# POST-OUTBREAK MALARIA MORBIDITY AND UPTAKE OF INTERVENTIONS IN MULEBA COMPARED TO KIGOMA DISTRICT, TANZANIA 2010

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**Masters of Science in Applied Epidemiology Dissertation**

**Muhimbili University of Health and Allied Sciences**

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# POST-OUTBREAK MALARIA MORBIDITY AND UPTAKE OF INTERVENTIONS IN MULEBA COMPARED TO KIGOMA DISTRICT, TANZANIA 2010

**By**

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**"A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Applied Epidemiology of Muhimbili University of Health and Allied Sciences"**

**Muhimbili University of Health and Allied Sciences**

**March, 2012**

## CERTIFICATION

The undersigned certify that they have read and hereby recommend for the acceptance of thesis/dissertation entitled ***Post-outbreak malaria morbidity and uptake of Interventions in Muleba compared to Kigoma, Tanzania 2010***, in fulfillment of the requirements for the degree of Masters of Science in Applied Epidemiology of Muhimbili University of Health and Allied Sciences.

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## DEDICATION

To my loving mom the late Asha S. Bonye and my father Yusuph A. Juya for their invaluable kindness in raising, supporting and taking care of me during my all childhood period. No words can exactly explain what they did to bring me where I am, but shortly I can say I am a product of their endless efforts and blessings from God the Almighty. May God the Merciful bless my parents.

# ABSTRACT


## Introduction

Malaria is widespread in tropical and subtropical parts of America, Asia and Africa. Approximately 350- 500 million malaria cases and, 1-3 million deaths are reported annually, majority are children under 5 years in Sub-Saharan Africa. In 2008, about 247million malaria cases and 1 million malaria deaths were reported, mostly among children living in Africa. About 90% of the burden of malaria occurs in Sub-Saharan Africa where it is mostly endemic with epidemics necessitating concerted community based control intervention strategies, which with sustained use would avert future malaria epidemics. Thus, the aim of this study was to assess current use of triple malaria interventions following control of malaria epidemic in Muleba district five years ago, compared to Kigoma district implementing regular malaria control intervention.

## Methodology

This was a cross-sectional analytic study, conducted between November 2010 and March 2011 in Muleba and Kigoma rural districts. Multistage sampling was used to get required study subjects who were heads of households or their delegates. A total of 400 participants (203 from Muleba and 197 from Kigoma rural districts) were involved in the study. Data was collected using structured questionnaires, data entry and analysis was done using Epi Info version 3.5.1.

**Results**

Among the study households 207 (51.7%) were headed by females and 314 (78.5%) household head age was more than 30years. The ownership and use of LLIN was higher in Muleba 91.6% and 66.5% respectively compared to Kigoma where 78.3% and 59.9% of the study population reported to own and use LLIN respectively. Among the factors found to be statistically significant were; level of education of LLINs user and size of family ($P<0.05$) in Kigoma. Reported malaria in the past two weeks was very low (12.3%) in Muleba compared to Kigoma, which was much higher (54.7%). Use of ACT among individuals with history of malaria was higher (76.8%) in Kigoma compared to Muleba (68.0%), the difference was not statistically significant ($P>0.05$). Although ACT use was higher in individuals with age >30yrs, level of education ≥ primary school, and households with under-fives ≥ 2, but these factors were not significant ($P > 0.05$).

**Conclusion and Recommendation**

The study revealed that people in Muleba continued and sustained the use of LLIN and IRS compared to Kigoma which was not exposed to the malaria control interventions. There was also very low reported malaria morbidity in Muleba compared to Kigoma suggesting a likelihood of averting malaria epidemic in the near future. The combination of three interventions (LLINs, ACT and IRS) in Muleba to control the epidemic was sustained and it might have contributed to the low malaria prevalence five years after the epidemic has been controlled. Control strategies used in Muleba can be applied to other places to increase uptake and utilization of malaria interventions. More studies should be done to explore factors associated with uptake of these interventions in order to maximize their coverage and use such lessons elsewhere thus maximize their benefits.

**Key words**: Muleba, Kigoma rural, combined malaria interventions

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## LIST OF ABBREVIATIONS

| | |
|---|---|
| ACT: | Artemesinin based Combination Therapy |
| AFENET: | African Field Epidemiology Network |
| ALu: | Artimether/Lumefantrine |
| CDC: | Centre for Disease Control and Prevention |
| CDR: | Crude Death Rate |
| CFR: | Case fatality Rate |
| CHMT: | Council Health Management Team. |
| DC: | District Commissioner. |
| DDT: | Dichlo-Diphenyl Trichloroethan |
| DED: | District Executive Director |
| DHS: | Demographic Health Survey |
| DMO: | District Medical Officer |
| DSS: | Demographic Surveillance System |
| GDP: | Gross Domestic Product |
| HFs: | Health facilities |
| HIV: | Human Immunodeficiency Virus |
| HMIS: | Health Management Information System |
| ICON: | Lambda-cyhalothrine |

| | |
|---|---|
| IDSR: | Integrated Disease Surveillance and Response |
| IPD: | Inpatient department |
| IRS: | Indoor Residual Spraying |
| LLINs: | Long Lasting Insecticidal Nets |
| MDG: | Millenium Development Goals |
| MoHSW: | Ministry of Health and Social Welfare. |
| MS Excel: | Microsoft Excel |
| MUHAS: | Muhimbili University of Health and Allied Sciences |
| NBS: | National Bureau of Statistics. |
| NMCP: | National Malaria Control Programme. |
| OPD: | Outpatient department |
| PCR: | Polymerase Chain Reaction. |
| P.falciparum: | Plasmodium falciparum |
| P.malariae: | Plasmodium malariae |
| P.ovale: | Plasmodium ovale |
| P.vivax: | Plasmodium vivax |
| RDT: | Rapid Diagnostic Test |
| RMO: | Regional Medical Officer. |
| Sq Kms: | Square kilometers |

| | |
|---|---|
| SP: | Sulfadoxine- Pyrimethamine |
| TACAIDS: | Tanzania Commission for AIDS. |
| TFELTP: | Tanzania Field Epidemiology and Laboratory Training Programme |
| THMIS: | Tanzania HIV/Malaria Indicator Survey |
| TNVS: | Tanzania National Voucher Scheme |
| USD: | United States Dollar |
| WHO: | World Health Organization. |

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Malaria is a mosquito-borne disease caused by a parasite belonging to the genus *Plasmodium*. Four species of plasmodium have been identified which cause malaria in humans, *Plasmodium falciparum*, *Plasmodium ovale*, *Plasmodium malariae* and *Plasmodium vivax*. The most severe form of the disease is caused by *Plasmodium falciparum*. There is a fifth species of plasmodium causing a similar infection in macaques (zoonosis), however can also infect humans.

Malaria is widespread in tropical and subtropical regions including parts of America, Asia and Africa. Each year there are approximately 350- 500 million cases of malaria, killing 1-3 million people, the majority of whom are young children under the age 5 years in Sub-Saharan Africa. About 90% of malaria- related deaths occur in Sub-Saharan Africa. In 2008, there were 247million cases of malaria and nearly 1million malaria-related deaths, mostly among children living in Africa (1) In Africa a child dies every 45 seconds of malaria, the disease accounts for about 20% of all child-hood deaths. Malaria is commonly associated with poverty but is also a cause of poverty and a major hindrance to economic development. Indeed if malaria prevalence stays on its present upwards course, the death rate could double in the next twenty years (1)

Almost half of the world's population is at risk of malaria (1) Specific population risk groups include;

- Young children in stable transmission areas who have not yet developed protective immunity against the most severe forms of the disease. Young children contribute the bulk of deaths worldwide.

- Non-immune pregnant women are at risk as malaria causes high rate of miscarriage (up to 60% in *Plasmodium falciparum* infection) and maternal deaths rates 10-15% (1).

- Semi-immune pregnant women in areas of high transmission. Malaria can result in miscarriage and low birth weights, especially during the first and second pregnancy.

- Semi-immune HIV-infected pregnant women in stable transmission areas are at increased risk of malaria during all pregnancies. Women with malaria infection of the placenta have also an increased risk of passing HIV infection to their newborns.

- People with HIV/AIDS are at increased malaria disease when infected.

- International travelers from non-endemic areas are at high risk of malaria and its complications because they lack immunity.

- Immigrants from endemic areas and their children living in non-endemic areas and returning to their homes are at risk because of waning or absent of the immunity.

Malaria remains one of the major threats to Public Health and economic development in Africa. It is estimated that out of 3 million deaths resulting from malaria every year around the world, Africa alone contributes more than 90% of this burden.

Malaria is still a leading cause of OPD and IPD admissions of children under 5 years at health facilities. Malaria is considered the major cause of loss of economic productivity in persons 15-56 years of age and hindrance to learning capacity in people 5-25 years of age (2).

Malaria is still a major public health concern for all Tanzanians, especially for pregnant women and children under five years of age. The disease is a leading cause of morbidity and mortality among both inpatient and outpatient admissions. Malaria contributes more than 40% of all outpatient attendances. Many parts of the country, including the uplands report malaria transmission throughout the year however, the transmission rate increases during and after rain seasons (i.e. April-May).

Children under the age of five years and pregnant women are at a higher risk than other groups of people because of their low natural immunity. Pregnant women are four times more likely to develop complications of malaria than non-pregnant women. Malaria is also considered to be the major cause of pregnancy loss, low birth weight and neonatal mortality.

The United Republic of Tanzania has a population of more than 39 million people, 90% of whom are at risk of malaria. Tanzania has the third largest population at risk of stable malaria in Africa after Nigeria and Democratic Republic of Congo (2).

In Tanzania, 14-18 million new malaria cases are reported every year, resulting in 120,000 deaths. Out of these, 70,000 deaths occur in children under the age of 5years.The annual malaria incidence rate is 400-500/1,000 people and this number doubles for children less than5 years of age. A community survey using verbal autopsies done in Muheza, Tanzania in 2007 revealed that malaria accounts for 34.3% of all deaths and 43.5% of all infants deaths (3)

Over the years since 1914, Tanzania has been experiencing Malaria epidemics in different districts due to different reasons. Muleba**,** one of the districts in the northwestern part of the country experienced malaria outbreak in Oct, 1997 to Mar, 1998 where 133,866 cases and 1,740 deaths were reported (4). Recently in Jan-Mar, 2006 the same district experienced another malaria epidemic. In this epidemic, the prevalence reached as high as 41% whereby 192,771 cases and 879 deaths were reported (with a

CFR of 0.5%). The data show that 36% of the reported cases and 87% of deaths were in children less than five years.

Following the last outbreak there was a close follow-up by the MoHSW/NMCP on the availability and utilization of ACT in Muleba. The drugs were supplied using the routine method of drug delivery by MSD, which is demand driven supply using report and request (R&R) forms. However due to the critical conditions of the outbreak, sometimes this routine system was accompanied by the push system whereby drugs were supplied without demand from the district so as to ensure availability of the drug at all levels of health facilities. Using these two methods ACT coverage reached higher than 95% in 2007(5) and therefore few cases of drug stock-outs were experienced and they were short lasting.

Also promotion and distribution of LLINs was intensified during and after occurrence of the outbreak. LLINs were distributed to all Muleba residents regardless of their age although preference was given to under-fives and pregnant women. Together with free distribution of LLINs to all age groups, the routine system of LLINs provision using Tanzania National Voucher scheme (TNVS) continued and impregnation of pre-existing nets at households with pyrethroids was carried out. The LLINs coverage in Muleba reached 56.8% in 2007 (5).

Treatment of households with indoor residual spraying was carried out in targeted areas and targeted households considered as being at a high risk. The targeted area was plateau inland from Lake Louise an area of coffee and banana plantation. In this round, 35,000 – 40,000 households were targeted whereby 95% of them were sprayed.

Before the introduction of the above three interventions in Muleba, malaria prevalence was 41% with Case fatality rate of five per 1000(5). After introduction of the three interventions malaria in Muleba dropped to 5.4% while anemia prevalence in under-fives declined to 0.5% (6).

### 1.12: Economic impact of malaria

Malaria causes significant economic losses, and can decrease gross domestic product (GDP) by as much as 1.3% in countries with high levels of transmission. Over the long term these aggregated annual losses have resulted in substantial differences in GDP between countries with and without malaria, particularly in Africa (1)

The health costs of malaria include both personal and public expenditures on prevention and treatment. In some heavy burden countries, the disease accounts for:

- Up to 40% of the public health expenditure;
- 30% to 50% of inpatient hospital admissions;
- Up to 60% of outpatient health clinic visits (1)

Malaria disproportionately affects poor people who cannot afford treatment or have limited access to health care, trapping families and communities in a downward spiral of poverty.

In Tanzania the cost of malaria in relation to GDP, is estimated to consume $240 out of $280 annually. It is estimated that Tanzania spends $2.14 annually on malaria services of every $11 spent per person per year on Health. Approximately 75% of the expenditure for malaria is borne by Households with the government contributing 20% and development partners 5%. It is estimated that 30% of this expenditure at the Household level is spent for anti-malarial drugs, 50% for mosquito nets, insecticides, coils and other strategies. The burden of malaria is greatest especially among the poor, given the vicious circle of poverty and ill health (2).

### 1.13: Measurement of malaria burden in Tanzania

One of the serious problems in the malaria control activities in Sub-Saharan Africa is the availability of reliable sources of data for estimation of malaria burden and evaluation of intervention programmes. Where Databases are available they me be not working

properly or personnel working with the databases are not skilled enough. In some other places no databases existing at all and no data available for estimation of health problems or evaluation of programmes.

In Tanzania, the most commonly used tools to estimate malaria burden are

- Demographic surveillance system (DSS),
- Health management information system (HMIS),
- Integrated disease surveillance and response (IDSR) and
- Health facility based sentinel surveillance for malaria control

**1.14 Malaria transmission and Endemicity**

Malaria is transmitted exclusively through a bite of a female anopheles mosquito. When the mosquito bites an infected person it takes a small amount of blood together with malaria parasites. In the mosquito the parasites develop for about one week, and when the mosquito takes another blood meal it injects the parasites into a person being bitten through mosquito saliva. In a newly infected person the parasites spend a period of 2 weeks to several months (rarely years) before starting multiplication in the red blood cells and causing symptoms of malaria including fever, headache, joints pain and generalized body weakness. If the disease is not treated early, it can develop to severe form leading to coma and finally death.

Intensity of malaria transmission depends on factors related to the parasite, the vector, the human host and the environment. About 20 different species of anopheles are found around the world, however all the important vector species bite at night. They breed in shallow collections of freshwater, like puddles, rice fields, and hoof prints;. Transmission is more intense in places where the mosquito is relatively long- lived (so that the parasite has enough time to complete its development in the mosquito) and where it prefers to bite humans rather than other animals. For example the long life span

and a strong human biting habit of the African vector species is the underlying reason why more than 85% of malaria deaths occur in Africa (1).

Human immunity is another important factor especially in areas of moderate and intense transmission. Immunity develops over years of exposure but does not give a complete or life-long protection; it just reduces the risk that malaria infection will cause severe disease. For this reason most malaria deaths in Africa occur in young children, whereas in areas with less transmission and low immunity the risk is similar in all age groups.

Malaria transmission also depends on the climatic conditions that may affect the abundance and survival of the mosquito such as rainfall patterns, temperature and humidity. However, in many places transmission is seasonal with peak during and just after rain season. Malaria epidemics occur when climate and other conditions suddenly favour transmission in areas where people have little or no immunity to malaria.

**1.15: Types of malaria**

There are four types of malaria infections basing on the species of the parasite;

***Plasmodium falciparum*** is wide spread in tropical and sub-tropical areas of the Central and South America, Africa and South-East Asia. This species is responsible for the most severe infections and causing about 90% of malaria- related deaths in Sub-Saharan Africa. Studies done in 2002 showed that 2.2million people were at risk of contracting *Plasmodium falciparum* malaria, and about 70% of these infections are in Africa while 25% in South East Asia (1)

Cerebral malaria is the most serious complication of malaria caused by *P.falciparum*. This occurs when malaria parasites infect very small blood capillaries that flow through the tissues of the brain. Cerebral malaria carries a case fatality rate of about 15% or more and extremely lethal

***Plasmodium vivax*** malaria; this has the widest geographic distribution through the world and causes much of the debilitating disease. It is usually found in Central and

South America, India and South East Asia. About 60% of malaria infections in India is due to *Plasmodium vivax*. Malaria caused by *Plasmodium vivax* is not fatal. Some strains of P.vivax have ability to incubate in the liver for about 6-10 months or more, delaying appearance of initial symptoms of the disease. In these instances malaria can be overlooked as a diagnosis. Sometimes *P.vivax* can remain dormant in the liver for months to years and reactivate later causing relapsing malaria.

*Plasmodium vivax* accounts for about 70-80million new cases every year (about 20% of the global burden of 350-500 million total cases of all human malaria).

*P.vivax* pre-dominates more temperate regions as it can tolerate cooler temperatures and more widespread than *P.falciparum*, however its transmission is low because it depends on the climate changes (seasonal-dependent).

In the Korean Peninsula the primary vector of *P. vivax* is *Anopheles sinensis* which breed in the fresh-sun exposed water in the rice fields. In US, about 1,000 cases of *P.vivax* malaria are diagnosed every year, most from travelers or immigrants from malaria risk areas of the world.

***Plasmodium malariae***, has a restricted distribution, and is said to cause less than 1% of malaria in India. It is found in tropical and sub-tropical areas of Central and South America, Africa and South East Asia.

Paroxysms of malaria caused by *P.malariae* show a periodicity of 72 hours and thus termed as Quartan malaria. *Plasmodium malariae* does not cause life-threatening malaria but ranks third in its prevalence. *Plasmodium malariae* is also known to cause malaria in dogs.

***Plasmodium ovale***, is the rarest of the four species and is found in tropical West Africa in countries including Ghana, Liberia and Nigeria. In high endemic areas a patient may be infected with one or more species of malaria parasites. In India for instance about 1-4% of malaria are due to mixed infections. *P.ovale* can also hibernate in the liver for up-

to 4 years after the person is bitten by the infected mosquito. When the parasites reactivate and invade red blood cells the person can fall sick.

**1.16: Malaria symptoms and treatment**

The symptoms characteristic of malaria include flu-like iLLINess with fever, chills, muscle ache and headache. Some patients may develop nausea, vomiting, cough and diarrhea. Fever and chills due to malaria show a periodicity of 1-3 days. Sometimes patients may develop yellowing of the skin and whites of the eye (jaundice) due to destruction of the red blood cells by malaria parasites. Patients with severe form of the disease may develop bleeding tendencies, shock, liver and kidney failure, central nervous system deterioration leading to coma and finally death. Cerebral malaria (coma or altered mental consciousness) can occur with *Plasmodium falciparum* infection. Cerebral malaria is highly lethal if not treated quickly, however even with treatment 15-20% of cases die.

Early diagnosis and treatment of malaria reduces disease and prevents death. It also contributes to reducing malaria transmission. WHO recommends that malaria be confirmed by parasite-based diagnosis before giving treatment. Treatment solely based on symptoms be considered when a parasitological diagnosis is not possible.

The classic and most used test for malaria is the blood smear on a microscope slide that is stained with Giemsa or Field reagents to show the parasites inside red blood cells. Although this test is easily done, its results depend on the skills of technician who prepares and examines the slide. Other malaria tests exist, these include an immunological based test, rapid diagnostic test (RDT) and Polymerase chain reaction (PCR). RDT method is simple, quick and does not require additional infrastructure or intensive training to perform. However these are not widely available and relatively expensive than the traditional Giemsa smear.

Treatment of malaria depends on two main factors,

- Condition of the patient (severity of the disease, age, other conditions like pregnancy, allergy history, any underlying disease, etc)
- Drug susceptibility of the parasite(s)

Different areas of the world have different anti-malarials according to species of the parasites and parasite drug susceptibility profiles at their localities.

Mild malaria can be treated by oral medications but severe malaria requires intravenous medications. Malaria treatment should be done by a physician who is familiar with malaria treatment protocols.

The most commonly first line medications for mild malaria is Artemesinin based combination therapy and for severe form of the disease intravenous quinine is used. In Middle East severe malaria caused by *P. falciparum* i/v chloroquine is used but in Africa where *P.falciparum* is resistant to chloroquine i/v quinine is used. In Tanzania, malaria treatment guidelines direct Artimether/Lumefantrine abbreviated as ALU, an artemesinin combined therapy as a the first line treatment for malaria and Quinine reserved for severe or complicated malaria

Severe malaria is defined as having positive blood slide/RDT and one or more of the following, impaired level of consciousness/coma, severe anemia, renal failure, pulmonary edema, acute respiratory distress syndrome, shock, disseminated intravascular coagulation, spontaneous bleeding, acidosis, hemoglobinuria, jaundice, repeated generalized convulsions,

### 1.17 Drug resistance

Resistance to antimalarial drugs has grown very rapidly, slowing malaria control effects. When treated with monotherapy, patients are likely to discontinue treatment early

following rapid disappearance of malaria symptoms. This leads to partial treatment and leaves persistent malaria parasites in blood.

Unless a second drug given as part of combination (as in ACT), these parasites can survive and taken by a mosquito and passed to another person. Monotherapies and irrational drug use are therefore the forces behind development of drug resistances by malaria parasites.

WHO recommends routine monitoring of antimalarial drug resistance, and assists countries to strengthen their efforts in this area of work.

**1.18 Malaria control strategies**

The history of malaria control in Africa started in early 1900s, when malaria seemed to be a major threat to development in areas where malaria was endemic. In Tanzania colonial government instituted a number of interventions to combat the disease including environmental management, improved housing designs, personal protective measures and use of anti-malarials. In Tanzania (formally known as Tanganyika) malaria control efforts were initiated to protect German colonial personnel in 1890s (7). Efforts were gradually increased during British colonial era and Tanganyika participated in malaria eradication efforts through Pare-Taveta scheme that conducted indoor spraying and prompt treatment. Since Tanzania got its independency in 1961, a number of intervention, management and control measures were instituted. Currently most of the interventions are vertical in nature. However the fundamental problem in malaria control measures is lack of good baseline data. Several attempts to produce malaria vaccine that will provide high level of immunity against malaria for sustained periods have been done but none of them proved to be effective.

Vector control is the primary public health intervention for reducing malaria transmission at community level. It is the only intervention that can reduce malaria from very high transmission levels to close to zero (1). In high transmission areas it can

reduce child mortality rates and the prevalence of severe anemia. For individuals, personal protection from mosquito bite represents the first line of defense for malaria prevention.

Two forms of vector control are effective and commonly used in a wide range of circumstances, these are;

i. **Insecticide- treated mosquito nets** (**LLINs**). Long lasting Insecticide impregnated nets (**LLIN**s) are the most preferable for public health distribution programmes. WHO recommends universal vector control coverage, and in most places the most cost effective way to achieve this is through distribution of LLINs, so that everyone in the high transmission area sleeps under a LLIN every night. LLINs can protect communities in high malaria transmission when the coverage is at least high (at least 80% of the targeted population in the community sleeping inside them). LLINs are effective for 3-5years depending on the models and conditions of use (1). With coverage of 80% LLINs alone can reduce malaria prevalence to below 1% in low transmission areas (8).

ii. **Indoor Residual spraying** with Insecticides (IRS). When well programmed and implemented, IRS is the most powerful way to reduce malaria in high transmission areas. The full potential of IRS is realized when at least 80% of houses in targeted areas are sprayed. Indoor spraying is effective for 3-6 months depending on the type of the insecticide used and type of surface on which it is sprayed while DDT can be effective for 9-12 months in some areas (1). Longer-lasting insecticides are under development.

**Use of Artemisinin based Combination Therapy (ACT)**

In addition to vector control strategies, proper case management using appropriate antimalarial drugs can reduce malaria and its complications. Currently more than 40 countries in malaria endemic areas in Sub-Saharan Africa recommend Artemisinin based

combination therapy ACT as first line treatment for uncomplicated falciparum malaria. Zambia was the first country in Africa to adopt artimether/lumefantrine (AL; coartem) as the first line therapy in national malaria treatment guidelines in 2002 (1).

The use of ACT together with vector control interventions (IRS and LLINs), by 2008 Zambia reduced the rates of in-patient cases and deaths by 61% and 66% respectively compared with 2001-2002 (9).

The same study showed that use of ACT in combination with vector control interventions (IRS and LLINs) reduced malaria-related out-patient cases and admissions in KwaZulu-Natal each by 99% from 2001 to 2003 and malaria- related deaths by 97% over the same period (9).

During major malaria outbreak from May- Oct 2005 in Tigray region in Ethiopia, the district in which local community health workers were operating had half malaria-related mortality compared to the district in which ACT was only available at State Health facilities, and over 2 years follow- up period community based deployment of ACT significantly lowered the risk of malaria specific mortality by 37% (9,10). In moderate transmission areas, 80% coverage of LLINs coupled with ACT reduced malaria prevalence to below 1% (8).

### 1.2 Rationale of the study

In response to the high prevalence (41%) and several outbreaks of malaria in the district, combined interventions were introduced in late 2006 and early 2007 and implemented concurrently to reduce the disease burden. These interventions were: (i) Indoor Residual Spraying (IRS), (ii) increased emphasis on the use, coupled with the distribution of free long lasting insecticide treated bed nets (LLINs), (iii) increased ACT coverage and (iv) introduction of Rapid diagnostic test (RDT) for early detection and prompt treatment of malaria. To the best of the knowledge of the researcher, studies have been done to evaluate the effect of IRS as a single strategy on the reduction of malaria in Muleba

which was the prior method before the introduction of the combined interventions strategy, but no studies have been done to evaluate the outcome of the combined strategies (IRS, ACT, RDT and LLINs). This study is aimed at evaluating the outcomes of the combined malaria interventions instituted in Muleba and therefore elucidating its achievements in reducing malaria morbidity and mortality and whether those interventions worth to implement in other malaria endemic areas to benefit similar achievements experienced in Muleba.

The information obtained from this study will provide highlights of the effect of the combined interventions strategy in the malaria control activities in Tanzania and elsewhere where malaria is endemic. This will help to know whether all interventions should be instituted concurrently or just one or few of them are enough and as good as all four interventions combined, and therefore help to avoid unnecessary wastage of resources.

Also findings obtained from this study will create room for further studies and serve as baseline information for other similar studies.

### 1.3 Problem statement

There is lack of information on utilization behavior of malaria control interventions (LLINs, ACT, and IRS) after successful control of malaria epidemic in Muleba in 2006 and whether use of malaria interventions and malaria morbidity differ from similar districts that have not been implementing such interventions. Muleba district experienced malaria outbreak in 2006 with high number of reported cases (192,771) representing a prevalence of 41% (5,11). There was also significant mortality as 879 deaths due to malaria were reported (five per 1000 case fatality rate), several interventions were put in place to control the outbreak. The control strategies included Indoor residual spraying (IRS) using lambda-cyhalothrin (ICON), promotion and distribution of long lasting nets (LLINs), and improved case management by introducing

RDT for fast and easy detection of malaria together and use of ACT as the first line drug for malaria treatment.

Uptake of the interventions was high as IRS household coverage was 93%, while LLINs coverage was 65% and ACT coverage was 61% (12). A huge amount of resources have been invested to reduce the disease burden in the district. Additional efforts included health education, community mobilization with remarkable success as evidenced by high uptake of the interventions and ending of the outbreak. It is now five years since the outbreak without any other reported outbreak, however further prevention of any outbreaks shall depend on the sustained use of the interventions. Compared to Kigoma a district without such malaria interventions, there is no evidence that communities in Muleba district had continued and sustained the use of malaria prevention interventions introduced during the control of the malaria epidemic. In other words there is no recent information from Muleba on whether the communities have maintained the immediate post-outbreak utilization of the interventions avoiding subsequent epidemics and its burden on people's health. Thus the aim of this study was to compare use of malaria prevention interventions in Muleba a district that had implemented strategies to control malaria epidemic with Kigoma one that had not experienced an epidemic.

This study is therefore aimed at assessing the current use of the triple malaria interventions, following control of malaria epidemic in Muleba district compared to Kigoma district implementing regular malaria control intervention.

### 1.4 Broad objective

To determine malaria morbidity and current use of the triple malaria interventions following control of malaria epidemic in Muleba district compared to Kigoma district implementing regular malaria control interventions

1.41 **Specific objectives**;

1.42 To determine the proportion of households which sleep under LLINs in both Muleba and Kigoma Districts.

- To determine the proportion of malaria cases that used ACT during their iLLINess for the past 6 months in both Muleba and Kigoma Districts.
- To determine the proportion of households that had IRS for the last 12 months in Muleba District.
- To determine factors associated with the uptake of each of the interventions
- To compare the uptake of malaria interventions and related malaria morbidity between Muleba and Kigoma Districts.

# CHAPTER 2

## 2.0 LITERATURE REVIEW

In recent years following high burden of malaria, global and local initiatives fighting against the disease have come up with different strategies. All of these strategies can be categorized into two; either preventive or curative. Some of the preventive strategies include, Indoor residual spraying which targets vector, use of LLINs, use of mosquito repellents, larviciding and behavior change for human being to reduce exposure to the vector. In curative, attempts have been made to improve proper, easy and quick diagnosis of the disease and diagnostics tools like RDT have been developed. Researches and training have been employed to improve proper case management to reduce malaria prevalence and its associated complications. In view of the huge amount of resources allocated in malaria interventions, studies have been done to evaluate effectiveness and impact of different interventions.

A community based study on the use of targeted IRS in malaria control done in Kenya showed that, at a coverage of more than 80% using lambda-cyhalothrin (ICON), malaria prevalence in school children was reduced by 64.4% in the intervention valley area and by 46.3% in the intervention uphill area after 12 months of follow-ups (13), and reduction in the incidence by 65.4% in the intervention valley area and by 46.4% in the intervention uphill area after 14weeks. *Anopheles funestus* densities were reduced by 85.3% and 69.2% in the intervention valley and up-hill areas respectively. This proved huge positive impact in the reduction of malaria in that area.

Another study done in Ladji in Benin using experimental huts showed that IRS alone using chlorpyrifos methyl could reduce vector by 95% and LLIN alone impregnated with the same insecticide showed that vector reduced by 45% (14).

A similar study to assess the impact of use of LLIN in reduction of malaria vectors was done in Kilombero in Tanzania showed that, the density of vectors (*Anopheles gambiae sensustricto)* was reduced by 79% and that of *Anopheles arabiensis* was reduced by 38% (15).

Another study done in Rwanda and Ethiopia showed that a combination of mass distribution of LLIN to all <5 years or all households and nationwide distribution of ACT in the public sector was associated with a substantial declines of in-patient malaria cases and deaths by 55% and 67% in Rwanda and 73% and 62% in Ethiopia (16).

A study done in the Island of Principe also showed that a combination of four major control methods have produced a rapid decline in malaria morbidity and mortality on the Island of Principe. Malaria decreased by 99% between 2003 and 2008 with an incidence risk of the population of 5 5/1,000 in 2008. No malaria death reported since 2005 (17).

Another similar study to evaluate the impact of combined malaria control measures using LLINs and IRS in Pemba Island, in United Republic of Tanzania showed that, malaria prevalence decreased from 30% to <1% between 2003 and 2005 (18). A study done in three countries of southern Africa, Mozambique (Maputo Province), South Africa (KwaZulu-Natal) and Swaziland where malaria prevalence in children <15 years was high ranging between 62% and 86% to evaluate the 3 years impact of implementation of IRS revealed that, malaria prevalence was significantly reduced by 56% to 95% between 2002-2005 (19).

A Similar study done in highlands of Burundi to evaluate the effect of IRS in reducing malaria showed dramatic reduction in the malaria prevalence. For children aged ≤ 9 years prevalence was reduced by 12-64% and for the age group >9 years by 14-59% (20)

The impact of use of LLINs, SP (from 2003 to 2006) and ACT (from 2007 to 2008) was studied in two villages in Korogwe, Tanzania from 2003 to 2008 where community-based data was used. In this study it was shown that, use of LLINs and the two drugs

(SP and ACT) have reduced the prevalence of malaria parasitemia in the lowland village from 78.4% in 2003 to 13.0% in 2008, and in the highland village from 24.7% to 3.1% in the same period (21). Similarly the incidence of malaria episodes in the two villages dropped by almost 85% during the same period, and there was a marked reduction in the number of children who suffered from anemia in the lowland village.

A steep decline in the malaria morbidity and mortality trends in Eritrea was shown in a study conducted to evaluate the impact of combined malaria interventions between 2000 and 2004. A cross-sectional survey was used to collect data from households, community and health facilities on coverage and usage of LLINs, IRS, larvicidal activities and malaria case management.

The coverage of LLINs was 81% while that of IRS was more than 80%. At these coverages, there was a steep decline of malaria morbidity and case fatality by 84% and 40% respectively during the period (22).

Another study done in Bioko Island to assess combined malaria interventions, where IRS and proper malaria case management (using artesunate in combination with sulfadoxine-pyrimethaamine) were implemented together showed similar results on the reduction of malaria prevalence.

In this study before and after intervention data was collected and analyzed, results showed that overall mean prevalence of *P.falciparum* infection reduced from 46% at baseline in 2004 to 31% in 2005 (23).

A comparative study to evaluate individual effectiveness of IRS and LLINs when instituted separately and when carried out concurrently was done in Namawala, Tanzania. In this study a mathematical modeling was used assess the effectiveness of the interventions mentioned above.

The study showed that, although both IRS (with DDT) and LLINs provide personal protection, humans with only LLINs are better protected than those with only IRS, and high coverage of IRS with Bendiocarb may interrupt transmission as can simultaneous high coverage of LLINs and IRS with DDT (24).

A similar study carried out by Curtis CF and Mnzava AE to compare effectiveness of IRS and LLINs showed that, pyrethroid treated nets were at least as efficacious as house spraying with DDT, malathion of pyrethroid. However when data from carefully monitored house spraying projects carried out between 1950s and 1970s at Pare-Taveta and Zanzibar (United Republic of Tanzania), Kisumu (Kenya), and Garki (Nigeria) are compared with recent LLINs trials with apparently similar vector populations, the results with LLINs were much less impressive. Possible explanations include longer durations of most of earlier spraying projects and the use of non-irritant insecticides (25).

Other studies have been done to compare effectiveness of different types of insecticides used in IRS. These studies are very important as resistance of vector species to some insecticides is currently growing very fast. A study done in Benin where *Anopheles gambiae* species are resistant to pyrethroids and DDT has revealed that, this species of vector can be controlled using another type of insecticide called Chlorpyrifos-methyl in either nets or indoor house spraying.

This study showed that, IRS with Chlorpyrifos-methyl killed 95% of *Anopheles gambiae* entered the hut as compared to 31% lambdacyhalothrin and 50% with DDT. Control of C*x quinquefasciutus* showed a similar trend, although the level of mortality with chlorpyrifos was lower (66%) but higher than that of DDT (14%) and pyrethroids (15%). Nets impregnated with Chlorpyrifos-methyl killed 45% of *A. gambiae* and 15% of *Cx quinquefasciutus,* however the effect is short lived (13, 26).

Sometimes it becomes difficult to institute them concurrently due to limited amount of resources and other barriers. Under these conditions a need to select one or two of them rises. Comparative cost analysis studies have been done for some of these interventions.

For example a retrospective cost analysis study done in Kenya in 2002 comparing IRS and LLINs showed that, the financial cost for IRS was USD 0.86 per protected compared to USD 4.21 for LLIN. The economic cost per person protected by IRS was USD 0.88 compared with USD 2.34 for LLINs. The costs for LLINs were sensitive to the number of nets delivered to the community, as the delivery costs constituted more than 40% of the total cost. However even marked increases in efficiency of these groups can not reduce the cost of LLINs to that comparable of IRS except if more than one cycle of IRS was needed (27).

Another study to compare cost-effectiveness of IRS between urban and rural settings was conducted in Southern Mozambique showed that, economic cost covered per person per year using carbamates for IRS in the rural area, excluding the cost of project management, monitoring and surveillance was $ 3.48 and in the peri-urban area $2.16. The financial cost per person covered in the rural area and peri-urban per year were $3.86 and $2.41 respectively. The economic cost per person covered were respectively increased by 39% and 31% when project management, monitoring and surveillance were included (28)

Another cost analysis study on IRS and LLINs which involved seven African Countries (Tanzania, Mozambique, Malawi, South Africa, Eritrea, Senegal and Togo) revealed that, for conventional LLINs the cost per treated net- year of protection ranged from USD 1.21 in Eritrea to USD 6.05 in Senegal. The cost per child death averted ranged from USD 438 to USD 2,199 for a successful targeting of children. For LLINs of five years duration, the cost per treated net year of protection ranged between USD 1.38 in Eritrea to USD 1.90 in Togo. IRS, cost per person-year of protection for all ages were USD 3.27 in KwaZulu Natal and USD 3.90 in Mozambique.

If only children under fives of age were included in the denominator the cost per person year-protection was higher, USD 23.96 and USD 21.63. As a result the cost per child death averted was higher than for LLINs; USD 3,933- 4,357 (29).

In view of the above and other findings on the effectiveness of combined malaria control measures, Tanzania through NMCP and partners instituted a number of control measures from 2005 to date.

These measures include change of malaria treatment guidelines from SP as a first line for uncomplicated malaria to ACT in Dec, 2006, increased and complete coverage of IPTp for pregnant women, emphasis on the increased coverage and use of LLINs through NVS and national campaigns coupled with free distribution of LLINs to all children less than 5 years, advocacy on behavioral change to reduce man-vector contact and targeted IRS in Kagera region in 2007 and introduction of RDT in Muleba for prompt and correct malaria diagnosis to improve proper case management.

A national survey done by the Government of United Republic of Tanzania and partners in 2007 showed that; about 39% of total population owns LLINs and about 36% of pregnant women and children less than 5 years use them (30).

In this study fever was used as a proxy for malaria. Studies show that fever in under-fives is highly associated with malaria in endemic areas and in the absence of reliable diagnostic facilities can be used as proxy for malaria provided that no other causes of it have been identified. A study done by Genton B et al titled usefulness of clinical criteria for improving the diagnosis in a highly endemic area showed that fever is associated with malaria by 73% in children <10 yrs in the absence of other known causes (31). Another study done by Lulu Muhe *et al* titled clinical algorithm for malaria during low and transmission seasons showed that, Fever with a history of previous malarial attack or absence of cough or a finding of pallor gave a sensitivity of 83% in the high risk season and 75% in the low risk season, with corresponding specificities of 51% and

60%; fever with a previous malaria attack or pallor or splenomegaly had sensitivities of 80% and 69% and specificities of 65% and 81% in high and low risk settings, respectively (32). Also a study done by Wakgari Deressa in Adami Tulu district in south-central Ethiopia, a pre-tested interviewer administered structured questionnaire was used for self reported malaria basing on the symptoms (33).

# CHAPTER 3

## 3.0 METHODOLOGY

### 3.1 Study area:

This study was conducted in two districts; Muleba district in Kagera Region and Kigoma Rural district in Kigoma region.

Muleba District is one of the five districts making up Kagera region that is located in the Northwestern part of Tanzania. Muleba lies between latitude 1°50’22.992”S, and longitude 31°39’15.840”E. It is at an altitude of 1,237-1500 m above sea level. Muleba occupies an area of 10, 739sq Kms. According to 2002 national census, Muleba has a population of 386,328 people and about 79,107 households. It has an average annual population growth rate of 3.1%. Muleba is 1010 and 158kms from Dar es Salaam and Mwanza respectively. It receives an average rainfall of 2,000mm annually. Muleba experiences an average temperature of 20°C- 30°C throughout the year, although it can fall to 10°C at night during rainy season.

Muleba district was selected due to the fact that, before November, 2006 use of LLINs and proper case management using monotherapy drugs were the only intervention strategies to control malaria in Muleba. Use of Artemisinin based combination therapy (ACT) was introduced in December, 2006, Indoor Residual Spraying (IRS) and Rapid diagnostic test (RDT) for malaria were introduced in 2007 after the outbreak. The introduction of ACT in Muleba was not due to the occurrence of the outbreak but it was a coincidence with policy change in the malaria treatment guidelines. There was a change in the treatment of malaria from monotherapies as first line drugs to ACT. However ACT introduction was associated with intense promotion and supply in Muleba so as to achieve the maximum coverage and utilization of the drug to ensure proper case management, and therefore taken as one of the intervention strategies to fight against the outbreak

Kigoma Rural district was selected as control since it has only two interventions of ACT and use of LLINs, the district also has climatic conditions and geographical features similar to that of Muleba.

Kigoma Rural District council is one of the four councils in Kigoma Region. It covers an area of 19,574 sq kms, among which 8029 sq kms is water body of Lake Tanganyika, swampy water, Luiche and Malagarasi rivers.

The district is situated between latitude $4^0 – 6^0$ south of the Equator and Longitudes $29^0 – 39^0$ East of Greenwich, in the North. Kigoma District Council borders Kasulu District on the East, Urambo district (Tabora Region) on the South. It also share borders with Mpanda district (Rukwa Region) while in the west it boarders the Democratic Republic of Congo and Burundi, with Lake Tanganyika as common boundary.

The climate of the district is mainly divided into two zones, the highlands comprising of mountains, hills and the low Lands zone including Lake Tanganyika which influences rainfall pattern and distribution. The district receives sufficient amount of rainfall that ranges from 600mm 1600mm annually. The annual mean temperature varies from $17^0 – 25^0$C. The district population is estimated to be 648,189 for the year 2010 from an increase of 4.1% per annum according to the projection of 2002 census. There are 99,690 households having 311,131 males and 337,058 females.

### 3.2 Study design

This was a community based cross-sectional study, which was done between November 2010 and March 2011 in two districts of Muleba and Kigoma Rural Districts.

The uptake and utilization of triple malaria interventions (IRS, LLINs and ACT) and its related morbidity in Muleba was assessed pre and post outbreak, and then compared with Kigoma rural as a control district where only two interventions (LLINs and ACT) were implemented.

### 3.3 Study population

This study involved residents of Muleba and Kigoma rural districts who were in the sampled villages and households.

### 3.4 Sample size Estimation

The sample size, ***n***, was estimated by using formula:

$$n = \frac{\{u\sqrt{[P_1(1-P_1)+P_2(1-P_2)]}+v\sqrt{[2P(1-P)]}\}^2}{(P_1- P_2)^2}$$

$P = (P_1+ P_2)/2$

u = Two-sided percentage of the normal distribution corresponding to 100% - power,

Taking power = 80%, 100-80 = 20%, and u = 1.64

V = Percentage point of the normal distribution corresponding to the (two-sided) significance level = 5%, v = 1.96

$P_1$ and $P_2$ = the two proportions in the two districts (in this case Post-outbreak LLIN coverage in Muleba and Kigoma districts, which are 93.0% and 46.4% respectively)

Hence, the sample size, $n = \frac{\{1.64\sqrt{[0.65(1-0.65)+0.464(1-0.464)]}+1.96\sqrt{[2x0.557(1-0.557)]}\}^2}{(0.65-0.464)^2}$

$n = 181.9 \approx 182$

Assuming 10% non-response, then the required sample size (n) for each district will be;

$$n = 182 \times \frac{100\%}{(100-10)\%} = 202$$

Therefore for the two districts, the total sample size was 202x2= 404

### 3.5 Sampling technique

Research subjects for the study were obtained by Multistage sampling method.

### 3.51 Stage 1. Selection of Wards

First stage involved compiling a list of all wards in each district. The frame was serialized starting with one and a random number table was then used to select two wards in each district.

### 3.52 Stage 2. Selection of Villages

Second stage involved compiling a list of all villages in each of the selected wards and giving them a serial number. It was followed by random selection of five villages from the two districts.

### 3.53 Stage 3. Household selection

Third stage involved the compiling list of all households in the selected villages from which in Muleba, 203 households were randomly selected shared equally between the villages and it was similarly the case in Kigoma district. For convenience, households were selected by systematic random sampling. Sampling fractions were calculated for each village and then households were selected depending on that fraction.

### 3.54 Household definition

A household was defined as group of individuals who eats from the same pot and slept under the same roof in the previous night. Head of the household was selected to respond to the study. In case the head of the household was not available his/her delegate was selected for the study.

### 3.6 Data collection procedures

Before sampling process is carried out the research team was introduced to the district authority (DED, DC and DMO). The district authority was informed on the aim of the team, what is going to be done, who will do it, for how long and who will be involved. The district authority was also requested to provide a guide person who helped the research team giving direction and the best way of reaching the sampled villages.

Each household was pre-visited and an appointment was done. On the interview days after introduction and obtaining consent was done, the head of the household was interviewed in privacy. Informed consent was obtained by reading the consent form to the research subject and allowing her to ask questions where he/she didn't understand and letting him/her to decide whether to participate or not to participate and finally signing the consent form by the research subject.

### 3.61 Data Collection tool

Structured pre-tested Swahili questionnaires were used to collect relevant information from Households in the sampled villages. The data collection tool elicited information on:

- Household use of IRS within the last 12 months
- Household use of LLINs
- ACT users among subjects with history of fever/malaria in the past 6 months
- Malaria morbidity

### 3.62 Training and selection of research assistants

Prior to data collection process, 3 research assistants were recruited and trained for two days on the data collection tool (i.e. Swahili version questionnaire) and were involved in the pre-testing the tool before data collection process started. They were clinical officers and their training addressed mainly the tool itself (Swahili version questionnaire), procedures of data collection, ethics and consent requisition, and which data to collect.

In each district, data collection was done by three research assistants and the investigator himself. The research assistants were clinical officers who were trained together on questionnaire administration and the broad objectives of the study. The author supervised the research assistants daily while he was also collecting data. Qualification for the research assistants was that they should be health workers who can communicate in both Swahili and English.

### 3.63 Data quality

As the data collection process continued the investigator monitored for the accuracy, correctness and completeness of the filled questionnaires. This was done by spot inspection of the filled questionnaire and every evening following submission of the questionnaire to the investigator. All detected errors were corrected accordingly.

### 3.7 Data analysis

Data was entered, cleaned and analysed using Epi info 5.3.1.

### 3.71 Descriptive Analysis

Frequencies were generated and data cleaning was done. Descriptive percentages were generated and comparisons were done.

### 3.72 Univariate analysis

This included socio-demographic characteristics of research subjects, proportion of households that used LLIN, proportion of subjects with history of fever/malaria in the past 6 months who used ACT, and proportion of households had IRS in the past 12 months. P-values for the significance of difference between proportions of use of LLIN between the two districts was done.

### 3.73 Bivariate analysis

This was done using two by two tables to determine association between instituted the interventions and socio-demographic factors of research subjects in each district. Also to determine the association between malaria prevalence and socio-demographic characteristics of the research subjects in the two districts.

### 3.74 Logistic regression

Logistic regression was done to control for potential confounders age and sex. Dummy outcome binary variables were created; if a household used a LLIN it was given a value of 1 and 0 if it did not. Similar binary variables were created for use of LLIN and other dependent variables. Using one level of the independent variables as references association of the next level with the dependent variable control for the rest of the independent variables was done using SPSS version 15.0.

### 3.8 Ethical consideration

Research permission was sought from MUHAS research ethics Committee then regional and district levels. After arriving to the districts I introduced myself to DMO who took me to DED and DC for further introduction. I explained to them, what was the aim of the study, how is it going to be done, who will do it, for how long and who will be involved as research subjects. I requested the district authority to provide me with a guide person who helped me to reach the sampled villages. Confidentiality of the data was highly observed. Before any interview, consent from interviewee was requested.

# CHAPTER 4

## 4.0: RESULTS

### 4.1: Distribution of research subjects by Districts and villages

A total of 400 research subjects were enrolled into the study making response rate of 99.0% as the calculated sample size was 404, of whom from Muleba were 203 (50.7%) and 197(49.3%) were from Kigoma (Table 1). Villages within districts contributed almost equally to the study sample.

Table 1: Distribution of research subjects according to Districts and villages (N=400)

| District | Village | Number of research subjects | Percent (%) |
|---|---|---|---|
| **Muleba (N=203)** | Ijumbi | 104 | 26.0 |
| | Rubao | 99 | 24.7 |
| **Sub-total** | | **203** | **50.7** |
| **Kigoma (N=197)** | Kazuramimba | 65 | 16.3 |
| | Mahembe | 66 | 16.5 |
| | Mlela | 66 | 16.5 |
| **Sub-total** | | **197** | **49.3** |
| **Total** | | **400** | **100.0** |

### 4.12: Socio-demographic features of study population

Among the study population males were 205 (51.2%), and the majority (40.7%) were in age group 26-40 years (Table 2). In addition majority of study population 255 (63.7%) completed primary education, while 31 (7.8%) never attended school, and none had tertiary level education. Table 2 shows socio-demographic characteristics of the study population.

Table 2: Socio-demographic features of research subjects

| Characteristic | Muleba(n=203) | Percent(%) | Kigoma(n=197) | Percent(%) |
|---|---|---|---|---|
| **Sex** | | | | |
| Male | 91 | 55.2 | 102 | 48.2 |
| Female | 112 | 44.8 | 95 | 51.8 |
| **Age group** | | | | |
| ≤ 25 | 17 | 8.4 | 19 | 9.6 |
| 26-35 | 47 | 23.2 | 63 | 32.0 |
| 36-45 | 55 | 27.1 | 55 | 27.9 |
| 46-55 | 53 | 26.1 | 38 | 19.3 |
| **Level of education** | | | | |
| <Primary | 25 | 12.3 | 63 | 32 |
| Primary | 136 | 67.0 | 119 | 60.4 |
| Secondary | 33 | 16.3 | 14 | 7.1 |
| Tertiary | 9 | 4.4 | 1 | 0.5 |
| **No. of <5s per HH** | | | | |
| <2 | 112 | 55.2 | 72 | 36.5 |
| 2+ | 91 | 44.8 | 125 | 63.5 |
| **Size of family (No. of people/HH)** | | | | |
| <3 | 10 | 4.9 | 11 | 5.6 |
| 3-6 | 111 | 54.7 | 99 | 50.3 |
| 7+ | 82 | 40.4 | 87 | 44.2 |

The following sections, present the results of the study according to each specific objective followed by discussions and conclusions

**1. To determine proportion of households slept under LLIN in both Muleba and Kigoma Districts**

Table 3 below presents the results of LLIN use by district; overall 78.3% of households in Muleba reported ownership and use of LLIN while in Kigoma it was much lower 59.9%. In Muleba 186 (91.6%) reported to have LLINs, and 159 (78.3%) reported to sleep under LLINs last night, while in Kigoma 131 (66.5%) reported to have LLINs and 118 (59.9%) slept under LLINs last night. Both ownership and use of LLINs is higher in Muleba than in Kigoma. The difference in the use of LLIN between the two districts was statistically significant (P-value <0.05). ($\chi^2_{=}$ 15.1)

Table 3: Percent sleeping under LLIN by household socio-demographic characteristics in Muleba and Kigoma districts

| | **Muleba (n=203)** | **Percent(%)** | **Kigoma (n=197)** | **Percent(%)** | **%difference** | **P-value** |
|---|---|---|---|---|---|---|
| **Sex of head** | | | | | | |
| Male | 91 | 79.1 | 102 | 61.8 | -17.3 | 0.0001 |
| Female | 112 | 77.7 | 95 | 57.9 | -19.8 | <0.0001 |
| **Age group of head** | | | | | | |
| ≤30 | 34 | 85.3 | 52 | 63.5 | -21.8 | <0.0001 |
| 31+ | 169 | 76.9 | 145 | 58.6 | -18.3 | 0.0001 |
| **Education level of HH head** | | | | | | |
| <Primary | 25 | 88.0 | 63 | 36.5 | -51.5 | <0.0001 |
| Primary+ | 178 | 77.0 | 134 | 70.9 | -6.1 | 0.1644 |
| **No. of <5s per HH** | | | | | | |
| <2 | 112 | 79.5 | 72 | 52.8 | -26.7 | <0.0001 |
| 2+ | 91 | 76.9 | 125 | 64.0 | -12.9 | 0.0047 |
| **Size of family** | | | | | | |
| ≤6 people | 121 | 76.9 | 110 | 53.6 | -23.3 | <0.0001 |
| 7+ | 82 | 80.5 | 87 | 67.8 | -12.7 | <0.0001 |

**Bivariate analysis of LLIN use in Muleba**

In the bivariate analysis of the factors associated with LLIN use in Muleba as shown on the table 4 below, no factor was seen to be statistically significant (P-values > 0.05).

Table 4: Bivariate analysis of LLIN use in Muleba by socio-demographic characteristics

| **Household characteristic** | **Categories** | **O.R (crude)*** | **95% C.I** | **P-value** |
|---|---|---|---|---|
| **Sex** | Male | 1.0 | 0.47-1.80 | 0.804 |
| | Female | 1 | | |
| **Age group** | ≤30 | 1.74 | 0.63-4.80 | 0.280 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 2.19 | 0.63-7.70 | 0.160 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 1.16 | 0.59-2.29 | 0.450 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 0.81 | 0.41-1.61 | 0.541 |
| | 7+ | 1 | | |

* Based on Chi-square test

However, in Kigoma factors significantly associated with use of LLIN were education level of the head of the household and household size of family. Households heads with low education compared with high education 76% less likely to have an LLIN (OR=0.24, 95%CI0.13-0.45; p-value <0.001), households whose size was more than 4 compared with those with more than 5 were 62% less likely to own and use an LLIN (OR=0.38, 95%CI 0.21-0.69). Table 5: Bivariate analysis of LLIN use in Kigoma by socio-demographic characteristics

Table 5: Bivariate analysis of LLIN use in Kigoma by socio-demographic characteristics

| Household characteristic | Categories | O.R (crude) | 95% C.I | P-value |
|---|---|---|---|---|
| **Sex** | Male | 1.08 | 0.52-1.84 | 0.793 |
| | Female | 1 | | |
| **Age group** | ≤30 | 0.88 | 0.46-1.68 | 0.705 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 0.24 | 0.13-0.45 | <0.001 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 0.82 | 0.46-1.49 | 0.521 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 0.38 | 0.21-0.69 | 0.001 |
| | 7+ | 1 | | |

**Multivariable analysis of factors associated with Uptake of LLIN**

In multivariate analysis education and family size remained significantly associated with LLIN use. Those with higher education compared with low education were more than four times likely to own an LLIN (O.R=4.4, 95% CI= 2.26-8.54, P-value<0.0001) (Table 6). On the other hand those coming from households with house hold size more than seven compared to those with less were 65% less likely to own an LLIN (O.R=0.35, 95% CI=0.18-0.69, P-value=0.0024).

Table 6: Multivariable analysis of factors associated with LLIN use in Muleba (N=203) and Kigoma (N=197)

| | Muleba | | | Kigoma | | |
|---|---|---|---|---|---|---|
| **Factor** | **O.R (adjusted)** | **95% CI** | **P-value** | **O.R(adjusted)** | **95% CI** | **P-value** |
| Male | 1.20 | 0.60-2.41 | 0.5989 | 0.94 | 0.50-1.77 | 0.8562 |
| Female | 1 | | | 1 | | |
| **Age group** | | | | | | |
| ≤ 30 | 1.88 | 0.66-5.34 | 0.2336 | 1.33 | 0.64-2.75 | 0.4489 |
| 31+ | 1 | | | 1 | | |
| **Education level** | | | | | | |
| <Primary | 0.42 | 0.12-1.52 | 0.1869 | 4.40 | 2.26-8.54 | <0.001 |
| Primary+ | 1 | | | 1 | | |
| **No. of<5s per HH** | | | | | | |
| <2 | 1.21 | 0.61-2.41 | 0.5833 | 0.88 | 0.46-1.68 | 0.6904 |
| 2+ | 1 | | | 1 | | |
| **Size of family** | | | | | | |
| ≤6 | 0.71 | 0.35-1.46 | 0.3541 | 0.35 | 0.18-0.69 | 0.0024 |
| 7+ | 1 | | | 1 | | |

**2. Malaria Prevalence by Socio-demographic characteristics in both Muleba and Kigoma Districts**

Malaria prevalence was higher in Kigoma (54.8%) than in Muleba (12.3%). In both districts the prevalence was higher in age group 31+yrs than in ≤30yrs group, higher in people with education level primary and above than in less than primary in Kigoma, and higher in households with more than 2 under fives compared to households with less than 2 under fives. Households with family members less than 7 had higher malaria prevalence compared to households with members 7 and above. There was significant difference in malaria prevalence between the two districts (P<0.0001) in all socio-demographic characteristics. See table 7

Table 7: Malaria prevalence by socio-demographic characteristics in Muleba and Kigoma

| Characteristic | Muleba (N=203) | Percent(%) | Kigoma (N=197) | Percent(%) | %difference | P-value |
|---|---|---|---|---|---|---|
| **Sex** | | | | | | |
| Male | 91 | 13.2 | 102 | 54.9 | 41.7 | <0.0001 |
| Female | 112 | 11.6 | 95 | 54.7 | 43.1 | <0.0001 |
| **Age group** | | | | | | |
| ≤30 | 34 | 8.8 | 52 | 48.1 | 36.3 | <0.0001 |
| 31+ | 169 | 13.0 | 145 | 57.2 | 44.8 | <0.0001 |
| **Level of education** | | | | | | |
| <Primary | 25 | 12.0 | 63 | 60.3 | 48.3 | <0.0001 |
| Primary+ | 178 | 12.4 | 134 | 52.2 | 39.8 | <0.0001 |
| **No. of <5s per HH** | | | | | | |
| <2 | 112 | 8.0 | 72 | 48.6 | 40.6 | <0.0001 |
| 2+ | 91 | 17.6 | 125 | 58.4 | 40.8 | <0.0001 |
| **Family size** | | | | | | |
| ≤6 people | 121 | 11.6 | 110 | 54.5 | 42.9 | <0.0001 |
| 7+ | 82 | 13.4 | 87 | 55.2 | 41.8 | <0.0001 |
| **LLIN ownership** | | | | | | |
| Yes | 187 | 12.3 | 132 | 54.5 | 42.2 | <0.0001 |
| No | 16 | 12.5 | 65 | 55.4 | 42.9 | <0.0001 |

**Bivariate analysis of Malaria prevalence by socio-demographic characteristics in Muleba**

Among the factors analysed, no factor was significantly associated with malaria (P-value>0.05), this implies that individuals/households stand an equal chance of suffering from malaria in Muleba district basing on the five factors used. See table 8

Table 8: Bivariate analysis of Malaria prevalence by socio-demographic characteristics in Muleba

| **Household characteristic** | **Categories** | **O.R (crude)** | **95% C.I** | **P-value** |
|---|---|---|---|---|
| **Sex** | Male | 1.16 | 0.52-1.84 | 0.793 |
| | Female | 1 | | |
| **Age group** | ≤30 | 0.94 | 0.46-1.68 | 0.705 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 0.97 | 0.13-0.45 | <0.001 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 0.41 | 0.46-1.49 | 0.521 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 0.84 | 0.21-0.69 | 0.001 |
| | 7+ | 1 | | |
| **LLIN ownership** | Yes | 0.98 | 0.21-4.60 | 0.6137 |
| | No | 1 | | |

**Bivariate analysis of Malaria Prevalence by household Socio-demographic characteristics in Kigoma**

Similarly in Kigoma, malaria prevalence did not show any significant association (P-value>0.05) with any of the socio-demographic characteristics studied. See table 9.

Table 9: Bivariate analysis of Malaria prevalence by socio-demographic characteristics in Kigoma

| Household characteristic | Categories | O.R (crude) | 95% C.I | P-value |
|---|---|---|---|---|
| **Sex** | Male | 1.01 | 0.55-1.84 | 0.9814 |
| | Female | 1 | | |
| **Age group** | ≤30 | 0.69 | 0.35-1.37 | 0.2545 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 1.39 | 0.72-2.67 | 0.2879 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 0.67 | 0.36-1.26 | 0.1837 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 0.98 | 0.36-1.26 | 0.9300 |
| | 7+ | 1 | | |
| **LLIN ownership** | Yes | 0.97 | 0.53-1.78 | 0.9114 |
| | No | 1 | | |

**3. To determine proportion of ACT use among subjects with history of malaria**

Among 25 (12.3%) of the households who had history of malaria episode in the past two weeks in Muleba 17 (68.0%) used ACT, while in Kigoma 108 (54.8%) had history of malaria and 83 (76.8%) used ACT. In both districts male-headed households had higher ACT use than female headed. Table 10 shows utilization of ACT among individuals who reported to have malaria in the past 2 weeks. There was no significant difference in the use ACT between the two districts across the socio-demographic characteristics households (p-value >0.05).

Table 10: Percent households using ACT by socio-demographic characteristics in both Muleba and Kigoma during malaria episodes

| | **Muleba (n=25)** | **Percent(%)** | **Kigoma (n=108)** | **Percent(%)** | **%difference** | **P-value** |
|---|---|---|---|---|---|---|
| **Sex** | | | | | | |
| Male | 12 | 75.0 | 56 | 80.4 | 5.4 | 0.5476 |
| Female | 13 | 61.5 | 52 | 73.1 | 11.6 | 0.2498 |
| **Age group** | | | | | | |
| ≤30 | 4 | 75.0 | 25 | 64.0 | -36.0 | 0.0004 |
| 31+ | 21 | 66.7 | 83 | 80.7 | 18.8 | 0.0436 |
| **Level of education** | | | | | | |
| <Primary | 3 | 66.6 | 38 | 78.9 | 12.3 | 0.1906 |
| Primary+ | 22 | 68.2 | 70 | 75.7 | 7.5 | 0.4394 |
| **No. of <5s per HH** | | | | | | |
| <2 | 9 | 66.7 | 35 | 82.9 | 16.2 | 0.0688 |
| 2+ | 16 | 68.8 | 73 | 74.0 | 5.2 | 0.5976 |
| **Size of family** | | | | | | |
| ≤6 people per HH | 14 | 71.4 | 60 | 78.3 | 6.9 | 0.4600 |
| 7+ | 11 | 63.6 | 48 | 75.0 | 11.4 | 0.2481 |
| **Total** | | **68.0** | | **76.8** | | |

**Bivariate analysis of ACT use in Muleba**

No socio-demographic factor was significantly associated with use of ACT in Muleba (P-value >0.05) as shown on the table 11 below.

Table 11: Bivariate analysis of ACT use in Muleba by socio-demographic characteristics

| Household characteristic | Category | O.R (crude) | 95% C.I | P-value |
|---|---|---|---|---|
| **Sex** | Male | 1.13 | 0.21-6.05 | 0.613 |
| | Female | 1 | | |
| **Age group** | ≤30 | 1.50 | 0.10-45.13 | 0.180 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 0.93 | 0.07-12.11 | 0.704 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 0.91 | 0.55-1.71 | 0.626 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 1.43 | 0.26-7.74 | 0.504 |
| | 7+ | 1 | | |

**Bivariate analysis of ACT use in Kigoma**

Bivariate analysis of the factors associated with use of ACT in Kigoma showed no factor was significantly associated with the ACT use (P-value >0.05) as shown on the table 12 below.

Table 12: Bivariate analysis of ACT use in Kigoma by socio-demographic characteristics

| **Household characteristic** | **Category** | **O.R (crude)** | **95% C.I** | **P-value** |
|---|---|---|---|---|
| **Sex** | Male | 0.66 | 0.27-1.63 | 0.370 |
| | Female | 1 | | |
| **Age group** | ≤30 | 0.42 | 0.16-1.13 | 0.082 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 1.20 | 0.46-3.12 | 0.704 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 1.70 | 0.61-4.73 | 0.306 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 1.21 | 0.46-2.95 | 0.683 |
| | 7+ | 1 | | |

**4. To determine proportion of households had IRS in the last 12 months in Muleba**

Table 13 below shows the proportion of Households sprayed with IRS in the last 12 months in Muleba. The uptake of IRS among the households involved in the study was 98.5%.

Table 13: Proportion of households had IRS in Muleba by socio-demographic characteristics

| | **Muleba (n=203)** | **Percent (%) used IRS** |
|---|---|---|
| **Sex** | | |
| Male | 91 | 97.8 |
| Female | 112 | 99.1 |
| **Age group** | | |
| ≤30 | 34 | 94.1 |
| 31+ | 169 | 99.4 |
| **Level of education** | | |
| <Primary | 25 | 100.0 |
| Primary+ | 178 | 98.3 |
| **No. of <5s per HH** | | |
| <2 | 112 | 98.2 |
| 2+ | 91 | 98.9 |
| **Size of family** | | |
| ≤6 people per HH | 121 | 97.5 |
| 7+ | 82 | 100.0 |

**Bivariate analysis of uptake of IRS by socio-demographic characteristics in Muleba**

Among the factors studied, no factor was significantly associated with uptake of IRS in Muleba (i.e., p-value>0.05), see table 14.

Table 14: Bivariate analysis of IRS use in Muleba

| Household characteristic | Category | O.R (crude) | 95% C.I | P-value |
|---|---|---|---|---|
| **Sex** | Male | 0.40 | 0.04-4.49 | 0.422 |
| | Female | 1 | | |
| **Age group** | ≤30 | 0.10 | 0.00-1.40 | 0.073 |
| | 31+ | 1 | | |
| **Level of education** | <Primary | 0.2 | 0.46-3.12 | 0.763 |
| | Primary+ | 1 | | |
| **No. of <5s per HH** | <2 | 0.61 | 0.02-0.77 | 0.999 |
| | 2+ | 1 | | |
| **Size of family** | ≤6 people per HH | 0.000 | 0.00-3.31 | 0.274 |
| | 7+ | 1 | | |

# CHAPTER 5

## 5.0 DISCUSSION

The study found out that Muleba district five years after the Malaria epidemic still a high proportion (78.3%) of households used LLIN and also a very high proportion (98.5%) used IRS in their households. On the other hand in Kigoma a comparison district LLIN use was lower (59.9%) and there was no implementation of IRS. Consequently, malaria morbidity was high in Kigoma (59.9%) but much lower (12.3%) in Muleba. However, low malaria morbidity in Muleba notwithstanding, ACT use was high (76.8%) in Kigoma and lower (68.0) in Muleba district. Thus there was sustained use of malaria control interventions after the epidemic control evidenced by low prevalence of reported malaria

### 5.1 Uptake of LLINs

LLIN Ownership and use was high in Muleba which above the national targets five years after the epidemic probably because of the strategy used to scale out the intervention during the control of the epidemic. Epidemic control strategies where multi-sectoral and community-involved massive campaigns coupled with free distribution of LLINs was used. This not only raised the coverage but also helped to sustain use of LLIN in Muleba community. This gives an indication that when communities are involved and different sectors participate in the scaling out of malaria interventions, there is a high chance of raising coverage and use of the interventions.

The findings of high ownership and use of LLINs was higher in Muleba and low use in Kigoma are also supported by the DHS findings of national surveys in 2004/05 and 2007/08 (5, 34), which reported that ownership of mosquito nets in Kagera was higher than that in Kigoma. Similar post epidemic control findings were observed in other studies done in Ethiopia and Kenya (35, 36). Another study done in six different

countries in Africa by Carol, Baume and Celeste (37) also showed that LLINs use was higher in females than in males. Also a study done in Gambia by Aikins M.K et al (38) showed that LLINs use was higher in females than in males, and higher in older people than in young people.

Though in Muleba none of the independent variables was associated with use of LLIN due to the high coverage, in Kigoma the study found that the use of LLINs was high among those households with head whose education was high compared to those with low education (O.R= 0.24, CI 0.13-0.45, P-value<0.001) and also those coming from households with fewer people (i.e. <3 people per household) compared with many (O.R= 0.38, C.I=0.21-1.69, P-value= 0.001). This suggests that, higher level of education will increase the likelihood someone to receive health message, internalize it and then make a decision to own and use LLINs. On the other hand household with many people over stretches the family merger resources, leading to limited knowledge and capacity to the services.

However, it is very likely that during the campaigns to control the Malaria epidemic efforts was made to reach everyone in the community. Consequently, all people of different background were equally reached with information and services and hence it could be the reason that in Muleba none of the studied factors were related with ownership of LLINs despite the fact that the intervention had the same duration of implementation in both districts. The findings from this study suggests that while low education and large family sizes could take long to change, campaigns when well done and targeted could address the negative effects of such factors leading to better health outcome. This agrees with findings of a study done by Chukwuocha et al (39,40) that shows that educating community and consequent empowerment increases utilization of LLINs**.** Also as the size of family increases, it decreases the tendency of LLINs use. Also a study done in Gambia by Virginia W et al it was found that the high education of

the head of household has the more likelihood of using LLIN and the larger the family size the less the likelihood of using LLINs (41).

### 5.2 Uptake of Artemisinin based combination therapy (ACT)

This study found that ACT use among individuals with history of fever/malaria in the past 6 months in Kigoma was higher (76.8%) than in Muleba (68.0%), however this difference was not statistically significant (P-value >0.05). High use of ACT in Muleba could be due to high malaria morbidity in the past which prompted people to use ACT more than in Kigoma. Among the socio-demographic factors analyzed in this study sex, age, education, number of under-fives per household and size of family, no single factor was found to be statistically significant in affecting ACT use. This is probably due to the fact that the number of cases obtained in the study population was small (Muleba=25, Kigoma=108), and therefore no difference was detected. ACT use is health system intervention and the lack of differences reflects effectiveness of national intervention strategies to reach equally all health facilities and health facility decisions to implement. Therefore strategies used to distribute and promote ACT use in both districts are the same and therefore the difference in the uptake of the intervention between the two districts was not significant to be detected by this software. However studies done in different countries show different factors were associated with use of ACT as treatment for malaria which included knowledge on the symptoms of malaria, knowledge on the availability of antimalarial in the market correct use of the medicine (42). In another study done in Nigeria by Lindsay Mangham et al (43) showed that factors significantly associated with ACT use were patient's demand for ACT, patient's level of education, patient's gender and health service providers' knowledge on ACT. Another study assessing factors affecting type antimalarial drug used among individuals with malaria revealed that, age, size of the household, source of the drug and availability of the drug at the source work together to influence the type of antimalarial used by the patient (44).

### 5.3 Uptake of Indoor Residual Spray (IRS)

This study found that the uptake of IRS among the households involved in the study in Muleba was as high as 98.5%. This coverage was far high above the WHO recommended coverage (i.e. 80%) for the intervention to give its desired outcome (1). There was a small difference in the uptake of IRS between the two villages involved in the study. This high coverage can again be explained by the strategy used. Following the malaria epidemic in Muleba there was a massive epidemic control campaigns that involved different sectors and community as well. Through these multi-sectoral epidemic control campaigns the coverage of IRS was raised and sustained above recommended level. Households in Muleba were educated on IRS through well organized sensitization public and group meetings, fliers, posters and house-to-house visits. Consequently, IRS remained very high after Malaria outbreak interventions signifying that an infrastructure for IRS maintenance remained effective even after active control measures. With such a high coverage sustained five years later it could also be a reason for the very low malaria morbidity observed in Muleba hence justifying post-campaign efforts to sustain the gains.

### 5.4 Malaria prevalence and uptake of interventions

Following the malaria outbreak in 2006, malaria prevalence in Muleba was as high as 41.0% (5,11). This led to intense institution of malaria control interventions in Muleba by the government and partners which raised the coverage of LLIN to 91.6%, IRS use to 98.5% and ACT was also high. The interventions halted the epidemic with community focus to sustain and consolidate the control strategies. Five years later still there was a very high use of the interventions. As a result malaria morbidity remained significantly lower compared to neighboring Kigoma district that did not had an opportunity to implement multiple malaria control interventions.

This study also suggests that fielding multiple malaria interventions might bring better results in the reduction of malaria prevalence than the two interventions (LLINs and ACT) implemented alone. Similar findings were shown by studies done in different

countries assessing effectiveness of the triple malaria interventions (LLINs, ACT and IRS), which showed that malaria parasite prevalence among fever patients, decreased from 83.0% in 2004 to 0.7% in 2008, and prevalence in under-fives from 20.0% in 2006 to 11.0% in 2008 (45). Another study done in São Tomé and Príncipe by Pei-Wen Lee et al (46) showed that a steep decline of malaria morbidity and mortality was observed between 2004 and 2008 with use of combined control methods (LLINs, IRS and ACT), whereby malaria prevalence decreased to <1%. In Pemba (Tanzania) the combination of these three interventions could significantly reduce prevalence of malaria from 39.0% in 2005 to 1.4% in 2007 (47). This marked reduction in the prevalence of malaria is possibly due to either synergistic effect of IRS on LLINs and ACT use, or the added effect of IRS on LLINs and ACT use. A study done in Bioko in Equatorial Guinea by Pardo G et al (48) showed that the two interventions (IRS and LLINs) implemented together reduced malaria prevalence in children from 40.0% in 2004 to 21.7% in 2005.

# CHAPTER 6

## 6.0 CONCLUSION AND RECOMMENDATIONS

### 6.1 Conclusion

The study revealed that people in Muleba continued and sustained the use of LLIN and IRS compared to Kigoma, which was not exposed to the malaria control interventions. There was also very low reported malaria morbidity in Muleba compared to Kigoma suggesting a likelihood of averting malaria epidemic in the near future. The combination of three interventions (LLINs, ACT and IRS) in Muleba to control the epidemic was sustained and it might have contributed to the low malaria prevalence five years after the epidemic has been controlled.

Thus community based strategies to control malaria epidemic achieved reasonable sustainable community use of the interventions. This strategy can be adopted in other malaria endemic areas and exploit the benefits of the combined interventions.

### 6.2 Recommendations

Improved and sustained combined malaria control interventions using campaign strategies could improve outcomes of malaria control efforts. However there is also a need to find out the best campaign strategy to improve uptake and sustained use of the preventive interventions. Communities should be educated and regularly sensitized on the proper ways of malaria prevention for the maximum prevention effects to be achieved. More research is required to harness lessons emerging from control of epidemics to sustain positive community changes and consequently achieving sustainable disease control and hence achieve national goals for health and eventually the MDGs.

# CHAPTER 7

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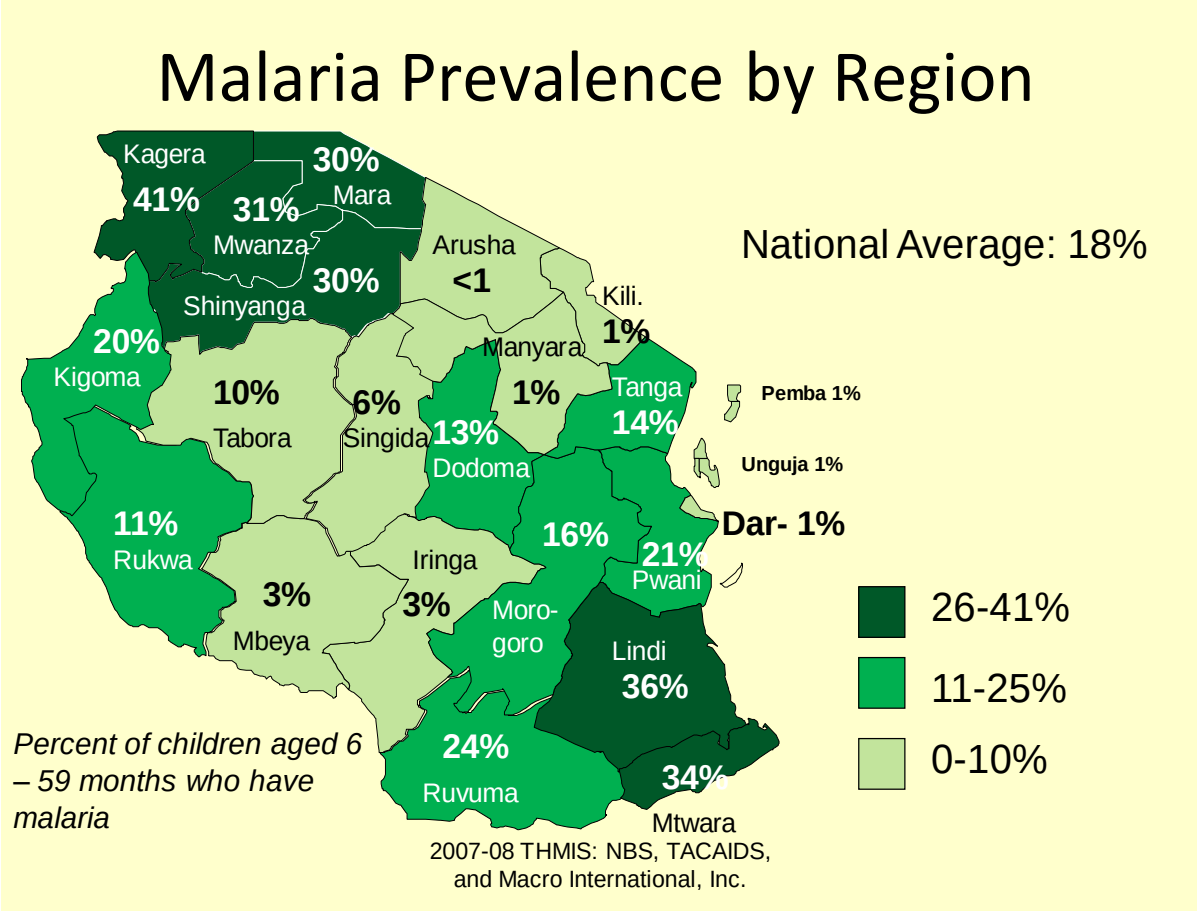
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**Appendix: 1**

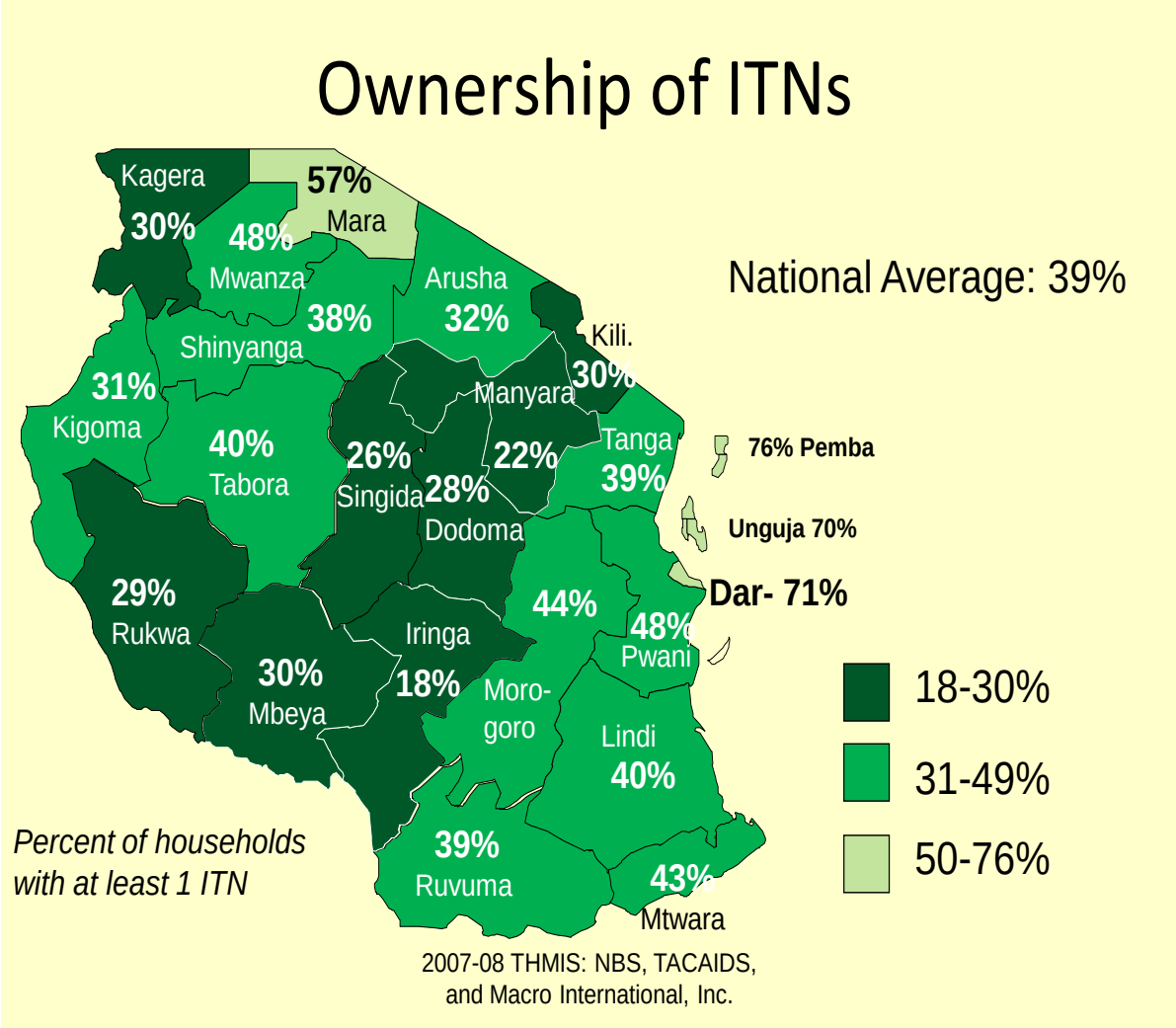
Fig.1. Map of Tanzania showing prevalence of malaria by region by 2008, THMIS 2007-08




(**Source: Tanzania HIV/Malaria Indicator Survey, 2007-08, NBS, TACAIDS, and Macro International, Inc**

**Appendix: 2**

**Fig.2. LLINs coverage by Region in Tanzania, 2008 (THMIS 2007-2008)**




**(Source: Tanzania HIV/Malaria Indicator Survey, 2007-08, NBS, TACAIDS, and Macro International, Inc).**

**Appendix : 3**

**QUESTIONNAIRE**

**Questionnaire No…….** **Date……**

1. Name of District……... 2. Name of village……

3. Name of interviewee. ……. 4. Sex (a) male (b) female

5. Age of interviewee…… 6. Number of people in the household…

7. Sex of the head of the household (a) Male (b) Female

8. Age of the head of the household. ……(yrs) 9. Number of children under five…

10. Level of education of the head of the household

(a) None (b) Primary drop out (c) Primary completed (d) Secondary education

(e) Higher education

11. Does your household have:

a) Electricity? (b) Paraffin lamp? (c) Radio? (d) Television?

(e) Telephone/mobile phone? (f) An iron (either charcoal or electricity)

(g) Refrigerator

12. Main material of the floor (*Just by observation*)

(a) Earth/sand (b) Palm/bamboo (c) Dung (d) Grass (e) Polished wood

(f)Cement (g) Ceramic tiles (h) Others, specify…….

13. Wall materials (*Just by observation*)

(a) Grass (b) Poles and mud (c) Sun dried bricks (d) Baked bricks (e) Timber

(f) Cement bricks (g) Stones (h) Others, specify……..

14. Roof materials (*Just by observation*)

(a) Grass/leaves/mud (b) Iron sheets (c) Tiles (d) Concrete (e) Asbestos

(f) Others, specify…….

15. What is the main source of drinking water for this household?

(a) Piped water (b) Water from open hand dug well (c) Water from covered well/bore hole

(d) River/stream (e) Lake/pond (f) rain water (g) Spring water

16. How long does it take you to go there, get water and come back on foot? .....

17. What kind of toilet facilities does your household have?

(a) Flush toilet (b) Pit toilet/latrine (c) Ventilated improved pit (VIP) latrine

(d) No facility/bush/open field (e) Others, specify ……..

18. Do you share this facility with other household? (a) Yes (b) No

19. Does your household have waste pit? (a) yes (b) No

20. Does your household have a rack for drying domestic utensils? (a) Yes (b) No

21. How long does it take you to reach the nearest functional road? …….

22. How long does it take you to reach the nearest health facility? ……...

23. How far is it to the nearest market? ……

24. How far is it to the nearest shop? …….

25. Do you have mosquito net (or is there any mosquito net for you)?

(a) Yes (b) No (c) I don't know

*If yes, Observe* (a) Present (b) Absent

*If No, go to question No.37*

26. How many mosquito nets are there in this household? .....

27. How many sleep under mosquito net? .....

28. How was/were the nets obtained?

(a) Bought from shop (b) Tanzania national voucher scheme program

(c) Free of charge, through immunization and reproductive and child health program

(d) Free of charge through other procedure

(e) Other methods, mention _____

(f) I don't know

29. Do you consistently sleep under mosquito net?

(a) Yes (b) No

30. Why? .....

31. How many people in your house consistently sleep under mosquito net?

……..

32. Does your mosquito net have a name?

(a) Yes (b) No (c) I don't know

*If the answer is No, go to question No.**33***

33. Mention the name of your mosquito net

(a) MmbuNet (b) OlysetNet (c) PermaNet (d) SafiNet (e) MOTEXNet (f) AfyaNet

(g) IcoNet (h) K-ONet (i) Zuia mbu (j) Others, mention_____

34. Did you sleep under mosquito net last night?

(a) Yes (b) No (c) I don't know

35. When did you get that mosquito net?

……. /…… (Month / year)

36. Did you ever treat that mosquito net with insecticides?

(a) Yes (b) No (c) I don't know

*If the answer is No, go to question No.**37***

37. When was that mosquito net treated with insecticide for the last time?

…… ./…….. **(**Month / year)

38. Do you think using mosquito nets/LLINs is important?

(a) Yes (b) No (c) I don't know

39. Why? ……

40. What are your opinions on the use of mosquito nets/LLINs?

…….

……..

…….

41. Is there anybody who has suffered from fever/malaria in this household in the last 6 months?

(a) Yes (b) No (c) I don't know

*If the answer is No, go to question No.**45***

42. How many? .....

43. How many were underfives?.....

44. Were they tested for malaria?

(a) Yes (b) No

45. If yes, what were the results?

(a) Malaria positive (b) Malaria negative (c) I don't know

46. Do you have a history of fever in the past 6 months?

(a) Yes (b) No (c) I don't know

*If No, go to question No. **51***

47. If yes, what are/were the other symptoms of this disease? *Don't read this list*

(a) Fever/ high temperature/cold/ shivering

(b) Headache (c) generalized body pain

(d) Dizziness (e) diarrhoea

(f) Vomiting (g) cough

(h) Fast breathing (i) loss of consciousness

(j) Convulsions/seizures

(k) Others, mention…….

(l) I don't know

48. Did you get any treatment or medicines for this disease?

(a) Yes (b) No (c) I don't know

*If the answer is No, go to question No.**51***

49. Where did you get that treatment?

(a) At home/neighbour/relative

(b) At hospital

(c) At health centre or dispensary

(d) At medical store

(e) At ADDO

(f) Local doctor

(g) Normal shop/ market

(h) Traditional healer

(i) At private laboratory

(j) Other service provider

(k) herbs

50. Please mention the name of medicine you used for this disease

**(**a) ALu (b) Quinine (c) SP/fansidar/oroder (d) Chloroquine (e) metakelfin

(f) amodiaquine (g) herbs (h) I don't know (i) others, mention…….

51. Have you ever used ACT for treatment of malaria in the past 6 months?

(a) Yes (b) No **(c)** I don't remember

52. Do you think using ACT is helpful for treatment of malaria?

(a) Yes (b) No (c) I don't know

53. Why? ……

54. What are your opinions on this medicine (ACT)?

……

***(QNs 55-66 for Muleba Only)***

55. Is the house you are living ever been sprayed with IRS?

(a) Yes (b) No (c) I don't know

*If No, go to question No. 39*

56. If yes, who did that IRS to your home?

…….

57.When was it last sprayed?

(a) Last 6 months (b) last 12 months (c) I don't know

58. How many cycles/frequencies of spraying have been done?

(a) 1 (b) 2 (c) 3 (d) 4

59. Were you educated on the IRS before it was done?

(a) Yes (b) No

60. Were you sensitized before IRS was done?

(a) Yes (b) No (c) I don't know

61. Which media were used for sensitization?

(a) Moving cars with loud speakers (b) Meetings (c) Posters (d) Radio

(e) Television (f) House to house (g) I don't know

(h) Others, mention …….

……..

62. Do you know the name of the IRS sprayed to the house you are living?

(a) Yes (b) No

63. If yes, please mention the name of that insecticide

(a) DDT (b) Pyrethroid (c) ICON (d) Chlorpyrifos

64. What are your opinions on the IRS ?

……

…….

…….

……

65. Other than IRS and LLINs have you ever used any method for malaria control?

(a) Yes (b) No (c) I don't know

66. If yes, mention that method

……

**Appendix: 4**

**DODOSO**

Namba ya dodoso…….  Tarehe…….

1. Jina la Wilaya……...  2.Jina la kijiji……

3. Jina la mhojiwa…….  4. Jinsia (a) me  (b) ke

5. Umri wa mhojiwa……  6. Idadi ya watu katika kaya……

7. Jinsia ya Mkuu wa kaya (a) Me (b) Ke  8.Umri wa mkuu wa kaya…….

9. Idadi ya watoto umri chini ya miaka 5……

10. Kiwango cha elimu cha Mkuu wa kaya

(a) Hakusoma kabisa (b) Hakumaliza elimu ya msingi (c) Amemaliza elimu ya msingi (d) Elimu ya Sekondari (e) Elimu ya juu

11. Je nyumba yako ina:

(a) Umeme? (b) Taa ya mafuta? (c) Redio? (d) Luninga/TV?

(e) Simu/simu ya mkononi? (f) Pasi (ya mkaa/umeme) (g) Jokofu?

12. Sakafu imetengenezwa kwa (angalia tu, kisha ujaze):

(a) udongo/mchanga (b) Majani ya mchikichi/Mwanzi (c) kinyesi cha ngombe (d)Majani (e) Mbao (f) Sementi (g) Marumaru (h) Vingine, taja….

13. Kuta zimetengenezwa kwa (angalia tu, kisha ujaze)

(a) Majani/nyasi (b) Miti na tope (c) Tofali zilizokaushwa juani (d) Tofali za kuchoma (e ) Mbao (f) Tofali za sementi (g) Mawe (h) vingine, taja……

14. Dari imetengenezwa kwa (angalia tu, kisha ujaze)

(a) Majani/udongo (b) Mabati (c) Vigae (d) Zege

(e )Mabati ya saruji/asbesto (f) Vingine, taja…….

15. Kipi chanzo kikuu cha maji ya kunywa kwa ajili ya kaya hii?

(a) Maji ya bomba (b) Kisima cha wazi kilichochimbwa kwa mkono

(c) Kisima kilichochimbwa kwa mashine kilichofunikwa (d) Mto/mfereji

(e) Ziwa/bwawa (f) Maji ya mvua (g) Chemchem

16. Inakuchukua muda kiasi gani kwenda kuchota maji na kurudi kwa miguu?.....

17. Kaya yenu ina choo cha aina gani?

(a) Choo cha maji/cha kuvuta (b) Choo cha shimo (c) Choo cha shimo kilichoboreshwa/cha kisasa (d) Hakuna choo/tunajisaidia vichakani/porini (e ) Vingine, taja…..

18. Je mnachangia choo na kaya nyingine? (a) Ndiyo (b) Hapana

19. Je kaya yenu ina shimo la taka? (a) Ndiyo (b) Hapana

20. Je kaya yenu ina kichanja cha kukaushia vyombo? (a) Ndiyo (b) Hapana

21. Inakuchukua muda kiasi gani kuifika barabara iliyo karibu inayotumika?.....

22. Inakuchukua muda kiasi kufika kituo cha huduma za afya kilicho karibu?.....

23. Pana umbali kiasi gani kulifikia soko la karibu?.....

24. Pana umbali kiasi gani kulifikia duka la karibu?.....

25. Je una chandarua (au chandarua kipo kwa ajili ya matumizi yako) ?

(a) ndiyo (b) hapana (c) sijui

*Kama jibu hapana, nenda swali namba 38*

26. Mna vyandarua vingapi katika kaya yenu? .....

27. Wangapi wanalala katika chandarua? ……..

28. Chandarua/vyandarua vyenu vilipatikana vipi?

(a) kilinunuliwa dukani (b) mpango wa hati punguzo

(c) bure, katika mpango wa chanjo na afya ya uzazi na mtoto

(d) bure kwa utaratibu mwingine

(e) njia nyingine, taja _____ (f) Sijui

29.Je unalala kwenye chandarua kila siku?

(a) Ndio (b) Hapana

30. Kwa nini? ……

31. Watu wangapi katika kaya yako wanalala kwenye chandarua kila siku? ……

32. Je chandarua chako kina jina?

(a) ndio (b) hapana (c) sijui

*Kama jibu ni hapana, nenda swali namba 34*

33. Taja jina la chandarua chako

(a) MmbuNet (b) OlysetNet (c) PermaNet (d) SafiNet (e) MOTEXNet (f) AfyaNet

(g) IcoNet (h) K-ONet (i) Zuia mbu (j) Nyingine, taja_____

34. Je usiku wa jana ulilala kwenye chandarua?

(a) ndiyo (b) hapana (c) sijui

35. Je chandarua hicho ulikipata lini?

……. /……( mwezi / mwaka)

36. Je umewahi kukiweka dawa chandarua hicho?

(a) ndiyo (b) hapana (c) sijui

*Kama jibu ni hapana, nenda swali namba 38*

37. Chandarua hicho kiliwekwa dawa kwa mara ya mwisho lini?

……./……..( mwezi / mwaka)

38.Je unafikiri kutumia chandarua chenye dawa ni muhimu?

(a) Ndiyo (b) Hapana (c ) Sijui

39. Kwa nini?.....

40. Nini Maoni yako juu ya matumizi ya chandarua chenye dawa?.....

41. Je kuna mtu yeyote aliyeugua homa/malaria ndani ya miezi 6 iliyopita?

(a) ndiyo (b) hapana (c) sijui

*Kama jibu ni hapana, nenda swali namba 46*

42. Kama jibu ndiyo, wangapi? …….

43. Wangapi walikuwa watoto chini ya miaka 5? …….

44. Je, walipimwa malaria? (a)Ndio (b) hapana

45. kama ndio, majibu yalikuwaje?

(a) Ana malaria (b) hana malaria (c) Sijui

46. Je umewahi kupata homa ndani ya miezi 6 iliyopita?

(a) Ndio (b) hapana (c) Sijui

*Kama jibu ni hapana, nenda swali namba 51*

47. Kama ndio, dalili gani nyingine ulikuwa nazo wakati wa homa hiyo? (*usiisome orodha)*

(a) homa/ joto kali(kuchemka)/ baridi/ kutetemeka

(b) kuumwa kichwa (c) maumivu ya mwili

(d) kizunguzungu (e) kuharisha

(f) kutapika (g) kikohozi

(h) kupumua harakaharaka (i) kupoteza fahamu

(j) degedege/ shtuka-shtuka

(k) nyingine / taja …….

(l) Sijui

48. Je ulipata matibabu yoyote au dawa zozote kwa ugonjwa huu?

(a) ndiyo (b) hapana (c) Sijui

*Kama jibu ni hapana nenda swali namba 51*

49. Je matibabu ulipata wapi?

(a) Nyumbani/jirani au jamaa

(b) Hospitali

(c) Kituo cha afya au Zahanati

(d) Duka la dawa baridi

(e) Duka la dawa muhimu

(f) Mganga wa mitaani

(g) Duka la kawaida, kioski, genge

(h) Mganga wa kienyeji

(i) Maabara ya binafsi

(j) Mtoa huduma mwengine

(k) Dawa za miti shamba

50. Ninaomba unitajie majina ya dawa ulizotumia (mtoto alizotumia) kwa ajili ya ugonjwa huu

(a) ALu (b) Quinine (c) SP/fansidar/oroder (d) Chloroquine (e) metakelfin

(f) amodiaquine (g) miti shamba (h) Sijui (i) nyingine/taja…….

51. Umewahi kutumia dawa mseto (Alu) kwa ajili ya malaria ndani ya miezi 6 iliyopita?

(a) Ndio (b) hapana (c) Sikumbuki

52. Je unafikiri dawa mseto zinasaidia katika kutibu malaria?

(a) Ndiyo (b) Hapana (c) Sijui

53. Kwa nini?.....

54. Nini maoni yako juu ya hii dawa?

……

***(swali la 55-66 ni kwa ajili ya Muleba tu)***

55. Je nyumba unayoishi imeshawahi kupuliziwa dawa ya ukoka ya kuua mbu?

(b) Ndiyo (b) Hapana (c) sijui

*Kama jibu ni hapana, nenda swali namba 59.*

56. Kama ndiyo, ni nani aliyepulizia dawa hiyo katika nyumba yako?

…….

57. Kwa mara ya mwisho ilipuliziwa lini?

(a) Miezi sita iliyopita (b) Miezi 12 iliyopita (c) sijui

58. Imepuliziwa mara ngapi (mizunguko mingapi)?

(a) 1 (b) 2 (c) 3 (d) 4

59. Je mlielimishwa juu ya zoezi la upuliziaji wa dawa ya ukoka ya kuua mbu majumbani kabla ya zoezi lenyewe halijafanyika?

(a) Ndio (b) hapana (c) Sijui

60. Je mlihamasishwa juu ya zoezi hilo la upuliziaji dawa ya ukoka kabla zoezi lenyewe kufanyika?

(a) Ndio (b) Hapana (c) Sijui

61. Njia gani za uhamasishaji zilitumika?

(a) Magari yalizunguka na vipaza sauti (b) Mikutano (c) Mabango (d) Redio

(e) Luninga/TV (f) Uhamasishaji wa kupita nyumba hadi nyumba (g) Sijui

(h) Njia nyingine, taja ……..

62. Je unafahamu jina la hiyo dawa iliyopuliziwa katika nyumba unayoishi?

(a) Ndiyo (b) hapana

63. Kama ndiyo naomba nitajie jina la hiyo dawa

(a) DDT (b) Pyrethroid (c) ICON (d) Chlorpyrifos

64. Nini maoni yako juu ya dawa ya ukoka ya kuua mbu inayopuliziwa majumbani?

……

……

……

65. Mbali na dawa ya ukoka ya kuua mbu inayopuliziwa majumbani na chandarua, umewahi kutumia njia nyingine yoyote kwa ajili ya kudhibiti malaria?

(a) Ndio (b) Hapana (c) Sijui

66. Kama jibu ni ndio, taja njia hiyo.....

…….

**Appendix: 5**

**MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES (MUHAS)**

**DIRECTORATE OF RESEARCH AND PUBLICATION**

INFORMED CONSET FORM

ID-NO _____

**Consent to participate in this study**

Greetings,

My name is …… I am working on this research project with the objective of assessing Post-outbreak malaria morbidity and uptake of interventions in Muleba compared to Kigoma District 2010.

**Purpose of the study**

This study has the purpose of collecting information on malaria interventions in Muleba that will enable determination of malaria interventions coverage and its related morbidity in the district as well as exploration of programme factors that affect malaria intervention services. You are requested to participate in this study because you have particular knowledge and experiences that may be important to the study.

**What participation involved**

If you agree to participate in this study, you will be required to answer series of questions that have been prepared for the study through interviewing in order to obtain the intended information.

**Confidentiality**

I assure you that all the information collected from you will be kept confidentially. Only people working in this research will have access to the information. We will be compiling a report, which will contain responses from participants without any reference to any individual. We will not put your name or other identifying information on the records of the information you provide.

**Risks**

You will be asked questions about factors that are associated with malaria morbidity and uptake of malaria interventions. Some questions could potentially make you feel uncomfortable. You may refuse to answer any particular question and stop the interview at any time. We do not expect any harm to happen to you because of participation in this study

**Right to withdraw and alternatives**

Taking part in this study is completely your choice. If you choose not to participate in the study or if you decide to stop participating in the study you will not get any harm. 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**

The information you provide will help to increase our understanding on current malaria morbidity and uptake of malaria interventions in Muleba/Kigoma district. The report of this study will be shared with Muleba/Kigoma District Authority and to policy makers at the national level for improvement of malaria treatment and control programmes in the district.

**In case of injury**

We do not anticipate that any harm will occur to you or your family as a result of participation in this study

**Who to contact**

If you ever have questions about this study, please, contact the study coordinator or the

Principal Investigator; **DR. AMIRI Y. JUYA**, Muhimbili University of Health and Allied Science (MUHAS), P. O. Box 65001, Dar es Salaam, (Tel: 0784384899 or 0712686364). If you have questions about your rights as a participant and need further clarification you may call **Dr. Said Aboud**, MUHAS P.O. Box 65001 Dar es Salaam.Tel:2150302-6, Dr. Innocent Semali (0754269838) and Dr. Mohamed A. Mohamed (0787292393) who are supervisors of this study.

**Signature**

Do you agree?

Participant agrees……. Participant does not agree……

I ……. have read the content in this form, my questions have been answered; I voluntarily agree to participate in this study.

Signature of Participant…….…….

Signature of Research Assistant…….

Date of signed consent……..

**Appendix: 6**

**Swahili version**

**CHUO KIKUU CHA AFYA NA SAYANSI YA TIBA CHA MUHIMBILI KURUGENZI YA UTAFITI NA UCHAPISHAJI**

FOMU YA RIDHAA

ID-NO _____

**Ridhaa ya kushiriki**

Habari? Ninaitwa……...……. Ninafanya kazi ya kutafiti juu ya kiwango cha malaria baada ya mlipuko wa malaria Muleba na matumizi ya njia za kujikinga na malaria Muleba ikilinganishwa na Wilaya ya Kigoma vijijini 2010.

**Madhumuni ya utafiti**

Utafiti huu unalenga kukusanya taarifa juu ya matukio na huduma zinazohusu malaria katika wilaya ya Muleba/Kigoma rural amabazo zitawezesha kuapata kiwango cha huduma za kudhibiti malaria kilichofikiwa katika wilaya pamoja na kuainisha kiwango cha upatikanaji wa huduma hizo pamoja na kiwango cha malaria na sababu za ki-mfumo zianazoathiri huduma za malaria. Unaombwa kushiriki kwenye utafiti huu kwa sababu unao ujuzi ama unafahamu matukio ambayo ni muhimu kwa utafiti huu.

**Nini kinahitajika ili kushiriki**

Ili kushiriki katika utafiti huu inabidi kukubali na kujiunga kwa kujibu maswali toka kwenye dodoso wa kwa ajili ya utafiti huu ili kupata taarifa iliyokusudiwa.

**Usiri**

Ninakuhakikishia kuwa taarifa zitakazokusanywa kutoka kwako zitakuwa siri na hakuna mtu yeyote ambaye hafanyikazi kwenye utafiti huu atakayeambiwa ulichosema. Itaandaliwa taarifa ya utafiti huu ambayo haitamtaja mshiriki yeyote. Jina lako na wala utambulisho mwingine wowote hautawekwa kwenye taarifa unazozitoa.

**Hatari**

Katika utafiti huu utaulizwa maswali ambayo inawezekana yakakufanya usijikie vizuri. Una hiari ya kujibu au kutojibu maswali hayo. Hakuna hatari yeyote itakayotokea kwako kutokana na ushiriki wako kwenye utafiti huu

**Haki ya kujitoa au vinginevyo**

Ushiriki katika utafiti huu ni hiari, aidha unaweza kuamua kutoendelea kushiriki wakati utafiti unaendelea. Kutokushiriki au kujitoa kutoka kwenye utafiti hakutakuwa na adhabu yoyote na hutapoteza stahili zako endapo utaona ni vema kufanya hivyo.

**Faida**

Kama utakubali kushiriki kwenye utafiti huu utakuwa umetusaidia kwa vile utafiti huu una lengo la kuchunguza kiwango cha malaria cha sasa na matumizi ya njia za kujikinga na malaria hapa Muleba/Kigoma. Matekeo ya utafiti huu yataisaidia Halmashauri ya Wilaya ya Muleba/Kigoma pamoja na watunga sera katika ngazi ya Taifa katika kuboresha huduma za malaria.

**Endapo utapata madhara au la**

Hatutegemei kuwa utapata madhara yoyote kutokana na ushiriki wako katika utafiti huu.

**Nani wa kuwasiliana naye**

Kama kuna swali kuhusiana na utafiti huu unaombwa kuwasiliana na mtafiti mkuu, **DR. AMIRI Y, JUYA** , wa Chuo Kikuu cha Afya na Sayansi ya Tiba Muhimbili, S.L.P. 65001 DSM, simu: 0784384899 or 0712686364 . Kama una maswali zaidi unaweza kuwasiliana na **Dr. Said Aboud**, Chuo Kikuu cha Muhimbili**,** simu:022 2150302-6, au Dr. Innocent Semali (0754269838) na Dr. Mohamed A. Mohamed (0787292393) ambao ni wa simamizi wa utafiti huu.

Je, unakubali?

Mshiriki anakubali……..... Mshiriki hakubali…….....

Mimi……...nimesoma maelezo ya fomu hii, maswali yangu yamejibiwa na nimeridhika. Nakubali kushiriki katika utafiti huu.

Sahihi ya Mshiriki……

Sahihi ya mtafiti msaidizi……

Tarehe ya kutia sahihi ya kushiriki…….....