PREVALENCE OF MALARIA AND ASSOCIATED FACTORS AMONG UNDERFIVE CHILDREN ATTENDING REPRODUCTIVE AND CHILD HEALTH CLINIC AT NACHINGWEA DISTRICT HOSPITAL

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School of Public Health and Social Sciences

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Dissertation submitted in (Partial) fulfilment of the requirements for the Degree of Master of Public Health of Muhimbili University of Health and Allied Sciences

October, 2019

CERTIFICATION

The undersigned certifies that she has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation titled: ***'Prevalence of malaria and associated factors among underfive children attending RCH clinic at Nachingwea District Hospital'*** in (partial) fulfilment of the requirements for the degree of Masters of Public health of Muhimbili University of Health and Allied Sciences.

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DR. MARYCELINA MUBI

(Supervisor)

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Date

DECLARATION AND COPYRIGHT

I, **Livigha, Walemba Krispin,** 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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Lastly but not least, I say thank you to the Hospital Management and Laboratory Team at Nachingwea District Hospital, and parents/guardians of the under-five children who participated in this study, without them I would not have been able to complete this work.

DEDICATION

I dedicate this dissertation to my beloved Parents who nurtured and provided me with a good education foundation that brought me to where I am today.

ABSTRACT

Background: Malaria in humans is caused by five species of parasites belonging to the genus *Plasmodium*. Globally in 2017,an estimated 219 million cases of malaria occurred worldwide, while the estimated number of deaths was 435 000, and 91% of them occurred in sub-Saharan Africa (World malaria report, 2018).In Tanzania, the prevalence is now estimated at 7.3%. Children under the age of five years are the most vulnerable group due to low immunity. These children attend RCH clinic but are not tested for malaria. Testing for malaria can help to diagnose asymptomatic malaria infection and provide treatment early before the diseases becomes complicated. A number of factors, such as geographical location, parent/guardian education status and occupation, use of ITN and availability of breeding sites have been associated with malaria infection.

Objective: To determine the prevalence of malaria and associated factors among under-five children attending RCH clinic at Nachingwea District Hospital.

Material and Methods: A cross sectional study design was used. Under-five children attending the RCH clinic at Nachingwea District Hospital were consecutively recruited into this study from September to October 2018.These under-five children were from different four wards(Nambambo, Boma, Ugawaji, Kilimanihewa) with different physical characteristics.Diagnosis of malaria was done by both microscopy and RDT using finger prick blood samples. Demographic and socio-economic characteristics of the children and their parents/guardians were collected and filled into a data collection form, data was entered and analyzed using statistical package for social sciences (SPSS) software version 20. Data were presented as frequencies and percentages in tables.

Results: A total of 269 under-five children participated in this study, of which 122 (45.35%) were males and 147 (54.65%) were females. Only two (2) children (0.74%), one male and one female were positively diagnosed with malaria by both Malaria rapid diagnostic test – PF/PAN and microscopy. Most of the children were reported to use ITNs, with only 20 (7.4%)

children reported not to use. Those diagnosed positive for malaria were both from parents/guardian who were farmer's, with primary education level. They were also reported to use ITNs.

Conclusions and recommendations:

The significantly low prevalence of malaria in this study can be due to the reported high proportion of ITN use among under five children in Nachingwea district. Low prevalence could also be due to the fact that the study was conducted during the dry season, which is the low transmission season. Further studies should be conducted at different seasons of the year to determine the association between malaria, climatic conditions and other factors.

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LIST OF ABBREVIATIONS

ACT	Artemisinin- based Combination Therapy
ALu	Artemether-lumefantrine
IRS	Indoor Residual Spraying
ITN	Insecticidal Treated Nets
HSS	Health Systems Strengthening
LLIN	Long Lasting Insecticidal Nets
MRDTs	Malaria Rapid Diagnostic Tests
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MOHSW	Ministry Of Health and Social Welfare
MUHAS	Muhimbili University of Health and Allied Sciences
NMCP	National Malaria Control Programme
OCGS	Office of the Chief Government Statistician
PMI	President's Malaria Initiative
RCH	Reproductive and Child Health
SP	Sulfadoxine/Pyrimethamine
TACAIDS	Tanzania Commission for AIDS
TMIS	Tanzania Malaria Indicator Survey (2017 TMIS)
USAID	United States Agency for International Development
URT	United Republic of Tanzania
WHO	World Health Organization
WSEB	Window Screen and Eave Baffles

DEFINITION OF TERMS

Asymptomatic parasitaemia: the presence of asexual parasites in the blood without symptoms of illness

Prevalence: is the proportion of population found to have the condition (typically a disease such as malaria). It is arrived by comparing the number of people found to have the condition with the total number of people studied, and usually expressed as a fraction, as a percentage or as the number of cases per 1,000 people.

Rapid diagnostic test (RDT): an antigen based stick, cassette or card test for malaria in which a coloured line indicates the presence plasmodium antigen

Severe malaria: acute falciparum with signs of severity and/or evidence of vital organ dysfunction

Stable malaria: is when malaria infections occur for many months in a year, over many years. People living in highly endemic areas usually exhibit a high level of *immunity* and tolerate the infection well (and therefore endemic).

Uncomplicated malaria: symptomatic malaria parasitaemia with no signs of severity and/or evidence of vital organ dysfunction

Unstable malaria: malaria refers to a seasonal type of transmission seen in areas of low endemicity, or to outbreaks in areas previously without malaria, or among non-immune persons (epidemic).

1. INTRODUCTION

1.1. BACKGROUND

Malaria remains a major public health problem in many countries of the world, especially in sub-Saharan Africa. In 2000, it was estimated that there were 262 million cases of malaria globally, leading to 839 000 deaths. Although various interventions have been implemented to control malaria, it is estimated that 219 million cases of malaria occurred worldwide in 2017, leading to 435,000 malaria deaths (World malaria Report, 2018). The majority of these, 92% of cases and 93% of deaths occurred in the African region. In spite of the decrease in the number of deaths over the years, malaria remains a leading public health problem in many areas of sub-Saharan Africa, especially in children under five years of age who remain most at risk of frequent and severe malaria episodes with high mortality. Adults are also affected and may have low or no production activities, becoming dependants, leading to poor quality of life.

In Tanzania, malaria was the leading cause of health service attendance and the disease contributed to approximately 40% of all morbidities reported in children under five presenting in outpatients clinics at health facilities(Mazigo et al., 2011). Ninety three percent of the population on the Mainland and the entire population of Zanzibar live in areas at risk of malaria transmission. 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.

Malaria is a vector borne disease caused by parasites of the genus *Plasmodium*. Five species of this parasite, namely *Plasmodium falciparum, Plasmodium vivax, Plasmodium malariae, Plasmodium ovale* and *P. knowlesi* cause malaria in humans. *Plasmodium falciparum* accounts for 96% of malaria infection in Tanzania, with the remaining 4% due to *P. malariae* and *P. ovale* (USAID, 2016). The disease is transmitted between humans by adult female mosquitoes

of the genus *Anopheles*. The principal vectors of malaria in Tanzania are mosquitoes of the *Anopheles gambiae* complex (*An. gambiae* and *An. arabiensis*), with *An. arabiensis* increasing to 80% of the vector population in the Lake Zone sentinel site collections in 2015 (USAID and CDC, 2017).The disease is endemic in tropical and sub-tropical regions of the world (Gunathilaka et al., 2016).

Malaria is an acute febrile illness that can be categorized as uncomplicated or severe (complicated). However, some patients with malaria infection may be completely asymptomatic. The symptoms of uncomplicated malaria are usually nonspecific and comprise of headache, lassitude, fatigue, abdominal discomfort and muscle and joint aches, usually followed by fever, chills, perspiration, anorexia and vomiting. Children may also present with poor feeding, cough and lethargy. Delay in diagnosis and treatment or treatment with ineffective drugs may lead to progression to severe disease. Patients with severe malaria present with one or more of the following: cerebral malaria (convulsions or coma), metabolic acidosis, severe anaemia, hypoglycaemia, acute renal failure or acute pulmonary oedema. Severe malaria is fatal if not treated promptly and effectively (WHO, 2015).The most severe cases occur among persons who have not yet developed sufficient immunity to malaria through previous exposure (for example, young children) or persons who have reduced natural malaria immunity (for example, pregnant women). Children under age five are at highest risk. Pregnant women are four times as likely to experience the complications of malaria as non-pregnant women, and malaria is a major cause of pregnancy loss, low birth weight, and neonatal mortality (TACAIDS, 2013).

Since the progression towards severe and fatal disease is rapid, especially in children under five years of age, it is recommended that diagnosis and initiation of treatment of uncomplicated malaria be made within 24 hours from the onset of symptoms. WHO recommends that every suspected malaria case be confirmed by microscopy or malaria rapid diagnostic tests (mRDT) before treatment (WHO, 2011). Laboratory investigation is mandatory and urgent for all patients suspected to have malaria. Parasite-based diagnosis by

microscopy is important, as it allows for identification of the infecting species as well quantification of parasites. However, in the absence of good quality microscopy, mRDTs may be an alternative. Malaria RDTs detect parasite-specific antigens or enzymes that are either genus or species specific, giving qualitative results.Accurate diagnosis improves the management of febrile illnesses and ensures that antimalarial medicines are only used when necessary.

WHO recommends Artemisinin-based combination therapy (ACTs) for the treatment of uncomplicated *Plasmodium falciparum* malaria.The NMCP adopted Artemether-lumefantrine (ALu) as the first-line drug with artesunate-amodiaquine (ASAQ) as an alternative, second line drug for the treatment of uncomplicated malaria, and Quinine (QN) being the drug of choice for management of severe malaria.

The government through the National Malaria Control Programme (NMCP) is undertaking different activities geared towards the control of malaria in Tanzania. These activities include case management; vector control (ITN and IRS), information and education, and surveillance, monitoring and evaluation (including operational research)(USAID & CDC, 2017)**.**The use of insecticide-treated mosquito nets (ITNs) is a primary health intervention designed to reduce malaria transmission in Tanzania, and have been proven to be a practical, highly effective and cost-effective intervention against malaria(TACAIDS, 2013).Through these efforts, the prevalence of malaria among under-fives has been significantly reduced in Tanzania, from 18.1% in 2008 to 7.3% in 2017 (TMIS).

Although significant achievements have been made in controlling malaria, there has been upsurge in malaria prevalence and distribution in some areas in recent years. The overall prevalence of malaria was 7.3% in 2017, with a range from<1% to 24%, with regions in the Lake Zone and Southern Coastal areas having the highest prevalence (TMIS, 2017).Climate variability is suspected to be a major factor in the recent resurgence and inter annual variations in the incidence of malaria(Hashizume, Terao, & Minakawa, 2009).Climate change

parameters most often considered for their impact on mosquitoes are temperature, rainfall, and humidity, but others such as atmospheric particle pollution and wind can also have an impact. Many studies have examined the impacts of global climate change involving temperature, rainfall, and humidity on common mosquito-borne diseases like malaria(Ramasamy & Surendran, 2012) .

1.2. PROBLEM STATEMENT

Tanzania is heavily affected by malaria which is one of the leading causes of morbidity and mortality in the country, accounting for over 7.3% of the national disease burden (TMIS, 2017). Although the overall prevalence of malaria in Tanzania is now estimated at 7.3%, some areas of the country are still experiencing high prevalence rates; especially the Lake Zone and Southern Coastal region. Children under five years of age affected by malaria bear the brunt of the disease with abnormal growth, while those of school age are unable to participate in social activities such as education. The RCH clinic provides health services to reduce maternal and child`s mortality. The RCH clinic services to under-fives include the following:Prenatal care, Emergency obstetric care, postnatal and newborn evaluation and care, Prevention of HIV/AIDS transmission from mother to child (PMTCT), immunizations and wellness checks for children under age five, management of childhood diseases and nutrition counseling. In areas of high malaria transmission, these clinics could help in early detection and treatment of malaria.

Nachingwea is one of the districts in the southern regions which are high endemic areas. No published studies have been conducted in Nachingwea district to determine the prevalence of malaria among under-five and factors associated with it. Therefore, this study was conducted to determine the current prevalence of malaria in children under five attending RCH clinics, and factors associated with it; such as geographical distribution, use of ITN among under-fives, parents/guardian education, their occupations and age of their parents or guardians.

1.3. RATIONALE

The government through the National Malaria Control Programme (NMCP) is undertaking different activities geared towards the control of malaria in Tanzania. These activities include case management; vector control (ITN and IRS), information and education, and surveillance, monitoring and evaluation (including operational research)(USAID & CDC, 2017). Information generated from all these activities is helpful in assessing progress towards control and identifying appropriate measures to control malaria in the area. The study will therefore provide up-to-date information on malaria prevalence in under-five children and factors associated with it, information that may be used by stakeholders to design appropriate interventions to control malaria infections in the district.

1.4. CONCEPTUAL FRAMEWORK

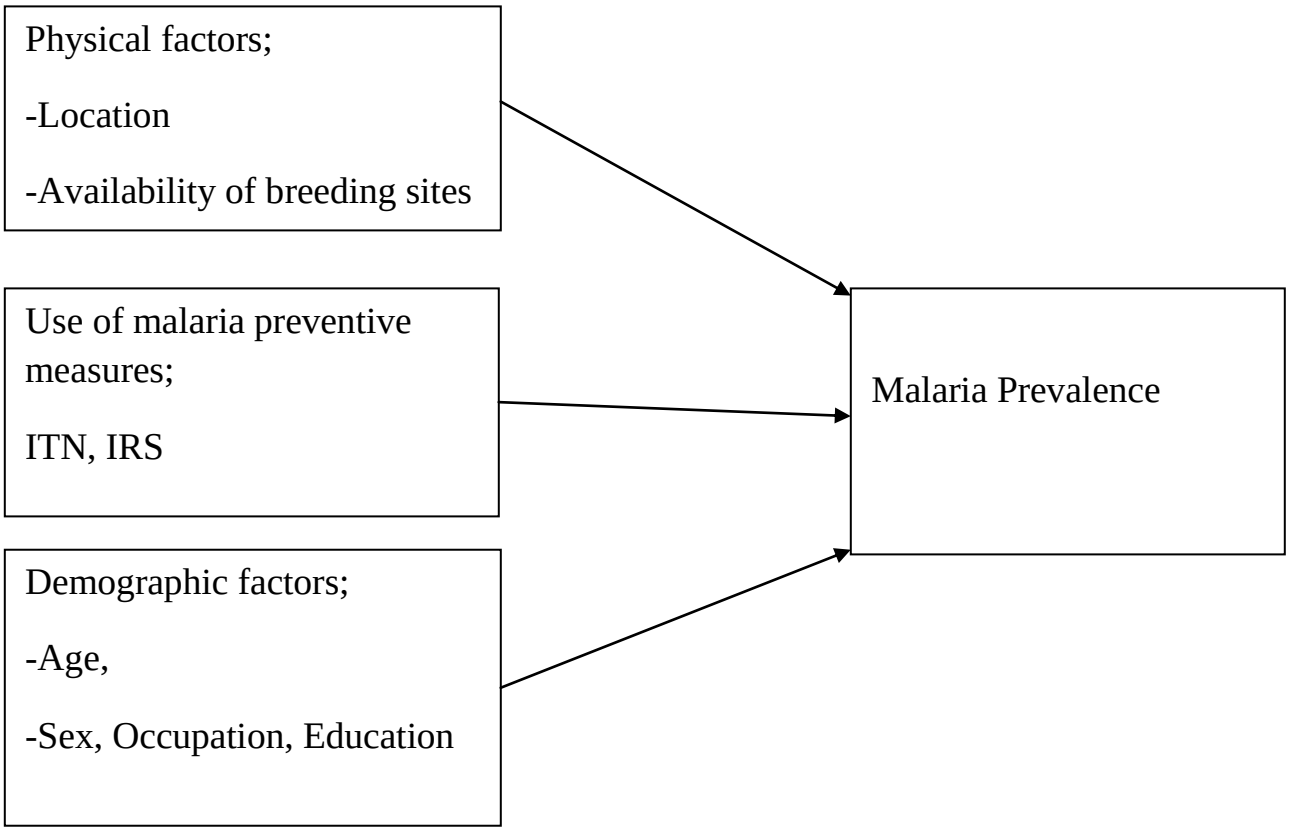


Figure 1: The conceptual framework

Description of the conceptual framework

The use of insecticide-treated mosquito nets (ITNs) is a primary health intervention designed to reduce malaria transmission in Tanzania. ITNs used for protection against mosquito bites have proven to be a practical, highly effective and cost-effective intervention against malaria. Temperature affects the development rates and survivorship of malaria parasites and mosquito vectors. Rainfall influences the availability of mosquito larval habitats and thus mosquito demography. Temperature and rainfall may have synergistic effects on malaria transmission demographic factors, such as, parents' education levels and occupation, use of personal protective measures, ethnic groups and family living standards are important risk factors for

malaria transmission and epidemics. Knowledge of malaria and socio-economic upliftment are key factors in adopting the appropriate intervention strategies. Keeping in mind that there is a large number of risk factors that influence vulnerability to malaria including proper knowledge about malaria transmission and prevention, demography and socio-economic status of different population groups.

1.5. RESEARCH QUESTIONS

1. What is the prevalence of malaria among under five children attending RCH clinic in Nachingwea district hospital?
2. What is the geographical distribution of malaria infection among the villages/streets in Nachingwea District?
3. What are the factors associated with malaria infection among under-fives**.**

1.6. OBJECTIVES

1.6.1. BROAD OBJECTIVE

To determine the prevalence of malaria and associated factors among under-five children attending RCH clinic at Nachingwea District Hospital.

1.6.2. SPECIFIC OBJECTIVES

1. To determine the prevalence of malaria among under-five children attending RCH clinic at Nachingwea District Hospital.
2. To determine the geographical distribution of malaria in children attending RCH clinic in Nachingwea district.
3. To identify factors associated with malaria infection among under-five children attending the RCH clinic at Nachingwea district hospital

2. LITERATURE REVIEW

2.1. Malaria as a public Health problem

Causes and symptoms of malaria

Malaria is a vector borne disease caused by parasites of the genus *Plasmodium*, transmitted between humans by adult female mosquitoes of the genus *Anopheles*. The disease is endemic in tropical and sub-tropical regions of the world(Gunathilaka et al., 2016).Five species of parasites belonging to the genus *Plasmodium cause malaria in humans*. Four of these are: *Plasmodium falciparum, Plasmodium vivax, Plasmodium malaria* and *Plasmodium ovale* are human malaria species that are spread from one person to another, while the fifth parasite, *P. knowlesi is* a parasite monkeys that can be transmitted to humans in certain forested areas of South-East Asia. Current information suggests that *P. knowlesi* malaria is not spread from person to person, but rather occurs in people when an *Anopheles* mosquito infected by a monkey bites and infects humans (zoonotic transmission)(WHO, 2015). There are about 400 different species of *Anopheles* mosquitoes, but only 30 of these are vectors of major importance.

Malaria is an acute febrile illness that can be categorized as uncomplicated or severe (complicated). However, some patients with malaria infection may be completely asymptomatic. The symptoms of uncomplicated malaria are usually nonspecific and comprise of headache, lassitude, fatigue, abdominal discomfort and muscle and joint aches, usually followed by fever, chills, perspiration, anorexia and vomiting. Children may also present with poor feeding, cough and lethargy. Delay in diagnosis and treatment or treatment with ineffective drugs may lead to progression to severe disease. Severe malaria is usually the result of organ failure or abnormalities. Patients with severe malaria present with one or more of the following: cerebral malaria (convulsions or coma), metabolic acidosis, severe anaemia, hypoglycaemia, acute renal failure or acute pulmonary oedema. Severe malaria is fatal if not treated promptly and effectively (WHO, 2015).Severe malaria affects mainly children under five years of age.

Transmission of Malaria:

Malaria transmission in sub-Saharan Africa occurs mainly during late hours of the night. This period coincides with the peak biting behaviour of the primary malaria vectors: *Anopheles gambiae*sensu lato and *Anopheles funestus*(Milali, Sikulu-Lord, & Govella, 2017)**.**The principal vectors of malaria in Tanzania are mosquitoes of the *Anopheles gambiae* complex (*An. gambiae* and *An. arabiensis*), with *An. arabiensis* increasing to 80% of the vector population in the Lake Zone sentinel site collections in 2015 (USAID and CDC, 2017).

Although increasing surface water pollution caused by rapid urbanization was believed to have hampered the development of *Anopheles* larvae and eliminate certain species like *Anopheles funestus*, others such as species of the *Anopheles gambiae* complex have adapted well and continue to breed even in organically polluted water bodies. This is contrary to the conventional view that *Anopheles* mosquitoes breed only in clean or clear water habitats. Anopheles mosquitoes exploit varying habitats for breeding. They breed in and around vicinities of deteriorating infrastructure such as broken water pipes, poorly maintained drains, culverts, market gardens/urban agricultural sites, pools at construction sites, lorry tire tracks on unpaved roads and low lying areas that are liable to flooding. These are all found close to or in-between houses in urban settings. Perceivably, all available landscapes within the city, whether natural or man-made, that collect any form of stagnant water are potential breeding places for mosquitoes and may possibly be habitats for *Anopheles* mosquitoes (Mattah et al., 2017).

Laboratory diagnosis of Malaria

WHO recommends that every suspected malaria case be confirmed by microscopy or malaria rapid diagnostic tests (mRDT) before treatment (WHO, 2011). Laboratory investigation is mandatory and urgent for all patients suspected to have malaria. Parasite-based diagnosis by microscopy is important, as it allows for identification of the infecting species as well quantification of parasites. However, in the absence of good quality microscopy, mRDTs may be an alternative. Malaria RDTs detect parasite-specific antigens or enzymes that are either genus or species specific, giving qualitative results. At present, molecular diagnostic tools

based on nucleic-acid amplification techniques such as loop-mediated isothermal amplification or PCR do not have a role in the clinical management of malaria (WHO, 2016). The Ministry of Health directs that laboratory tests results be interpreted in conjunction with clinical findings (MOHSW, 2013). Accurate diagnosis improves the management of febrile illnesses and ensures that antimalarial medicines are only used when necessary. Since the progression towards severe and fatal disease is rapid, especially in children under five years of age, it is recommended that diagnosis and initiation of treatment of uncomplicated malaria be made within 24 hours from the onset of symptoms.

Malaria treatment:

Prompt and appropriate treatment of uncomplicated malaria is critical in preventing progression to severe disease and death. WHO recommends Artemisinin-based combination therapy (ACTs) for the treatment of uncomplicated *Plasmodium falciparum* malaria.ACTs were officially launched in Mainland Tanzania on December 15, 2006. The NMCP adopted Artemether-lumefantrine (ALu) as the first-line drug with artesunate-amodiaquine (ASAQ) as an alternative, second line drug for the treatment of uncomplicated malaria, with Quinine (QN) being the drug of choice for management of severe malaria. Recently dihydroartemisin-piperaquin (DP) has also been recommended as an alternative ACT. In 2013 the NMCP revised the national treatment guidelines to include injectable artesunate for the treatment of severe malaria. It is essential that full doses of the recommended drugs be given to patients with confirmed malaria to effect cure (WHO, 2015).

Control and Prevention of Malaria

The government of Tanzania, primarily through the Ministry of Health and Social Welfare, is committed to the control and prevention of malaria. This is due to the fact that a considerable amount of the health budget is allocated to address malaria and malaria-related illnesses. Household expenditures related to malaria are also high and are mainly spent on malaria treatment (TACAIDS, 2013).

The use of insecticide-treated mosquito nets (ITNs) is a primary health intervention designed to reduce malaria transmission in Tanzania (TACAIDS, 2013). Studies revealed that ITNs

used for protection against mosquito bites have proven to be a practical, highly effective and cost-effective intervention against malaria. A decline in malaria in sub-Saharan Africa is attributed to malaria control measures, predominantly to the use of ITNs, IRS and ACT, which have been implemented on a wide scale (Nzobo, Ngasala, & Kihamia, 2015).LLINs and IRS can reduce malaria transmission by killing sufficient numbers of vector mosquitoes when they attack sleeping humans or rest indoors (Killeen et al., 2017).

Although there is a growing commitment to the fight against malaria in recent years, adequate delivery of existing interventions remains one of the main challenges for the weak health systems of Sub- Saharan Africa. Effective treatment of malaria episodes is a fundamental pillar of the malaria control strategy (Eriksen *et al.*, 2010).

2.2. Malaria in under five children

Children are most vulnerable to morbidity and mortality associated with malaria. It is estimated that nine out of ten deaths in children were caused by malaria in Africa(Sultana et al. 2017).Also,435000 malaria deaths out of 219 million cases were reported in 2018 (WHO,2018).Approximately two thirds of these deaths occurred in the African region. In areas of high malaria transmission infants and young children carry a very high disease burden, but protective immunity is developed in early childhood(Lusingu et al., 2004). Adults and older children are able to control parasitaemia and therefore only rarely suffer from mild malaria symptoms. In areas of low malaria transmission, immunity develops slowly and malaria affects all age groups. Children attending Reproductive and child health clinic are not tested for malaria routinely although they can have symptomatic malaria and look health. Testing for malaria to these children could be helpful for early diagnosis and treatment before becoming severe.

In the absence of treatment, *P. falciparum* malaria can rapidly progress from uncomplicated malaria to severe, life-threatening malaria. Severe *Plasmodium falciparum* malaria is a medical emergency. Delay in diagnosis and provision of appropriate treatment may lead to serious complications and even death. In Tanzania the commonest presentations of severe malaria are severe anaemia and coma (cerebral Malaria). Complications include hyperpyrexia,

convulsions, shock, hypoglycaemia, metabolic acidosis, acute renal failure or pulmonary oedema (MOHSW, 2013).

2.3. Geographical Distribution of malaria

All areas in Tanzania at altitudes below 1800 metres may contain the presence of malaria, with >85% of the infections being primarily *Plasmodium falciparum*, followed by *P. malariae and P. ovale* with a combined incidence of >10% while *P. vivax*is rarely reported (Heather et al. 2015).

Previous studies suggest that rainfall provides ample breeding sites for anophelines to lay their eggs and temperature plays an important role in larval development and survival, which takes about 10 days to metamorphosize from an egg to adult stage at an optimum temperature of 28°C (Pandey, Das, & Dhiman, 2016).

In Tanzania there are two rainy seasons, the short rains occur sometime between mid-October and mid-December. They are shorter and less predictable than the long rains, which last from mid-March to mid-May. Between these there are drier periods with little rain and less malaria transmission, except in swampy areas with standing water (Wort, Hastings, Carlstedt, Mutabingwa, & Brabin, 2004).

Recent studies suggested that residents of highland areas generally lack immunity to malaria and are particularly vulnerable to malaria infection. At high altitudes, where malaria transmission intensity is low, human populations have poorly developed immunity to malaria because exposures are infrequent, and persons are vulnerable to severe clinical illness and complications from malaria infection (Wanjala&Kweka, 2016). The proportion of asymptomatic individuals is usually lower in highlands than in high-transmission areas where there is small among-season variation in malaria prevalence and parasite densities Thus, a small increase in the abundance of vectors may lead to a significant malaria outbreak in the highlands.

Geographical differences in availability of breeding sites and housing conditions may also affect the distribution of malaria within an area, and may explain the existence of hotspots

where malaria control has been relatively successful (Moise et al, 2016). Identification of such areas may help in targeting specific interventions in areas where transmission is still intense. Although the same township or district can have the same geographical/climatic characteristics, distribution of malaria within the district can be vary since there are other factors such as presence of seasonal water bodies, housing condition, population and waste water disposal system. These factors can result into different distribution of malaria within a district.

2.4. Socio-demographic factors associated with malaria

Despite the climatic factors that favour transmission, malaria transmission is also determined by the socioeconomic conditions and knowledge of and access to malaria prevention tools as well as the healthcare services. Various socio-demographic factors, such as parents' education levels and occupation, use of personal protective measures, ethnic groups and family living standards are important risk factors for malaria transmission and epidemics. Knowledge of malaria and socio-economic upliftment are key factors in adopting the appropriate intervention strategies. Keeping in mind that there is a large number of risk factors that influence vulnerability to malaria including proper knowledge about malaria transmission and prevention, demography and socio-economic status of different population groups(Yadav, Dhiman, Rabha, Saikia, & Veer, 2014).

In Africa, malaria transmission is comparatively higher among the rural setting than urban areas which may be because of the higher vector density, lower housing quality, and the poor drainage systems in rural settings(Sultana et al., 2017). Also; sex, age, ownership of mosquito net, season and altitude were significantly associated with malaria infection(Selemani et al., 2015).The people living in malaria endemic countries are faced with many other problems, such as hunger, poverty and other diseases; and may direct their efforts to eliminate poverty and hunger, rather than malaria. Therefore, in addition to strengthening the healthcare system, the success of malaria control depends significantly upon the knowledge and socio-economic status of the affected populations in the malaria endemic countries. Malaria is frequently referred to as a disease of the poor and the economic status of populations at risk has proved to

be a great challenge in malaria control programmes. Malaria-associated morbidity and the cost of treatment are important burdens, and create barriers for the overall social and economic development(Yadav et al., 2014). Although these socio-demographic factors such as high parents' education levels, occupation and use of personal protective measures are important factors that can help to reduce malaria transmission and epidemics but children can have malaria since parents/guardians can have less time to take care of their children against mosquito bite.

3. METHODOLOGY

3.1. Study Area

The study was conducted at Nachingwea district hospital located in Nachingwea district, Lindi Region in southern Tanzania. The district lies between latitude 10°23′South and longitude 38°46′East. The district has a total area of 6120 square kilometres, a population of 178,464 and the average households size is 3.4 (NBS, 2012).

There are 36 wards in Nachingwea district and Nambambo is the ward where the hospital is located. Study participants were from four different wards which are: Nambambo, Boma, Kilimanihewa and Ugawaji with different physical factors. Nambambo and Kilimanihewa wards are characterised with seasonal rivers, streams and ponds with poor waste water systems. These form breeding sites for mosquitoes and so increase their population hence, the chance to transmit malaria. The other two wards; Boma and Ugawaji are characterised by dry areas with few seasonal water bodies such as rivers and ponds.

Most of the district is characterized by flatlands with seasonal ponds and rivers, only two wards; Kilimarondo and Ruponda are characterised by hills. The climate is tropical and the average annual rainfall is 905 mm. The mean annual temperature is 24ºC. It experiences two rain seasons; heavy rainfall from February to April and short rain season between November and January which forms seasonal rivers and ponds, and the presence of poor drainage systems creates small temporary water bodies favouring mosquito breeding. Also the presence of geographical differences within a district such as hills, flatlands and lowlands may contribute to differences in mosquito breeding and hence malaria infection.

Nachingwea district hospital serves as the referral hospital of the district which has two (2) health centres and 38 dispensaries. It offers outpatient and inpatient services with 188 beds, as well as diagnostic services, blood transfusion, surgical services and Reproductive and child health services. The mode of health service delivery is based on curative, preventive and promotive health care and rehabilitative services. In these health facilities malaria is among

the top ten diseases in under-five children, and the rest are diarrhoea, pneumonia, urinary tract infection, intestinal worms, skin diseases and dental conditions.

3.2. Study design

A cross sectional study design was used to determine the prevalence of malaria and associated factors among under-five children attending RCH clinic at Nachingwea district hospital.

3.3. Study population

The study population comprised all children attended RCH clinic at Nachingwea District hospital from September to October 2018.

3.4. Sample size estimation

The estimated sample size N, was computed using the formula below:

$$N = \frac{Z^2 p (1-p)}{e^2}$$

Where;

N = Estimated Sample Size

Z = is the standard deviation in normal population, which turns out to be 1.96 on using the 95% confidence interval.

P= Prevalence value, 7.3% from the 2017 Tanzania Malaria Indicator Survey (2017)

e= margin of error

Therefore, sample size,

$$N = \frac{(1.96)2 \times 0.073 \times (1-0.073)}{(0.05)2} = 244 \text{ participants}$$

Adding 10% for non-response (24.4) = 268.4

N=269 participants.

3.5. Selection criteria

The Inclusion criteria;

- Under five children attending RCH clinic at the Nachingwea district hospital with parental consent.

The exclusion criteria will be;

- Children attending RCH clinic and are under malaria treatment.

3.6. Sampling technique

Sampling was done consecutively until required sample size was obtained.

3.7. Data collection and management

3.7.1. Data Collection

Training of Research assistants for two days (two laboratory technicians) was done to familiarise them on how to test for malaria using MRDT and microscopy and on filling the data collection form two days before the activity. The study instruments were pretested before the study activity, pilot cases were done on the day of training; five collected data performed by the principle investigator and the remaining five by assistants. The data generated were used to test and refine the study data compilation sheet. During data collection, the principal investigator assessed the completed datasheets to check for completeness or omissions. This helped to ensure good quality of data collection. All the completed data sheets were stored in safe cabinet with limited access so as to maintain confidentiality.

3.7.2. Blood sample collection

Blood samples were collected from a finger prick for laboratory analysis, which included thick blood smears for microscopy and RDT performance.

3.7.3. Laboratory analysis

Microscopy and RDT were used to detect presence of malaria parasites. Giemsa-stained (10%Giemsa stain) thick blood smears were used for microscopy. Thick blood films were prepared on a glass slide using 10μL of blood, evenly spread to cover an area of 15 × 15 mm of the slide. The smear was stained with 10% Giemsa for 10 minutes and then examined under oil immersion with a light microscope (magnification × 1000), and 100 microscopic fields were examined in the thick smear before concluding that the blood slide was negative. When found positive, the number of parasites per 200 white blood cells was recorded (quantification of parasites). Rapid diagnostic tests were also performed. In this study, SD Bioline Malaria Antigen P.f/Pan detecting HRP2 RDTs (Lot number 090385) were used. The tests were

performed according to manufacturer's instructions, and results were recorded as positive or negative**.**

3.8. Study variables

3.8.1. Dependent variables;

-Malaria infection and ITN use

3.8.2. Independent variables

-Age and sex of child/parent/guardian, education, occupation and residential location

3.9. Data analysis

After completing data collection activity, data entry and analysis were done using SPSS version 20 software. Analysis was done according to the study objectives. Then the findings from the study were presented as frequencies and percentages in tables in relation to the research objectives and variables. It was not possible to determine the association between malaria and studied variables (by using Chi-square, bivariate and multivariate analysis) due to the small number of children positive for malaria.

3.10. ETHICAL CONSIDERATION

Ethical clearance to conduct the study was obtained from Muhimbili University of Health and Allied Sciences Ethical Review Board. Permission to do the study at Nachingwea District Hospital was obtained from the District Executive Director – Nachingwea and District Medical Officer. Permission to include the children in the study was also requested from parents/guardians of the children. Although patient names were recorded on the data compilation forms, they were only used for follow-up for those who were diagnosed as positive for malaria so that they could get treatment. There were minimal risks to study participants, which is a slight pain from the finger prick, but more benefits to the patients as they knew their malaria infection status and got treatment

4. RESULTS

4.1. Demographic characteristics of study population

A total of 269 children participated in this study, of whom 122(45.35%) were males and 147(54.65%) were females. The mean age of the children was one year and four months old, and the age ranged from four months to five years old. The majority of parents/guardians (245) were in the informal sector (236 farmers, 5 tailors and 4 had no specific jobs), while the rest (24) were in the formal sector (13 involved in business, 6teachers and 5 health workers). Concerning guardians/parents education levels, 197(73.2%) were having primary or no formal education, while the rest had secondary or higher level of education. Use of ITNs was reported by the majority (92.6%) of the participants.

Table 1: Socio - demographic characteristics of study participants

Socio-demographic characteristics	N (%)
Age groups (months)	
0 to 11	138(51.3)
12 to 35	105(39.0)
36 to 59	26(9.7)
Sex	
Male	122(45.35)
Female	147(54.65)
Residence (Wards)	
Nambambo	46(17.1)
Ugawaji	100(37.2)
Boma	89(33.1)
Kilimanihewa	34(12.6)
Use of ITN	
Used	249(92.6)
Not used	20(7.4)
Occupation	
Formal	24(8.9)
Non formal	245(91.1)
Guardian/Parent education level	
Primary education and Non-formal	197(73.2)
Secondary education and above	72(26.8)

4.2. Prevalence of malaria among under five children attending RCH clinic in Nachingwea district hospital

Of the 269 children examined, only two (0.7%) were found to be positive by both mRDT and microscopy, and with high parasite counts (>3800 parasites/200 wbc). The children, one male from Nambambo ward aged four and six months years and another child was female from Boma ward age done year and one month. Both from parents/guardians engaging in non-formal activities and have no formal education but also reported to use INTs.

4.3. Relationship between ITN use and malaria infection among under-fives.

Almost all children (92.6%) were reported to use ITN, while only 7.4% were not using them. The two infected children were reported to use ITNs as shown in table 3 below.

Table 2: Relationship between ITN use and malaria infection among underfives

Use of ITN	Malaria MRDT Negative N (%)	Malaria MRDT Positive PF/PANN (%)	Total N (%)
No	20(100)	0(0.0)	20(7.4%)
Yes	247(99.2)	2(0.8)	249(92.6%)
Total	267(99.3)	2(0.7)	269(100%)

4.4. Relationship between parents/guardians occupations and malaria infection among under-fives

In this study, parents/guardians occupations were grouped into formal and non-formal activities. Those with formal activities (business, teachers and health workers) were 24(8.9%) while those with non-formal activities (farmers and tailors) were 247(91.1%).The two(0.7%) children diagnosed with malaria had parents/guardians with non-formal activities, both engaging in small scale farming.

4.5. Relationship between Parent/guardian education levels with malaria infection among under-fives.

Most of the parents/guardians were having primary education and non-formal education 197(73.2%), compared to 72(26.8%) with formal education (secondary education and above). The two out of 197 children with malaria infection were from parents/guardians with no formal and primary education group.

4.6. Geographical distribution of malaria infection among the Wards in Nachingwea District.

Under five children enrolled in this study came from four wards which are Boma (33.1%), Kilimanihewa (12.6%), Nambambo (17.1%) and Ugawaji (37.2%).Among the two (0.7%) children with malaria positive, one was from Bomaand one from Nambambo wards. No children were diagnosed positive in Kilimanihewa and Ugawaji wards.

5. DISCUSSION

This study was conducted to determine the prevalence and factors associated malaria among under five children attending Reproductive and child health clinicat Nachingwea district Hospital.

The study found a low prevalence of malaria (0.7%) among the study participants. The low prevalence of malaria can be due to high response to ITN use (92.6%) which are distributed freely to the parents/guardians by the government. Also the study was conducted during the dry season which has few breeding sites and so lowers mosquito population. This is much lower than the previously reported level (12%) at the Nyasa Health Centre located in Nzega District(Mazigo et al., 2011), and 6% reported in Pakistan (Hozhabri et al,.2002).The studies were conducted in the same dry season (August to October), but high prevalence could be due to the fact that the study was conducted among children with fever or history of fever.

Due to the small number of children found positive for malaria (2) in this study, we could not establish an association between prevalence of malaria with age and sex of children since only two (2) children one of each sex out of 269 participants were positive.

Previous studies have found an association between age and malaria infection even among underfives. The study done by Zgambo et al revealed that older children under the age of five years were more likely to test positive for malaria parasites compared to younger children(Zgambo, Mbakaya, & Kalembo, 2017). Normally, the child's care pattern is that younger children (0 to 11 month) are given more priority and are in the total care of their mothers or guardian whereas older children spend more time in the evening playing with siblings before going to bed, and in the process they are bitten by mosquitoes. At night they may move close to the edge of the net and are susceptible to mosquito bites. Younger children normally share the same bed with their mothers; as such they are properly covered under the mosquito net at night. A study conducted in Uganda showed that children who share a bed with their mothers were 21 times more likely to use the mosquito nets compared to those who did not(Shakely et al., 2013).

Our study did not establish an association between malaria infection and sex of the child. Aprevious study conducted by Nyarko and Cobblah in Ghana reported a higher incidence of malaria among males than females(Nyarko & Cobblah, 2014). It is possible that boys and girls are vulnerable to malaria in different ways that are shaped by their behavioural and socially determined roles within their communities and families. A previous study in Muheza district showed a contrasting, though non-significant, reduced risk of malaria in male children (Win skill et al., 2011).

In this study, the association between malaria infection in children and the occupation of the parent or guardian could not be establish. However, parent/ guardian who is a farmer or engaged in on formal activities may have lower education and be busy with activities that bring low income to the family. Therefore, they may not be well informed and cannot afford to protect the child from getting malaria. One possible reason would be that household socio-economic status plays an important role in the prevention and management of illnesses because individuals with higher income have more resources to afford preventive measures and access health care on time(Kweku et al., 2017).These parents/guardians also spend much time in their activities and have little time to take care of their children, including protecting them from mosquito. Also while spending the whole day in their activities they miss important information regarding malaria and child health which could help them to protect their children against malaria. In other hands, those with formal activities have good access to health information regarding malaria and child health which helps them to take care of good care of their children and protect them from malaria.

The association between education of parents/guardians and malaria infection in children could not be determined in this study. Other studies have reported that educational level of an individual particularly that of a child's caregiver is an important risk factor of malaria. It is assumed that more educated individuals have a better understanding of health-related issues. In regards to malaria, compared to children who had caregivers with a secondary education, those with caregivers who had lower levels of education or no education were most at risk(Kweku et al., 2017).High ITN use in the community contributes to a community

protective effect so that people who do not use ITNs are also protected from malaria. ITNs are one of the main interventions recommended by the WHO Global Malaria Programme for malaria control. In this study, a large majority of children were reported to use ITNs, and there was no association between ITN use and malaria infection among young children, as the 2 children diagnosed to be malaria positive were reported to use ITNs. Previous studies identified two main reasons that may undermine the protection offered by ITN use. First, the ITNs used may have lost their insecticidal protection, making the nets less efficient; second, some users may not place the net correctly due to the perceived heat increase and fear of suffocation that come with the use of ITNs(Kweku et al., 2017).

STRENGTH OF STUDY

The strength of this study lies in the fact that the study assessed malaria prevalence among children attending the RCH clinic, where both asymptomatic and symptomatic children could be found. Both MRDT and microscopy method were used to diagnose malaria and gave similar results.

LIMITATIONS OF THE STUDY

In this study, the children under five who participated in the study were found at the RCH clinic at Nachingwea district hospital. This might be a select group of children from health conscious parents. The low prevalence observed in this study may not be a true representation of prevalence of malaria in all the children under five in the district. The low prevalence observed in this study did not allow for determination of association of malaria and factors that have been found to be associated with it in other areas.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. CONCLUSIONS

A low prevalence of malaria infection was found among children under five years of age attending the RCH clinic at Nachingwea District hospital. The significantly low prevalence of malaria in this study can be due to the reported high proportion of ITN use among under five children in Nachingwea district. The low prevalence could also be due to the fact that this study was conducted during dry season which does not support mosquito growth and hence lower malaria infection. The geographical distribution of malaria in Nachingwea district was almost the same since only 0.7% diagnosed with positive malaria. However, since under five children are the most affected group with malaria than any other group, it is important to take into consideration the socio- demographic factors that are normally associated with malaria prevalence among under five aged children when planning or implementing malaria control interventions.

6.2. RECOMMENDATIONS

1. Investigations of malaria prevalence amongst under five children should be conducted during the high transmission season as well to establish whether there is seasonal transmission of malaria
2. Despite the low prevalence of malaria detected among under-fives in this study, health education should continue to be provided to parents/guardians on malaria prevention as the source of infection (positive cases) still exists in the community.
3. The government should continue with free distribution of ITNs especially in rural areas/districts where the socio-economic status of families it low, and educate parents/guardians on proper use of ITNs.

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8. APPENDICES

8.1. Appendix I: CONSENT FORM (ENGLISH VERSION)

ID no…….

Consent to participate in the study on the prevalence of malaria and associated factors among under-five children attending RCH clinic at Nachingwea District Hospital.

Greetings! My name is Walemba Livigha, postgraduate student at MUHAS, investigating on prevalence of malaria among under-five children attending RCH clinic at Nachingwea District Hospital.

The purpose of the study: To determine prevalence of malaria among under-five children attending RCH clinic at Nachingwea District Hospital.

What participation involves:

If you agree to participate in the study, you will be interviewed, and your child will be tested for malaria

Confidentiality:

All information collected on the data collection form and malaria test result will be entered into computer with special identification number and handled with greater secrecy in order to maintain confidentiality.

Risks: There is no risk associated with this study.

Right to withdraw and alternatives: Taking part in this study is completely a voluntary choice. If you choose not to participate in the study, you will continue to receive all services that are normally provided in the hospital.

Benefits: If you agree to take part in this study, there will be no direct benefits to you. However the overall study will be of benefit to other persons now and in the future.

In case of any injury: We do not expect any harm as blood sample is going to be collected by finger prick.

Whom to contact: If you have any question about the study or in case of further information, you can contact Walemba Livigha phone number 0719968300. If you have questions about your rights as a participant you may contact my supervisor Dr Marycelina Mubi or Chairman of MUHAS Research and Publications Committee.

P.O.BOX 65001 Dar es Salaam. Tel 2150302-6

Do you agree?

Participant agrees…….. Participant does NOT agree……

I ……have read and understood the content of this form. My questions have been answered and I voluntarily agreed to participate in this study.

Signature of participant…….

Signature of witness…… Date of signed consent…….

8.2. APPENDIX II: FOMU YA RIDHAA (KISWAHILI VERSION)

Namba ya usaili …….

Maambukizi ya malaria kwa watoto wenye umriwa miaka chini ya mitano wanaohudhuria kliniki ya afya ya uzazi na mtoto katika hospitali ya wilaya ya Nachingwea

Salaam! Jina langu ni Walemba Livigha, natokea Chuo Kikuu Cha Sayansi za Afya na Tiba-Muhimbili. Nafanya Utafiti kuhusu uwepo wa maambukizi ya malaria kwa watoto wenye umri wa miaka chini ya mitano wanaohudhuria kliniki ya afya ya uzazi na mtoto katika hospitali ya wilaya ya Nachingwea.

Madhumuni ya Utafiti huu

Madhumuni ya utafit huu ni kufahamu uwepo wa mambukizi ya malaria kwa watoto wenye umri wa miaka chini ya mitano wanaohudhuria kliniki ya afya ya uzazi na mtoto katika hospitali ya wilaya ya Nachingwea

Jinsi ya kushiriki

Kama utakubali kushiriki, utaulizwa maswali yanayohusian ana malaria wewe na mtoto

Utunzaji wa siri

Taarifa zote za mzazi /mlezina mtoto zitatunzwa kwa siri katika kompyuta

Madhara /Athari

Hakuna madhara au athari yoyote inayotegemewa kutokea kutokana na ushiriki wako katika uatafiti huu.

Uhuru wakushirirki

Una uhuru wa kushiriki au kutoshiriki kwenye Utafiti huu, pia unaweza kujitoa wakati wowote. Kama utachagua kutoshiriki, utaendelea kupata huduma zote unazostahili katika hospitali hii kama kawaida.

Faida ya utafiti

Kama utakubali kushiriki katika utafiti huu na endapo mtoto atagundulika kuwa na malaria, atapatiwa rufaa kwenda kuonana na wataalamu wa afya ili mtoto aweze kupatiwa matibabu . Matokeo ya utafiti huu pia yatasaidia kupanga na kuboresha matibabu ya watoto wengineambao hawajashiriki utafiti huu,kwa sasa na baadaye.

Taarifa:

Endapo unahitaji kupata maelezo kuhusu haki zako au taarifa zaidi ,wasiliana na Walemba Livigha, Mtafiti, kupitia namba ya simu 0719968300 au Dr MarycelinaMubi au Mwenyekiti wa Kamati ya Utafiti, MUHAS S.L.P 651001,Dar es salaam, Simu 2150302-6

Je unakubali kushiriki kwenye utafiti? weka alama ya vema(√)

Ndiyo..... hapana.....

Mimi ....., nimeelezwa na nimesoma maelezo haya hapo juu na kuyaelewa na Ninakubali kwa hiari yangu,mimi na mtoto kushiriki kwenye utafiti huu.

Sahihi ya Mzazi/Mlezi wa mtoto.....

Sahihi ya ndugu/shahidi .....

Sahihi ya Mtafiti .....Tarehe……

8.3. APPENDIX III: DATA COLLECTION FORM

DATE OF DATA COLLECTION…… COLLECTED BY……..... DESIGNATION ……..

PT.NO:	NAME	AGE	SEX	ADDRESS	USE OF ITN	MALARIA MRDT POS/NEG	BSRESULT	OCCUPATION	GUARDIAN/PARENT EDUCATION LEVEL
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

8.4 Appendix: IV: Ethical Clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
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MPH-Distance Learning
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "PREVALENCE OF MALARIA AND ASSOCIATED FACTORS AMONG UNDERFIVE CHILDREN ATETNDING REPRODUCTION AND CHILD HEALTH CLINIC AT NACHINGWEA DISTRICT HOSPITAL"

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 19th September, 2018 to 18th September, 2019. In case you do not complete data analysis and dissertation report writing by 18th September, 2019, you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

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

8.5 APPENDIX V: INTORDUCTION LETTER

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/T.4922015

20th September, 2018

District Medical Officer
Nachingwea District Hospital
NACHINGWEA.

Re: INTRODUCTION LETTER

The bearer of this letter Mr. Walemba K. Livigha is a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MPH-Distance Learning.

As part of his studies he intends to do a study titled:"***Prevalence of malaria and associated factors among underfive children attending Reporudction and Child Health clinic at Nachingwea District Hospital ".***

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of his research.

We thank you for your cooperation.

Kamby

Ms. S. Kamby
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Public Health and Social Sciences
cc: Mr. Walemba K. Livigha

8.6 APPENDIX VI: INTRODUCTION LETTER 2

HALMASHAURI YA WILAYA YA NACHINGWEA

(Barua zote zitumwe kwa Mkurugenzi Mtendaji Wilaya)

MKOA WA LINDI:
Simu: 0732 - 933112
Nukushi: 0732 - 933112
Baruapepe:dednachingwea@lindi.go.tz

S.LP. 291
NACHINGWEA

LG.E.10/50/WL X/111 **27/09/2018**

MKUU WA IDARA YA AFYA,
S.L.P. 291,
NACHINGWEA.

YAH: UTAMBULISHO WA NDUGU WALEMBA K. LIVIGHA

Husika na mada tajwa hapo juu,

Mtajwa hapo juu ni mwanafunzi wa Chuo Kikuu cha Tiba na Sayansi Shirikishi Muhimbili (MUHAS) ambaye anasoma shahada ya Uzamili (MPH – Distance Learning)

Namtambulisha kwako kwa ajili ya utafiti wake na apewe ushirikiano..

B. Yongwa
KNY; MKURUGENZI MTENDAJI (W)
NACHINGWEA.

KNY: MKURUGENZI MTENDAJI (W)
NACHINGWEA

NAKALA:
- Walemba K. Livigha