FACTORS ASSOCIATED WITH CONTINUED TRANSMISSION OF MALARIA IN GEITA DISTRICT, TANZANIA

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FACTORS ASSOCIATED WITH CONTINUED TRANSMISSION OF MALARIA IN GEITA DISTRICT, TANZANIA

By

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A Dissertation Submitted in (Partial) Fulfilment of the Requirements for the Degree of Master of Science in Parasitology and Medical Entomology of Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled "***Factors associated with continued transmission of malaria in Geita district, Tanzania*",** in (partial) fulfilment of the requirements for the degree of Master of Science (Parasitology and Medical Entomology) of Muhimbili University of Health and Allied Sciences

_____

Dr. Marycelina Mubi

(Supervisor)

Date: _____

DECLARATION AND COPYRIGHT

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

Signature _____ Date _____

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DEDICATION

This dissertation is dedicated firstly to my lovely wife Pendo Enock Mihayo and Secondly to my daughters Tizila, Perpetua, Hope and my son Mahega J.Makelemo.

ABSTRACT

Background: Malaria is still a public health problem in Tanzania causing morbidity and mortality among the population, especially the underfives and pregnant women who are the most at risk group. Through the introduction and scale-up of key malaria interventions, significant progress has been made in the fight against malaria in Tanzania. Data from the 2011/12 THMIS showed a nationwide decline of malaria prevalence from 18% to 9%, equivalent to 50% decline. However, in some districts like Geita, the prevalence remains high at 32%. The factors associated with persistence of high prevalence have not been explored.

Objective: This study examined the current prevalence of malaria among underfive children and the factors associated with persistence of high prevalence in Geita district.

Methodology: A qualitative cross-sectional study of 182 household and 351 underfive children was carried out in two wards of Geita District in August 2015. Finger prick blood samples from underfives were examined using malaria rapid diagnostic tests to establish the current prevalence of malaria. Questionnaire interview were conducted with heads of households to obtain information on factors such as knowledge, attitudes and practices affecting use of insecticide treated nets and indoor residual spraying. Also, a survey for observation and identification of potential breeding sites associated with malaria transmission was carried out.

Results: Overall prevalence of malaria among underfive was 18.2 %, while for the two wards of Kalangalala and Mtakuja it was 4.9% and 32.5% respectively. Knowledge about insecticide treated nets was high, at 49.5 % and low about indoor residual spraying 11%. The level of insecticide treated nets ownership was 57.1 %, while indoor residual spraying acceptance was 76.4%. Among the household interviewed, 93.4 % of respondents said children were out door at night with their mothers while preparing meals.

Conclusion: The overall prevalence of malaria among underfive in Geita district has declined from 32% to 18%, although it is still high when compared to the overall nationwide malaria prevalence of 9%. Area of residence, nocturnal outdoor behaviour and presence of productive anopheline mosquito larva habitats contribute to continued malaria transmission. Effective control and intervention measures together with strong health education campaigns, as well as promotion of behaviour change will bring impact in reducing malaria transmission.

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ACRONYMS/ABBREVIATIONS

ACT: Artemisinin-based Combination Therapy

AIDS: Acquired Immune Deficiency Syndrome

API: Annual parasite index

CDC: Centre for Disease Control

DDT: Dichloro-diphenyl-trichloromethane

EIR: Entomologic inoculation rate

GHI: Global Health Initiative

GGM: Geita Gold Mine

GMP: Global Malaria Program

HEAT: Health Education and Training

HIV: Human Immunodeficiency Virus

IPTp: Intermittent Preventive Treatment of malaria in pregnancy

IRS: Indoor Residual Spray

ITN: Insecticide Treated Nets

KAP: Knowledge Attitude and Practice

LLIN: Long Lasting Insecticidal Nets

MIS: Malaria Indicator Survey

MoHSW: Ministry of Health and Social Welfare

MPAC: Malaria Policy Advisory Committee

NBS: National Bereau of Statistics

NMCF: National Malaria Control Forum

NMCP: National Malaria Control Program

PMI: President's Malaria Initiative

RBM: Roll Back Malaria

mRDT: Malaria Rapid Diagnostic Test

TDHS: Tanzania Demographic Health Survey

THMIS: Tanzania HIV/AIDS and Malaria Indicator Survey

TVCSP: Tanzania Vector Control Scale-up Project

WHO: World Health Organization

WHOPES: WHO Pesticide Evaluation Scheme

DEFINITION OF KEY TERMINOLOGIES

Malaria is a mosquito-borne infectious disease of humans caused by parasitic protozoans belonging to the genus Plasmodium that is transmitted to humans by the Anopheles mosquito Malaria causes symptoms that typically include fever, fatigue, vomiting and headaches. In severe cases it can cause yellow skin, seizures, coma or death.

Artemisinin-based Combination Therapy (ACT): is a treatment for uncomplicated falciparum malaria that combines several antimalarial drugs, one of which is a derivative of artemisinin. The most common artemisinin derivatives used in ACTs are artesunate and artemether. The drugs commonly used in combination with the artemisinin derivative include mefloquine, lumefantrine, and amodiaquine**.**

Insecticidal treated net: is a mosquito net that repels disables and/or kills mosquitoes coming into contact with insecticide on the netting material.

Indoor residual spray: it is an application of long-acting chemical insecticides on the walls and roofs of all houses and domestic animal shelters in a given area, in order to kill the adult vector mosquitoes that land and rest on these surfaces

Long lasting insecticidal net: is a mosquito net treated in the factory with an insecticide incorporated into the net fabric which makes the insecticide last at least 20 washes in standard laboratory testing and three years of recommended use under field conditions.

CHAPTER ONE

1. INTRODUCTION

1.1.1 Biology of malaria

Malaria is a tropical disease caused by a protozoan parasite of the genus *Plasmodium* of which there are four species namely: *P. falciparum, P. malariae, P. vivax* and *P. ovale* (Cook et al 2009). Recently a fifth species, *Plasmodium knowlesi* that affect monkeys has been found to naturally infect humans (Cox-singh et al. 2008). Malaria parasites are transmitted by the blood sucking female *Anopheles* mosquitoes. Two main species are responsible for malaria transmission Africa namely *Anopheles gambiae complex* in the rainy season (Nkwengulila et al. 2010)and *Anopheles funestus* in the dry season (Kamwi et al. 2012)

1.1.2 Global malaria situation

In developing countries, malaria still causes high morbidity and mortality. Malaria is an entirely preventable and treatable mosquito-borne illness. Despite recent declines in malaria transmission, largely due to increased distribution of long-lasting insecticide-treated nets (LLINs) and a switch to artemisinin-based combination therapy (ACT) drugs, sub-Saharan Africa still suffers greatly from the disease, where an estimated 90% of all malaria deaths occur, of whom the under five children account for 78% of all deaths (WHO, 2014).

Between 2000 and 2012, the scale-up of interventions namely Insecticide-treated mosquito nets (ITNs) and Indoor residual spraying (IRS) helped to reduce malaria incidence rates by 25% globally, and by 31% in the WHO African Region. The scale-up of malaria interventions also saved an estimated 3.3 million lives, 90% or 3 million of these are in the under-five age group in sub-Saharan Africa (WHO, 2013).

1.1.2 Malaria situation in Tanzania

On the Mainland, 93% of the population lives in areas where malaria is transmitted, while the entire population of Zanzibar is prone to malaria infection. Unstable seasonal malaria transmission occurs in approximately 20% of the country, while stable malaria with seasonal variation occurs in another 20%. The remaining malaria endemic areas in Tanzania (60%) are characterized as stable perennial transmission. *Plasmodium falciparum*

accounts for 96% of malaria infection in Tanzania, with the remaining 4% being due to *P. malariae* and *P. ovale* (PMI, 2014).

The 2011–2012 Tanzania HIV/AIDS Malaria Indicator Survey (THMIS) showed that 9% of Mainland children under five had tested positive for malaria, down from 18% in 2008-2009. Prevalence varied by region from <1% in the highlands of Arusha to 26% along the Lake Victoria shores and 0.2% in Zanzibar. On the Mainland, more than 40% of all outpatient attendance is attributable to malaria, resulting in an estimated 10 -12 million clinical malaria cases annually**.**

In Tanzania, malaria accounts for over 30% of the National disease burden and is the leading cause of morbidity and mortality especially among under five children. The National Malaria Control Programme (NMCP) estimated that 60,000-80,000 malaria deaths occur annually in the Mainland among all age groups.(National Bureau of Statistics (NBS) [Tanzania], 2012)

Malaria control interventions have been implemented and recently intensified as an effort to attain the World Health assembly, Roll Back Malaria, and Millennium Development Universal targets with the aim of reducing and interrupt disease transmission in Sub-Saharan Africa. Tanzania was announced as a President's Malaria Initiative (PMI) country in June 2005, and PMI has collaborated with the Tanzania National Malaria Control Programme (NMCP) on a number of interventions aimed at controlling malaria. ITNs have been distributed since 2005 and a universal coverage campaign of LLIN was completed in 2011. There has been a greater than 50% reduction in malaria admissions to health centres and hospitals between 2000 and 2010, which coincides with the scaling-up of malaria control activities.

The government of United Republic of Tanzania through the Ministry of Health and Social Welfare (MoH&SW) initiated IRS intervention program funded by the PMI in 2007 in two epidemic prone districts of Kagera region i.e Muleba and Karagwe, Northwest Tanzania. A report of 2007/08 THMIS showed a striking difference in malaria prevalence among

regions in mainland Tanzania. The prevalence of malaria among under-fives was high in the following regions in the Lake Zone: Kagera (41.1%), Mwanza of which Geita was one of its districts (31.4%), Mara (30%) and Shinyanga (29.5%). Since 2009, the IRS programme has been extended to include 18 districts around Lake Victoria (West et al. 2013).

Due to high malaria prevalence in Geita district, implementation of ITN's distribution and IRS were started between 2008 and 2009 to control malaria. In 2010, an estimated 201,893 clinical malaria cases were reported in Geita District. Approximately 37% of all hospital outpatient cases in Geita District were attributed to malaria, resulting in 9,539 admissions and 350 deaths among those admitted per year, most of them children under five years of age. Most of the indoor residual spraying (IRS) operations took place in rural areas where malaria is abundant. However, two wards, one urban and the other peri-urban, Kalangalala and Mtakuja, were also included in the second cycle of the U.S. Agency for International Development's (USAID's) Tanzania Vector Control Scale-up Project (TVCSP). This round of IRS in Geita District was a collaborative public-private partnership (USAID-TVCSP, 2012)**.**

Another Malaria survey that was conducted in 2011/12 revealed a lowered malaria prevalence in some regions such as Kagera (8.3%) and Shinyanga (6.8%), slightly lowered in Mara (25%) and Mwanza excluding Geita district (19%) (National Bureau of Statistics (NBS) [Tanzania], 2012). However despite of all those efforts, the prevalence of malaria was still high in Geita district. According to Malaria Indicator Survey of 2011- 2012, the prevalence of malaria among under-fives in Geita was 32% by Rapid Diagnostic Tests (RDT) (National Bureau of Statistics (NBS) [Tanzania], 2012)

1.2 Problem statement

Despite the availability of basic malaria control tools, and success achieved by the different intervention that resulted into a decline in malaria prevalence in other regions in Tanzania mainland; Geita still recorded high malaria prevalence rate (32%) in 2011. It has not been clear why the prevalence of malaria has persistently remained high in Geita district.

To date there is no published reports identifying factors associated with continued malaria transmission in Geita district. Therefore there was a need to update the current status of malaria in the district and identify factors associated with malaria transmission after the intensification of ITN and IRS interventions. Hence, this study was an attempt to fill the gap by determining the current prevalence of malaria among underfives and exploring factors associated with its malaria transmission in Geita district.

1.3 Conceptual Framework

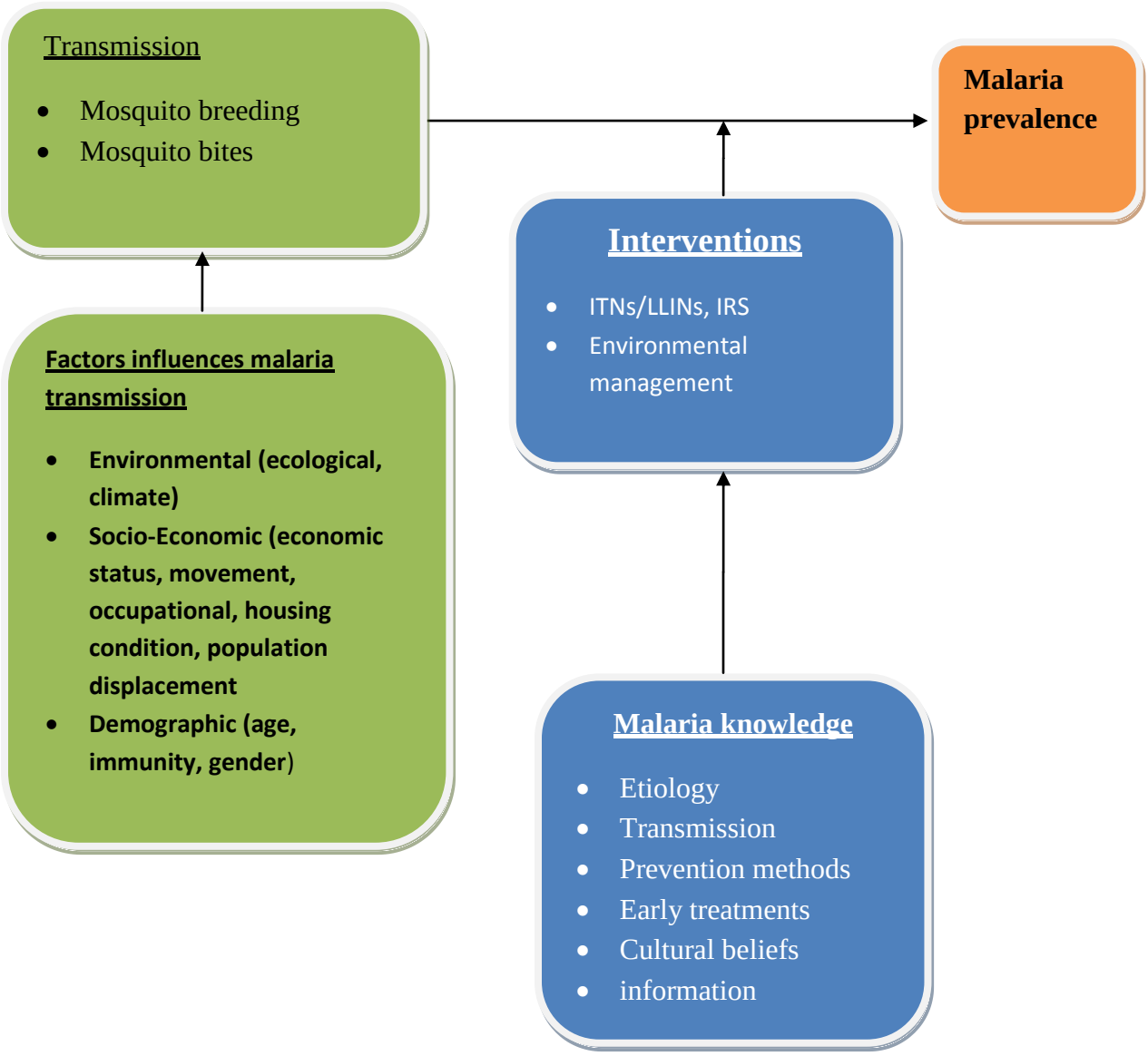


Fig. 1: Adopted from: //www.xpowerpoint.com/Monitoring-and-Evaluation-Frameworks--PPT. html with few modifications.

1.4 Research question

i. What is current prevalence of malaria among underfive children in Geita district?
ii. What are the factors associated with persistent high prevalence of malaria in Geita district?

1.5 Objectives

1.5.1 Broad Objective

To determine the prevalence of malaria among underfives and factors associated with its transmission in Geita district.

1.5.2 Specific objectives

i. To determine the prevalence of malaria among underfive children in Geita district.
ii. To assess knowledge, attitudes and practices of the community members related to ITNs interventions in Geita district.
iii. To assess knowledge, attitudes and practices of the community members related to IRS interventions in Geita district.
iv. To determine the social demographic and livelihood factors associated with malaria transmission in Geita district.
v. To identify potential breeding sites associated with malaria transmission in the area.

1.6 Rationale of the study

Between 2000 and 2012, the scale-up of interventions helped to reduce malaria rates by 25% globally and by 31% in the WHO African Region (WHO 2013). A lot of funds had been used to execute different interventions with the aim of minimizing the problem of malaria. In Tanzania, an integrated malaria intervention was carried out using IPTs, ACTs, ITNs and IRS that resulted with successful outcome by decline of malaria prevalence among children age 6 – 59 months from 18% in a year 2008 to 9% the year 2011 (National Bureau of Statistics (NBS) [Tanzania], 2012) however this decline was not observed in Geita district. This study sought to determine whether there was been a change in the prevalence of malaria after an intensified intervention with ITNs and IRS in the area, and identify factors associated with continued high prevalence of malaria. Findings from this study will inform the Geita district council and other stakeholders on the current prevalence of malaria and the way forward in malaria control program in the district.

CHAPTER TWO

1 LITERATURE REVIEW

2.1 Malaria interventions measures

2.1.1 Malaria vector control

The member states at the World Health Assembly and Roll Back Malaria Partnership established a goal to reduce the number of malaria cases and deaths recorded in 2000 by 50% or more by the end of 2010 and 75% or more by 2015 (WHO 2009). It was recommended that malaria control interventions be intensified, the main strategies being protection of all people at risk with ITNs and IRS; early laboratory diagnosis, treatment with effective antimalarial drugs and intermittent preventive treatment (IPTp) for pregnant woman (WHO, 2009).

In order to ensure that there is substantial reduction of morbidity and mortality attributable to malaria, in 2013 the malaria Policy Advisory Committee came with more emphasis on malaria elimination, recommending intensification of vector control interventions whereby all persons at risk should be protected by ITNs or IRS that have demonstrated impact in reducing malaria, appropriate early diagnosis and prompt treatment with ACTs and preventive therapy to vulnerable groups (WHO**,** 2013). To meet the target of universal access to ITNs, WHO recommended that LLIN be distributed for every two people at risk of malaria and spraying of ≥ 80% houses or structures in targeted area for any round of spraying.

2.2 Global Perspective on ITNs Vs IRS intervention

In an effort to accelerate malaria transmission reduction, many countries particularly in sub-Saharan Africa have adopted the combination of IRS and ITNs as prevention measures to control the vectors, hence interrupt disease transmission, reducing the malaria disease burden (WHO, 2013).

In the year 2006, WHO recommended IRS as major means of vector control to reduce and eliminate malaria transmission. Currently, the Pest Evaluation Scheme (WHOPES) recommends 12 insecticide compounds and formulations, belonging to four chemical

classes for deployment in indoor spraying program namely: organochlorines, pyrethroids, organophosphates and Carbamates (WHO, 2006). An insecticide for IRS should be selected for a given area on the basis of community acceptance, data on insecticide resistance, the residual efficacy of the insecticide, type of surface to be sprayed, safety and cost (WHO, 2013).

However, a single strategy may not be effective in reducing malaria incidence, therefore, WHO recommended in addition to IRS the use of ITNs and treatment with effective drugs. Evidence has shown that when ITNs coverage rates are high and are effectively used, malaria incidence is reduced. It has been shown that if ITNs are used by the total population, they are able to lower transmission by 90%, malaria incidence by 50% and all cause child mortality by 18 % (Global Malaria Programme, 2006).

In the Americas' Suriname, a 90% decrease in the number of cases was noted after enough ITNs were distributed to cover 78% of the population at risk apart from IRS that was implemented selectively in targeted areas. While in Ecuador, a reduction of 96% confirmed malaria cases was noted and IRS had been the principal vector control method unlike ITNs in Suriname (WHO, 2011) .

The use of ITNs and IRS in combination has been shown to be highly effective and cost effective methods for malaria vector control in sub-Saharan Africa (Yukich et al,2008). A study done in Rachuonyo District, Kenya, found that the use of both ITNs and IRS reduced malaria infections by 62% and by 67% among those 6 months to 4 years, the most vulnerable compared with use of ITNs alone. IRS also reduced the numbers of anopheline mosquitoes. These data suggested that by using both interventions, people living in areas that receive the interventions benefit considerably (Hamel et al. 2011)

2.3 IRS and Vector Control

Vector control is an essential approach of malaria prevention. Such control has been proven to successfully interrupt malaria transmission when coverage is high, with ≥ 80% of houses or structures in a community sprayed. Indoor residual spraying had for a long time been used in malaria control mainly with Dichlorodiphenyl- trichloromethane (DDT). A study

done in East Shoa Zone of Ethiopia to determine the usefullness of IRS on the incidence of malaria, revealed that IRS with DDT was effective in reducing malaria incidence in that particular epidemic area (Hamusse et al, 2012). The initial effort of malaria eradication programme with IRS concentrated in some countries that included Asia, Latin America, Southern Africa, Europe, former USSR, and countries in Asia and the Carribean. However, the major part of the Afriaca continent was not involved (WHO, 2006).

Following effectivenes of DDT insecticide, in the year 2006, WHO encouraged many counties globally to use the chemical to control the malaria transmission; in response to that out of 108 malaria burdened countries 44 reported to adopt the IRS method of which 12 countries used the recommended DDT insecticide (Kim et al, 2012).

Indoor residual spraying (IRS) of houses, the second major vector control tool after ITN continued to be scaled up; and the proportion of the population protected by IRS increased substantially in the African Region during 2006–2008. The increased coverage was maintained during 2009–2011, at 10%–12% of the population at risk and contributed to the decrease in this disease (Kleinschmidt et al. 2009; WHO, 2013).

2.4 Factors associated with malaria transmission:

Despite recent encouraging efforts to reduce malaria transmission largely through increased distribution of ITNs, use of artemisinin-based combination therapy (ACT) drugs, together with IRS; sub-Saharan Africa still suffers greatly from the disease. According to WHO estimates, in 2013, of the 584,000 deaths attributed to malaria worldwide, 90% occurred in Africa (WHO, 2014). A variety of factors may contribute to this including, social economic status, poor housing quality, nocturnal outdoor activities that expose individual to mosquito bites (Chirebvu et al., 2014) , availability of water pools as potential vector breeding sites (Clennon et al, 2010) and environmental factors.

2.4.1 Environmental factors

Climate and environmental conditions greatly affect the transmission and incidence of malaria, by influencing primarily the abundance and survival of vectors and parasites, and also exposure of humans and other hosts. A study done in Sudan on the effects of climate change on the distribution and spread of malaria revealed that increasing temperatures are estimated to progressively extend the distribution of malaria (Rasha & Elshayeb, 2012).

Heavy rainfall also encourages vector species to multiply; hence malaria transmission is often highest following the rainy season. It was observed that in Sub-Saharan Africa, *Plasmodium falciparum* is predominantly transmitted by *Anopheles gambiae*, and transmission tends to be high in the rainy season. This was observed in a study conducted by West and colleague in Northern Tanzania where the overall prevalence *P. falciparum* was high (21%) in the long rainy season and low (15%) in the short rainy season (West et al. 2013).

2.4.2 Socio-economic factors

Factors that affect malaria transmission, but which are not related to the climate, are called non-climatic factors. The environmental development and urbanization, population movement and migration, the level of immunity to malaria in the human hosts, all have a role in affecting the severity and incidence of malaria.

Malaria transmission is influenced by variations in factors, which impact the biology of the parasite and its vector, together with socio-economic conditions, such as levels of urbanization, poverty, education and human activities which impact human vulnerability and vector habitat (Lowe et al. 2013).

A study conducted in norhern Ghana observing for outdoor-sleeping and other night-time activities reveals that despite targeted IRS over a six-year period and free mass distri-bution of ITNs, malaria rates remained high due to continued exposure to infective mosquito bites influenced by a lot of outdoor activities that took place in the evening that involved all ages. The observed activities included dancing, eating, playing, socializing within the

compound and small bussiness activities whereby infants and young children were also outdoors on their mothers backs (Monroe et al. 2015).

2.5 Knowledge Levels and the use of Indoor Residual Spraying

Vector control by use of IRS is one of the key method recommended by WHO to be used for malaria control. Following this recommendation, Globally, community knowledge and perceptions in relation to house spraying have been found to be important for the IRS programme to be successful (Global Malaria Programme, 2006).

A Study conducted in Soroti district, eastern Uganda; revealed inadequate knowledge about IRS and this had an influence on community perception toward IRS programme, whereby in rural and less educated individuals it resulted into negative attitude towards the spraying exercise, as they feared about health problems that might arise, such as carcinoma (Ediau et al, 2013).

In another study on the assessment of the level of knowledge, attitude and practices of the community towards malaria prevention and control options done in Amhara National Regional State, Ethiopia; it was revealed that a very low proportion of partcipants was knowdgeable about malaria intervention by use of IRS, and this had an influence on attitudes toward the spraying exercise, as very low proportions of the participants accepted IRS (Aderaw et al, 2013).

However, a study conducted in Geita district, northern Tanzania to assess community knowledge, attitudes, and practices related to malaria intervention revealed high knowledge about IRS. In that study, most of the respodents stated clearly the reason that made them willing to accept the chemical spraying practice that was to kill mosquitoes. Sush level of knowledge and attitude has an advantage for implementing effective IRS program(Mazigo et al, 2010).

2.6 Knowledge Levels on malaria and disease prevention

Globally, an estimated half of the world population are at risk of malaria and on top of that, knowledge, attitude and practice of the community about malaria disease transmission and prevention is low, and this is due to existence of misconception about the disease transmission and prevention measures (Aderaw et al., 2013).

A study conducted in Rufiji, a rural district in southern, Coast region of Tanzania assessing knowle- dge and preventive actions against malaria, showed a gap between knowledge and preventive actions among the respodents. Many inhabitants in Rufiji have sufficient knowledge to avoid malaria and access treatment in appropriate facilities, however, they opt not to use this knowledge. An explanation for this mismatch might be that information on the consequences of malaria may not have had much impact on the population in rural Rufiji (Spjeldnæs et al. 2014)**.** Also a study done in North West Tanzania indicated that only 6% of the respondents have mentioned *Plasmodium* organisms as a cause of malaria (Mazigo et al, 2010). Poor knowledge of the community about the disease and its transmission may lead to resistance in accepting and using malaria control interventions

CHAPTER THREE

3. METHODOLOGY

3.1. Description of the Study Area

This study was conducted in Geita district which is located in the Geita Region of Tanzania. The District is bordered to the southeast by Shinyanga Region, to the North and East by Mwanza region, to the Northwest by Kagera Region, to the South by Bukombe District and to the Southwest by Chato District. Being a mining area, there is high influx of people from neighbouring districts coming for mining business and other social activities. The District lies at an altitude of between 1100 and 1300 m above sea level. The topography of the district is characterized by the hilly areas in the north and west and with a gentle slope towards the south and southeast. The area experiences bimodal rainfall seasons in a year with short rains (Vuli) between November and December, and long rains (Masika) between February and May. The mean annual minimum and maximum temperature for the area lies between 14ºC and 30ºC. For administrative purposes the municipality has 35 wards with urban, peri-urban and rural wards. Kalangalala and Mtakuja wards were study areas that are located within urban and peri-urban areas respectively. The main economic activities in Geita District are farming, livestock keeping, trading, fishing and mining (large scale and small scale miners (artisans).

3.2. Study Design

This was a qualitative cross-sectional study of 182 household and 351 underfive children that was carried out in two wards of Geita District in August 2015.

3.3. Study Population

The survey was conducted at household level and involved the head of household and children under five years of age. A household was defined as a person with his/her spouse, unmarried children and related or unrelated persons, who live together and constitute one unit. The head of the household or another adult were interviewed using a well constructed questionnaire to answer the objectives of this study. Blood samples were also taken from children under five years of age to check for malaria parasites using mRDT and microscopy. During household visits, there was an observation of physical structures and

breeding sites nearby residential. Each ward within the study area was searched for open water bodies. To locate areas of potential breeding sites, the search was led by municipal malaria experts with a good knowledge of the area.

3.4. Study Unit

The unit of study included individuals in households selected randomly in chosen streets and villages in Kalangalala and Mtakuja wards.

3.5. Eligibility (Study participants)

Inclusion criteria:

- Children 6-59 months old found within the selected households, whose parents/ guardians agreed for them to participate in the study.
- Heads of the selected households or in the absence of head, another adult member 18 years of age and above in the selected household was eligible for the study.

Exclusion criteria:

Persons who were not around during previous IRS application and any individuals who were not willing to participate in the study were excluded from the study

3.6. Sample Size

The minimum sample size for the prevalence survey was obtained from the single population proportion formula.

Formula:

$$n = \frac{Z^2 p\,(1-p)}{\varepsilon^2}$$

Where,

n = required sample size

Z= confidence level at 95% (standard value of 1.96)

p = estimated prevalence of malaria in Geita region which was 32% according to 2011/2012 malaria survey (NBS, 2012)

ε = margin of error at 5% (standard value of 0.05)

Hence, $n = \frac{1.96^2 \times 0.32\ (1-0.32)}{(0.05)^2}$

n = 334

Adding 5% of non-response (17), therefore the calculated sample size for the prevalence survey was 351.

3.7. Sampling Techniques

In this study, purposive and cluster sampling technique was employed to select households to be included in the study. Geita was purposively selected since it is one of high malaria prevalence district in the country, the two wards were also purposely selected, one urban and the other peri-urban since they were the first wards to participate in the initial rounds of IRS project in the district. In each ward 5 streets and villages were respectively surveyed. The total number of streets/villages and household was obtained at wards offices. Cluster sampling at ward level (urban and peri-urban) was employed to select study streets and villages. Then a simple random sampling technique using a table of random numbers was used to determine households to be visited on each street and village/sub-villages from the list of households. Research assistants with medical background were recruited and oriented in the study; these were two nurse assistants and two medical laboratory technicians /assistants. The nurse assistant was responsible for managing the questionnaires and request informed consent from participants in the study. The laboratory technicians were responsible for blood sample collection, staining and reading blood smear microscopically. The principle investigator read and interpreted mRDT results.

3.8. Data collection procedures

3.8.1.Questionnaire interview

A structured and pre-tested questionnaire was developed and administered by interview. The questions sought to gain insight into a respondent's knowledge, attitude and practices towards malaria intervention. It also covered demographic characteristics of respondents and Social economic and human activities and was administered to all eligible participants. The interview was conducted in Swahili language.

The questionnaire was divided into 5 major areas that included:

Demographics — had 11 questions that covered a wide range of social demographic areas.

Basic knowledge about Malaria—had 5 questions that related to different aspects of malaria. They ranged from sources of basic information and disease awareness, causative agent, transmission, signs and symptoms of malaria.

Knowledge, Attitudes and practice about ITN intervention on Malaria—had a combination of 17 positive and negative statements that used to measure the knowledge, attitude and practice of respondents towards different aspects of malaria intervention by use of ITN.

Knowledge, Attitudes and practice about IRS intervention on Malaria—had 9 questions that related to different aspects of malaria intervention by IRS application. They ranged from program awareness, sources of basic information about insecticide spraying, insecticide employed, part of structure to be sprayed, frequency of spraying, practice, acceptance and reasons for not accepting IRS.

Social economics and human activities—had 5 probing questions related to nocturnal outdoor human behaviour

3.8.2. Parasitological Examination.

Presence of malaria parasites among underfive year's children was ascertained during this study by using SD BIOLINE Malaria Ag *P.f*/Pan malaria rapid diagnostic test (mRDT). SD BIOLINE Malaria Ag P.f/Pan test is a rapid, qualitative and differential test for the detection of histidine-rich protein II (HRP-II) antigen of *Plasmodium falciparum* and common *Plasmodium* lactate dehydrogenase (pLDH) of *Plasmodium* species in human whole blood. It distinguishes the infection between *P. falciparum* and other *Plasmodium* species and has a sensitivity of 99.7% for *P.f*, 95.5% for non-*P.f*, and a specificity of 99.5% (Standard Diagnostics Inc., 2013).

Specimen collection and testing

Consent to draw blood from the children was obtained from their parents/guardian. All test devices were labelled properly using a pencil and registered in registration book. Disposable gloves were worn and a new pair of gloves was used for each children. The

fourth finger (the ring finger) was sterilized using cotton swab soaked in 70% ethanol, left to dry, then pricked with sterile lancet. The drop of blood was touched by using a capillary tube and 12µL of blood was collected.

The test was performed according to manufacturer's instructions. Briefly, the procedure was as follows: Blood drawn by inverted capillary pipette was dispensed into the round sample well (marked "S ") on mRDT device placed on flat surface. Then 4 drops of assay diluent was dispensed into the square well marked "B" and results read in sufficient light after twenty (20) minutes lapse.

Malaria parasites produce proteins called antigens in the red blood cell surface. These antigens from infected persons are the ones that are detected using immune chromatographic methods such as mRDT. Test principle of mRDT is based on antigens present in blood. The antigens react with antibodies on the test device and produce microscopic particles that stick to a band on the mRDT device eventually forming a visible, coloured line in the test area and the person will test positive. When malaria antigens are not present there will be no visible line in the test area and the person will test negative. Negative result for mRDT was indicated by one pink strip on the control window, while positive result was indicated by two pink strips on control window and test window. The invalid result was indicated by absence of a line in the control window, irrespective of whether or not a line be present in the test window.

3.8.3. Quality Control

Microscopy quality control was conducted whereby thick blood smears were prepared from each child. The smears were labelled with initials of children name, date, month and year of the specimen collection, then thin smear was fixed, air dried and both thin and thick smear stained with Giemsa stain at Geita district hospital after the survey. Microscopy examination was done after completion of field work by experienced laboratory technician in Geita. A second reading was carried out by highly experienced technician at MUHAS parasitology laboratory and then results were compared. Both technicians were blinded to the mRDT results.

The questionnaire was translated into Swahili language and pre-tested to check if the questions were easily understood and logically sequentially arranged and to know average time taken to interview one participant. The researcher checked the questionnaires at the end of each day for completeness and accuracy before analysis.

3.8.4. Identification of breeding sites

To identify mosquito breeding sites, each ward within the study area was searched for open water bodies. Two wards were involved in the study namely: Mtakuja (sub-urban area) with two villages: Mbabane and Mpomvu and Kalangalala (urban area) with Shilabela and 14 Kambarage streets which were visited to locate areas of potential mosquito breeding sites (i.e. fresh open water pools). The search was guided by the District malaria experts accompanied by VEO (Village Executive Officer) and Street Executive Officers with a good knowledge of the areas in respective villages and streets. All open bodies of water or possible water collection places were taken as potential breeding site. Observation was done to detect presence of anopheline larva in the following potential breeding places: river edges with permanent still and clean water, swamps, sand mining water pools, rice fields, small temporary rain pools (puddles), man-made brick making holes, open channel alongside the roads, tractor tracks and open drainage systems.

The presence of larvae was determined by dipping. From every potential breeding site up to 5 dips were taken with a standard white 350 ml dipper and sample stored in a clean large container. Larva was examined morphologically to establish whether they were anopheles larva or not.

3.9. Study Variables

Dependent Variables

Malaria parasite results

Independent Variables

Age, Gender, level of knowledge, acceptance of IRS, ITNs utilization, Residence, Employment, outdoor night time activities and presence of anopheline mosquito larva.

3.10 Data Management and Analysis

The collected data from the study areas was coded and entered in Microsoft excel spreadsheet. Statistical analysis was performed using the SPSS version 17 (SPSS Inc., 2007). Descriptive statistics was carried out to measure percentages, averages, and relative frequencies of the variables. The differences between groups for categorical variables were analysed by chi-square tests. Regression analysis (Bivariate logistic regression) was performed to assess the association and relationship between independent and dependent variables. A P-value of <0.05 at 95% Confidence interval was considered statistically significant. The results are presented into tables. Observation and identification of potential breeding sites associated with malaria transmission was done.

3.11 Ethical Consideration

Ethical clearance was obtained from the Institution Review Board (IRB) of Muhimbili University of Health and Allied Sciences before commencing the study. Then permission was requested from the District Executive Director (DED) through District Medical Officer to allow the Principal Investigator to conduct this study in their wards and households. Written informed consent to participate was requested from each respondent before the questionnaire was administered. Parents/guardians filled the written informed consent form on behalf of their children. During data collection procedures, children diagnosed with malaria were referred to the nearest health facility for appropriate treatment. Prior arrangement was done and the head of the health facility accepted the malaria report and provided treatment accordingly.

CHAPTER FOUR

4.0RESULTS

4.1.Socio-demographic characteristics of participants

A total of 182 heads of households were recruited and interviewed from the two wards of Kalangalala and Mtakuja in Geita District. The median age of the respondents was 28 years (interquartile range 22-34). About half (54.9%) were in age group 18-28 years, while 12.1% were found in the age group ≥ 40 years. The majority of respondents were female (86.3%). Most of the participants had primary education (67%), while 15.4 % had never been to school. The main occupation was farming, being the predominant activity in Mtakuja, while at Kalangalala small scale business was also common. Table 1 summarizes the socio-demographic characteristics of respondents in selected households in the two wards.

Table 1: Social demographic characteristics of respondents (heads of households) in Geita districts

	Kalangalala n=107		**Mtakuja n=75**		**Total N=182**	
	frequency	%	Frequency	%	frequency	%
Sex						
Male	17	15.9	8	10.7	25	13.7
Female	90	84.1	67	89.3	157	86.3
Age						
18 – 28	64	59.8	36	48.0	100	54.9
29 – 39	29	27.1	31	41.3	60	33.0
≥ 40	14	13.1	8	10.7	22	12.1
Education level						
No formal education	14	13.1	14	18.7	28	15.4
Primary education	64	59.8	58	77.3	122	67
Secondary and above	29	27.1	3	4.0	32	17.5
Occupation						
Unemployed	5	4.7	0	0	5	2.7
Farmers/peasants	40	37.4	67	89.3	107	58.8
Housewife	25	23.4	0	0	25	13.7
Small scale business	33	30.8	4	5.3	37	20.3
Public service	4	3.7	4	5.3	8	4.4
Marital status						
Married	94	87.9	69	92	163	89.6
Single/Separated /divorced/widowed	13	12.2	6	8	19	10.4
No of children aged 6 -59 months						
One	59	55.1	27	31.4	86	47.3
Two	34	31.8	16	21.3	50	27.5
Three	8	7.5	19	25.3	27	14.8
Four	1	0,9	7	9.3	8	4.4
Five	5	4.7	5	6.7	10	5.5
Six	0	0	1	1.3	1	0.5

A total of 351 underfives were recruited in the study. The proportion of children from the two wards was 51.9% and 48.1% for Kalangalala and Mtakuja wards respectively. There were 161 males (45.9%) and 190 (54.1%) females. The mean age of the children was 32.8 months; however there was not much difference in the number of children across the different age groups. Table 2 shows more details of social demographic status of children.

Table 2: Socio-demographic characteristics of underfive children in Geita district

	Wards					
	Kalangalala n=182		**Mtakuja n=169**		**Total N=351**	
Characteristics	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Sex						
Male	83	45.6	78	46.2	161	45.9
Female	99	54.4	91	53.8	190	54.1
Age (months)						
6-12	39	21.4	32	18.9	71	20.2
13-24	45	24.7	32	18.9	77	21.9
25-36	38	20.9	37	21.9	75	21.4
37-48	27	14.8	26	15.4	53	15.1
49-59	33	18.1	42	24.9	75	21.4
Overall	**182**	**51.9**	**169**	**48.1**	**351**	**100**

4.2. The prevalence of malaria parasites among the under-fives children in Geita district

A total of 351 children from the two wards were tested for parasitemia during the survey using a rapid diagnostic test (mRDT) and blood smear microscopy. The overall prevalence of malaria among the underfives was 18.2% (64/351) by RDT. The prevalence of malaria by ward was 4.9 % for Kalangalala and 32.5% for Mtakuja. The difference in prevalence of malaria between these two wards was statistically significant (P-value = 0.001). The association between the prevalence of malaria and the age groups was statistically significant (P value = 0.003). The prevalence was increasing with increasing age. The

overall prevalence of malaria by microscopy was 15.9% (56/351). Table 3 shows the details on the prevalence of malaria among underfives in the wards.

Table 3: Prevalence of Malaria among the under-fives by social demographic Characteristics (N=351)

Characteristic	Positive (%)	Negative (%)	Total (%)	p-value
Wards				
Kalangalala	9 (4.9)	173 (95.1)	182	
Mtakuja	55 (32.5)	114 (67.5)	169	**0.001**
Sex				
Male	34 (20.9)	129 (79.1)	163	
Female	30 (16.0)	158 (84.0)	188	**0.147**
Age (Months)				
0 – 12	6 (8.6)	64 (91. 4)	70	
13-24	12 (15.0)	68 (85.0)	80	
25-36	15 (20.3)	59 (79.7)	74	**0.003**
37-48	11 (21.2)	41 (78.8)	52	
49-59	20 (26.7)	55 (73.3)	75	
Overall	64 (18.2)	287 (81.8)	351	

4.3 The coverage of ITNs and IRS in the population

The coverage of ITN and IRS in the study area is summarised in table 4.

Table 4: ITN ownership and IRS acceptance

Coverage of ITNs /IRS	Kalangalala Frequency	n= 107 %	Mtakuja Frequency	n=75 %	Total Frequency	N=182 %
Have you ever head of ITN						
Yes	106	99.1	72	96.0	178	97.8
No	1	**0.9**	3	4.0	4	2.2
How many ITNs do you have in the household?						
One	34	31.8	18	24.0	52	28.6
Two	23	21.5	15	20.0	38	20.8
Three and above	13	12.1	1	1.3	14	7.7
Have you ever head of IRS						
Yes	100	93.5	73	98.6	174	95.6
No	7	6.5	1	1.4	8	4.4
Did you accept your house to be sprayed						
Yes	72	67.3	67	89.3	139	76.4
No	35	32.7	8	10.7	43	23.6

The proportion of respondents who said their households owned ITNs was 57.1%, while 42.9% did not have them**.** Net ownership was highest in Kalangalala than Mtakuja, at 64.5% and 45.3% respectively**.** Among those who owned ITNs, 50% possess one, 36.5% possess two and 13.5% possess three or more ITNs. IRS acceptance was also assessed

during the household survey, the overall acceptance of IRS application being higher in Mtakuja (89.3%) than Kalangalala (67.3%).

4.4. Knowledge of the community members on ITN and IRS

4.4.1 Knowledge of household respondents on ITN.

The respondents were asked questions on basic information about ITNs. The results are presented in the table 5 below.

Table 5: Respondents' knowledge level about ITN interventions

Level	Frequency	%
Low	17	9.3
Median	75	41.2
High	90	49.5

About half of the respondents, 90 (49.5%) had high knowledge level about ITN interventions as they stated correctly the usefulness of children sleeping under treated nets that "it protects from mosquito bites".

4.4.2 Knowledge of household respondents on IRS.

The respondents were asked about the basic information about IRS. The level of knowledge of respondents about IRS intervention is presented in the table 6 below.

Table 6: Respondents' knowledge level about IRS interventions

Level	Frequency	%
Low	147	80.8
Median	15	8.2
High	20	11.0

Knowledge level about insecticide employed during IRS was low among respondents. More than 80% did not know and remember the correct insecticide employed during spraying, and only 11.0% had high knowledge as they were able to correctly mention the chemical used, that is ICON and correctly mentioned the exact part of the house sprayed, which is the surface of internal walls.

4.5 Attitude of the Community Members towards ITN and IRS Interventions

4.5.1 General Attitude of Respondents' Toward ITNs

All the household respondents were asked attitude related questions. The results are summarised in table 7.

Table 7: Respondents' attitudes towards ITNs

Attitude	Frequency	%
Positive	145	79.7
Negative	37	20.3

Majority of respondents had positive attitude toward ITN interventions on malaria, while a few of them

(20.3%) had negative attitude toward its usage, as they thought that sleeping under the ITN may cause negative effects on health, which included skin rash, suffocation and sweating.

4.5.2 General Attitude of Respondents about IRS

Household respondents were asked a range of attitude related questions including whether or not their houses were sprayed. Among respondents who did not accept spraying, 32.6% had negative attitude toward IRS application and the main reasons given were, it smells bad. The results are presented in table 8.

Table 8: Respondents' attitude toward IRS: N=43

Attitude	Frequency	%
Positive	29	67.4
Negative	14	32.6

4.6 The practices of the respondents related to ITN and IRS

4.6.1 Practice of the community members about ITN intervention

Respondents who owned ITNs were asked questions in relation to source of ITN, use and other practices executed as part of ITN intervention on malaria transmission. Results are presented in table 9 below.

Table 9 Respondents practices in relation to ITN intervention

	Kalangalala n=70		Mtakuja n=34		Total N=104	
Variable / Response	**Number**	**%**	**Number**	**%**	**Number**	**%**
Do you sleep under ITN?						
Yes	64	91.4	32	94.1	96	92.3
No	6	8.6	2	5.9	8	7.7
When do you normally sleep under the ITN?						
Every day at night when I go to bed	65	92.9	31	91.2	96	92.3
When fallen sick	0	0	2	5.9	2	1.9
During rainy season	5	7.1	1	2.9	6	5.8
Did you use it last night?						
Yes	65	92.8	31	91.2	96	92.3
No	5	7.1	3	8.8	8	7.7
Frequency of ITN washing						
No wash at all	2	2.9	1	2.9	3	2.9
Once per month	39	55.7	21	61.8	60	57.7
4 times per month	24	34.3	6	17.6	30	28.8
After three month	4	5.7	6	17.6	10	9.6
After six months	1	1.4	0	0	1	1

The majority (92.3%) of respondents said they use the nets every day, including the night before the survey. These proportions were more or less the same for the two wards. More than half of ITN users (57.7%) reported to frequently wash their treated nets that in three years net lifetime will be more than 20 times.

4.6.1 Practice of the community members about IRS intervention

Respondents who allowed their houses to be sprayed were asked questions about the actions they executed before, during and after the spray exercise. The responses to these questions are as shown in table 10.

Table 10: The practices of the respondents related to IRS

Practice	Kalangalala n=72		Mtakuja n=67		Total n=139	
	Frequency	%	Frequency	%	Frequency	%
What were roles of household heads toward IRS:						
Asking people to vacate from the house prior to spraying						
Yes	71	98.6	67	100	138	99.3
No	1	1.4	0	0	1	0.7
To ensure people stay out of the house during and after spraying(for at least 2 hours)						
Yes	68	94.4	66	98.5	134	96.4
No	4	5.6	1	1.5	5	3.6
To provide spray team with clean water for mixing chemicals						
Yes	59	81.9	60	89.5	119	85.6
No	13	18.1	7	10.5	20	14.4

Among respondents who allowed their houses to be sprayed, the majority carried out some desirable preparatory, supportive, precautionary actions related to IRS campaign.

For pre-spray preparatory practices, 99.3% said they asked and enabled people (including children) to vacate the house prior to spraying. The practices that were not named among the key practices by respondents but performed were removing some of the household items from the house prior to spraying Majority of the respondents (85.6%) gave support to the spraying team by providing them with clean water for mixing chemicals. Most of the respondents (96.4%) also practiced precaution by ensuring people stay out of the house during and after spraying for at least 2 hrs.

4.7 Social economic and human activities

All the household respondents were asked a range of questions related to social economic and human activities associated with malaria transmission. The questions asked and responses to them are as summarised in table 11.

Table 11: Social economic and human activities (N=182)

	Kalangalala		Mtakuja		Total	
Variable	**Frequency**	**%**	**Frequency**	**%**	**Frequency**	**%**
Family member at bed	**n=107**		**n=75**		**N=182**	
At 8:00 PM	22	20.6	23	30.7	45	24.7
At 9:00 PM and beyond hours	85	79.4	52	69.3	137	75.3
Outdoor activities at night						
Selling local brews	2	1.9	3	4.0	5	2.8
Food vending	9	8.4	4	5.3	13	7.1
Drinking and socializing at outdoor bars	9	8.4	6	8.0	15	8.2
Trading in small shops and kiosks	38	35.5	7	9.3	45	24.7
***** Other business	49	45.8	55	73.3	104	57.1
Children outdoor at night						
Yes	102	95.3	68	90.7	170	93.4
No	5	4.7	7	9.3	12	6.6
Why are children outdoor at night?	**n=102**		**n=68**		**N=170**	
Playing and socializing on their own	6	5.9	5	7.3	11	6.4
Accompanied their mothers while cooking and when working in small shops and kiosks	82	80.4	16	23.5	98	57.6
Accompanied by their siblings when talking with friends	14	13.7	47	69.1	61	36

*****Other business reported in this study included: Attending mourning gathering, small scale commercial business e.g. operating hair dressing saloons, selling vegetables, motorcycle driving and charcoal preparation, transportation and its selling.

The study revealed that some human behaviour and social economic activities that may influence malaria transmission are prevalent in the area. As shown in the table, the majority of respondents reported to go to bed at 9pm or later (75.3%), and the proportion of those going to bed late was higher in Kalangalala (79.4) than Mtakuja (69.3%). The main night time outdoor activities reported were trading in small shops and kiosks, selling local brew, vending food, drinking and socializing. Moreover, the majority of respondents (93.4%) also reported that children were also outdoors at night, accompanying their mothers while cooking or when working in small shops and kiosks. This outdoor nocturnal behaviour exposed them to mosquito bites and hence continued malaria transmission.

4.8 Factors associated with continued malaria transmission in Geita District

Several household level factors were associated with malaria transmission in Geita district. Results of bivariate analysis of presence of malaria by household characteristics are shown in Table 12.

Table 12: Factors associated with persistent malaria prevalence in Geita district

	Malaria Presence											
	Kalangalala N=107					Mtakuja N=75						
Characteristic	**Positive**		**Negative**		**Total**	**Positive**		**Negative**		**Total**	**Chi-square**	**P-value**
	n	**%**	**n**	**%**		**n**	**%**	**n**	**%**			
Age of household head												
18 - 28	5	7.8	59	92.2	64	15	41.1	21	58.3	36		
29- 39	2	6.9	27	93.1	29	19	61.3	12	38.7	31	6.119	0.047
≥ 40	0	0	14	100	14	3	37.5	5	62.5	8		
Sex (gender)												
Male	2	11.8	15	88.2	17	6	75.0	2	25.0	8		
Female	5	5.6	85	94.4	90	31	46.3	36	53.7	67	0.968	0.325
Marital status												
Single /Divorced /Separated/widowed	1	7.7	12	92.3	13	3	50.0	3	50.0	6		
Married	6	6.4	88	93.6	94	34	49.3	35	50.7	69	0.113	0737
Education of household head												
No formal education	0	0	14	100	14	6	42.9	8	57.1	14		
Primary education	5	7.8	59	92.2	64	29	50.0	29	50.0	58	3.403	0.182
Secondary education and above	2	6.9	27	93.1	29	2	66.7	1	33.3	3		
Occupation												
Unemployed	1	20.0	4	80.0	5	0	0	0	0	0		
Peasant	2	5.0	38	95.0	40	33	49.3	34	50.7	67		
Housewife	0	0	25	100	25	0	0	0	0	0		
Small scale business	4	12.1	29	87.9	33	2	50.0	2	50.0	100	13.552	0.009
Public service	0	0	4	100	4	2	50.0	2	50.0	100		
ITN Use												
Yes	3	4.7	61	95.3	64	18	56.3	14	43.8	32		
No	4	9.3	39	90.7	43	19	44.2	24	55.88	43	0.587	0.444
IRS												
Yes	5	6.9	67	93.1	72	35	52.2	32	47.8	67	6.795	0.009
No	2	5.7	33	94.3	35	2	25.0	6	75.0	8		
Children outdoor at night												
Yes	7	6.9	95	93.1	102	32	47.1	36	52.9	68	2.144	0.143
No	0	0	5	100	5	5	71.4	2	28.6	7		

The proportion of households with children positive for malaria was highest in households whose head was aged 29-39 years, and lowest in those aged 40 years and above, and the difference in the presence of malaria by the age of household heads was not statistically significant (p-value=0.047). There was also a statistically significant association between malaria presence in the household and the occupation of the household head. Households headed by peasants (low income group) had more malaria positive children compared to those who were in other occupations (p-value=0.009). The association between IRS

application and presence of malaria was also statistically significant, the proportion of malaria positive cases being higher in households where IRS was applied (p-value=0.009). This most probable was influenced with some factors such as longer interval of spraying using ICON in a year contrary to recommended cycle**.** However, there was no significant association between sex, education level of the household head and net usage with presence of malaria positive cases in the household.

4.9 Potential breeding sites associated with malaria transmission

Observation was done to detect presence of anopheline larva in the following potential breeding places: river edges with permanent still and clean water, swamps, sand mining pools, rice fields, small temporary rain pools (puddles), man-made brick making holes, open channels alongside the roads, tractor tracks and open drainage systems. A total of 54 potential mosquito breeding sites in the 2 villages and 2 streets of Mtakuja and Kalangalala wards were identified. Of these, 25 (46%) were dry at the time of the survey. Among the 29 sites which contained water 13.7% (4/29) were found to contain the anopheline larva and this included 1 big pond, 2 small ponds in Mbabane village in Mtakuja ward and 1 river edge with permanent, stagnant and clean water along Rwenge basin that stretch along the Mpomvu village (about 800 meters near residential area) in Mtakuja ward and extend to Kalangalala ward (500 meters near residential areas).

The presence of larvae was determined by dipping. From every potential breeding site up to 5 dips were taken with a standard white 350 ml dipper and sample stored in a clean large container. Larva was examined morphologically to establish whether they were anopheles larva or not. Morphological features used in identification of *Anopheles* larva were absence of a siphon, and the position of the larva which is parallel to the water surface (Service M., 2012).

CHAPTER FIVE

5.0 DISCUSSION

This study was carried out in Geita District Council where the primary objective of the study was to determine the prevalence of malaria among the under-five children and the factors associated with continued malaria transmission.

5.1 Prevalence of Malaria

The overall prevalence of malaria infections by mRDT (18.2%) found in this study is still high, although there is a decline when compared to a previous study that was conducted in the same area which indicated an overall malaria prevalence of 32% in Geita district(National Bureau of Statistics (NBS) [Tanzania] 2012). Our findings indicate a 43% reduction in the prevalence of malaria from the 2012 figures. Furthermore, it was observed that the prevalence of malaria by wards was higher in Mtakuja ward (32.5%) as compared to Kalangalala ward (4.9 %). Several factors were associated with this high prevalence and these included: the location of Mtakuja being more rural, socio-economic factors, human behaviour, favourable physical environmental factors (potential mosquito breeding sites).

5.2 Factors associated with continued malaria prevalence

In this study it was revealed that residential location of community members has an association to continued malaria transmission in the area. High prevalence of malaria among underfives was observed from Mtakuja (32.5%), the peri-urban ward when compared with Kalangalala (4.9%), the urban ward. This was due to the abundance of potential mosquito breeding sites near residential area within Mtakuja ward, contributing to the big difference in malaria prevalence between peri-urban which in our case is a typical rural area and the urban area.

Education clearly influences the knowledge level on Malaria and is commonly thought to play an important role in malaria transmission and prevention. The presence of malaria among underfives was observed to decrease with the increase in education level of

parents/guardians, although the association was not statistically significant. It was revealed that children whose parents/guardians had primary education showed high malaria prevalence, while those having parents/guardians with secondary and tertiary level of education had the lowest malaria prevalence. This is consistent with the finding of a study in Ghana where malaria prevalence was found to be higher among children whose mothers had lower education level (Nyarko et al, 2014). On the other hand it was noted within this parameter that, children of non-educated parents or guardians had lower malaria prevalence compared to those of parents with primary education level. This observation was contrary to other findings of a study done in a community in Geita district northwest Tanzania where only 3.7% of illiterate people associated malaria transmission with the bites of mosquito which have fed on malaria patients, as compared to 22.8% of literate people which was predictive factor of parasitemia (Mazigo et al, 2010). Also a study done in Ghana(Asiedu & Okwabi, 2014) had contrasting outcome whereby in the education category, a child whose mother had primary education was 0.99 times less likely to suffer from malaria compared to a child whose mother had no education. The probable explanation for this observation is that illiterate people are usually more receptive and compliant to public health education that is given to the community to prevent malaria during government campaigns and during the time when they attend clinics at health facilities.

Moreover, a significant association was observed between respondents' economic status (employment status) and continued malaria prevalence among the underfives during the survey. The proportion of households with malaria was high in households whose heads were peasants compared to other group of employment groups. This finding concur with a study done in Ghana where results showed that malaria infection increases with the decrease in socioeconomic level of families and among the unemployed (Brenyah, RC 2013). The standard of living and income earning status for majority of peasants in Tanzania is very low and is comparable to unemployed group, hence they are poor and cannot afford the cost of preventing malaria.

From the study, it was further observed that outdoor nocturnal behaviour is an important factor contributing to individual exposure to mosquito bites. One of the major challenges in

the control of malarial infection in Geita district was human behaviour of some family members for staying outdoor during late evening and nights, as 75.3 % of respondent reported that they spent part of their night time outdoors and go to bed at 9.00 pm and beyond. The main outdoor activities performed were food vending, selling local brews, other commercial activities, social gatherings and relaxing. Likewise, young children in our study were said to accompany their parents/guardians outdoors at night while performing some activities such as food preparation as being reported by 56.6 % of respondents. Therefore they could have picked the infection before they went to bed to be under mosquito net and IRS protection. Similar association was observed in a study done in Botswana (Chirebvu et al,2014) whereby the majority of respondents mentioned that they were involved in late outdoor activities that included social gatherings, relaxing outdoors, preparing meals, etc. Therefore some livelihood activities associated with outdoor nocturnal behaviour could have played an important role in malaria transmission in the place.

5.3 Knowledge, attitudes and practices of the community members on ITNs and IRS interventions

Regarding preventive measures, the majority of respondents (92.3 %) declared to use ITNs and most of them reported to sleep under the ITN the night before the survey. This was an encouraging observation and an improvement compared to previous survey done in Geita that revealed only 27% ITN usage for households, whereby at least one ITN was used for every two people who stayed in the household the night before the survey (National Bureau of Statistics (NBS) [Tanzania] 2012). However, there was no significant association between ITN usage and presence of malaria, with the prevalence of malaria among those who were not using ITNs being slightly high compared to those who used the treated nets. Similar results have been reported from a study done in western Kenya where the overall infection prevalence for all age groups was significantly lower among net users compared to non-net users (12. 8% vs. 16.7%) (Atieli et al., 2011).

Another important factor that may contribute to individual exposure to mosquito bites is ineffective IRS application. Obviously, indoor residual spraying (IRS) remains one of the key strategies of the NMCP, though primarily used for epidemic prevention and response.

IRS is a proven effective malaria vector intervention if correctly implemented using WHO recommended insecticides (Chanda et al. 2015).

Our study showed that there was a significant association between IRS application and presence of malaria in households. Given that this study was conducted after three rounds of the IRS campaign in Geita district, it was found that malaria presence was high among those who accepted spraying compared to those who refused especially in suburban area, this could be associated with factors such as longer interval between spraying, that was greater than six month which is recommended when applying the ICON insecticide as the maximum duration of effective action of the chemical is six months only. As shown in our study, the prevalence of malaria among underfives was higher in Mtakuja ward. The other reason for Mtakuja to have high malaria prevalence despite being under IRS application might be due to its proximity to potential mosquito breeding sites and the behaviour of family member including young children staying outdoor at night, being exposed to mosquito bites before they enter the protection of ITNs and IRS. This finding is similar to an observation in a study done in Northern Ghana (Monroe et al., 2015) where outdoor sleeping and other night time social, cultural and economic activities increased exposure to infective mosquito bites hence being possible contributors to high malaria rates in the place.

Moreover, through general observation that despite of their houses being sprayed, some family members on villages within Mtakuja ward spent some of days with their children in a mining area to collect gold stone leftover famously known as Magwangala. In that place, residential house or structures are temporary, mainly plain thatched houses (locally known as “maduku”) where indoor residual spraying was not done because the houses were not eligible for spraying, hence contribute to continued malaria transmission in neighbouring places areas such as Mbabane village through people who visit such places.

Regarding knowledge of respondents on interventions against malaria; it was observed that**,** about half (49.5%) of the study respondents who were aware about ITN had high knowledge level in relation to ITN intervention as they were able to state correctly the usefulness of the treated nets that it protects people from mosquito bites hence reduces the

burden of malaria. This proportion is lower when compared to finding observed in a study done in Swaziland which indicated that 78% of the respondent knew that malaria is a preventable disease (Hlongwana et al. 2009). Our findings are somewhat higher than finding in a study done in Nepal which indicated that only 33% of respondents knew that malaria is a preventable disease (Parajuli et al, 2010). It is an advantage for any malaria prevention and control intervention to have majority of community members being aware of preventive measures. However, the persistent high malaria prevalence in the area pose a public health challenge that need to be address through behaviour change communication campaigns in order to control malaria.

In addition to that, a large proportion of respondents (95.6 %) have heard about IRS. However, most of the respondents were not aware of the details such as the interval of spraying, the frequency of IRS application and the recommended insecticide despite of the exercise being conducted for three rounds. This gap shows that most probable people didn't appreciate and support the exercise.

ITN ownership was 57.1%, which is much lower when compared to set target of ≥ 80% coverage recommended by the 2005 World Health Assembly (WHO, 2008). Among respondents who do not use ITNs, several factors were identified to influence this and included: a belief that it can cause skin rashes when touched, suffocation, excessive sweating or that it does not prevent mosquito bites.

The majority of respondents (76.4%) accepted their houses to be sprayed. However, this proportion was slightly lower as compared with WHO guidelines on IRS coverage which recommends that it should be more than 80% within targeted communities (WHO, 2006). A small number of respondents stated that they didn't accept spraying of their houses because the chemical had bad smell, also it causes walls to be dirty, and others feared that it may cause infertility and impotence.

5.4 Potential breeding sites associated with malaria transmission

The area was observed to have many potential breeding sites which could be associated with continued malaria transmission; although some of these sites were dry as it was dry

season. However, river edges, large man made ponds and small natural ponds were important mosquito larval habitats. These habitats are permanent with still and clear water in sunlight making conditions favourable for the development of anopheline mosquitoes. This observation is similar to the study which reported that river edges were important habitat productive for anopheline mosquitoes (Soleimani-Ahmadi et al. 2013). Within this study area that a mining area, a lot of shallow man made pits were identified that become filled with water during the rainy season and support proliferation of mosquitoes. Moreover, the area north of Mtakuja ward is characterized by small scale mining activities where the people are busy doing processing of leftover gold stones by crushing them in mining quarry crusher and washing the crushed stones in water collection popularly known as "mialo", so the place has a lot of standing water points that are potential mosquito breeding sites.

Study limitation and mitigation

A potential limitation of this study is that some of the prevention practices were self-reported such as ownership and use of ITN, as well as whether and how IRS was conducted as they could not be observed for verification. This could have led to overestimation of these variables by people giving desired responses. Nevertheless asking of questions was done carefully with probing and follow-up questions to reduce bias and false response.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 CONCLUSION

Intensified malaria intervention by use of ACT, ITNs and IRS have been executed since 2007 in Geita district and have shown a substantial reduction in the prevalence of malaria from 32% in 2012 to 18% in 2015 as revealed in this study. Although the reduction is encouraging, this is still far from the National average of 9% prevalence among underfives reported in 2012.

There are several reasons malaria control efforts may be ineffectual in this setting, these included the proximity of residences to open water bodies that are potential mosquito breeding sites, human behaviour that is associated with nocturnal outdoor activities, and limited use of malaria protective measures such as insecticide treated nets and IRS.

6.2 RECOMMENDATIONS

Based on the findings of this study, the following issues should be considered for improving malaria prevention and control behaviour amongst the residents of Geita district.

1. In order to ensure further reduction of malaria prevalence, the Geita district council should intensify public health education by use of public meetings, drama, film, and photos, local radio broadcasting, posters, pamphlets, discussion among community members and peer group education on the importance of ITNs and IRS use in protection against mosquito bites during night hours.

2. Geita district council with the aid of National Malaria Control Program (NMCP) should conduct more prevalence surveys in the various wards to identify the malaria hot spots so that malaria interventions programmes can be targeted in order to reduce transmission.

3. Intensify ITNs distribution to increase coverage and ensure the recommended coverage of one net per two family members is achieved, as well as to promote the use ITNs by community involvement using local leaders and community health workers.

4. Since there are many potential mosquito breeding sites, there is need to improve the malaria control strategy through integrated approach by adding larviciding on top of the present key intervention methods of ITN and IRS, so as to reduce mosquitoes at their source.

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APPENDICES

Appendix 1: Informed Consent form, English Version

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

DIRECTORATE OF RESEARCH AND PUBLICATIONS

INFORMED CONSENT FORM

TITLE: FACTORS ASSOCIATED WITH CONTINUED TRANSMISSION OF MALARIA IN GEITA DISTRICT – UNDER THE MALARIA CONTROL INTERVENTIONS

CONSENT FOR PARTICIPATION IN THE RESEARCH STUDY.

ID No | | | | | | | | | | | |

Consent to participate in the study

Greetings! My name is **Joram Shadrack Makelemo**, a student from Muhimbili University of Health and Allied Sciences, doing a study on Msc Parasitology and Medical Entomology.

Purpose of this study

The aim of this study is to determine the current prevalence of malaria among under five children and the factors associated with its transmission in Geita district.

What Participation Involves.

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

Confidentiality

All issues pertaining to you and your child's participation will be kept confidentially and no unauthorized person will have access to the data. On demand, the findings will be provided to you.

Risks

Except for minor discomfort at the finger prick, there is no harm for those who will participate in the study, and those who will be found positively with the malaria will be referred for treatment to the nearby health facility. There is also no risk for participating in the household survey.

Benefits

Your participation in this study will allow us to determine the current prevalence of malaria in your area and factors associated with its transmission. This will allow health authorities to know the current situation for better planning and implementation of malaria control interventions.

Rights to Withdraw and Alternatives

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

Who to Contact

If you have any enquires or reservations you may contact me by sending a letter to this address: **Joram S. Makelemo**, **MUHAS. P. O. BOX 65015 Dar es Salaam**. Or if you

have serious questions about you or your child's rights as a participant you may contact **Prof. Mainen J. Moshi,** Chairman of the Senate Research and Publications Committee, **P.O. BOX 65001, Dar es Salaam. Tel: 2150302-6, 2152489.**

Agreement part

I therefore request you to participate in this study.

Do you agree? YES: …… NO: …… (Tick appropriate)

I, _____ have read the contents in this form. My questions have been answered. I agree to participate in this study with my child.

Head of household sign: ……..... Date ……..

Witness sign (if head of household cannot read) …… Date …….

Data collector sign: ……..... Date ……

Appendix 2: Informed Consent form, Swahili Version

CHUO KIKUU CHA SAYANSI ZA AFYA MUHIMBILI

KURUGENZI YA UTAFITI NA MACHAPISHO

FOMU YA RIDHAA

Utafiti kuhusu Kiwango cha malaria Kwa watoto wenye umri chini ya miaka mitano na sababu zinazoambatana na maambukizi kwa ugonjwa huo wilaya ya Geita.

RIDHAA YA KUSHIRIKI KWENYE UTAFITI

Namba ya | | | | | | | | | | | **Utambulisho**

Habari! Mimi naitwa **Joram Shadrack Makelemo**, ni mwanafunzi wa Chuo Kikuu cha afya na sayansi shirikishi Muhimbili nikisomea shahada ya uzamili katika fani ya vijidudu na vimelea vya magonjwa.

Dhumuni kuu

Kufanya utafiti wa kutathimini ukubwa kwa sasa wa maambukizi ya malaria kwa watoto wenye umri chini ya miaka mitano na sababu zinazoambatana na maambukizi kwa ugonjwa huo katika kata za Kalangalala na Mtakuja wilaya ya Geita.

Ushiriki unahusisha nini

Kama utakubali kushiriki katika utafiti huu, nitakuuliza maswali kuhusu mtoto, kisha nitakuomba uniruhusu kuchukua damu ya kidoleni kwa mtoto kwa kuutumia kitoboleo

nadhifu. Kama wewe ni mkuu wa kaya, utaulizwa maswali kuhusu kaya yako, ufahamu wako na njia mbalimbali za kupambana na malaria zinazotumika na kaya yako.

Usiri

Taarifa zote tunazokusanya katika fomu zitaingizwa katika kompyuta ambapo tutatumia namba za utambulisho badala ya majina. Taarifa zote za mshiriki ni siri na hakuna wa kuziingilia isipokuwa mimi mwenyewe.

Faida

Watoto wote watakaopatikana kuwa na malaria watapatiwa matibabu bure katika hospitali au vituo vya afya vya serikali. Ushiriki wako katika zoezi hili pia utasaidia kuweza kufahamu ni kwa kiasi gani tatizo la malaria lipo katika eneo letu, Mamlaka husika zitaweza kutumia matokeo ya utafiti huu katika kuweka mipango iliyo bora zaidi ya kuzuia maambukizi ya malaria na kupunguza tatizo kwa Kiwango kikubwa katika eneo hili na wilaya ya Geita kwa ujumla.

Madhara

Hatutegemei kwamba madhara yoyote yatakupata kwa sababu ya kujiunga na utafiti huu, zaidi ya maumivu kidogo atakakayopata mtoto wakati anatolewa damu kidoleni**.**

Haki za kujitoa katika utafiti

Ni hiari yako kuwa mshiriki katika utafiti huu. Kukataa kushiriki au kujitoa katika utafiti hakutahusisha faini au hasara yoyote kwako. Unaweza kuacha kushiriki katika utafiti huu muda wowote, hata kama tayari umeshatoa ridhaa.

Mawasiliano

Kwa yeyote mwenye kutaka kujua zaidi anaweza kuwasiliana na mimi kwa barua akiandika Joram S.Makelemo **MUHAS, S.L.P 65015 Dar es Salaam**. Au kufanya mawasiliano na **Prof. Mainen J. Moshi**, Mwenyekiti wa bodi ya chuo ya Utafiti na uchapishaji. **S.L.P 65001**. **Dar es Salaam. Simu 2150302-6, 2152489**

Kipengele cha makubaliano

Je, unakubali? Ndiyo: …… Hapana: …… (Weka tiki panapostahili)

Mimi _____ nimesoma maelezo ya fomu hii. Maswali yangu yote yamejibiwa na ninakubali kwa hiyari yangu kushiriki kwenye utafiti huu pamoja na mtoto wangu.

Sahihi ya Mkuu wa kaya: ……..... Tarehe …….....

Sahihi ya shuhuda (Kama Mkuu wa kaya hajui kusoma) ……..…….....

Tarehe ……

Sahihi ya mtafiti: ……..... Tarehe …….....

Appendix - 3: QUESTIONNAIRE (English version)
ID number_____

RESEARCH TITLE: **FACTORS ASSOCIATED WITH CONTINUED TRANSMISSION OF MALARIA IN GEITA DISTRICT – UNDER THE MALARIA CONTROL INTERVENTIONS**

PART A: IDENTIFICATION

1. Division _____
2. Ward _____
3. Village/street _____
4. Sub-village _____

Part B: Socio-demographic factors

5. Name…….

6. Gender:

1. Male

2. Female [ ]

7. Age of respondent in years ……

8. Marital status:

1. Single
2. Married
3. Divorced [ ]
4. Separated
5. Widow

9. What is the highest level of education completed?

1. None
2. Primary
3. Secondary [ ]
4. College
5. Others .....

10. **Occupation status**

1. Unemployed
2. Peasant [ ]
3. Housewife
4. Small scale business
5. Public service
6. Private sector
7. Others (fishermen etc)…….....

11. No of children aged 0-5 years in the household

Age	No
Total	

PART C: Knowledge on Malaria:

12. Have you ever heard about malaria?

1. Yes [ ]
2. No

13. Where did you get information on malaria?

1. Radio program
2. Television program [ ]
3. Health workers
4. Health facilities
5. I suffered from malaria
6. Others; specify……..

14. What causes malaria?

	1)YES	2)NO
1.Germs		
2.Mosquito bites		
3.Plasmodiu organisms		
4.Stagnant waters		
6.Don't know		

15. How is malaria transmitted?

1. By bites of any mosquito [ ]
2. By bites of mosquito that have bitten a malaria patient

16. Mention the symptoms and signs of malaria

	1)YES	2)NO
1.Fever		
2.Headache		
3.Feeling cold		
4.Joint pains		
5.Don't know		

6. Others, specify…….

PART D: Knowledge, Attitude and Practice on ITNs intervention:

17. Have you ever seen or heard of insecticide treated mosquito nets (ITNs)?

1. Yes [ ]

2. No

18. Where did you get information on ITNs?

1. From Radio

2. From Television

3. Health Facility [ ]

4. Others; specify……..

19. Does your family own an ITN?

1. Yes
2. No [ ]

If No skip to question (28); if yes proceed to next questions

20. How many ITNs do you have in the household?

1. One
2. Two
3. Three and above [ ]

21. How did you get them?

	1)YES	2)NO
1.Free from the government		
2.Voucher system		
3.Purchase from shops		

22. What is the current situation of the available ITN?

1. In good order
2. Torn/worn out [ ]

23. Do you sleep under ITN?

1. Yes [ ]
2. No

If NO skip to question (27); if yes proceed to next questions

24. When do you normally sleep under the ITN?

1. Every day at night when I go to bed
2. When I fall sick [ ]
3. During rainy season

25. Did you use it last night?

1. Yes
2. No [ ]

26. Why didn't you sleep under the ITN?

1. I do not have ITN
2. It is uncomfortable as it causes excessive sweating

3. It reduces air circulation
4. It cannot prevent malaria [ ]
5. I fear they can poison me
6. Other reasons, specify……

27. What are the reasons for not having or owning the ITNs?

1. Lost/stolen
2. Old, torn, thrown away [ ]
3. Expensive/I cannot afford)
4. Not available in our locality

28. What are the other uses of ITNs at your home?

1. Protection of chickens against predators
2. Fencing gardens at home yard to protect vegetables [ ]
3. Other uses, specify …….....

29. Do you think sleeping under ITNs cause any negative effect on your health?

1. Yes
2. No [ ]

30. What are the negative effects you think are caused by the use of ITNs

1. It can cause skin rashes
2. Causes suffocation
3. Causes impotence [ ]
4. Feeling hot (sweating) when asleep
5. Other reasons; specify …….

31. Did the under five children at your home sleep under ITN in the previous night?

1. Yes
2. No [ ]

32. What do you think are the advantages of the children sleeping under the ITNs?

1. Protect them from mosquito bites and hence reduce burden of malaria on them
2. Help to save money that could be used for treatments [ ]
3. Child sleeps better
4. Other, specify ……..

33. How often do you wash your ITNs?

1. Once per month
2. 4 times per month
3. After 3 months [ ]
4. After 6 months
5. Not washed since I started to use it

PART E: Knowledge, Attitude and Practice on IRS intervention:

34. Have you ever heard of IRS?

1. Yes
2. No [ ]

35. What was the Source of information about IRS?

1. Radio program
2. TV advertisement
3. Community health workers [ ]
4. GGM workers
5. Government campaign
6. Others

36. Did you accept your house to be sprayed with insecticide in the first round?

1. Yes
2. No [ ]

If no skip to question (No.42)

37. What was the Insecticide employed for IRS?

1. DDT
2. ICON [ ]
3. Don't know

38. What are the exact parts of the house to be sprayed during IRS?

House parts to be sprayed	1)YES	2)NO
. On the surfaces of inner walls		
. On the surfaces of outer walls		
. On the inner surfaces of the roof		

39. What is the Importance of IRS (multiple responses accepted)

Importance of IRS	1)YES	2)NO
To kill mosquitoes		
To kill other domestic insects		
To kill rodents		

40. What are roles of household heads in IRS? (multiple responses accepted)

Roles of household in IRS	1)YES	2)NO
Removing some of the household items from the house prior to spraying		
Removing people from the house prior to spraying		
To ensure that people stay out of the house during and after spraying (for at least 2 hours)		
Provide spray team with clean water for mixing chemicals		

41. Frequency of spraying

1. Once
2. After every three months
3. After every six months [ ]
4. Annually
5. Don't know

42 .Reasons for not accepting IRS

1. Insecticides have bad smell
2. Insecticides may kill my children
3. Insecticides may kill my animals [ ]
4. Insecticide dirties the walls

5. Insecticides may cause infertility
6. Others

PART E: Social Economic and Human activities

43. At what time does a family member go to bed?

1. At 8.00 PM
2. At 9.00 PM
3. At 10.00PM [ ]
4. At 11.00 PM
5. At 12.00 midnight

44. What type of activities keeps some house hold members outdoor in the evening and night?

1. Selling local brews
2. Food vending
3. Drinking alcohol and socializing at outdoor bars [ ]
4. Trading in small shops and kiosks
5. Other business, explain.....

45. Are children also being kept outdoor for long time in the late evening or night?

1. Yes
2. No [ ]

46. With whom are the children outdoor during the evening and night?

1. Mother
2. Siblings [ ]
3. On their own

47. Why are they outdoor during evening and night hours?

1. Playing and socializing on their own
2. Carried by their mothers on their back and other children watching their mothers cooking
3. Accompanying their parents while working in small shops and kiosks [ ]
4. Accompanying their sibling when meeting and talking with friends in the verandals

Appendix 4: Dodoso (Swahili version).

Namba ya Dodoso_____

DODOSO KUHUSU: KIWANGO CHA MAAMBUKIZI YA UGONJWA WA MALARIA KWA WATOTO WALIO CHINI YA UMRI WA MIAKA 5 NA SABABU ZINAZOAMBATANA NA MAAMBUKIZI YAKE KATIKA WILAYA YA GEITA, TANZANIA.

Sehemu: A UTAMBULISHO

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

Sehemu ya B: Taarifa binafsi

5. Jina…….

6. Jinsia: 1. mme [ ] 2.mke [ ]

7. Umri……

8. Hali ya ndoa:
    1. Hajaoa/hajaoelewa
    2. umeoa/umeolewa
    3. Mtalaka [ ]
    4. Ametengana
    5. Mjane/Mgane

9. Kiwango cha elimu:
    1. Sijasoma
    2. Elimu ya msingi [ ]
    3. Sekondari
    4. Chuo
    5. Nyinginezo …….

10. Shughuri ufanyazo:

1. Sijaajiliwa
2. Mkulima
3. Mama wa nyumbani [ ]
4. Mjasiria Mali
5. Mtumishi wa umma
6. Mashirika binafsi
7. Zinginezo (wavuvi, walinzi wa usiku,)…….....

11. Idadi ya watoto wenye umri chini ya miaka mitano

No	Umri

Sehemu C: Elimu kuhusu Malaria

12. Je, unaufahamu ugonjwa wa malaria?

1. Ndiyo
2. Hapana [ ]

13. Uliufahamu je ugonjwa huu?

1. Kwa kusikiliza redio
2. Kwa kuangalia runinga
3. Wakati wa maongezi nyumbani [ ]
4. Wakati naongea na wataalam wa afya.nilishawahi kuugua malaria
5. Kwa namna nyingine;

   eleza.....

14. Nini husababisha ugonjwa wa malaria?

	1)Ndiyo	2)Hapana
1. Gems		
2. Kuumwa na mbu		
3. Vijidudu vya plasmodium		
4.Maji machafu yaliyotuama		
5.Sijui		

15. Malaria huambukizwaje?

1. Kwa Kuumwa na mbu wa aina yoyote [ ]
2. Kwa Kuumwa na mbu mwenye vijidudu vya malaria

16. Taja dalili za ugonjwa wa malaria?

	1)Ndiyo	2)Hapana
1. Homa		
2.Kichwa kuuma		
3.Kuhisi baridi		
4. Viungo vya mwili kuuma		
5. Sijui		

6 Dalili zingine, taja…….

Sehemu D: Elimu, tabia na vitendo kuhusu kujikinga na malaria kwa kuutumia vyandarua vyenye viwatilishi

17. Je umewahi kukiona ama kukikisiskia chandarua chenye dawa (kiatilifu) ya kuua mbu?

1. Ndiyo
2. Hapana [ ]
3. Sijui

18. Ulifahamu je habari za chandarua/vyandarua vyenye dawa

1. kwa kusikiliza redio
2. kupitia runinga [ ]
3. Nilivikuta kituo cha afya
4. Others; specify……..

19. Je unacho chandarua chenye dawa?

1. Ndiyo
2. Hapana [ ]

Kama jibu ni Ndiyo endelea na maswali hapo chini na kama hapana jibu swali (namba 26)

20. Je una vyandarua vingapi vyenye dawa ndani ya nyumba yako?

1. Kimoja
2. Viwili [ ]
3. Zaidi ya vitatu.

21. Chandarua /vyandarua Hivyo vyenye dawa ulivipataje?

	1)Ndiyo	**2)Hapana**
1.Bure kwa mgao wa serikali		
2.Kwa utaratibu wa hati punguzo		
3.Nilikinunua dukani		

22. Hali ya chandarua/vyandarua Hivyo ikoje kwa sasa?

1. Kizima
2. Kimechanika [ ]

23. Je kwa sasa unakitumia chandarua/vyandarua chenye dawa?

1. Ndiyo
2. Hapana [ ]

Kama jibu ni Ndiyo endelea na maswali hapo chini na kama hapana jibu swali (namba 26)

24. Kwa kawaida ni wakati upi hulala (hukitumia) ndani ya chandarua chenye dawa?

1. Kila siku wakati wa kulala usiku.
2. Wakati wa Masika mbu wanapokuwa wengi [ ]
3. Wakati tu tunapokuwa wagonjwa.

25. Je ulilala ndani ya chandarua chenye dawa usiku uliopita?

1. Ndiyo
2. Hapana [ ]

26. Kwa nini hutumii chandarua chenye dawa wakati wa kulala usiku?

1. Mazingira ya nyumba hayaruhusu
2. Sijisikii vizuri kulala kwenye chandarua chenye dawa
3. Sipati hewa ya kutosha [ ]
4. Vyandarua hivi haviui mbu
5. Nahofia sumu iliyoko kwenye vyandarua hivyo

27. Kwa nini huna chandarua chenye dawa?

1. Kimepotea /kimeibiwa
2. Kimechakaa nikakitupa [ ]
3. Vinauzwa bei kubwa
4. Havipatikani maeneo ya hapa kwetu

28. Je kuna matumizi gani mengine ya vyandarua vyenye kiatilifu nyumbani kwako?

1. Kuweka uzio kukinga vifaranga vya kuku wasichukuliwe na mwewe [ ]
2. Kuzungushia uzio kwenye bustani za mbogamboga kwenye viunga vya nyumbani
3. Sababu zingine, eleza …….....

29. Je una fikiri kutumia chandarua chenye dawa kuna madhara yoyote?

1. Ndiyo
2. Hapana [ ]

30. Je ni madhara yapi unafikiri yanasababishwa na kutumia vyandarua vyenye kiatilifu

1. Husababisha vijipele
2. Husababisha upungufu wa hewa na kupumua kwa shida
3. Husababisha upungufu wa nguvu za kiume [ ]
4. Husababisha kutoka jasho jingi tunapokuwa tumelala
5. Sababu zingine; eleza …….

31. Je usiku uliopita watoto wenye umri chini ya miaka mitano walilala ndani ya chandarua chenye kiatilifu?

1. Ndiyo
2. Hapana [ ]

32. Je unafikiri ni manufaa yapi wanayopata watoto wakilala ndani ya chandarua chenye kiatilifu?

1. Kuzuia wasing'atwe na mbu ,hivyo kupunguza maambukizi ya malaria
2. Kuokoa pesa ambayo ingetumika kwa matibabu
3. Husaidia watoto kulala kwa utulivu [ ]
4. Sababu zingine, eleza ……..

33. Ni mara ngapi chandarua chako chenye dawa unakifua?

1. Mara moja kwa mwezi
2. Mara 4 kwa mwezi
3. Kila baada ya miezi mitatu [ ]
4. Kila baada ya miezi sita
5. Hakijawi kufuliwa toka nimeanza kukitumia

Sehemu E: Elimu, tabia na vitendo kuhusu kujikinga na malaria kwa kunyunyizia dawa ya ukoko

34. Je umeshawi kusikia dawa ya ukoko inayonyunyiziwa ndani ya nyumba

1. Ndiyo
2. Hapana [ ]

35. Ulifahamu dawa hii ya ukoko kupitia chanzo kipi cha habari?

1. Redio
2. Matanganzo ya runinga
3. Kupitia wahudumu wa afya ya Jamii [ ]
4. Kupitia wafanyakazi wa GGM.
5. Kampeni za serikali kuhusu kunyunyizia dawa ya ukoko
6. Vyanzo vingine; eleza.....

36. Je nyumba yako ilipuliziwa dawa ya ukoko kwenye mzunguko wa kwanza?

1. Ndiyo
2. Hapana [ ]

Kama Ndiyo endelea na maswali yafuatayo na kama hapana nenda (swali namba 42)

37. Ni dawa gani ya ukoko ilitumika kunyunyizia nyumba yako.

1. DDT
2. ICON [ ]
3. Sijui
4. Sikumbuki

38. Je ni maeneo yapi ya nyumba yafaa kunyunyiziwa dawa ya ukoko?

Sehemu za kunyunyizia dawa	1)Ndiyo	2)Hapana
Kuta za ndani ya nyumba		
Kuta za nje ya nyumba		
Kwenye dari		

39. Kuna manufaa yapi ya kunyunyizia dawa ya ukoko?

Manufaa ya kunyunyizia dawa	1)Ndiyo	2)Hapana
Kuua mbu		
Kuua wadudu walioko ndani ya nyumba.		
Kuua mapanya		

40. Yapi ni majukumu ya mkuu wa kaya wakati wa kunyunyizia dawa ya ukoko

Majukumu ya mkuu wa kaya	1)Ndiyo	2)Hapana
Kusimamia watu wote watoke ndani ya nyumba kabla ya kuanza kunyunyizia.		

Kuhakaikisha wanakaya wanabaki nje ya nyumba kwa muda wote wa unyunyiziaji (takribani masaa 2).		
Kushirikiana na wanyunyiziaji kwa kuwapatia maji safi kwa ajili ya kuchanganyia kemikali.		

41. Je ni mara ngapi unyunyiziaji wa dawa ya ukoko hufanyika kwenye kaya?

1. Mara moja tu
2. Kila baada ya miezi mitatu
3. Kila baada ya miezi sita [ ]
4. Kila baada ya mwaka mmoja
5. Sijui.

42. Ni sababu zipi zilikufanya usikubali nyumba yako kunyunyiziwa dawa ya ukoko

1. Kemikali hizi huacha harufu mbaya
2. Ninahofia kemikali hizi zitaua Watoto wangu.
3. Ninahofia kemikali hizi zitaua mifugo walioko nyumbani [ ]
4. Kemikali huchangia ugumba na utasa.
5. Kama una sababu zingine; eleza.....

PART F: Tabia binafsi na Shughuri za kila siku kwa wanakaya

43. Je ni wakati upi wanakaya huenda kulala?

1. Saa mbili usiku.
2. Saa tatu usiku
3. Saa nne usiku [ ]
4. Saa tano usiku
5. Saa sita usiku

44. Ni Shughuri zipi huwaweka wanakaya nje nyakati za jioni na usiku

1. Biashara ya pombe za kienyeji
2. Baba lishe/Mama lishe
3. Kuburudika na kunywa pombe kwenye viunga vya baa [ ]
4. Kufanya Biashara kwenye maduka na viosiki
5. Shughuri nyingine, eleza.....

45. Je watoto wadogo pia huwa nje kwa muda mrefu nyakati za jioni ama usiku?

1. Ndiyo
2. Hapana [ ]

46. Watoto wadogo huambatana na akina nani nyakati za jioni ama usiku?

1. Mama zao
2. Ndugu zao(kaka/dada) [ ]
3. Pekee yao

47. Kwa nini huwa nje nyakati jioni na usiku?

1. Wakicheza
2. Wakibebwa na mama zao mgongoni na wengine wakitazama mama zao wakipika
3. Wakiambatana na Wazazi wao wakati wakifanya Biashara kwenye maduka na viosiki vyao.
   [ ]
4. Wakiwa na Ndugu zao wakati wa maongezi na marafiki zao kwenye mabaraza ya nyumba zao.

Appendix 5: Field Laboratory Investigation Form.

Form number (ID no.)_____ (Should be the same as with Questionnaire number)

Finger pricks blood sample results:

1. Malaria parasites with mRDT

    1. Positive

    2. Negative

2. Malaria parasite blood smears with Microscopy

    1. Positive

    2. Negative

Appendix 6: Ethical clearance letter from MUHAS IRB

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

Directorate of Postgraduate Studies

P.O. BOX 65001
DAR ES SALAAM
TANZANIA.

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

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

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

28th July, 2015

Mr. Joram S. Makelemo
MSc. Parasitology and Medical Entomology
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "PREVALENCE OF MALARIA AMONG UNDER FIVE CHILDREN AND THE FACTORS ASSOCIATED WITH ITS TRANSMISSION IN GEITA DITRICT"

Reference is made to the above heading.

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

The ethical clearance is valid for one year only, from 27th July, 2015 to 26th July, 2016. In case you do not complete data analysis and dissertation report writing by 26th July, 2016, you will have to apply for renewal of ethical clearance prior to the expiry date.

Prof. O. Ngassapa
DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publication
cc: Dean, School of Public Health and Social Sciences

Appendix 7: Permission letter to do research in Mtakuja Ward, Geita from Geita Town Council Med. Officer



HALMASHAURI YA MJI GEITA

MKOA WA GEITA
Simu No. 0282520437
Nukushi No. 0282520437

Barua Pepe: **td@geitatc.go.tz**
Wakati wa kujibu taja :

Kumb Na ;GTC/M.1/2/42.

Idara ya Afya Tiba
Halmashauri ya Mji,
S.L.P. 384
GEITA
07.08.2015

AFISA MTENDAJI
KATA YA..... MTAKUJA .....
S.L.P. 384
GEITA

YAH ;**BWANA JORAM SHADRACK MAKELEMO KURUHUSIWA KUFANYA UTAFITI KUHUSU MALARIA KATIKA KATA YAKO.**

Kichwa cha barua hii chahusika sana. Mtajwa hapo juu ni mwanafunzi Kitivo cha AFYA Muhimbili. Kwa kipindi hiki yuko katika kufanya Utafiti wa UgonjwawaMalaria kama hitaji mojawapo katika kukamilisha masomo yake.

Amepitia hatua zote za Kiutafiti na ameruhusiwa. Hivyo naomba umpokee na kumpatia ushrikiano wakati atakpokuwa anakusanya takwimu mbalimbali katika eneo lako.

Ahsante
Nakutakia ushrikiano mwema

.....
Dr.B.Ndaki
Kaimu Mganga Mkuu
Halmashauri ya Mji
GEITA.

MGANGA MKUU
HALMASHAURI YA MJI
GEITA.

Nakala ;
Mkurugenzi Halmashauri ya Mji kwa taarifa—Aione kwenye Jalada.

Appendix 8: Permission letter to do research in Kalangalala Ward, Geita from Geita Town Council MED OFFICER

HALMASHAURI YA MJI GEITA

MKOA WA GEITA
Simu No. 0282520437
Nukushi No. 0282520437

Barua Pepe: **td@geitatc.go.tz**
Wakati wa kujibu taja :

Idara ya Afya Tiba
Halmashauri ya Mji,
S.L.P. 384
GEITA
07.08.2015

Kumb Na ;GTC/M.1/2/42.

AFISA MTENDAJI
KATA YA..... KALANGALALA .....
S.L.P. 384
GEITA

YAH ;**BWANA JORAM SHADRACK MAKELEMO KURUHUSIWA KUFANYA UTAFITI KUHUSU MALARIA KATIKA KATA YAKO.**

Kichwa cha barua hii chahusika sana. Mtajwa hapo juu ni mwanafunzi Kitivo cha AFYA Muhimbili. Kwa kipindi hiki yuko katika kufanya Utafiti wa UgonjwawaMalaria kama hitaji mojawapo katika kukamilisha masomo yake.

Amepitia hatua zote za Kiutafiti na ameruhusiwa. Hivyo naomba umpokee na kumpatia ushrikiano wakati atakpokuwa anakusanya takwimu mbalimbali katika eneo lako.

Ahsante
Nakutakia ushrikiano mwema

.....
Dr.B.Ndaki
Kaimu Mganga Mkuu
Halmashauri ya Mji
GEITA.

MGANGA MKUU HALMASHAURI YA MJI GEITA.

Nakala ;
Mkurugenzi Halmashauri ya Mji kwa taarifa—Aione kwenye Jalada.