PREVALENCE OF MALARIA INFECTION AMONG UNDER-FIVES AND THE ASSOCIATED FACTORS IN MULEBA DISTRICT-KAGERA REGION TANZANIA.

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BY

UPENDO MUSHASHU

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 recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: ***Prevalence of malaria infection among under-fives and associated factors in Muleba District-Kagera Region, Tanzania,*** in (partial) fulfilment 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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Profesor: Zul. Premji.

(Supervisor)

Date: _____

DECLARATION AND COPYRIGHT

I, **Upendo Mushashu**, declare that this **dissertation** is my own original work and that it has not been presented and will not presented to any other university for a similar or any other degree award.

Signature..... Date.....

ACKNOWLEGDEMENT

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DEDICATION

This work is dedicated to my young sister and brother: Diana and Edwin Mushashu, to inspire them to move forward and advance in their career.

ABSTRACT

Background: In Tanzania malaria is the leading cause of morbidity and mortality, especially in children under 5 years. The disease ranks number one in both outpatient and inpatient statistics. The socio-economic impact of malaria is so high that it contributes highly to poverty and underdevelopment.

Malaria control and elimination interventions have been scaled up and intensified as the current efforts to attain World Health Assembly, Roll Back Malaria, and Millennium development targets, to reduce and interrupt disease transmission. The major malaria intervention tools now include: The use of long-lasting Insecticidal Nets (LLIN), Artemisinin-based Combination therapy (ACT), Indoor Residual Spraying of insecticide (IRS), and Intermittent Preventive Treatment in Pregnancy (IPT). Despite these interventions the prevalence remains high among the under five children hence this study.

Objectives: This study aimed at examining the prevalence of malaria and the associated factors among the under-five year's children in Muleba District.

Methodology: Descriptive cross-sectional survey was carried out in Muleba district which is a malaria endemic area. Every head of the randomly selected household either female or male who were present at home at the time of data collection were interviewed in Kiswahili language using a pre-tested structured questionnaire - on ITNs ownership, actual usage among those who own ITNs, IRS coverage, socio-demographic factors and malaria parasites in the under-five population were ascertained using a Malaria rapid diagnostic test (mRDT).

Results: A total of 391 under-fives aged between 1-60 month (mean age =22.8 month) were recruited and ascertained for parasitemia using the mRDT. The overall prevalence of malaria was 26.3%. Out of the screened children 79.5% reported to sleep under the ITNs the previous night. The coverage of IRs was observed to be 94%.

Conclusion and recommendation: The higher prevalence could be the result of several factors as explained in this study. Therefore effective malaria control measures should be implemented in order to reduce the prevalence of malaria among the under-fives and hence ensure the public health at large.

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LIST OF ABBREVIATION

ACTs	Artemisinin Based Combination Therapy
DALYs	Disability Adjusted Life Years
HIV/AIDS	Human immunodeficiency virus infection / acquired immunodeficiency syndrome
IPTp	Intermittent preventive therapy in pregnancy
IRS	Indoor-residual spraying
ITNs	Insecticide-treated mosquito nets
LLITNs	Long Lasting Insecticide Treated Nets
MOHsw	Ministry of Health and Social Welfare
MOP	Malari Operational Plan
NIMR	National Institute of Medical Research
NMCP	National Malaria Control Programme
NMTSP	Natinal Malaria Medium Term Strategic Plan
RBM	Roll Back Malaria
RDTs	Rapid Diagnostic Tests
TDHS	Tanzania Demographic health survey
TNVS	Tanzania National Voucher scheme
U5CC	Under-five catch-up campaign
UNDP	United Nations Development Programme
UNICEF	United Nations Children Education Fund
WHO	World Health Organization

DEFINITION OF TERMS

Stable malaria transmission: Areas with a stable transmission have a persistent transmission and hence prevalence of infection. r

Unstable malaria transmission: In areas with an unstable malaria transmission the prevalence of infection varies highly over time and space

Holo-endemic endemic at a high level in a population, affecting most of the children and so affecting the adults in the same population less often

Hyper- endemic - an area exhibiting a high and continued incidence—used chiefly of human diseases

Endemicity the quality or state of being endemic

Epidermic affecting or tending to affect an atypically large number of Individuals within a population, community, or region at the same time. A malaria epidemic is defined as an abrupt increase in Malaria transmission that exceeds by far the inter-seasonal variation normally experienced in a given area and often associated with Increased morbidity and mortality.

CHAPTER ONE

1.0 BACKGROUND

Malaria is the most important parasitic disease of man. Approximately 5% of the words population is infected. Malaria remains one of the major threats to public health and economic development in Africa. It is estimated that three million death results from malaria throughout the world, with Africa having more than 90% of this burden (Breman, et al 2004).

Malaria is the cause of outpatient, inpatient and admissions of children less than five years of age at health facilities in Tanzania (WHO, 2002).The high burden of malaria in Tanzania this is due to the fact that, every year 14-18 million new malaria cases are reported. The annual incidence rate is 400-500/1,000 people and this number doubles for children less than five years of age. There are 100,000-125,000 annual deaths due to malaria, (70-80,000 in under-fives) (Mercia et al, 2004)

1.1 The Parasite and its Life Cycle

The malaria parasite is a mosquito- transmitted protozoan. Plasmodia are sporozoan parasites of red blood cells transmitted to animals (mammals, birds, reptiles) by the bite of mosquitoes. There are four species of *Plasmodia* (*P. falciparum, P. vivax, P. ovale* and *P. malariae*) which can cause malaria in humans and lead to disease (Gilles, 1987). In sub-Saharan Africa most malaria episodes are caused by *P. falciparum*, which is the agent of the most severe and fatal malaria disease.

Transmission of the *Plasmodium* parasite is mainly from person to person through the bite of a female *Anopheles* mosquito. Rarely transmission can be through accidents, such as transfusion, inoculation of infected blood from one person to another, or transfer through the placenta from an infected mother to her unborn child.

The malaria parasite has an unique life-cycle adapted to man over the years. The life cycles of all *Plasmodium* species transmitted to humans are the same with three reproductive phases.

An initial phase consisting of a single cycle of sexual reproduction occurring in the female mosquito is known as sporogony, and produces sporozoites that infect man. At 24°C sporogony takes 9 and 21 days in *P. falciparum* and in *P. malariae* respectively. When the infected mosquito bites man it injects the sporozoites into the blood.

The sporozoites then travel to the liver where the next phase, a single cycle of asexual reproduction (five to seven days for *P. falciparum*) takes place in the human Liver cell called hepatic schizogony or pre-erythrocytic phase producing merozoites. The merozoites enter the blood when the liver cells burst and invade the red blood cells.

The third or final phase known as erythocytic schizogony or erythrocytic cycle consists of several cycles of asexual reproduction (each cycle lasting about 48 hours for *P.falciparum, P. ovale* and *P. vivax,* but 72 hours for *P. malariae*) which takes place in red blood cells. This phase produces new merozoites during each cycle which invade new red blood cells and start the erythrocytic cycle again.

However, due to unknown mechaninsm yet some of these merozoites differentiate into male and female gametocytes, which are taken up by the blood-sucking female *anopheles* to start the next sporogonic cycle in the mosquito.

1.1.1 Clinical features

The clinical manifestations of malaria are dependent on the previous immune status of the host. In areas of intense *P.falciparum* malaria transmission, asymptomatic parasitemia is usual in adults. Sever malari is not common in this age group, it is mostly confined to the first years of life, and becomes progressively less frequent with increasing age. The majority of childhood malaria infections present with fever and malaise and responds rapidly to appropriate antimalaria treatment.

Symptoms of malaria include high fever and a variety of other symptoms like headache, body pains, and non specific vomiting and others (Warrell & Gilles 2002). The intensity of malaria ranges from asymptomatic (mainly in semi-immune populations) to severe and

fatal. Severe anaemia is a common manifestation of severe malaria in semi-immune children and are responsible for long-term developmental impairments and high death rate in children.

1.1.2 Acute malaria

Some days after inoculation of the sporozoites, the first symptom the typical fever. There is fever peak every 48 hours (*P. falciparum*). A fever peak appears as a result of the synchronized bursting of blood schizontes.Through asexual division of the parasite the infected erythrocytes burst and release endotoxins into the blood. The endotoxins are mostly Interleukine-1 and TNF-alpha, which lead to high fever. Other signs of acute malaria are headache, myalgia (muscle pain) and diarrhoea. Malaria infected children may be asymptomatic, or they also exihibit vomiting and hypoglycaemia.

1.1.2 Severe malaria

In patients infected with *P. falciparum* the sequestration of infected erythrocytes leads to complications. Infected erythrocytes have on their surface special receptors. They lead to adherence with other erythrocytes and with the epithelium of the blood vessels. This prevents removal of the parasite in the spleen. Sequestration leads to cerebral malaria, respiratory distress and generalised organ failure. Anaemia is another important complication in malaria infected patients (Warrell & Gilles 2002).

1.2 Global Burden of Disease

Malaria is considered the most consequential parasitic infection in humans. There are as many as 350-500 million clinical episodes per year world wide (UNICEF, 2003) and while most estimates of mortality caused by malaria lie at around 1 million deaths per year (Snow *et al.* 2005), some calculations go as high as 3 million (Breman et al, 2004). Almost all of these deaths occur in children (Phillips, 2001), living in malarious countries in sub-Saharan Africa (SSA) (Ukoli, 1990) where 25% of all childhood mortality below the age of five (about 800,000 young children (Shepard et al., 1991) is attributable to malaria . Of those children who survive cerebral malaria, more than 15% suffer

neurological deficits (NIMR 2006, & Schönfeld et al, 2007) which include weakness, spasticity, blindness, speech problems and epilepsy. Where such children are poorly managed and do not have access to specialized educational facilities, these deficits may interfere with future learning and development Children under the age of five years are at highest risk for malaria because they have not yet aquired protective immunity. People with semi-immunity are infected, but do not get a severe disease as a rule. In stable transmission areas newborns are protected by the IgM antibodies of their mother and through breastfeeding. After three months children have a higher susceptibility for an infection with the parasite. In high transmission areas this time period lasts until the age of 3-5 years. In areas with a seasonal transmission the period can last 10 years. Without re-infection the acquired immunity can dissapear in a matter of years (Eddleston et al. 2008).

Furthermore children under five years of age experience the biggest malaria burden because they are often super-infected with other parasites and/or that they often suffer from nutritional deficiencies. These lead to a weaker immune system, which leads to a higher susceptibility for malaria. Moreover, a malaria infection and malnutrition are reasons for an increasing anaemia burden in children (Greenwood et al.1991)

1.2.1 Malaria in Africa

It is a universally accepted fact that malaria is a disease of public health importance globally. The disease causes the greatest suffering and impoverishment among poor people, particularly in Africa. In 2001, theWorld Health Organization (WHO) ranked malaria as the eighth-highest contributor to the global disease burden as reflected in disability-adjusted life years (DALYs), and the second highest in Africa (WHO 2002.)

As a matter of fact, malaria prevalence is highest among the poorest sections of the society, since they cannot afford protection from malaria through improved housing, clean environment and are particularly vulnerable to the impact of ineffective diagnosis and treatment (Staedke et al, 2003).

There are between 300 and 500 million malaria infections and 1 million malaria attributed deaths worldwide each year. About 90% of these deaths occur in sub-Saharan Africa, and the majority of them occur among women and children. Most of the estimated over one million malaria deaths every year are in children up to 5 years old who live in areas of intense transmission of *P. falciparum*, especially in sub-Saharan Africa (WHO, 1996) Malaria also presents major obstacles to social and economic development of affected countries (WHO, 2002).

1.2.2 Economic cost

Malaria has significant measurable direct and indirect costs, and has recently been shown to be a major constraint to economic development. The direct costs of malaria include a combination of personal and public expenditures on both prevention and treatment of the disease. Personal expenditures include individual or family spending on insecticide treated mosquito nets (ITNs), doctors' fees, anti-malarial drugs, transport to health facilities, support for the patient and sometimes an accompanying family member during hospital stays. Public expenditures include spending by government on maintaining health facilities and health care infrastructure, publicisly managed vector control, education and research. In some countries with a heavy malaria burden, the disease may account for as much as 40% of public health expenditure.

The indirect costs of malaria include lost productivity or income associated with illness or death. This might be expressed as the cost of lost workdays or absenteeism from formal employment and the value of unpaid work done in the home by both men and women. In the case of death, the indirect cost includes the discounted future lifetime earnings of those who die. (Roll Back Malaria WHO, UNDP, UNICEF and the World Bank in 2001-2010)

1.2.3 Malaria Preventive Measure

Series of trials in Africa have shown that proper mosquito net use reduces malaria incidence among children by anywhere from 14 to 63 per cent (Lengeler, 2004). With ITN use, all cause-mortality in children has been shown to decline by 25 per cent in The Gambia (D'Alessandro et al, 1995), 33 per cent in Kenya (Nevill et al, 1996), and 17 per

cent in Ghana (Binka *et al* 1996). Based on findings such as these, the promotion of ITN use has become a central element of national and international efforts against malaria (Frederick et al 2004) The UNICEF corroborates that under-five mortality rates could be reduced by about 25-30% if all young children in malaria endemic areas were protected by treated bednets at night.

Important components for reducing the burden of malaria morbidity and mortality include more sensitive diagnostic tools, effective use of antimalarial drugs, and improved personal protection and mosquito control. The approach to elimination or control of malaria includes these basics, along with improvements in tracking of human illness and parasite surveillance, and effective resource delivery.

Fortunately, effective interventions for preventing malaria mortality in children are available and are being scaled-up across malaria endemic areas of Africa. These include insecticide-treated mosquito nets (ITNs), indoor-residual spraying (IRS) and intermittent preventive therapy in pregnant women (IPTp). Both ITNs and IRS prevent malaria transmission by reducing the chances that an individual will be bitten by an infective *Anopheles* mosquito. ITNs and IRS are recommended strategies for preventing malaria in children with their impact on all-cause child mortality well demonstrated (Lengeler, 2004 &Thomas et al 2010).

1.3 Malaria in Tanzania

Malaria is the single most significant disease in Tanzania causing an enormous burden to health and economy of its 40 million inhabitants (projections from the population census of 2002). The population groups most vulnerable to malaria are children under five years and pregnant women. It is estimated that 90% of about 40 million people in Tanzania are at risk of malaria infection resulting into 11 million clinical malaria cases per annum (NMCP, 2008).

The disease is responsible for more than one-third of deaths among children under the age of 5 years and for up to one-fifth of deaths among pregnant women (MOH Tanzania 2006). Malaria contributes to 39.4% and 48% of all outpatients less than 5 years of age

and aged 5 years and above, respectively (MOH Tanzania 2006). In terms of hospital admissions, malaria accounts for 33.4% of children under the age of 5 years and 42.1% in children aged 5 years and above (MOH Tanzania 2006). In Tanzania, most of the malaria attributable cases and deaths occur in rural villages away from effective diagnostic or treatment facilities.

Malaria poses many societal and economic burdens in Tanzania, ranging from school absenteeism to low productivity in the workplace. In the short term, widespread malaria reduces agricultural production and other economic outputs. Additionally, the cumulative effect in the long term may be a decrease in national economic capacity and development.(TDHS 2010)

The main focus of malaria control measures in Tanzania includes case management (early diagnosis and prompt treatment with effective drugs), vector control using insecticides treated mosquito nets (ITNs), malaria intermittent treatment in pregnant women, malaria epidemics prevention and control, information, education and communication, and operational research (Humphrey et al, 2010). Despite these strategies, malaria cases and deaths have been increasing in the country, mainly due to injudicious use of antmalarial drugs, delayed health seeking, and reliance on the clinical judgment without laboratory confirmation in most of the peripheral health facilities (Humphrey et al, 2010).

1.3.1 Malaria Prevalence and the Associated Factors

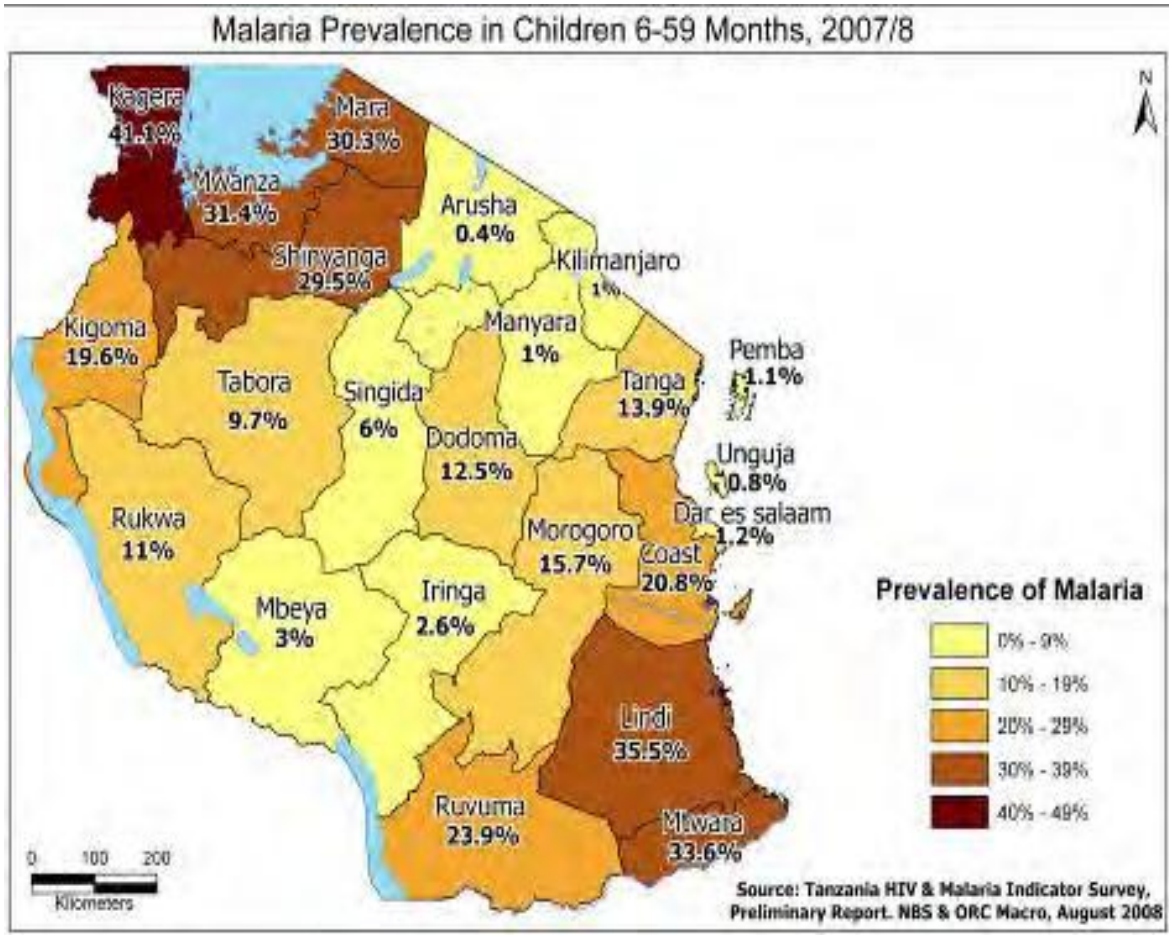
Due to the instability of transmission in the highlands small variations in environmental or human related factors can have dramatic consequences for malaria transmission due to the low immune status of the human population (Lindsay et al 1998 & Shankar,2000) Different factors can drive these changes by influencing the vector's transmission capacity and the malaria prevalence. These factors can be grouped into three classes: (1) environmental factors such as altitude and climate (2) biological factors related to the *Anopheles* vector, the parasite and the human host and (3) human related factors such as socio-economic status, health access, migration, gender, control activities (IRS, Insecticide Treated Net, and Intermittent Preventive Treatment) and land use (irrigation, deforestation, swamp drainage and living near breeding sites).

Due to these factors malaria epidemics have been increasingly reported in various part of Tanzania due to various factors (Mboera & Kitua, 2001; Mboera, 2004). It was reported that the burden of malaria and the consequence of the disease in the health of the population was characterised high in kagera region MOP 2011 with an overall prevalence of 41.1 % among the under-five children. (fig.1).

Muleba district is among districts in Tanzania, highly affected by malaria epidemics in recent years. The first most devastating malaria epidemic occurred in 1997/98 following the EL- Nino rains. Delayed treatment seeking, ant malarial drug resistance, disruption of the infrastructure and poor health delivery system were the most likely factors that contributed to the high mortality rates observed in Muleba District (Garay, 1998).

The district experienced another malaria epidemic in recent years (2006). Muleba district authority noticed a drastic increase in number of outpatient and inpatient malaria cases accompanied by increased mortality especially of under-five children. There was a two-fold increase in the number of outpatient malaria cases from 2573 in January 2006 to 4388 in May 2006 in under-five children. There was also an increase of inpatient underfive children from 1094 (January 2006) to 1927 (May 2006). The Case Fatality Rate (CFR) for under-fives increased from 10/1000 (January 2006) to 29/1000 (May 2006) (Ministry of Health, unpubl). The government responded to the epidemic by changing the first line antimalarial drug from sulfadoxine-pyrimethamine to artemether-lumefantrine in Muleba district. This was followed by introduction of indoor residual spraying in 2007.

Figure 1: Malaria Prevalence Map - Tanzania



1.3.2 Malaria Control Strategies

Prevention of malaria in highly endemic countries relies largely on vector control through one of two main methods: insecticide treated (mosquito) nets (ITNs) and indoor residual (house) spraying (IRS). Use of Long Lasting Insecticide Nets (LLINs) and implementation of Indoor Residual Spraying (IRS) prevents mosquitoes transmitting malaria parasites between people and reduces re-infection of people that have been recently cured. In many cases, these methods are used together in the same households, especially to suppress transmission in holoendemic and hyperendemic scenarios.

Free distribution of long lasting insecticidal nets (ITNs) is currently being conducted through campaigns, public health facilities, faith-based organisations (FBO), and non-governmental organisations (NGOs) with the goal of achieving universal access for the at-

risk population of children under age five and pregnant women (A Road Map for Malaria Control in Nigeria Abuja; 2008.) Though widespread, there has been some evidence of low coverage of ITNs use.

The effective ways of reducing malaria and saving lives is by correctly diagnosing people infected and then quickly eliminating malaria parasites using anti-malaria drugs. Rapid Diagnostic Tests (RDTs) are now used by community health workers (CHWs) to correctly diagnose malaria. Confirmed cases can then be fully cured by treatment with highly effective Artemisinin Combination Therapy (ACT) drugs, thus reducing malaria and potentially saving thousands of lives. In most endemic countries millions of pregnant women are now also provided with prophylactic anti-malaria drugs as part of the Interruptive Preventive Treatment (IPT), during their second and third trimesters to prevent infections

1.3.3 Malaria control Intervention Strategies in Tanzania

The government of Tanzania through its Ministry of Health has been at the forefront of malaria control and actively involved in the global effort against malaria under the RBM initiative. Currently, the Ministry of Health through a 5-year strategic plan under the NMCP (National Malaria Control Program) was introduced by the Tanzanian Government after the Abujia Summit in 2000 advocates four main approaches in the fight against the disease. These include improved case management, vector control using insecticide treated mosquito nets, prevention and control of malaria in pregnancy and epidemic preparedness, prevention and control and information, education and communication; and operational research.

The national health policy formulated in 1990's provided the basis for the development of the national malaria medium strategic plan of 2002 whreby the broad objectives of the first MMTSP 2002-2008 were to reduce malaria mortality and morbidity in all 20 regions to an extent where it is neither a major public health problem nor an obstacle to socio-economic development by 25% by 2007 and by 50% by 2010 (Ministry of Health, National Medium Term Malaria Strategic Plan (2002–2007). In 2008 the second plan 2008-2013 was implemented with the aim of reducing the burden of malaria by 80% by the end of 2013 from the 2007 levels.

1.3.4 Vectors Control

The use of ITNs to protect children from malaria parasite transmission is one of the main strategies recommended by the Roll Back Malaria (RBM) partnership . A major objective of the (RBM) campaign is to have 80% of pregnant women and children aged under-five sleep under ITNs by 2010 (WHO, 2005).

It is anticipated that widespread use of ITNs will reduce mosquito density and biting intensity. ITNs are being promoted through three main channels: (1) in the public sector as community-based projects, (2) in public/private partnerships implemented by nongovernmental organisations directly in the community, and (3) in the private sector as social marketing initiatives, such as those assisted by Population Services International (PSI). (TDHS 2010)

Tanzania is one of the countries that has made a strong commitment to socially marketed ITNs; in 1998 the first ITN effectiveness trial demonstrated a reduction in child mortality associated with socially marketed ITNs in southern Tanzania (Schellenberg JR, 2009). From 2004 the Tanzanian Net Voucher Scheme (TNVS) was introduced to improve equity of ITN coverage among the poorest communities while preserving the commercial sector; this provided pregnant mothers with a voucher that can be used to purchase an ITN of their choice in a commercial outlet for less than $1, the balance being redeemed by the shopkeeper

In this context ITNs is defined as either an ordinary net treated with ordinary insecticide within 12 months of the survey date, or ordinary net evertreated with longer-lasting insecticide or long lasting insecticidal net (LLINs). Ideally, an untreated net provides a complete physical barrier to mosquitoes. In practice, even intact tucked in nets offer only partial protection; This is where insecticide-treated mosquito nets (ITNs), that is mosquito nets treated with repellent insecticides, can make a big difference. Studies have demonstrated the efficacy of ITNs . They not only kill insects but inhibit feeding, and drive mosquitoes and other insects from their hiding places (Lines 1996)

In 2007, the NMCP changed its ITN strategy from a subsidized voucher scheme targeting only pregnant women and infants to a national scale up of free net distribution, starting with a “catch-up” strategy that distributes free nets to every child aged below five years followed by a universal coverage campaign that distributes a LLIN to every sleeping space.

The under-five catch-up campaign (U5CC) started in May 2009 and ended in May 2010. To date, 3.9 million and 1.3 million ITNs have been distributed through the voucher scheme to pregnant women and infants, respectively.
Hung-up Campaign was also introduced to improve net use; NMCP introduced a hung-up strategy for the U5CC. The hung-up campaign starts a month after the distribution of the nets. Where by the trained volunteers visited every household to assist with the hunging of the nets (if not already hunged), and educate the community to sleep under a net every night.

The ITNs coverage to date is estimated to have reached 63% of households with at least one ITN, and 25% and 26% of children under 5 and pregnant women, respectively, using ITNs (2007-08, THMIS). Despite the intensive campaigns on the use of ITNs, the coverage indicators which have only been targeting children under five and pregnant women have not increasedsignificantly.

1.3.5 Indoor Residual Spraying

IRS on the Mainland was launched in 2007 in Muleba and Karagwe Districts, which were experiencing malaria outbreaks at that time. These districts are located in Kagera Region that has the highest malaria prevalence (41%) in Tanzania. Kagera region is in located in North Western Tanzania, on the shores of Lake Victoria, and is characterized by stable transmission with seasonal variation. To date, Muleba and Karagwe districts have had four and three rounds of IRS, respectively. In 2009, PMI supported the expansion of IRS to cover the remaining five districts of Kagera Region. In the first round of 2009, over 55,991 households in Muleba were sprayed (NMCP2008)

1.3.6 Treatment

Prompt treatment is recommended for all symptoms of the disease, within 24 hours if possible. Early treatment will shorten the duration of malaria and prevent complications. To avoid resistance, the best available treatment, artemisinin-based combination therapy (ACT) should be used. ACT is used to reduce the chances of *P. falciparum* becoming resistant to either drug (WHO, 2009& Bhattarai et al, 2007).

Appropriate drugs should be given in adequate dosage and correctly administered during the period of time recommended (Fergusson Trust, 2007). Coartem has become the national medicine of choice to treat malaria in Tanzania, known as "Alu".

Challenges

Number of challenges have been identified to face malaria control in Tanzania. They include inadequate human and financial resources, inefficiency healthcare system, and lack of an efficient disease surveillance system (Mboera et al., 2007). Although Tanzania adopted the WHO Integrated Disease Surveillance and Response strategy in 1998, its health management information system (HMIS) is still underdeveloped (Mghamba et al., 2004; Rumisha et al., 2007). Most of epidemiological information is health facility-based data; which is incomplete, untimely and unreliable. The lack of reliable data on the magnitude and cause(s) of death in developing countries has implication on the capacity for planning, monitoring and evaluation of health interventions.

This study focuses on **Muleba district** which is an area that is within Kagera Region in the North-West of Tanzania. Muleba is known to be a malaria epidemic prone area with an overall prevalence of malarial infection of 49-53.3% (Mboera et a., 2006)

1.4 STATEMENT OF THE PROBLEM

Malaria control and interventions have been implemented and in the recent past and intensified as an effort to attain the World Health Assembly, Roll Back Malaria, and Millennium Development universal targets with the aim of reducing and interrupt disease transmission in sub Saharan Africa.

Kagera Region is a malaria endemic area in which malaria control measures such as the use of Artemisinin combined therapy (ACT), the use of insecticide treated bed nets (ITNs), indoor residual spraying of insecticide (IRS), and Intermittent Preventive Treatment (IPTp) for pregnant women and children have been implemented. Despite of all these efforts yet the overall prevalence of malaria infection remains high among the under-five children: 49-53.3%, (Mboera et a., 2006) study done in Muleba District.

This verifies that there could be several reasons for this situation including the deficiencies in the Health system that leads to lack of access to malaria control interventions and low effectiveness of these interventions than expected. Thus it is very essential that operational research is conducted to identify the gaps.

Therefore this work involves a community approach first to confirm the prevalence of malaria in under-fives, coverage of ITNs, IRS as well assessing of malaria prevalence among the under-five children, determining the coverage of ITN use among community members, as well as assessing the factors (socio-economic, physical, environmental, demographic factors) associated with malaria prevalence in Muleba district.

1.5 RATIONALE FOR THE STUDY

Despite of the availability of the malaria control measures and intervention, the morbidity and mortality in under-fives is still unacceptably high. (MoH, 2006).

This study is then designed to investigate the changing epidemiological data of malaria. The collected data will provide the understanding on the factors that influence the high prevalence of malaria parasite among the under five year's children in Muleba District. The information that will be collected will be an essential component in the effectiveness of Malaria control and elimination interventions that are currently being scaled up hence it will be used to realign the effectiveness of Malaria control measures so as to effectively reduce malaria burden and achieve elimination.

1.6 RESEARCH QUESTIONS

1. What is the prevalence of malaria parasitemia among the under-five years in the Community
2. What are the factors contributing to the prevalence of malaria among the under-five In Muleba district
3. What is the coverage of ITN use among the community members
4. What is the coverage of IRS in the households in Muleba.

1.7 BROAD OBJECTIVE

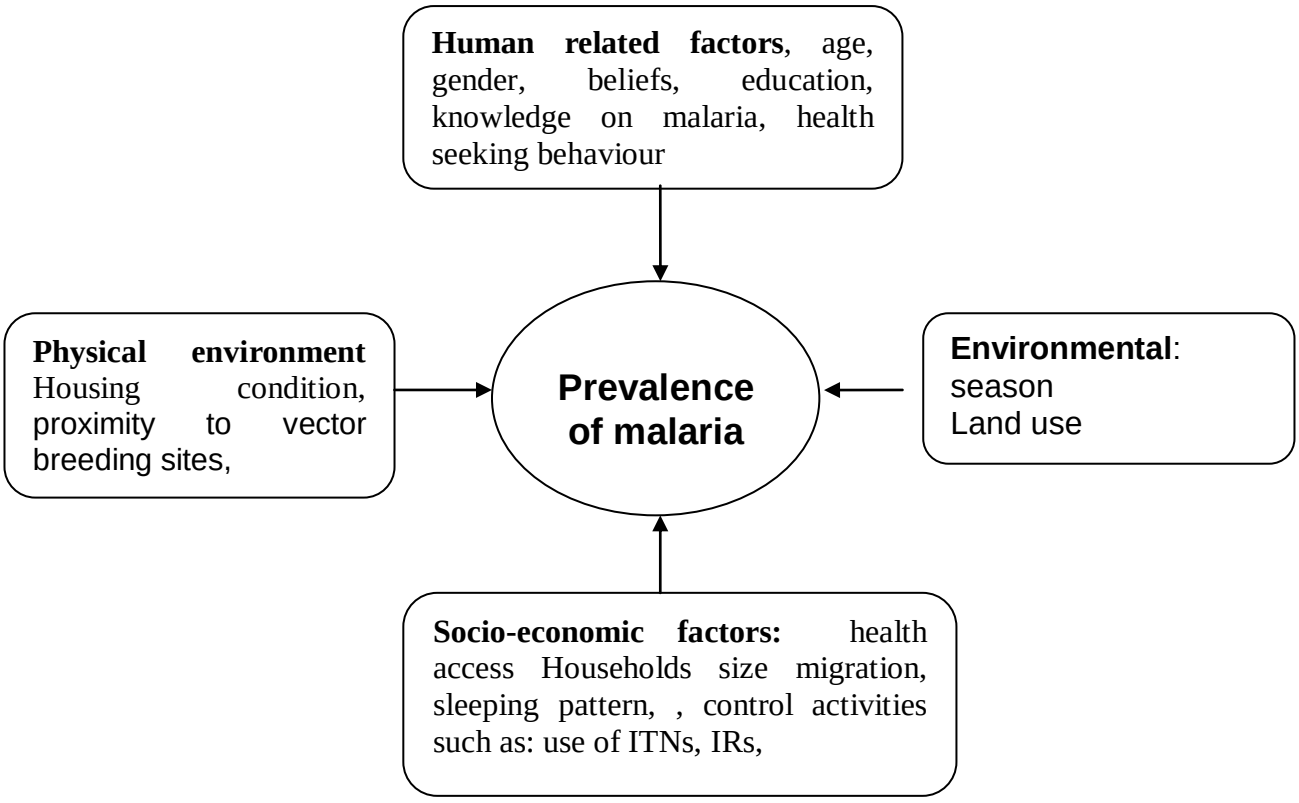
To determine the prevalence of malaria infection and its associated factors among the under-five children in Muleba district.

1.8 SPECIFIC OBJECTIVES

1. To estimate the prevalence of malaria parasite among the under-fives children in Muleba district
2. To determine the factors associated with the prevalence of malaria among under-fives in Muleba district
3. To determine the coverage of ITN use among the community members
4. To determine the coverage of IRS in the community members

1.9 Conceptual Framework

The conceptual framework represents a relationship between factors that influence the prevalence of malaria among the under fives in Muleba district



CHAPTER TWO

LITERATURE REVIEW

Malaria is a major cause of morbidity and mortality worldwide, especially in young African children. It is a major parasitic disease that can be prevented and treated (US PMI, 2009). Several efforts based on protection of individuals, households at community level (Warrell et al, 2002) have been initiated to ensure morbidity and mortality due to malaria is reduced. Currently several proven and cost effective malaria control interventions have been largely initiated in malarious areas. These include prompt treatment with Artemisnin Based Combination (ACTs), high coverage with LLITNs, Intermittent Preventive Treatment in pregnancy (IPTp) and Insecticide Residual Spray (IRS). These measures have significantly proven to reduce clinical and risks of malaria infection particulary in pregnancy and childdren under five years who are vulnerable groups to malaria.

Prevalence of malaria in young children has been reported in many studies from both developing and underdeveloped countries. In Democratic Republic of Congo, surveys which were conducted in 1980s and 2000 reported two fold increase of blood smears positivity from 17% in 1980s to 34% in 2000. In Tanzania the first national, population-based 2007-08 Tanzania HIV/AIDS Malaria Indicator survey (2007-08 THMIS) showed that 18% of children under five years of age had tested positive for malaria on the Mainland, whereby in rural areas higher prevalence of 20% compared to the urban areas of 8% was reported. There were marked regional variations that ranged from 0.4% in the highland areas around Arusha to 41.1% in the northwestern region of Kagera. The survey also showed an increasing prevalence by age from about 9% in infants (6-11 months) to 22% in children aged 2-4 years. Malaria prevalence showed a direct relationship with the socio-economic status and education of the mother of children under-five years of age. Households with lowest wealth quintile were more likely to test positive for malaria than those from households in the highest quintile. Those children whose mothers had no formal education had a malaria prevalence that was four times higher than those who had secondary education and above.

Numerous studies have been conducted globally that describe socioeconomic, socio-demographic, and environmental risk factors associated with malaria and malaria-related knowledge, perceptions, and prevention practices. (Mabaso et al 2007&Aikins et al, 1994) Seasonality, irrigation, farming, poverty, education, house construction, distance to water bodies, and the location of residences have all been linked to malaria transmission; proximity to health clinics, perception of risk, assets, and education have been shown to be important determinants of ITN use and personal protection practices against malaria. Net use and personal protection have also been linked to simple avoidance of mosquitoes, irrespective of knowledge of malaria risk. (Agyepong & Manderson, 1999)

Human related factors

There is a large amount of data on malaria related morbidity and mortality in children under five. (Menard et al, 2010) suggested that, the risk of infection and its severity is lower in the first few months of life. Reasons for this are complex but probably include transmission of protective antibodies across the placenta, the presence of red cells containing Hbf – which are relatively resistant to malaria infection, breast feeding and lack of exposure (Hviid, & Staalsoe T.2004). The protective effect of maternal antibody is likely to be less when effective malaria control is achieved and the overall level of malaria infection declines.

In lower transmission settings clinical malaria is spread more widely across the age groups. In such settings, occupational issues may become more important than age; this is especially true where mosquitoes which transmit malaria bite outdoors away from dwellings. Forest workers in south-east Asia are one example of this phenomenon (Erhart et al, 2004). In these settings young adults, especially males, may be more at risk than children; because they are the group at most risk from being bitten by forest dwelling vectors (Dysoley et al 2008).

Furthermore this information was supported by a study that was done in Kenya that explored factors affecting use of permethrin-treated bed nets during a randomized controlled trial found that children less than five years of age were less likely to use nets compared to the individual adults (Alaii et al, 2003)

Gender

Evidence of biological differences between men and women in acquiring malaria is limited; however the evidence of sex differences is accumulating. The literature on gender differences in malaria relates mainly to pregnancy, occupational risks (e.g.: forest workers) and care-seeking behaviors. (Desai et al 2007)

Reported gender differences with regard to increased risk of infection and impact of malaria on individuals largely focus on women; however, there is some evidence that suggests that in some countries men have increased exposure because they spend more time sitting outside in the evenings during peak mosquito biting times (Vlassoff & Bonilla 1994) and that some male-dominated types of work lead to increased exposure. For example, agricultural work extending to the evenings or sleeping away from settlements may raise risk, especially in forests, which can make men more vulnerable than women. (Incardona et al 2007& Erhart A, *et al* 2004).

Knowledge on malaria

A number of studies have investigated differences in knowledge and reported health seeking behavior between men and women. Most found either no difference or those women had more limited decision-making and financial power to act. This was associated with failures and delays in seeking treatment, with differential understanding of malaria between men and women, and differential health-seeking behaviour. Women delayed seeking care until men were available, while men were less willing to spend on child health. (Al-Taiar et al 2009 & Oberlander and Elverdan 2000).These differences are critical when considering the main child-caring role of women and children's increased vulnerability to malaria.

Further more according to (Minja et al., 2001), it was stated that knowledge, attitude and behavior practices regarding malaria were shown to influence the ITN ownership. Some other studies that were done by (Victora 2003, Nganda 2004& Magesa et al., 2005) reported that knowledge of the problem; affordability and accessibility are among major obstacles for the ITN ownership and use.

Net ownership has also been related to the educational levels of household members. This is a complicated relationship since educational attainment can have the impact on an individual's ability to understand and access information regarding malaria prevention

methods. In Malawi it was found that net ownership was less common in households where the head/caretaker had not completed primary school and in homes where the house had mud walls or a grass roof (Holtz et al., 2002). This is being supported by (Nuwaha, 2001) with an evidence that educational attainment is associated with malaria-specific knowledge and uptake of preventive measures.

Rhoida Y *et al* 2004 concluded that the success in implementing preventive interventions amongst pregnant women in Tanzania is thus likely to be determined in part by awareness of malaria and the strategies available to prevent it. In order for the ITN distribution programme to succeed, the knowledge gaps, practices and attitudes that may negatively influence the intervention uptake.

Health seeking behaviour

In Tanzania, available information indicates that health education and information communication provided to the community has had limited impact on behavioral changes and hence disease prevention and control. (Mboera et al, 2007)

This was also supported by a study which was done by (Alaii et al, 2003) which found out that despite the health education that was associated with the research, 30% of the nets that were distributed for free were still unused after the study. This shows how difficult it is to impact on human behavior, and supports the idea that a careful and sustained health education program must accompany any ITN intervention. The leading reasons that associated this action was the ‘’too hot’’ weather. Children considered the vulnerable group were also not found using the nets due to this reason and more including distortion of sleeping arrangements, inability to spread the nets over mats and no room to hang bed nets as a result to house construction.

Health education communication is one of the key components in malaria control and prevention. Serious obstacles in most disease control strategies include lack of effective health information, education, and communication programs. Community and health providers need to understand the problem in all its relevant aspects, as well as be aware of the options available for improvement (Mboera et al, 2007).This means it is important for

health providers and communities to appreciate the epidemiologic and technical dimensions of the malaria problem as well as the factors that affect whether particular control options will be feasible, technically possible, socially acceptable, environmentally friendly, and politically advantageous. For individuals and households, effective health communication can help raise awareness of health risks and solutions to provide the motivation and skill needed to reduce these risks, help them find support from other people in similar situations, and affect.

Socio-economic factors

Socioeconomic conditions of the community have direct bearing on the problem of malaria. Ignorance and impoverished conditions of people contribute in creating source and spread of malaria and hinder disease control strategy (Collins et al, 1997& Yadav *et al.,* 1999). This was also evidenced by Filmer 2002) that high costs of malaria treatment may lead to delays in treatment seeking behavior, whereby he found that the poorest groups in a society did not seek care as much as the non-poor, and did so at lower level public facilities.

Economic inequities in areas such as the control of household resources also affect access to ITNs. In one study in Benin, many women explained that since they were financially dependent on their husbands, they were unable to purchase an ITN for themselves and their children unless their husbands prioritized the use of bednets (Krause G, *et al* 2000)). The study also revealed that when women did earn an income and had control over this income, they were much more likely than men to purchase an ITN for their household. (Krause G, *et al* 2000)

Alnwick 2000, also observes that malaria afflicts primarily the poor, who tend to live in dwellings that offer little or no protection against mosquitoes. Furthermore, (Brown, 1997) notes that “the continuation of brutal poverty and hunger in much of the world is undoutbtedly linked to large numbers of unnecessary deaths from malaria.” A survey in Zambia also found a substantially higher prevalence of malaria infection among the poorest population groups (Roll Back Malaria, 2001).

According to (Makundi et al, 2007) it was reported that the burden of malaria is greatest among poor people, imposing significant direct and indirect costs on individuals and households and pushing households into in a vicious circle of disease and poverty. Furthermore vulnerable households with little coping and adaptive capacities are particularly affected by malaria. Households can be forced to sell their food crops in order to cover the cost of treatment (Wandiga et al, 2006.) Depleting household resources and leading to increased food shortages, debts, and poverty for the poorest households. The costs of malaria are highly regressive, with the poorer households spending a significantly higher proportion of their income on the on the treatment of malaria than their least poor counterparts.

In Ghana, both direct and indirect costs associated with a malaria episode represent a substantial burden on poorer households. A study found that while the cost of malaria care was just 1 per cent of the income of the rich, it was 34 percent of the income of poor households (Akazili, 2002). Similarly, (Kuate, 1997) found that the burden of illness rests disproportionately on the economically disadvantaged women who were not employed, women living in poor neighbourhoods, and those living in households without modern facilities. This is being supported by studies that were done on the use of ITNs where by It was only recently appreciated that a net treated with insecticide offers much greater protection against malaria. Unfortunately, the commercial price of nets and insecticide is beyond the poorest income groups of the population (World Health Organization, 2003).

Ziba et al 1994: found that in Malawi, use of malaria prevention measures (bednets, insecticides, mosquito coils, other insect repellants, burning leaves, etc) was income-dependent. In households where the head earned a larger than average income, use of commercial methods (mosquito coils, insecticide spray, bednets) was more common. Use of inexpensive, and less effective, natural methods (burning leaves, dung, or wood) was associated with lower income.

Occupational and cultural differences related to undertaking activities likely to lead to malaria transmission; and when malaria is acquired, access to health services is more mixed and varies considerable across different cultural settings.

Alternatively, if a household only has one bednet, priority may be given to the male head of the household as he is often considered the primary breadwinner. (Krause, et al 2000) Before the ITNs project started in Bagamoyo, Tanzania, it was reported that it was mainly the adult men who used the nets, followed by women and children under two who sleep with their mothers, while elder children were frequently the last to gain access (Makemba et.al.1995).

ITNs availability and efficacy

The use of insecticide-treated nets is currently considered one of the most cost-effective methods of malaria prevention in highly endemic areas Tanzania being inclueded. This has been achieved through free distribution of long lasting insecticidal nets (ITNs) that hs been conducted through campaigns, public health facilities, faith-based organisations (FBO), and non-governmental organisations (NGOs) with the goal of achieving universal access for the at- risk population of children under age five and pregnant women.

The use of ITNs in Tanzania has increased markedly over the past few years. Statistics indicate that the proportion of households with at least one untreated net has increased from 14% in 2001 to 58% in 2005. ITNs coverage is estimated to have reached 63% of households with atleast one ITN and 25%b and 26% of children under 5and pregnant wome respectively sleeping under an ITN However, more effort is needed to further increase this to reach the globally agreed target of 80 (2007-2008 YHMIS).

According to the (MoHSW 2006): report Insecticide-treated mosquito nets (ITNs) used for protection against mosquito bites have proven to be a practical, highly effective, and cost-effective intervention against malaria. This was also supported by (Roll Back Malaria, 2005). which reported that ITNs reduces human contact with infected mosquitoes and have been shown to be an effective malaria prevention measure. In addition to the direct benefit to the individual, ITNs use offers a protective benefit for the entire community (Teklehaimonot et al., 2007).

Studies examining ITN's efficacy suggest a significant reduction in malaria episodes. If used universally, ITNs could prevent approximately 7% of the global under-five mortality (Jones et al, 2003). The UNICEF corroborates that under-five mortality rates could be reduced by about 25-30% if all young children in malaria endemic areas were protected by treated bednets at night

This was also evidenced by (Lengeler's, 2004) review which demonstrates the efficacy of ITNs in both stable and unstable transmission areas where by it was documented the wide spread use of ITNs resulted in an overall reduction in mortality of 19 percent, protected against anemia, and had a substantial impact on mild disease episodes. Another One large-scale rural study in Tanzania found that ITNs and untreated nets reduced mortality of children one month to four years, with protective efficacies of 27 and 19 percent, respectively **(**Armstrong and Schellenberg, 2002).

Hill et al wrote in 2006 that despite of all these efforts and its efficacy, only 3% of African children sleep under these treated nets while only about 20% sleep under any other kind of nets. This however may account for the high rate of mortality amongst children due to malaria and its related problems. Despite the evidence that the use of ITNs decreases malaria-related morbidity and mortality, the use of ITNs in sub-Saharan Africa remains relatively low.

ITN ownership and use

A number of authors have described the relevance of social, cultural and economic research for understanding the views of the population on the transmission, diagnosis, treatment and prevention of malaria and the issue examined in several studies are the differences in people's socio-economic status in relation to net use.

Hanson and Worrall (2002) in Tanzania found that net ownership was more common among households where women had a source of cash income. After controlling for the possibility that these households were more wealthy the results were less clear, but they still gave some support to the argument that households where women have a cash income are more likely to own nets. Women's control of their cash income, however, did not seem to be related to the likelihood of owning a net.

Clearly, net ownership is a necessary prerequisite for net use. However, whether or not a net owner will use a net every night, some nights, or not at all depends on complex multi-level interactions between individual characteristics, household characteristics, social and cultural factors, community-level factors, aspects of the physical environment and characteristics of the net itself.

Although ITN distribution has been massively expanded in most parts of malaria endemic sub-Saharan countries since 2005, there is limited information on community based actual use of nets owned, area specific reasons for non-use, and the possible impact of the variations in use on malaria vector densities and transmission in either Tanzania or other countries where malaria is seasonal and unstable, Net ownership has been found to be lowest among the poorest households (UNICEF and WHO 2003) thus possibly linking possession to the cost of the net (Guyatt et al, 2002)

In addition, several studies reveal that even when access to ITNs is expanded, many households do not use them. This was reported in western Kenya that even when nets were given away for free, approximately 30% of them were unused likewise, in southern Tanzania, a year after free net distribution, nets were found stored in their bags and had not been utilized by a number of households. (Alaii et al, 2003).

It has been also stated by (Minakawa et al, 2008) that Although ITNs are the most cost effective interventions against malaria, some unforeseen consequences of distribution of nets have been reported. LLIN have been used for drying fish and for fishing among residents of fishing villages along Lake Victoria. The main reasons were that the bed nets were cheap or free and that fish dried faster on the mosquito nets. This was also supported by a study that was done in Kenya of which showed that villagers were using their nets for fishing rather than malaria prevention (Minakawa N et al 2008)

It was furthermore being reported by (Okech et al, 2008) that one factor contributing to low net coverage rates is the impact of local customs on net usage. For example, a study in

Kenya found that the youngest children in a household were given the lowest priority for bed net use, despite being a higher-risk population

The evidence regarding mosquito net and ITN ownership points firmly to the conclusion that net ownership is strongly determined by social economic status with large differences between rural and urban net ownership. For example, recent evidence from a Tanzanian DSS site indicates that eight percent of the poorest socio-economic quintile owned nets compared to 51 % of the least poor quintile (de Savigny et al., 2002)

Apart from coverage, issues regarding the utilization of ITNs are very crucial. This is because the ITNs that are available at a household level may be left unused or even if they are used, vulnerable members of the household may not be given priority and/ or the usage may be intermittent.

Physical environment/housing condition

Certain types of housing may influence malaria transmission. Greater exposure to the outdoors (lack of windows or screens, for example), may increase contact between an individual and the mosquito vector. Similarly, the presence of particular structural features that limit contact with the mosquito vector are likely to reduce infection. (Shell, 1997). Housing that places individuals at increased risk of malaria infection is used more frequently by those in lower socio-economic strata than those in higher socioeconomic.
In other instance physical environment determines appropriate ITN use, this was according to (Toe et al, 2009) who found out in their study that the perception that a limited space in the house cannot contain the nets, the obvious problem of having a bulky product suspended in the middle of a room, having to perform some routine functions of hanging and removing nets every morning and evening because some people sleep in kitchens, halls and living area. Besides people cannot be allocated sleep space together just because some vulnerable children must sleep under bed nets. This becomes a hindrance to appropriate ITN use.

Furthermore major urban centers, experiencing rapid and unplanned population growth due to intense migratory movements, face serious problems with sanitation, overcrowding, poor housing, pollution, lack of food, and inadequate water. This combination of conditions is conducive to transmission of vector-borne diseases (malaria, dengue, filariasis) and tuberculosis. Poorly maintained water supply, sanitation, and drainage systems contribute to the transmission of malaria by providing potential breeding areas for mosquitoes. The relative impact of this depends on the local mosquito vectors, but some impact is found in almost all countries. Even in Africa, where important vectors are broadly less selective with regard to breeding sites; this can play a role in both urban and rural settings.

Restoring, cleaning and maintaining the drainage network and introducing an effective system for solid waste management (to stop solid waste collecting in draining channels) may be important for vector control. (Amoatey PK *et al* 2008) Pools of stagnant water can be eliminated by repairs or improvements to the water supply system; soak pits can be built to remove water accumulating around stand pipes; and cisterns (water tanks) can be covered with mosquito nets or lids.

Environmental factors/climate:

Malaria is governed by a large number of environmental factors, which affect its distribution, seasonality and transmission intensity (Snow et al, 1999).

Climate and environmental conditions greatly affect the transmission and incidence of malaria, by influencing primarily the abundance and survival of vectors and parasites, and also exposure of humans and other hosts. (Lafferty, 2009). The most important environmental factors for malaria transmission have to do with conditions for *Anopheles* mosquito breeding and survival – water in which they can breed, and minimum temperatures and humidity to allow them to survive long enough for the vector stage of the parasite's life cycle to be completed – usually about ten days. These factors are influenced by climate, as well as by topography and soil conditions, drainage, vegetation cover, land use and water – all of which vary greatly depending on local conditions. As such, changes in climate and land use such as water management, agriculture,

urbanization, and deforestation can lead to significant increases or decreases in malaria transmission, depending on local contexts. (Reiter P.2001)

Some agricultural practices facilitate the spread of vector-borne diseases. Also, the presence of cattle in marshy areas results in the creation of hoof prints that potentially offer ideal conditions for mosquito breeding.

Within man- made malaria, excluding the migration of non-immunes to endemic areas, the most important impacts on transmission are probably brought about by water resource development and land use change. Human modification to the environment also can create larval development sites and malaria (Denise et al, 2003).

This may especially be true for man- made malaria in which man by his farming activity or any other activity may create the environments which suit mosquito breeding and protective measures may be widely distributed. The identification of predictors of malaria incidence could provide a useful means of identifying targets for intervention of manmade malaria (Ghebreyesus et al., 2000).

Furthermore Utilization of ITNs has, however, been found to vary with Binka et al showed seasons of the year and acceptability of the nets in terms of size, colour and shape. that the time of the year during which the nets are delivered affects use. 99% of the net recipients were found to use the nets during rainy season, while only 20% used it during the dry season this was evidenced by a study which was done in Burkina Faso of which reported a decreased use of bed nets during the dry season due to a perceived lower risk of mosquito bites and the practice of sleeping outdoors (Frey et al, 2006).

Malaria control strategies need to consider how changing environmental conditions may be linked to an increase or decrease of malaria transmission. Opportunities exist for integrating environmental management interventions into vector control strategies in order to reduce malaria risk.

CHAPTER THREE

METHODOLOGY

3.1 Study Design

The study design was a community based descriptive quantitative cross-sectional household survey which was conducted between April and May, 2012 in four selected villages

3.2 Description of the Study Area

This study was conducted in Kagera region, with a focus on Muleba district. Muleba district was selected purposively as it is one on malaria endemic areas.Muleba District (1°45'N, 31°40'E) is in the North-western part of Tanzania with an area of 10,739 km^2, of which 62.0% consists of Lake Victoria. Most parts of the district lie at 1200-1500 m above sea level.

Administratively the district has 5 divisions, 31 wards, and 134 villages. It has a population of 425,172 people with 85,035 (20%) being children under the age of five years with the majority being the Haya.

The district has 36 health facilities, 3 of them being hospitals (Rubya, Kagondo and Ndolage). Others are health centres (4) and dispensaries (29). The district has two rain seasons which occur in March - June and September-December during which malaria transmission peaks.

Agriculture is the main economic activity in the Muleba district. The main food crops grown include banana and beans, while less important ones include maize, cassava, sorghum, groundnuts, sweet potatoes, rice plant and yams. Cash crops include coffee, cotton, and tea. Fishing is another important activity, particularly for villages adjacent to the Lake Victoria shore; e.g., Nshambya village in Muleba district district.

Health information:

Muleba district is known to be a malaria epidemic prone area with unstable transmission of varying seasonality. The highest peak of malaria transmission is usually reached between May - July and November-January, which results from proceeding rain seasons
The first most devastating malaria epidemic occurred in 1997/98 following the *EL- Nino* rains. The district experienced another malaria epidemic in recent years (2006). The government responded to the epidemic by changing the first line antimalarial drug from sulfadoxine-pyrimethamine to artemether-lumefantrine in Muleba district. This was followed by introducing of indoor residual spraying in 2007.

Three hospitals and two health centers that are found within Muleba District, with inpatient facilities saw malaria-related admissions and death rates in children under five years of age in 2006 and 2010 drop dramatically from 145 to 23 per 1000 (84% reduction) and from 42 to 5 per 10 000 (89% reduction), respectively. IRS results in Muleba district were impressive. An average of 100 000 house structures were sprayed per round in the selected areas up to 2009 and over 200 000 house structures between 2009 and 2011, with spray coverage of targeted structures exceeding 95%.(NMCP,-country report,2012)

In the transmission season of 2011 (May-July) a number of health facilities reported an increased number of malaria cases compared to the previous three years. High mosquito densities were also recorded in some foci within the district. Several factors were associated with this increase: acute ACT stock-outs in first level health-care facilities, evidence of decreased susceptibility to the insecticide used for IRS in localized areas, suboptimal net distribution in some communities, and low reported net use.
This event demonstrates the risk for malaria resurgence in areas where it has been successfully controlled. %.(NMCP,-country report,2012)

3.3 Study Population

The study population was divided into two groups: (1) under fives who were checked for malaria parasites using the mRDT, (2) Head of households/mother/guardians with under-five year's children or their representative when the head of households was not around at the time of the study

3.4 Sampling method

Random sampling design was employed as the sampling method.

3.5 Sampling Procedures

Study villages were selected using a multistage random sampling procedure and a cluster sampling procedure as the final stage. Selection was made with the assistance of village and sub village heads.

In the first stage, names of divisions were obtained from the office of DMO where by two divisions were selected randomly out of the five division found in Muleba district.
Out of the randomly selected divisions one ward from each division was selected randomly. A ward is an administratively demarcated area below the district level, which may comprise three to five villages (rural)

In the third stage a list of villages found in each ward were listed from records obtained from the district medical officer's office and randomly two villages were selected

In the fourth stage, out of the two randomly selected villages, two sub-villages were randomly selected making a total of four sub villages.

From these list two divisions namely Muleba and Kimwani were randomly selected. Out of the randomly selected division two wards were randomly selected namely Gwanseri and Kasharunga wards. Villages namely, Kasheno, Nshambya, Nkomero , Kiteme were randomly selected. Another four sub-villages were randomly selected from a list of

randomly selected villages namely Kimeya, Byantanzi, Kaina Kasheno, making a total of four sub villages.

With the assistance of sub village heads as well as the village health care workers, a list of all household with under fives was made from which 16 to 20 households per sub village were randomly selected to give an overall sample size of 391 study participants which was considered sufficient for the study.

In the fourth (final) stage, level of parasitemia among the under-five children in the selected households were ascertained during surveys using a rapid diagnostic test (mRDT-SD/bioline) with the aid of a well trained laboratory technician. Consent to draw blood from the children was obtained from their parents/guardian

3.6 Sample Size

Sample size was calculated basing on the prevalence of malaria among the under-fives in Kagera region (41%) (MOP 2009) Using the formula below and after an adjustment for non response, estimated sample size was **391** study participants /under-five year.

The sample size is calculated from the following formula

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

Where:

N- Total number of subjects required in the sample

Z= a standardized normal deviate value that correspond to a level of statistical significance equal to 1.96

P= estimate of prevalence of malaria in <5years children-41%

d= margin of error which correspond to the level of precision of results desired

$$N = \frac{(1.96)^2 0.41(1-0.41)}{(0.05)^2} = 371.71$$

N = 372

Non-response rate = 5% of N = 5/100*372 = 18.6

Total sample size 372+19 =**391**

N= 391

3.7 Data Collection Method

A structured and pre-tested questionnaire was used to collect information on socio-demographic factors, knowledge about the transmission and prevention of malaria, utilization and coverage of ITNs were administered to the 391 eligible participants, whereby every head of the selected household either female or male present at home was interviewed in Kiswahili language

Parasitological based

Presence of parasitemia among the under-five children was ascertained during surveys using a rapid diagnostic test (mRDT) with the aid of a well trained laboratory technician. Consent to draw blood from the children was obtained from their parents/guardian.

3.8 Data Management and Analysis

Questionnaire was checked for errors and completeness before entry into Data base where by summary statistics sheet was analysed using SPSS statistical software, version 16.0

Bivariate and multivariate logistic regression analysis was employed to examine the association between socio demographic variables and other risk factors with malaria prevalence, and the Factors associated with malaria infection were generated from this regression.

Association between proportions of the under-five children who we tested positive and those who were tested negative was compared using Chi–square. A p-value of less than 0.05 was considered significant.

3.9 Ethical Issues

Ethical clearance to conduct the study was granted by the Muhimbili University of Health and Allied Sciences (MUHAS) research and publication committee. Permission to conduct research was sought and granted by the Regional Administrative Secretaries of Muleba district. A written consent to participate was sought from each respondent before the questionnaire was administered.

Before commencement of the study, the principal investigator and his research team conducted meetings with local leaders and communities in all selected villages during which the objectives of the study including procedures to be followed were explained. Feedback to the study population was conducted in the form of dissemination meetings after completion of the study.

For those children who were found positive were referred to the nearest health facility for the appropriate treatment. This arrangement was done and the head of the health facility cooperated to provide treatment.

CHAPTER FOUR: RESULTS

4.1: characteristics of the study population.

This study was basically characterises malaria epidemiology among the under-fives who were from Kimwani and Muleba division.

Three hundred ninety one under-fives were recruited in the study and their age ranged from 0-60 months whereby females were 200 (51%) and males were 191(49%). The mean age of the children was 22.8 month Out of these 150 (38%) children were in the age group of 0-12 month, 89 (23%) children in the age group 37-60 month, 86(22%) in the age group 13-24 month years and 66 (17%)were in the age group of 25-36 month.

Table 1 shows more details of social demographic status of children

Table 1: Social demographic characteristics by division of the <5 years children (N=391)

		Division					
		Kimwani N=174	**(%)**	**Muleba N=217**	**(%)**	**Total**	**(%)**
Sex							
	Male	80	46	111	51	191	49
	female	94	54	106	49	200	51
Age of under-fives(months)							
	≤12	70	40	80	37	150	38
	13-24	41	24	45	21	86	22
	25-36	19	11	47	22	66	17
	≥37	44	25	45	21	89	23

A total of 391 study participants 42 (11%) males and female 349 (89%) were also being recruited and interviewed from both division being Muleba and Kimwani.

While 248 (63%) reported to have attained primary education, 113(29%) had secondary education, and 6(2%) had some college education, 24 (6%) reported to have never been to school.
Out of the 391 participants 102 (26%) were in the age group 31-35 years, 206 (53%) in the age group 26-30 years, and 78(20%n) were found in the age group 21-25 years and only 5(1%) were in the age group of 15-20 years. And out of these 363 (93%) participants were married, while the rest, 28 (7%), were either single, divorced widowed or cohabiting.

Regarding the participants main source of income, the main occupations of the inhabitants of the two divisions were subsistence farming 227 (58%), 80(20%) participants were running small business, and the rest, 84 (22%), were employed in either public or private sectors or were employed in the formal sector.

The majority of the respondents from Kimwani division were of the sukuma tribe. They were not born within the study area, and the majority had moved to the area within the past six month. The major occupation in kimwani was farming and fishing.
Table 2 shows more details on social demographic characteristics of respondent.

Table 2: Social demographic characteristics of respondent by division (n=391)

	Kimwani N=174 (%)	**Muleba N=217 (%)**	**Total (%)**
Sex			
Male	30, 17%	12, 6%	42, 11%
Female	144, 83%	205, 94%	349, 89%
Marital status			
Married	171, 98%	192, 88%	363, 93%
Single	1, 0.6%	16, 7%	17, 4%
Divorce	1, 0.6%	3, 1%	4, 1%
Widow	0, 0%	6, 3%	6, 2%
Cohabit	1 , 0.6%	0, 0%	1, 0.2%
Education status			
Primary school	107, 61%	141, 65%	248, 63%
Secondary school	41, 24%	72, 33%	113, 29%
Collage	5, 3%	1, 0.5%	6, 2%
Not gone to school	21, 12%	3, 1%	24, 6%
Employment status			
Public service	19, 11%	28, 13%	47, 12%
Self employment	38, 22%	42, 19%	80, 20%
Private sector	14, 8%	23, 11%	37, 9%
farmer	103, 59%	124, 57%	227, 58%
Age of adults			
15-20 years	1, 0.6%	4, 2%	5, 1%
21-25 years	29, 17%	49, 23%	78, 20%
26-30 years	101,58%	105,48%	206, 53%
31-35 years	43, 25%	59, 27%	102, 26%

4.2: The prevalence of malaria parasite among the under-fives children in Muleba district

Children from the two divisions Muleba and Kimwani division were tested, where by a total number of 391 under-five were ascertained for Parasitemia during survey using a rapid diagnostic test (mRDT). Malaria Rapid Diagnostic Tests (RDTs) assist in the diagnosis of malaria by detecting evidence of malaria parasites in human. The overall prevalence of malaria was 103 (26.3%) of these males were 50 (26.2%), females were 53 (26.5%).

Out of the total under-fives who were tested 217 (55%) were from Muleba division whereby 17 (7.8%) of these tested positive. The rest 174 (45%) were from Kimwani division where by 86 (50%) tested positive

Due to the sensitivity, specificity and ability of the test to detect specific antigens(proteins) produced by the malaria parasites that are present in the blood of infected individuals, the test was also able to differentiate pure Pf/Plasmodium falciparum and the other species (PfPan) -*Plasmodium vivax, Plasmodium Ovale, Plasmodium Malariae*.

Those who tested malaria positive-Pf were 52 (13.2%) while those who tested malaria positive Pf/ Pan were 51 (13%). Out of children who were from muleba division 7 (3%)had PF infection and 10 (5%)had PFPan/mixed infection. And out of children who were form kimwani division 45 (26%) had Pf infection and the rest 41 (24%) had PfPan(Pf/other species)

Table 3; shows more details on the prevalence of malaria among the under-fives in both divisions.

Table 3: Prevalence of Malaria among the under-fives by social demographic Characteristics (N=391)

Characteristic		Malaria prevalence			p- value
		Negative (%)	Positive (%)	Total (%)	
Sex	Male	141, (73.8%)	50, (26.2)	191, (100%)	
	Female	147,(3.5 %%)	53, (26.5%)	200, (100%)	0.942
	Overall	**288, 73.7%**	**103, 26.3%**	**391, 100.0%**	
Age	0-12 month	119, 79.3%	31, 20.7%	150, 100.0%	0.047
	13-24 month	65, 75.6%	21 ,24.4%	86, 100.0%	
	25-36 month	48, 72.7%	18, 27.3%	66, 100.0%	
	37-60 month	56, 62.9%	33, 37.1%	89, 100.0%	
Division	Kimwani	88, 50.6%	86, 49.4%	174, 100.0%	0.000
	Muleba	200, 92.2%	17, 7.8%	217, 100.0%	

From the table above the prevalence of malaria was found to vary according to social demographic characteristics with higher prevalence 86 (49.4%) being observed in children who were from in kimwani division. The difference in prevalence of malaria between these two divisions was highly statistically significant p- value was (P=0.000). The association between sex and the prevalence of malaria was also observed and the results were not statistically significant (P=0.9426). Furthermore the association between the prevalence of malaria and the age groups was also found not to be statistically significant. (P=0.047).

4.3 Factors associated with the prevalence of malaria among under-fives in Muleba district

Malaria was found to be associated with variety of factors. Table 4, shows the results from bivariate analysis of the factors that are associated with the prevalence of Malaria. From the analysis the education status of the parents/guardians was statistically significant. The likelihood of getting malaria was found to increase 9.95 times more as compared to those who were educated. [OR= 9.953(3.83, 25.87) and the association between the education status and the prevalence of malaria was found to be highly statistically significant. (P=0.000)

It was further observed that the chances for the under fives to get malaria was 1.24 times to those who were self employed than those who were the employee of the public service. [OR=1.24 (0.53, 2.86)] And the likelihood of getting malaria among the under fives whom their parents were farmers was 1.31 times higher as compared to public service workers. [OR=1.31 (0.63, 2.736)].

Health seeking behavior was found to be associated with the prevalence of malaria among the under fives hence the association between children who were having episodes of fever within the past six month and yet were not taken to the health facility with the prevalence of malaria was statistically significant (P=0.001). And the likelihood of getting malaria among children who were not being taken to the hospital was 1.34 time higher than those who were taken to the hospital. [OR=1.339 (0.832,2.154).

Table 4: Bivariate analysis of the factors associated with the prevalence of malaria. (N=391)

Factor	N	Malaria prevalence		P- value	OR	CI
		Negative	Positive			
Education status						
Educated	367	282, 76.8%	85, 23.2%		1	
Not educated	24	6, 25%	18, 75%	0.000	9.953	3.829,25.87
Employment status						
Public service	47	36, 76.6%	11, 23.4%			
Self employment	80	58, 72.5%	22, 27.5%	0.612	1.241	0.53, 2.86
Private sector	37	32, 86.5%	5, 13.5%	0.257	0.511	0.16, 1.63
farmer	22	162, 71.4%	65, 28.6%	0.467	1.313	0.63, 2.736
Health seeking behavior						
Episodes of fever in the last six month						
Yes	286	198, 69.2%	88, 30.8%	i	1	
no	105	90, 85.7%	15, 14.3%	0.001	0.375	0.205, 0.684
Child taken to hospital						
Yes	269	203, 75.5%	66, 24.5%		1	
No	122	85, 69.7	37, 30.3	0.228	1.339	0.832,2.154
Physical/housing env.						
Prox. to breeding sites	30	12, 40%	18, 60%	0	1	
Clean environment	211	173, 82%	38, 18%	0	0.146	0.065,0.329
Prox. to farming activities	150	103, 68.7%	47, 31.3%	0.004	0.304	0.136,0.682
Window screened						
Yes	125	109, 87.2%	16, 12.8%		1	
No	266	179, 67.3%	87, 32.7%	0.000	3.311	1.85,5.93
Presence of separate room						
Yes	382	284, 74.3%	98, 25.7%		1	
No	9	4, 44.4%	5, 55.6	0.044%	3.622	0.954, 13.76
Condition of the room						
Allows net to be hanged	319	250, 78.4%	69, 21.6%		1	
No space for hanging	33	15, 45.5%	18, 54.5%	0.000	4.348	2.084,9.069
The rooms are small	39	23, 59%	16, 41%		2.52	1.262, 5.03

ITN use						
Yes	311	241, 77.5%	70, 22.5%		1	
No	80	47, 58.8%	33, 41.2%	0.001	2.417	1.439, 4.06
IRS						
Yes	369	277, 75.1%	92, 24.9%		1	
No	22	11, 50%	11, 50%	0.013	3.011	1.26, 7.18

Table 4, further explains the likelihood of having malaria in association with physical/housing environmental factors. It was observed that the association between the prevalence of malaria and the houses which were situated proximal to the farming activities was statistically significant (P=0.004). Houses with windows that were not screened with mosquito wire mesh; the likelihood of getting malaria was 3.31 times higher than the screened ones. [OR=3.31(1.84,5.94)

Furthermore presence of separate room in the house was also being observed as one of the associated factors with the prevalence of malaria whereby it was observed that the likelihood of getting malaria in those houses withought separate rooms was 3.62 times higher than the houses which were having separate rooms.

In houses with rooms that had no space for hanging nets, the likelihood of getting malaria was 4.34 times higher than the houses of which their rooms had a space for hanging the nets. [OR=4.34 (2.084, 9.069)]. This association was highly statistically significant.

In addition the association between the prevalence of malaria and the use of ITNs/LLITNs was statistically significant (P= 0.001). And the likelihood of getting malaria among the families whom their houses were not sprayed with IRS was 3.011 times higher than the houses sprayed with IRS.

4.4 Awareness on Malaria

It was further observed that 379 (97%) of the respondents knew that malaria was transmitted through mosquito bite, however 11(3%) of respondents in the study still couldn't know what caused Malaria and 1(0.2) of the respondent mentioned that Fleas were the main cause for Malaria.

A total of 283 (72%) mentioned vomiting, fever 327 (84%), feeling cold 268 (69%), body weakness 205(52%), and abdominal pain 248(63%) as major symptoms/signs of malaria, respectively.

ITNs, as the main preventive measure of malaria, were also being reported by the majority to be304 (78%); followed by the use IRS 287 (73%), then the use of ant malaria ALU, 264 (68%), Environmental cleanliness 257(66%), Destroying of mosquito breeding sites, 251 (64%), The use of traditional medicine 212(54%), Use insecticide sprays, 190 (49%) and Using repellents 177 (45%).

4.5 Seasonality and the use of ITNs

Rainfall plays a crucial role in malaria transmission hence it is being regarded as one of the factor that are associated with the prevalence of malaria by providing breeding sites for the aquatic stages of the mosquito's life cycle. In this study it was observed that 231 (59%) families frequently mentioned that ITNs were used throughout, 106 (27 %) mentioned that they were using the ITNs during the rainy season, 49 (13%) mentioned that they were not sure of the season and 5 (1%) mentioned that they were using the ITNs during the dry season.

Furthermore the association of the risk factors with the prevalence of malaria was adjusted so as to control for confounding factors. This adjustment was done using logistic regression analysis whereby the same factors from bivariate analysis were used.
Table 5. shows the adjusted association of risk factors with the prevalence of malaria observed among the under-fives.

Table 5: Adjusted association of the factors and the prevalence of malaria

Factor	N	Malaria prevalence		P- value	AOR	95.0% C.I.
		Negative	Negative			
Education status	367	282, 76.8%	85, 23.2%	0.000	7.802	2.706, 22.492
Health seeking behaviour						
Episodes of fever	286	198, 69.2%	88, 30.8%	0.001	0.305	0.150, 0.622
Children taken to hospital	269	203, 75.5%	66, 24.5%	0.018	2.067	1.130, 3.783
Physical/housing environment						
Prox. To breeding sites	30	12, 40%	18, 60%	0.058		
Clean environment	211	173, 82%	38, 18%	0.032	0.333	0.122, 0.909
Prox. To farming activities	150	103, 68.7%	47, 31.3%	0.231	0.534	0.191, 1.492
Windows screened	125	109, 87.2%	16, 12.8%	0.093	1.744	0.912, 3.336
Presence of separate rooms	382	284, 74.3%	98, 25.7%	0.173	2.972	0.620, 14.243
Condition of the room						
Allows nets to be hanged	319	250, 78.4%	69, 21.6%	0.696		
No space for hanging	33	15, 45.5%	18, 54.5%	0.405	1.521	0.568, 4.074
Rooms are small	39	23, 59%	16, 41%	0.991	1.004	0.446, 2.264
ITN use	311	241, 77.5%	70, 22.5%	0.228	1.477	0.783, 2.784
IRS	369	277, 75.1%	92, 24.9%	.287	1.710	0.636, 4.594

In multivariate analysis the association between the prevalence of malaria and the education status of the parents/guardians remained to be highly significant (P=0.000). This was also being observed in the factor that was concerning with the episodes of fever within the past six month (P=0.001), it was also observed that the likelihood of getting malaria among children who were not taken to the hospital, was 2.067times higher as compared to those who were taken to the hospital. [OR=2.067(1.130, 3.783)].

The association between the housing environment and the prevalence of malaria remained significant whereby the likelihood of getting malaria among the under fives who were living in the houses of which their windows were not screen was 1.744 times higher. [OR= 1.744, (0.912, 3.336).

Furthermore it was observed that, the likelihood of getting malaria to the houses which were not having separate rooms was 2.972 times higher. [OR= 2.972(0.620, 14.243)], and to the houses with the rooms which had no space for hanging ITNs the likelihood was 1.521times higher. [OR=1.52(0.568, 4.074)]. The odds of getting malaria were also being observed to be 1.004 times among the houses of which their rooms were small as compared to the houses that were having rooms with space. [OR= 1.004 (0.446, 2.264)]

4.6 The coverage /ownership/ use of ITNs in the population

ITNs ownership was observed among the participants whereby only 31(7.9) participants did not own the mosquito nets and out of these 23(74%) were from Kimwani and 8 (25%) were from Muleba division. Out of the interviewed participants 118 (30.2%) said that their households owned at least one mosquito net, 240(61.4%) said their household owned two mosquito nets and 33(8.4%) of them owned more than three mosquito nets.

The reason for not owning the ITNs were mentioned: whereby 14(8.4%) mentioned that their nets were old and neither they couldn't afford buying the mosquito nets, 10(6%) mentioned that they were lost and yet they were not available at the health facilities, and 7(4.2%) said that they were being used for other purpose.

It was further being observed that 116 (30%) acquired them for free from the government while 200(51%) of the population acquired them thorough the voucher system and the rest 75(19%) bought their nets from the nearby shops.
Out of the screened children, 311(79.5%) slept under a mosquito net during the previous night and only 80 did not. Mosquito net coverage was observed to be 68% in Kimwani Division and 89% in Muleba division. The overall coverage of the total net use in both divisions was 79.5%.

The reasons for not using the ITNs were also being analyzed whereby 33(8.4%) mentioned that they were afraid of toxicity, followed by 15(3.8%) who mentioned the absence of bed, while 13(3.3%) said that the housing structure could not allow the Net use, 4 (1%) mentioned weather and 6 (1.5%) said that ITNs do not prevent malaria.

Table 6: shows the use and coverage of ITNs by division.

Table 6: Coverage of ITNs by division

Coverage of ITNs	**Dvisions**		
	Kimwani(%)	**Muleba (%)**	**Total**
Owning ITNs yes	151, 41.9%	209, 58.1%	360
No	23, 74.2%	8, 25.8%	31
overall	174, 44.5%	217, 55.5%	391
ITN use last night yes	118, 37.9%	193, 62.1%	311
No	56, 70.0%	24, 30.0%	80
Number of ITNs			
One	52, 41.1 %	66 , 55.9%	118
two	101, 42.1%	139, 57.9%	240
>three	21, 63.6%	12, 36.4%	33
Source of ITN			
Government	51, 44.0%	65, 56.0%	116
Voucher	92, 46.0%	108, 54.0%	200
shops	31, 41.3%	44, 58.7%	75

4.7 To determine the coverage of IRS in the population

IRS was also being assessed during the household survey, and the coverage was observed in both divisions as follows. Table 4.6

Table 4.7: coverage of IRS by division

	Divisions		
IRS sprayed	**Kimwani (%)**	**Muleba (%)**	**Total**
yes	164, 44.4%	205, 55.6%	369, 100%
No	106, 45.5%	125, 45%	22, 100%
Total	174, 44.5%	217, 55.5%	391, 100%

From the table above the overall coverage of IRS was 94%

CHAPTER FIVE

5.1 DISCUSSION

This study was carried out in Muleba District Council where the primary objective of the study was to determine the prevalence, of malaria among the under-fives and the associated factors. This study was done in mid April and this was a high malaria season hence the high prevalence.

The test was done using the mRDT where by overall prevalence of malaria among the under-fives in the study area was (26.3 %). The prevalence of other species (*P.Vivax, P. Ovale, P.Malariae*) were also being observed higher (13%). This reflects that perhaps we are missing other species with the microscopy.

For the diagnosis of malaria, microscopy is considered as the reference method, but expert microscopy may be lacking in both endemic and non-endemic settings. In resource-poor endemic settings, there may be problems related to equipment, expertise and workload, whereas I non-endemic settings in industrialized countries, there may be a lack of routine among the laboratory staff, resulting in low expertise. In these circumstances, the use of malaria rapid diagnostic tests (MRDTs) can be valuable in the diagnosis of malaria. MRDTs detect antigens specific to one or more of the Plasmodium species.

The prevalence of malaria infections found in this study was low as compared to a previous study conducted in the same area of which indicated an overall prevalence of malarial infection to be 49-53.3% in Muleba district (Mboera *et al*., 2006. However the findings were similar high when compared to the findings from other studies carried out in developing countries. For example, Malaria has the least prevalence, 27.6 percent, in children age 6 to 59 months in the South East region of Nigeria. (Nigeria malaria fact sheet2010)

Furthermore it was observed that the prevalence of malaria was higher in Kimwani division 50% as compared to Muleba division of which was 17%. Several factors were observed to be associated with the high prevalence, these includes: socioeconomic factors, physical/environmental factors of which favors the mosquito breeding sites as well as ineffective implementation of malaria control measures such as the use of ITNs and IRS.

For example, It was revealed and supported by a study that was done in Kenya, (Bloland PB, *et al* 1999) that the majority of caretakers in the study had <8 years education, which was predictive factor of parasitemia. This concured with the analysis of an education status variable of this study where by the multivariate models revealed that the parents/guardians education status was significantly associated with increased risk of the under fives getting malaria.

Employment status of the respondents was also being observed to be one among the possible factor that were associated with the prevalence of malaria among the under fives during the survey. This concurred with (Makundi EA *et al* (2007) who reported that the burden of malaria is greatest among poor people, imposing significant direct and indirect costs on individuals and households and pushing households into in a vicious circle of disease and poverty. This was also being observed in a study done by Wandiga SO, et al. (2006.) who stated that, vulnerable households with little coping and adaptive capacities are particularly affected by malaria hence they can be forced to sell their food crops in order to cover the cost of treatment

Furthermore, according to the study findings housing and environmental factors such as the proximity of the house to the breeding sites/ and farming activities were found to be associated with the prevalence of malaria. This was also being revealed in a study done by, (Lindsay SW, *et al* 1993) whereby it was reported that the relationship between malaria vector density and the distance of settlement from a water body like river is an important indicator of malaria transmission. It was also being supported by (Shell, 1997), who reported that Certain types of housing may influence malaria transmission. Greater

exposure to the outdoors (lack of windows or screens, for example), may increase contact between an individual and the mosquito vector.

According to the findings of the study, the concept of using of ITNs was considered as one of the protective factor against the mosquito bite; hence reduce the prevalence of malaria among the under-fives. This was supported by the MoHSW (2006) report, which stated that Insecticide-treated mosquito nets (ITNs) used for protection against mosquito bites have proven to be a practical, highly effective, and cost-effective intervention against malaria.

Despite the fact that the use of ITNs was considered as one of the protective method, It was further being identified that the prevalence of malaria among those who were not using the ITNs was observed high as compared to those who were using: in Kimwani division the 70% of the surveyed households were not using the Insecticide treated Nets

Selective indoor residual spraying (IRS) remains one of the key strategies of the NMCP, though primarily used for epidemic prevention and response. Indoor residual spraying with insecticide has been shown to be highly effective as a malaria control measure in reducing the incidence of malaria infections and deaths in a number of settings. (Oaks SC Jr, *et al* 1991). However the study findings supported that IRS, was associated with protection from parasitemia in both bivariate and multivariate analysis, it was also being observed that many of the residents who were residing in Kimwani division were migrants who were coming for the purpose of cultivating rice plant. Due to the issue of settlement then people were found staying in places which were not sprayed by IRS hence this increased the chance of mosquito bites and thus the high prevalence.

Taken together, the results presented here illustrates that: ITNs use, IRS, parents/guardians education status, economic status; physical/environmental factors are the predictive factors of the prevalence of malaria among the under-fives.

5.2 Study limitations

1. To some of the houses no physical check was done at household levels regarding ownership of LLITNs
2. The use of LLITNs in the previous night may not reflect the actual regular use
3. The issue of asking parents/guardian verbally whether their children have experienced an episode of fever within the past six month to determine the prevalence of malaria.

CHAPTER SIX:

CONCLUSION AND RECOMMENDATIONS.

6.1 CONCLUSION

It can be concluded that Muleba district specifically kimwani divisions has the prevalence of malaria that is more being observed among the under-fives as compared with Muleba Division. The higher prevalence could be the result of several factors as explained in this study.

The finding of the study reflects that if the control measures will be implemented appropriately then the prevalence of malaria will decrease. Carefully-coordinated surveillance and response are required to address ongoing, low-level transmission hot spots as well as acute outbreaks once sustained control of malaria will be eventually achieved.

RECOMMENDATIONS

1. There is the need for a strong collaboration among major stakeholders including the Government, District Assemblies, and Non- Governmental Organizations to sensitize the communities on Malaria as a disease as well as developing the holistic and effective methods for prevention and control of the disease.
2. Though the uses of IRS, LLITNs are identified as the major method of prevention due to their availability and affordability for many households, the implementation of these methods is still questionable. Therefore the implementation of these methods needs to be re-assessed by concerned authorities in order not to endanger the health of the people.
3. Efforts must be seriously made by the major players in the health sector to make the net readily available in the communities at low prices to enable the ordinary Tanzanians to purchase it.
4. In order to improve timeliness of treatment, the service consequently needs to be closer to the communities especially those found in the remote and malarious endemic areas like Kimwani/ Kasharunga village in Muleba district.

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APPENDICES

Appendix 1: 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 INTERVIEW

Greetings! My name is **Upendo Carithasy Mushashu** and I am working on this research project with the objective of investigating the prevalence of malaria among the under-five children and factors influencing the use of ITN in Muleba district.

Purpose of the study

The study is intended to collect information about the use of ITNs from parents/head of the house in Muleba District. Findings from the study will help the principal investigator to write a dissertation which is a partial fulfilment of MSc (TDC) for academic year 2010/20102.

What Participation Involves

If you agree to participate in the study, you will be required to answer questions and if possible to allow me to draw blood from the under-five children if she/he is available in the family so as to investigate the presence of malaria parasite. Do not hesitate because in this interview there is no RIGHT or WRONG answers.

Confidentiality

All collected information we will be entered into computers with only the study identification number. Confidentiality will be provided and unauthorized persons will have no access to the data collected.

Rights to Withdraw and Alternatives

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

Benefits

If you agree to take part in this study, you will benefit directly or indirectly. Indirectly, the information you will provide will help us to understand and know the magnitude of ITNs use and ownership in muleba District, and the findings will be disseminated to the policymakers especially health planners so as to help in addressing the problem. And directly, you may receive assistance to any problem(s) which may be known during the study period including being given the ant malaria if your child will be found with the malaria parasite immediately. Furthermore I will tell you about the new information from this or this study that may affect your health, welfare, or willingness to stay in the study.

Who to contact

If you ever have questions about this study, you may contact the study Coordinator or the Principal Investigator: **Upendo Carithasy Mushashu, Muhimbili University of Health and Allied Sciences, P. O. Box 65015, Dar es Salaam.** If you ever have questions about your rights as a participant, you may call **Prof: Z. Premj** – the Supervisor of this study, or you may call Prof M.Aboud **Chairman of Senate Research and and Publications Committee, P. O. Box 65001, Dar es Salaam. Tel: 2150302-6.**

Signature:…….

Do you agree? Participant agrees…… Participant does not agree …… .

I _____have read/listened the contents in this form. My questions have been answered. I agree to participate in this study wiht my child.

Signature of participant _____

Signature of witness (if mother/caretaker cannot read) _____

Signature of research assistant_____

Date of signed consent_____

Appendix 2: Questionnaires (English version)

Part I: IDENTIFICATION

1. Division_____
2. Ward_____
3. Village_____
4. Sub-village_____

Part II Socio-demographic factors

Sehemu ya II: Taarifa binafsi

5. Sex: male [ ] female [ ]
6. Age: _____-
7. Marital status: single [ ] married [ ] divorced [ ] separated [ ] widow
8. Level of education: primary school [ ] secondary school [ ] college [ ] others(pleas specify)_____
9. Employment status [ ] public service [ ] self employed. [ ] private sector [ ] [ ] others_____
10. No. of children _____
11. No of children aged 0-5 years

No.	age	weight

Availability, ownership and use of ITNs

12. Have you ever seen or heard of mosquito nets treated with insecticide YES [ ] NO [ ] don't know [ ]
13. Do you own one? YES [ ] NO [ ] if No then answer No 22.

14. How many ITNs do you have in the household? One [ ] Two[ ] Three and above [ ] none [ ]
15. The current situation of the available ITN: in good order[ ] torned [ ]
16. Is your ITN treated with insecticide? Yes [ ] No [ ] don't know [ ]
17. Are they currently being used -Currently used [ ] Not used [ ] if they are not in use please answer the question number 23
18. Did you use it last night? YES [ ] NO [ ]
19. Frequency of mosquito net use; always [ ] not always [ ]
20. How did you get them? Free from the government source,[ ] voucher system, [ ] others/specify [ ]
21. Date when an ITNs supplied : < 6 months [ ], ≥6 months [ ]
22. Reasons for unavailability of ITNs /not owning the ITNs
    a) Not available
    b) Cost/affordability
    c) Lost/stolen
    d) Used for other purposes
    e) Old; then thrown away
    f) Others_____
23. Reasons for not using the available ITNs
    a) Housing structure affects net use
    b) Absence of bed
    c) Nets do not prevent malaria
    d) Afraid of its toxicity
    e) weather
    f) Other (specify)_____--
24. Did the child/Children who is/are the under-five years age slept under ITN in the previous night: Yes [ ] No [ ]
25. What do you think are the advantages of children sleeping in the nets
    a) reduce the burden of malaria on them [ ]
    b) help save money for other purposes [ ]
    c) child sleeps better [ ]

d) saves time from visiting the hospital [ ]

26. In case you did not receive an ITN from the hospital, can you afford one?Yes [ ] No [ ] if No . Explain why_____

Knowledge on malaria / The influence of health seeking behaviour

27. Within the past six month did your child had episodes of fever? Yes [ ]No[ ]
28. Was she/he taken to the hospital? Yes [ ] no [ ]
29. If the answer is no explain why! _____
30. Was she given the anti-malaria? Yes [ ] No [ ]
31. If the answer is yes, mention the name of the drugs that was given _____
32. what causes malaria
    a) _____
    b) _____
33. Can you mention signs and symptoms of malaria?
    a) Fever 2
    b) Headache
    c) Feeling cold
    d) With a tendency of bask in the sun
    e) General body weakness
    f) Body/joint pains
    g) Vomiting
    h) Abdominal pain/Diarrhoea
    i) Convulsion
    j) Don't know
34. What are the main preventive measures of malaria
    a) Use ITN
    b) environmental cleanliness
    c) destroying the breeding sites
    d) Use of Antimalarials/ALU
    e) Use traditional remedies
    f) Fumigants /IRS

g) Use insecticide sprays
h) Using repellents
i) Other_____

35. Normally what do you usually do when another member of the house/ under-five contract malaria ,where do you go for treatment
    a) Hospital
    b) Traditional herbalist
    c) Self medication
    d) Others(specify)

Housing environment

36. Housing environment
    a) Proximal to breeding sites: old tires, containers, ponds
    b) Clean environment
    c) farming activities,
37. Are the windows screened with the mosquito wire gauze .Yes [ ] no [ ]
38. Does the house have separate bed room? Yes [ ] No [ ]
39. What is the structure of the room?
    a) such that bottoms can be put up for hanging the nets[ ]
    b) such that there is no space for putting up bottoms for hanging the nets[ ]
    c) such that the rooms are so small there is hardly any space [ ]
40. In which season of the year does the family use the ITNs
    a) Rain
    b) Dry
    c) Throughout
    d) Don't know
    e) Others (specify)_____
41. What are the reason for ITNs use specifically in the above mentioned season _____
42. Has your house been sprayed with IRS yes[ ] No[ ]
43. If No, explain why_____

Thank you for your time

Appendix 3: Consent Form (Swahili Version)

CHUO CHA SAYANSI ZA TIBA MUHIMBILI
KURUGENZI YA UTAFITI NA MACHAPISHO
FOMU YA RIDHAA

ID-NO : ☐☐☐☐☐

RIDHAA YA USHIRIKI KATIKA UTAFITI

Habari! Jina langu ni **Upendo Carithasy Mushashu** ni mwanafunzi wa shahada ya pili ya uzamili katika Chuo Kikuu cha Sayansi za Afya Muhimbili. Ninafanya utafiti kama sehemu ya masomo yangu, kuhusu **Kiwango ugonjwa wa malaria kwa watoto wenye umri chini ya miaka mitano na kupata maelezo kuhusu matumizi ya vyandarua vyenye viuambu.** Utafiti huu unafanyika katika **wilaya ya Muleba**

Umuhimu wa utafiti huu

Matokeo ya utafiti huu yatasaidia kuelewa kiwango cha tatizo hili na kujua viashiria vyake katika eneo hili.

Ushiriki unahusisha nini

Ukikubali kushiriki katika utafiti huu kwa hiari itahusisha kukubali kujibu maswali kama yalivyo katika dodoso la utafiti huu. Na ikibidi kukubali niweze kuchukua damu kutoka kwa mtoto mwenye umri wa chini ya miaka mitano atakaekuwepo nyumbani ili kuweza kuchunguza uwepo wa wadufu waenezao ugonjwa wa malaria. Usisite kwani katika utafiti huu majibu yote ni sawa.

Usiri

Taarifa zote utakazo jaza katika dodoso ni siri na wala jina lako halitaingizwa katika kompyuta isipokua namba ya dodoso tu.

Haki ya kujitoa na mambo mbadala

Ushiriki wako katika utafiti huu ni wa hiari. Hivyo unayo haki ya kuacha ushiriki muda wowote ata kama utakua umekubaliana na ridhaa ya ushiriki. Kukataa kushiriki au kujibu swali lolote hakuna adhabu yoyote wala haupotezi haki zako kama mshiriki na katika kupata huduma za afya stahiki .

Faida kwa Mshiriki

Endapo utakubali kushiriki katika utafiti huu unaweza ukapata faida ya moja kwa moja au isiyo ya moja kwa moja. Faida isiyo ya moja kwa moja, ni kwamba majibu yako yatakuwa mchango mkubwa katika matokeo ya jumla ya utafiti huu kuhusu matumizi ya vyandarua vyenye dawa na tatizo la ugonjwa wa Malaria katika wilaya ya Muleba na matokeo haya yanatarajiwa kutumika kuleta mapendekezo yatakayosaidia kupunguza tatizo hili kati katika eneo hili. Faida ya moja kwa moja unaweza ukapata msaada kwa matatizo yatakayojulikana wakati wa utafiti huu ikiwa na kupata matibabu/dawa za mseto endapo mtoto atakutwa na wadudud wasababishao malaria. Kama utakuwa tatizo la kiafya au lisilokua la kiafy ambalo linaweza kuathiri ushiriki wako katika unashauriwa kumweleza mtafiti ambaye moja kwa moja kwa atatoa msaada zaidi.

Mawasiliano

Endapo utakuwa na swali lolote kuhusu utafiti huu tafadhali wasiliana na mtafiti mkuu **Upendo Carithasy Mushashu, Chuo Kikuu Kishiriki cha Sayansi za Afya, P.O.Box 65015,Dar es Salaam.**

Endapo una swali lolote kuhusu haki zako kama mshiriki katika utafiti huu, wasiliana na **Prof: Z. Premj** msimamizi wa utafiti huu au Prof M.Aboud**, Kaimu Mwenyekiti wa Utafiti na Machapisho, SLB 65001, Dar es Salaam. Simu: 2150302-6.**

Sahihi :…….

Unakubali kushiriki? Ninakubali kushiriki …… sikubali kushiriki …….....

Mimi _____nimesoma/ nimesomewa na kuyaelewa vema maelezo yaliyomo katika fomu hii. Maswali yangu yamejibiwa. Ninakubali kushiriki katika utafiti huu pamoja na mtoto wangu.

Sahihi ya mshiriki _____

Sahihi ya shahidi (endapo mama au mlezi hawezi kusoma) _____

Sahihi ya msaidizi wa utafiti _____

Tarehe ya kusaini fomu ya ridhaa_____

Appendix 4: Dodoso (Swahili)

Sehem I UTAMBULISHO

1. Tarafa_____
2. Kata_____
3. Kijiji_____
4. Kitongoji_____

Sehemu ya II Taarifa binafsi

5. Jinsia: mme [ ] mke [ ]
6. Umri_____
7. Hali ya ndoa: [ ] umeoa/umeolewa [ ] talaka [ ] ameachika[ ] mjane [ ]
8. Kiwango cha elimu : elimu ya msingi [ ] sekondari [ ] chuo [ ]nyinginezo_____
9. Hali ya Ajira : mtumishi wa umma [ ] umejiajiri [ ] mashirika binafsi[ ] mengineyo _____
10. Idadi ya watoto_____
11. Idadi ya watoto wenye umri chini ya miaka mitano

No.	Umri	uzito

Upatikanaji an umiliki wa chandarua chenye dawa.

12. Je umewahi kukiona au kukisikia chandarua chenye dawa? Ndiyo [ ] Hapana [ ] sijui[ ]
13. Je una chandarua chenye dawa? Ndiyo [ ] Hapana [ ] kama hapana jibu swali namba **22**

14. Idadi ya vyandarua vyenye dawa ndani ya nyumba: kimoja [ ] viwili [ ] vitatu na zaidi[ ] hakuna chandarua[ ]
15. Hali ya chandarua ikoje: kizima [ ] kimechanika [ ]
16. Je chandarua chako kina dawa? [ ] Ndiyo, [ ]Hapana , [ ]sijui
17. Je kwa sasa vinatumika? Vinatumika[ ] havitumiki [ ]kama hakitumiki jibu swali namba **23**
18. Je ulikitumia usiku uliopita? Ndiyo [ ] Hapana [ ]
19. Matumizi ya chandarua yakoje : kilasiku [ ] sio kilasiku[ ]
20. Umekipata/vipata vipi hivi vyandarua? Kutoka serikalini [ ] hati punguzo [ ]mengineyo _____
21. Tarehe ya kupata chandarua chenye dawa: ndani ya miezi 6[ ] chini ya miezi 6[ ]
22. Sababu za kutokua na chandarua chenye dawa
    a) Havipatikani
    b) Garama
    c) Kimepotea/ibiwa
    d) Kimetumika kwa matumizi mengine
    e) Kimezeeka
    f) mengineyo
23. Sababu za kutotumia chandarua chenye dawa kilichopo
    a) Mazingira ya nyumba hayaruhusu
    b) Hakuna kitanda
    c) Vyandarua hivi hazizuii ugonjwa wa malaria
    d) Nahofia a sumu
    e) Hali ya hewa
    f) Mengineyo/elezea _____--
24. Je mtoto wako mwenye umri wa chini ya miaka mitano alitumia chandarua usiku wa jana? Ndiyo [ ] Hapana [ ]
25. Unafikiri kuna faida gani za watoto wenye umri chini ya miaka mitano kutumia chandarua chenye dawa
    a) Kinasaidia kupunguza ugonjwa wa malaria
    b) kinasaidia kutunza pesa

c) mtoto analala vizuri
d) inapunguza muda wa kwenda hospital mara kwa mara

26. Kama ingetokea kuwa hukupata vyandarua vile vilivotolewa bure an hospital/selikari, je ungeweza kununua wewe binafsi? Ndiyo [ ] Hapana [ ] kama jibu ni hapana elezea_____

Elimu kuhusu ugonjwa wa malaria

27. Je dani ya miezi sita iliyopita mtoto wako alipata homa za vipindi?ndiyo [ ] hapana[
28. Je alipelekwa hospitali? Ndiyo [ ] Hapana [ ]
29. Kama jibu ni hapana elezea kwanini! _____
30. Je alipata dawa za kusuia malaria? Ndiyo [ ] Hapana [ ]
31. Kama jibu ni ndiyo taja jina la dawa aliyopatiwa_____
32. Ninini husababisha ugonjwa wa malaria
    a) _____
    b) _____
33. Je waweza taja dalili za ugonjwa wa malaria?
    a) homa
    b) kichwa kuuma
    c) kuhisi baridi
    d) tabia ya kupenda kukaa juani
    e) mwili kuwa dhaifu
    f) viungo vya mwili kuuma
    g) kutapika
    h) maumivu ya tumbo/ kuharisha
    i) kupata degedege
    j) sijui
34. Ni zipi njia za kuzuia ugonjwa wa malaria unazozifahamu na unazitumia kuzuia ugonjwa wa malaria apa nyumbani?
    a) Matumizi ya vyandarua vyenye dawa
    b) Kuweka mazingira safi

c) kuharibu mazalio ya mbu
d) kutumia dawa za malaria
e) kutumia dawa za mitishamba
f) kwa kupulizia dawa ya kuua mbu ndani
g) kwa kutumia dawa za kupulizia
h) kwa kutumia dawa za kujipaka
i) mengineyo _____
j) sijui

35. Kwa kawaida ni wapi uwa unakwenda endap mmoja wa wanafamilia akiwemo mtoto wa umri wa chini ya miaka mitano atugua ugonjwa wa malaria
    a) Hospital
    b) Tiba ya jadi
    c) Matibabu binafsi
    d) Mengineyo/elezea_____

Hali ya nyumba

36. mazingira ya nyumba
    a) Ipo karibu na mazalio ya mbu: matairi mabovu, kontena. Madimbwi
    b) Mazingira ni safi
    c) karibu na shuguli za kilimo
37. Je madilisha ya nyumba yamewekewa wavu wa kuziuia mbu.Ndiyo [ ] Hapana [ ]
38. Je nyumba ina vyumb vya tofauti. Ndiyo [ ] Hapana [ ]
39. je hali ya chumba ikoje
    a) inaruhusku kuweka chandarua kwa urahisi
    b) haina nafasi kwa ajili ya kuwekea chandarua
    c) vyumba ni vidogo mno havina nafasi ya kutosha
40. Ni katika kipindi gani cha mwaka familia uwa inatumia vyandarua vyenye dawa
    a) Wakati wa mvua
    b) Wakati wa kiangazi
    c) Wakati wote
    d) Sifahamu
    e) Mengineyo/ elezea_____

41. Nikwasababu kubwa zipi zinazowafanya mtumie vyandarua vyenye dawa wakati uo uliotajwa apo juu_____
42. Je nyumba yako ilipuliziwa dawa ya mbu? Ndiyo[ ] hapana [ ]
    Kama jibu ni hapana elezea ni kwa nini ----------

Ninashukuru kwa kukubali kunisikiliza!