MALARIA PREVALENCE AND RAPID ASSESSMENT OF INSECTICIDE TREATED NETS COVERAGE USING PRIMARY SCHOOL CHILDREN IN LINDI MUNICIPAL, TANZANIA.

By

Hussein Juma Athuman, DDS

A dissertation Submitted in Partial fulfillment of the Requirements for the Degree of Master of Science in Tropical disease control of Muhimbili University of Health and Allied sciences

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***Malaria prevalence and rapid assessment of insecticide treated nets coverage using primary school children in Lindi municipal, Tanzania,*** in (Partial) fulfillment of the requirements for the degree of Master of Science in Tropical Disease Control of Muhimbili University of Health and Allied Sciences.

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Prof. Zul. Premji

(Supervisor)

Date_____

DECLARATION AND COPYRIGHT

I, **Hussein Juma Athuman,** declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature_____ **Date**_____

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This dissertation is dedicated to my ever loved late father, Juma Athuman Juma and late brother Ally Juma Athuman, their wisdom and prayers have made me the man who I am.May His Almighty God be pleased with them and rest their souls in the heaven.

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LIST OF ABBREVIATIONS

BCC – Behavioural Change Communication

CDC – Centers for Disease Control and Prevention(United States of America)

CI – Confidence Interval

DRC – Democratic Republic of Congo

DSM – Dar es salaam

GDP - Gross Domestic Products

HIV – Human Immunodeficiency Virus

IRS – Insecticide Residual Spraying

IPTp – Intermittent Preventive Therapy for Pregnant Women

ITN – Insecticide Treated Nets (bednets)

LLINs – Long Lasting Insecticide Treated Nets

MDG – Millennium Development Goal

MEO – Municipal Education Officer

MMO – Municipal Medical Officer

MOHSW – Ministry of Health and Social Welfare

mRDT – malaria Rapid Diagnostic Test

MSc – Master of Science

MUHAS – Muhimbili University of Health and Allied Sciences

NMCP - National Malaria Control Program

OR – Odds Ratio

PE – Parasitology and Medical Entomology

RAS – Regional Administrative Secretary

RDT – Rapid Diagnostic Test

RBM – Roll Back Malaria Initiative

RMO – Regional Medical Officer

SSA – Sub Saharan Africa

TDC – Tropical Disease Control

THMIS – Tanzania HIV and Malaria Indicator Survey

U5CC – Under five Catch-up Campaign

UCC – Universal Coverage Campaign

UDSM – University of Dar esalaam

UN – United Nations

WHO – World Health Organization

DEFINITION OF TERMS

Appropriate knowledge is the ability to respond correctly to questions on malaria transmission and prevention.

Household refers to the people sharing the same cooking pot for their meal

ITNs/LLINs are personal protective materials (nets) that are put around sleeping places to prevent against mosquito bite and other vectors. In this study they may also include untreated nets.

Malaria is a disease caused by the parasite of the genus *Plasmodium* that is transmitted by the female *Anopheles* mosquito.

Pupils means the children at the age of studying primary school

Prevalence: - Proportion of a population that is affected by disease at a given time.

ABSTRACT

Background: Governments in sub-Sahara Africa are investing substantially in scaling-up treated mosquito net coverage for impact. Under the Insecticide Treated Nets (ITNs/LLINs) programme, a total of 27 million LLINs have been distributed by from 2009 to 2011 in Tanzania. During the same period, roughly 5.4 million nets will have been distributed through the Tanzania National Voucher Scheme to pregnant women and infants.

Currently monitoring and evaluation of such malaria interventions in Tanzania is mainly based on periodic household surveys in which under-five children and pregnant women form the sample population. But, these surveys are expensive, time consuming and labour intensive, and generally only undertaken every 3-5 years and therefore not ideal for routine monitoring at local levels. A cheaper and rapid complementary approach would be to use the existing school system for school-based malariometric surveys.

Study objectives: This study aimed at determining the malaria prevalence and rapidly assessing the population on ITN use using the primary school children in Lindi municipal.

Methodology: A cross sectional study was conducted from March to June 2013 in Lindi municipal. Structured questionnaires were used to get information on ITN use, knowledge on malaria and its control. Blood samples were taken to determineparasite prevalence. Furthermore households were visited to assess the real situation of ITN coverage and use. The data obtained was entered into and analysed by SPSS computer software.

Results: The overall prevalence of ITN use by school children was 90.6%, this prevalence was significantly higher urban part of the municipal 97.9% (188/192) than in peri-urban 87.0% (335/385). Malaria prevalence was 9.9%(57/577) (by mRDT). This prevalence was significantly higher in peri-urban 14.0% (54/385) compared to the urban 1.6% (3/192) {P value 0.00}. There was no difference in information obtained from the school and that from the households' survey regarding ITN.

Conclusion: Primary school children may be used to rapidly assess ITN use by them and under-fives in the community while at their schools. Malaria prevalence was relatively lower compared to those given by the previous studies

CHAPTER ONE: INTRODUCTION

1.1. BACKGROUND

The word ‘malaria’ comes from the Italian, and means literally ‘bad air' because people at that time thought the disease was caused by foul air emanating from in marshy areas (Cook et al., 2003). It was not until 1880 that scientists discovered that it was a parasitic disease which is transmitted by the *Anopheles* mosquito.

Malaria is an infectious disease of man and other animals caused by parasites of the genus *Plasmodium*, transmitted by the female mosquito of the genus *Anopheles.* Five species of *Plasmodium* can infect and be transmitted by humans. The vast majority of deaths are caused by *P falciparum* while *P. vivax*, *P.ovale*, and *P. malariae* cause a generally milder form of malaria that is rarely fatal. The zoonotic species *P. knowlesi* causes malaria in macaques but can also cause severe infections in humans (CDC, 2012).

Out of the 42 currently documented mosquito genera, only one genus has been found to have the ability to transmit human malaria. This genus is *Anopheles* mosquitoes (Warrell and Gilles, 2002). The most important vectors of *Plasmodium* in Africa are *Anopheles gambiae* complex (WHO, 2010). These vectors, though distributed in different parts of the world, they are not found in temperatures below 16ºC or above 33 ºC or altitudes above 2000m (Cook et al., 2003). This has been demonstrated in Iringa Tanzania, where by, the malaria parasites were not found in school children living at two villages located in altitudes of 1917m and 2075m (Mboera et al., 2008). The optimum conditions for transmission are high humidity and an ambient temperature between 20ºC and 30°C.

The natural ecology of malaria involves malaria parasites infecting successively two types of hosts, the female *Anopheles* mosquitoes, the definitive host where the sexual development occurs and the mammal, the intermediate host where asexual reproduction takes place (Warrell and Gilles, 2002). During a blood meal, a malaria-infected female *Anopheles* mosquito inoculates sporozoites into the human host. Sporozoites infect liver cells and mature into schizonts, which rupture and release merozoites. (Of note, in *P.*

vivax and *P. ovale* a dormant stage [hypnozoites] can persist in the liver and cause relapses by invading the bloodstream weeks, or even years later). According to Warrell and Gilles (2002) this stage takes 5.5-7 days in *P falciparum* infection while in *P. malariae* takes up to16 days. After this initial replication in the liver (exo-erythrocytic schizogony), the parasites undergo asexual multiplication in the erythrocytes (erythrocytic schizogony). Merozoites infect red blood cells. The ring stage trophozoites mature into schizonts, which rupture releasing merozoites. Some parasites differentiate into sexual erythrocytic stages (gametocytes). Blood stage parasites are responsible for the clinical manifestations of the disease (CDC 2012).

The gametocytes, male (microgametocytes) and female (macrogametocytes) are ingested by an *Anopheles* mosquito during a blood meal. The parasites' multiplication in the mosquito is known as the sporogonic cycle, which takes place between 8 and 35 days depending on the ambient temperature, species of the parasite and mosquito. While in the mosquito's stomach, the microgametes penetrate the macrogametes generating zygotes. The zygotes in turn become motile and elongated (ookinetes) which invade the midgut wall of the mosquito where they develop into oocysts. The oocysts grow, rupture, and release sporozoites, which make their way to the mosquito's salivary glands. Inoculation of the sporozoites into a new human host perpetuates the malaria life cycle (CDC, 2012).

Malaria is one of the diseases of public health concern in the world. According to the World Malaria Report (2011), there were 216 million episodes of malaria in 2010, of which approximately 81%, or 174 million cases, were in the African Region about 91% being due to *P. falciparum*). The vast majority of cases (81%) were in the African Region followed by the South-East Asia (13%) and Eastern Mediterranean Regions (5%).

In year 2010, there were 655 000 malaria deaths worldwide compared to 781,000 in 2009. It has been estimated that 91% of deaths in 2010 were in the African Region, followed by the South-East Asia (6%) and Eastern Mediterranean Regions (3%). About 86% of deaths globally were in children under 5 years of age (World Malaria Reports,

2010, 2011). More deaths in individuals aged 5 years or older has been estimated in a systematic analysis of global malaria mortality between 1980 and 2010: 435 000 (307 000—658 000) deaths in Africa and 89 000 (33 000—177 000) deaths outside of Africa in 2010 (Murray et al., 2012).

In Africa, nineteen countries – Rwanda, Angola, Zambia, Guinea, Chad, Mali, Malawi, Cameroon, Niger, Burkina Faso, Côte d'Ivoire, Ghana, Mozambique, Uganda, Kenya, United Republic of Tanzania, Ethiopia, Democratic Republic of the Congo and Nigeria – accounted for 90% of all WHO estimated cases in 2006 (UK Aid, 2010). Of the 35 countries that accounted globally for ~98% of malaria deaths, 30 were located in sub-Saharan Africa, with four countries (Nigeria, Democratic Republic of Congo, Uganda and Ethiopia) alone accounting for ~50% of deaths on the continent (World Malaria Report, 2010)

The malaria-attributed mortality in Africa is estimated to be over a million, mainly because of the premature death of children younger than 5 years of age and the adverse consequences during pregnancy. Therefore, children and pregnant women—the most vulnerable segments of society—bear the greatest burden. Malaria is responsible for keeping millions of people in the vicious cycle of ill-health, diminished cognitive capacities among children, and absenteeism from activities of daily living, productivity and income loss, and poverty (Sambo, 2007)

Tanzania has the third population at risk of malaria in Africa after Nigeria and DRC. It is of the major public health problem in Tanzania causing an enormous burden to health and economy (MOHSW, NMCP 2008). Approximately 40 million of Tanzania's population lives in areas where malaria is transmitted and it is also the major cause of death whereby up to year 2009, some 60,000- 80,000 deaths have occurred. It is the leading cause of morbidity and mortality in both adults and children under five (RBM, P&IS, 2012).

Economically, the estimated decrease in economic growth due to malaria in highly endemic countries is more than one percentage point per year. Also malaria season in the

year generally coincides with planting and/or harvesting season and brief periods of illness exact a high cost in the world's poorest regions (UN Millennium Project, 2005).

Various malaria control activities are underway in the country under the National Malaria Control Program (NMCP, Tanzania) and these include integrated malaria vector control, intermittent preventive therapy to pregnant women (IPTp), Early Diagnosis and Effective treatment, Behaviour Change and Communication (BCC), Monitoring, Evaluation and Surveillance, Systems support: Regional and District/Councils (MOHSW, NMCP 2008).

The integrated vector control includes Insecticide Treated Nets (ITNs/LLINs), Indoor Residual Spraying (IRS), Larviciding project in Dar es Salaam and Environmental Management (MOHSW, NMCP, 2008)

Under the Insecticide Treated Nets (ITNs/LLINs) programme, Tanzania implemented two mass LLIN distribution campaigns from 2009-2011 {the 2009-2010 Under Five Catch Up Campaign (U5CC) and the 2010-2011 Universal Coverage Campaign (UCC)} to achieve universal coverage nationwide. A total of 27 million LLINs have been distributed by the end of the exercise. During the same period, roughly 5.4 million nets will have been distributed through the Tanzania National Voucher Scheme to pregnant women and infants (Koenker et al., 2011).

Currently monitoring and evaluation of some malaria interventions in Tanzania is mainly based on periodic household surveys, such as Tanzania HIV and Malaria Indicator Survey (THMIS) in which under-five children and pregnant women form the sample population. The principal advantages of such household surveys are that they adequately capture the underlying variation in the sampled population and the flexibility of data collection instruments which can accommodate a number of questions on a variety of topics (Gitonga et al., 2010).

However, household surveys are expensive, time consuming and labour intensive, and generally only undertaken every 3-5 years and therefore not ideal for routine monitoring at local levels. Furthermore, estimates of *Plasmodium* infection collected among young children and pregnant women may not be optimal due to the modifying presence of maternal antibodies and sequestered parasites (Brooker et al., 2009). A cheaper and rapid

complementary approach to household surveys would be to use the existing school system for school-based malariometric surveys (Brooker et al., 2009).

This has already been done in East African countries like Uganda where it was shown that school children's report of bed net use monitored by school teachers through a questionnaire could give a good approximation of household ownership of bed net at community level with about ±5% difference between community and school surveys (Ndyomugyenyi and Kroeger, 2006).

This research work primarily aimed at investigating an easier and more feasible method to assess ITN coverage in the community using the primary school children. Additionally it would also define the impact of ITNs by measuring parasite prevalence amongst these pupils.

1.2. STATEMENT OF THE PROBLEM

Tanzania NMCP rightly adopted the use of ITNs as malaria control strategy. In this strategy the aim is to increase the proportion of households owning at least one ITN from 36% of year 2007 to 80% by 2013 (MOHSW, NMCP, 2008). To accomplish this target, the programme implemented two mass LLIN distribution campaigns from 2009-2011, whereby under-fives were given free nets followed by giving free nets to each sleeping space. A total of 27 million LLINs have been distributed. The aim was to attain high coverage. This undertaking requires periodic assessment of coverage and utilization and this is done by house hold surveys which are expensive in terms of financial and human resources, and time consuming.

Is there any alternative method which can be used instead of house hold surveys?

So this research aimed to investigate whether using primary school children can replace house hold surveys and whether this method would provide accurate results for coverage and usage.

If the primary school children may be used to determine the magnitude of the mosquito net use while in their schools then, the expenses will be minimized, time saved and the results may be obtained rapidly and immediately.

In addition, Lindi is among the Regions with highest prevalence of malaria (by using mRDT in under-fives). Recent report given by the THMIS (2012) has shown that the

malaria prevalence increases with age (to include the school age children). Therefore, there is a need to know the malaria prevalence in school children.

1.3.RATIONALE OF THE STUDY

The results of this study will have a big impact in implementation of ITN programs, not only in Tanzania but also in other endemic countries. If the school children method gives the positive results, the net distribution coverage and usage assessment can be done by this method instead of the house hold surveys. The school children method can be deployed and assessments can easily be done in any specific area and the coverage and needs can be measured. Thus speedy remedial actions can be taken. Therefore this will support the fundamental goal of malaria elimination and eradication.

1.4.RESEARCH QUESTIONS

1. What is the prevalence of ITN use among children living at Lindi municipal?
2. Does this prevalence reflect the real situation in children's respective homes?
3. What proportion of children has appropriate knowledge about malaria transmission and prevention?
4. What factors are associated with the mosquito net use among the children in Lindi municipal?
5. What is the prevalence of malaria parasitaemia in school children in Lindi municipal?

1.5. STUDY OBJECTIVES

Broad objective

To assess the population ITN use using the primary school children in Lindi municipal as well as to determine their parasite prevalence in order to generate useful information for policy and planning towards improving malaria control.

Specific study objectives

1. To determine the proportion of ITN possession and use among primary school children in Lindi municipal.
2. To determine the proportion of school children's households possessing and using ITNs.
3. To determine the reliability of the reported information about possession and use of ITN by the children at school compared to the real observed situation at their respective homes.
4. To determine factors associated with mosquito net use among primary school children in Lindi municipal.
5. To determine malaria parasite prevalence in primary school children in Lindi municipal.
6. To determine the proportion of the primary school children with appropriate knowledge on malaria transmission and prevention.

CHAPTER TWO: LITERATURE REVIEW

According to the *World malaria report 2011*, there were about 216 million cases of malaria (with an uncertainty range of 149 million to 274 million) and an estimated 655 000 deaths in 2010 (with an uncertainty range of 537 000 to 907 000). Most deaths occur among children living in Africa where a child dies every minute from malaria (WHO, 2011).

It is an important cause of illness and death in many parts of the world, especially in sub-Saharan Africa. There has been a renewed emphasis on preventive measures at community and individual levels. Insecticide-treated nets (ITNs) are the most prominent malaria preventive measure for large-scale deployment in highly endemic areas (Lengeler, 2004).

The Roll Back Malaria Partnership has raised coverage targets to ≥80% ITN use by the entire population at risk and called for universal coverage through ownership by all households of at least one long-lasting insecticide-treated net (LLIN) for every two inhabitants (RBM, 2011). Insecticide treated nets, if used by the total population, have shown to be able to lower transmission by 90%, malaria incidence by 50% and all case child mortality by 18 % (RBM,GMAP 2012). Several countries have recently shown rapid improvement in equitable LLIN/ITN ownership and use following mass free distribution campaigns (Bonner et al., 2011).

Insecticide treated bed nets, ITNs provide both the physical and chemical barriers to man against host seeking mosquitoes. They may also be considered as mosquito traps baited by the odor of the sleeping man. The chemical barrier used is a quick-acting insecticide of low human toxicity (Curtis et al., 2003). The insecticides used for the treatment of mosquito nets belong to the class of synthetic pyrethroids and include permethrin, deltamethrin, lambdacyhalothrin and cypermethrin. They share the property of a relatively long residual activity when kept out of daylight but break down rapidly under influence of UV-radiation. Their mammalian toxicity is low but their effect on arthropods, including crustaceans, is generally serious (Takken, 2002). Because of their high toxicity for mosquitoes, coupled with a long-lasting residual activity on textiles, they are considered safe for use on mosquito nets (Barlow et al., 2001).

The use of insecticide treated bed nets has an important impact on mortality since it has substantially reduced the incidence of child hood anaemia a leading cause of death (D'Alessandro, 2001). Insecticide-treated nets (ITNs), and more recently long lasting insecticide nets (LLINs), are a key tool in the control of malaria, with demonstrable health benefits of ITN use, especially among young children and pregnant women (Lengeler, 2004). The appropriate and consistent use of ITNs is essential to preventing malaria, but ITN use often lags behind ITN ownership. This appropriate use of ITNs will prevent malaria, which contributes to the high rate of anaemia in children and has been associated with worse cognitive outcomes (Engle et al., 2007)

Tanzania and elsewhere have shown that when whole community is provided with treated nets, so many mosquitoes of anthropophilic species are killed by contact with the nets that the density and/or sporozoite rate of the vector population is reduced (Curtis et al., 2003). The sustained pyrethroid susceptibility of malaria vectors in Tanzania is encouraging for successful malaria control with ITNs (Kulkarni et al., 2007).

The use of ITN has been associated with the decrease of malaria parasitaemia prevalence in children. As a result of ITN use, it has been shown that there is the marked reductions in all-cause child mortality, a 50%, 29% and 13% reduction in uncomplicated malaria, high density parasitaemia and any parasitaemia, respectively in under-fives (Terlouw et al., 2010). Malaria mortality rates have fallen by more than 25% globally since 2000 and by 33% in the WHO African Region (WHO, 2011).

This has also been shown in a multicounty meta- analysis of associations between ITN use and health outcomes that sleeping under an ITN was associated with a pooled relative reduction in parasitaemia prevalence in children of 24% (95% CI 1%–42%; I2 = 79.5%, $p<0.001$ for I2 value) (Lim et al., 2011). Another survey from Somalia done by Noor et al., (2008) showed that, the age-specific protective effectiveness (PE) of bed net ranged from 39% among <5 years to 72% among 5–14 years old.

In Tanzania, it was found that, the children that used Insecticide treated materials were slower to become re-infected with malaria and had lower parasitaemias. Also their use produced a 54% reduction in the prevalence of anaemia among young children (Premji et al., 1995). Another study done at Muheza district, Tanzania showed that, using an insecticide-treated mosquito net of any type proved to be highly protective against

malaria (OR 0.75, 95% CI 0.59-0.96). Children aged five to thirteen years were at higher risk of having malaria than those aged less than five years (OR 1.71, 95% CI 1.01-2.91) (Winskill et al., 2011).

The net ownership has been shown to increase rapidly in the country, (treated or not treated nets: from 58% to 83%; treated nets: from 10% to 61%) and also treated nets had a protective efficacy of 62% (95% confidence interval 38% to 77%) on the prevalence of parasitaemia (Abdulla, 2001).

ITNs possession does not necessarily means ITNs use. According to the study done in Sierra Leone, of the 900 households (with a total of 4997 members) interviewed, 83.4 %(751) owns at least one LLIN, out of these, 94.1% (707/751) had the LLIN(s) correctly hanging over the bed. Of the 4997 household members, 67.2% reported sleeping under an LLIN the night before the study, including 76.8% of children under 5 years and 73.0% of pregnant women (Gerstl et al., 2010).

A multi-country assessment in SSA using national and sub-national household surveys between 1991 and 2001 found a considerable gap between use and possession among children. The analysis showed that household possession of ITNs ranged from 0.1% to 29%, whereas use by children younger than 5 years old ranged from 0% to 16%. Within households possessing at least one ITN, only 55% of children were found to have slept under an ITN the previous night (Korenromp et al., 2003).

Governments in sub-Sahara Africa are investing substantially in scaling-up treated mosquito net coverage for impact. However, certain significant factors still prevent the use of the treated mosquito nets, even among those who possess them (Afolabi et al., 2009): these include: the number of ITNs in the household , number of ITNs hung per household , knowledge that ITNs kill malaria mosquitoes, and no problem while using ITNs, increased the likelihood of ITN use by at least one member of the household (Deressa et al., 2011).

The current Tanzania national prevalence of ownership of at least one ITN is 91% (but the use is below the set 80% target) of households compared with 39% in 2007-08. With 72% of children aged 6-59 months and 75% of pregnant women slept under an ITN the night before the survey(THMIS, 2012). The UCC survey report shows that, a total of 1792 nets were reported in the surveyed households but only 66% were reported to have

been used in the night preceding the survey. The reasons for not using the net were “the net is not hanged” (66.5%). “No mosquitoes around” was mentioned only for three nets (0.5%). Other reasons were “person travelled” (14%), “net worn out” 27/612 (4%) and “net was washed” (4%)] (Nathan and Sedekia, 2011). Other factors are: the availability of health care services (Mboera *et al*, 2008), and income, perception that insecticides have health effects to the users, and presence or absence of under-five children in the household have been observed(Matovu et al., 2009).

In Nigeria, it was found that the presence of health facility within the community, religion and wealth index by caregiver's education were among the predictors of use of ITN among under-five children (Oresanya et al., 2008). Availability of alternative malaria prevention products such as sprays, repellents, and coils in the household could also impact the rate of utilization of ITNs (McElroy et al., 2009)

The Abuja target, and the Millennium Development Goal 6 (80% coverage of children and pregnant women) (UN, 2005:356), do not account for scaling ITN to achieve high coverage of all population divisions, which may act as reservoirs of infection. The age group least likely to use ITNs are school-aged children (Noor et al. 2009), and few data exist on patterns of net use and effectiveness of nets among this age group (Leenstra et al., 2003).

In multinational evaluation of ITN use by age, including Tanzania, the pattern of overall ITNs use with age was similar by country with ITNs use initially high among children <5 years of age, sharply declining among the population aged 5-19 years, before rising again across the ages 20-44 years and finally decreasing gradually in older ages, where by the highest proportion of the population not protected by ITNs (38% - 42%) was among those aged 5-19 years (Noor et al., 2009).

The previously done surveys in Tanzania provide the evidence that recent declines in malaria transmission and prevalence may shift the age groups at risk of malaria infection to children older than five years (Winskill et al., 2011) and (Abdulla, 2001). Risk of malaria infection was significantly higher in children of five to thirteen years of age, compared to those aged six months to four years (Winskill et al., 2011).This has also been shown in Tanzania that, although the national malaria prevalence of 10% in under-fives is relatively lower as compared to previous years, this prevalence increases with

age (THMIS, 2012). This means that this increase in prevalence will include the school children.

Balliraine et al., (2009) in Kenya found that, parasite densities in blood decreased with age, ranging from <40 to 44,600 parasites/μL among children aged 5–9 years, from <40 to 27,840 parasites/μL among those aged 10–14 years, and from <40 to 360 parasites/μL among those aged >14 years. At this increased age the low levels of parasitaemia that are common in asymptomatic people, may fail to be detected by microscopy. More importantly, asymptomatic people are major reservoirs of infection (Alves et al., 2005). This is due to the fact that, parasites from asymptomatic people are more infectious to mosquitoes than are parasites from symptomatic individuals (Gouagna et al., 2004). Nevertheless, the enormous number of symptomatic malaria infections continues to result in widespread absenteeism at work and school, hindering development and worsening poverty (Castillo-Riquelme et al., 2008)

Therefore, targeting individual protection to vulnerable groups, namely under-fives and pregnant women, is an accepted priority, but community-level impacts of broader population coverage to cover other child ages and adults are largely ignored even though they may be just as important (Killeen et al., 2007). This is supported by the fact that, malaria might be more of a problem in adults than it was previously thought before as suggested by high proportion of adults dying of an “acute febrile illness” in Tanzania (Kitange et al., 1996).

The prevalence of ITN use in school children was found to be 16.1% in Iringa, Tanzania (264/1643 screened children) and further analysis showed that in 73.6% of the school children who had malaria parasites were not using mosquito nets (Mboera et al., 2008). Also the *Plasmodium falciparum* (93.1%) was the predominant species of malaria in the surveyed area. *P. malariae* and mixed infections of *P. falciparum* + *P. malariae* and *P. falciparum* + *P. ovale* and *P. malariae* + *P. ovale* accounted for 2.5%, 3.7%, 0.5% and 0.2%, respectively. The overall Iringa mean prevalence rate of *P. falciparum* was 25.9% n Iringa Di(Mboera et al., 2008).

Despite widespread knowledge about the morbidity of malaria, understanding about its transmission, treatment and prevention was low in India. About 84.7% of the respondents (mean age of about 13 years) had heard about malaria and 8.6% were aware

about the causative agent (Dambhare et al., 2012). Transmission of malaria by mosquito bite was known to 69.8% of the adolescents. Some of the adolescents had misconception regarding the mode of transmission of malaria like houseflies (32.8%). Nearly half (51.1%) of the adolescents had knowledge of symptoms of malaria as fever. None of the adolescents were aware about the new strategy of insecticide treated bed nets (Dambhare et al., 2012). The main source of information about malaria to most of the adolescents was television and radio (51.7%). About 47.4% of the adolescents practiced the prevention of breeding places of the mosquitoes by cleaning the surrounding. Nearly one fifth (20.7%) of the adolescents were using mosquito nets (Dambhare et al., 2012).

Another study done to boarding schools in Northern Nigeria, majority of the respondents (87.3%) knew about and had actually seen an ITN while only 43.3% were current users. Most of the current users of ITN noticed a significant reduction in malaria episodes in the last 12 months, which was statistically significant (P=0.004). Cost and availability were reasons given by non-ITN users (Aliyu and Alti-Mu′azu, 2009)

In Tanzania, a study done in Kyela district involving school children showed that more than 85% of the respondents were knowledgeable on malaria and preventive measures. The perceived best control measures were untreated nets (32.1%), treated nets (21.4%), environmental management (25.7%) and burning mosquito coils and insect repellents (20.8%). Sources of information about malaria and its control were mainly from their teachers (47.4%), print materials (21.9%), family members (20.4%), television and radio (7.3%) and medical personnel (2.2%) (Edson and Kayombo, 2007). These findings suggest that schoolchildren are aware about malaria and its prevention methods. More education and advocacy is needed to strengthen this knowledge on malaria transmission and prevention, especially the use of ITNs as one of the malaria preventive measures.

CHAPTER THREE: MATERIALS AND METHODS

Study area

Lindi Municipal, Lindi Region.

Lindi Municipal Council is one among 6 Councils in Lindi Region in Southern part of Tanzania. It is surrounded by Lindi District Council in all sides except in the Eastern side where there is an Indian Ocean. The Council has 3 divisions, 18 wards, 63 streets and 20 villages forming one election constituency. It has 31 Primary schools and 9 Secondary schools. Literacy rate is 54.8% and enrolment rate of standard one is 71% of the eligible.

Lindi municipal is dominated by Coastal zone which experiences temperature ranges from 24^{o}C and 27^{o}C. This temperature favours the availability and survival of the malaria vectors, the *Anopheles* mosquitoes. The Municipal Council gets an average rainfall ranging from 800mm to 1,000mm per annum. This rainfall also favours the breeding of mosquitoes, though heavy rainfall may wash away mosquito larvae.

Most of residents in the Council depend on agriculture, petty trade/business and fishing as their main economic activities. The agricultural activities in Lindi Municipal are based on two areas, commercial and subsistence farming. The potential commercial crops are cashew nuts, simsim and ground nuts.

Fishing is one of the major economic activities of the residents of coastal areas of Lindi Municipal Council. Despite having abandons fish, the major problem of the fishermen in Lindi is lack of modern fishing gears and technology.

The employment situation in Lindi Municipal Council is not good. It is estimated that only 31% of the eligible group are employed. The employment is based on public, private sector and self-employment. The private sector is not well performing to increase employment opportunities in the Council. There are very few projects and small industries providing employment.

Study design

Cross sectional design with cluster random sampling technique where by schools will be clusters of pupils.

The study consisted of two parts, the first part was investigating net availability and usage and the other part was determination of prevalence of *Plasmodium* infection by RDT and microscopy

Study population

Primary school children aged from 7- 15 years living Lindi municipality. This is because; primary schooling in Tanzania usually begins at the age of seven and ends at thirteen. But in some rural settings, the beginning may be above seven years of age and this explains the extension of our upper age limit to 15 years.

Sample size estimation

The formula used was;

$$n = \frac{z^2 \times p(1-p)f}{d^2}$$

Where, n= sample size, p= proportion of pupils who use ITNs, f= design effect, d= margin of error/ desired precision, z= standard normal deviate set at 1.96 for 0.05 level of significance

Assuming the level of significance to be 0.05, 1.5 design effect and 0.04 margin of error for 95% confidence interval, then;

I. From the study done by Mboera et al in 2008, the prevalence of pupils using ITNs was found to be 16% then the sample size n will be;

$$\left(\frac{1.96^2 \times 0.16(1-0.16)}{(0.04)^2} 1.5 = \right) 484$$

Therefore n = 484 pupils

II. But also from the same study by Mboera et al, the malaria prevalence among pupils was found to be 74%, then the sample size n will be;

$$\left(\frac{1.96^2 \times 0.74(1-0.74)}{(0.04)^2} 1.5 \right) = 693$$

Hence, n = 693, approximately 700 pupils.

From the above calculations, the bigger sample size, i.e. 700 was preferred over the smaller one.

Therefore, the study sample size was **700** primary school children

Eligibility criteria

Inclusion criteria: Primary school children aged from 7-15 years living at Lindi town that were willing to participate in the study.

Exclusion criteria: Pupils below the aged of 7 and above 15 and the not residents of Lindi town.

Sampling procedure

The number of primary schools in the urban part is nine (9) and those found in periphery of the municipal are twenty two (22), making a total of 31 schools, with a sum total of 12844 pupils divided in classes/standards one to seven. The average number of pupils in each class is 60.

Sampling was done in three steps; firstly, from a total of 31 schools in the municipal six schools were randomly selected with proportional distribution in the two parts. This was done as follows;

Np = (ns/Ts) 6

Where Np is the number of schools included in urban/ rural part of the municipal, ns is number of schools in the division and Ts is total number of schools in the municipal.

From the above formula, the number of schools included in urban and rural municipal was 2 and 4 schools respectively

Then using the lottery method, the given number of schools, i.e. 2 and 4 schools, were

selected randomly from the total number of schools from the respective divisions.

Secondly was to obtain the distributed sample size from the two municipal divisions. This was done as follows;

-The total number of pupils in the urban and peripheral part being 4914 and 7930 respectively, and then, using the proportionate distribution formula;

$$Nz = \left(\frac{nt}{NT} \right) n$$

Where, Nz is distributed sample size in a study area, nt total number of pupils in the study area, NT total number of pupils in the Municipal and n is the sample size.

Then, after entering the above data in the formula, we got the distributed sample size of 268 and 432 pupils for the urban and periphery parts of the municipal respectively.

Thirdly, was obtaining the number of pupils to be included in the selected schools. This was obtained by;

In the urban setting, 268/2= 134, and in the peri urban by 432/4= 108 pupils.

Therefore, the number of pupils included in the study in each school of the urban and peri-urban areas of the municipal was 134 and 108 respectively.

The classes included in each school were randomly selected by a lottery method, where by papers with class numbers (1,2, 3,….7) were be put in a bag and another person rather than the researcher picked the papers bearing the class numbers, where the number of pupils in the selected class was smaller than the required number, the upper subsequent one was taken, and when the uppermost class seven was selected and the number of pupils found inadequate for the school, the lower immediate class, i.e. standard six was selected.

Variables

Dependent variables: use of bed net, RDT and Microscopy results.

Independent variables: use of bed net, age, sex, knowledge about malaria transmission and prevention, number of bed nets in the house holds, socio-economic status.

Study logistics

An introductory letter attached with ethical clearance letter was submitted to municipal DED who gave permission to conduct the study and directed me to the MMO and MEO where I was sent to School Health Coordinator (SHC) who wrote the letter to the head teachers of the selected schools to inform them about the research.

Data Collection and analysis

Data collection was done using the structured questionnaire with open and closed ended questions on demography and socio economic status of the children, use of bed nets and factors associated with their use and knowledge on malaria transmission and prevention.

The questionnaire was translated into Swahili to make it understandable to the children and before the interview; I sought permission from the children's parents/guardians with the special letter and consent form which was in Swahili.

Blood specimens for examination of malaria parasites were collected from all children who were willing to participate using sterile blood lancets, sterile alcohol swab and clean wrapped slides.

These specimens were then tested for malaria using RDTs (SD Bioline Malaria antigen P. f/Pan) and other part of the specimen formed the thick smear on the microscopy glass slide, which after being left to dry within the slides boxes were sent Sokoine Lindi Regional Hospital Laboratory where staining and reading was done. The smears were stained by 10% Giemsa stain for ten minutes then washed with distilled water and left to dry. The slides were then examined for malaria parasites under the light microscope 100 X oil immersion objective.

These data were collected by the principal investigator and ten research assistants who were trained on how to interview and fill the questionnaires. The assistants, clinical medicine students from Lindi Clinical Officers' training colledge were also trained to

take blood specimens for malaria parasite examination and the principle investigator was supervising and overseeing the whole exercise.

The stained blood slides were sent to Parasitological Laboratory at Muhimbili University of Health and Allied Sciences for further examination and quality control.

Quality Control

Before starting the study, the questionnaire was tested at Rahaleo Primary school which was not included in the study and then adjusted, where needed.

Also after every ten MRDT tests, another test was done for quality control, this also included the microscopy slides where by each tenth slide in the slide box was re-examined by the other person than the previous examiner. The stained malaria microscopy slides were also sent for quality control at MUHAS parasitology laboratory where in the series of the slides list, every tenth slide was picked and then re-examined.

Data entry and analysis

Data was cleaned and entered in SPSS computer software and cleaned again for analysis. Descriptive analysis was done by using frequencies and cross tabulations. The estimation of Chi-Squares was also done. Multiple logistics regression was performed to compare association of ITN use with malaria prevalence and parasitaemia and then Odds Ratio and 95% confidence interval were estimated. The association between the information obtained at school and that at the household was determined using WINPEPI computer software.

Ethical issues

I requested and obtained ethical clearance to conduct this study from Muhimbili University of Health and Allied Sciences Research Ethical Committee. In addition, I also requested the permission to conduct the study in Lindi municipal from the Municipal Medical and Educational Officers and headmasters/headmistresses of the primary schools.

The parents/guardians of the participating children were informed on the aims and procedures of the study and consent was sought from each parent/guardian of the recruited children. Also an assent was sought from the participating children.

Study limitation

Self-reporting on whether the net has been treated or not by the interviewee might not be accurate.

CHAPTER FOUR: RESULTS

In this study, 577 (82.4%) out of 700 school children participated in the study by answering all the questions. Of these 576 (99.82%) accepted to give their blood sample for malaria diagnosis and only one pupil refused the finger prick.

4.1 Characteristics of the study population

Among the pupils who participated in the study, 265 (45.9%) were males and 312 (54.1%) were females. The median age of the pupils was 12 years (Min., 7, Max., 17 years). A high percentage of the children were aged between 10- 12 years (48.7%) followed by the children aged 13 years and above (32.9%) and those aged 7- 9 years (18.4%). Majority of the children (66.7%) participants were from schools found in the peri- urban area of the municipal, while the rest, (33.3%) were from schools found in the urban part of the municipal. The observed high percent of the children in the peri- urban is due to a higher number of schools in the area compared to the urban part due to the government initiative to construct many schools in the rural to increase the enrolment and number of children with primary education. Table 1 shows the distribution of study population according to sociodemographic characteristics.

Table 1: Distribution of primary school children by sociodemographic characteristics

Characteristic	N (577)	Percentage
Sex		
Male	265	45.9
Female	312	54.1
Age		
7- 9	106	18.4
10- 12	281	48.7
13+	190	32.9
Residence/ Location		
Urban	192	33.3
Peri- urban	385	66.7

4.2 Proportion of ITN possession and use among primary school children

Proportion of ITN possession

In the school, a total of 577 children were interviewed. Of these 12 children (2.1%) responded that they had no ITN at home, 39 (6.8%) had one ITN, 148 (25.6%) children had two ITNs, 224 (38.8%) had three ITNs and 154 (26.7%) children had four ITNs and above in their households. 526 (91.2%) children had at least two ITNs in their households.

There was higher proportion of children's households without an ITN in peri-urban 10 (2.6%) as compared to the urban municipal 2 (1.0%). Also a higher proportion of children who have one ITN in peri-urban 27 (7.0%) compared to the urban 12 (6.3%).

There was higher proportion of children with at least two ITNs in the urban 178 (92.7%) compared to peri-urban 348 (90.4%).This difference in ITN possession between peri-urban and urban parts of the municipal was statistically not significant [P value 0.43].

Table 2 Proportion of ITN possession

	Location		
No. of ITNs	Urban	Peri-urban	Total
No (Zero)	2 (1.0%)	10 (2.6%)	12 (2.1%)
One	12 (6.3%)	27 (7.0%)	39 (6.8%)
At least Two	178 (92.7%)	348 (90.4%)	526 (91.2%)

Proportion of ITN use

537/577 (93.1%) school children were found to use ITN. Out of these, males were 251 (43.5%) and females were 286 (49.6%) with no statistical significant difference in ITN use between the two sexes (P value >0.15).

There was a statistical difference in ITN use between peri-urban part of the municipal 349/385 (90.6%) and the urban part 188/192 (97.9%) [P value 0.01].

523/577 (90.6%) children reported to sleep under the ITN the night before the survey, males 242 (41.9%) and females 281 (48.7%) with no statistical difference between the two sexes (P Value >0.61). Out of 523 children reported to use the ITN the night before the survey, 335/385 (87.0%) children were from peri-urban and 188/192 (97.9%) were from the urban. This difference was statistically significant (P value 0.01).

Table 3: Proportion of pupils slept under the ITN the night before the survey

Location	No. of pupils	Prevalence (%)	95% CI	P value
Urban	188	97.9%	(94.8 - 99.4)%	
Peri-urban	335	87.0%	(83.2 - 90.2)%	0.01
Total	523	90.6%	(88.0- 92.9)%	

4.3 House hold visit to verify ITN possession and use

Out of 570 households visited 16 (2.8%) had no ITN, 16 (2.8%) owned one ITN and 538 (94.4%) owned at least two ITN in their households.

The prevalence of ITN use among the pupils basing on the household information is 91.8% (523/570). This proportion is significantly higher in the peri-urban 93.5% (360/385) as compared to the urban part of the municipal 84.9% (163/192) [P value 0.00].

Also the overall prevalence of ITN use in under-fives and pregnant women according to the household survey was 94.2% (210/223) and 86.9% (20/23) and that from the school was 88.8% (253/285) and 93.5% (29/32) respectively. The table below compares the information obtained from the school to the above information obtained after the household visit/survey.

Table 4: Comparison between information obtained at school and that from household visit.

Category		School	Household	95% CI
ITN possession	No ITN	2.1	2.8	-0.013- 0.027
(Proportion in %)	One ITNs	6.8	2.8	0.014- 0.066
	At least two ITNs	91.2	94.4	-0.002- 0.062
ITN use in the night				
before the survey	(by) school children	90.6	91.8	-0.262- 0.042
(Prevalence in %)	(by) under-fives	88.8	94.2	-0.019- 0.102
(by) pregnant women	93.5	86.9	-0.129-0.269	

From the above table, the 95% CI in the category of ITN possession includes zero in the possession of no ITN and at least two ITNs but not in the possession of one ITN. This means that there was no difference in the proportions of ITN possession of no ITN and at least two ITNs obtained from the school to that from the household but there is a difference in the proportions of ITN possession of one ITN obtained from the school to that from the household survey.

There was no difference between the prevalence of ITN use in school children, under-fives and pregnant women obtained from the school to that from the household (95% CI includes zero).

4.4 Factors associated with ITN use among the primary school children

Bivariate logistic regression was done where by each factor was measured in association with the use of ITN the night before the survey. Place of residence, number of nets in the household, presence of wire gauze in the windows and knowledge on why people use nets are significantly associated with ITN use. Other factors associated with ITN use were age group and presence of under-fives in the household.

There was almost an equal chance of using the ITNs between males and females. Children aged 13 years and above are 0.59 times more likely to use nets as compared to those aged 10- 12 years, and almost equal chances of using the ITNs as compared to those aged 7-9 years.

Residents of peri- urban are significantly 0.18 more likely to use the ITNs compared to those living in the urban.

Those possessing at least three nets were significantly 5.15 more likely to use nets compared to those with at least two ITNs in their households and incomparable to those with no ITN. This is because, it gave undefined OR due to number zero (0), i.e. zero ITNs.

Absence of under-fives in the households increased the chance of using the ITN by 0.57 whereby there was almost equal chances of using the ITN between those with inner ceilings in their houses and those without.

Pupils whose house windows have no wire gauze have 3 times chances of using ITNs than those with wire gauze on their windows.

Pupils with appropriate knowledge on why do people use nets are more likely to use the ITNs by 0.5 times compared to those with inappropriate knowledge.

After controlling the confounders that might be present in the above analysis where by each factor was separately associated with ITN use, the following table is obtained after analysis of all the factors by measuring their collective association with ITN use using bivariate logistic regression.

Table 5: Adjusted factors associated with ITN use

Factor		No. of pupils	Proportion (%)	P value	OR (95% CI)
Sex	Male	242	46.3		1.32 (0.66 – 2.62)
	Female	281	53.7	0.43	1
Age group	7- 9 years	94	18	0.26	0.43(0.16–1.19)
	10- 12 years	261	49.9		0.74 (0.35 – 1.55)
	13 years and above	168	32.1		1
Residence	Peri- urban	336	64.2		0.21 (0.61 – 0.72)
	Urban	187	35.8	0.01	1
No. of ITNs	No ITN	0	0		Undefined (0.0-_)
	At least 2 ITNs	27	5.2		4.4
	At least 3 ITNs	496	94.8	0.00	1
Presence of	YES	247	47.2		0.42 (0.21 – 0.86)
under-fives	NO	276	52.8	0.02	1
Presence of	YES	206	39.4		0.87 (0.42 – 1.80)
Inner ceiling	NO	317	60.6	0.71	1
Presence of wire	YES	268	51.2		2.67 (1.19 – 6.00)
gauze (in windows)	NO	255	48.8	0.02	1
Knowledge on	Appropriate	509	88.2		0.79 (0.30 – 2.12)
reason for ITN use	Inappropriate	68	11.8	0.65	1

The factors that remain significantly associated with ITN use after controlling for the confounders are residence of the pupils, the number of ITNs at home, presence of under-fives and presence of wire gauze in the windows.

4.5 Malaria prevalence by mRDT

The overall malaria parasite prevalence in the school children in Lindi municipal was found to be 9.9% (57/577). Out of this, 32 (12.1%) were males and 25 (8.0%)were females. There was no significant difference in malaria prevalence by mRDT between males and females (P value 0.07).

Malaria prevalence by mRDT was found to be significantly higher in the peri-urban part of the municipal 54 (14.0%) compared to the urban part 3 (1.6%) {Pvalue 0.00).

4.6 Malaria prevalence by microscopy

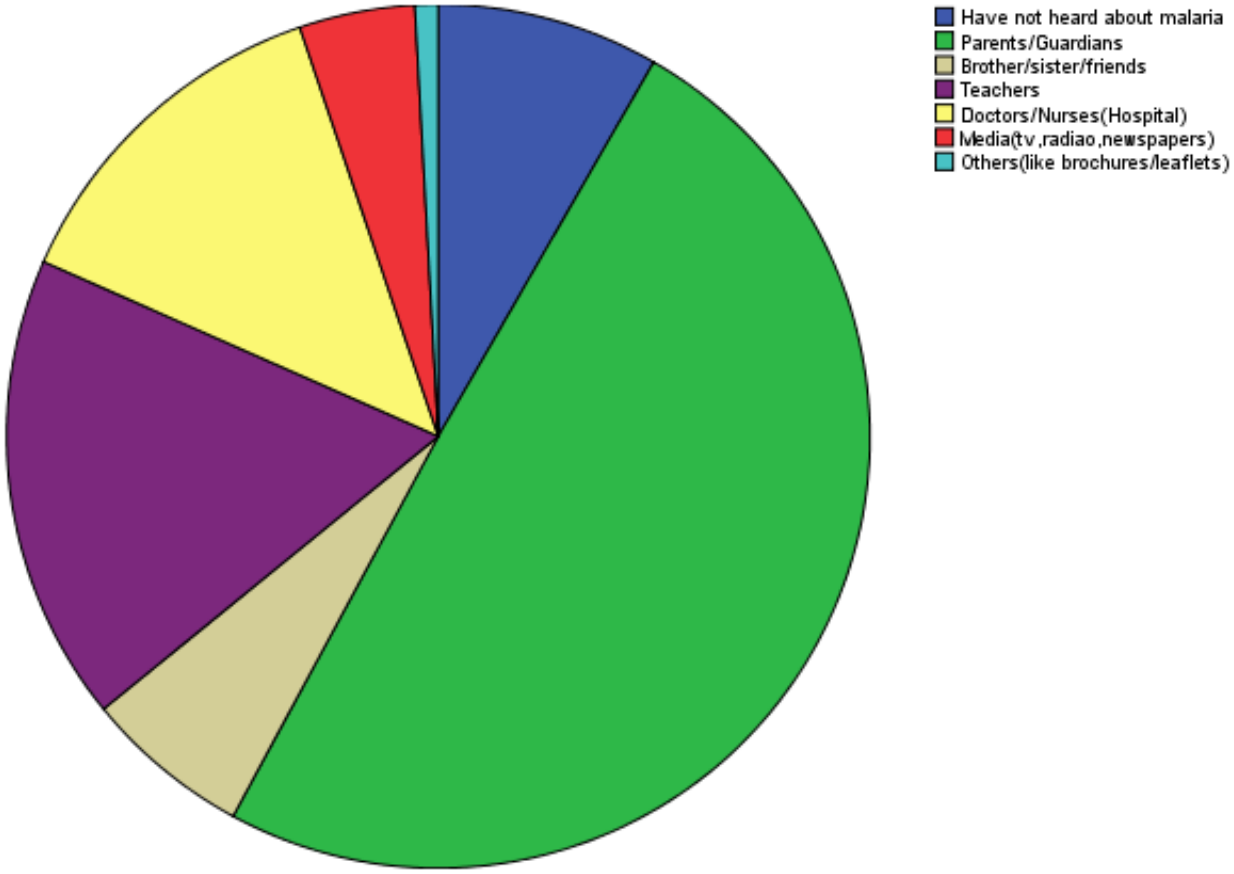
The overall prevalence of malaria by microscopy was 5/577 (0.9%). Males had insignificant higher percentage of malaria prevalence (1.5%) compared to females (0.3%) {P value 0.18}.

Prevalence with respect to residence/location was found to be 5/385 (1.3%) in peri urban and 0 (0%) in urban, where by all microscopically positive malaria pupils were from peri-urban part of the municipal. This difference was not statistically significant (P value 0.18).

4.7 Knowledge on malaria transmission and prevention

The results show that, 529 (91.7%) pupils have heard about malaria and 48 (8.3%) pupils have not heard anything about malaria. Those who have heard it, they did so from various sources. The sources were their parents/guardians 48 (54.1%), teachers 101 (19.1%), doctors/nurses 76 (14.4%), brothers/sisters and friends 36 (6.8%), media, like magazines, television and radio 25 (4.7%) and others like leaflets etc 5 (0.9%). This is illustrated in the chart below:

Chart 1: Proportion of pupils who have heard about malaria and the source of the information



About the cause of malaria, 481(83.4%) responded that it is caused by the mosquito bite, 11 (1.9%) not sleeping under the net, 2 (0.3%) parasites. While 67 (11.6%) pupils don't know the cause of malaria, 3 (0.5%) pupils responded that the houseflies and tsetse flies are the sources, 11(1.9%) dirty environment/drinking/eating dirty foods/water and 2 (0.3%) pupils said AIDS and cold are the causes.

"Malaria is a preventable disease", this was a response of about 410/577 (71.1%) interviewed pupils. Others, 66/577 (11.4%) responded that malaria cannot be prevented and 101/577 (17.5%) pupils don't know whether malaria can be prevented or not.

Out of 410 pupils who responded that malaria is preventable, the preventive measures given were use of mosquito nets 62.4%, Early diagnosis/treatment 16.3%, Environmental management 8.8%, Use of sprays, coils and repellants 1.7%, Both use of nets and environmental management 7.1%, and 3.7% do not know any of the preventive measures.

About where do people go for malaria treatment, 567/577 (98.3%) responded that people go to the hospitals/health care delivery centers for the treatment, 2/577 (0.3%) to traditional healers and 8/577 (1.4%) don't know.

The above results show that the knowledge of malaria transmission and prevention is high among the primary school children in the municipal.

CHAPTER FIVE: DISCUSSION

This study investigated the rapid assessment of ITNs and malaria prevalence using primary school children. The malaria prevalence was relatively lower (9.9%) compared to that reported from other studies done in Kenya, Nigeria and Iringa Tanzania where prevalence was 34%, 21% and 74% respectively (Baliraine et al.,2009, Ekpenyong et al., 2008, Mboera et al, 2008).

This prevalence in school children is also lower than that of under-fives (26.4%) found by the THMIS (2012) which also found that malaria prevalence seemed to increase with age. This prevalence is also contrary to the findings of Winskill et al. (2011) and Abdulla (2011), which together found that there may be increase of malaria prevalence with age. The reason is that, as malaria prevalence decrease, there will be loss of naturally acquired immunity and this may lead to changes in the risk groups.

The low prevalence in this study may be due to effective malaria control measures particularly extensive availability of mRDTs and ACTs which have been very effective in the treatment of malaria. The seasonality may be another factor as the study was conducted in April, the dry season low transmission period.

There was significantly higher malaria prevalence in peri- urban compared to the urban (14.0% and 1.6% respectively). This may be due to a lower proportion of children who slept under the ITN (in the night before the survey) in peri- urban (87%) compared to the urban (97.9%) found by this study. Other reasons may be due to poor housing characteristics, inadequate drugs distribution outlets and inadequate environmental management practices in the peri-urban compared to the urban. A long distance to the health facilities may also be a contributory factor.

The prevalence of ITN ownership was very high, 98% and 91.2% owning at least one and two ITNs respectively compared to the current national prevalence of ownership of at least one ITN of 91% (THMIS 2012).

Prevalence of ITN use among the pupils was very high (93.1%) [90.6% pupils reported

they slept under the ITN the previous night] compared to 16.1% given by Mboera et al. (2008). Also the prevalence of ITN use among the under-fives and pregnant women is 94.2% and 86.9% respectively was higher compared to that of 72% and 75% for under-fives and pregnant women respectively that was given by THMIS (2012) and that of 76.8% and 73% respectively (Gerstl et al., 2010).

The higher ITN use by the under-fives than the pregnant women (94.2% vs. 86.9%) found by this study is similar to that found in Eritrea (Eisele et al., 2006). However, some studies found that more pregnant women use ITN than under-fives (Oresanya et al., 2008, Korenromp et al., 2003).

The result of this high coverage in ITNs possession and use is the result of massive distribution of ITNs through various campaigns by Tanzania NMCP since 2009 including Under-fives coverage campaign, Universal coverage campaigns and National voucher scheme whereby about 32 million ITNs were distributed nationally (Koenker et al., 2011) and also the community sensitization and mobilization through various BCC campaigns.

There was higher prevalence of ITN use in peri-urban compared to the urban and the reason behind may be the availability of the alternative malaria control measures like use of sprays, repellants etc (McElroy et al., 2009) and the presence of many houses with wire gauze/mesh on the windows in the urban as the latter has been found by this study to significantly influence ITN use.

The understanding about malaria transmission, prevention and treatment was high among the pupils where by 91.7% heard about malaria, 83.7% were aware about its causative agent or its vector, 62.4% were aware that ITN use prevents malaria and 98.3% had the correct information that people go to health care delivery centers for treatment compared to Kyela district Tanzania, school children's knowledge about malaria preventive measures was almost like these findings where more than 85% of the respondents were knowledgeable on malaria preventive measures. Whereby majority of the sources of information were from their parents and teachers in Lindi, Teachers and print materials were the main sources in Kyela (Edson and Kayombo, 2007). This is opposite to the findings in India where this knowledge was relatively lower, for 84.7% heard about malaria, 69.8% were aware of the causative agent and none of the

adolescents was aware about the ITN strategy to prevent malaria (Dambhare et al., 2012).

This increased awareness is due to various BCC and educational activities that are widely undertaken in the country.

Several factors have been found to be associated with ITN use. Place of residence, number of nets in the household, presence of wire gauze in the windows and knowledge on why people use nets were significantly associated with ITN use. Other factors were age group and presence of under-fives in the household.

The information regarding ITN use obtained from the school was reliable in the aspects of ITN use by the pupils, under-fives and pregnant persons compared to the real observed situation at their households (i.e. there is no difference between the two prevalence of ITN use). The same was shown in Uganda where school children's report on bed net use monitored by teachers through a questionnaire could give a good approximation of household situation with about ± 5% difference between community and school surveys (Ndyomugyenyi and Kroeger, 2006).

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

CONCLUSION

This research has revealed the fact that we can use primary school children while in their schools for the rapid assessment of community ITN use.

The high prevalence of ITNs use amongst the school children, under-fives and pregnant women was very encouraging and it gives a clear manifestation of the effective implementation of malaria control strategies. More efforts are needed for its sustainability.

The malaria prevalence in school children is low (9.9% by mRDT). But since this was obtained from asymptomatic pupils at school, which may act as reservoirs of infection, there is a need to increase efforts to control malaria, not only in this age group, but also other groups than the pregnant women and under-fives.

RECOMMENDATIONS

i. Further studies on the rapid assessment of ITNs using school children should be done so as to get more information and to identify the school ages to be included in the assessment.

ii. Further studies are needed to determine malaria prevalence in school children should be done, especially in rainy seasons to get the picture in high transmission seasons.

iii. There is a need to ensure the sustainability of the high prevalence of ITN use by the community.

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APPENDICES

***Appendix 1*: Informed Consent form, English Version**

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCIES

DIRECTORATE OF RESEARCH AND PUBLICATIONS, (MUHAS)

INFORMED CONSENT FORM FOR PARENTS OR GUARDIANS

Form No……..

I am **HUSSEIN JUMA ATHUMAN,** a student from MUHAS doing a study on malaria among primary school children in Lindi municipal. I have passed through your municipal leaders and they have allowed me to proceed with this study. I have also met with your community leaders and local leaders and they have given me the permission to proceed with my study.

You all understand that diseases have problems, like the disease I want to study in your area. Problems associated with malaria include many deaths especially in young children and pregnant women, diminished cognitive capacities among children, and absenteeism from activities of daily living, productivity and income loss, and poverty.

Purpose of this study

To assess the population ITN use using the primary school children in Lindi municipal as well as to determine their parasite prevalence in order to generate useful information for policy and planning towards improving malaria control.

Participation involved

If you agree to join the study, your child will answer some questions**,** your household will be visited and some observations made and you will be asked some questions about your household and net use and your child will be required to give some blood specimen for malaria parasite testing.

Benefits and Risks

First participating in this study allows understanding the malaria parasite prevalence in your area and also will give the picture of the mosquito nets usage, their conditions and since we want to test whether we can use the school children for rapid assessment of mosquito net population coverage, these all information will help authorities to plan for better control interventions of this killer disease.

No harm for those who will voluntary participate in the study and for those who will be found positive with the disease will be referred for treatment into nearby health facility and be treated.

Confidentiality

All issues pertaining to participation will be kept confidential and no any unauthorized person will have access to the data. Findings will be provided to your Municipal Medical officer and on request they will be available.

Address

If you have any enquires or reservation you may contact me by sending a letter using this address: **Hussein Juma Athuman, MUHAS, P .O. BOX 65015 Dar es Salaam**. Or if you have serious question about your child's rights as a participant you may contact my supervisor **Prof. Mainen J. Moshi, Chairman of the Senate Research and Publications Committee, P.O. BOX 65001, Dar es Salaam.** Tel 2150302-6, 2152489.

Agreement part

I therefore request you and your child to participate in this study, participation in this study will involve asking some questions**,** your household being visited and a blood sample taking from your child for *Plasmodium sp*. Infection detection and quantification.

Now, **DO YOU AGREE YES: …… NO: ……** (Put tick for appropriate response)

If you agree, sign it below

Parent/Guardian sign: …….. Date ……..

Data collector sign: ……. Date ……

Appendix 2: **Informed Consent form, Swahili Version**

CHUO KIKUU CHA SAYANSI YA AFYA NA TIBA SANIFU CHA MUHIMBILI

Fomu ya Makubaliano na Walezi au Wazazi wa Watoto

Namba ya Fomu……..

Mimi naitwa **Hussein Juma Athuman,** ni mwanafunzi wa Chuo Kikuu MuhimbiliI nikisomea shahada ya uzamili katika ya kuzuia magonjwa ya kitropikia. Nipo hapa Manispaa ya Lindi katika utafiti wa ugonjwa wa malaria kwa wanafunzi wa shule za msingi zilizopo hapa manispaa. Nimetoa taarifa za kuwepo kwangu hapa kwa viongozi wa manispaa na wameniruhusu kuendelea na utafiti wangu. Pia nimefika katika ofisi za viongozi wa kata na serikali ya mtaa na kutoa taarifa ya kuwepo kwangu nao pia wameniruhusu.

Wote tunafahamu kuwa magonjwa mbalimbaili huua, huathiri afya na utendaji kazi na mara nyingine hufanya mgonjwa kukosa amani kutokana na ugonjwa alionao, Malaria ni sehemu ya magonjwa hayo. Moja ya matatizo yanayoambatana na malaria ni vifo, hususan vya watoto wadogo chini ya umri wa miaka mitano na mama wajawazito, kutokuhudhuria masomo na kupungua ufahamu kwa watoto, na pia kutohudhuria katika shughuli mbalimbali za uzalishaji mali, hivyo kusababisha umaskini katika jamii.

Dhumuni kuu

Kufanya utafiti juu njia ya haraka ya kujua matumizi ya vyandarua katika jamii kwa kuwatumia wanafunzi wa shule za msingi, na kujua ukubwa wa tatizo la maambukizi ya vimelea vya malaria ili kuzishauri mamlaka husika kuchukua hatua zaidi katika kudhibiti wa ugonjwa wa malaria.

Ushiriki

Endapo utakubali mtoto wako ataulizwa maswali mbalimbali kuhusu malaria na vyandarua, pia tutatembelea nyumbani kwako kwa lengo la kuangalia na kukuuliza maswali mbalimbali

yahusuyo malaria. Pia mtoto wako atatakiwa kutoa damu kwa ajili yakuchunguza maambukizi ya vimelea vya malaria.

Faida na hasara

Kuelewa ukubwa wa tatizo la maambuzkizi ya malaria katika eneo lako, na pia itatuwezesha kuangalia uwezekano wa kuwatumia wanafunzi wa shule za msingi katika

kutathmini kwa haraka matumizi ya vyandarua kwenye jamii, mambo ambayo yatasaidia mamlaka husika katika kupanga njia bora zaidi za udhibiti wa ugonjwa huu hatari wa malaria.

Hakutakuwa na madhara kwa yeyote atakayeshiriki katika utafiti huu na kwa wale watakaogundulika kuwa na maambukizi ya ugonjwa huu watapelekwa katika vituo vya kutolea huduma za afya kwa matibabu.

Usiri

Taarifa zote za mshiriki ni siri na hakuna mtu asiyehusika atakayeruhusiwa kuziona. Pia matokeo ya utafiti huu yatafikishwa katika ofisi ya Mganga Mkuu wa Manispaa na pia yatapatikana pale yatakapohitajika.

Mawasiliano

Kwa yeyote mwenye kutaka kujua zaidi anaweza kuwasiliana na mimi kwa barua akiandika **Hussein Juma Athuman, MUHAS, S.L.P 65015 Dar es Salaam**. Au kufanya mawasiliano na msimamizi wangu kwa kumwandikia **Prof. Mainen J. Moshi, Chairman of the Senate Research and Publications Committee, P.O. BOX 65001, Dar es Salaam.** Tel 2150302-6, 2152489

Kipengele cha Makubaliano

Baada ya maelezo hapo juu, nakuomba ushiriki katika utafiti wangu kwa kuturuhusu kumuuliza maswali mtoto wako, kutembelea nyumbani kwako na kukuuliza maswali kuhusu malaria na tumtoe damu mtoto wako kwa ajili ya kuchunguza maambukizi ya vimelea vya malaria.

UNAKUBALI **Ndiyo: ……** **Hapana: ……** (Weka tiki panapostahili)

Kama ndiyo weka sahihi hapo chini

Mzazi/Mlezi: …….. Tarehe ……..

Mtafiti: ……. Tarehe ……

Appendix 3: **CHILD PARTICIPANT ASSENT FORM**

***Study title*:** Malaria prevalence and rapid assessment of insecticide treated nets coverage using primary school children in Lindi Municipal, Tanzania.

Principal Investigator and address:Hussein J. Athuman, **MUHAS**, P .O. BOX 65015 **DSM.**

About the research

We are doing a research in your area. A research study is a special way to find out about something. We are trying to find out more about malaria prevalence and rapid way of assessing insecticide treated net use using primary school children in Lindi municipal. This is why you, as the primary school child are being asked to join the study.

Participation involved

By participating in this study, you will be asked some questions and also some little blood will be drawn from your finger for malaria parasite testing.

Benefits and Risks

In case the test results become positive to malaria parasites, you will be sent to the health facility for treatment. Another good thing is that, we hope to learn something that will help other people someday.

There is no harm by participating in this study, but rather, in case you are malaria positive, you will be sent to a nearby health facility for treatment.

Confidentiality

Your information will remain secret to me. When we are done with the study, we will write a report about what we found out. We won't use your name in the report.

Is there any other choices?

Yes, you can choose not to participate in the study.

Agreement

I understand that my parents/guardian have/has given permission for me to participate in this study. My participation is voluntary and I have been told that I may stop my participation in this study at any time without penalty and loss of benefit to myself.

☐ Yes, I will be in this research study. ☐ No, I don't want to do this.

_____	_____	_____
Child's name	signature of the child	Date
_____	_____	_____
Person obtaining Assent	signature	Date

Appendix 4: **Translated assent form into Swahili**

FOMU YA IDHINI YA MSHIRIKI MTOTO

Utafiti kuhusu: Kiwango cha maambukizi ya malaria na njia ya haraka ya kutathmini matumizi ya vyandarua vyenye dawa ya viuatilifu katika jamii kwa kuwatumia wanafunzi wa shule za msingi manispaa ya Lindi.

Jina na anuani ya mtafiti mkuu: Hussein Juma Athuman, Chuo kikuu Muhimbili S.L.P. 65001, **DSM**.

Kuhusu utafiti

Tunafanya utafiti katika eneo lako. Utafiti ni njia maalum zitumikazo katika kutafuta majibu juu ya masuala fulani. Tunataka kujua kuhusu kiwango cha maambukizi ya malaria nanjia ya haraka ya kutathmini matumizi ya vyandarua vyenye dawa ya viuatilifu katika jamii kwa kuwatumia wanafunzi wa shule za msingi manispaa ya Lindi. Ni kwa sababu hii ya kuwa kwako mwanafunzi wa shule ya msingi ndio maana ukahusishwa katika utafiti huu.

Ushiriki

Kwa kushiriki utafiti huu, utaulizwa maswali mbalimbali kuhusiana na malaria. Pia utatolewa damu kidogo kutoka kidole chako kwa ajili ya uchunguzi wa maambukizi ya malaria.

Faida na hasara

Iwapo utagundulika na maambukizi ya malaria, utapelekwa hospitali kwa ajili ya matibabu.

Faida nyengine ni kwamba, tutakayojifunza kutokana na utafiti huu yatakuwa na manufaa kwa watu wengine na jamii.

Hakutakuwa na madhara kwa yeyote atakayeshiriki katika utafiti huu na kwa wale watakaogundulika kuwa na maambukizi ya ugonjwa huu watapelekwa katika vituo vya kutolea huduma za afya kwa matibabu.

Usiri

Taarifa zako zitakuwa ni siri. Tutakapomaliza utafiti tutaandika taarifa kuhusu tulichokiona katika utafiti huu. Hatutatumia jina lako katika taarifa hiyo.

Je, kuna chaguo mbadala?

Ndio, unaweza kuchagua kutokushiriki katika utafiti huu**.**

Makubaliano

Ninaelewa kuwa mzazi/mlezi wangu ameruhusu nishiriki katika utafiti huu. Ushiriki wangu ni wa hiari na nimeambiwa kuwa naweza kusitiha ushiriki wangu bila adhabu yeyote ama kupoteza manufaa kwagu.

☐ Ndio, nitashiriki katika utafiti huu. ☐ Hapana, sitaki kushiriki.

_____	_____	_____
Jina la mtoto	Sahihi ya mtoto	Tarehe
_____	_____	_____
Jina la anayechukua idhini	Sahihi	Tarehe

Appendix 5: **The questionnaire**

QUESTIONNAIRE

IDENTIFICATION AND DEMOGRAPHIC INFORMATION

(Instructions: Please circle the correct response for closed ended questions**)**

1. Serial number……
2. Name of school……
3. Class…….
4. Sex 1. MALE 2. FEMALE
5. Age of the pupil……..
6. Name of the interviewer……..

HOUSING CHARACTERISTICS

7. What is the material used to construct the house wall?

SCORE

a. Bricks/ blocks 4
b. Poles mud and cement 3 TOTAL SCORE…….
c. Poles with mud 2
d. Mud only 1

8. What is the material used to construct the house roof?

SCORE

a. Tiles 4
b. Iron sheet 3 TOTAL SCORE…….
c. Thatch 2
d. Mud 1

9. What is the material used to construct the house floor?

SCORE

a. Tiles 4
b. Cement 3 TOTAL SCORE…….
c. Mud 2
d. Earth 1

10. Are windows screened with mosquito wire gauze? YES NO
11. Is the house having the inner roof? YES NO
12. Is there a pregnant woman in the house? YES NO DON'T KNOW
13. If yes, how many?.....
14. Is there any child in your home that has not reached the school age? YES NO
15. If YES, how many?.....

KNOWLEDGE ON MALARIA INFECTION AND ITN

16. Have you heard about the disease called malaria? YES NO
17. If yes, what are the causes of malaria?

    a ……..

    b ……..

    c ……...

    d ……..

    e ……..

18. Do you know the signs and symptoms of malaria? YES 1 NO 0

		SCORES	
a.	Fever	2	
b.	Chills	2	
c.	Headache	2	
d.	Vomiting	2	
e.	Diarrhoea	2	TOTAL SCORE…….
f.	Anaemia	2	
g.	Joints pain	2	
h.	Abdominal pain	2	
i.	Muscular pain	2	
j.	Enlargement of the spleen	2	

19. Where do people go for the treatment when they contract malaria?

a. Hospital
b. Traditional healers
c. Worshiping centers

d. Don't know

e. Others (specify)……..

20. Is malaria preventable disease? YES NO

21. If yes, how is malaria prevented?

SCORE

a. By using bed nets 1

b. Using antimalarial drugs 1

c. Destruction of breeding sites 1

d. Cleaning the environment 1 TOTAL SCORE…….

e. Using repellants 1

f. Using sprays 1

g. Insecticide residual spraying 1

h. Don't know 0

22. Have you heard about bed nets? YES NO

23. If yes, why do you think people use bed nets?

SCORE

a. To protect themselves against mosquito bites 1

b. To protect themselves against other vectors 1 TOTAL SCORE……

c. To protect themselves against malaria 1

d. Don't know 0

24. At home, how many bed nets are there? …….

25. Do you have bed net in your sleeping place? ……..

26. How many people sleep under the bed net at your home? ……

27. (If YES to qn.12) Do the pregnant women in your home sleep under the bed net?

YES NO

28. (If YES to qn.14)Do those children below school age in your home sleep under the bed net? YES NO

29. Do you use bed net? YES NO (go to 34)

30. If yes, how frequently?

a. Every night

b. Some nights

c. Once for a while

31. Did you sleep under the bed net last night? YES NO

32. If no, why?

…….

…….

……..

MALARIA DIAGNOSIS

33. Pupil's response to malaria diagnosis

1. Blood sample taken
2. Pupils not present
3. Pupil refused
4. Others (specify)

34. RDT NEGATIVE POSITIVE

35. Microscopy NEGATIVE POSITIVE

36. If POSITIVE, parasite density /200wbc

HOUSEHOLD SURVEY

37. Has the head of the household accepted to be interviewed?

OBSERVE OR ASK (40-44)

38. What is the material used to construct the house wall?

e. Bricks/ blocks 4

f. Poles, mud and cement 3 TOTAL SCORE……

g. Poles with mud 2

h. Mud only 1

39. What is the material used to construct the house roof?

e. Tiles 4

f. Iron sheet 3 TOTAL SCORE……

g. Thatch2

h. Mud 1

40. What is the material used to construct the house floor?

e. Tiles

f. Cement

g. Mud

h. Earth

41. Are windows screened with mosquito wire gauze? YES NO

42. Is the house having the inner roof? YES NO

43. Is there a pregnant woman in the house? YES NO

44. If yes, how many?

45. Is there any child in your home that has not reached the school age?

46. If YES, how many?

47. If YES, how many rooms are used in your house for sleeping?

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

49. How many mosquito nets does your household have?

50. How long ago did your household obtain the mosquito net?

51. Is your net treated with an insecticide? YES NO

52. OBSERVE OR ASK THE BRAND OF MOSQUITO NET

53. Did you purchase the net? YES NO

54. PLEASE RECORD OR ASK THE GENERAL CONDITION OF THE NET.

1 Good (no holes)

2 Fair (no holes that fit a torch battery)

3 Poor (1-4 holes that fit a torch battery)

4 Unsafe (>5 Holes that fit a torch battery)

4 Unused (still in package) Unknown OBSERVE OR ASK

55. PLEASE RECORD OR ASK THE COLOR OF THE NET.

1. Green
2. Blue
3. Red
4. White

5. Black

   Other _____

56. PLEASE RECORD OR ASK THE SHAPE OF THE NET

1. Conical
2. Rectangular

   Other _____

57. Is the net hanging for sleeping?

    PLEASE OBSERVE OR ASK IF THE NET IS HANGINGYES NO

58. Did anyone sleep under this mosquito net last night?
59. If yes, is one of the following among them?

1. Under five children
2. School age children
3. Pregnant woman

THANK YOU FOR YOUR COOPERATION

Appendix 6: **Questionnaire, Swahili version**

UTAMBUZI NA TAARIFA ZA MSAILIWA.

1. Namba ya dodoso……
2. Jina la shule……
3. Darasa…….
4. Jinsia1.M/ME 2. M/MKE
5. Umri…….
6. Jina la msaili……

SIFA ZA NYUMBA

7. Nyumba uayoishi kuta zake zimejengwa kwa;

		Alama	
a.	Tofali	4	
b.	Fito, udongo na saruji	3	Jumla ya alama….....
c.	Fito na udongo	2	
d.	Udongo peke yake	1	

8. Nyumba unayoishi imeezekwa kwa;

a.	Vigae	4	
b.	Bati	3	Jumla ya alama….....
c.	Nyasi	2	
d.	Udongo	1	

9. Nyumba unayoishi imesakafiwa kwa;

a.	Vigae	4	
b.	Saruji	3	Jumla ya alama….....
c.	Udongo	2	
d.	Sakafu ya ardhi	1	

10. Je madirisha ya nyumba unayoishi yana wavu wa kuzuia mbu

    1. Ndio 2. Hapana

11. Je nyumba uayoishi ina dari?

1. Ndio 2. Hapana

12. Je nyumbani kwenu kuna kinamama wajawazito wangapi? ……..

13. Je nyumbani kwenu kuna watoto wangapi wasio na umri wa kwenda shule? …….

UFAHAMU KUHUSU UGOJWA WA MALARIA

14. Je, ulishawahi kusikia ugonjwa unaoitwa malaria?

1. Ndio 2. Hapana

15. Kama ndio, unaweza kuniambia kuwa malaria husababishwa nan nini?

a. ……..
b. ……..
c. …….
d. …….
e. ……..

16. Je, unazijua dalili za ugonjwa wa malaria?

1. Ndio 2. Hapana

17. Kama ndio, unaweza kutaja dalili za malaria unazozijua?

		Alama	
a.	Kuhisi homa	2	
b.	Kuhisi baridi	2	
c.	Kichwa kuuma	2	
d.	Kutapika	2	
e.	Kuharisha	2	
f.	Upungufu wa damu	2	Jumla ya alama….....
g.	Viungo kuuma	2	
h.	Kuumwa tumbo	2	
i.	Misuli kuuma	2	
j.	Kukosa hamu ya kula	2	
k.	Kuvimba kwa bandama	2	

18. Je, watu wakiugua malaria huwa wanakwnda kutibiwa wapi?

a. Hospitalini

b. Kwa waganga wa jadi
c. Sehemu za ibada
d. Sijui
e. Mengineyo, taja…….

19. Je, kuna uwezekano wa kuzuia malaria?
1. Ndio 2. Hapana 3. Sijui

20. Kama ndio, unawezaje kuzuia ugonjwa wa malaria?

a. Kulala ndani ya chandarua	1	
b. Kutumia dawa za malaria	1	
c. Kuharibu mazalio ya mbu	1	
d.Usafi wa mazingira	1	Jumla ya alama….....
e. Kutumia dawa za kufukuza mbu	1	
f. Kutumia dawa za kuua mbu	1	
g. Kupulizia dawa katika kuta za ndani ya nyumba	1	
h. Sijui	0	

21. Je, ulishawahi kusikia kuhusu chandarua?
1. Ndio 2. Hapana

22. Kama ndio, unafikiri ni kwa nini watu hutumia chandarua?

	Alama	
a. Kujikinga na kuumwa na mbu	1	
b. Kujikinga dhidi ya wadudu wengine	1	Jumla ya alama …….
c. Kujikinga na ugonjwa wa malaria	1	
d. Sijui	0	

23. Je nyumbani kuna vyandarua vingapi? ……..
24. Je, una chandarua sehemu unayolala? ……..
25. Watu wangapi nyumbani kwenu wanalala ndani ya chandarua? …….
26. (Kama ndio kwa swali 12), Je kinamama wajawazito nyumbani kwenu wanalala ndani ya chandarua?
1. Ndio 2. Hapana

27. (Kama ndio kwa swali 14), Je watoto chini ya umri wa kwenda shule nyumbani kwenu wanalala ndani ya chandarua?

1. Ndio 2. Hapana

28. Je,wewe unalala ndani ya chandarua?

1. Ndio 2. Hapana

29. Kama ndio, ni kwa kiwango gani?

a. Kila siku b. Baadhi ya siku c. Situmii kabisa

30. Je, jana usiku ulilala ndani ya chandarua?

1. Ndio 2. Hapana

Kama HAPANA, ni kwa nini?(taja sababu);

a. …….

b. …….

c. …….

UCHUNGUZI WA MALARIA

31. Mwitiko wa mwanafunzi wakati wa vipimo vya uchunguzi wa malaria.

a. Sampuli ya damu imehukuliwa

b. Mwanafunzi hayupo

c. Mwanafunzi amekataa

d. Nyengineyo(Taja)……..

32. RDT (Kipimo cha haraka cha malaria) CHANYA…….. HASI…….

33. Matokeo ya darubini CHANYA…….. HASI…….

34. Wingi wa vimelea ……../200WBC

DODOSO LA NYUMBANI

35. Nyumba uayoishi kuta zake zimejengwa kwa;

	Alama	
a. Tofali	4	
b. Fito, udongo na saruji	3	Jumla ya alama….....
c. Fito na udongo	2	

d. Udongo peke yake 1

36. Nyumba unayoishi imeezekwa kwa;

	Alama	
a. Vigae	4	
b. Bati	3	Jumla ya alama….....
c. Nyasi	2	
d. Udongo	1	

37. Nyumba unayoishi imesakafiwa kwa;

a. Vigae	4	
b. Saruji	3	Jumla ya alama….....
c. Udongo	2	
d. Sakafu ya ardhi	1	

38. Je madirisha ya nyumba unayoishi yana wavu wa kuzuia mbu?

1. Ndio 2. Hapana

39. Je nyumba uayoishi ina dari?

1. Ndio 2. Hapana

40. Je nyumbani kuna kinamama wajawazito?

41. Kama ndio, ni wangapi? ……..

42. Je nyumbani kwenu kuna watoto wangapi wasio na umri wa kwenda shule(chini ya umri wa miaka mitano)?

43. Kama ndio, ni wangapi?.....

44. Je, nyumbani kwako kuna sehemu ngapi za malazi?.....

45. Je, hapa nyumbani kwako kuna vyandarua vingapi?

46. Je, vimepatikanaje?

a. Umenunua

b. Umepewa bure

c. Kupitia hati punguzo

d. Nyengineyo (taja)

47. Je vyandarua hivyo vimewekwa dawa ya kuua mbu? NDIO HAPANA

48. ANGALIA AMA ULIZA NEMBO YA CHANDARUA…….

48. TAFADHALI ANGALIA AMA ULIZA HALI YA CHANDARUA

a. Nzuri (haijatoboka)

b. Kawaida (hauna matundu kiasi cha ukubwa wa betri za tochi)

c. Mbaya (matundu 1-4 yenye ukubwa wa betri ya tochi)

d. Si salama (matundu 5 au zaidi yenye ukubwa wa betri ya tochi)

e. Haijatumika (bado ipo ndani ya pakiti)

49. TAFADHALI ANGALIA AMA ULIZA RANGI YA CHANDARUA

a. Kijani

b. Blue

c. Nyeupe

d. Nyengineyo (taja)

50. TAFADHALI ANGALIA AMA ULIZA UMBILE LA CHANDARUA

a. Mduara

b. Mstatili

c. Nyengineyo (Taja)

51. Je chandarua kimening'inizwa kwa ajili ya kulalia?

1. Ndio 2. Hapana

52. Je, kuna mtu yeyote aliyelala kweye chandarua usiku wa kuamkia leo?

1. Ndio 2. Hapana

53. Kama ndio, katika wafuatao yupo aliyelalia chandarua?

a. Watoto/mtoto chini ya umri wa miaka mitano

b. Watoto wenye umri wa kwenda shule/watoto wa shule

c. Mama mjamzito

AHSANTE SANA KWA USHIRIKIANO WAKO

Appendix 7:Ethical clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Directorate of Postgraduate Studies

P.O. BOX 65001
DAR ES SALAAM
TANZANIA.

Website: http://www.muhas.ac.tz

Tel: +255-(0)22-2150302 Ext 207.
Tel (Direct): +255-(0)22-2151378
Telefax:255-(0)22-2150465
E-mail: *dpgs@muhas.ac.tz*

Ref. No. MU/PGS/SAEC/Vol.IX/

27th March, 2013

Mr. Athuman Hussein Juma,
MSc.in Tropical Disease Control,
MUHAS.

Re: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED "MALARIA PREVALENCE AND RAPID ASSESSMENT OF INSECTICIDE TREATED NETS POPULATION COVERAGE USING PRIMARY SCHOOL CHILDREN IN LINDI MUNICIPAL, TANZANIA"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has on behalf of the Senate approved ethical clearance for the above-mentioned study.

Thus ethical clearance is granted and you may proceed with the planned study.

Please liaise with bursar's office to get your research fund.

Prof. O. Ngassapa
DIRECTOR, POSTGRADUATE STUDIES

/emm

c.c. Vice Chancellor, MUHAS
c.c. Deputy Vice Chancellor – ARC, MUHAS
c.c. Dean, School of Public Health and Social Sciences, MUHAS