PREVALENCE OF MALARIA INFECTION AMONG SCHOOL CHILDREN FOLLOWING WIDE SCALEUP OF MALARIA INTERVENTIONS IN KISARAWE DISTRICT,

TANZANIA

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By

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A dissertation Submitted in (partial) Fulfillment of the Requirements for the Degree of Masters of Science (Tropical Diseases Control) of Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***Prevalence of Malaria Infection among Primary School Children following wide Scale up of Malaria Interventions in Kisarawe Districts***, in (Partial) fulfillment of the requirements for the degree of Master of Science (Tropical Diseases Control) of the Muhimbili University of Health and Allied Sciences.

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(Supervisor)

Date _____

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I, Saturini Manangwa, 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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DEDICATION

I would like to dedicate this work to my supervisor Dr. D. S. Tarimo and my beloved parents Ernest Manangwa and Elizabeth Sombi, secondly to my wife Febronia Lasway and my daughter Karen, lastly to my brother Aloyce Manangwa, my sisters Pulcheria Manangwa, Oliver Manangwa and Josephina Manangwa.

ABSTRACT

Background: A study among primary school children in Kisarawe district by Otito in 1994 showed that the prevalence of malaria parasitemia and anemia was 24.3% and was 86.1% respectively. The use of Insecticides Treated Nets (ITNs) and Artemisinin-based Combination Therapies (ACTs) has the potential of interrupting malaria transmission thus changing the epidemiology of malaria in endemic areas such as Kisarawe. Following scaling up of these interventions, it is not known how much they have changed the epidemiology of malaria in the Kisarawe district, in particular among primary school children.

Objective: This study aimed to determine the malaria parasite rate and hemoglobin level among primary school children in Kisarawe district after wide scale use of ITNs and ACTs.

Methodology: A descriptive cross sectional study of 300 school children was carried out in Kisarawe district, a holoendemic area for malaria. A random cluster sampling and simple random sampling methods were used to obtain schools and participants. Finger prick blood samples were collected for malaria parasite detection and hemoglobin level. ITNs and ACTs use were also assessed. The main outcome was proportion of school-aged children with asymptomatic malaria parasite infection and anemia as well as ITNs and ACTs use.

Results: A total of 300 pupils in standard four to seven with mean age 12.4 years, range 8 – 17 years participated in the survey in both steps. The prevalence of asymptomatic malaria was very low, only 9 (3.0%) [95% CI (1.38, 5.20)] had malaria parasites and anemia was 10.3% [95% CI (7.1, 14.0)]. The overall use of ITNs is 83.7% [95% CI (79.0, 87.6)] but 75.9% [95% CI (70.3, 81.2)] were reported to use ITNs last night and the proportion of ACTs use for treatment of malaria was 86% [95% CI (81.6, 89.7)]. There was no association between anemia and history of malaria, use of ITNs, use of ACTs, age groups and sex.

Conclusion: There is a significant decline in asymptomatic malaria from 24.3% in 1994 to 3% in 2012 which is the evidence of wide scaled up of ITNs and ACTs use as intervention of malaria. Decline in malaria could have also reduced the prevalence of anemia since it is the one among major cause of anemia. More effort on scaling up ITNs and ACTs intervention and sustainability are needed for elimination of the disease. However further studies with large sample size are needed to explore the prevalence of asymptomatic malaria as well as possible causes of existing anemia.

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LIST OF ABBREVIATIONS

AC……Asymptomatic Carrier

ACT……..Artemisinin based Combination Therapy

AIDS……Acquired Immunodeficiency Syndrome

ALU……..Artemerther Lumefantrine

IPTp……..…Intermittent Preventive Treatment during pregnancy

ITN……Insecticide Treated Nets

MFEA……Ministry of Finance and Economic Affairs

MUHAS……Muhimbili University of Health and Allied Sciences

NBS……National Bureau of Statistics

NSGRP…….National Strategy for Growth and Reduction of Poverty

PMI……..President's Malaria Initiatives

RBM……Roll Back Malaria

RDT……..…Rapid Diagnostic Test

TDHS……...Tanzania Demographic and Health Survey

THMIS…….Tanzania HIV and Malaria Indicators Survey

USAID…….United State Agency for International Development

WHO……...World Health Organization

COR…….Crude Odds Ratio

AOR…….Adjusted Odds Ratio

TACAIDS… Tanzania Commission for AIDS

ZAC……. Zanzibar AIDS Commission

MUCHS…..Muhimbili University College of Health Sciences

CHAPTER ONE: INTRODUCTION

Malaria is a communicable disease caused by Protozoa of the genus *Plasmodium* transmitted by the female mosquitoes of the genus *Anopheles* that flourishes in the tropical and sub-tropical regions of the world (Warrell and Gilles, 2002). There are five species of *Plasmodia*, of which *P. falciparum* is the most virulent species accounting for 90% of the infections. The major vectors in Tanzania are *Anopheles gambiae, Anopheles funestus* and *Anopheles arabiensis* (WHO, 2011). Malaria remains a major cause of global morbidity and mortality for long time, with most of the burden being in sub-Saharan Africa **(**Beiersmann, 2011), in Tanzania malaria is the leading cause of morbidity and mortality in both adults and children under five (Widmar, 2009)

1.1 Global malaria situation

An estimated 216 million malaria cases were recorded in 2010 with nearly 655,000 deaths, the burden of the disease is higher to the under fives and African region. 81% of the cases and 91% of deaths occurred in Africa where as under fives malaria deaths accounted 86% of all malaria deaths (WHO, 2011). Since time in memorial, malaria has been a leading cause of morbidity and mortality in sub-Saharan Africa that carries 90% of the global malaria burden, affecting mainly under fives and pregnant mothers especially to primigravida (WHO, 2010). Economically malaria is responsible for an annual loss of USD 12 billion and about 40% of the public health expenditure in Africa (USAID, 2009). The current global malaria control efforts involve several interventions including prompt accurate diagnosis and treatment using Artemisinin based Combination Therapies (ACTs), Intermittent Preventive Treatment in pregnancy (IPTp) and use of Insecticides Treated Nets (ITNs) which is supported by selective larviciding and Indoor Residual Spray (IRS). Insecticide treated bed nets (ITNs) have been shown to significantly reduce malaria related morbidity especially among pregnant mothers and children under- five years of age. Due to its efficacy in reducing the burden of malaria disease, it has been emphasized by WHO roll back malaria program as one of the key malaria control measures in holo-endemic countries in order to reach the millennium development goal that targets to halt by 2015 (Eshetu, 2006).

In malaria-endemic areas of sub-Saharan Africa, acute malarial clinical disease is almost always confined to young children who suffer high parasite densities. If untreated, this can progress very

rapidly to severe malaria, which can cause death. The diagnosis of malaria is based on clinical criteria (clinical diagnosis) and supplemented by the detection of parasites in the blood by examination of blood film under the microscope (NBS, 2010).

There has been a reduction in malaria case incidence of 17% globally between 2000 and 2010 where deaths have been reduced from 781,000 to 655,000 between 2010 and 2011 reports. In Africa it has been observed a decrease from 709,000 to 596,000 malaria deaths between 2010 and 2011. The decrease could be attributed partly by improved malaria control interventions (WHO, 2011).

1.2 Malaria situation in Tanzania

Malaria is a major public health concern for all Tanzanians, especially for pregnant women and children under 5 years age, also it is a leading cause of morbidity and mortality among outpatient and inpatient admissions whereby it accounts for up to 40% of all outpatient attendance (NBS, 2010).

In Tanzania, malaria is chiefly caused by *P. falciparum* that accounts for 96% of the infections; the major vectors being *Anopheles gambiae* and *Anopheles funestus* (USAID, 2011). About three quarters of the country is characterized as having intense perennial malaria transmission with peaks during rainy seasons (MARA/ARMA, 2005). The number of clinical cases per year is estimated to be 17-20 million cases resulting to approximately 80,000 deaths annually (TACAIDS, 2009). Malaria control in Tanzania focuses on early diagnosis and treatment of uncomplicated malaria with ALu, Sulfadoxine Pyrimethamine IPTp and use of ITNS in combination with selective larviciding and indoor spray with residual insecticides (MFEA, 2010).

1.3 The changing malaria epidemiology in Tanzania

Tanzania currently has been experiencing a decline in malaria transmission, severe anemia, fever incidences and malaria inpatient admissions (MFEA, 2010). This is partly explained by improvements in the coverage of insecticide-treated nets (ITNs), even though the coverage is still lower in rural areas compared to urban areas and other malaria interventions such as introduction

of highly-effective artemisinin based combination therapy "ALu", Rapid Diagnostic Tests (RDTs), larviciding and indoor residual spraying (MFEA, 2010).

ACTs are known to decrease rapidly parasite density and gametocyte levels in treated patients, and, therefore, greatly reduce the level of infectiousness, and transmission of resistant strains (Eastman and Fidock, 2009; Kalilani-Phiri et al, 2011) while ITNs are known to reduce the longevity of adult Anopheles female mosquito which results in reducing chance of parasite to mature enough to be transmitted to human host, in so doing reducing malaria transmission (Kere, 1996).

Evaluation of the malaria program suggests that following 36 folds increase in the ITN use among under fives between 1999 and 2010, it has been observed 50% decline in severe anemia prevalence and 45% decline in mortality rate among under fives (WHO, 2011). ITN has been considered as the principal vector control measure and it is the part of national malaria control program intervention.

Kisarawe district is located as a holoendemic area (MARA/ARMA, 2005), however it is not known what is the level of endemicity would be following this scaling up of the use of ACTs and ITNs. This study aimed to determine the prevalence of malaria infection among school children following malaria interventions of ACT and ITNs implemented in recent years.

1.4 Problem Statement

Most of the primary school age children in endemic areas carry malaria parasites without symptoms due to the developing immunity following constant exposure (Smith, 2007; Barger, 2009). Asymptomatic malaria infection serves as a rich source of malaria transmission in the community, indeed it contributes to the high rate of childhood anemia and other health problems which have then been associated with worse cognitive outcomes (Hare 2004; Engle et al 2007). The existence of asymptomatic malaria infections is crucial to result in widespread of infections in the community which then results in absenteeism at work as well as school, hindering development and worsening poverty as a result of developing symptomatic disease(Barger, 2009).

Following the recent achievements in global malaria control, there is increased emphasis on monitoring these achievements and on refining the epidemiological landscape in order to

determine intervention needs and guide implementation. Household surveys, including Tanzania HIV/AIDS and Malaria Indicators Surveys (MISs), Demographic Health Surveys and Multiple Indicator Cluster Surveys are commonly used to achieve these surveillance and monitoring goals, but they are expensive, time-consuming and technically complicated to undertake. A complementary, inexpensive framework for malaria surveillance may be provided by school malaria surveys (Ashton et al, 2011).

Following the scale up of ACTs and ITNs use in sub-Saharan Africa, there is a growing evidence of decline in malaria transmission, especially in East Africa (MFEA, 2010). This requires the re-establishment of malaria endemicity in different localities of the country, Kisarawe being one of them. Available data for Kisarawe show that in 1994, the prevalence of asymptomatic malaria parasitemia and anemia among school children was 24.3% and 86.1% respectively (Otito, 1994). However there is no current information on the malaria epidemiology in Kisarawe district following wide scale up of interventions. Due to the lack of current information about malaria infection in Kisarawe district, this study enabled to determine the current prevalence of malaria as well as the impact of wide scaled up interventions.

1.5 Research Questions

1. What is the current prevalence of Malaria parasitemia after scaling up of malaria interventions among school children in Kisarawe district?
2. What is the anemia situation following scaling up of malaria interventions among school children in Kisarawe district?
3. What is the extent of the malaria interventions i.e. ITNs and ACTs have been implemented among school children in Kisarawe district?

1.6 Objectives

1.6.1 Broad objective

To assess prevalence of malaria infection following wide scaling up of malaria interventions among school children in Kisarawe district, Tanzania.

1.6.2 Specific objectives

1. To determine the prevalence of malaria parasitemia among primary school children in Kisarawe district
2. To determine the prevalence of anemia among primary school children in Kisarawe district
3. To determine the proportion of ACTs use among primary school children with history of malaria in past 6 months for treatment of malaria in Kisarawe district
4. To determine the proportion of ITNs use among primary school children in Kisarawe district
5. To determine association between anemia with ITNs use, ACTs use, malaria infection, age and sex
6. To determine association between ITNs use with history of malaria infection, use of ACTs, age and sex

1.7 Rationale

This study enabled to establish the current level of asymptomatic infection for primary school children in Kisarawe district following several interventions which have been implemented in country wise. The study also enabled to establish the magnitude on the problem of low hemoglobin (anemia) among school children which may bring more attention for integration of the problem intervention in the school health programs. The coverage and use of ITNs and use of ACTs have been emphasized; this study enabled to determine availability and use of such interventions within the study area since they are crucial factors for changing malaria situation.

CHAPTER TWO: LITERATURE REVIEW

Malaria is an acute communicable disease caused by *Plasmodia* parasites, which are transmitted by the female *Anopheles* mosquitoes. *Plasmodium* that affects humans include *Plasmodium falciparum, Plasmodium vivax, Plasmodium ovale, Plasmodium malariae and Plasmodium knowlesi*, but malaria due to *Plasmodium falciparum* is the most deadly and predominates in Africa. There are more than 30 anopheline species which are responsible in malaria transmission to humans by the bite of infected female anopheline species concerned (WHO, 2011). Malaria parasite rate especially *Plasmodium falciparum* follows a well-established pattern as a function of age and transmission intensity, it rises during infancy and early childhood, settles to a plateau in older children and declines in adolescents and adults as malaria immunity develops (Smith, 2007). *Anopheles gambiae* is responsible for approximately 80% of malaria transmission in sub-Saharan Africa and the mosquito vector abundance and malaria transmission intensity fluctuate between dry and rainy seasons. Depending on the specific locality, dry seasons may last from one month to several months, during which *Anopheles gambiae* density is very low. However, mosquito populations increase rapidly following the onset of the rainy season and malaria cases peak a few weeks after the rainy season begins (Wang, 2011). However the major vector responsible for transmission in Tanzania includes *Anopheles gambiae* although *Anopheles arabiensis* and *Anopheles funestus* are also available (WHO, 2011).

2.1 Asymptomatic Malaria

Asymptomatic carriers (AC) are individuals who harbor the *P. falciparum* asexual forms, with or without gametocytes, but do not present clinical symptoms of the disease. In malaria-endemic countries, a large proportion of *P. falciparum* infections are asymptomatic or sub-clinical. Microscopy-detected levels of asymptomatic carriage as high as 60% have been reported. AC does not usually seek treatment for their infection, and therefore constitute a reservoir of parasites for the inoculation of newly-hatched mosquitoes which then contribute to the transmission of the disease. Literature shows that malaria parasites are found in the blood circulation all the time in about 90%-100% of children less than 5 years old in parts of Africa and it declines as the child is getting older due to naturally acquired immunity which develop as

a result of constant exposure (Parija, 2009). The detection and treatment of asymptomatic carriers of *Plasmodium falciparum* as an innovative strategy for malaria control has been previously considered and the latest WHO Guidelines for the treatment of malaria note that infectivity-reducing drug regimens will have a useful role to play in maintaining the reductions in disease transmission achieved through integrated control programs (Wiseman et al, 2003).

By the time children reach school age, the risk of clinical attacks and death is reduced due to the immunity that they acquire in early childhood (Clarke et al, 2008) however they often develop asymptomatic infection due to such immunity which then end up with anemia (Barger, 2009) and being reservoir crucial for maintaining transmission. *Plasmodium falciparum* infection in school children is associated with reduced ability to learn which then affects the academic performance in the school (Ashton et al, 2011, Clarke, 2008 and Silva, 2009). Patients with asymptomatic *P. falciparum* chronic infection especially children usually experience an increased morbidity due to anaemia, and reduced cognitive development (Kern et al, 2010). Malaria chemoprophylaxis given to African school children is associated with lower rates of malaria parasitemia and severe anaemia, fewer clinical attacks and malaria deaths and reduced school absenteeism due to malaria (Clarke et al, 2008), however the intervention is not effectively established in several areas of Africa. In the study done by Stoltzfus et al (1998) in Zanzibar on epidemiology of iron deficiency anemia, she found that school children with circulating asymptomatic malaria parasitemia had worst anemia status as compared to those without asymptomatic malaria parasitemia. Since asymptomatic infections might contribute to ongoing transmission in a community, but are unlikely to be detected or treated in a context where only individuals feeling unwell access diagnostic services, much interventions might be needed to eliminate malaria. Detecting and treating asymptomatic carriers would likely produce benefits at both the individual and at the community level (Ashton et al, 2011). This suggests that together with other interventions, alternative strategies must be used to identify and treat asymptomatic infections and stop the progress of transmission (Ashton et al, 2011).

Several countries have recently generated accurate maps through dedicated Malaria Indicator Surveys and the Malaria Atlas Project (MAP) has meta-analyzed existing parasite prevalence surveys to produce global estimates of *P. falciparum* transmission intensity. This is due to renewed interest in the eradication of *Plasmodium falciparum* malaria which stimulated efforts to

define its spatial epidemiology. This can guide the allocation of resources to areas in greatest need and facilitate evaluation of the effectiveness of control measures (Taylor, 2011). In Tanzania currently about 73% of the population is still regarded being at high risk of transmission i.e. more than one case per 1000 population per year (WHO, 2011).

2.2 Insecticide Treated Nets

An insecticide-treated net (ITN) is a factory-treated net that does not require any further treatment, or a net that has been soaked with insecticide within the past 12 months (NBS, 2010). ITNs are responsible to provide barrier between human and mosquito especially during sleeping and in doing so it prevent mosquito bites which reduce chance of malaria transmission. On the other hand it has a significant role of reducing mosquito longevity where by the life span of the mosquito is reduced to the extent that Plasmodium species can not develop enough before transmission to human. The number of deaths attributable to malaria has significantly decreased in some parts of Africa, owing to combined strategies of mass distribution and an increased use of long lasting insecticide-treated nets (LLITN), intermittent preventive treatment in pregnancy (IPTp) and widespread adoption of artemisinin-based combination therapy (ACT) (Kern et al, 2010). The percentage of households owning at least one ITN in sub-Saharan Africa is estimated to have risen from 3% in 2000 to 50% in 2011and 96% of them actually use it (WHO, 2011). Also ITNs have been shown to reduce child mortality by about 20%, saving six lives for every 1000 children under five years of age protected per year in sub- Saharan Africa (SSA) and the cost-effectiveness of ITNs has also been demonstrated (Wiseman et al, 2003). Between 2008 to 2010 Tanzania conducted national campaign on distribution of ITN among under fives where by Coastal region implemented in late 2009 to 2010 (NBS, 2010), however by 2010 the ITNs available in Tanzania were sufficient to protect more than 50% of the population at risk although until this time there was no policy or strategies of free distribution of ITNs for the whole population (WHO, 2011). The coverage of mosquito nets in Tanzania has greatly improved in all regions since 2004 but rural households are less likely than urban households to own a mosquito net although the gap between rural and urban is narrowing (NBS, 2010). However there are some challenges toward effective use of ITN in the community, misconceptions towards ITNs distribution and use as well as negative

attitudes among community members leading to misuse and misallocation of ITNs have been experienced in Tanzania (Widmar et al,2009).

2.3 Artemisinin-based Combination Therapies

Following resistance of *Plasmodium falciparum* to chloroquine and sulphadoxine–pyrimethamine, currently most countries in sub-Saharan Africa have switched to using ACT as the first- and/or second-line of treatment of malaria (Kalilani-Phiri et al, 2011). Prompt access to effective antimalarial treatment is one of the major strategies for reducing the burden of malaria, this means having treatment available as near as possible to the house so that drugs are given within 24 hours of the onset of symptoms (NBS, 2010). ACTs comprise semisynthetic artemisinin derivatives paired with distinct chemical classes of longer acting drugs.

These artemisinins are exceptionally potent against the pathogenic asexual blood stages of *Plasmodium* parasites and also act on the transmissible sexual stages. These combinations increase the rates of clinical and parasitological cures and decrease the selection pressure for the emergence of antimalarial resistance (Eastman and Fidock, 2009). Recently the number of rapid diagnostic tests (RDTs) and artemisinin-based combination therapies (ACTs) procurement has increased, and the percentage of reported suspected cases receiving a parasitological test has also increased, from 67% globally in 2005 to 76% in 2010, with the largest increase in sub-Saharan Africa (WHO, 2011). Although Tanzania is currently using ACT as first line drug of choice for the treatment of clinical malaria, its availability is still not for free for all ages in public sector (WHO, 2011).

In most endemic areas malaria has decreased due to increased investment on malaria control interventions. A total of 8 countries in the WHO African Region including Tanzania showed more than 50% reduction in either confirmed malaria cases or malaria admissions and deaths in recent years. Roll Back Malaria (RBM) targets were updated in June 2011focusing on reduction of global malaria deaths to near zero and cases by 75% from 2000 levels by the end of 2015. These targets will be met by achieving and sustaining universal access to and utilization of preventive measures and achieving universal access to case management in the public and private sectors including accelerating the development of surveillance systems. (WHO, 2011).

CHAPTER THREE: METHODOLOGY

3.2 Study area

The study involved primary schools within Kisarawe district which were selected during sampling procedure. Kisarawe district was used since it is one among malaria endemic districts in the country. Kisarawe district is one among 6 districts in the coastal region and is bordered with Indian Ocean to the east, Dar es Salaam city to the north east, by Kibaha district to the north, Morogoro region to the west and Rufiji district to the south. The district is located along coastal zone which is characterized by high temperature and humidity with rainfall ranging around 500 – 1100mm, short rains comes around November to December while long rains from February to June but with some fluctuations.

Most of residents are involved in subsistence agriculture which is the basic economic backbone for the district. The basic cash crops are cashew nuts, coconuts, citrus fruits, mangoes, papaws and pineapples while food crops includes cassava, rice, sweet potatoes, maize and millets. Apart from agricultural activities also some people work on fishing and some little poultry keeping. Food security at house hold level is limited by the poverty, lack of income, poor food production and preservation therefore even little of food crops and fruits grown are sold to generate cash for other demands.

Zaramo is the dominant tribe but also less representative tribes are Kwere, Ndengereko, Makonde and Sukuma who are fairly scattered in many of the coast regions districts. Majority of residents use Swahili language for communication and most of them are Muslims as well as polygamists where women get married relatively early and even before 18 years of age.

Basically most of Kisarawe district residents used to have two meals per day and some of the foods such as eggs and some species of sea fishes are restricted to pregnant women while eating pica is very common among them. The main staple foods are rice, cassava and maize, these are served with vegetable sauces such as cassava leaves or small fishes i.e. sprats however fishes and meat are expensive hence they are rarely included in the meals for the majority. Chicken are fairly available but are not used as routine part of their meal, instead they are used for visitors, rituals and fund raising for the basic needs.

3.1 Study design

A descriptive cross sectional study was conducted in Kisarawe district to determine the prevalence of malaria infection among school children following roll out of ITNs and ACTs use in Tanzania.

3.3 Study population

The study population involved primary school children from grade 4 to grade 7 in Kisarawe district from which blood samples were taken for malaria parasites examination and haemoglobin level followed by interviews regarding ITNs and ACTs use

3.4 Eligibility criteria

3.4.1Inclusion criteria

All primary school children in grade 4 to grade 7 who agreed to participate with signed informed consent form from their parents or care takers and attended to school at a day when data collection was done were included.

3.4.2 Exclusion criteria

School children who were severely ill or who had not attended to the school during the study and those who refused to consent for the participation and had no signed informed consent form from their parents or caretakers were excluded from the study.

3.5 Sample size

The sample size was calculated from the following formula which was adopted from Kirkwood (2003).

$$N=\frac{z^2 p\,(1-p)}{d^2}$$

Where: N= total number of subjects required in the sample

z= a standardized normal deviate value that correspond to a level of statistical significance of $P \leq 0.05$ which is 1.96

p= estimate of proportion of malaria parasitemia among school children in Kisarawe district which is 24.3%, (Otito, 1994). This p was used since the author did the study using the same methodology in the same study area.

d=margin of error on p which is 0.05

$$N = \frac{(1.96)^2\ 0.243(1-0.243)}{(0.05)^2}$$

= 283 + 14 (allow 5% for missing) = 297 ≈ 300 subjects.

3.6 Sampling technique

A random cluster sampling technique was used to obtain schools and simple random sampling was used to obtain participants as a representative sample size. From the list of all primary schools in the district, a random cluster sampling was employed to obtain 10 schools, then within each selected school a simple random sampling was employed to obtain 30 subjects from the list of all children from grade 4 to grade 7 who attended the school during sampling day. The eligible school children were mobilized in one classroom and asked to pick one folded small paper which was either plain or written word “YES” after short description about the study. Those who picked the piece of paper with word YES were recruited to participate in the study. Selected children were then given written informed consent form for their parents/guardians to read and sign if they agree for children to participate on the study. For illiterate parents, students were instructed to read for their parents.

3.7 Recruitment of research assistants and piloting of research tools

Two research assistants with interviewing skills and medical background were recruited and oriented to the study for two days and these were assistant laboratory technician and laboratory technician. Prior to commencing the study, questionnaires were pre tested in one of the primary schools which was Chanzige A primary school in Kisarawe district to check if the questions were well understood, if the sequence of the questions was logical and if there was a need for any modification in terms of structuring or rephrasing the questions. To avoid bias this school

was excluded in the study during data collection. Thereafter amendments of the questionnaire was made, this was to remove some questions which appeared not to be well understood to the primary school children, add some new questions with easier language to the primary school children.

Information collected by the research assistant was validated by the principal investigator in the field by checking each questionnaire. Primary school children were interviewed by the research assistant to fill in the questionnaire.

3.8 Data collection procedures

Laboratory investigation of peripheral blood collected from finger prick for malaria parasite and hemoglobin level was done by laboratory technicians trained as research assistants. Thick and thin blood smears were fixed and stained with 10% Giemsa and examined for malaria parasites at Kisarawe district hospital and MUHAS laboratories. Two laboratory technicians read the slides, a minimum of 100 microscopic fields were examined for final diagnosis of no malaria parasite and when results differ between them, a third reader was required to ensure validity. Third reader also read 10% of the positive slides and 5% of the negative slides that were selected randomly for quality assurance. Hemoglobin level was investigated at the field using portable Hemo Cue machine by examining peripheral blood from finger pricks. Definition of anemia was based on WHO criteria and national guidelines definition where hemoglobin level is < 7g/dl is regarded as severe anemia, hemoglobin level between 7-9.9g/dl is moderate anemia, hemoglobin level between 10-10.9g/dl is mild while hemoglobin level of ≥ 11g/dl is regarded as normal hemoglobin level (WHO, 2011). A structured questionnaire was used to interview subjects for capturing information on, availability and use of ITNs and the history of ATCs use in past 6 months for malaria infection treatment. Questionnaires were reviewed after interview to check for the completeness and errors.

3.9 Study logistics

An introductory letter attached with ethical clearance letter from Muhimbili University of Health and Allied Sciences (MUHAS) was submitted to the District Executive Director (DED) to give

permission to conduct the study within his/her area. I requested support from District Medical Officer (DMO) and District Education Officer (DEO); selection of the schools was assisted by the DEO who also wrote the letter to the heads of the schools selected for the permission and support. At the school a meeting was held with teachers for the briefing about the study and request for the permission and support.

3.10 Ethical Consideration

Before conducting the study, ethical clearance was sought from Muhimbili University of Health and Allied Sciences Institution Review Board after reviewing of the proposal and then the permission was requested from the District Education Officer. The informed consent was requested from head teacher in each school after having a permission letter from District Education Officer and finally written informed consent form was given to the selected subjects in advance. They were requested to go with them to their care takers and request them to read and sign if they allow children to participate in the study and all selected children brought back signed informed consent forms. For those subject who were diagnosed having anemia and any other health problem were referred to the nearest health facility for proper management.

3.11 Variables

3.11.1 Dependent Variables

1. Malaria parasite infection
2. Hemoglobin level

3.11.2 Independent Variables

1. Use of ACTs
2. Use of ITNs
3. Age
4. Sex

3.12 Data Entry and Analysis Plan

The data entry, storage and data analysis were done by the principal investigator using SPSS Version 13.0 computer software. The double entry was done for raw data to minimize possibilities of errors during data entry. Frequencies and cross tabulation were produced to obtain proportions and chi squared tests for each of the study variables. Bivariate and multivariate analysis using logistic regression was done to obtain association between independent and dependent variables by calculating crude odds ratios and adjusted odds ratios as well as 95% confidence intervals. Epi info computer soft ware was used to obtain 95% confidence intervals of the proportions. Statistical significance for statistical tests was achieved when P value was ≤ 0.05.

CHAPTER FOUR: RESULTS

4.1 Study population

A total of 300 school children in Kisarawe district were recruited for the study and all agreed to participate fully with their parents signed consent forms, there was no refusal. The sample comprised 30 children from standard four to standard seven from each primary school where by 10 schools were selected for the study. The study population was examined for the asymptomatic malaria infection and anemia problems then they were interviewed about the use of ITNs as well as use of ACTs for the malaria interventions.

4.2 Demographic characteristics

The schools which were selected include Chanzige B, Kibasila, Kazimzumbwi, Masaki, Kauzeni, Kibuta, Masanganya, Chang'ombe, Mfuru and Mengwa primary schools. Of the total study population, male were 130 (43.3%) and female were 170 (56.7%), female population appeared to be slightly higher. The minimum age was 8 years and maximum age was 17 years with mean age 12.4 (S.E=0.091) years. Out of the 300 school children, 75 (25%) were standard four, 68 (22.7%) were standard five, 81(27%) were standard six and 76 (25.3%) were standard seven with no statistical difference distribution by age. (χ^2=0.699, p value= 0.874). The Table 1 below summarizes the study population distribution by schools and grades while Table 2 is summarizing the study distribution according to different demographic characteristics which are sex, age groups and classes.

Table 1: Distribution of study participants by schools and grades

	Grades			
Schools	**Grd Four. N (%)**	**Grd Five. N (%)**	**Grd Six. N (%)**	**Grd Seven. N (%)**
Chanzige B	10 (13.3)	5 (7.4)	5 (6.2)	10 (13.2)
Kibasila	10 (13.3)	8 (11.8)	4 (4.9)	8 (10.5)
Kazimzumbwi	6 (8.0)	6 (8.8)	9 (11.1)	9 (11.8)
Masaki	9 (12.0)	10 (14.7)	10 (12.4)	1 (1.3)
Kauzeni	13 (17.3)	2 (2.9)	9 (11.1)	6 (7.9)
Kibuta	6 (8.0)	6 (8.8)	7 (8.6)	11 (14.5)
Masanganya	5 (6.7)	8 (11.8)	10 (12.4)	7 (9.2)
Mengwa	7 (9.3)	7 (10.3)	7 (8.6)	9 (11.8)
Chang'ombe	5 (6.7)	8 (11.8)	9 (11.1)	8 (10.5)
Mfuru	4 (5.3)	8 (11.8)	11 (13.6)	7 (9.2)
Total	75 (100)	68 (100)	81 (100)	76 (100)

Table 2: Demographic characteristics of studied population

Characteristic	N (300)	%
Sex		
Male	130	43.3
Female	170	56.7
Age groups(years)		
7-11	79	26.3
12-14	192	64
≥15	29	9.7
Grades		
Grade four	75	25
Grade five	68	22.7
Grade six	81	27
Grade seven	76	25.3

4.3 Prevalence of malaria and anemia

The overall point prevalence of malaria was observed to be very low; only 9 blood samples (subjects) which equals to 3.0% [95%CI (1.38, 5.20)] had asymptomatic malaria parasites in peripheral blood. All 9 positive blood samples had only *P. falciparum* species and 6 blood samples out of 9 which were positive showed sexual stage of malaria parasites i.e. gametocytes. This indicates the proportion of gametocytes among malaria positive individuals is higher than expected.

The mean hemoglobin level was observed to be 12.415g/dl (S.E=0.72) with minimum hemoglobin level of 7.7g/dl and maximum value of 16.3g/dl. The overall prevalence of anemia (hemoglobin level below 11g/dl) was 10.3% [95%CI (7.1, 14.0)]. Among anemic school

children, 10 (32.3%) [95%CI (16.7, 49.4)] had moderate anemia i.e. had hemoglobin level ranging from 10 to 10.9g/dl and 21 (67.7%) [95%CI (48.6, 82.7)] had mild anemia which was equivalent to hemoglobin level ranging from 7.1 to 9.9g/dl. The Table 3 below presents the prevalence of anemia according to demographic characteristics.

Table 3: Prevalence of anemia among school children by demographic characteristics

		Anemia			
Demographic characteristics	**N**	**Number of anemia cases**	**Prevalence**	**χ^2(df)**	**p- value**
Overall	300	31	10.3	-	-
Sex					
Male	130	15	11.5		
Female	170	16	9.4	0.36(1)	0.549
Age groups(years)					
7-11	79	4	5.1		
12-14	192	23	12		
15-17	29	4	13.8	3.30(2)	0.192

From the above Table 3, anemia was found to vary according to sex and age but all variations were statistically not significant. Male were found to be more anemic with prevalence of 11.5% versus 9.4% for female(p-value=0.549), also the prevalence of anemia is increasing with increase of age which is 5.1%, 12% and 13.8% for age groups of 7-11, 12-14 and 15-17 years respectively (p-value=0.192).

4.4 Factors associated with anemia among school children

Association of anemia with some factors including demographic characteristics, history of malaria episode in last one month, use of ITN, and use of ACT was done. However none of these associations are statistically significant. Table 4 indicates results from bivariate analyses of risk factors associated with anemia among school children.

Table 4: Bivariate and Multivariate analysis for association between anemia and risk factors (sex, age, malaria infection, ITNs use and ACTs use) among school children

Factor	N	Number of anemia cases(Percentage)	COR (95%CI)	AOR (95%CI)
Overall	300	31(10.3)	-	-
Sex				
Male	130	15 (11.5)	1.26(0.6-2.64)	1.07(0.45-2.59)
Female	170	16 (9.4)	1	1
Age group(years)				
7-11	79	4 (5.1)	0.33(0.06-1.74)	0.31(0.07-1.45)
12-14	192	23 (12.0)	0.85(0.25-3.18)	0.55(0.16-1.89)
15-17	29	4 (13.8)	1	1
Malaria episode				
≤ 1 month	90	8 (8.9)	0.83(0.33-2.07)	1.2(0.46-3.15)
> 1 month	210	22 (10.5)	1	1
ITN use among who possess				
Use in last night	190	19 (11)	2.33(0.79-7.38)	1.28(0.45-3.62)
No use last night	62	5 (8.1)	1	1
ACT use				
Yes	258	27 (10.5)	1.11(0.34-3.98)	0.98(0.27-3.55)
No	42	4 (9.5)	1	1

From the table it shows that all these risk factors didn't show statistically significant association with anemia when bivariate analysis was done. The association of these risk factors with anemia was further adjusted for sex, age groups, history of malaria episodes, ITNs use as well as ACTs use to control for confounders. This was done by the use of multivariate regression analysis. However all factors showed no statistical significant association with anemia as well.

4.5 Proportion of ACTs

The study reported history of malaria episode within the last one month during survey was 70 children 23.3% [95% CI (18.66%- 28.27%)] out of 300 subjects and 86% [95% CI (81-6%, 89.7%)] were reported to use ACTs for the treatment of malaria. Others reported that they used quinine 1.7%, Sulfadoxine pyrimethamine 0.3% and 12% gave other responses such as panadol, melafin, didn't know and didn't remember. Most of them were able to access ACTs in health facilities that is 82% and 12.3% in the small pharmaceutical shops while 5.6% didn't knew where ACTs can easily be accessed. About how they accessed ACTs when they were sick, 60.7% reported that they pay money after prescription to get ACTs while 27.7% reported that they get them free of charge and 11.6% said they don't have idea about how ACTs can be accessed. Table 5 below shows a summary of proportional of ACTs use among school children by demographic characteristics.

Table 5: Proportional of ACT use among school children by demographic characteristics

Characteristics	N	ACT use		χ^2(df)	*p-value*
		No of ACT use	Prevalence		
Overall	300	258	86	-	-
Sex					
Male	130	115	88.5		
Female	170	143	84.1	1.155(1)	0.283
Age groups(years)					
7-11	79	67	84.4		
12-14	192	166	86.5		
15-17	29	25	86.2	0.127(2)	0.938

The Table 5 above shows the proportional of ACT use has slight difference among male and female (88.5% versus 84.1%), however the difference is not statistically significant, p-value = 0.283. This was similar case for the different age groups where the use of ACT differed slightly from 7-11 years, 12-14 years and 15-17 years with 84.4%, 86.5% and 86.2% respectively (p-value=0.938).

4.6 Proportion of ITNs use among school children

The overall reported use of ITNs among 300 school children during the survey was 251 (83.7%) [95%CI (79.87.6)] while 34(11.7%) reported not to use ITNs and 15(5%) had no ITNs at their home. About 59.4% of those 251 who reported to use ITNs were using them daily and 75.7% reported to use ITNs last night. Use of ITNs last night was considered more reliable to minimize recall bias, below is Table 6 summarizing the prevalence of ITNs use in the last night in relation to demographic characteristics.

Table 6: Proportion of ITNs use last night among school children who reported to possess ITN by demographic characteristics

Characteristics	N	ITN use		χ^2 (df)	*p-value*
		No of ITNs use	Prevalence (%)		
Overall	251	190	75.7	-	
Sex					
Male	106	26	24.5		
Female	145	35	24.1	0.01(1)	0.943
Age groups(years)					
7-11	66	52	78.8		
12-14	161	119	73.9		
15-17	24	19	79.2	0.78(2)	0.678

The Table 6 suggests that the prevalence of ITN use in last night has no statistical significance variation with demographic characteristics. The prevalence among male was slightly higher than female i.e. 24.5% versus 24.1% however, the difference was not significant p value= 0.943. Similarly the use of ITN was not associated with different age groups as shown in Table 6 as well, p value = 0.678.

All study subjects reported that they had heard about ITNs, however the source of information differed among individuals in the group. Among them 90 school children reported to get information in the school, this is 30% [95%CI (25, 35.3)], 19.3%[95%CI (15, 24)] reported to receive information from media,18.7%[95%CI (14.4, 23.3)] from health facilities, 18.7% [95%CI (14.4, 23.3)]from campaigns on ITNs use, 13%[95%CI (9.4, 17)] from parents and 0.3%[95%CI (0.01, 1.23)] from reading a book. The figure 1 below summarizes these findings for the source of information about ITNs among the studied population.

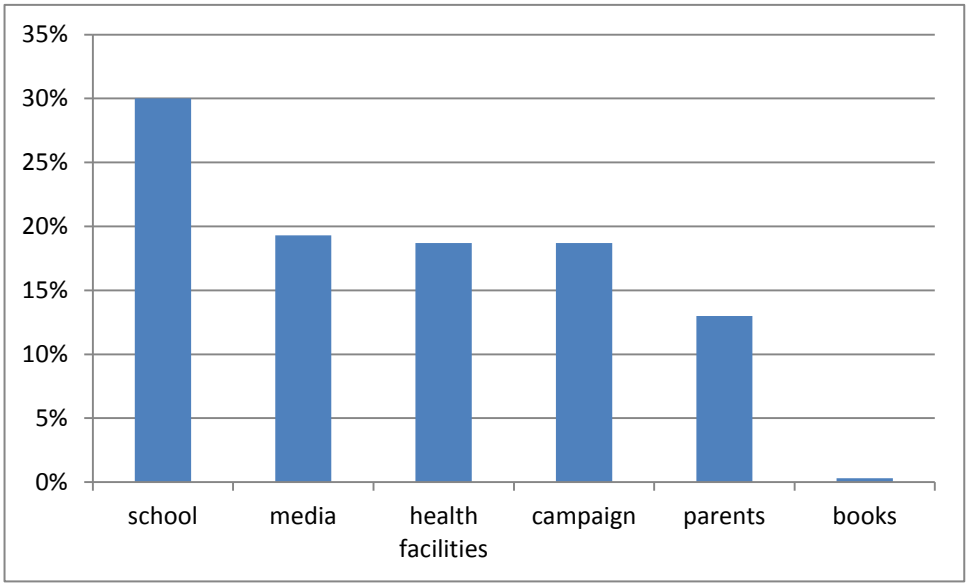


Figure 1: Different source of information about ITNs

4.7 Factors associated with ITN use last night among school children reported to possess ITN

Table 7 summarizes factors that associate with the ITNs use among the studied children. All factors seem to have slightly variations which were not statistically significant. There was a very small difference on use of ITNs last night with regards to sex, malaria episodes in last month, age groups and use of ACTs for treatment of malaria with no statistical significant differences.

Table 7: Factors associated with use of ITNs last night among school children

		ITNs use			
Factor	**N**	**No of ITN use**	**Percentage**	χ^2	***p*-value**
Sex					
Male	106	80	75.5		
Female	145	110	75.9	0.05	0.943
Age group(years)					
7-11	66	52	78.9		
12-14	161	119	73.9		
15-17	24	19	79.2	0.778	0.678
Malaria episode					
≤ 1 month	74	53	71.6		
> 1 month	177	137	77.4	0.95	0.330
ACT use					
Yes	219	167	76.3		
No	6	5	83.3	0.29	0.589

CHAPTER FIVE: DISCUSSION

5.1 Prevalence of asymptomatic malaria

Kisarawe district has been selected as one of the endemic area for malaria with possibly wide intervention scale against malaria infection. Malaria poses many societal and economic burdens in Tanzania, ranging from school absenteeism to low productivity in the workplace. This survey of 300 primary school children reported a point prevalence of asymptomatic malaria to be 3.0% (95% CI 1.38, 5.20) basing on microscopy examination. Surprisingly 6 subjects out of 9 who had asymptomatic malaria had gametocytes in their blood samples although ACTs are currently wide used. This low prevalence may conceivably be explained by the wide scale up of the malaria control measures as compared to the prevalence reported by Otito 1994 which was 24.3%, this is a significant reduced prevalence (χ^2 =85.5, p-value < 0.01). Similar observations were made in an area with similar malaria endemicity along the coastal zone where a malaria prevalence of 1.4% was recorded in school age children in the same age range (Kilamile, 2011). These findings do look similar to the study reported in Solomon Island (Harris et al. 2010) where the prevalence was 2.7%.

On the other hand, the study conducted in Iringa on 2008 indicated high prevalence of asymptomatic malaria ranging from 14.83% to 73.66% in different localities of the low and intermediate land by altitude (Mboera, 2008). This is significant high prevalence as compared to my study, however could be due to some reasons which includes ITNs use and age of study population where the prevalence of ITNs use in Iringa was only 16.1% which is relative low and age range of the study population was 5.9-12.3years with probably lower mean age as compared to the one in my study which was 12.4years. The study of Mboera was conducted in 2008 where most of the interventions such as ITNs and ACTs were not implemented and scaled up as compared to 2012.

Current focus about malaria includes an explicit shift in emphasis from control alone and now it includes a progression from control to elimination and eventual eradication (Laxminarayan. R, 2008). Since elimination may require new tools such as vaccine, resources for the short term are likely to focus on expanding coverage with existing tools which include not just ITNs and indoor

residual spraying (IRS) to reduce transmission but also effective antimalarials that are essential to any sustained malaria control strategy.

The reduction of malaria reported in this study could be likely attributed by the increase availability of ITNs and particularly utilization by the young children, the same report in Burkinafaso rural areas was published where a study about falciparum malaria in young children compared data in 1999 and 2009, ITNs use showed strong association with reduction of malaria infection (Beiersmann. C, 2011). Wide use of ACTs for the treatment of malaria is another factor that contributed to significant reduction of malaria infection due to the fact that it kills both asexual and sexual forms (gametocytes) of malaria parasites. Combination of ITNs intervention and ACT wide distribution observed to have significant impact on malaria control, the similar observation has been reported in Rwanda and Ethiopia where by initial evidence indicated that the combination of mass distribution of ITNs to all children < 5 years or all households and nationwide distribution of ACTs in the public sector was associated with substantial declines of in-patient malaria cases and deaths by more than 50% in both Rwanda and Ethiopia (Otten et al, 2009).

With the support of current malaria treatment guidelines, ACTs have been used as first line treatment of malaria almost all over the country, this has made them being available in all government health facilities and most of the private facilities. These wide scaled up intervention especially in Kisarawe district has been attributed by several non-governmental projects which have been implementing several health services within the district. Plan International and Ahead project are NGOs which facilitate and accelerated distributing ITNs especially to school children via school health programs as part of their activities in the district, the combination efforts have made ITNs available to a significantly big number for Kisarawe residents.

However the study didn't find any significant association between asymptomatic malaria and ITN use, since the prevalence of asymptomatic malaria is very low then the association could not be addressed enough. There was exclusion of school children below standard four who may probably have more risk of asymptomatic malaria due to their age being averagely lower and probably resulted to lower prevalence of asymptomatic malaria. Indeed the sample size of 300 probably was small not sensitive enough to pick up asymptomatic individuals, this consideration is due to the fact that the prevalence used for calculation was of several years back before

interventions i.e. it was very big compared to the current situation. On the other hand this suited funding situation where the fund was small compared to the study design.

5.2 Prevalence of anemia

Anemia is characterized by a low level of hemoglobin in the blood and is a major health problem in Tanzania, especially among young children and pregnant women. One among the most common cause of anemia is nutritional anemia resulting from inadequate dietary intake of nutrients necessary for synthesis of hemoglobin, such as iron, folate, vitamin B12, or other nutrients. Anemia also results from sickle cell disease, malaria, or parasitic infections. A number of interventions have been put in place to address anemia in children which include promotion of use of insecticide-treated mosquito nets (ITNs) by children and deworming.

The point prevalence of anemia in this study was reported to be 10.3% [95%CI (7.1, 14.0)] and there was no severe anemia, this is according to WHO definition that has been adopted by the country which regard severe anemia when hemoglobin is < 7g/dl and normal status when hemoglobin is >11g/dl. This is significantly lower prevalence when it is compared to the study by Otito in the same area in 1994 which reported the point prevalence of anemia to be 86.1% among the same study population. When association of anemia was made with possibly risk factors related to malaria which were history of malaria, status of using ITNs, status of using ACTs, age and sex they showed there was no any statistical significant association. Since also malaria prevalence is very low this suggests that the existing anemia could be due to other factors apart from malaria related factors such as nutritional and soil transmitted helminthes infections.

5.3 Proportion of ACTs use

ACT is the first-line drug for treatment of malaria in both Mainland Tanzania and Zanzibar; it has been introduced due to the emerging resistance of malaria parasites to the mono therapy anti malarial drugs such as sulphadoxine pyrimethamine (SP) and chloroquine which were commonly used in the country. It has been reported that ACTs are more effective as compared by other anti malaria medicines such as Chloroquine especially in the speed of alleviating malaria signs and

symptoms following treatment i.e. fever and parasite clearance, Cochrane Review via evidence updates reported (Cochrane Review, 2011).

This study reported that the proportional of ACTs use among primary school children was 86% [95%CI (81.6, 89.7)]. These findings show that there is higher proportional of acceptance of ACTs on current malaria treatment regimen within the community. This achievement was probably influenced both by comprehensive information to the public which includes promotion through media and health care staff and by the strong commitment of the government to rapidly ensure coverage of the ACTs at free cost to special groups and subsidized cost to other groups. A lot of funds in malaria are spent to expand access to ACTs through the public, NGO and commercial private sectors with the aim of saving lives and preventing emergence of resistance associated with the use of artemisinin monotherapies and so it is critical to maintain the effectiveness of ACTs as first-line treatment (Laxminarayan. R, 2008). Similarly, the study done in Zanzibar in 2007 reported high deployment of the ACTs after commitment from the government on advocating ACTs as first line drug of choice for malaria treatment, which together with ITNs use they were reported to reduce mortality, morbidity and malaria infections significantly (Bhattarai A et al, 2007)

5.4 Proportion of ITNs use

The use of ITNs is a primary health intervention to reduce malaria transmission in Tanzania where it reduces biting intensities and offers protection against malaria at individual level. Widespread use of ITNs also reduces malaria at the population level by decreasing the length of adult mosquito life spans. ITNs are being promoted through three main channels which are the public sector, public/private partnerships implemented by nongovernmental organizations directly in communities and private sector social marketing initiatives.

The proportion of ITNs use was reported to be 83.7%[95%CI(79,87.6)] among school children who reported to have ITNs at their home but only 59.4%[95%CI(53,65)] among them were reported to use ITNs consistently after reporting that they use them every day, however 75.7%[95%CI(69.9,80.8)] reported to use ITNs during the last night, the report of using ITN last night could be more valid since it minimize recall bias. This is significant high proportion of ITNs use and it is around the target provided by RBM (≥80% ITNs coverage). This prevalence

of ITNs use is not much different with the one obtained in Zanzibar which was surveyed and reported within 4-9 months after a wide distribution of free ITNs i.e. 87.7% in Micheweni and 91.8% in North A district (Beer *et al*, 2010). Free ITNs distribution in Zanzibar which was done in 2006 has been reported bringing significant impact towards reduction of malaria infection prevalence, (Bhattarai A et al, 2007) reported10 folds reduction of the malaria parasite prevalence.

On the other hand, the study conducted by Matovu in 2009 which was assessing equitable on bed net ownership and utilization in Tanzania reported the overall use of ITNs to be 38% (Matovu, 2009), this was below RBM target. However most of areas in Tanzania especially in main land were not well reached with efforts on ITNs distribution from the government as well as NGOs. Also in the study conducted in 2009 in Mpanda and Kisarawe districts reported the use of ITNs to be 77% and 42% respectively for 2007/2008 (Ruhago, 2011). These data shows low prevalence for Kisarawe compared to the present situation, Mpanda district was reported to receive free distribution of ITNs while Kisarawe represented district without free distribution of ITNs rather subsidized cost of ITNs. Present situation in Kisarawe realized high proportion of ITNs use which could be due to the wide scale of free ITNs distribution not only by government but also NGOs such as Plan International.

Prior to the free distribution of ITNs however sensitization of the community and information, education and communication (IEC) to advocate ITNs use are vital to ensure acceptance and correct use. The misuse of ITNs has been reported in several areas within the countries, this is supported by this study where by 19% of school children reported to use ITNs for other uses at their home apart from mosquito protection. The common other uses include protection of chickens against predators as well as during farming to protect crops from birds and other animals, also 3% reported that ITNs use is associated with some side effects such as skin rash, fever and suffocation. These facts are alarming that without enough education and community sensitization the efforts of ITNs deployment could be compromised. The best platforms for giving information, education and communication to the children about ITNs use and its benefits especially in the remote areas where media such as TVs and Radios are not so common include schools, campaigns and parents.

5.5 Study limitations

1. The study didn't include school children below standard four who could have lower mean age. The younger children could probably have more risk of infection.

2. To differentiate ITNs from untreated net might be difficult for some children and might results invalid responses.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The significant decline of asymptomatic malaria prevalence observed in this study is the evidence supporting the major public health benefits of ACT and ITNs in a stable endemic malaria transmission setting in sub-Saharan Africa. High community uptake of the two interventions is probably required but indeed achievable if, as in our study, they are easily available free of charge. According to the findings from this study, malaria infection has dramatically dropped following wide scaled up of interventions which includes ITNs and ACTs which showed by high proportion of being used.

The prevalence of anemia has dropped as compared to the previous study which could be due to decrease in asymptomatic malaria which is one of the major causes for anemia among children. The prevalence of anemia showed that is not associated with malaria however there might be other causes of anemia which could be such as STHs and nutrition.

The UN Millennium Development Goals to alleviate malaria as a major public health problem and substantially reduce the under-five mortality in sub-Saharan Africa are thus achievable even in settings with historically intense malaria transmission. The sustainability of these efforts as well as surveillance to prevent resurgence of malaria represents key research and programmatic follow-up issues of malaria control in Africa.

6.2 Recommendations

1. ITNs and ACTs are important interventions for the significant reduction of malaria infection in the area with stable malaria transmission.

2. The interventions have significant impact on reduction of anemia problem attributed by malaria infection among school children

3. More studies on the prevalence of asymptomatic malaria that includes younger children from lower classes and with large sample size is needed to be conducted.

4. The possible causes of the prevailing anemia problem should be investigated including nutritional factors as well as soil transmitted helminthes infection.
5. Malaria interventions which include ITNs and ACTs should be more implemented to cover the whole community for more effectiveness.

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APPENDICES

Appendix I: Consent Form English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS

INFORMED CONSENT FORM

ID-NO_____

Consent to participate in the research study.

Greetings! My name is **Saturini Manangwa** from **MUHIMBILI UNIVERSITY OF HEALTHAND ALLIED SCIENCES (MUHAS), MSc TDC Candidate.** I am conducting research project with the objective of investigating "**Prevalence of Malaria infection following wide scaling up of malaria interventions among School Children in Kisarawe District, Tanzania".**

Study Purpose.

The study is intended to collect information about proportional of malaria parasitemia, anemia and use of ITNs and ACTs among school children in the district. Findings from the study will help to map the current situation of the problem and strengthen the malaria control measures.

What Participation Involves.

If you agree your child to participate in the study, he/she will be required to answer questions during interview and to provide a finger prick blood sample for malaria and anemia investigation.

Confidentiality.

All collected information will be entered into computers with only the study identification number without involving names. Confidentiality will be provided and unauthorized persons will have no access to the data collected.

Benefits

If you agree your child to take part in this study, he/she will benefit directly and indirectly. Directly, any child found with any health problem including anemia will be referred to the nearest health facility for management. Also he/she may receive assistance to any problem(s) which may be known during the study period. Indirectly, the information that he/she will provide will help us to understand and know the magnitude of malaria and anemia among primary school children in Kisarawe District, and the findings will be disseminated to the policymakers especially public health specialists and planners for addressing the problem.

Potential Risks

I assure you that no harm will be expected to happen to your child because of participation in this study however during finger prick one may feel some pain.

Rights to Withdraw and Alternatives

Participation in this study is completely your choice. You can stop child participating in this study at any stage, even if you have already given your consent. Refusal to participate or withdrawal from the study will not involve any penalty or loss of any benefits to which you are otherwise entitled.

Contacts.

If you ever have questions about this study, you may contact the study Principal Investigator:

Saturini Manangwa, Muhimbili University of Health and Allied Sciences, P. O. Box 65015, Dar es Salaam.

Mobile number: +255784 715 825. E Mail: saturinem@yahoo.co.uk

Also you may contact **Prof. M. Aboud, a Chairman of Senate Research and Publications Committee, MUHAS, P. O. Box 65001, Dar es Salaam.**

Tel: 0222150302-6.

I _____have read/listened the contents in this form. I agree my child to participate in this study.

Signature of the care taker_____

Signature of the Principal Investigator_____

Date of signed consent _____

Appendix II: Consent Form Swahili Version

CHUO CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA UTAFITI NA MACHAPISHO

FOMU YA RIDHAA

NAMBARI YA UTAMBULISHO_____

Ridhaa ya ushiriki katika utafiti

Habari! Jina langu ni **Saturini Manangwa,** natoka katika Chuo Kikuu cha Sayansi za Afya Muhimbili, mwanafunzi wa shahada ya uzamili. Ninafanya utafiti wenye lengo kuu la kuchunguza **Kiwango cha maambukizi ya malaria na upungufu wa damu baada ya upanuzi wa shughuli za kukinga maambukizi baina ya wanafunzi wa shule za msingi wilayani Kisarawe, Tanzania**.

Lengo la utafiti

Utafiti huu unakusudia kukusanya takwimu kuhusu kiwango cha vimelea vya malaria katika damu, upungufu wa damu na matumizi ya vyandarua vyenye dawa pamoja na matumizi ya dawa mseto kwa wanafunzi wa shule za msingi katika wilaya hii. Matokeo katika utafiti huu yatasaidia kujua ukubwa wa tatizo na kushauri juu ya uimarishaji zaidi wa shughuli za kuzuia maambukizo.

Ushiriki unahusisha nini

Iwapo unakubali mtoto wako kushiriki katika utafiti, mtoto ataombwa kujibu maswali katika dodoso atakayoulizwa na pia kutoa kiasi kidogo cha damu ya kidoleni kwa ajili ya kupima malaria na wingi wa damu.

Usiri

Taarifa zote zitakazokusanywa zitaingizwa katika kompyuta pamoja na nambari ya utambulisho bila kuandika jina la mtoto. Siri zote zitatunzwa na taarifa zilizokusanywa hazitamfikia yeyote asiyehusika katika utafiti huu.

Faida za kushiriki katika utafiti huu.

Iwapo utakubali mtoto wako kushiriki katika utafiti huu, mtoto atapata faida za moja kwa moja na zisizo za moja kwa moja. Faida za moja kwa moja ni pamoja na kwa mtoto atakayegundulika kuwa na tatizo la kiafya ikiwa ni pamoja na upungufu wa damu atapewa rufaa kwa matibabu

katika kituo cha afya kilicho karibu na shule. Pia ataweza kupata msaada kwa tatizo lolote litakalojulikana wakati wa utafiti huu.Faida zisizo za moja kwa moja ni pamoja na taarifa atakazotupatia mtoto zitatusaidia kujua na kuelewa ukubwa wa tatizo la malaria na upungufu wa damu kwa wanafunzi wa shule za msingi katika wilaya hii na majibu hayo yatapelekwa kwa watunga sera za afya na hasa wataalam wa afya ya jamii kwa ajili ya kushughulikia tatizo.

Uwezekano wa kutokea jambo lolote la hatari.

Nakuhakikishia kwamba sitarajii kama kuna hatari yeyote yaweza kutokea kwa sababu ya ushiriki wa mtoto wako katika utafiti huu. Pengine anaweza kuhisi maumivu kidogo tu kutokana na kuchoma kidole cha mkononi kwa ajil ya kupima malaria na wingi wa damu.

Haki ya kujitoa na mambo mbadala

Ushiriki wake katika utafiti huu ni wa hiari yako kabisa. Unaweza kumsimamisha ushiriki wake katika utafiti huu katika hatua yeyote hata kama ulishatoa ridhaa. Kukataa kushiriki au kujitoa katika ushiriki hautahusisha adhabu yeyote au kupoteza haki zako zozote unazostahili.

Mawasiliano

Endapo utakuwa na swali lolote kuhusu utafiti huu unaweza kuwasiliana na mtafiti mkuu: **Saturini Manangwa**, **Chuo Kikuu Kishiriki cha Sayansi za Afya, S. L. P 65015,Dar es Salaam.**

Simu ya kiganjani: +255784 715 825. Barua pepe: saturinem@yahoo.co.uk

Pia unaweza kuwasiliana na **Prof. M. Aboud, Mwenyekiti wa Kamati Utafiti na Machapisho MUHAS, S. L. P 65001, Dar es Salaam.**

Simu ya mezani: 0222150302-6.

Mimi _____ nimesoma/nimesomewa na kuyaelewa vyema maelezo yaliyomo katika fomu hii. Ninakubali mtoto wangu kushiriki katika utafiti huu.

Sahihi ya mzazi/mlezi _____

Sahihi ya Mtafiti _____

Tarehe ya kusaini _____

Appendix III: Questionnaire English Version

Questionnaire No…….

PREVALENCE OF MALARIA INFECTION FOLLOWING WIDE SCALING UP OF MALARIA INTERVENTIONS AMONG SCHOOL CHILDREN IN KISARAWE DISTRICT, TANZANIA

PART A: Demographic Data

1. What is the name of your School……..
2. Sex [ ]
    1. Male
    2. Female
3. What is your age in years…...?
4. Which grade are you [ ]
    1. Standard four
    2. Standard Five
    3. Standard Six
    4. Standard Seven

PART B: Use of Insecticide Treated Nets (ITNs)

1. Have you ever heard about ITNs? [ ]
    1. Yes
    2. No (if no go to 3)
2. Where did you get information about ITN [ ]
    1. Media
    2. Health facility
    3. School
    4. Others specify
3. Do you have ITN at your home? [ ]
    1. Yes
    2. No (if no go to 9)
4. How do you normally get ITNs at your home [ ]
    1. Buying at shops
    2. Free of charge from campaign
    3. Subsidized price from health facility
    4. Others specify
5. Do you sleep under ITN? [ ]
    1. Yes
    2. No (if no go to 9)
6. How often do you sleep under ITN [ ]
    1. Every day during sleeping
    2. Some time
    3. When am sick
    4. Others specify
7. Did you sleep under the ITN last night? [ ]
    1. Yes
    2. No

3. Others specify

8. Why don't you sleep under ITNs [ ]
    1. Not comfortable to me
    2. Not important
    3. I don't have ITN
    4. Others specify
9. Why don't you have ITN? [ ]
    1. Expensive
    2. Not important
    3. Others specify
10. What are the other uses of ITNs at your home [ ]
    1. Fishing
    2. Chicken protection against predators
    3. Others specify
11. Do you think are there any negative effects might be caused by use of ITNs during sleeping? [ ]
    1. Yes
    2. No
12. What are the negative effects following use of ITNs do you think? [ ]
    1. Causes skin rashes
    2. Causes impotence
    3. Causes fever
    4. Others specify

PART C: Uses of Artemisinin-based Combination Therapies (ACTs)

1. When did you last have malaria episode [ ]
    1. This week
    2. Last week
    3. Last two weeks
    4. Last month
    5. More than a month ago
2. Have you ever heard about ACTs? [ ]
    1. Yes
    2. No (go to 4)
3. What are the ACTs [ ]
    1. Drug used as first line for treatment of uncomplicated malaria
    2. Drug used for the treatment of the diarrhea
    3. Drug used for the treatment of pneumonia
    4. Others specify
4. When you get malaria episode, which drugs do you normally take [ ]
    1. ACTs
    2. Sulfadoxine Pyrimethamine
    3. Chloroquine
    4. Quinine
    5. Others specify
5. Where do you normally get ACTs for treatment of malaria [ ]
    1. At the dispensary health centre/hospital
    2. Small pharmacy drug shop
    3. Others specify
6. At the hospital, how do you get ACTs [ ]
    1. Buying
    2. For free

3. Others specify

7. When you are sick what do you do before starting treatment [ ]
    1. Go to hospital for diagnosis and prescription
    2. Buy the drug and take it without prescription
    3. Wait until condition is worse
    4. Others specify

Appendix IV: Questionnaire Swahili Version

DODOSO Nambari ya dodoso_____

KIWANGO CHA MAAMBUKIZI YA MALARIA NA UPUNGUFU WA DAMU BAADA YA UPANUZI WA SHUGHULI ZA KUKINGA MAAMBUKIZI BAINA YA WANAFUNZI WA SHULE ZA MSINGI WILAYANI KISARAWE, TANZANIA

SEHEMU A: Takwimu za kidemografia

1. Shule yako inaitwaje? _____
2. Jinsia [ ]
    1. Mwnaume
    2. Mwanamke
3. Una umri gani?_____
4. Uko darasa la ngapi? [ ]
    1. Nne
    2. Tano
    3. Sita
    4. Saba

SEHEMU B: Matumizi ya Chandarua Chenye Dawa

1. Umewahi kusikia kuhusu vyandarua vyenye dawa? [ ]
    1. Ndiyo
    2. Hapana (nenda 3)
2. Ulipata wapi taarifa kuhusu vyandarua vyenye dawa? [ ]
    1. Katika vyombo vya habari
    2. Vituo vya afya
    3. Shuleni
    4. Vinginevyo
3. Kuna chandarua chenye dawa nyumbani kwenu? [ ]
    1. Ndiyo
    2. Hapana (nenda 9)
4. Huwa mnapataje vyandarua nyumbani kwenu? [ ]
    1. Kununua dukani
    2. Kupewa bure kutokana na kampeni
    3. Kupewa hati punguzo kutoka kituo cha afya
    4. Vinginevyo
5. Unatumia chandarua chenye dawa wakati wa kulala? [ ]
    1. Ndiyo
    2. Hapana (nenda 7)
6. Ni mara ngapi unatumia chandarua chenye dawa? [ ]
    1. Kila siku wakati wa kulala
    2. Mara chache chache
    3. Wakati naumwa
    4. Vinginevyo
7. Umetumia chandarua wakati wa kulala usiku wa kuamkia leo? [ ]

1. Ndiyo
2. Hapana
3. Vinginevyo

8. Kwanini hutumii chandarua chenye dawa wakati wa kulala? [ ]
    1. Sijisikii vizuri nikitumia chandarua chenye dawa
    2. Haina umuhimu kutumia chandarua chenye dawa
    3. Sina chandarua chenye dawa
    4. Vinginevyo
9. Kwanini huna chandarua chenye dawa? [ ]
    1. Vinauzwa bei kubwa sana
    2. Havina umuhimu kuwa navyo
    3. Vinginevyo
10. Ni matumizi gani mengine ya vyandarua nyumbani kwenu? [ ]
    1. Kuvulia samaki
    2. Kukinga vifarana dhidi ya mwewe
    3. Vinginevyo
11. Unadhani kuna madhara yeyote yanaweza kusababishwa na kutumia chandarua chenye dawa wakati wa kulala? [ ]
    1. Ndiyo
    2. Hapana
12. Ni madhaa gani mtu anawezakupata kwa kutumia chandarua chenye dawa wakati wa kulala? [ ]
    1. Inasababisha vipele katika ngozi
    2. Inapunguza nguvu za kiume
    3. Inasababisha homa
    4. Vinginevyo

SEHEMU C: Matumizi ya Dawa Mseto

1. Ni lini mara ya mwisho uliugua malaria? [ ]
    1. Wiki hii
    2. Wiki iliyopita
    3. Wiki mbili zilizopita
    4. Mwezi uliopita
    5. Zaidi ya mwezi uliopita
2. Umewahi kusikia kuhusu dawa mseto? [ ]
    1. Ndiyo
    2. Hapana (nenda 4)
3. Nini maana ya dawa dawa mseto? [ ]
    1. Dawa ya kwanza inayotumika kwa matibabu ya malaria isiyo kali sana
    2. Dawa inayotumika kwa matibabu ya kuharisha
    3. Dawa inayotumika kwa matibabu ya homa ya kifua
    4. Vinginevyo
4. Ukiugua malaria, ni dawa gani unaitumia kwa matibabu? [ ]
    1. Dawa mseto
    2. SP
    3. Chloroquine
    4. Quinine
    5. Vinginevyo
5. Katika hali ya kawaida huwa unapata wapi dawa mseto kwa ajili ya matibabu ya malaria? [ ]
    1. Katika kituo cha afya
    2. Katika duka la dawa za binadamu
    3. Vinginevyo
6. Ukiwa hospitalini, huwa unapataje dawa mseto? [ ]
    1. Kununua
    2. Bure

3. Vinginevyo

7. Wakati unaumwa malaria, huwa unafanya nini kabla ya kuanza matibabu? [ ]
    1. Naenda hospitali kwa ajili ya uchunguzi na kuandikiwa dawa
    2. Nanunua dawa na kunywa bila ya kuandikiwa na mtaalam wa afya
    3. Nasubiri mpaka hali iwe mbaya zaidi
    4. Vinginevyo

Appendix V: Laboratory Form

Form No……. (SHOULD BE THE SAME WITH QUESTIONNAIRE No)

Blood Sample Results

1. Haemoglobin level (g/dl) [ ]
    1. Hb below 7g/dl (severe anemia)
    2. Hb between 7 and 9.9g/dl (moderate anemia)
    3. Hb between 10 and 10.9g/dl (mild anemia)
    4. Hb of 11g/dl and above (no anemia)
2. Blood smear results for malaria parasites [ ]
    1. Positive
    2. Negative
3. Parasites asexual stage [ ]
    1. Present
    2. Absent
4. Parasites count (No/200WBC) [ ]
    1. <10 parasites
    2. >10 parasites
5. Parasites species [ ]
    1. P. falciparum
    2. P. malariae
    3. P. ovale
    4. P. vivax
    5. P. knowlesi