CONTRIBUTION OF LARVICIDING AND FACTORS AFFECTING ITS IMPLEMENTATION IN REDUCING MALARIA BURDEN AMONG SCHOOL AGE CHILDREN IN TANGA REGION

Chelu Beatrice Mkombo (BHSM)

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By

Chelu Beatrice Mkombo

A Dissertation Submitted in (partial) Fulfilment of the Requirements for the Degree of Master of Public Health Implementation Science of Muhimbili University of Health and Allied Sciences

October, 2024

CERTIFICATION

The undersigned, certify that they have read and recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled ***contribution of Larviciding and factors affecting its implementation in reducing Malaria burden among school-age children in the Tanga region*** in (Partial) fulfillment of the requirements for the degree of the Master of Public Health-Implementation Science of Muhimbili University of Health and Allied Sciences.

_____

Prof. Billy Ngassala

(Supervisor)

_____

Date

_____

Dr. Candida Moshiro

(Co – Supervisor)

_____

Date

_____

Dr. Idda H. Mosha

(Co – Supervisor)

_____

Date

DECLARATION OF COPYRIGHT

I, **Chelu Beatrice Mkombo**, declare that this dissertation is my 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 would like to thank management and Employees of Tanga City Council and Mr Frank Chacky from National Malaria Control Program for their collaboration in Data preparation for my study.

DEDICATION

"I dedicate this dissertation to the precious gift I have ever received from God, my Children, Gama, Lau and Ema. I love you"

ABSTRACT

Background: The World Malaria Report of 2022 reported an estimated 247 million cases of Malaria, a 2 million increase from 2020. Tanzania is one of the top ten African countries responsible for approximately sixty-six percent of the world's Malaria cases. WHO recommends an integrated approach in the control and elimination efforts of Malaria including vector control using Larviciding. In Tanzania, the government began promoting Larviciding in the early 2000s after it was successful in Dar es Salaam.

Objective: To assess the contribution of Larviciding in reducing Malaria burden among school-age children and to explore factors affecting its implementation in Tanga Region.

Method: A Mixed triangulation study with a convergence model was applied where a cross-sectional case study was conducted together with a phenomenological study. In a cross-sectional study, secondary data from the National School Malaria Parasitaemia Survey of 2015 – 2023 was used to examine the trend of Malaria infection in Muheza District Council (No Larviciding) and Tanga City Council (Larviciding). In a phenomenological study, in-depth interviews were employed to gather information on the factors affecting the implementation of Larviciding. Qualitative data was analyzed manually. Data analysis was done by using a thematic approach.

Results: The trend of Malaria is declining from 2015 to 2023 for both districts, however, the decline is gradual and steady in Tanga CC, and the Malaria burden in prevalence is lower in Tanga CC by 6.5 %. The factors found affecting the intervention of Larviciding were few community volunteers, pungent smell of the larvicides, lack of transportation for the activity, inaccessibility of some very big breeding sites with long grasses, environmental challenges such as climatic changes in rainy seasons, insufficient incentives to community volunteers, volunteers resigning after they being trained and climatic changes.

Conclusion and recommendation: There is a significant contribution of Larviciding in the reduction of the Malaria burden among school-age children. Adding more Malaria prevention interventions to this age group of school-age children will be of importance in reducing the Malaria burden to this specific age group.

TABLE OF CONTENT

CERTIFICATION i
DECLARATION OF COPYRIGHT ii
ACKNOWLEDGEMENT iii
DEDICATION iv
ABSTRACT v
LIST OF TABLES x
LIST OF FIGURES x
ABBREVIATIONS xi
DEFINITIONS OF KEY TERMS xii
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Problem statement 4
1.3 Conceptual Framework 5
1.4 Rationale 6
1.5 Research questions 7
1.5.1 Main research question 7
1.5.2 Specific Research Questions 7
1.6 Objective of the study 7
1.6.1 Main objective 7
1.6.2 Specific objectives: 7
CHAPTER TWO 8
2.0 LITERATURE REVIEW 8

2. 1 Malaria trend among school-age children 8
2.3 Effects of Larviciding 9
2.4 Implementation process 9
2.5 Factors influencing Larviciding 10
CHAPTER THREE 11
3.0 MATERIAL AND METHODS 11
3.1 Study area 11
3:2 Intervention Descriptions 12
3.3 Quantitative part 12
3.3.1 Study design 12
3.3.2 Target and study population 12
3.3.3 Sampling technique and Sample size 13
3.3.4 Variables 14
3.3.5 Dependent variable 14
3.3.6 Independent variables 14
3.3.7 Data collection tools and procedure 14
3.3.8 Data Quality Control 14
3.3.9 Data analysis 14
3.4 Qualitative component 15
3.4.1 Study design 15
3.4.2 Target and study population. 15
3.4.3 Sampling technique and sample size 15
3.4.4 Data quality control 15
3.4.5 Data Collection Procedures 16

3.4.6 Data analysis 17
3.5 Ethical issues 17
CHAPTER FOUR 18
4.0 RESULTS 18
4.1 Quantitative Results 18
4.1.1 Demographic characteristics 18
4.2 QUALITATIVE FINDINGS 21
4.2.1. Characteristics of the Participants 21
4.2.2 Malaria and Larviciding overview 23
4.2.3 Larviciding intervention in the community 23
4.2.4 Monitoring and evaluation of the intervention 25
4.3 Integrated Findings 25
CHAPTER FIVE 26
5.0 DISCUSSION 26
5.1. Malaria trend 26
5.2. Characteristics of Malaria Trend 27
5.3. Malaria and Larviciding Overview 27
5.4 Larviciding intervention in the community 28
5.5. Monitoring and evaluation 30
5.6 Study limitations and mitigation 30
CHAPTER SIX 32
6.0 CONCLUSION AND RECOMMENDATIONS 32
6.1 Conclusion 32
6.2 Recommendations 33

6.2.1 Including school aged children in the category of vulnerable age group.....33

6.2.2 A Call for More Research 33

6.2.3 In-cooperating Community health workers in the program 33

6.2.4 Shifting financial costs to Health facilities 33

REFERENCES 34

APPENDICES 39

Appendix I: In-Depth Interview Guide for Malaria Focal Person and Health Officer (English Version) 39

Appendix II: Muongozo Wa Mahojiano Ya Kina Kwa Mratibu Wa Malaria/Afisa Afya 42

Appendix III: In-Depth Interview Guide for A Community Member/Community Leader (English Version) 44

Appendix IV: Muongozo Wa Mahojiano Ya Kina Kwa Mwanajamii/ Kiongozi Wa Jamii .46

Appendix V: Consent Form 48

Appendix VI: Fomu Ya Ridhaa Ya Kushiriki Kwenye Utafiti 50

Appendix VII Ethical Letter 52

Appendix VIII: Permission Letter From Tanga City Council 54

LIST OF TABLES

Table 1: Number of children enrolled in surveys in each year in respective districts.....13

Table 2: Distribution of study participants.....19

Table 3: Characteristics of the Study Participants.....21

Table 4: Themes and Subthemes Determined in the Study.....22

LIST OF FIGURES

Figure 1: Conceptual framework for factors influencing implementation of Larviciding.....6

Figure 2:The trend of Malaria prevalence among school age children from 2015-2023 in Muheza DC and Tanga CC. 20

ABBREVIATIONS

ACT –	Artemisinin-based Combination Therapy
CC –	City Council
CHMT –	Council Health Management Team
CIs –	confidence intervals
CORPs –	Community-owned resource persons
DC –	District Council
GRAMMS -	Good Reporting of a Mixed Methods Study
IPT –	Intermittent Preventive treatment
IRS –	Indoor Residual Spray
ITNs –	Insecticide-treated nets
IVM –	Integrated Vector Management
KII –	Key Informant Interviews
LLINs –	Long Lasting Insecticides Nets
LSM –	Larval Source Management
MRDT –	Malaria Rapid Diagnostic Test
MUHAS –	Muhimbili University of Health and Allied Sciences
NMCP -	National Malaria Control Program
NMSPS -	National wide Malaria School Parasitaemia Survey
PO-RALG –	President's Office Regional Administrative and Local Governments
SSA –	Sub Saharan Africa
TBPL –	Tanzania Biotech Products Limited
WHO –	World Health Organization

DEFINITIONS OF KEY TERMS

Larviciding	The regular application of biological insecticides to water bodies
A school-age child	is a child aged 5 to 16 years in a public primary school
Malaria Burden	This refers to the overall impact of malaria on a population, including the number of malaria cases, mortality rates, economic impact, and the social and healthcare challenges associated with the disease.
Larval Source Management (LSM)	This is a method used to control malaria by targeting the aquatic habitats where mosquito larvae develop.
Malaria	A potentially life-threatening disease caused by parasites of the *Plasmodium* genus, transmitted to humans through the bites of infected *Anopheles* mosquitoes
Malaria Parasitaemia	The presence of malaria parasites in a person's blood, detectable through laboratory tests.
Parasitic Malaria	Refers to malaria infections caused by *Plasmodium* parasites
Anti-Malarial Therapy	Treatment protocols involving drugs specifically designed to target and eliminate *Plasmodium* parasites in humans.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

World Malaria Report of 2022 showed an estimated 247 million cases of Malaria were reported worldwide in 84 endemic countries in 2021, a 2 million increase from 2020. The report also showed that Africa has a greater crisis of Malaria than ever known before due to the COVID-19 pandemic (1). However, between 2000 and 2019, the trend of Malaria in Africa showed significant progress in lowering the burden of the disease. Case incidence, or cases per 1000 populations at risk, decreased from 368 to 222.9, and mortality rate, or deaths per 100,000 populations at risk, decreased from 149.6 to 56 (2).

Sixty-six percent of the world's Malaria cases are caused by Tanzania and nine other African nations. Over 50% (>339 million) of Africa's under-19 population is school-age, with 5 to 16-year-olds making up this age group. Malaria and anemia are major causes of this age group's cognitive development delays(3). The trend of Malaria infection in all age groups, when compared to the 625,000 deaths from Malaria in the first year of the COVID–19 pandemic, an estimated 619 000 deaths from Malaria occurred worldwide in 2021 (4).

From an ecological perspective, the available options for controlling Malaria vectors can be divided into the following categories: First, methods that target reducing vector density, whereby Larval Source Management (environmental modification, manipulation, Larviciding, biological control) and space-spraying insecticides are the two techniques that fall under this category. Larviciding is one of the methods of Larval Source Management (LSM), along with habitat modification, habitat manipulation, and biological control. Larviciding is the application of biological or chemical insecticides that kill mosquito larvae. (5) Second, strategy to lessen contact between humans and vectors. There are techniques in this category, all of which use Long Lasting Insecticide Treated Nets (LLINs), utilizing repellents, fumigant insecticide dispensers, and screening windows, eaves, and doors. Third, techniques meant to raise adult

vector death. This category includes two methods: community-wide use of insecticide-treated nets and indoor Residual House Spraying (IRS)(6).

The World Health Organization (WHO) released a position statement on Larviciding in 2012, advising that it be used as a helpful assistant to core interventions, but only in a few designated areas. Therefore, Larviciding may be appropriate as an addition to core therapies for selected clearly defined habitats(7). The control of aquatic habitats, or water bodies, that may serve as mosquito larval homes to halt the development of the immature stages is known as Larval Source Management (LSM) (8)(9). Recently the use of larvicides has become more popular due to its characteristic of being nature-friendly compared to other Malaria interventions. Larviciding is a good way to manage mosquito vectors that feed outside (exophagic) and rest outside (exophilic) in crowded areas where breeding sites are marked, simple to locate, and easily accessible(10).

In Africa, Larviciding might be a practical alternative for integrated vector control. Understanding the impact of larvicides on the Malaria burden is very important in understanding what measures should be taken on board as interventions that involve Malaria vector control through larvicides (11). Studies have indicated that incorporating larviciding into current control programs may reawaken the enormous potential for the control of a wide range of vector-borne diseases. Other than those research, sub-Saharan Africa lacks regular LSM implementation, which results in a dearth of information on the costs and advantages of the practice on a broad scale(12). Some African nations have developed innovative larvicide products and delivery methods, however, breeding site mapping is clearly needed to be improved. Accurate and timely spatial intelligence regarding the location of potential breeding sites could completely change how LSM is conducted (13).

Malaria Vector control in Tanzania has gained momentum recently by using several interventions among which larvicides is included. According to Andria (16), the reproductive rate of Malaria Vectors is much higher in the absence of larvicides compared to when they are present. The Tanzanian government began promoting larviciding in all rural and urban councils across the country in the early 2000s after it was successfully introduced in Dar es Salaam. This

was done to supplement other numerous interventions that had been put into place years earlier (11). The intervention of LSM was done by applying weekly larvicides in areas that are open to the possibility of weekly Anopheles larvae production. Every three months, closed habitats which primarily yield Culex quinquefaciatus were treated. It should be highlighted, that monitoring or follow-up procedures were put in place for open habitats that were the main focus of the intervention (9).

School-age children are known to be the age group most frequently infected with parasitic Malaria (14). According to recent data from Tanzania national surveys of 2022, only 37% of feverish children seek medical attention from qualified professionals, and many times patients do not receive first-line anti-malarial therapy as required by national policy(15).

The prevalence of Malaria is higher in school-age children (5–16 years old) than in children under five, despite increased efforts to control the disease. Up to 70% of school-age children in high-transmission settings have Malaria parasitaemia, which greatly increases the reservoir for transmission (11). A survey measuring nutritional status, anemia, and Plasmodium infection was conducted among schoolchildren in 50 schools in the Zomba District of Malawi. In total, 60.0% of children had Plasmodium falciparum infections. The high Malaria burden emphasizes the necessity of treating Malaria in school-age children (16).

Due to Tanzania's policy of universal education, primary school students represent a proportion of the population that is both at risk of contracting Malaria and easily accessible for the implementation and monitoring of interventions, strengthening the data source for this age group. This study was conducted in the Tanga region due to the fact it is found in a moderate Malaria-risk stratum (17).

1.2 Problem statement

In high-transmission areas, up to 70% of school-age children are infected with Malaria parasites. A previous systematic review reported a prevalence of Malaria parasitemia among school-age children ranging from 18 to 83% at different time points across sixteen high transmission settings in sub-Saharan countries causing anemia and around 50% of their age-specific overall mortality, which in turn impairs the educational achievement of children (18). In Tanzania Malaria in school-age children had an overall prevalence of 21.6%, with variations between regions and councils of <0.1 to 53% and 0 to 76.4%, respectively. Among the 166 councils, 62 of the councils have a Malaria prevalence which was less than 5%, over 50% in 18 councils, and between 5 and 50% in the remaining councils (19). Most of these children show no symptoms at all, but between 13 and 50 percent of school absences are associated with Malaria. Thus, school-age children are important parasite reservoirs in the population's ongoing Malaria transmission, according to epidemiological research (11). Children in school (5–16 years old) have gotten less attention because their morbidity and incidence of severe outcomes are lower and less documented (20).

Malaria has significant negative effects on health, but it also has a significant financial cost to people, households, and the economy as a whole. In certain African nations, the disease Malaria has been shown to lower potential economic growth rates by 1.3% annually (21).

The current methods for controlling Malaria are necessary but insufficient to guarantee sustainable control; as a result, Larviciding may be necessary after other vector control interventions have reached the limits of their applicability. Therefore, data regarding the viability and efficacy of using bacterial larvicides to control mosquito populations is crucial for planning and carrying out larvae control programs that support adult mosquito-targeting interventions (22).

However, the uptake of these interventions varies in different countries. In Tanzania, the government began promoting larviciding in all rural and urban councils across the country in the early 2000s after it was successfully introduced in Dar es Salaam. There is limited information on the effectiveness of Larviciding and factors affecting its implementation in

different regions of Tanzania. This study seeks to examine the contribution of Larviciding on the Malaria burden and to explore factors affecting the implementation of Larviciding in the Tanga Region. According to the study by Dambach (23), the infrastructure and labor costs account for the majority of the costs associated with larviciding-based vector control programs, it may be advantageous for future research to examine the potential factors influencing larviciding interventions on private compounds, given that these areas serve as a variety of habitats for mosquito species that are relevant to disease.

1.3 Conceptual Framework

The Consolidated Framework for Implementation Research (CFIR) is a comprehensive framework designed to guide the systematic assessment and understanding of factors influencing the uptake and scale up of interventions in various settings. It provides a structured approach to investigating the implementation of policies, treatments, or procedures in communities or organizations. CFIR comprises five domains: Innovation domain, Outer setting domain, Inner setting domain, Individual domain, and implementation process domain.

The domains of the frame work applied are as follows;

- ✓ Outer setting referred to as external elements like the social, political, and economic environment. Environmental challenges were examined in this research.
- ✓ Inner setting which is the organizational elements that could affect how an intervention is implemented. One construct on available resources (financing and health personnel) was in the study.
- ✓ Individual characteristics represent the traits of the people who are participating in the intervention. Acceptability, knowledge about Larviciding and attitude towards Larviciding was assessed.

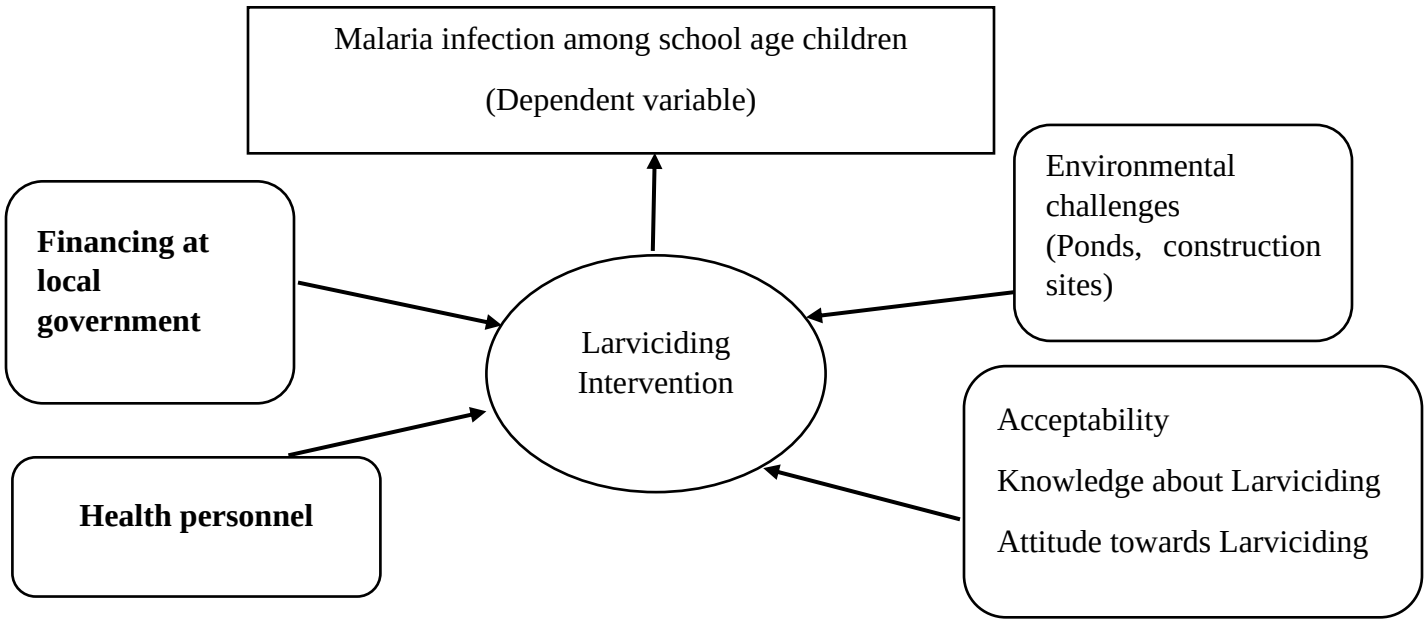


Figure 1: Conceptual framework for factors influencing implementation of Larviciding (24)

1.4 Rationale

This study will be a source of information on how Larviciding can be of importance in Malaria prevention programs hence reducing the Malaria burden among school-age children. This is to mean scaling up the intervention of Larviciding in the entire country and meet the goal of Malaria reduction.

The findings of the study shed light on the factors affecting the implementation of Larviciding. This would enable the strengthening of the existing strategies and the allocation of staff and resources for public health as well as the repurposing of prevention programs. Also, the study findings would create an opportunity for more research to be conducted to equip our national program with enough information concerning Malaria infection in this age group.

1.5 Research questions

1.5.1 Main research question

What is the contribution of Larviciding and factors affecting its implementation in reducing Malaria burden among school-age children in the Tanga region?

1.5.2 Specific Research Questions

i. What is the trend of Malaria burden among school-age children from 2015 to 2023 in Tanga CC compared to Muheza DC?
ii. What are the factors affecting Larviciding implementation in Tanga CC?

1.6 Objective of the study

1.6.1 Main objective

To assess the contribution of Larviciding and factors affecting its implementation in reducing Malaria burden among school-age children in Tanga CC.

1.6.2 Specific objectives:

1. To compare the trend of Malaria burden among school-age children from 2015 to 2023 in Tanga CC and Muheza DC.
2. To explore factors affecting Larviciding implementation in Tanga CC

CHAPTER TWO

2.0 LITERATURE REVIEW

This chapter elucidates detailed literature corresponding to the study objectives. It gives perspectives on the context of the matter of Malaria among school-age children and Larviciding intervention globally, regionally, and countrywide.

2. 1 Malaria trend among school-age children

Increases in access to malaria control interventions have led to notable drops in malaria-related morbidity and mortality during the past 15 years. Sub-Saharan African reports indicate that school-age children are more likely than younger children and adults to contract Plasmodium falciparum. In Africa, 200 million school-age children are susceptible to malaria, with over 50% of the continent's children suffering from the disease (12). Reduced cognitive function, anaemia, weakened health, and poorer academic performance are all linked to severe malaria infections. A significant source of the human-to-mosquito P falciparum infection that fuels malaria transmission and thwarts efforts to eradicate the disease is infections in school-age children. It is very necessary to implement novel interventions to both lessen the reservoir of P falciparum that is circulating in endemic communities and shield these children from the negative effects of P falciparum infection (22).

Research indicates that school-age children have the highest prevalence of Plasmodium infection. Despite this, these children are frequently the least likely to receive malaria interventions, making them an untreated reservoir for parasite transmission. Chronically infected children may experience various health and educational consequences due to the high rates of infection among school-age children (13). However, school-age children still bear an underappreciated burden of malaria in terms of detectable parasitemia and asymptomatic infections. Small-scale studies conducted to date on older children has yielded limited data, but it has indicated that adolescents bear a growing share of the malaria burden (16).

2.3 Effects of Larviciding

The use of Larviciding has been largely disregarded for the purpose of controlling Malaria in Sub-Saharan Africa (SSA), despite the established importance of larval control and the past effectiveness of such interventions. As an adjunct to core interventions (long-lasting insecticide-treated nets [LLINs] and Indoor Residual Spraying [IRS]) in settings where larval habitats are few, fixed, and findable, such as urban areas, desert fringes, high altitudes, and rural areas with high population densities, the World Health Organization (WHO) recommends Larviciding in settings with moderate to low transmission. As previously summarized, there has been mounting evidence over the past few decades that suggests controlling the larval source that is; applying larvicides may be able to reduce the density of mosquito vectors.

Depending on what works best in a given area, the WHO advises nations to use biological control methods like bioLarviciding or environmental modification and manipulation instead of insecticides or adult control methods like those used for adult control (8). The regular application of biological insecticides to water bodies, known as "bioLarviciding," is thought to be safe for human use to have minimal negative effects on the environment. It is effective in reducing the number of Malaria mosquitoes (12).

2.4 Implementation process

In the past decades, environmental management and larval control have been crucial to the eradication of malaria. Larviciding in particular has long been the go-to vector control method in the US and Europe, and it's still the main method in use today. It has been demonstrated that luring mosquito larvae to death and lowering adult populations is successful (25).

Larviciding has been implemented in other places in Africa (26)(12), where it has faced several challenges in the course of its implementation. Among many challenges found in studies done in Kenya and Burkina Faso (26)(12), are such as poor perception of the prevalence of Malaria; community members, limited awareness of the intervention; limited knowledge of Larviciding; low distribution and supply of larvicides; execution of Larviciding; absence of awareness about safety; insufficient financial support, insufficient availability of larvicides, some community

opposition, insufficient cooperation with non-governmental organizations, and insufficient involvement in the early stages among VSOs and ward health officers at the district level (17).

2.5 Factors influencing Larviciding

A number of things have led to a resurgence of interest in LSM. Firstly, it assists in reducing two of the primary issues that LLINs and IRS deal with, which are pesticide resistance and outdoor biting behavior. This is due to the fact that it attacks mosquitoes during their aquatic phases using physical or biological substances to which they are not anticipated to become resistant. Moreover, LSM has the potential to be extremely economical in urban environments, which makes it a desirable option given the rate at which sub-Saharan Africa is becoming more urbanized and the expansion of the invasive Anopheles stephensi species, which is thriving in urban environments, throughout Africa. Eventually, the detection and treatment of water bodies can be made easier by new technology like artificial intelligence and drones(12).

In fact, the percentage of water bodies that can be located and treated (intervention coverage) has a significant impact on the efficacy of LSM activities. Regrettably, operational challenges have hampered efforts to introduce LSM, and more especially larviciding, to sub-Saharan Africa, resulting in a lack of coverage and a poor reduction in mosquito populations (27).

CHAPTER THREE

3.0 MATERIAL AND METHODS

A Mixed triangulation study with convergence model was applied where a cross-sectional case study was conducted together with phenomenological study. Mixed study gives Comprehensive Understanding by giving a fuller picture of the situation providing measurable evidence of the effectiveness of larviciding as well as capturing factors affecting its implementation.
Meanwhile a complementary Insights may show the correlation between larviciding and Malaria reduction, and help explain why certain factors affect the success of the intervention. This provides a richer, more nuanced understanding of the context. Mixed methods is also ideal for informing about a practice, as it offer evidenced quantitative data while also highlighting practical challenges or enabling factors through qualitative insights. The reporting structure of this mixed study is adopted from GRAMMS framework (28).

3.1 Study area

The study was conducted in Tanga Region in Tanga City Council (CC) and Muheza District Council (DC) was the comparison group. Tanga region is among the coastal regions with the second large port, which makes it among the essential business centers in Tanzania. Both in total the two districts have a population of 631,689 people. Tanga region is among the regions which are categorized in the group of moderate Malaria transmission strata (19). The climate of the Tanga Region is a tropical Savanna. The annual precipitation level in the Tanga region ranges from 1,100 to 1,400 millimetres(19). Tanga city council where Larviciding is implemented have 27 administrative Wards. However, larviciding is implemented in selected wards where there are identified breeding sites for mosquitoes. The wards which larviciding is implemented within the program of the intervention are Duga, Masiwani, Pongwe, Tangasisi, Mabawa and Maweni(29).

3:2 Intervention Descriptions

The Tanga City Council is the location where volunteers from the community have been performing Larviciding from 2018 until the present year 2024. Larviciding is implemented using a community-based strategy in which local residents are trained and accountable for carrying out LSM implementation in their communities. A village executive officer and chairperson oversee the selection of two volunteers from each village. Within their individual wards, the ward executive officer and ward health officer oversee their daily operations. The activity at the council level is overseen by the district environmental officer, health officer, and Malaria focal person. Breeding sites are located and Larviciding is done in weekly basis in 8 consecutive weeks. The intervention is done in 3 rounds in a year during dry seasons at any point of time in the year. During the heavy rainfall Larviciding is not done so as to avoid the chemical from being flashed by rain. The type of Larviciding used is Bti and Bs which are manufactured from TBPL in Kibaha town, Coast region. This is the intervention characteristic of the CFIR framework where larviciding intervention is detailed in the context of Malaria prevention.

However, other Malaria prevention interventions in Tanga which are still ongoing are such as ITN for pregnant women and young children, IRS in selected areas, IPTP's for pregnant women and as well as Case management and diagnostics(21).

3.3 Quantitative part

3.3.1 Study design

This was a cross-sectional case study design. This involved a quantitative approach using secondary data from the repeated cross-sectional nationwide school Malaria parasitaemia surveys 2015, 2017,2019, 2021 and 2023 (30) (specific objectives 1) and a qualitative approach using a Phenomenological design in Tanga CC 2024 (specific objective 2).

3.3.2 Target and study population

The target population was all school age children 5-16 years from communities around the schools in Tanga CC and Muheza DC. The study population was all school children age between

5 and 16 years who were present during the day of the survey in the sampled public primary schools in Tanga CC and Muheza DC.

3.3.3 Sampling technique and Sample size

Data from the nationwide school Malaria parasitaemia survey database from National Malaria Control Program (NMCP) was used. The National School Malaria Parasitaemia surveys (NSMPS), coordinated by the National Malaria Control Program, are repeated cross-sectional surveys conducted among primary school children. The survey was designed to estimate the prevalence of Malaria among public primary school-enrolled pupils in each council. The first NSMPS was conducted between August 2014 and October 2015. The second, third, fourth, and fifth surveys were conducted in 2017, 2019, 2021, and 2023 respectively. The sample size was estimated at the council level to provide a plausible estimate of health indicators for each council. A three-stage cluster sampling was used to select representative schools and ultimately pupils for the survey.

In the first stage, wards were randomly selected from each stratum. The second stage involved random selection of one street/village hosting a school from selected wards. In case there was more than one school located in a village, one school was randomly selected. Proportionate stratification was used to obtain the actual number of children to be tested at each school. In each school, all seven primary school classes were included with an equal number of children in each class, balancing the sample for gender groups. Stage 3 involved random selection of pupils and from each selected school (22). Table 1 shows the number of primary school children enrolled in the two districts. Since data was extracted from the database, all enrolled children in each year were included in the study.

Table 1: Number of children enrolled in surveys in each year in respective districts

District	2015	2017	2019	2021	2023
Muheza DC	196	230	226	208	294
Tanga CC	367	363	280	293	322

3.3.4 Variables

3.3.5 Dependent variable

Malaria infection

3.3.6 Independent variables

The independent variables are as follows; Age, sex, year of the data collected, number of the people slept under net the night before data was collected.

3.3.7 Data collection tools and procedure

Five years (2015, 2017, 2019, 2021, 2023) records of data was extracted from Nationwide school Malaria parasitaemia survey in public primary schools' database of Tanzania which focused on Malaria RDT results, the use of mosquito net, history of fever and demographic characteristics. NSMPS Data from NMCP was transferred from Excel to SPSS for analysis.

3.3.8 Data Quality Control

The completeness of the nationwide school Malaria parasitaemia survey data was checked before data extraction to ensure the quality of data. Data was checked by the researcher by year from 2015 to 2023, for completeness of all variables required by the researcher.

Then, a data collection format sheet was prepared using Microsoft Excel and used for data extraction, where by variables named in 3.5 above were extracted. The overall process of data management was done by checking for accuracy, completeness, and consistency before analysis. Any data that was not properly documented and not completely registered was excluded from analysis

3.3.9 Data analysis

Extracted data from NMPS was analyzed using SPSS version 22. For specific objective 1, descriptive statistics was employed to calculate frequencies and percentages of Malaria infection in terms of years, gender, age and other variables. Findings were summarized using a table, and a bar chart.

3.4 Qualitative component

3.4.1 Study design

Phenomenology is applied to explore how individuals are experiencing factors affecting the process of larviciding and its perceived impact on reducing Malaria among school-age children.

3.4.2 Target and study population.

Included community leaders, community members, health officers and Malaria Focal Person in the intervention area (Tanga CC)

3.4.3 Sampling technique and sample size

The minimum sample size was 15 participants. The final sample size was based on the saturation principle (31) which states that data collection should end when the amount of information gathered has reached saturation that is the point at which new data no longer adds new insights to the study questions. Saturation is generally understood to mean that additional data collection and/or analysis is not required based on the data that have already been gathered or analyzed(13). An in-depth interview guide was employed to gather information on experiences, acceptance, and level of awareness. This capture the domain of CFIR named characteristics of an individual which highlight about how community members are experiencing the intervention facilitating and hindering factors.

A purposive sampling was done to get the key informants who was the Malaria focal person while a convenient sampling was employed to select community leaders, community members, WEO, Ward health officers and council's health officer who was a vector control coordinator.

3.4.4 Data quality control

Triangulation was done by using different sources of groups during interviews whereby there were WEO (ward executive officers), Health officers, community members who are volunteers in the intervention, and community members who are not volunteers

3.4.5 Data Collection Procedures

After the researcher was introduced by acting council executive director to the Malaria focal person, specific wards to conduct interviews were selected conveniently. Conveniently interviewees were followed in such specific wards where each day a maximum of four interviews were done. The investigator conducted the interviews. The participants' consent was obtained before the interviews were audio recorded. Interviews were taking place in the community focusing on whether the community is aware of ongoing Larviciding intervention, implementation challenges, facilitating factors, and how they are focusing on making the program sustainable. Every interview took place in Kiswahili and lasted for fifteen to sixty minutes.

Trustworthiness: To establish trustworthiness, the results were aligned with the data by making sure that a rigorous and methodical process was followed (32)(33).

Credibility: Triangulation was done by using different sources of groups during the interview whereby there were WEO (ward executive officers), Health officers, community members who are volunteers in the intervention, and community members who are not volunteers(34).

Dependability: Documenting the entire research process, including data collection, analysis techniques, and study decisions, was how the audit trail was accomplished. additionally, the researcher used the Code-Recode Strategy, which involved coding the same data at various points in time to ensure consistency (33).

Transferability: Selecting individuals or cases that were informative and pertinent to the research questions was done through purposeful sampling, which can aid in understanding the phenomenon as a whole. However, contextualization was taken into consideration by clearly articulating the particular context in which the study was conducted and assisting others in determining the applicability of the findings to various contexts (35).

Confirmability: This was done through audit trail and reflexivity whereby the principal researcher documented how data were collected, including interview guides, observation protocols, and any changes made during the process.

3.4.6 Data analysis

After the interview, the audio recordings of the key informant interviews were translated from Kiswahili to English and transcribed verbatim. The written transcripts were supplemented with field notes. Microsoft Word and Microsoft Excel were used for the analysis of the written transcripts. A thematic analysis approach was used to analyze data where coded items were categorized using both deductive and inductive coding methods (36). The inductive codes were produced after careful transcript reviews, and the deductive codes were developed using an in-depth interview guide. Emergent patterns were used to identify themes, and similar codes were grouped. Participants' direct quotes were used to bolster the themes.

3.5 Ethical issues

Ethical clearance Ref. No.DA.282/298/01.C/2318 (see appendix VII) was obtained from the Institutional Review Board (IRB) of MUHAS. Permission to access data from the National Malaria Parasitaemia Surveys was sought from the National Malaria Control Program, the custodian of the database. Data collection in Tanga CC was done after permission with the introduction letter Kumb. Na.TCC/CMOH/MR.10/42/105 (see appendix VIII) participants were given consent forms to sign. The consent explained how the study ensured safety, confidentiality, and anonymity. All respondents who were involved were given a detailed explanation of the survey (as explained in the information sheet) and informed consent was obtained before interview sessions.

CHAPTER FOUR

4.0 RESULTS

This chapter elaborates on the study findings on the analyzed contribution of Larviciding in reducing Malaria burden among school-age children in the Tanga region. Also, this chapter presents the findings on how and what factors are affecting the implementation of Larviciding intervention in the Tanga Region.

4.1 Quantitative Results

4.1.1 Demographic characteristics

During the years of the survey, 2023 had a higher percentage of participants compared to the rest of the years before. It is also observed that school children within the age group 9 – 12 occupied 53.7% of all participants during the survey from 2015 – 2023. Age and sex distribution were comparable between the two regions (Table 2).

Table 2: Distribution of study participants

Variables	Tanga CC		Muheza DC		Total	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Year						
2015	367	22.6	196	17.0	563	20.3
2017	363	22.3	230	19.9	593	21.3
2019	280	17.2	226	19.6	506	18.2
2021	293	18.1	207	18.0	501	18.0
2023	322	19.8	294	25.5	616	22.2
Age group						
5-8	368	22.8	238	20.9	606	22.0
9-12	853	52.9	624	54.8	1477	53.7
13-16	392	24.3	276	24.3	668	24.3
Sex						
male	808	49.7	582	50.5	1390	50.0
female	817	50.3	571	49.5	1388	50.0
Number of people slept under the net the night before the survey						
Yes	1597	98.3	1114	96.6	2712	97.6
No	28	1.7	39	3.4	67	2.4

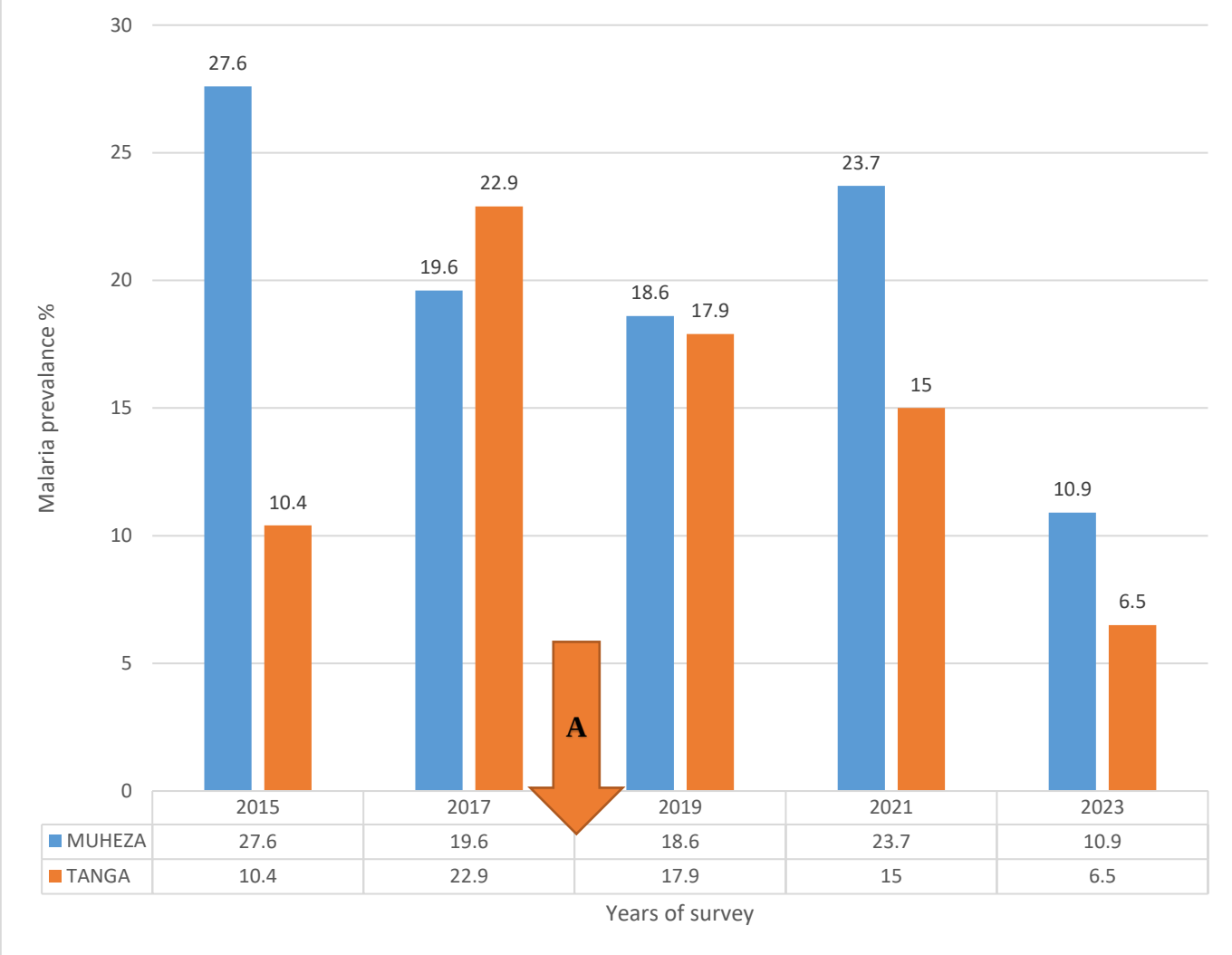


Figure 2: The trend of Malaria prevalence among school-age children from 2015-2023 in Muheza DC and Tanga CC.

At point **A** in 2018 Tanga CC started implementing Larviciding in all wards as a community-led intervention.

The trend of Malaria declined from 2015 to 2023 for both districts, however, the decline is gradual and steady in Tanga CC in years 2017, 2019, 2021, and 2023, and the Malaria burden in prevalence is lower in Tanga CC by 6.5 %.

4.2 Qualitative Findings

4.2.1. Characteristics of the Participants

A total of 16 in-depth interviews were conducted. The mean age of the participants was 44 years. The minimum level of education among 16 participants had Ordinary Secondary School education and the highest education level was a master's degree. More than half of the participants had more than a year in their positions and some of them had been acting on their positions during the study.

Table 3: Characteristics of the Study Participants

Characteristics	**Number (n)**	**Percentage (%)**
Sex		
Male	7	44
Female	9	56
Age (years)		
25-35	4	25
36-45	6	37.5
46-55	4	25
56-65	1	6.25
>66	1	6.25
Level of education		
Primary level	0	0
Secondary level	1	6.3
University/Vocational training	15	93.7
Any other form of education	0	0
Title		
Community volunteers	2	12.5
Community member	4	25
Health officers	2	12.5
WEO	8	50

According to the qualitative specific objective, the conceptual framework and participants' responses, three (3) themes and eight (8) sub-themes were emerged from the data. The Table below 6 summarizes the themes and subthemes identified in this study.

Table 4: Themes and Subthemes Determined in the Study

SN	THEME	SUB THEME/CODE
1	**THEME 1:** Malaria and Larviciding Overview	• **The burden of Malaria among school-age children** This code includes all information on the respondent concerning how the community perceives Malaria burden among school-age children.
		• **Education to the community about Larviciding** This code includes all responses concerning how the community is educated on preventing school-age children through Larviciding
2	**THEME 2:** Larviciding intervention in the community	• **Facilitating factors for acceptance of Larviciding** This code includes all the information about how the community was facilitated to engage in the Larviciding intervention.
		• **Challenges encountered during the implementation of Larviciding** This code includes all the information about what challenges are encountered during the implementation of the intervention of Larviciding in the community
		• **Collaboration and partnership** This code includes all the information about collaborators in the course of implementing Larviciding, including their roles
3	**THEME 3:** Monitoring and evaluation	• **Plans for the intervention of Larviciding** This code includes all the information regarding what ways the program is planned to be prosperous

4.2.2 Malaria and Larviciding overview

The burden of Malaria among school-age children

It has been found that there are limited Malaria prevention programs that directly target this age group of school-age children; hence even the exact information on how this age group is affected by Malaria was not easily found. However, most of the respondents said that the Malaria burden has been declining in the community in general through observing the decline of Malaria cases in health facilities.

> "*…Aaahh, Malaria disease among school-age children…aaaah…currently we say it is like it is declining in a significant amount but it's a group which has been affected by Malaria disease in a large amount at our area. Because we have been having various research conducted which among them is school Malaria parasitemia survey done every after 3 years" (IDI 01_July, 2024)*

Education to the community about Larviciding

Among the facilitating factors of Larviciding which were narrated by respondents during the study was healthy education concerning environment management and Larviciding. Educative sessions were said to be done before the commencement of the implementation of the intervention.

> *"…before the commencement of the program we went through village meetings to give health education and ensure awareness to the people concerning Larviciding…." (IDI 06_June, 2024)*

4.2.3 Larviciding intervention in the community

Facilitating factors for acceptance of Larviciding

In the course of implementing the intervention of Larviciding, there were several facilitating factors reported which made the program more accepted and received cooperation from the community. Pre-information before the onset of the program and the use of community embers to perform the activity were among the good footsteps which were used by community leaders and health officers so as to ensure the smooth ongoing and acceptance of the program.

"…. things which helped them when they saw the importance of it, because community members were gathered in meetings where education about A B C of the program was done, that there would be an activity of spraying Larvicides and its importance. So the community itself accepted with that, which is why they cooperate in places where the spraying is done…" (IDI 03_June2024).

Challenges encountered during the implementation of Larviciding

Since the study's objective was to explore the factors affecting implementation of Larviciding, a general understanding of the challenges facing the intervention is crucial. Most of participants reported a couple of factors and only one participant said there were no challenges in the implementation of the intervention of Larviciding; Factors that challenged the activity were; few community volunteers, pungent smell of the larvicides, lack of transportation for the activity, inaccessibility of some very big breeding sites with long grasses, environmental challenges (natural and man-made), insufficient incentives to community volunteers, volunteers resigning after they are being trained and climatic changes.

"…. big challenges which we are facing are in places where no people are living. You find people are…having large areas which are not built and there are breeding sites…." (IDI 05_June, 2024).

Collaboration and partnership

The study also explored who are partners in the program and how do they collaborate on making the program prospering. Respondents narrated that they get support from donors who are Global fund who are helping in supplying of some equipment, and also Swiss HTP (donor) who are helping in the activity of spraying larvicides.

"Yes, we have collaborators, whom we are collaborating with, first is the government itself, but also we have Global fund who are helping in supply of some equipment, but we also have Swiss HTP who are helping in the activity of spraying larvicides, back then we had PMI for mosquito net…."

4.2.4 Monitoring and evaluation of the intervention

Future plans of the intervention of Larviciding

Most of the participants elaborated some plans for the future whereby they said they are planning to introduce larvicides which are in small packages so that the community can use them by themselves at their premises without waiting for volunteers to come to their places for spraying. This will ensure reduction of breeding sites which are located around house places most of which are man-made due to environmental mismanagement like water in unused tin and stagnant water around houses.

> *"…the big plans which we are trying to do by now, we are…. passing house to house distributing larvicides so they can spray in places where there are breeding sites like chambers, dams, in streams, and other outside breeding sites…" (IDI 06_June, 2024).*

4.3 Integrated Findings

From 2015 to 2023, the trend of Malaria prevalence has shown a consistent decline in both districts. However, in Tanga City Council (Tanga CC), this decline has been more gradual and steady, particularly in the years 2017, 2019, 2021, and 2023. By 2023, the Malaria burden in Tanga CC was 6.5% lower compared to the other districts, indicating a relatively better outcome in reducing Malaria prevalence. Despite this positive trend, there are significant challenges associated with implementation of the larviciding intervention, as most participants reported several obstacles to its success. These included a shortage of community volunteers, the unpleasant odor of larvicides, lack of transportation for field activities, and the inaccessibility of large mosquito breeding sites due to long grasses and environmental barriers. Other key issues were related to both natural and man-made environmental challenges, insufficient incentives for volunteers, and the frequent resignation of volunteers after receiving training. Only one participant mentioned that no challenges were encountered during the intervention. Overall, while the quantitative data show a positive trend in Malaria reduction, particularly in Tanga CC, the qualitative findings highlight persistent operational and logistical difficulties that may be limiting the full potential of the intervention in both districts. Addressing these challenges could enhance the effectiveness of Malaria control efforts.

CHAPTER FIVE

5.0 DISCUSSION

This chapter explains and interprets the results obtained from the study, their implications, and acknowledgement of the study's limitations.

Introduction

A worldwide obstacle to the eradication of Malaria is the resistance of Malaria vectors to pesticides. Meanwhile, Malaria prevention in Tanzania has been gaining a new picture after the implication of resistance of insecticides in Malaria vector control. This means that techniques for controlling larvae, like Larviciding, must be added. Larviciding hasn't been used very often in Tanzania, thus, the purpose of this study was to investigate the factors affecting the use of Larviciding.

5.1. Malaria trend

According to the results above, the trend of Malaria is observed to be declining from 2015 to 2023 for both districts as it is visualized in the bar graph. The Malaria status is seen to be lower in Tanga CC where Larviciding is implemented compared to Muheza where Larviciding is not implemented. Although Larviciding is supplement prevention, it is seen to have an effect on the trend of Malaria Status in Tanga CC. The decline of Malaria prevalence from 27.6% to 10.9% in Muheza DC compared with 10.4% to 6.5% in Tanga CC is a substantial observation. Moreover the decline is gradual and steady in Tanga CC in year 2017, 2019, 2021 and 2023, and the Malaria burden in prevalence is lower in Tanga CC by 6.5 %.

The study recognizes the possibility of having other factors than Larviciding which may cause the decline nevertheless, the reduction of breeding sites and lava density as well as matured mosquitoes is a justification to the contribution brought by larvicides to the reduction of Malaria burden to school age children.

5.2. Characteristics of Malaria Trend

The shifting trend of Malaria infection is seen to incline to the age group of 9-12 years in both districts. This is likely to be similar to the study by Makenga et al (37) where it was found that the age group 10 -15 had a higher Malaria infection of 28% compared to other younger age groups in the same study. This same shifting trend towards this age group was also observed in Malawi (38) where by the survey narrated the existence of a significant occurrence of asymptomatic Malaria infection.

This shifting of the Malaria burden toward older school-age children aged 9- 12 may be a result of most Malaria programs targeting children under 5 and leaving the older age to be reservoirs of Malaria parasites(38). The change in the epidemiology of Malaria has been ascribed to more interventions, some of which included children under the age of ten, and which previously excluded schoolchildren. However, several studies have recommended treating Malaria in school-age children or young adolescents, highlighting the significance of Malaria infection in schoolchildren for public health (39).

5.3. Malaria and Larviciding Overview

The burden of Malaria among school-age children

Based on the response from the majority of respondents, Malaria has been seen to decline by the declining of cases which was declared by most of the respondents. On the other hand, most Malaria prevention programs are based on other groups like under-five children and pregnant women or focus on the general population, hence the exact information on how this specific age group is affected by Malaria was not easily found. It is in recent years in this decade surveys have tried to focus on this age group to ascertain the extent to which Malaria is burdening this age group. Few studies like the one done by Makenga et al (11) have stipulated that school-age children are at high risk of Malaria infection in the Muheza district. This can elaborate on the way the burden of Malaria is higher in Tanga than in Muheza.

Education to the community about Larviciding

In evaluating about if the communities are aware and have information about Larvicides, the community showed a significant awareness and they are well informed about Larviciding activities in their environments, and how they will benefit from it. Health education concerning cleaning and managing the environment including dealing with breeding sites is among facilitating factors of the program which were narrated by respondents during the study. Educative sessions were said to be done before the commencement of the implementation of the intervention and also regularly during the activity. Yet, despite acknowledgment and support from a variety of sectors, such as national governments and international organizations, Larviciding techniques have not received enough attention or value up to this point (29). However, other studies have shown a significant knowledge gap concerning larviciding. In order to close their knowledge gap, an evaluation of the effects of community-wide larviciding on the incidence and prevalence of malaria was carried out in peri-urban areas of Brazil. A biological larvicide that is safe for the environment and has strong residual activity (reducing larval density by 90% to 100%) was used (10). This can be adopted in Tanzania so as to scale up the end results of the intervention.

5.4 Larviciding intervention in the community

Facilitating factors for acceptance Larviciding

Facing the truth that Larviciding is an additional prevention program to the already available ones, the community members were found to be more hesitant to accept its implementation, this is seen by how it was received by community members, by myths and beliefs that it is harmful to human health, nevertheless In the course of implementing the intervention of Larviciding, there were several facilitating factors which made the program to be accepted and received cooperation from some of the community members. Pre information before the onset of the program and the use of community members to perform the activity were among the good footsteps which were used by community leaders and health officers so as to ensure the smooth ongoing and acceptance of the program. Acceptance of Larviciding by the community was also realized in east-central Tanzania (29) where by sensitization to key stake-holders decision

makers and the community itself, was among the factors which ascertain reception of the intervention.

Challenges encountered during the implementation of Larviciding

Due to the need of increasing scalability of Larviciding in Tanzania, the assessment of where and how the challenges are undermining the intervention is of great importance. Most of participants analyzed similarities in factors from one location to another; how-ever one participant said there are no challenges in the implementation of the intervention of Larviciding. The similarity of these challenges is also seen in southern Tanzania (40), where by President's Office, Regional Administration and Local Government (PO-RALG) reported the ineffectiveness of the implementation of biolarvicides due to the same above named challenges, where by 12 councils were assessed. Logistical challenges and resource constrains were also challenges addressed in Brazil, Italy, USA, Israel, Sri Lanka and China despite the fact that they have managed to eliminate Malaria in their countries (13).

Collaboration and partnership

Among the anticipated factor to affect the implementation of Larviciding is the availability of stakeholders to support the intervention in various ways such as financial, material and personnel. In Tanga CC, a substantial support from Global fund and Swiss HTP was narrated by participants to be among the influencing factors which made the community to volunteer to the activities within their localities. Although other studies like that done in Rwanda, discussed about the community to contribute on the cost of implementation of Larviciding (12), in Tanga there was no participant who suggested that the community should contribute financially. Relying only from donors and the government to support the program is making it to incur more challenges during the implementation.

5.5. Monitoring and evaluation

Plans for the intervention of Larviciding

In the course of minimizing factors that affect the implementation of the intervention, planning is of vital importance. In Tanga CC it is planned that the larvicides will be available in small scale so as to be accessible by community members for them to apply on their own convenience in breeding sites around their premises. In doing this there will be more familiarity on the intervention and the larvicides by the community members. This will ensure reduction of breeding sites which are located around house places most of which are due to environmental mismanagement. In the study conducted in Ethiopia, the planning is done during the end of the program whereby it is included in the process of evaluation of the intervention (41). This is contrary to what was observed in Tanga CC where planning was ongoing during the time of implementation of the intervention.

In the development of other larval source management strategies, these results highlight the need for more supervision, training, and monitoring and evaluating protocol adherence, which may help on ensuring the minimization of challenges addressed by this study. It is possible to distinguish between the successfully executed larvicide intervention to lower the burden of Malaria in the human population and the successfully implemented larvicide application program through process evaluation of a Malarial Larviciding intervention. However, in Kenya. Larviciding intervention showed a significant reduction of Malaria burden in their setting (20).

5.6 Study limitations and mitigation

In this study, the following are the limitations and how they are mitigated.

The study focuses on school-age children, which means the findings might not be generalizable to other age groups, like infants or adults.

Mitigation: No mitigation can be done to this limitation due to the fact that this age group is selected purposefully.

Not able to collect information on additional variables of the secondary data to be used by the researcher.

Mitigation: In the course of using secondary data, the researcher eliminated variables that were irrelevant to the study so as to remain with only information that was of help in making the relevant output of the objectives of the study.

Confounders: Presence of other vector control interventions which may also have effect on Malaria infection during the time which data was collected. Other vector control interventions which the study might be affected by are ITN, IPT, and Insecticides.

Mitigation: Larviciding is regarded as a supplementary intervention by WHO despite of availability and usage of other vector control interventions which would have had effect on the study during the collection of secondary data.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

This chapter presents the generalized conclusion from the study and suggests the way forward for implementing Larviciding in Tanzania.

6.1 Conclusion

In general, Malaria disease has been declining in the past decade. In the analysis done by this study, the general conclusion is that Larviciding has shown to be contributing to the much more declining of Malaria trend in school-age children in Tanga CC different from Muheza DC where there is a slow decline. The reduction of mosquito lava, adult mosquitos, and less Malaria cases reported from health facilities are factors which implies the contribution of Larviciding in reduction of Malaria burden.

The Larviciding intervention is found to be well accepted by the community by engaging themselves in volunteering in the activity, accepting it to be sprayed on their premises and the willingness for the program to continue in the future. The attitude of community leaders on planning for more health education and the ways of mitigating challenges encountered are among the factors which narrated the acceptability of the intervention.

However, the list of factors affecting the intervention is more of a financial deficit in nature. Key informants have shown the means by which the authorities have laid down plans on how to meet the cost of implementation of the intervention and all activities associated with the pam. Nevertheless, the plans do seem to be not enough as they were still insisting on getting more collaborators such as donors.

Lastly, the study was not able to cover the qualitative part of interviewing school-age children and teachers in respective schools due to the inconvenience of resources to do so. It is believed that this study will call upon more studies to cover the insight to increase the scope of Malaria prevention among school-age children.

6.2 Recommendations

6.2.1 Including school aged children in the category of vulnerable age group

More intervention to be incorporated in guidelines and make this neglected group more covered in Malaria prevention programs. Adding more Malaria prevention interventions to this age group of school-age children will be of importance in reducing the Malaria burden to this specific age group.

6.2.2 A Call for More Research

The shifting trend of positive Malaria- cases in the age group of 9-12 calls for more intervention to be tailored to serve this group of adolescents-to-be children. Moreover, the more researches are done on this population group the easier the availability of data related to Malaria prevention among school-age children.

6.2.3 In-cooperating Community health workers in the program

To combat the deficit of personnel responsible for spraying larvicides, community health workers might be of great importance as they are abundant at the village level of authority. This will also overcome the challenge of those volunteers who quit their tasks resulting in a gap during the rotations of the activities.

6.2.4 Shifting financial costs to Health facilities

Each ward has a health center, it could be a better option to in-cooperate with the financial cost to the facility due to the reason that the management of funds is easier at that level and may help to reduce the deficit of the activity.

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APPENDICES

Appendix I: In-Depth Interview Guide for Malaria Focal Person and Health Officer (English Version)

My name is Chelu B. Mkombo, I am a student at Muhimbili University of Health and Allied Science, per suing Masters of Public Health. I am conducting a research study to compare the Malaria infection trends among school-age children and evaluate the challenges associated with implementing mosquito net use and early Malaria diagnosis in districts employing Larviciding compared to those without Larviciding. I would like to request for your cooperation in this study by responding to the questions during our dialogue.

A. PERSONAL DETAILS OF THE INFORMANT

1. Gender: 1) Female 2) Male

2. Age: 1) <25 years 2) 25-35years 3) 36-45years 4) 46-55years 5) >56years

3. Educational Level: 1) None 2) Primary level 3) Secondary level 4) College/vocational training

4.Marital status: 1) single 2) married 3) cohabited 4) divorced 5) widowed

B. STUDY INFORMATION

1. **Introduction and Background:**

- ✓ Can you please provide a brief overview of your role as the Malaria Focal Person?
- ✓ How long have you been Malaria focal person in this area.?

2. **Current State of Malaria in Schools:**

- ✓ How would you describe the current status of Malaria in schools within our region or jurisdiction?
- ✓ Can you highlight any recent trends of Malaria infection in schools?
- ✓ Can you highlight any recent challenges related to Malaria infection in schools?

3. **Existing Malaria Prevention Programs:**

- ✓ What specific Malaria prevention programs or initiatives are currently in place for school age children?
- ✓ How are these programs tailored to address the unique challenges of Malaria prevention within a school setting?

4. **Collaboration and Partnerships:**

- ✓ Are there collaborations or partnerships with other organizations or government agencies to support Malaria prevention efforts in school age children?
- ✓ How do these collaborations contribute to the effectiveness of Malaria programs in schools?

5. **Education and Awareness:**

- ✓ How are schools involved in educating students, teachers, and parents about Malaria prevention?
- ✓ Are there strategies used to raise awareness about Malaria? I yes Please elaborate them

6. **Preventive Measures:**

- ✓ What are key preventive measures implemented in schools to reduce the risk of Malaria among school age children?

7. **Monitoring and Evaluation:**

- ✓ How do you monitor the success and impact of Malaria prevention programs in school age children?
- ✓ Are there specific indicators or metrics that are regularly assessed to measure the effectiveness of these programs?

8. **Challenges and Solutions:**

- ✓ What are challenges faced in implementing Larviciding in the community.?
- ✓ How are those challenges being addressed?
- ✓ Are there any innovative solutions being explored to overcome these challenges?

9. **Community Involvement:**

- ✓ To what extent are local communities engage in supporting and sustaining Malaria prevention efforts among school age children.?
- ✓ Can you share any successful examples of community involvement in Malaria programs?

10. **Future Plans and Priorities:**

- ✓ What are the future plans and priorities for enhancing Malaria prevention in schools?

Appendix II: Muongozo Wa Mahojiano Ya Kina Kwa Mratibu Wa Malaria/Afisa Afya

Jina langu ni Chelu B. Mkombo, ni mwanafunzi wa chuo kikuu cha afya na sayansi shirikishi Muhimbili, ninasoma shahada ya uzamili ya afya ya Jamii. Nafanya utafiti kubaini ulinganifu wa ugonjwa wa Malaria kwa watoto wa umri wa kwenda shule katika wilaya zilizofanyiwa umwagiliaji wa viuatilifu vya kuua viluilui wa vijidudu wa Malaria na wilaya amazo umwagiliaji huo haukufanyika na pia kubaini changamoto za matumizi ya vyandarua na utambuzi wa mapema wa ugonjwa wa Malaria.

Nakukaribisha katika utafiti huu

A. TAARIFA BINAFSI

1. Jinsia a) Ke b) Me

2.Umri 1) miaka <25 2) miaka 25-35 3) miaka 36-45 4) miaka 46-55 5) miaka>56

3.Kiwango cha elimu 1) Sina elimu yoyote 2) Darasa la saba 3) Kidato cha nne 4) Chuo/elimu ya ufundi

4.Hali ya ndoa 1) sijaolewa 2) nimeolewa 3) Kuishi pamoja 4) kutalikiwa 5) mjane

B. TAARIFA ZA KIUTAFITI

1. Tafadhali naomba elezea majukumu yako katika uratibu wa ugonjwa wa Malaria.
   - Je umekua mratibu wa Malaria katika eneo hili kwa muda gani.?
2. Unaielezeaje hali ya ugonjwa wa Malaria kwa watoto wenye umri wa kwenda shule wa eneo unalolisimamia kama mratibu.?
   - Je unaweza kuangazia mwenendo wa Malaria na changamoto zake kwa kipindi hiki cha karibuni.?
3. Je kwa sasa kuna program zipi mahususi za kukinga ugonjwwa wa Malaria kwa watoto wenye umri wa kwenda shule.?
   - Je Program hizi zimeandaliwaje kuhakikisha zinashughulikia changamoto za kuzuia na kupambana na ugonjwa wa Malaria kwa watoto wenye umri wa kwenda shule.?
4. Je kuna wadau wowote mbalimbali wakisaidiana na serikali katika kuweka nguvu Zaidi kwenye kuwezesha juhuzudi za kuzuia Malaria kwa watoto wenye umri wa kwenda shule.?

- Ushirikiano huu wa wadau na serikali katika kuzuia Malaria umewezaje kuleta ufanisi wa program hizo kwa watoto wenye umri wa kwenda shule.?

5. Ni kwa namna gani uongozi wa shule unajihusisha katika kutoa elimu kwa wanafunzi, waalimu, na wazazi kuhusu kujikinga na ugonjwa wa Malaria.?
   - Je kuna mbinu zinazotumika kuongeza ufahamu kuhusu Malaria.?.kama zipo tafadhali zielezee.
6. Je kuna mbinu zozote mahususi zinazotekelezwa na shule kwaajili ya kuwakinga watoto wenye umri wa kwenda shule na ugonjwa wa Malaria.?
7. Unapima vipi matokea ya mikakati na program za kukinga Malaria kwa watoto wenye umri wa kwenda shule.?
   - Je kuna viashiria vipi ambavyo hupimwa ili kutathmini ufanisi wa program hizo.?
8. Ni changamoto zipi zinazotokea katika utekelezaji wa program ya umwagiliaji wa viuatilifu vya kuua lava.?
   - Je unazishughulikiaje changamoto hizo?
   - Je kuna mikakati mahususi inayowekwa kwaajili ya kutatua changamoto hizi.?
9. Ni kwa kiasi gani jamii zinajihusisha na kusaidia jitihada za kuzuia Malaria kwa watoto wenye umri wa kwenda shule?
   - Je unaweza kutushirikisha mfano wowote wa mafanikio ya jitihada za jamii katika program za Malaria.?
10. Kuna mipangp ipi na vipaumbele vilivowekwa ili kuwezesha kujikinga na Malaria kwa watoto wenye umri wa kwenda shule.?

Appendix III: In-Depth Interview Guide for A Community Member/Community Leader (English Version)

My name is Chelu B. Mkombo, I am a student at Muhimbili University of Health and Allied Science, per suing Masters of Public Health. I am conducting a research study to compare the Malaria infection trends among school-age children and evaluate the challenges associated with implementing mosquito net use and early Malaria diagnosis in districts employing Larviciding compared to those without Larviciding. I would like to request for your cooperation in this study by responding to the questions during our dialogue.

A. PERSONAL DETAILS OF THE INFORMANT

1. Gender: 1) Female 2) Male
2. Age: 1) <25 years 2) 25-35years 3) 36-45years 4) 46-55years 5) >56years
3. Educational Level: 1) None 2) Primary level 3) Secondary level 4) College/vocational training
4. Marital status: 1) single 2) married 3) cohabited 4) divorced 5) widowed

B. STUDY INFORMATION

1. **Introduction and Background:**
   - ✓ Can you please describe what you know about Malaria disease?
   - ✓ Can you describe your current bedtime routine for your school-age child?
2. **Knowledge of Larviciding importance**
   - ✓ How regularly do you use Larviciding in your community?
   - ✓ What is the importance of Larviciding in preventing Malaria?
3. **Challenges associated**
   - ✓ Have you ever faced any challenges or concerns regarding the use of Larviciding in your community?
   - ✓ Are there specific factors that influence your decision for you and your family to accept Larviciding in your community consistently?
   - ✓ What do you do when you recognize your school-age child is sick?

4. **Education and awareness**
   - ✓ How do you communicate the importance of Larviciding use to your child?
   - ✓ Are there any misconceptions or myths about Larviciding that you've come across?
5. **Implementation strategies**
   - ✓ What strategies do you use to make Larviciding use more appealing or comfortable for your community?
7. **Suggestions**
   - ✓ Are there any additional resources or support you feel would help in promoting consistent Larviciding use in your community?

Appendix IV: Muongozo Wa Mahojiano Ya Kina Kwa Mwanajamii/ Kiongozi Wa Jamii

Jina langu ni Chelu B. Mkombo, ni mwanafunzi wa chuo kikuu cha afya na sayansi shirikishi Muhimbili, ninasoma shahada ya uzamili ya afya ya Jamii. Nafanya utafiti kubaini ulinganifu wa ugonjwa wa Malaria kwa watoto wa umri wa kwenda shule katika wilaya zilizofanyiwa umwagiliaji wa viuatilifu vya kuua viluilui wa vijidudu wa Malaria na wilaya amazo umwagiliaji huo haukufanyika na pia kubaini changamoto za matumizi ya vyandarua na utambuzi wa mapema wa ugonjwa wa Malaria.

Nakukaribisha katika utafiti huu

A. TAARIFA BINAFSI

1. Jinsia a) Ke b) Me

2. Umri 1) miaka <25 2) miaka 25-35 3) miaka 36-45 4) miaka 46-55 5) miaka>56

3. Kiwango cha elimu 1) Sina elimu yoyote 2) Darasa la saba 3) Kidato cha nne 4) Chuo/elimu ya ufundi

4. Hali ya ndoa 1) sijaolewa 2) nimeolewa 3) Kuishi pamoja 4) kutalikiwa 5) mjane

B. TAARIFA ZA KIUTAFITI

1. Tafadhali unaweza kuelezea unaufahamu vipi ugonjwa wa Malaria.?
2. Ni mara ngapi huwa jamii yako inatumia viuatilifu vya kuua lava wa mbu wa Malaria.?
3. Je ni faida gani zinapatikana katika kutumia viuatilifu vya kuua lava wa mbu wa Malaria.?
4. Je umewahi kupata changamoto zozote zihusianazo na matumizi ya viuatilifu vya kuua lava wa Malaria katika jamii yako.?.tafadhali elezea
5. Je ni sababu zipi zinazopeleke wewe na jamii yako kushawishika kukubali matumizi ya viuatilifu vya kuua lava wa Malaria katika jamii yako.?
6. Unachukua hatua gani unapogundua mtoto wako mwenye umri wa kwenda shule ni mgonjwa.?
7. Unawaelezaje watoto wako wenye umri wa kwenda shule juu ya umuhimu wa matumizi ya viuatilifu vya kuua lava wa mbu wa Malaria?

8. Je umewahi kusikia dhana yoyote potofu ihusuyo matumizi ya viuatilifu vya kuua lava wa mbu wa malara?
9. Ni njia gani unazotumia kufanya matumizi ya viuatilifu vya kuua lava wa mbu wa malara kuwa rafiki/rahisi kwa jamii yako?
10. Je kuna rasilimali zozote unazoona zinaweza kuwezesha uhamasihaji na utumiaji wa viuatilifu vya kuua lava wa mbu wa malara katika jamii yako?

Appendix V: Consent Form

Muhimbili University of Health and Allied Sciences

School of Public Health and Social Sciences

A research study to assess the contribution of Larviciding in reducing Malaria burden among school-age children and exploring factors affecting Larviciding implementation in the Tanga region

Dear sir/madam

I am humbly inviting you to participate in a study to be conducted by Chelu B. Mkombo, I am a student at the Muhimbili University of Health and Allied Science, persuing Master of Public Health.

Your participation in this study is entirely voluntary, the information below provides you with insight of the study and help you decide whether to participate or not.

APROVAL FOR THE STUDY: This study has been reviewed and approved by the Ethical Committee of Muhimbili University of Health and Allied Sciences (MUHAS).

WHO WAS IN THE STUDY

All individuals who meet the criteria for participating in the intervention of Larviciding and are found in the sample of the study at community level from the Regional authority to village level was included in this study.

FREEDOM TO PARTICIPATE IN THE STUDY

I would like to stress that your participation in this study is strictly voluntary. Should you decide not to participate; it was not affect it. You are also free to withdraw your participation in this study at any point.

PURPOSE OF THE STUDY: Is to compare the Malaria infection trends among school-age children and explore the factors affecting implementation of Larviciding.

BENEFITS: This study was help on identifying the trend of Malaria infection in relation to Larviciding as one of the additional Malaria vector control intervention in this less referred age group and hence finding the best means of implementing Malaria intervention on them and meat the goal of Malaria reduction.

RISK AND DISCOMFORT: There are no risks or discomforts in this study

COMPENSATION: There was no payments or compensation for participating in this study. There is also no cost that you was incur during participation in this study except your time.

CONFIDENTIALITY: Your participation in this study is confidential

RESULTS DISEMINATION: The results for this study was available for you if needed and it was used as a partial fulfillment of master's degree.

CONSENT: I confirm that I have read the provided information about the study and understood well, and I agree to participate in this study.

Signature of the participant……Date…….
Signature of the interviewer……Date……..

Appendix VI: Fomu Ya Ridhaa Ya Kushiriki Kwenye Utafiti

Chuo kikuu cha Afya na Sayansi Shirikishi Muhimbili

Skuli ya Afya ya Jamii na Sayansi Shirikishi

Utafiti kuhusu mchango wa viuatilifu vya kuua lava wa mbu vinavyoweza kuathiri mwenendo wa maambukizi ya ugonjwa wa Malaria kwa watoto wa umri wa kwenda shule na uchunguzi wa changamoto zihusianazo na umwagiliaji wa viuatilifu hivyo.

Mpendwa mshiriki,

Napenda kukukaribisha kushiriki katika utafiti uliotajwa hapo juuunaofanywa na mimi Chelu B. Mkombo, Mwanafunzi wa Shahada ya pili ya uzamili ya Afya ya Jamii ya Chuo kikuu cha Afya na Sayansi shirikishi Muhimbili.

Kushiriki kwako katika utafiti huu ni kwa hiari, na taarifa zilizoweka katika fomu hii zitakusaidia kujua mambo yahusianayo na utafiti huu na kisha utaweza kufanya maamuzia ya kushiriki au la.

KUIDHINISHWA KWA UTAFITI: Utafiti huu ulipitiwa na kuidhinishwa na kamati ya maadili ya utafiti ya Chuo kikuu cha Afya na Sayansi Shgirikishi Muhimbili

DHUMUNI LA UTAFITI: Utafiti huu una dhumuni la kufanya ulinganifu wa mwenendo wa maambukizi ya ugonjwa wa Malaria kwa watoto wa umri wa kwenda shule na upembuzi wa changamoto zihusianazo na umwagiliaji wa viuatilifua vya kuua lava wa Malaria

FAIDA YA UTAFITI: Utafiti huu utawezesha kutambua mwenendo wa maambukizi ya ugonjwa wa Malaria kwa kuhusianisha na umwagiliaji wa viuatilifu vya kuua lava wa Malaria kama njia ya nyongeza katika mapambano dhidi ya ugonjwa wa Malaria kwa watoto wa umri wa kwenda shule, hivyo basi kupata namna bora Zaidi ya kuweka mikakati ya mapambano dhidi ya Malaria kwa kundi hili.

FIDIA: Hakutakuwapo malipo yoyote yatakayotokana na ushiriki wako katika utafiti huu, pia kama mshiriki hutakuwa na gharama yoyote utakayoingia isipokua kutumia muda wako tu

HATARI NA HASARA: Utafiti huu hauna madhara yoyote wala hauleti hasara dkwa kushiriki.

USIRI WA TAARIFA: Taarifa zitakazokusanywa katika utafiti huu ni taarifa za siri. Jina lako halitatumika katika taarifa zozote za utafiti huu.

MATOKEO: Baada ya kukamilika kwa utafiti huu, matokeo ya utafiti yatakua wazi kupatika kwa idhini ya chuo kikuu cha Afya na Sayansi shirikishi Muhimbili endapo yatahitajika, pia yatatumika kuwa kiambatanisho cha upatikanaji wa shahada yangu ya uzamili ya Afya ya Jamii.

IDHINI YAKO: Nathibitisha kuwa mimi..... nimesoma na kuelewa maelezo yote kuhusu utafiti huu na kuyaelewa. Nakubali/Nakataa kushiriki katika utafiti huu.

Sahihi ya mshiriki……Tarehe…….
Sahihi ya mtafiti……Tarehe……..

Appendix VII Ethical Letter

UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATIONS

Ref. No.DA.282/298/01.C/2318 Date: 07/06/2024

MUHAS-REC-06-2024-2318
CHELU BEATRICE MKOMBO
SCHOOL OF PUBLIC HEALTH AND SOCIAL SCIENCES
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: CONTRIBUTION OF LARVICIDING IN REDUCING MALARIA BURDEN AMONG SCHOOL AGED CHILDREN AND FACTORS AFFECTING ITS IMPLEMENTATION IN TANGA REGION

Reference is made to the above heading,

I am pleased to inform you that the Chairperson has on behalf of the University Senate, approved ethical clearance of the above-mentioned study, on recommendations of the Senate Research and Publications Committee meeting accordance with MUHAS research policy and Tanzania regulations governing human and animal subjects research.

APPROVAL DATE: 07/06/2024
EXPIRATION DATE OF APPROVAL: 07/06/2025

STUDY DESCRIPTION:
Purpose:
The purpose of this mixed study design is to assess the contribution of larviciding in reducing malaria burden among school aged children and factors affecting larviciding implementation in Tanga CC.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2015730.pdf and in the MUHAS archives.

The PI is required to:

1. Submit bi-annual progress reports and final report upon completion of the study.
2. Report to the IRB any unanticipated problem involving risks to subjects or others including adverse events where applicable.
3. Apply for renewal of approval of ethical clearance one (1) month prior its expiration if the study is not completed at the end of this ethical approval. You may not continue with any research activity beyond the expiration date without the approval of the IRB. Failure to receive approval for continuation before the expiration date will result in automatic termination of the approval for this study on the expiration date.
4. Obtain IRB amendment (s) approval for any changes to any aspect of this study before they can be implemented.
5. Data security is ultimately the responsibility of the investigator.
6. Apply for and obtain Data Transfer Agreement (DTA) from NIMR if data will be transferred to a foreign country.
7. Apply for and obtain Material Transfer Agreement (MTA) from NIMR, if research materials (samples) will be shipped to a foreign country.
8. Apply for and obtain permission to publish the results from National Institute for Medical Research. The application should be before submitting to a publisher and not concurrently through the email publications@nimr.or.tz.
9. Any researcher, who contravenes or fail to comply with these conditions, shall be guilty of an offence and shall be liable on conviction to a fine as per NIMR Act No. 23 of 1979, PART III section 10 (2)
10. The PI is required to ensure that the findings of the study are disseminated to relevant stake holders.
11. PI is required to be versed with necessary laws and regulatory policies that govern research in Tanzania. Some guidance is available on our website https://drp.muhas.ac.tz/.



Dr. Nahya Salim Masoud,
Chairperson, MUHAS Research and Ethics Committee

Appendix VIII: Permission Letter From Tanga City Council

JAMHURI YA MUUNGANO WA TANZANIA
OFISI YA RAIS
TAWALA ZA MIKOA NA SERIKALI ZA MITAA
HALMASHAURI YA JIJI LA TANGA

Kumb.Na.TCC/CMOH/MR.10/42/105 Tarehe: 14/06/2024

Watendaji Kata,
Kata ya Duga, Mabawa, Tangasisi,
Masiwani, Pongwe na Maweni,
S.L.P. 178,
Tanga.

YAH: UTAMBULISHO WA NDUGU. CHELU BEATRICE MKOMBO

Husika na kichwa cha habari hapo juu.

Napenda kumtambulisha kwako **ndg. Chelu Beatrice Mkombo** ambae ni mwanafunzi wa Chuo Kikuu cha Afya Muhimbili amefanya msomo yake ya Stashahada ya Uzamili katika Tasnia ya Sayansi ya Afya ya Jamii (MPH).

Kwa barua hii naomba umpe ushirikiano katika utafiti anaoufanya ili kukamilisha masomo yake. Utafiti wake unahusu **"Mchango wa Upuliziaji wa Viuadudu katika kuzuia Malaria kwa Watoto wa Umri wa kwenda shule na sababu zinazoathiri utekelezaji wake".**

Nakutakia utekelezaji mwema,

Dkt. Masoud Ntiga
Kny: MKURUGENZI WA JIJI
TANGA
Kny. MKURUGENZI JIJI TANGA

Nakala:- Mkurugenzi wa Jiji - **Tanga** – (Aione Kwnye Jalada)

" Mkuu wa Chuo,
Chuo Kikuu cha MUHAS,
S.L.P 65001,
Dar es salaam.

09 Barabara ya Hassani Ngwilizi, 21101 Central Tanga, S.L.P 178 Tanga, Simu: +27 2643068,+27 2644530/3. Nukushi: +255 27 2644141/272647905. Email:info@tangacc.go.tz. Tovuti:www.tangacc.go.tz