaria prevention and control among the primary school children in Busia District, Kenya. However, this is due to the fact that most students have a pre-exposure to malaria.

This study shows that only 12.5 % of the respondents use ITNs to protect themselves from malaria. When this number was extrapolated among the entire population of boarding students in the district, the figure of ITNs users was even lower. Again, assuming this was projected to the entire country, the number of students using an ITN will be quite insignificant. This low percentage agrees with that found by Edson and Kayombo (2007) in their study, which found that only 17.6 % of school children used ITNs, in Kyela district, South-western Tanzania.

Also, the current users of ITNs reported a marked reduction in frequency of clinical episodes of malaria attack compared to non-ITN users. Users of ITNs reported 19 episodes compared to 61 episodes among the non-ITN users in the last 12 months. This was statistically significant ($p = 0.003$). This agrees with the study by Aliyu and Alti-Mu'azu (2009) which found that most of the students who used ITNs noticed a significant reduction in malaria episodes in the last 12 months. Therefore, public health education must be strengthened to re-enforce ITNs use.

4.4 Reasons for Non-use of ITN among the Students

Most students identified the cost of the net 172 (44.7 %) as the main reason for not using ITNs while in school (Table 4.4). Other reasons mentioned by the respondents for not using the ITN were: availability 81 (21.2 %), lack of place to hang the net 31 (8.0 %), fear of losing the net to other students 40 (10.4 %), malaria is not a serious problem 42 (11.0 %) and other reasons 18 (4.7 %) (Figure 4.4).

Table 4.4: Reasons for Non-use of ITNs

Reason	Frequency (%)
Cost	172 (44.7)
Availability	81 (21.2)
Lack of Place to Hang the Net	31 (8.0)
Fear of Losing the Net	40 (10.4)
Malaria is Not a Serious Problem	42 (11.0)
Others	18 (4.7)
TOTAL	384 (100.0%)

Figure 4.4: Reasons for Non-use ITN among the Students

Lack of money to buy the net (44.7%) was mentioned frequently as the main reason for non-ownership of ITN. This was in agreement with the findings of Muula and Misiri (2004) which found that more than 63.7% of school children were not using ITN due to lack of money to buy the net, in peri-urban Blantyre, Malawi.

Chi-square analysis showed that there was significant relationship between net use and the cost of the net, availability, lack of place to hang the net and also fear of losing the net to other students especially among the students in lower classes (all had $p < 0.05$). Therefore, the study found that there is enough evidence to believe that these are the main reasons for non-use of ITNs among the students in boarding secondary schools. Hence, there was urgent need to make ITNs accessible to students willing to use them and those that are not willing to use ITNs should be encouraged to use them.

Using observation check-list, no dormitory was screened for mosquitoes. Also, casual observation revealed that most of the nets were old and torn especially in boys' dormitories.

When asked how serious malaria was a problem in their school, as many as 189

(49.0 %) of the surveyed students said it is very serious. Others mentioned serious 153 (40.0 %) and not serious 42 (11.0 %) respectively (Table 4.5).

Table 4.5: Malaria Burden as per Students' Opinion.

Response	Frequency (%)
Very Serious	189 (49.0)
Serious	153 (40.0)
Not Serious	42 (11.0)

As a control measure, 315 (82 %) of the students indicated that ITNs are necessary in boarding secondary schools. To ensure that ITNs are available to all willing to use them, 146 (38 %) of the students said government should provide free ITNs, 88 (23 %) said parent/guardian should buy the ITNs, and 134 (35 %) said ITNs should be provided in school as part of boarding facility.

However, 344 (89.6 %) of the respondents were optimistic that consistent use of ITNs which are regularly re-treated with insecticides can greatly prevent and control malaria. When asked whether they agree with the statement “**Consistent and proper use of ITNs which are regularly re-treated with insecticides can greatly prevent and control malaria**” 138(36 %) students strongly agreed, 196 (51 %) agreed, 42 (11 %) disagreed, and 8 (2 %) strongly disagreed with the statement (Figure 4.5).

Figure 4.5: Proportion of Students in Agreement that Use of ITNs can Prevent Malaria

Apart from using the net to prevent mosquito bite, 6 % of the students surveyed said they use local herbs, 15 % use mosquito repellants, 22 % wear long sleeved clothing at dawn and after sunset, and 57 % take no action all (Figure 4.6).

Figure 4.6: Actions Taken by the Students to Prevent Mosquito bite, apart from the Use of ITNs

4.5 Influence of School Nurse on the Use of ITNs among the Students

Although most schools had a school nurse, only eight (2.1 %) students were constantly using ITNs from the schools with a school nurse (Table 4.6). According to the respondents, rarely (7.3 %) does the school nurse encourage the learners to use the ITNs. This is clear evidence that the school nurses do not influence the use of ITNs among the students. It has been noted that most clinicians maintained that their job is to treat malaria and not to control mosquitoes (Aliyu and Alti-Mu'azu, 2009). The survey reviewed that the number of school with nurses promoting the use of ITNs among the students was very insignificant. Therefore, all members of the health team should know more about ITNs and be in a position to encourage their use. On that line, school nurses should assist the students to know what an ITN is, where to get one, how long to use before re-treating it, and what to do if one is not available.

Table 4.6: Influence of School Nurse on the Use of ITNs

	USE ITN	DO NOT USE ITN
With Nurse	8 (2.1 %)	32 (8.3 %)
Without Nurse	40 (10.4%)	304 (79.2 %)
Total	48 (12.5%)	336 (87.5 %)

($X^2 = 2.2963$, $df = 1$, $p = 0.210$)

Southern African Malaria Control (SAMC) in partnership with the WHO (2005) recommended the need for both primary and secondary schools to have a school health person such as a nurse. In most schools, from focused-group discussion, sick learners were permitted to seek treatment outside the school compound. As result, the learner may miss class several days as they are likely to be admitted or go home instead of going back to school. Also, others are likely to fake sickness in order to get permission to go out of the school. At the end there is a decline in academic performance of the affected learners.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study showed that a good number of students in secondary schools in the study area were knowledgeable about malaria transmission but there are knowledge gaps on the causative agent of malaria. These gaps must be filled by empowering teachers with information about malaria causation and prevention strategies so that such knowledge could be passed on to the learners.

The use of ITNs for malaria prevention among the students was quite low with most

respondents citing cost and availability of ITNs as the main reasons for non-use of ITNs among the students. Chi-square analysis reviewed that there is no significant relationship between having a school nurse and use of ITN ($X^2 = 2.2963$, $df = 1$, $p = 0.210$). Therefore, I failed to reject null hypothesis that having a school nurse as no effect on the use of ITNs.

ITNs use should be incorporated into the school health services. Owing to the fact that, malaria can be prevented by simple interventions and schools can serve as a gateway to teaching prevention measures that can be carried out by the students for life and shared within the community. Students need to acquire positive attitudes such as believing that using an ITN is a good way of preventing mosquito bite that can spread malaria, believing that obtaining and using an ITN is worth the effort, believing that hanging insecticide treated materials such as curtains on windows or doors is also a good investment of time and energy. Also, students need the skill to convince their parents/guardians to obtain ITNs for them, know how to use an ITN effectively, safely treat a net with insecticide and use mosquito repellent or wear protective clothing when an ITN is not available

5.2 Recommendations

To reduce malaria burden among the students in boarding secondary schools, I make the following recommendations:-

1. To meet Kenya's government vision 2030 and Millennium Development

Goals (MDGs) on malaria, the County governments should make ITNs available, affordable and sustainable among the students in boarding secondary schools. Each student should be provided with an ITN and encouraged to sleep under it every night to prevent mosquito bite.

2. To bridge the knowledge gaps on malaria etiology and transmission malaria education should be introduced in the school syllabus. Teachers should provide simple messages to develop necessary life skills related to malaria recognition, management and prevention.
3. The teachers should encourage the students to use mosquito repellants, if available, and other locally recommended and available methods of personal protection.
4. To help students acquire knowledge, attitude and skills that are relevant to ITN use, health educators should assist the students to know what an ITN is, how long to use it before replacing or re-treating it, and what to do if one is not available.
5. Boarding schools should encouraged to provide ITNs and screens on dormitory doors and windows to prevent entry of mosquitoes.

5.3 Recommended Further Research

Given the fact that students in boarding secondary schools are victims of malaria attack and the cost is the main factor limiting use of ITNs among the students, it is worthy studying the most cost-effective method of distributing ITNs among the

students in boarding secondary school.

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APPENDIX 1: QUESTIONNAIRE

INTRODUCTORY LETTER

Kenyatta University,
School of Health Sciences,
Department of Public Health,
P.O. Box 43844,
NAIROBI.

June, 2010.

Dear Respondent,

RE: COLLECTION OF SURVEY DATA

I am a postgraduate student at Kenyatta University, School of Health Sciences. In order to fulfill the Masters Degree requirement, I am undertaking research project on malaria. The study is entitled: ***"Use of Insecticide-Treated Nets for Malaria Prevention Among the Students in Boarding Secondary Schools in Igembe District, Kenya"***. The purpose of this study is to collect data that will assist to scale-up ITN use in boarding secondary schools in order to prevent and control malaria.

You have been selected to form part of this study. This is to kindly request you to assist me collect the data by filling out the accompanying questionnaire.

The information data you provide will be exclusively for academic purposes. My supervisor and I assure you that the information you give will be treated with strict confidence. At no time will you or your organization's name appear in my report. Your cooperation will be highly appreciated.

Yours faithfully,

DANIEL M. KINYUA
Student.

QUESTIONNAIRE

NOTE: INSTRUCTIONS

- i) *Tick or write appropriate answer in the space provided*
- ii) *Do not read out answers to the respondents*
- iii) *Include all the answer not categorized*
- iv) *The respondent should not discuss or answer questions in groups*

SECTION A: BACKGROUND INFORMATION

1. What is the name of your school?

2. Type of school. Please tick.

(a) Private [] (b) Public []

3. Category of the school. Please tick.

a) Boys boarding secondary school []

b) Girls boarding secondary school []

c) Mixed boarding secondary school []

4. What is the number of students in your school?

- (a) < 100 [] (b) 101-200 []
 (c) 201-300 [] (d) 301-400 []
 (e) 401-500 [] (f) > 500 []

5. How many dormitories are there in your school?

- (a) 1-2 [] (b) 3-4 [] (c) 5-6 [] (d) 7 and more []

6. How dormitories have screened windows to prevent entry of mosquitoes?

- (a) 1 [] (b) 2 [] (c) 3 [] (d) 4 [] (e) All dormitories []
 (f) None []

7. Are you a boy or a girl?

- (a) Boy [] (b) Girl []

8. In which class are you? Please tick.

- a) Form 1 [] (b) Form 2 []
 c) Form 3 [] (d) Form 4 []

9. What is your age in years?

- (a) 11-13 yrs [] (b) 14-16yrs [] (c) 17-19yrs [] (d) Over 20 yrs []

10. What is your religious affiliation?

- a) Catholic [] (b) Protestant []
 c) Muslim [] (d) Non-religious []
 e) Any other (specify)-----

11. What is the occupation of your parents/guardian?

- a) Farming [] (b) Business []
 c) Skilled employment [] (d) Unskilled employment []
 e) Any other (specify) -----

12. What is the estimated income for your family per month?

- a) Kshs. 0 – 5 000 [] (b) Kshs. 5001 – 10 000 []
 c) Kshs. 10 000 – 20 000 [] (d) Above Kshs. 20 000. []

**SECTION B: KNOWLEDGE ON MALARIA AND HEALTH
 SEEKING BEHAVIOR**

13. What do you think causes malaria? (Please tick)

- (a) Mosquitoes [] (b) Cold [] (c) Virus []
 (d) Bacteria [] (e) Protozoa/plasmodium []
 (f) Witchcraft [] (g) Don't know []
 (h) Any other cause (specify)

14. How is malaria transmitted?

- (a) By mosquito bite [] (b) By air []
 (c) By dirt water [] (d) Do not know []
 (e) Any other -----

15. What are the common symptoms of having malaria? (Please tick)

- (a) Fever [] (b) Painful joints []
 (c) Sweating at night [] (d) Vomiting []
 (e) Stomachache [] (f) All the above []
 (g) Don't know []

16. Have you ever suffered from malaria infection? Please tick

- (a) Yes [] (b) No []

17. If yes (in Q16 above), how many times in the last 12 months?

- (a) 1 [] (b) 2 [] (c) 3 [] (d) More than 3 []

18. If yes in Q 16 above, the last time you had malaria did you receive treatment?

- (a). Yes [] (b). No []

19. If yes in Q17 above, where did you obtain the treatment?

- a) School dispensary [] b). Bought drugs from the shop/chemist []
 c) Government health facility [] d) Private clinic []
 e) Local herbs []

20. How much money did you spend on the treatment? Kshs**SECTION C: USE OF ITNs IN MALARIA PREVENTION AND CONTROL****21. Do you sleep under mosquito net to protect yourself from mosquito bite?**

- (a) Yes [] (b) No []

22. If you sleep under the net (in Q21 above), is the net treated with insecticide?

- (a) Yes [] (b) No [] (c) Do not know []

23. If you sleep under the net (in Q21 above), state where you use the net?

- (a) At home [] (b) At school []
 (c) Both at home and school []

24. If you use the net (in Q17 above), do you sleep under the net every night?

a) Yes [] (b) No []

25. If you do not use the net at school give a reason.

- (a) Malaria is not Serious Problem []
- (b) Net is expensive to buy []
- (c) Net is stolen by other students []
- (d) There is no need for using the net []
- (e) There is no place to hang the net in the dormitory []
- (f) Any other (specify)

26. Have you ever heard of insecticide treated nets?

a) Yes [] (b) No []

27. Factors that greatly affect the use and effectiveness of bed nets in schools are: **cost, availability, old nets with holes, size of the bed, and authoritative rules that do not allow usage of bed nets.** Please indicate the extent to which the following factors have adversely affected the usage of nets in your school (**Tick**).

Factors	Greatly affected	Affects	Do Not Affect
Cost			
Availability			
Old nets with holes			
Size of the bed			
Authoritative rules which do not allow nets			

28. Is your net torn/have holes?

(a) Yes [] (b) No []

29. Do you think malaria is a problem in your school?

(a) Yes [] (b) No []

30. If your answer for Q 27 above is yes, how serious is the malaria problem?

- (a) Very serious [] (b). Serious [] (c). Not serious []
 (d) Not applicable []

31. Do you think insecticide treated nets are necessary in boarding secondary schools?

- (a) Yes [] (b) No []

32. If yes in Q 29 above, what can be done to ensure every student uses the net?

- a) School to provide []
 b) Parents to provide []
 c) Government to provide []
 d) Any other (specify)

33. Do you know of an insecticide treated mosquito net (ITN)?

- (a) Yes [] (b) No []

34. If yes in Q33 above, where did you get the information?

- (a) School nurse [] (b) Teachers [] (c) Parents, relatives and friends []
 (d) Mass media (radio, TV, Newspapers) [] (e) Do not remember []
 (f) Others []

35. Do you have a mosquito net in the dormitory?

- (a) Yes [] (b) No []

36. If you have the mosquito net is the net hanged over the bed or you are just keeping it in the box?

- (a) Net hanged over the bed [] (b) Net kept in the box []
 (c) Not applicable (if you have no net) []

37. If you have the net and you are just keeping it in the box, what is the main reason?

- (a) Lack of place to hang the net [] (b) Fear to loss the net []
 (c) No need of using the net [] (d) Any other reason (specify).....

38. If you do not have the mosquito net what are the reasons for not having the net?

- (a) Lack of money to buy the net [] (b) Mosquito nets are expensive []
 (c) They are not available [] (d) No place to hang the net in the dormitory
 []
 (e) Others (specify)
 (f) Not applicable []

39. If you have the net is the net treated with insecticide?

(a) Yes [] (b) No [] (c) Do not know [] (d) Not applicable []

40. If the net is not treated what is the main reason?

- (a) Lack of money to buy insecticide []
 (b) Insecticide is not available []
 (c) You do not know insecticide to use []
 (d) Any other reason.....
 (e) Not applicable (If your net is treated or you do not use the net) []

41. If you have the mosquito net, where did you get the net?

- (a) Came with the net from home []
 (b) Purchased from the near by shop []
 (c) Provided by the school []
 (d) Given free by an NGO dealing with malaria control []
 (e) Not applicable (If no net) []

42. How much did you pay for the net? (Not applicable if you do not have the net).

- (a) Kshs..... (b) Given free [] (c) Not applicable []

43. Does your school have a school nurse?

- (a) Yes [] (b) No []

44. If yes (in Q23 above), does the school nurse encourage you to use insecticide-treated mosquito net to protect yourself from mosquito bite?

- (a) Yes [] (b) No [] (c) Not applicable (If no school nurse) []

45. Do you agree with this statement? “Consistent and proper use of ITNs which are regularly re-treated with insecticides can greatly prevent and control malaria”.

- (a) Strongly agree [] (b) Agree [] (c) Disagree []
 (d) Strongly disagree [] (e) Undecided/neutral []

46. Apart from using nets, what actions do you personally take to prevent yourself from mosquito bite/contact?

- a) Using mosquito repellants []
 b) Wearing long sleeved clothing at dawn and after sunset []
 c) Use local herbs []
 d) No action taken []
 e) Any other (specify)

SECTION D: TYPES OF MOSQUITO NET AND THEIR PREFERENCE

47. Which type of mosquito net do you have?

- (a) Circular net []

- (b) Rectangular net []
- (c) Any other (specify).....
- (d) Not applicable (if you do not have the net) []

48. If you do not have the net which one would you prefer if asked to choose one?

- (a) Circular net []
- (b) Rectangular net []
- (c) Any other (specify).....
- (d) Not applicable (if you have the net) []

49. Why do you prefer the net you have stated in Q43/44 above?

- (a) It is easier to hang [] (b) It is attractive [] (c) It is more available []
- (d) It is cheaper []

50. What is the colour of your mosquito net?

- (a) White [] (b) Blue [] (c) Green [] (d) Yellow []
- (e) Other colour (specify)

51. Which colour of mosquito net would you prefer if asked to choose?

- (a) White [] (b) Blue [] (c) Green [] (d) Red [] (e) Yellow []
- (f) Other colour (specify).....

52. What activities can the school carry out to prevent malaria transmission?

- (a) Ensure all the bed in the dormitories have ITNs []
- (b) Indoor spraying for mosquitoes []
- (c) Window screening for mosquitoes []
- (d) Clearing bushes around the dormitories that serve as mosquito breeding sites[]
- (e) All the above []

53. Please share any other general comments/observation on malaria prevention among the students in boarding secondary schools.

.....
.....

THANK YOU FOR TAKING TIME TO COMPLETE THIS QUESTIONNAIRE

**APPENDIX 2: INTERVIEW GUIDE
(FOR THE SCHOOL HEADTEACHER)**

Hallo Sir/Madam,

I am a post graduate student at Kenyatta University, School of Health Sciences Department of Public Health. In order to fulfill the Masters Degree requirement, I am undertaking a research project on malaria. The study is entitled:

“Use of Insecticide Treated Nets for Malaria Prevention among the Students in Boarding Secondary School, Igembe District, Kenya”.

I have selected your school to form part of this study. This is to kindly request you to assist me collect the data by providing answers to the following questions.

1. Do you think malaria is a health problem in your school?

2.								
3.								
4.								
5.								
6.								
7.								
8.								
9.								
10.								

APPENDIX 4: RESEARCH BUDGET

STAGE	ITEMS AND SERVICES	COST PER ITEM (Kshs)	TOTAL AMOUNT (Kshs)
DEVELOPMENT OF RESEARCH PROPOSAL	Stationery		
	4 reams of foolscaps	@ 500	2000.00
	1 flash disk	@ 2000	2000.00
	1 calculator	@ 2000	2000.00
	5 biro pens	@ 20	100.00
	2 files	@ 150	300.00
	Literature search (internet)		
	Typing, Printing and binding	@ 1000	4,000.00
	Proposal 4 copies	@ 100	400.00

	Questionnaire 4 copies Travelling, accommodation and subsistence		15,000.00
	TOTAL		25,800.00
PILOTING	Stationery 1 reams of foolscaps 20 biro pens 5 files Typing, Printing and photocopying Questionnaire 20 copies Stapler 1 pc Travelling, accommodation and subsistence	@ 500 @ 20 @ 150 @ 100 @ 500	500.00 400.00 750.00 2,000.00 500.00 20,000.00
	TOTAL		24,150.00
DATA COLLECTION	Stationery 5 biro pens 4 files Flash disk 1 pc Photocopying 400 copies of questionnaire 3 copies of guide manuals Travelling, accommodation and subsistence (5 days)	@ 20 @ 150 @ 2000 @ 50 @ 50 @6,000 (per day)	600.00 600.00 2,000.00 20,000.00 150.00 30,000.00
	TOTAL		53,350.00
DATA ANALYSIS	Computer services Travelling expenses		10,000.00 12,000.00
	TOTAL		22,000.00
THESIS PREPARATION	Typing, Printing and binding 4 copies of Thesis Travelling, accommodation and subsistence	@ 1000	4,000.00 10,000.00
	MISCELLANEOUS	@30%of subtotal	41,800.00
	Total		55,800.00
	GRAND TOTAL		181,090.00

APPENDIX 5: RESEARCH SCHEDULE

ACTIVITIES	2011					2013							
	A	S	O	N	D	J	F	M	A	M	J	J	A
PROPOSAL WRITING						√							
PROPOSAL DEFENCE									√				



Figure 1 Malaria - causing mosquito (*Anopheles* spp.)

2.1.1 Global Malaria Distribution.

Malaria occurs throughout the tropics and sub-tropics. However, malaria transmission does not occur at temperatures below 16°C or above 33°C and at altitudes greater than 2000m above sea level because development in the mosquito (sporogony) can not take place. The optimum conditions for transmission

APPENDIX 7: Global Malaria Hotspots. Source: Pasvol, 2004.

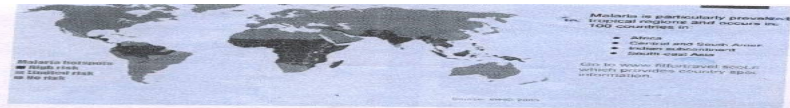


Figure 2 Global Malaria Hotspots

APPENDIX 8: A person sleeping under mosquito net. Source: CDC, 2007.

Untreated bed nets form a protective barrier around persons using them. However, mosquitoes can feed on people through the nets, and nets with even a few small holes provide little, if any, protection. The application of a residual insecticide greatly enhances the protective efficacy of bed nets. The insecticides used for treatment kill mosquitoes and other insects. The insecticides also have repellent properties that reduce the number of mosquitoes that enter the house and attempt to feed. In addition, if high community coverage is achieved, the numbers and longevity of mosquitoes will be reduced. When this happens, all members of the community are protected, regardless of bed net ownership. To achieve such effects, high community coverage is required, as for indoor residual spray.



Insecticide-treated bed nets (ITNs) are now a major intervention for malaria control.