AN INVESTIGATION OF CHALLENGES THAT IMPEDE THE ELIMINATION OF MALARIA IN ANDARA DISTRICT, KAVANGO EAST REGION, NAMIBIA

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SHEREEN KAUEJAO

201127148

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SUPERVISOR: DR LINDA. LUKOLO (UNIVERSITY OF NAMIBIA)

Abstract

This study was conducted to identify challenges that impede the elimination of malaria in Andara District, Kavango East Region, Namibia, so that efforts may be put to address such. Interventions which have been put in place include universal large-scale deployment of indoor residual spraying, distributing insecticide-treated bed nets and treating with artemisinin-based combination therapy and many others. However, cases of malaria morbidity and mortality in Andara District persisted. So, this research explored deeper the major challenges faced by the communities in trying to control this endemic disease in Andara District, Kavango region. This study used a mixed research design, meaning that both quantitative and qualitative research methods were used in this study to sufficiently capture the trends and details of the malaria situation in Andara District. Stratified random sampling method was used to collect 360 respondents from the population. A self-administered questionnaire and in-depth interviews were used to collect data. The study found that factors that impede malaria elimination in Andara District include limited research on traditional malaria prevention methods, uncontrolled cross border migration, favorable environmental conditions, good climatic conditions, resistance of mosquitos to insecticides and poor surveillance of malaria transmission hotspots. The study also found that some barriers to mosquito control and prevention in Andara District include the resistance of mosquitos to insecticides, shortage of nets and sprays and shortage of healthcare workers. In light of these findings, it was recommended that the Ministry of Health and Social Services should conduct surveillance to collect, analyze, and interpret data related to malaria. The information gathered should be used to inform the planning, implementation monitoring and evaluation of malaria cases and fatalities. Surveillance may also help the country to track evolving trends in malaria-related illnesses. It has also been recommended that the government of Namibia should implement different interventions such as mass drug administration, mass testing and treatment and mass relapse prevention in order to reduce malaria transmission. The government should also implement targeted testing and treatment, routine testing and treatment at points of entry and testing and treatment of people coming to or returning from Andara District. Moreover, since this study was limited to the Andara District, it has been recommended that further studies should be

carried out in all fourteen regions of Namibia in order to obtain findings that may be applied to the entire country.

Table of Contents

Abbreviations and Acronyms

CISDCP- China Information System for Diseases Control and Prevention

DSP- Directorate of Special Programs

GMEP- Global Malaria Eradication Programme

HEWs- Health Extension Workers

HIV/AIDS- Human Immuno-deficiency Virus/ Acquired Immune Deficiency Syndrome

IPA- Interpretive Phenomenological Analysis

IPTp- Intermittent Preventive Treatment of Malaria in Pregnancy

IRS- Indoor Residual House Spraying

MDA- Mass Drug Administration

MoHSS- Ministry of Health and Social Services

NIP- Namibia Institute of Pathology

PDMC- Post-Discharge Malaria Chemoprevention

PMC- Perennial Malaria Chemoprevention

RCD- Reactive Case Detection

RCD- Reactive Case Detection Theory

RDT- Rapid Diagnostic Testing

SADC- South Africa Development Community

SMC- Seasonal Malaria Chemoprevention

TDR- Tropical Diseases Research and Training Program

UN- United Nation

UNICEF- United Nations Children's Fund

WHO- World Health Organization

List of Figures

List of Tables

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Dedication

This dissertation is dedicated to the community of Andara district who were very forth coming in rendering their services to make this study successful. My family and friends who were very supportive during the entire study.

Declaration of own work

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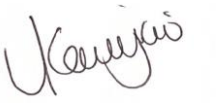

Shereen J. Kauejao Date: April 2025

CHAPTER ONE: INTRODUCTION

1.1 Introduction to the study

Malaria remains a leading cause of death and disease in many countries, with an estimated 249 million cases and 435,000 deaths occurring globally in 2022 (32). The infectious disease known as malaria is brought on by plasmodium parasites and is spread via female anopheles mosquito bites.

Globally, the number of cases and deaths from malaria has significantly decreased. Between 2000 and 2019, the incidence of malaria decreased by around 30% and fatality rates of this disease decreased by 60% (4). Global efforts to eradicate malaria, including the End Malaria Council and Fund, Roll Back Malaria Partnership, and World Health Organization (WHO), are primarily responsible for the drop in these cases (5). WHO organizes international efforts to combat malaria, establishes global targets, and gives recommendations. A comprehensive plan for the control and eradication of malaria is outlined in the WHO's Global Technical Strategy for Malaria 2016–2030. Roll Back Malaria Partnership is global partnership works to reduce malaria mortality and morbidity and supports efforts towards elimination. End Malaria Council and Fund is an initiative that was established by the United Nation (UN). It focuses on accelerating progress towards malaria elimination and mobilizing resources globally (5).

Countries in Southern Africa are moving closer to eliminating human malaria parasite cases completely, even as many other countries across the world keep stepping up their malaria control efforts (1). Namibia is one of the four members of the South Africa Development Community (SADC) that has banded together in a calculated effort to eliminate malaria from the subregions. Since 2015, there has reportedly been a decrease in malaria cases in every region of Namibia. Namibia's low malaria case rate indicates that the disease may be eliminated.

Namibia's malaria burden varies by location, with higher rates of morbidity in the northeastern parts of the country than in other regions (2). According to reports, malaria fatality rates have decreased by 33% in Africa and by more than 25% worldwide (27). In Namibia, there were 50 recorded fatalities in 2020 compared to 82 in 2018. There were 7

fatality instances in 2019, which is a significant decrease from 2018 and 2019. The decrease in malaria cases in 2019 was ascribed to the fact that it was a drought year and that the rainfall pattern differed from that of 2020 and 2018 (5). Following a decrease in local malaria transmission, Namibia is currently experiencing an epidemiological shift and will be able to eradicate local transmission by 2030. However, medical and contemporary preventive perspectives alone are unable to fully explain the incidence of malaria. There aren't many studies on sociocultural factors since it's possible that the continuation of malaria is due to their lack of recognition as potential preventive factors (31).

Achieving and maintaining malaria elimination is a significant public health milestone. Between 2017 and 2019, the number of cases of malaria has remained low, with 66141 cases recorded in 2017, 36451 in 2018, and 3404 in 2019 (5). However, in 2021 the country recorded 40 fatalities. There is a lack of knowledge regarding the resource allocations necessary to eliminate malaria transmission in these susceptible and extremely porous border areas. In certain communities, malaria transmission occurs for several months or even the entire year, while in other areas it occurs for a relatively short period of time (2). This research will close this gap by examining a few obstacles that the Andara District is facing in its efforts to eradicate malaria.

1.2 Background of the study

The plan to fight against malaria worldwide started with the World Health Organization (WHO) in 1955. WHO launched an ambitious plan namely: Global Malaria Eradication Programme (GMEP) in 1955 to eradicate malaria throughout the world (5). Some countries succeeded remarkably in reducing their burden of malaria. Some countries that have reached malaria elimination as of 2024 include Paraguay and Bhutan, which were declared malaria-free in 2018. United Arab Emirates also achieved malaria elimination status in 2018. El Salvador also achieved malaria elimination in 2020 (5). The success stories of these countries provide valuable insights into the possibility of global malaria elimination (6).

Malaria resurged in sub-Saharan Africa as a result of the region's inability to maintain the Global Malaria Eradication Programme, despite WHO attempts to eradicate the

disease globally (3). Malaria may occur anywhere, and Namibia is not exempt from its prevalence. It is estimated that 70% of people live in areas where malaria transmission is possible (34). The spread of malaria is erratic, seasonal, typified by outbreaks, and mostly affects seven northern endemic regions. The peak months for malaria transmission are April and May, but the malaria transmission season normally lasts from December to May. As one of various preventive measures, the Ministry of Health and Social Services is using indoor residual house spraying (IRS) to lower the population of malaria mosquitoes that transmit the disease. By doing this, the spread of malaria will be reduced and eventually eradicated (34).

The Ministry of Health and Social Services is in charge of spearheading efforts to eliminate this infectious disease called malaria in Namibia (6). Through an integrated budget for the Directorate of Special Programs (DSP), this ministry provides the majority of funding for the national malaria control program. In all areas of malaria control, technical and programmatic support is provided by WHO, UNICEF, and the Southern Africa Malaria Elimination Support Team (4).

Since 2019, the World Health Organization (WHO) and the Ministry of Health and Social Services (MoHSS) have been collaborating to carry out the WHO/AFRO II larviciding demonstration project in six districts including Kavango East region where malaria is spread. The project's goal is to increase the nation's ability to apply a variety of mosquito control strategies in order to help eradicate malaria (33). The project's goal in Namibia is to evaluate the efficacy of community-based mosquito larviciding; treating water bodies with a biological agent to kill the baby mosquitoes as an extra method of controlling mosquitoes and malaria, in addition to indoor house spraying and insecticide-treated nets. Additionally, it seeks to increase national capacity for implementing and expanding evidence-based, creative, diverse, and ecologically sound disease vector control interventions, with a focus on winter larviciding as an extra vector control strategy to eradicate malaria (33).

The Environmental Health Unit and DSP over see’s the focal points of malaria control at the national, regional, and district levels, according to MoHSS. Additionally, according to MoHSS, nurses at the health centre and clinic level offer assistance for diagnosing

and managing malaria in addition to distributing bed nets coated with insecticide (4). In addition, a district-level team works with households and communities to provide outreach services. In order to regularly provide information, education, and communication to a specified number of families, non-governmental groups also maintain delivery structures at the community level in some locations (4).

As Namibia borders Angola, the Andara District is susceptible to imported malaria. Angolan students attend Namibian schools (7), Angolan citizens travel to Namibia for better grazing, cattle herders travel to Angola for better medical care, and some Namibians own crop fields in Angola. There is constant people movement between the two nations. In the border region, such as Shadikongoro village, where cases have been imported from Kakutji village in Angola, malaria cases are concentrated. To comprehend and resolve those ongoing low malaria transmission levels, new strategies are required (6).

In the past, Andara District has seen some of Namibia's highest rates of malaria cases (2). According to the Namibia Institute of Pathology (NIP), Plasmodium falciparum infection accounts for 97% of malaria cases, with other species accounting for the remaining 3% (9). In order to completely stop malaria from spreading in the Andara District, the Ministry of Health and Social Services made sure that there were enough human resources available for vector control measures. With indoor residual spraying as the primary intervention, Namibia has reduced malaria case incidence by more than 75% since 2015. However, coverage varies due to issues with accessibility, insecticide stock outs, and staff shortages (5).

WHO supported the investigation of alternate therapies, including as the use of biological agents that are more environmentally friendly to treat mosquito breeding places, because it was suggested that the use of indoor residual sprays may have a detrimental effect on the environment and may lead to insecticide resistance. Andara District was chosen as one of the sites of the trial larviciding project. As an extra vector control intervention to achieve malaria elimination by 2022, the project intended to build national skills for the implementation and scaling up of evidence-based, creative, varied, and ecologically sound malaria vector control initiatives (34). However, there are still

cases of malaria in the country. Therefore, comprehending challenges which are impeding the elimination of malaria in the country is important to strengthen efforts to eliminate malaria transmission within the Andara District (35).

1.3 Research Problem

Given the high rates of morbidity and mortality associated with the disease in the area, the ongoing incidence of malaria and the deaths associated with it in the Andara District are a serious concern. In spite of the fact that malaria indicators decreased by almost 90% nationally between 2010 and 2020, the Andara District is still experiencing an increase in malaria incidence. In particular, during a recent outbreak in adjacent Zambezi in 2022, over 300 cases were documented; preliminary data for 2023 show that the situation has not improved, with rates of morbidity and mortality continuing to rise (7).

The Zambezi, Ohangwena, and Kavango East and West areas had the highest rates of malaria between 2016 and 2020, however Andara's problems continue. The issue is made worse by Andara's seasonal temperature, which is warm and humid. This leads to an increase in mosquito populations (8). A number of tactics, including as insecticide-treated bed net distribution, indoor residual spraying, and artemisinin-based combination therapy, have been used to fight malaria (7). Malaria is still endemic in the district, despite these efforts and government programs to train medical staff.

There are gaps in the current interventions, and new approaches to malaria elimination must be investigated in order to successfully address the high rates of morbidity and mortality. Consequently, the main study question is how malaria continues to be the leading cause of death and morbidity in the Andara District, requiring an examination of the obstacles to efficient malaria prevention and eradication initiatives (11).

1.4 Purpose of the study

The purpose of this study was to explore and analyze challenges that impede the elimination of malaria in Andara District, Kavango East Region, Namibia with the goal of providing recommendations for effective interventions to eliminate malaria in the region.

1.5 Research Objectives

- To identify the challenges which are impeding the elimination of Malaria in Andara District
- To analyse factors which influence transmission of malaria in Andara District
- To explore the burden of malaria in Andara District

1.6 Significance of the study

The Ministry of Health and Social Services may benefit from the study's conclusions since they can support programs that use evidence-based interventions and more efficient, cost-effective resource allocation.

The people living in the Andara District might benefit from this study. The study's recommendations could help save the lives of all the vulnerable people living in the targeted areas by reducing the spread of malaria in the Andara District. The study's conclusions and lessons will be applied more broadly in other nations to guarantee that attempts to eradicate malaria take the environment into account while saving lives.

The Kavango East Region as a whole may benefit from this study as well because it may reveal other tactics that can be employed to aid in the eradication of malaria in the area. Additionally, the results of this study might add to the understanding of programs aimed at reducing and eliminating malaria.

1.7 Limitations of the study

This study was restricted to Andara District, Kavango East Region, so it may not give a clear picture of what was happening across all regions nationwide.

Language was another limitation of this study. The questionnaire was written in English, yet there were various languages spoken in the Andara District, Kavango East. To overcome this limitation, the researcher wrote the questions in English and the researcher interpreted those questions in Thimbukushu (the local language) to those who do not understand English.

1.8 Delimitation of the study

Delimitation refers to the boundaries of the study (12). This study was conducted in Andara District, Kavango East Region. Given the size of the Kavango East Region,

doing research throughout the entire region was impossible. As a result, the Andara District was the only focus of this study. The researcher chose this particular District because it was one of the areas where malaria incidents were still occurring.

1.9 Operational definitions

Malaria elimination- a reduction in the number of malaria cases in a specified geographic area to zero. In order to prevent the disease from spreading again, healthcare providers must maintain ongoing efforts (MOHSS, p. 4). In this study, malaria elimination refers to the art of bringing the number of local cases of malaria to zero in Andara District, Kavango East, Namibia.

Malaria control- is the reduction of disease incidence, prevalence, morbidity, or mortality to a locally acceptable level as a result of deliberate efforts (11). In this study, "malaria control" refers to the on-going intervention that results in the deliberate decrease of malaria incidence, prevalence, morbidity, or death to a level that is acceptable locally.

Challenges- Challenges are obstacles that stand in the way of achieving zero malaria (MoHSS). In this study, challenges can be defined as the difficulties and concerns preventing malaria from being eradicated in Namibia's Andara District, Kavango East.

Impede- The definition of impede in Oxford Dictionary is to prevent or hinder. In this study, "impede" refers to obstructing, blocking, or hindering the Ministry of Health and Social Services' efforts to eradicate malaria.

1.10 Chapter Summary

In this chapter, the researcher provided the background of this study, explained the problem statement, and the study's aim. The researcher additionally delineated the objectives of this study and elucidated its constraints and boundaries. At the conclusion of this chapter, definitions of important terminology were also given.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The literature review of this study is presented in this chapter. The literature was examined from a variety of sources in order to contrast and compare the data collected in the field with information from books, journals, reports, and electronic sources. The main emphasis of the study was on examining data on malaria elimination from Namibia and other countries, as well as the main obstacles communities encounter in their efforts to manage this endemic disease. Along with discussing the applicability of the Reactive Case Detection (RCD) Theory and the 1-3-7 method to malaria elimination, the chapter also examines how malaria symptoms are recognized and perceived. The chapter also examines elements that influence malaria transmission and it concludes with options for eliminating malaria.

2.2 Malaria

Malaria is a potentially fatal illness that is primarily present in tropical regions and is transmitted to people by certain species of mosquito (36). The primary method by which malaria is transmitted to humans is by female Anopheles mosquito bites. Malaria can also be spread by contaminated needles and blood transfusions. The initial signs and symptoms of malaria may be obscure at first, resembling many other feverish conditions. If P. falciparum malaria is not treated, it can cause severe sickness and death in as little as 24 hours (36).

Different species of Anopheles mosquitoes differ in their capacity to transmit malaria. This depends on the biology and behavior of the mosquitoes. Mosquitoes in the Anopheles gambiae group (which includes A. arabiensis), are the most efficient malaria vectors in the world. These mosquitoes are found only in Africa. In fact, the higher incidence of malaria in Africa compared to other parts of the world is mainly due the efficiency of these mosquitoes in transmitting the parasites.

Malaria in human beings is caused by five different species of Plasmodium parasites, of which two species: P. falciparum and P. vivax pose the most risk. The most common malaria parasite in Africa is P. falciparum, which is also the deadliest. Outside of sub-Saharan Africa, P. vivax is the predominant malaria parasite. P. malariae, P. ovale, and P. knowlesi are the other malaria species that can infect humans (36).

2.3 Recognition and Perceptions of Symptoms of Malaria

At community level, malaria, like other illnesses, is first recognized at home, based on the belief systems that people hold and the categorization of the severity of the disease is influenced by the choice and type of treatment, and the personal priorities to seek care (17). In many countries, people reside in places in which malaria is endemic, where the symptoms of mild malaria are recognized as an everyday event. People have limited knowledge that malaria cases, though seen as mild, can suddenly develop into severe disease presenting with convulsions and anaemia.

Malaria symptoms range from mild to fatal. Cough, chills, and fever are considered mild symptoms. Breathing difficulties, exhaustion, disorientation, and convulsions are examples of severe symptoms. Usually, 10 to 15 days after being bitten by an infected mosquito, these symptoms appear (11).

Pregnant women, young children under five, travelers, and those living with HIV/AIDS are among the groups most at risk of infection. Extreme exhaustion, abnormal bleeding, repeated convulsions, breathing difficulties, black or bloody urine, jaundice (yellowing of the eyes and skin), and altered consciousness are examples of severe symptoms. Severe symptoms should be treated immediately with emergency care. If malaria is mild, therapy can prevent the infection from getting worse. Malaria infection during pregnancy can also cause premature delivery or delivery of a baby with low birth weight (12)

2.4 Responsibility to control malaria

Malaria control responsibility falls to national governments. At the country level, health ministries are the key local agency involved in planning and decision-

making on the ground. They are typically officially mandated and expected to use available evidence to make strategic planning decisions on malaria control (37). Yet with the vast burden of malaria falling on resource-constrained countries, a wide range of other stakeholders are typically involved in malaria control and decision-making at a national level, including non-governmental or civil society organisations, research agencies, donors, international implementing agencies and other government agencies (36). These agencies may have differing established strategies, expertise or ideas on how to respond to malaria, interacting with national bodies through formal and informal structures and ultimately influencing policy decisions and programmatic action. These economic, global and domestic political realities raise questions about what forces are driving malaria control decision-making at the national level, and how various arrangements of stakeholders and financing shape strategic and programmatic decision-making beyond the policy and planning approaches of technical evidence review alone (37).

2.5 The Reactive Case Detection (RCD) Theory

One of the theories which support methods for eliminating malaria and preventing its resurgence is reactive case detection (RCD) (44). RCD is the process of finding other cases after a case has been detected; it may entail testing co-travellers, co-workers, or neighbours who may have been exposed to the same thing, as well as household members and other people who live close to the index case. Namibia is currently using the RCD theory.(WHO) has advised that surveillance be seen as a fundamental intervention and as one of the three pillars of the Global Technical Strategy for Malaria 2016–2030 (44).

The RCD was developed with the rationale that malaria cases are substantially aggregated at low transmission intensities. This is the case in regions where the geographic and demographic distribution of malaria transmission is not uniform. In cases when one exists, there may be others. In this scenario, a tactic that could lessen and stop the transmission in a focus is the identification of additional cases from one index case. RCD is a crucial part of the elimination approach in low-

transmission zones and is associated with the previously discussed notion of focus research (44).

Many different activities are carried out by nations that they believe come under the purview of their active detection strategy. RCD is initiated by passively detected cases and entails screening households or individuals in a predefined radius, usually within a predefined area, surrounding an imported or locally acquired case. The aim is to identify additional infections, whether symptomatic or asymptomatic, in order to prevent further malaria transmission (42). RCD has been or is widely adopted with varying methodologies in many countries to achieve and maintain malaria elimination, despite the lack of evidence to support the impact of RCD on transmission. RCD involves screening communities for malaria around an index case, treating positive cases immediately, and usually combining these measures with malaria control interventions and health education (43).

During RCD, the positive cases are treated, and family members, neighbors, and other contacts of the index case identified using passive case detection are also diagnosed (43).The local epidemiology, the availability of health services, the method used to identify the case, any possible linkages, and the subjects undergoing testing will all influence the type of RCD that is used. In the framework of focus investigation, classification, and response, RCD is typically carried out in conjunction with vector control initiatives and community education and engagement. However, if vector control measures are in place and the malaria foci are known, RCD can be carried out on its own (44).

Based on transmission dynamics, the diagnostic techniques employed, and the manner in which it is carried out, RCD efficiency will differ. RCD is used in many nations in Asia, Africa, and America (10). That being said, there are no obvious signs on the best method to put it into practice. Seven papers from Senegal, Zambia, Swaziland, Thailand, and India were included in a systematic review on RCD that was undertaken in 2016 (11). According to the findings of this research, household members were five times more likely than their

neighbours to contract malaria (11). Considering the time and money spent, the average number of contacts screened to find a single case ranged from 2 to 216, suggesting that the benefits of RCD were unclear. However, these investigations varied in their diagnostic approaches, in their epidemiological settings, in their parasite types, in their range of action, and in three of the four studies, the timing of the RCD was not specified (14).

A study was conducted in Brazil to compare various time, radius and diagnostic techniques (PCR and microscopy) in order to assess the effectiveness of RCD for P. vivax. Compared to microscopy, PCR found more than twice as many infections. When day 0 and day 30 RCDs were performed, more instances were found in household members than in neighbours within less than 3 km of the index case. Nonetheless, on days 60 and 180, the positivity rates for the neighbors and household members were comparable. There is no information available regarding RCD's cost-effectiveness (8).

This study made use of the Reactive Case Detection (RCD) Theory because theory offered a methodical framework for the timely detection and management of malaria cases, which were essential for managing outbreaks and lowering transmission. This theory emphasizes the value of proactive case detection, in which healthcare workers actively seek out and treat patients displaying symptoms of malaria in order to disrupt the cycle of transmission (31).

The RCD Theory fitted very well with the study's objective of examining successful malaria elimination strategies in the Andara District, where enduring obstacles obstruct advancement. According to studies, early diagnosis and treatment can significantly reduce the rates of malaria morbidity and fatality (2). Furthermore, the RCD technique holds that communities should respond quickly to newly discovered cases, thus enhancing the overall effectiveness of malaria control programs (3).

This theoretical framework also provided guidance for future solutions as well as a perspective for understanding current issues by focusing on the barriers to effective malaria control. The application of RCD techniques could improve

community health outcomes and ultimately contribute to the area's objective of eliminating malaria by guaranteeing that cases of malaria are immediately managed (4).

2.6 The 1-3-7 approach to malaria elimination

One of the most successful approaches to malaria elimination is the 1-3-7 model, which calls for reporting confirmed cases of the disease within 24 hours (1 day), investigating cases confirmed by rapid diagnostic testing (RDT) within 3 days, and implementing targeted control measures to stop future transmission within 7 days (38). The 1-3-7 strategy was first developed and put into practice in China in 2012, and it has since been modified to fit the specific needs of various countries in Southern Africa and Southeast Asia (38). The 1-3-7 approach is presented in Figure 2.1 below:

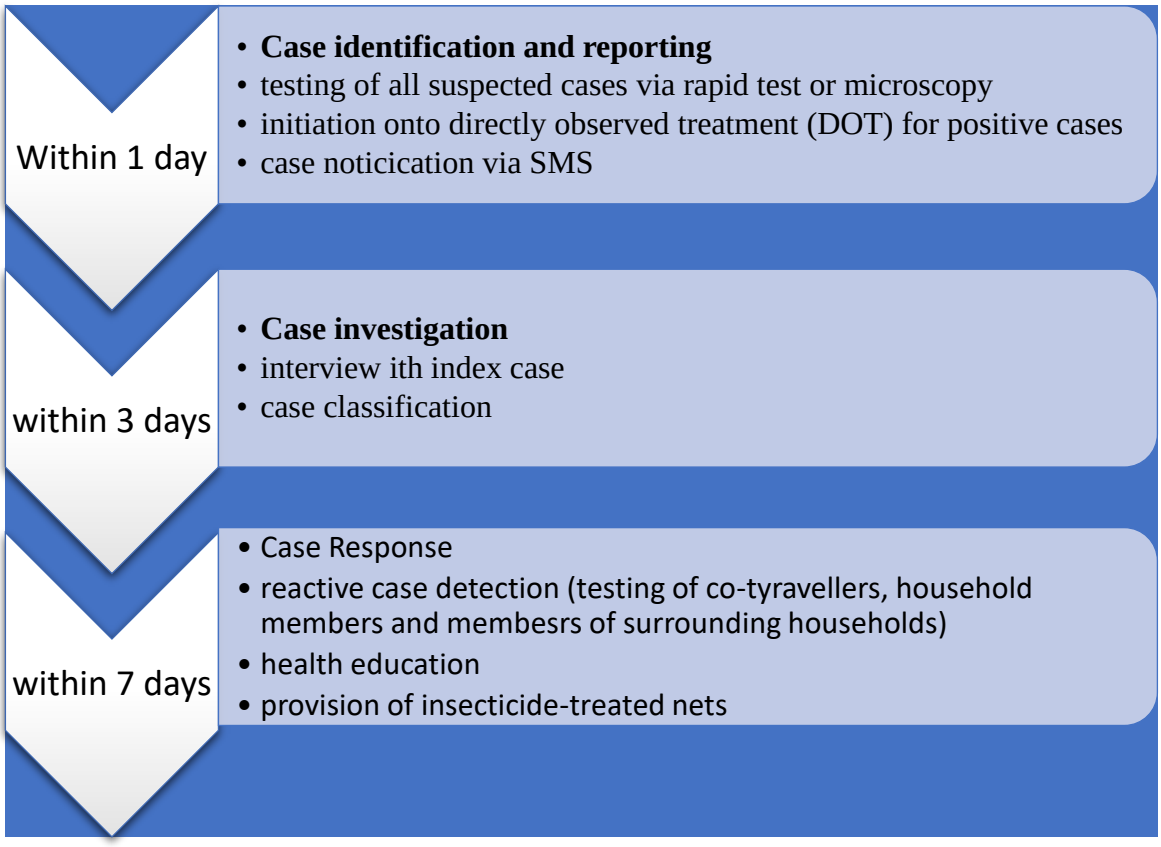

Figure 2.1. The 1-3-7 Approach to malaria elimination

Source: Biomed Central (2019).

Namibia's efforts to eliminate malaria have included the use of the 1-3-7 approach (13). Cases of malaria must be reported within 24 hours of diagnosis, investigations into cases must be finished within 3 days, and targeted investigations and interventions must be finished within 7 days. By ensuring prompt reporting and treatment which is essential considering Plasmodium vivax gametocytes develop quickly from sporozoitesthis strategy seeks to reduce the risk of malaria transmission (14).

Namibia's emphasis on a 24-hour reporting window is indicative of its dedication to timely case treatment, which is essential for stopping transmission (13). In order to provide a more realistic framework for response, case investigations must be completed within three days. This reflects the practical constraints that health workers may encounter in different areas (14). In general, the 1-3-7 approach is consistent with Namibia's objective of mitigating malaria cases and eventually achieving complete eradication via effective monitoring and prompt action protocols.

Briefly, according to the 1-3-7 strategy, malaria cases should be reported within 24 hours after diagnosis, case investigations should be finished within 3 days of reporting, and focus investigations and responses should be completed within 7 days. Malaria cases must be reported and treated within twenty-four hours (1 day) due to the plasmodium vivax's fastest gametocyte development from sporozoites. Preventing the danger of malaria transmission is the ultimate goal. It should be finished in three days, given the challenges of case verification and investigation in several locations.

Case reporting within 1 day

A preliminary diagnosis should be made by the doctor using the 1-3-7 technique, taking into account the patient's clinical presentations and epidemiological history. Any suspected, clinically diagnosed case of malaria in China, as well as fever patients with no known cause should be exposed to a malaria-related

laboratory examination right away. More crucially, Chinese healthcare facilities have one day or less to report instances directly online via the China Information System for Diseases Control and Prevention (CISDCP) after discovering them. These institutions should seek assistance from more advanced institutions if they are unable to conduct laboratory examinations linked to malaria or to oversee online reporting (38).

Case verification and investigation within 3 days

When a case is reported, the disease prevention and control agency's staff members need to get in touch with the reporting institutions right away in order to examine the blood smear under a microscope. Professionals finish an epidemiological case investigation in three days at the same time (38).

Focus investigation and response within 7 days

Plasmodium vivax takes around 10–18 days to complete its sporogonic cycle in a mosquito, based on the biological life cycle of the parasite (38). Focusing inquiry and reaction within 7 days can interrupt the transmission vector in time to prevent malaria transmission, given that patients typically seek treatment 3 days after symptoms begin (38). Furthermore, the exocytic phase takes six or seven days to complete when the P. vivax sporozoite enters the bloodstream through the saliva of Anopheles mosquitoes.

Following 48 hours of development within the erythrocyte, partial merozoites undergo differentiation into gametocytes, both male and female. The spread of malaria from infected mosquitoes may occur in as little as 8 days. It is believed that secondary infection has happened because a patient with P. vivax is contagious at the time of onset. It is possible to quickly identify secondary malaria and halt its spread by focusing inquiry and intervention within 7 days (38).

The term "focus" describes the villages, communities, or construction sites where malaria cases are found. These locations are further classified as active foci with the potential for transmission, inactive foci with the potential for transmission,

and pseudo foci without that potential. Active foci are endemic regions where local cases of malaria take place. Inactive foci are malaria cases that happen outside of the season of transmission in endemic locations. Alternatively, malaria instances happen when the disease is not effectively transmitted, during the transmission season. It is significant to remember that in China, Anopheles sinensis is unable to spread Plasmodium falciparum (38). Pseudo foci are places where malaria cases happen but where there are no malaria vectors to spread the disease.

2.7 Factors that influence transmission of malaria

There are different factors that have been identified as the major influence of transmission of Malaria in Namibian communities and other Southern African countries (2). These include limited studies on traditional practices in malaria prevention, human dispersion and livelihood, human factors and environmental factors that facilitate malaria transmission.

2.7.1 Limited Studies on Traditional Practices of Malaria Prevention

WHO suggests limited studies on traditional practices of malaria are some of the factors that influence the spread of malaria in Namibian communities (12). Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14).

2.7.2 Human Factors

There is a lack of sustainable long-term activities of awareness creation to effect change and less is communicated to the community about behaviours change especially in Namibia (15). There are new cases of malaria that emerge out of a variety of factors such as cross border migration especially with Angola to the north of Namibia and free movement of people which can facilitate the disease

transmission because it increases the risk of reception and vulnerability specially where migrants move from endemic areas to those that are less endemic (1)

2.7.3 Environmental Factors

According to WHO, fauna and flora such as the natural vegetation, agricultural crops and animal water points, provide potential breeding sites for mosquitoes while animals, such as domestic livestock provide food for the anopheles arabiensis (15). Therefore, it is very important for public health services to have knowledge of the entomological factors that influence the life of the mosquito and recognize the different species of mosquitos in a specific area in order to customise the messaging for disease control and prevention (15, p.22). Furthermore, this is consistent with many studies conducted worldwide which identify other factors such as the timing of rainfall and climate change, because malaria transmission is associated with rainfall.

In addition to the vector, the human, and the parasite, environmental factors also influence the malaria system's geographical spread, seasonality, and intensity of transmission. Although there is historical evidence of the usefulness of environmental strategies for controlling malaria, they are not the most often used at the moment. The significance of environmental elements is examined, along with their role in light of the current objectives for the eradication of malaria, the various approaches that can be used, and the difficulties that now face their implementation (43). Since eliminating malaria is a top priority for the health agenda, the best chance of achieving quick, efficient, and long-lasting results is to take an integrated approach that addresses every aspect of the malaria system, advances knowledge, develops local capacity, and improves the health of the community (44).

2.7.4 Climatic factors

The pattern and severity of malaria transmission in Africa, and the rest of the world are significantly influenced by climate conditions. Temperature, precipitation, and humidity are the main meteorological variables that have a direct impact on the spread of malaria (39). The development of the malaria

parasite and its mosquito vector, which controls malaria transmission, is significantly influenced by the ranges of minimum and maximum temperatures. In water, anopheline mosquitoes reproduce (39).

Of fact, excessive rain might temporarily wash away mosquito breeding grounds, but mosquitoes begin to reproduce as soon as the rain ceases. Flushing typically affects vector breeding habitats more in highland and mountainous regions than in lowland plains. Not every body of water is appropriate for the life cycle of a mosquito. Since anopheline mosquitoes prefer to breed in fresh water collections made after the rainy season, rainwater collects are the most significant breeding grounds in Ethiopia. These bodies of water may be murky or clear, but they are unpolluted. Thus, for mosquitos to reproduce, the proper quantity of rainfall is frequently necessary. Different kinds of water bodies are preferred by different anopheline mosquito species for breeding. Malaria transmission peaks after the rainy season in Ethiopia because water collections that facilitate vector reproduction mostly emerge after the rainy season. If a muddy rainwater collection is not contaminated, mosquitoes may breed there (39).

There are also places where less rainfall and drought can favour mosquito breeding and malaria transmission. Such places are usually covered by vegetation throughout the year and streams and rivers often flow rapidly. When the rains fail or are delayed, the flow of streams is interrupted and pooling occurs along the stream. Pooling creates a favourable environment for mosquito breeding. Malaria vectors mainly breed in stagnant water collections, rarely in slightly moving waters and never in rapidly flowing rivers and streams. In drier areas, rainfall can also affect malaria transmission indirectly through its effect on humidity. Vegetation cover increases after rainfall, which in turn increases the relative humidity of the environment (39).

Temperature and malaria parasite development

The malaria parasite's life cycle is impacted by temperature. The duration needed for the parasite to finish developing in the mosquito's gut is approximately ten days, though the temperature can affect this time. For a given Plasmodium

species, the number of days required to finish development rises with decreasing temperature. Because P. vivax and P. falciparum have shorter development cycles than P. ovale and P. malariae, they are more prevalent (39).

As the temperature rises from 21°C to 27°C—27°C being the ideal—the amount of time the parasite needs to finish developing in the mosquito drops to less than 10 days. 40°C is the highest temperature at which parasites can develop. P. falciparum has a restricted life cycle in the mosquito body below 18°C. The lowest recorded temperatures range from 14 to 19°C, and P. vivax can withstand lower temperatures than P. falciparum. Because Anopheles frequently inhabits buildings, which have a tendency to be warmer than the ambient temperature, malaria transmission in regions below 18°C can occasionally occur (39).

Temperature and altitude

Another significant element that affects how malaria spreads is altitude. Ethiopia's altitude ranges from 100 meters below sea level to almost 4,000 meters above it. By altering temperature, altitude has an indirect impact on malaria's dispersion and transmission. The temperature drops with altitude, making lowlands warmer and highlands colder. Only during seasons of exceptionally high temperatures does malaria transmission occur in the highlands of Ethiopia, which are situated between 2,000 and 2,400 meters above sea level (39).

2.7.5 Resistance to insecticides

Reduced sensitivity of anopheles mosquito to insecticides, in addition to other factors is one of the important factors increasing malaria cases in many parts of the world. WHO reports that there are some insecticides that have been approved for use in malaria control programmes. Currently, pyrethroids are the only class of insecticide used in treating bet nets to achieve protection against mosquitoes (13). However, resistance to insecticides among the anopheles' mosquitoes is increasing and spreading to newer areas. According to WHO, the declining effectiveness of the malaria insecticides has serious impact on mosquito control and malaria transmission (13).

2.7.6 Poor surveillance of malaria transmission hotspots

Poor surveillance to identify hotspots of malaria transmission was also cited as another factor impeding malaria elimination. James and Humbangu stated that there are weak links between research institutes and control programmes in a country create a gap in research. These data gaps often lead to inefficiencies and missed opportunities, making it difficult to identify the hotspots of malaria transmission (17).

2.8 The burden of malaria

In other areas of the world, malaria is a less prominent cause of deaths, but can cause substantial disease and incapacitation, especially in some countries in South America and South Asia. Direct costs (for example, illness, treatment, premature death) have been estimated to be at least US $12 billion per year. The cost in lost economic growth is many times more than that (40).

A number of variables combine to cause Africa to be the most affected. Anopheles gambiae complex, a highly proficient mosquito, is the cause of the high transmission rate (40).Plasmodium falciparum is the most common parasite species and the one that increases the risk of fatal malaria. Year-round transmission is frequently possible due to local meteorological conditions. Effective malaria control initiatives have been hampered by a lack of resources and socioeconomic instability.

An estimated 627,000 persons in sub-Saharan Africa lost their lives to malaria in 2020. Malaria control activities have quickly risen over the past ten years due to an increase in partners and resources. With the millions of lives saved and the 36% reduction in malaria mortality from 2010 to 2020 brought about by this scaling up of interventions, plans for elimination and eventually eradication have been sparked. Through its cooperative activities in numerous malaria-endemic nations and regions, the CDC contributes its technical expertise to assist these efforts (40).

Costs associated with malaria are high for both people and governments. Costs to individuals and their families include the cost of buying medication to treat

malaria at home, transport expenses to and from dispensaries and clinics, missed work days, missed school days, preventative measure costs, and funeral costs in the event of a death (40). The upkeep, provision, and staffing of healthcare facilities; acquisition of medications and supplies; public health measures against malaria, like the application of insecticides or the distribution of bed nets treated with insecticides; missed work days that result in lost revenue; and missed prospects for cooperative business ventures and tourism are among the expenses incurred by governments (41).

Building capacity for research at all levels, including operational research, as well as for the scientific and malaria program infrastructure and management is necessary to meet the new difficulties that the African region will inevitably encounter in the fight against malaria. In order to achieve success, a suitable combination of established, affordable technical interventions will need to be used, including early diagnosis and effective treatment of malaria at home; preventive measures such as bed nets treated with insecticide); forecasting and early detection, prevention, and control of epidemics; and the discovery and development of drugs derived from traditional medicines (43).

Achieving a better knowledge of the disease's varied symptoms and developing improved methods for tracking and assessing program actions will be crucial components of the research-operational interaction. The 23 multi-country African research projects financed by the MIM and the Tropical Diseases Research and Training Program (TDR/WHO) in collaboration with RBM serve as an example of the significance of research in support of malaria reduction efforts. These initiatives, which are all headed by African institutions and scientists, focus on a number of issues, including pathogenesis and immunology, drug-resistant malaria surveillance and control, vector biology and insecticide resistance, malaria transmission and mortality, and bio-prospecting for novel antimalarial medications (43).

In contrast to 244 million instances in 2021, there were 249 million cases of malaria in 2022, according to the most recent World Malaria Report. According to

estimates, 608 000 people died from malaria in 2022 compared to 610 000 in 2021 (41). WHO, the burden of malaria worldwide is still disproportionately heavy on the African Region. Approximately 94% of all malaria cases and 95% of deaths in 2022 occurred in the Region. Approximately 78% of all malaria deaths in the Region occurred in children under the age of five (41). Just over half of all malaria deaths globally occurred in four African countries: Mozambique (4.2%), Uganda (5.1%), Nigeria (26.8%), and the DRC (12.3%) (41).

2.9 Barriers to mosquito control and prevention

According to WHO mosquito control and prevention is a challenge, as vectors have developed resistance to insecticides or show low sensitivity to the compounds (12). Some insecticides have been suspended for decades because they were inefficient and they have not been replaced.

Lack of resources and operational barriers in rural hard-to-reach areas make it difficult to achieve goals in targeted places and communities living in endemic areas (16). In addition, access to prompt treatment at community level is complex and is influenced by a lot of factors other than availability and affordability (6). In addition, ecological changes such as increases in immigrants in and out of highly infected areas, poor implementation of surveillance systems and degrading of healthcare infrastructure are reported to be contributing factors to the malaria burden in South Africa (2).

2.10 Strategies to control and prevent malaria

2.10.1 Prevention

Malaria can be prevented by taking medication and avoiding mosquito bites, as verified by research. It is also suggested that before traveling to areas where malaria is common, people consult a doctor about taking drugs like chemoprophylaxis. A person's risk of malaria must also be decreased by avoiding mosquito bites. They have to sleep under a mosquito net if they live in a region where malaria is common. They also need to wear safety clothing, use window screens, use vaporizers and coils, and apply insect repellents after dusk falls (41).

2.10.2 Vector control

Because vector management is so successful at avoiding infection and limiting disease transmission, it is an essential part of methods for controlling and eliminating malaria. Indoor residual spraying (IRS) and insecticide-treated nets are the two main therapies.

However, Anopheles mosquito resistance to pesticides is posing a threat to worldwide malaria control success. The most recent World Malaria Report outlines additional risks to insecticide-treated nets, such as inadequate access, net loss from daily stressors outpacing replacement, and mosquito behaviour that appears to be changing; mosquitoes seem to be biting before people go to bed and resting outside, avoiding insecticide exposure (41).

2.10.3 Chemoprophylaxis

Visitors to regions where malaria is endemic should speak with their physician several weeks before to leaving. The doctor will decide which chemoprophylaxis medications are suitable for the destination nation. Certain chemoprophylaxis medications need to be started two to three weeks before to departure. Since parasites may still arise from the liver at this time, all preventive medications should be taken as prescribed throughout the duration of the visit to the malaria risk area and for an additional four weeks following the last potential infection exposure (41).

2.10.4 Preventive chemotherapies

The use of medications, either alone or in combination, to stop malaria infections and their effects is known as preventive chemotherapy. Regardless of whether the receivers have malaria or not, it calls for administering an entire course of treatment with an antimalarial medication to susceptible populations at specific times throughout the peak malarial risk (41).

Mass drug administration (MDA), post-discharge malaria chemoprevention (PDMC), intermittent preventive treatment of malaria in pregnancy (IPTp) and school-aged children (IPTsc), seasonal malaria chemoprevention (SMC), and perennial malaria chemoprevention (PMC) are examples of preventive chemotherapy. These secure and economical tactics aim to supplement current efforts to prevent malaria, such as vector

control measures, early detection of suspected cases, and antimalarial medication treatment of confirmed cases (41).

2.10. 5 Vaccine

Since October 2021, WHO has recommended broad use of the RTS,S/AS01 malaria vaccine among children living in regions with moderate to high P. falciparum malaria transmission. The vaccine has been shown to significantly reduce malaria, and deadly severe malaria, among young children. In October 2023, WHO recommended a second safe and effective malaria vaccine, R21/Matrix-M. The availability of two malaria vaccines is expected to make broad-scale deployment across Africa possible (41).

2.10.6 Treatment

Early detection and treatment of malaria lowers illness, averts fatalities, and helps to lower transmission. The World Health Organization advises that parasite-based diagnostic testing either by microscopy or a quick diagnostic test be used to confirm any suspected cases of malaria (41). As a dangerous infection, malaria always needs to be treated with medication. Malaria is treated and prevented by a variety of medications (41) Physicians will select one or more based on the following factors: kind of malaria, medication resistance of the malaria parasite, age or weight of the patient, and pregnancy status (p. 83).

Among the most widely used medications for malaria are: For P. falciparum malaria, combination therapy medications based on artemisinin are the most effective treatment option. Chloroquine should only be used to treat P. vivax infections in locations where the parasite is still susceptible to this medication. In order to stop P. vivax and P. ovale parasite infections from relapsing, primaquine needs to be included in the primary therapy. The bulk of medications are taken as pills. For injectable medications, some persons might need to visit a hospital or health center (41).

2.10.7 Antimalarial drug resistance

In the Greater Mekong subregion, partial artemisinin resistance has become a danger to international efforts to control malaria during the past ten years. The

WHO is gravely worried by reports of partial resistance to artemisinin in Africa, which have been verified in Tanzania, Rwanda, Uganda, and Eritrea most recently. To ensure early diagnosis and response to drug resistance, regular monitoring of antimalarial medication efficacy is necessary in regions where malaria is endemic (41).

2.10.8 Surveillance

The process of continuously gathering, analysing, and interpreting data linked to malaria and using that information to inform the development, execution, and assessment of public health interventions is known as malaria surveillance. Enhanced monitoring of malaria cases and fatalities facilitates the identification of the most afflicted regions or demographic groups by health ministries and allows nations to track evolving trends in the illness. Robust malaria monitoring frameworks facilitate the development of efficacious health interventions and enable nations to assess the results of their malaria prevention initiatives (41).

2.11 Strategies for malaria elimination

WHO suggests that there are three main strategies for malaria elimination and these are mass, targeted and reactive strategies which countries must adopt in order to eliminate malaria. Countries or areas that have attained very low to low levels of transmission require additional interventions in order to eliminate malaria. These interventions should accelerate the decline in malaria transmission to a level at which intensive surveillance ort follow-up of every case, is feasible and target specific groups at increased risk of infection that may not be reached adequately through routine prevention and treatment services. These interventions should also respond to individual cases and foci to interrupt transmission. The recommended strategies for malaria elimination are depicted in Figure 2.2 below.

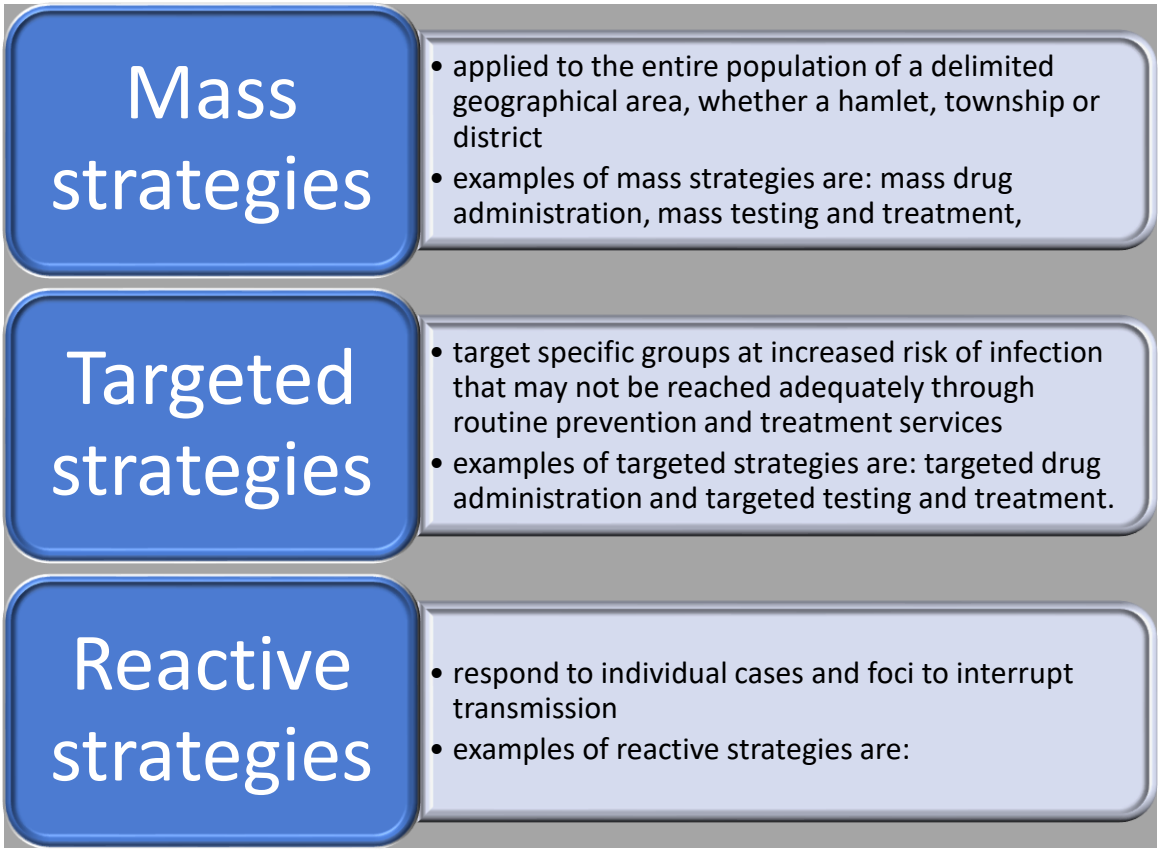

Figure 2.2: Strategies for malaria elimination (42)

2.11.1 Mass strategies

Mass strategies are generally not recommended for post-elimination settings unless there is a resumption of local transmission of malaria.

Mass Drug Administration

It is advised to use mass drug administration in very low to low transmission situations to lessen P. falciparum transmission. The impact fades in one to three months. To lower the chance of a revival, additional elements of a strong malaria elimination program should be in place (42). Areas with low import risk are taken into consideration and shouldn't take away from other crucial elements of a program for elimination. The length of the prophylactic period given by the antimalarial employed, the local malaria epidemiology, the expense and feasibility of administering each additional round, and the number of rounds and

duration of the mass drug administration program should all be taken into account (42).

Mass testing and treatment

Mass testing and treatment is another recommendation made by WHO, but this strategy should be used as the last resort. According to WHO, the incidence and prevalence of malaria are only slightly improved by widespread testing and treatment. The resources needed to put this plan into action are regarded as substantial (41). Nonetheless, WHO's conditional recommendation against mass testing and treatment acknowledges the possibility of exceptional situations where mass testing and treatment could be suitable, such as in settings with extremely low transmission where mass drug administration is not a practical or acceptable approach (42).

2.11.2 Targeted strategies

Targeted drug administration

WHO also advises healthcare providers to administer medications targeted at reducing malaria transmission. Antimalarial patients ought to be those who are more susceptible to infection. It should be simple to detect the factors that indicate which people or groups are more likely to contract an infection. P. vivax: give much thought to the safe and practical administration of treatment in order to avoid relapses. Refrain from stigmatizing populations with higher infection rates. According to WHO, there should be additional complementary measures in place to stop or stop the spread of malaria (42).

Targeted testing and treatment

It is not advised to use targeted testing and treatment to stop the spread of malaria. In extremely low to low or post-elimination settings, the impact of targeted testing and treatment on malaria transmission is probably negligible. Difficulties in identifying extremely low parasite densities and a deficiency in hypnozoite diagnostics (42). Research substantiates the possibility that there exist restricted situations in which focused evaluation and intervention could prove advantageous. When a population finds chemoprevention unacceptable and

individuals at higher risk of infection are readily identifiable, for instance, focused testing and treatment may be performed. If safe and effective implementation of radical cure is only possible for individuals with confirmed infections, then targeted testing and therapy may be employed to prevent P. vivax relapses (42).

It is advised that organized or recognizable groups traveling to or from malaria-endemic regions be tested for the disease and treated accordingly. In post-elimination settings, treating non-immune individuals after they return from malaria-endemic areas would probably be less effective than avoiding infections in these inhabitants using chemoprophylaxis. Foreign travel and well-being (42).

2.11.3 Reactive strategies

Reactive drug administration

It is advised to use reactive drugs to stop the spread of malaria. ability to investigate cases at the residence in order to ascertain the most likely site of infection and to pinpoint the people who were co-exposed with the index case. Ability to count and treat those living with or close to a confirmed malaria case as well as those who are at similar risk of infection with antimalarial drugs. Antimalarial medication recipients ought to be at the same risk of contracting an infection as the index case. RDA might not be beneficial if the virus was imported and the home is not in a welcoming region.

Reactive case detection and treatment (RCDT)

It is advised to recognize and treat reactive cases in order to stop the spread of malaria. It is doubtful that RCDT will have any impact on malaria transmission until an area is either post-elimination or close to elimination. When nations are getting close to cutting off transmission, RCDT becomes a crucial part of surveillance in order to track progress toward eradication. RCDT can support a nation's assertion that it has reached and sustained zero indigenous cases when that nation is post-elimination and pursuing certification. A crucial component of surveillance and reaction to stop the spread of malaria is RCDT.

Reactive indoor residual spraying

It is advised to use reactive indoor residual spraying. Only reactive IRS can be used in place of proactive IRS. Reactive IRS should be added to proactive IRS in a way that balances the potential for further benefit against rising costs and the possibility of pesticide resistance. It could be advantageous to start reactive IRS if none is happening. Reactive IRS could not be beneficial if the index infection was imported and the dwelling is not in a receptive location (42).

2.12 Chapter Summary

This chapter has provided the study's literature review. It has compared and contrasted field data with information from books, journals, papers, and internet sources using a variety of sources. The main emphasis has been on Namibian and other countries' efforts to eliminate malaria, emphasizing the major obstacles that local communities face in controlling this chronic illness. The chapter has also covered how malaria symptoms are identified and understood, as well as the applicability of the Reactive Case Detection (RCD) Theory and the 1-3-7 approach for eliminating malaria. Additionally, this chapter has examined the variables that impact the spread of malaria and has offered recommendations for eliminating this disease among communities.

CHAPTER 3. RESEARCH DESIGN AND METHODOLOGY

3. Introduction

This chapter focuses on the research design and research methodology which were used in this study. The researcher also provides an explanation on the population, sample, sampling technique, data collection and data analysis methods used in this study. Furthermore, the researcher explains the research ethics which were observed in this study and how they were observed.

3.1 Research Method and Design

3.1.1 Research Method

A research method can be defined as a strategy of inquiry (20). In this study, the researcher used a mixed research method of quantitative and qualitative methods in order to get some answers about the factors that were impeding malaria elimination in Andara District, Kavango West Region, Namibia. Mixed methods study combines quantitative and qualitative data collection and analysis in one study.

3.1.2 Research Design

Research design can be defined as an architectural outline. It serves to plan, structure and execute the research to maximise the validity of the findings (19). A convergent parallel design was used, which entails the simultaneous collection of quantitative and qualitative data. Data was then analyzed separately, and the results were compared. A convergent parallel research design as used in this study because it allowed for the collection of rich, detailed data and provided a comprehensive understanding of the factors that were impeding malaria elimination in Andara District. Findings from the qualitative and quantitative data were compared and interpreted.

The researcher used a cross-sectional design for the quantitative design. This design provided a robust framework for exploring the multifaceted nature of malaria elimination challenges in Andara District. The researcher was able to grasp the wider context of malaria transmission in the area by identifying connections and patterns by gathering data from a diverse sample. The cross-sectional approach was used because it allowed for the concurrent gathering of data on a variety of environmental and

demographic characteristics, offering insights into their linkages with attempts to eradicate malaria (29). Targeted treatments can be made easier by using this strategy to identify potential barriers and patterns that may affect health outcomes (4). The researcher could emphasize the value of health education in preventive methods, for instance, by examining the connection between educational achievement and knowledge of malaria.

Furthermore, this method was practical for this large-scale study due to its cost-effectiveness, which guaranteed that the researcher could collect enough data to make significant findings (5). Additionally, the cross-sectional method made data collection possible at a single point in time, which was advantageous for capturing the current state of factors related to malaria without requiring lengthy longitudinal tracking (6). This efficiency is particularly useful in situations with limited resources, where money and time are frequently limited.

For qualitative method, the researcher used a phenomenological design, which used in-depth interviews as a data collection method, to identify and describe in depth factors that were impeding malaria elimination in Andara District and focused on the experience of residents of Andara District about malaria.

Overall, integrating qualitative and quantitative methods gave the researcher more comprehensive findings and enabled the researcher to employ several techniques to gather data on the same issue. The researcher was able to obtain a more thorough and comprehensive understanding of the variables preventing the elimination of malaria in Andara District by utilizing the advantages of both quantitative and qualitative methodologies. This allowed for deeper insights to be reached.

3.2 Population

De Vos defines population as a complete group of individuals or items that possess a common trait that the researcher would like to draw conclusions about (20). According to Ministry of Health Report there were 30 508 people living in Andara District (4).

De Vos defines a population as an entire group of people or things that have anything in common that is pertinent to the goals of the research (20). The population of Andara

District, which amounted to 30,508 people as per the Ministry of Health and Social Services Report, was the study's target population (4). However, since this number includes all residents, including children, the study focused specifically on a subset of this population.

The population of this study comprised adult residents of Andara District who were at least eighteen years old at the time of this study. This particular age range was chosen to guarantee that the participants could offer knowledgeable perspectives regarding their knowledge and actions concerning malaria.

3.2.1 Inclusion Criteria

This study included adults who were willing to participate and give informed consent, aged 18 years or older, who had lived in the Andara District for at least six months prior to the survey. This population was selected for the purpose of the study because they were residing in the Andara district, which is endemic for malaria in the Kavango east region of Namibia.

3.2.2 Exclusion Criteria

The study excluded individuals under 18 years of age, temporary residents or those who had lived in Andara District for less than six months, and persons with severe health issues that could impair their ability to provide informed consent.

The study attempted to improve the validity and application of the findings by focusing on persons who were most likely to have relevant experiences and insights regarding malaria elimination in the Andara District. This was achieved by explicitly specifying the criteria.

3.2.3 Sampling and Sample Size

According to De Vos sampling is a process whereby the researcher chooses participants from the target population to represent the total population (20).

For quantitative sampling, stratified random sampling method was used to collect samples from the population for this study, 9 villages within Andara District were included in this study. These included Mukwe, Dyapanga, Shamundambo, Kapako,

Shadjunu, Ndongo, Divundu, Shadikongoro, and Rudhiva. The researchers divided the population in areas mentioned above into subgroups based on characteristics that they shared such as gender and occupation. After dividing the population into subgroups, the researcher randomly selected participants from each subgroup using simple random sampling method.

Stratified sampling method was used in this study because it allowed each member of Andara district population to have an equal chance of being selected as a participant. Findings obtained from the sample were generalized to the entire population. This provided the researcher with more in-depth information and an overall picture of the challenges that were impeding malaria elimination in Andara District, Kavango East Region, Namibia.

The sample size of this study was 379 participants from Andara District. These samples were drawn through random sampling. This sample size was determined using Yamane formula as follows:

Equation 1: Yamane Formula

$$\text{n (sample size)} = \frac{N\ (total\ population)}{1+N\times e^2}$$

n= is the sample size, N is the total population, and e= the Standard deviation 5% or 0.05.

Hence, the sample of this study was **379** respondents.

For qualitative data, the participants of this study were chosen through purposive sampling method. The researcher conducted individual in-depth interview with 10 participants who comprised two community leaders, two nurses (malaria clinical mentors), two environmental health practitioners, two health extension workers and two community members. Data saturation occurred at the 10th interviewee. The aforementioned individuals were selected for this study because the researcher recognized that, as residents of Andara District, they possessed first-hand knowledge of the obstacles preventing the elimination of malaria in their region.

3.3 Research Instruments

A research instrument can be defined as a tool used by the researcher to collect data (19). Since this study used a mixed approach, both questionnaire and interviews were used in this study to collect data from inhabitants of Andara district.

For quantitative data collection, a self-administered questionnaire was used in this study. The variables for questionnaires were geographic location, distance to the health facility, level of education and occupation and housing condition. A questionnaire was used in this study because it allowed the researcher to collect large amounts of data from the participants about the challenges that were impeding the elimination of malaria in Andara District, within a short period of time. Thus, a questionnaire saved time and it was cost effective. The subjects for the questionnaires were residents of Andara District, including those who had been infected and not infected by malaria. The variables in the questionnaires were sex, level of education, occupation, geographic location, distance from the health center and house structure.

An interview guide was utilized to collect qualitative data. There were three open-ended questions in the interview guide, which required the participant to respond in his/her own words. The central question was, “What factors might be contributing to Andara District not reaching the malaria elimination stage?” The last question was, “What may be done to make sure there are no new cases of malaria transmission in Andara District?” The participants answered these questions in their own words. Probing questions followed for clarity and more explanation.

3.4 Validity, Reliability and Trustworthiness of data

3.4.1 Validity

Validity is defined as the degree to which the researcher has measured what he/she has set out to measure (20). To ensure face and content validity of the questionnaire, the researcher ensured that each question had a logical link with the objectives of the study. The researcher pilots the questionnaire with residents in Kavango East.

Face validity was checked by the supervisors to confirm if the components and structure of instrument were covering all the information that was required to answer

the research questions. Further, the questionnaire was checked by study supervisors, members of the ethical clearance committee of the University and the research office of the Ministry of Health and Social Services, who assessed the study instrument for meeting the expected institutional standards, content and faces validity.

3.4.2 Reliability

Reliability refers to the extent to which the research instrument is consistent, stable, predictable and accurate. A research instrument is said to be reliable only if it is consistent, predictable and accurate (21). To ensure that the questionnaire was reliable, the researcher ensured that it was carefully worded. Reliability was tested through various mechanisms; the pilot study was conducted for questionnaire with different participants. The supervisor and other experts made an evaluation of the questionnaire, checking if it covered and answered the study objectives. The researcher also applied salient mechanisms to minimize inherent inadequacies of individual methods.

3.4.3 Trustworthiness of data

This section explains measures that were taken to ensure trustworthiness of data.

3.4.3.1 Transferability

Transferability in this study's context refers to the degree to which the research findings can be used in different contexts (28).Transferability of this study was ensured through providing thorough descriptions of the Andara District, including social, cultural, environmental, and demographic aspects that contributed to the spread of malaria in this district. This contextual information can aid readers in evaluating the applicability of the findings of this study to other communities dealing with comparable issues.

Furthermore, incorporating a diverse spectrum of viewpoints from community members and community leaders to healthcare professionals through diverse sampling approaches, particularly stratifies and purposive sampling methods helped to improve the researcher's knowledge of the obstacles to the eradication of malaria. By taking this strategy, there is a greater chance that the results of this study may be relevant in different settings. Moreover, insights gained from this study can benefit larger malaria management initiatives in Namibia and elsewhere.

3.4.3.2 Confirmability

Confirmability guarantees that participant experiences, not the researcher's preconceptions or prejudices, have formed the findings. Maintaining audit trails is crucial for achieving confirmability (28). It this study, the researcher preserved a thorough documentation of the whole process of this research, including data collection and analysis methods so that subsequent researchers can follow the reasoning behind the conclusions and validate that they are based on the facts. Also, in order to spot potential biases and present alternate viewpoints, peer debriefing was done. The researcher involved experts and the research supervisor in a discussion about the process and finding of this study.

3.4.3.3 Credibility

Credibility refers to the confidence in the truth of the findings. In this study, credibility was ensured through triangulation. The researcher used multiple data sources and methods to corroborate findings. The researcher combined qualitative and quantitative approaches and gathered data from different participant groups to strengthen the credibility of the findings of this study.

Credibility was also ensured through prolonged engagement with the participants of this study. The researcher spent sufficient time in the field to build rapport with participants and gain a deeper understanding of the various viewpoints and experiences of the participants regarding factors impeding malaria elimination in their district, thereby strengthening the data collected. Persistent observation allowed the researchers to focus on specific elements or themes over time. This ensured that findings of this study were based on comprehensive and accurate representations of participants' experiences.

3.4.3.4 Dependability

Reliability guarantees that study results are consistent and replicable in similar settings. In this study, the researcher included thorough documentation of the methodology, data collection and analysis strategies in order to improve reliability. This thorough documentation makes it possible for other researchers to repeat the study and validate the results. This study also continued to use consistent data collection techniques. The

researcher evaluated and updated these techniques on a regular basis to make sure stay current and useful throughout time.

3.5 Data Collection Procedure

- **Quantitative data**

Data collection procedure can be defined as a process that is followed by the researcher in order to collect data from participants (21). In this study, the researcher initially obtained permission from the MoHSS to conduct this study and a clearance letter from the University Committee of research and publication. Additional permission was obtained from the Director of health at the head office in Rundu and the Senior Medical Officer, Primary Health Care supervisor of Andara District to access participants in that district.

Data collection took place in the villages of Andara District. It took one and a half month for the researcher to collect data. Permission to enter the villages was obtained from the village headmen of this district. The researcher requested permission to enter the villages in this district through letters addressed to the local headmen in order to gather data for the study. Thankfully, approval was given. Following that, the researcher conducted a village familiarization tour to every village that was part of the study, explaining to everyone involved the goals and purposes of the research. Following this familiarization tour, data collection got underway. This tour was a good entry method to the community to support the context-oriented approach contemplated by the researcher and was supported by the established interpersonal relationships.

The researcher self-administered the questionnaires to the participants for them to fill them out. After participants had finished filling out the questionnaires, the researcher collected them.

Each participant was asked to give oral consent before taking part in the data collection process. The written consent was obtained from each respondent before taking part in the study. The researcher administered the survey questionnaire to 379 respondents. The researcher then collected and kept all the questionnaires from the participants once they were done completing questions contained therein.

Qualitative data

Qualitative data was collected through individual in-depth interviews. Interviews with village headmen and villagers took place at their places of residents in their respective villages, while interviews with nurses (malaria clinical mentors), environmental health practitioners and health extension workers took place at their workplaces during their spare time. The interview consisted of only three questions. The researcher asked questions to each participant and recorded the responses of the participant using two cell phones. In case, if the sound recording of one cell phone was poor, the other cell phone served as a backup device.

The first question asked the participant about factors which were contributing to Andara District not reaching the malaria elimination stage, according to the participant's view point. The second question was about challenges that were impeding the elimination of Malaria in Andara district. The last question asked the researcher about what could be done to make sure there were no new cases of malaria transmission in Andara District.

Data saturation occurred on the 10^{th} interview. The duration of each interview was 20-25 minutes. Each interview ended when the researcher had obtained answers for all research questions. After each interview was completed, the researcher created a folder in a computer and kept the interview recordings in the computer. The folders were saved to Google-drive so that in case if the computer malfunctioned, or was stolen, the researcher could still get data from the Google drive. The recordings were secured with a password both in the computer and on Google-drive to ensure confidentiality of data.

Individual in-depth interviews were conducted in this study because they enabled the researcher to obtain original and unique data about factors which were impeding malaria elimination in Andara District directly from the participants. By asking open-ended questions, the researcher obtained in-depth information from the participants. Thus, interviews were easy to carry out and they helped the researcher obtain reliable data from the participants more quickly.

3.6 Data Analysis

Quantitative data analysis

Data analysis can be defined as a process of describing, combining and making inferences from numbers (20). In this study, all the data from the questionnaires was cleaned, coded and entered using different forms of descriptive statistics. The data was analysed through the Statistical Package for Social Sciences (SPSS) version 27. Descriptive statistics was used to describe the quantitative data. Quantitative data was expressed in numbers in the form of percentages to help the researcher to communicate the findings of the study. The study findings were be presented in tables, graphs and charts.

Qualitative data analysis

Qualitative data was analysed through interpretive phenomenological analysis (IPA). According to De Vos (20) interpretive phenomenological analysis helps the researcher to understand the events, situations or experiences of individuals or groups of people in a society. After each interview, the researcher made an interview transcription, categorised data and found themes and patterns that accurately and fully described participants' lived experiences in the malaria-infested Andara District. The researcher then turned the themes and patterns into final narrative, which was then presented as data in Chapter 4.

Interpretive phenomenological analysis was used in this study because it enabled the researcher to understand the experiences of people in Andara District, Kavango East Region, about challenges that were impeding malaria elimination in their area.

3.7 . Ethical Principles

Strydom (18) argues that ethical considerations are very important in research undertakings that involve human beings. The ethical principles that researchers must observe are spelt out in the Declaration of Helsinki. In terms of the Declaration of Helsinki, researcher have an obligation to respect and protect the human rights, and the general welfare of the participants. In this study, ethical considerations which were observed include respect for institutions, voluntary participation and informed consent, privacy and confidentiality and anonymity, and maleficence.

3.7.1 Principle of respect for institutions

The Nuremburg Code (30) requires researchers to respect all institutions concerned about research. In this study, the researcher sought ethical approval to conduct this study from the Ethics Committee of the University of Namibia. Permission to conduct the study in Andara District was obtained from the Ministry of Health and Social Services, and the Director of Health in Kavango East Region, Namibia.

3.7.2 Informed consent

The ethical principle of informed consent requires the researcher to inform participants of the study about the key elements of a research study and what their participation will involve (23, p. 122). In this study, the researcher informed each participant about this study, purpose of this study, the kind of participation expected from them, and then sought their consent to participate in this study. Only those from whom consent had been obtained managed to participate in this study.

3.7.3 Voluntary participation

The principle of voluntary participation requires the researcher not to force participants to participate in the study (19). In this study, the researcher assured the participants their right to participate freely. The researcher also assured them of their right to withdraw from this study at any time without facing any form of punishment.

3.7.4 Confidentiality

The principle of confidentiality requires he researcher to keep all personal or sensitive information of participants private and ensure that no third party has access to such data (20). To comply with this moral principle, the researcher kept all personal information of participants confidential and took all necessary measures to ensure that no one had access to it. All the questionnaires were locked in a locker; all processed data was stored in a computer and secured with a password for confidentiality and safety reasons.

3.7.5 Anonymity

The moral principle of anonymity requires the researcher to report the study findings in such a way that it cannot be linked to any participant. In this study, the researcher told the respondents not to write their names, contact addresses or any personally identifiable

information on the questionnaires. This helped to ensure that even if these questionnaires were accidentally found by a third person, he/she could link the information contained therein to any participant of this study.

3.7.6 Principle of justice

This study also recognised the principle of justice. According to the Declaration of Helsinki, the principles of justice require medical researchers to be fair to all research subjects during the research (31). In this study, the respondents were selected fairly through systematic sampling procedure. This helped the researcher not to take advantage of vulnerable populations. In order to ensure fair treatment of respondents throughout the entire study, the researcher asked participants the same questions through a questionnaire.

3.7.7 Principle of beneficence

According to De Vos (20) the principle of beneficence requires researchers to do good and to act in the best interest of the research subjects. To uphold this principle in this study, the researcher comforted and gave hope to people living in malaria-infested areas and shared with them other methods which could help them to prevent themselves against malaria.

3.7. 8 The principle of non-maleficence

The principle of non-maleficence is another important ethical principle that was adhered to in this study. This principle states that researchers should not injure research subjects in any way, including bodily, psychological, emotional, or social pain. It highlights the significance of evaluating risks and putting mitigation plans in place in order to protect participants' health and dignity (20).

Before the study started, the research proposal was sent to the Ministry of Health and Social Services and the University of Namibia's ethical committee, respectively. The study was verified to comply with ethical norms by means of an independent review process, specifically with respect to the principle of non-maleficence. The committee oversaw the research procedure to guarantee participant protection and assessed potential risks and benefits.

Participants were given the opportunity to talk about their experiences and any emotions that surfaced throughout the study during a debriefing session after signing up. It was crucial to take this action in order to address any unresolved issues or discomfort and give participants a safe space to express their feelings.

3.8 Chapter Summary

This chapter focused on the research design and research methodology which were used in this study. The researcher also provided an explanation on the population, sample, sampling technique, data collection and data analysis methods used in this study. Furthermore, the researcher explained the research ethics which were observed in this study and how they were observed.

CHAPTER 4: DATA PRESENTATION AND INTERPRETATION

4. Introduction

This chapter focuses on data presentation and interpretation. The data is presented using both quantitative and qualitative techniques. The quantitative methods include both the descriptive and inferential statistics while thematic presentation is employed as a qualitative method of data presentation in this chapter. The data was analyzed based on the following research objectives: to identify the challenges which are impeding the elimination of Malaria in Andara District, to analyse factors which influence transmission of malaria in Andara District and to examine the burden of malaria in Andara District. The data is also presented in graphs, pie charts and tables.

Quantitative data will be presented first, followed by qualitative data.

4.1 Response rate

The response rate of this study is presented in Figure 4.1:

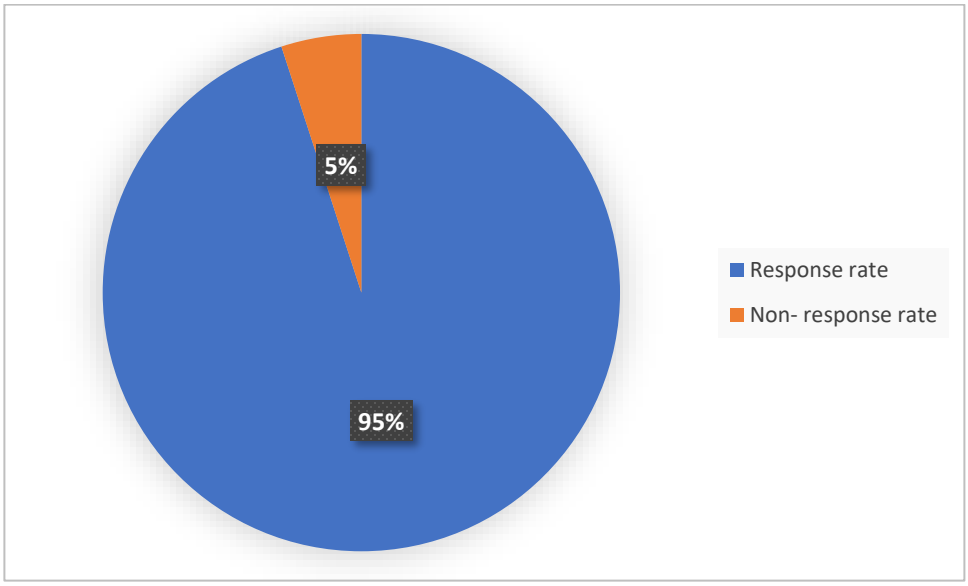

Figure 4.1 Response rate

Figure 4.1 shows the response rate of this study. Out of the sample size of 379, it was noted that the 95%, that is, (360) of the respondents in Andara district answered the questionnaires while 5% (19 respondents) did not answer the questionnaires.

4.2 Demographic Information

The demographic characteristics of the respondents are shown below.

4.2.1 Gender of respondents

The data below shows the gender composition of the respondents.

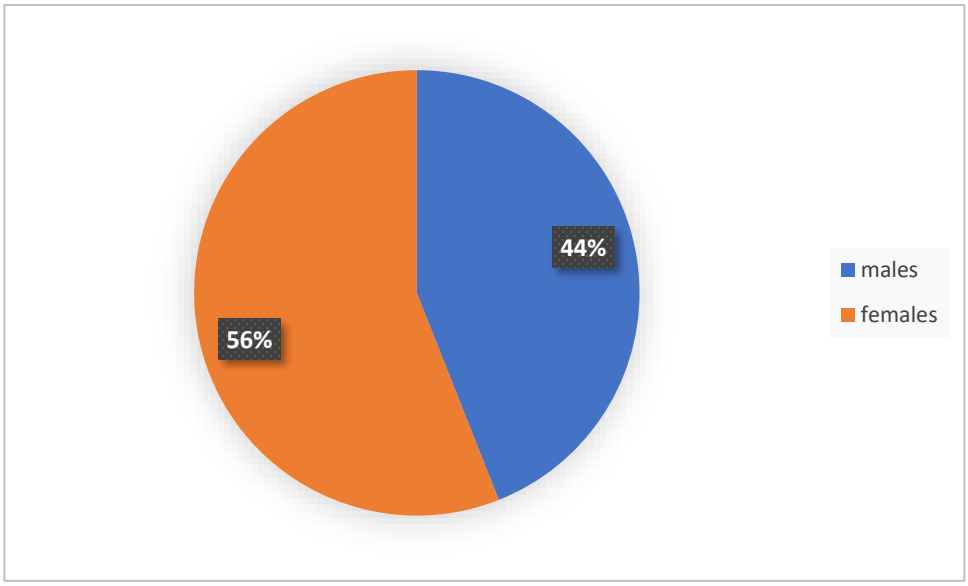

Figure 4.3 Gender Composition of the participants

The data indicates that 44% (159 people) of the respondents were men while the 56% (201) of respondents were women.

4.2.2 Level of Education

The figure below shows the highest level of education of the respondents.

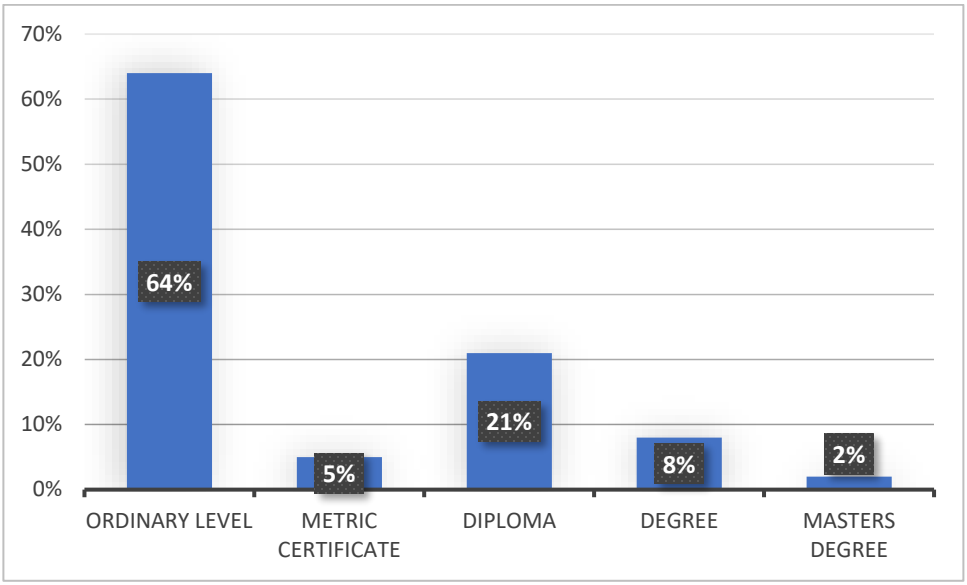

Figure 4.4 Highest level of education of the participants

It was observed from the data set that 64%(230) of the respondents attained the ordinary level. The data additionally revealed that 21% (76) of respondents possessed diplomas, and 5% (18)said that their highest level of education was a metric certificate. Furthermore 2% (7) of respondents reported that they had a master's degree, and 8% (29) of the respondents indicated that they had either a general or honors degree.

4.2.3 Age groups of respondents

The figure below shows the age groups of the respondents.

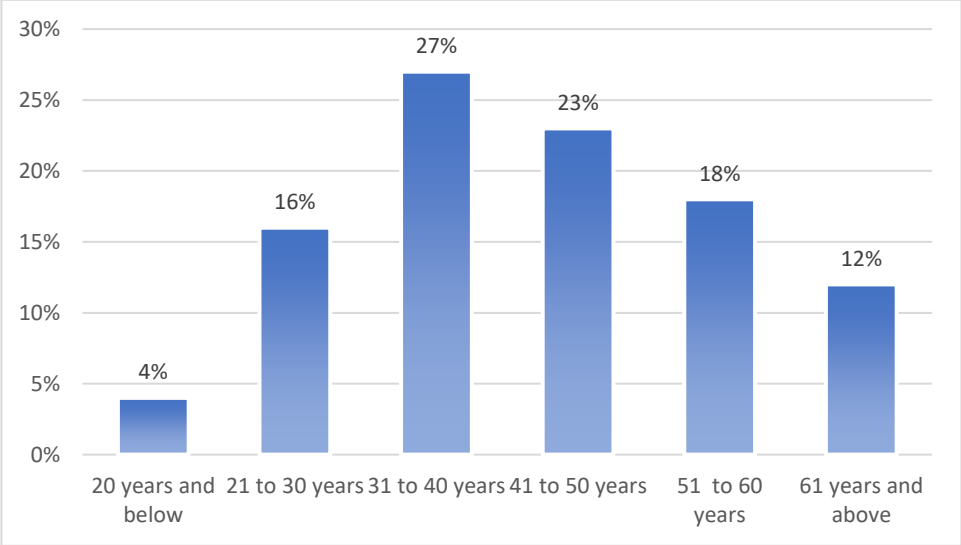

Figure 4.5 Age groups of the respondents

The data indicated that the 12% (43) of the respondents were 61 years and above. It was also shown that 4% (14) of the respondents were in the age group of 18 to 20 years and 16% (58) were aged between 21-30 years. The data also showed that 27% (98) of respondents showed age group of 31 to 40 years and the 23% (82) of the respondents were in the age group 41 to 50 years. It was noted that 18% (65) of the respondents were in the age group of 51 to 60 years.

4.2.4 Marital Statu

The figure below shows the marital status of the respondents

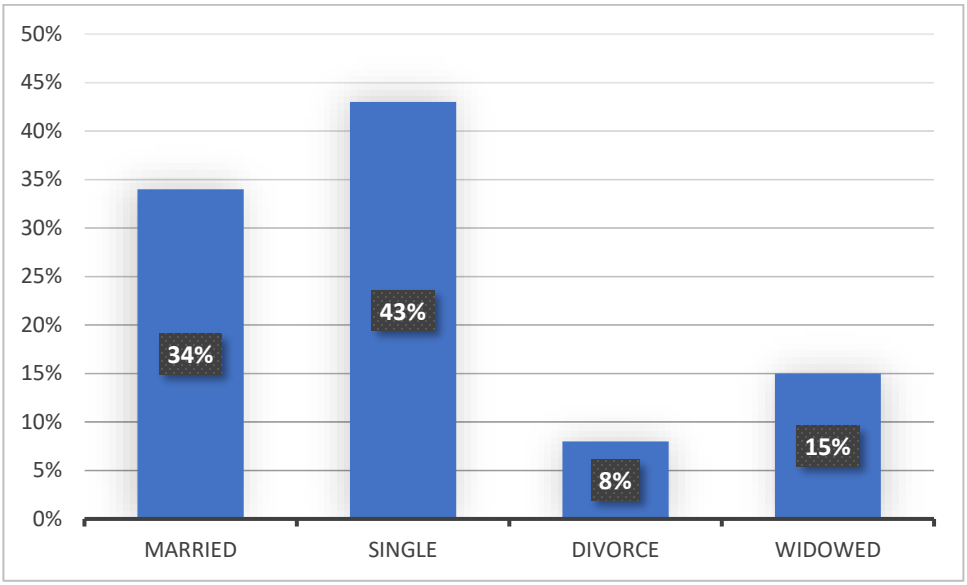

Figure 4.6 Marital status of the respondents

The data indicated that the 43% (155) of the respondents were single and 15% (54) were widows. The data also showed that 8% (29) of the respondents divorced. It was also noted that 34% (122) of the respondents were married. The marital status of the participants showed that all the participants were involved in the research study.

4.2.5 Employment status

The figure below shows the employment status of the people.

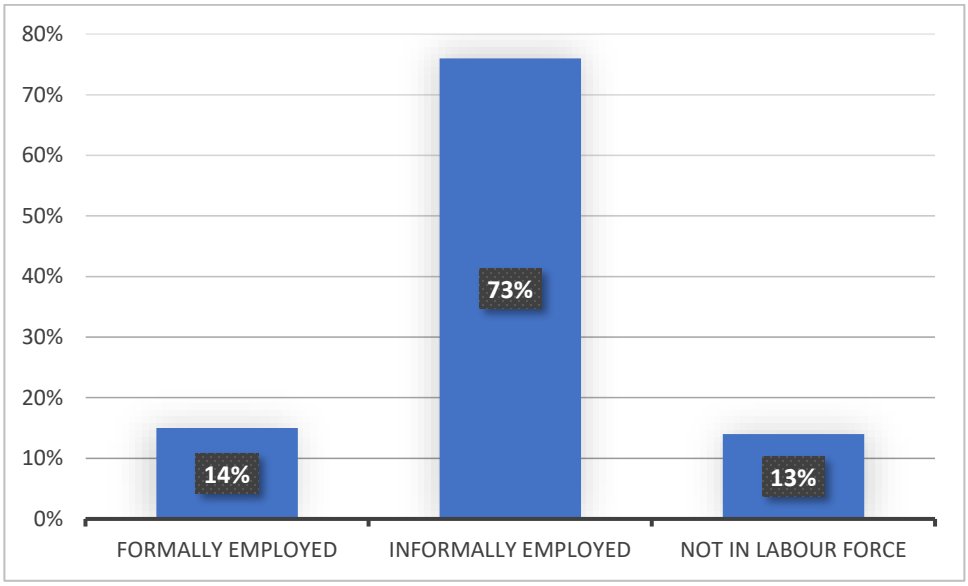

Figure 4.7 Employment status

The data indicated that 73% (263) of the respondents were informally employed while 14% (50) of the respondents were formally employed. It was also noted that 13% (47) of the respondents were not in the labour force.

4.3. Challenges which are impeding the elimination of malaria in Andara District

Below are the findings based on the challenges which are impeding the elimination of Malaria in Andara District.

4.3.1 Major challenges which are impeding the elimination of malaria

The figure below shows the reaction of the respondents on the challenges which are impeding the elimination of malaria.

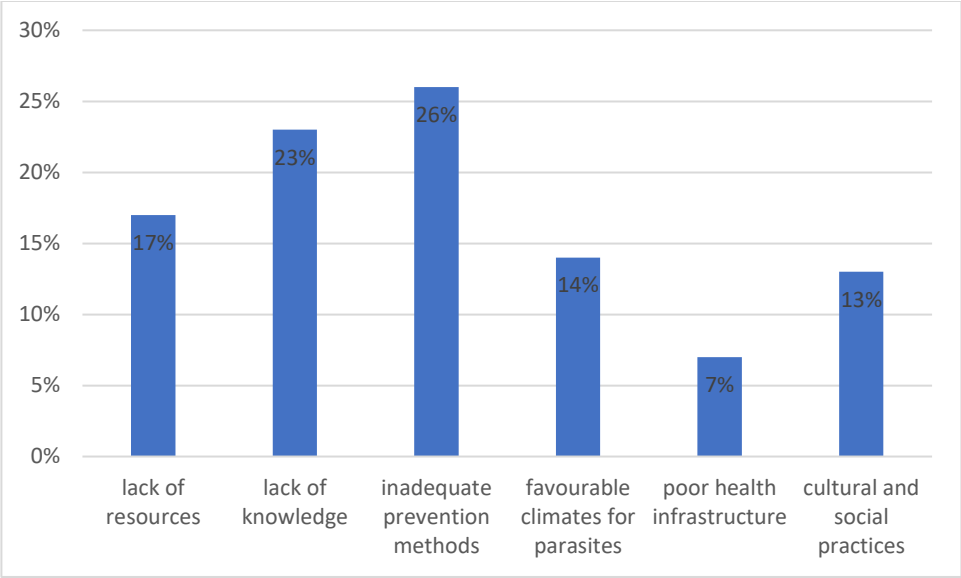

Figure 4.8. Challenges impeding malaria elimination in Andara District

Figure 4.6 above illustrates that 17% (61) of the respondents stated that lack of resources was one of the challenges that were impeding malaria elimination in Andara District while 23% (83) of the respondents cited that lack of knowledge was impeding malaria elimination in this district. About 26% (94) of respondents said that one of the issues preventing malaria from being eradicated was the lack of effective preventive methods. The smallest proportion of respondents, just 7% (25) of the participants said that inadequate infrastructure was the main challenge impeding malaria elimination in Andara District.

4.3.2 Culture as a major impediment of elimination of malaria

Figure below shows views of people on whether the culture is an impeding factor for eliminating malaria.

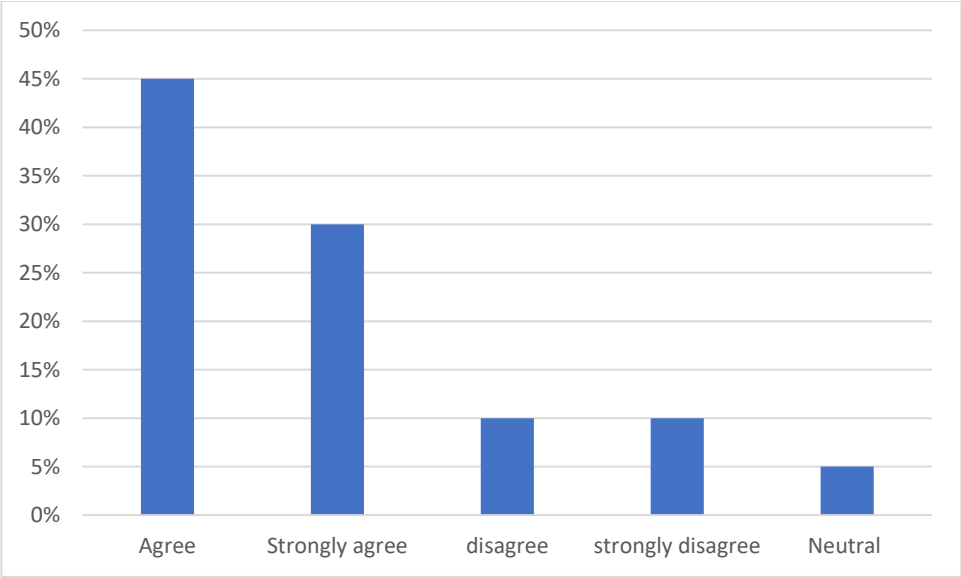

Figure 4.9 'Culture' as a factor impeding malaria elimination in Andara District

The data presented in Figure 4.7 indicates that a significant proportion of respondents 45% (162) expressed agreement with the statement that culture is a major obstacle to the eradication of malaria. Similarly, 30% (108) of respondents strongly agreed that culture is a barrier to the elimination of malaria. Only 5% (18) of the participants had a neutral opinion about the notion that cultural practices impede the elimination of malaria.

4.4 Factors which influence transmission of malaria in Andara District

Below are the suggested factors which influence transmission of malaria in Andara District.

4.4.1 The major factors that influence malaria transmission in Andara District

The figure below shows the reaction of the respondents on the factors which influence transmission of malaria in Andara District.

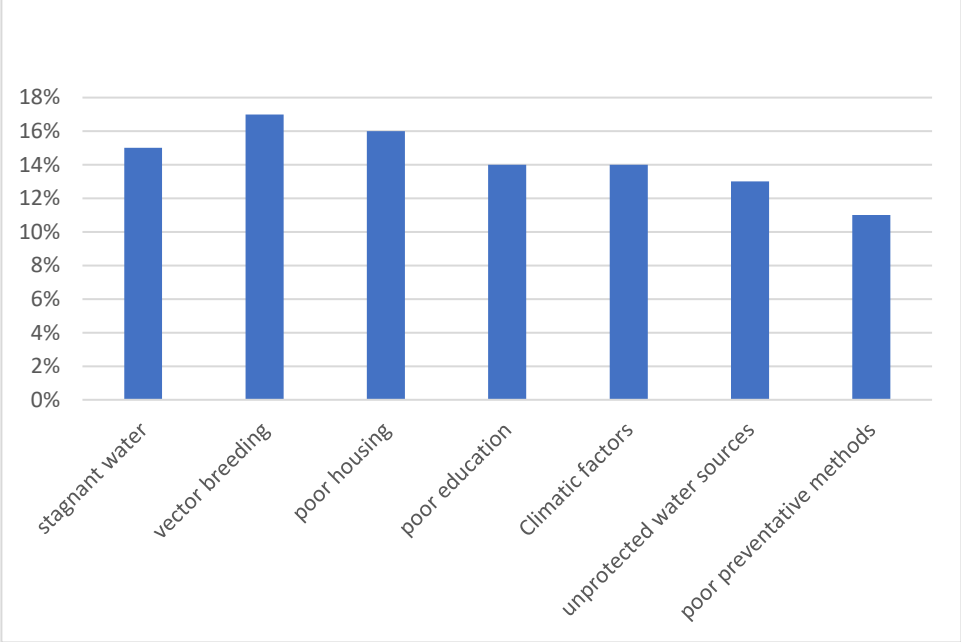

Figure 4.10 Factors impeding malaria elimination in Andara District

It was noted that 17% (61) of the respondents said that stagnant water in ponds, reservoirs, and ponds were factors which influence transmission of malaria in Andara District. It was also indicated that 16% (58) of the respondents suggests that poor housing in Andara District was among the factors which influenced transmission of malaria in Andara District. The data indicated that 14% (50) of the respondents showed that favourable climatic conditions for the parasites factors which influence transmission of malaria in Andara District. The data showed that 14% (50) of the respondents suggested that poor education was one of the factors which influence transmission of malaria in Andara District. It was also shown that 13% (47)of the respondents suggested that unprotected water caused breeding of mosquitos and was among factors which

influence transmission of malaria in Andara District. The data showed that 11% (40) of the respondents suggested that poor preventative methods of malaria was one of the factors which influence transmission of malaria in Andara District.

4.4.2 Shortage of preventative resources in Andara District

Figure below shows views of people on whether lack of preventative resources in Andara District.

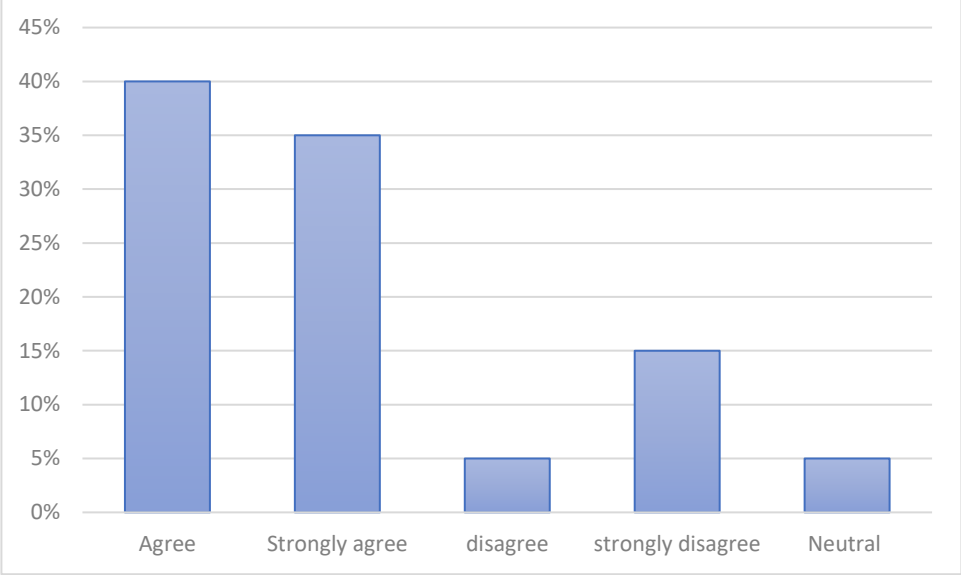

Figure 4.11 Lack of preventative resources in Andara District

According to the data in Figure 4.9, the majority of respondents, about 40% (144), said they agreed that the main factor influencing malaria transmission in Andara District was lack of resources. Similarly, 30% (108) of respondents strongly agreed with this statement. Just 5% (18) of respondents expressed a neutral opinion regarding this statement, however, 15% (54) of respondents strongly disagreed with it.

4.5 The burden of malaria in Andara District

The figure below shows the reaction of the respondents on the major burden of malaria in Andara District.

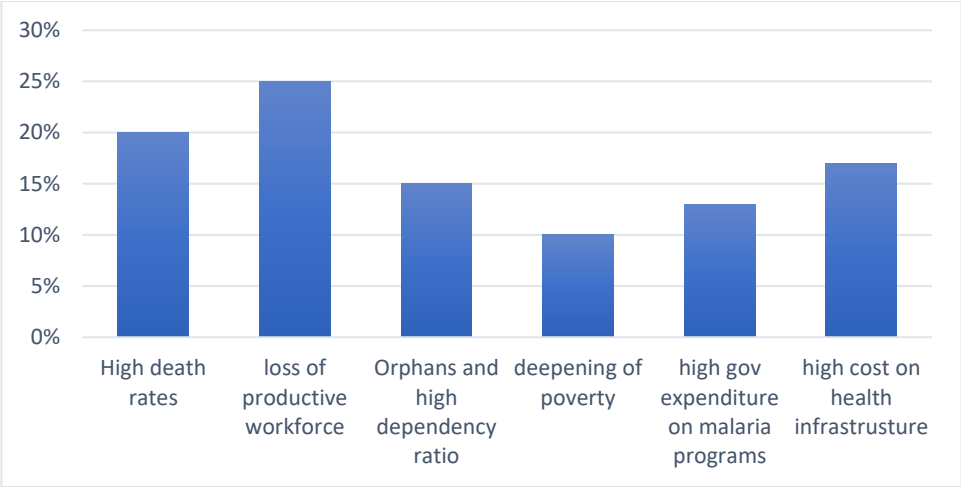

Figure 4.12 The burden of malaria in Andara District

Findings in figure 4.10 shows that 25% (90) of respondents said that the primary cause of malaria in Andara District was the departure of productive workers. Similarly, 20% (72) of them claimed that the primary malarial burden in Andara District was attributable to deaths from the disease. Additionally, it was shown that 15% (54) of respondents believed that the primary causes of malaria in Andara District were the district's high dependency rate and orphan population. Also, 13% (47) of the respondents said that the primary cause of malaria in Andara District was excessive government spending. Additionally, data indicated that 17% (61) of respondents believed that the primary cause of malaria in Andara District was the high level of spending on health facilities. However, only 10% (36) of respondents, said that the primary cause of malaria in Andara District was the region's growing.

4.5.1 High death rates

Figure below shows views of people on whether high malaria related death was a major burden in the district in Andara District.

Figure 4.12: Malaria related death as a major burden in the district in Andara District

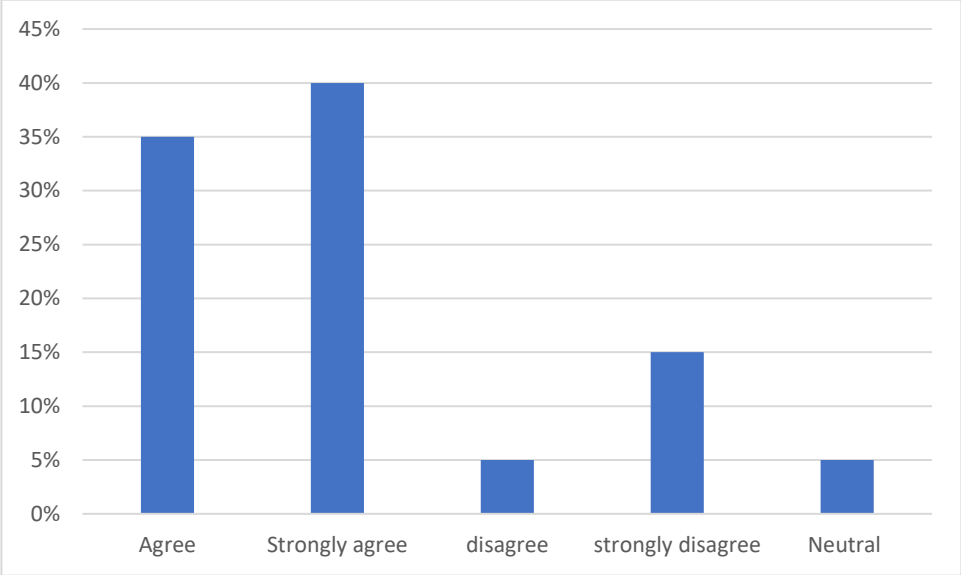

Figure 4.13 High malaria-related deaths

From the data which was collected from the field, it was noted that 35% (126) of the respondents indicated they agreed that there is high malaria related death in the district. The data also indicated that 40% (144) of the respondents strongly agreed that there is high malaria related death a major burden in the district. The data indicated that 5% (18) of the respondents disagreed that there is high malaria related death in the district which was a burden to the community. It was also noted that 15% (54) of the respondents strongly disagreed that the major burden was high malaria related death in the district . However, the remaining 5% (18)of the respondents were neutral about the view that the major burden was high malaria related death in the district.

4.6 Inferential statistics

4.6.1 The impediments of elimination of malaria in Andara District

De Vos (28) suggested that test the suitability of the variables as well as consistency of the data collected, a multiple regression should be used. They can be used to establish covariance relationships between variables with hidden factors that are mainly affected by brand management of the organisation. The variables include lack of resources, poor surveillance systems, poor healthcare infrastructure, inadequate prevention of Malaria, social and belief practices in Andara District, lack of knowledge and climatic conditions of the Andara District. The following were the proposed hypothesis of this study and was concluded based on the t-statistics of the variables:

H1: Lack of resources was the impediment of elimination of malaria in Andara District

H2: Poor surveillance system was one of the impediments of elimination of malaria in Andara District

H3:Poor healthcare infrastructure was an impediment of elimination of malaria in Andara District

H4: Inadequate prevention of Malaria in the district of Andara is the impediment of elimination of malaria

H5: Social and belief practices in Andara District is an impediment of elimination of malaria

H6: Lack of knowledge is the major impediment of elimination of malaria in Andra District

H7:Climatic conditions are the impediment of elimination of malaria in Andara District.

The regression output is summarized below.

Table 4.1 Regression output

SUMMARY OUTPUT							

REGRESSION STATISTICS								
Multiple R	0.716175							
R square	0.72672							
Adjusted R	0.502436							
Standard error	226.4243							
Observation	300							
ANOVA	Df	SS	F	Significance F				
Regression	2	219650.5	2.142179	0.188007				
Residual	300	358876						
Total	301	578626.5						
	Coefficients	standard error	t-Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	421.2665	299.2794	1.40763	0.20207	286.416	1148.948	286.416	1148.948
H1: Lack of resources	3057188	86.26793	0.354388	0.736486	234.562	173.4283	234.562	173.4283

H2: Poor surveillance systems	65.18728	173.4075	0.3759388	0.718148	344.8467	475.2211	344.8467	475.2211
H3:Poor healthcare infrastructure	323.57188	87.26793	0.394388	0.786486	235.562	175.4283	235.562	174.4283
H4: Inadequate prevention of Malaria	66.18728	175.4075	0.559387	0.768148	347.8467	477.2211	346.8467	479.2211
H5: Social and belief practices in Andara District	31.57188	90.26793	0.74387	0.796486	264.562	176.4283	235.562	176.4283
H6: Lack of knowledge	65.18728	173.4075	0.3759387	0.718148	344.8467	475.2211	344.8467	475.2211
H7:climatic	31.57188	90.26793	0.74387	0.7964	264.56	176.42	235.56	176.4

conditions.				86	2	83	2	283

The above table represents the output of multiple regression which can provide the *R*, R^2, adjusted R^2 as well as the standard error of the estimate which is essential for determining how well the regression model fits the data: It was shown that lack of resources had a t- statistics of 0.354388. This showed that it was a contributing factor to the impediment in elimination of malaria in Andara District. Poor surveillance system also showed a t-statists of 0.3759388 and this showed that it was one of the impediments of elimination of malaria in Andara District. The data indicated that poor healthcare infrastructure had a t-statistics of 0.394388. This showed that it was an impediment of elimination of malaria in Andara District. Inadequate prevention of Malaria in the district of Andara showed a t-statistics value of 0.559387 and this showed that it was an impediment of elimination of malaria. Social and belief practices in Andara District showed a t-value of 0.74387 and this showed that it was an impediment of elimination of malaria. Lack of knowledge 0.375938 and this showed that it was a major impediment of elimination of malaria in Andra District. Climatic conditions showed 0.7438 and it showed it was an impediment of elimination of malaria in Andara District.

From the table above shows that the "R" column which represents the value of R, the multiple correlation coefficient. R in this case should be used to measure the quality as well as efficient of prediction of the dependent variable. The 73% indicates a good level of prediction. The "R Square" is used to represents the R squared value which is referred to as the coefficient of determination which is the proportion of variance which is in the dependent variable that can accurately explained by the independent variables. In short it is the proportion of variation which is accounted for by the regression model beyond and above the mean model. The above data showed that the value of 0.5027 explain the variability. The Adjusted R Square is used to determine how the researcher has accurately reported the data and it can also explain the reasons for this as well as the output enhanced multiple regression guide.

4.6.2 Statistical significance

From the table 4.2 below, the *F*-ratio which is in the ANOVA table has showed that tests whether the overall regression model is a good fit for the data. The data showed that there are independent variables that can be statistically and significantly used to predict the dependent variable, $F(2.14, 95) = 32.393, p < .0005$ and this showed that the regression model is a good fit of the data.

4.6.3. Cronbach's Alpha

The table below shows Cronbach's alpha of multidimensional variables.

Table 4.2 Cronbach's Alpha

Constructs	Cronbach's Alpha	p values
Lack of resources	.7020	.000
Poor surveillance systems	.7450	.000
Poor healthcare infrastructure	.7920	.000
Inadequate prevention of Malaria	.7820	.000
Social and belief practices in Andara District	.7850	.000
Lack of knowledge	0.7840	.000
climatic conditions.	0.8560	0.000

The Cronbach's alpha is based on the internal stability and consistency as well as the reliability of the variables that were employed in the research and should have a minimum required level of 0.7 (Kai, 2018). In this study, Cronbach's Alpha levels was between 0.702 and 0.792 which is acceptable.

4.6.4 Goodness of fit test

The table below shows the goodness of fit test

Table 4.3 Goodness of fit test

Item	GoF	GoF (Bootstrap)	Standard error
Absolute	0.330	0.334	0.014
Relative	0.930	0.904	0.015
Outer model	0.975	0.974	0.005
Inner model	0.952	0.925	0.014

The above data shows that the interaction of the variables that can be statistically and significantly used to predict the dependent variable, $F(2.14, 95) = 32.393$, $p < .0005$.

4.7 The Qualitative Findings

4.7.1 Introduction

This section presents qualitative findings from the in-depth interviews which were conducted on factors impeding the elimination of malaria in Andara District. The interviews were conducted in different areas such as Mukwe, Dyapanga, Shamundambo, Kapako, Shadjunu, Ndongo, Divundu, Shadikongoro, and Rudhiva. The participants were 1 up to 10. The research questions were: What factors might be contributing to Andara District not reaching the malaria elimination stage?" The second question was, "What challenges are impeding the elimination of Malaria in Andara district?" The last question was, "What may be done to make sure there are no new cases of malaria transmission in Andara District?" The participants answered these questions in their own words. The findings are therefore presented in this chapter.

The themes and subthemes drawn from this study are presented in Table 4.

Table 4 Themes and subthemes

Theme	Subthemes
Factors that influence the transmission of malaria in Andara District	• limited research on traditional malaria prevention methods • uncontrolled cross border migration • favourable environmental conditions • good climatic conditions • resistance of mosquitos to insecticides • poor surveillance of malaria transmission hotspots.
Barriers to mosquito control and prevention in Andara District.	• resistance of mosquitos to insecticides • shortage of resources such as nets and sprays, shortage of healthcare workers • long distance to the hospital.
The burden of malaria in Andara District	• increased cost to families and communities • costs to the government • morbidity and high mortality rates.

The above themes and subthemes are discussed in detail below.

Theme 1. Factors that influence malaria transmission

The participants were asked about different factors that influence the transmission of malaria in Andara District. After analysing the data, six themes were generated from the responses of the participants; they are as follows: limited research on traditional malaria prevention methods, uncontrolled cross border migration, favourable environmental conditions, good climatic conditions, resistance of mosquitos to insecticides and poor surveillance of malaria transmission hotspots. These findings will be discussed below:

a. Limited research on traditional malaria prevention methods

In response to a question concerning the factors influencing the elimination of malaria in the Andara District, the participants mentioned limited research on traditional malaria prevention as one of the factors actors influencing the transmission of malaria in the district. Participants 4, 5, and 6 stated as follows:

"The traditional practices in malaria prevention, human dispersion and livelihood, human factors, and environmental factors that facilitate malaria transmission are the major challenges which are impeding the elimination of malaria in Andara District."

Participant 7 stated further that:

"Despite the effectiveness of insecticides used to control malaria, it is so challenging for the residents of Andara District to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places. In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities."

These findings concur with previous empirical reviews' conclusions (14), which confirm that limited study has been conducted to establish the effectiveness of traditional malaria prevention measures. For instance, in Malawi, it was discovered that a lack of research on conventional malaria prevention techniques encourages dependence on untested or ineffective tactics, spreads false information, and impedes the uptake of interventions with scientific backing. According to the report, effective attempts to eradicate malaria in this nation must prioritize research and evidence-based policy (14).

Another study on how limited research on traditional malaria prevention methods influences malaria transmission found that traditional knowledge and practices can offer valuable insights into malaria prevention, but without research, opportunities for innovation or adaptation of these methods alongside modern approaches may be missed (15). This was supported by a recent study conducted in Kampala, Uganda, which found that many traditional practices, such the use of herbal treatments or certain ceremonies, had been practiced for years in Uganda without undergoing a thorough scientific

analysis. However, it is uncertain if they are useful in preventing malaria due to a dearth of study (17). This study suggests that communities may continue to use these techniques in place of tried-and-true preventive strategies like indoor residual spraying or insecticide-treated nets, which are widely acknowledged to dramatically lower the transmission of malaria. According to this Ugandan study, further investigation can assist pinpoint elements of conventional approaches that effectively suppress mosquito populations and incorporate them into more comprehensive malaria control plans.

WHO recommends that in order to eradicate and eliminate malaria in African nations, everyone living in mosquito-infested areas should have equitable access to free medications used to treat malaria. There are certain false beliefs and misconceptions regarding the efficacy of traditional malaria prevention techniques, however these approaches have not been verified, according to a study on the factors preventing the elimination of malaria in Sesheke, Zambia (6). People prefer these approaches over scientifically proven ones, the report claim, which increases exposure to malaria-carrying mosquitoes and increases the rate of transmission (6).

The literature review's findings indicate that a lack of research on conventional malaria preventive techniques may encourage the use of ineffective or unproven approaches, which could prolong the spread of this disease. The insufficient research on conventional malaria prevention strategies feeds false information and impedes the uptake of scientifically proven malaria control approaches, as the empirical review also reveals. For effective malaria control and elimination activities in Andara District, it is imperative that these myths and untested practices be addressed through research and evidence-based policy.

b. Uncontrolled cross border migration

Another sub-theme that can be derived from the responses of participants about factors that influence malaria transmission in Andara District is uncontrolled cross-border migration. In this regard, Participant 1,3and 7 said:

"There are new cases of malaria that emerge out of a variety of factors such as cross border migration especially with Angola to the Andara District as we have the relatives living in Angola and this free movement of people facilitate the disease transmission

because it increases the risk of reception and vulnerability specially where migrants move from endemic areas to those that are less endemic.

A recent study conducted in Kenya, Tanzania, and Uganda supported the findings of this study, indicating that unregulated cross-border migration can have a substantial impact on malaria transmission in a number of ways (31). Their approach to the issue, like that of other nations in Asia and Latin America, is to promote efficient malaria interventions including prevention and management of imported malaria infections. Evidence from research and experience in these nations spoke to the difficulties in controlling and preventing imported malaria infections in nations that have long-distance land borders with endemic neighbors. The challenge of eliminating malaria in these countries is due to a number of factors, such as human migration, mosquito populations, and the parasites they carry. For instance, in East Africa, hotspots of origin-specific immigrants from neighboring countries with varying migration patterns were identified for Kenya, Tanzania, and Uganda (28).

In order to prevent, control, and eradicate imported malaria infections from neighboring countries, additional research is necessary, according to a recent WHO study (32). This study found that individuals who migrate from high-malaria-prevalence regions, such as the Democratic Republic of the Congo, Mozambique, Tanzania, and Niger, typically bring malaria parasites with them to new locations where prevention efforts have lowered transmission. This brings in fresh infection sources, which fuels future localized outbreaks or a return of malaria (32). An additional empirical investigation verified that the mobility of infected persons is a contributing factor to the elimination of malaria in Sub-Saharan Africa (33). This study suggests that migrants who carry malaria parasites on their travels may transfer the disease to new locations. This is especially important in locations where individuals migrate from high-transmission to low-transmission areas, as this could expose local populations that haven't developed immunity to malaria.

Data from South Africa suggests that certain migrants disregard malaria prevention strategies such indoor re

sidual spraying, insecticide-treated nets, and early antimalarial medication treatment. As a result, their mobility may jeopardize regional attempts to stop the spread of malaria,

increasing the disease's incidence and prevalence (34). The study also discovered that public health surveillance systems face difficulties from unregulated migration between some nations. Because of this, it is more difficult to identify and follow malaria cases between different nations, particularly when they affect individuals who are constantly on the move and lack a fixed address or reliable access to healthcare.

High rates of malaria case importation have been attributed to sugar plantation workers, whose travel patterns between these two nations are well established, according to a 2018 study on travel patterns and demographic characteristics of malaria cases in Eswatini (39). In the Eswatini study in the early months of 2018, a significant number of imported cases of malaria were noted. It's said that laborers from Mozambique who returned to Eswatini in January after the Christmas and New Year holidays are probably to blame for these elevated malaria incidences (39). Additionally, the study found that international travelers, particularly those who go to malaria-endemic regions, are more likely to contract malaria since they often spend longer time away from home than domestic travelers. The likelihood of bringing parasites back with you increases with this duration of stay (39).

Given the aforementioned, it was proposed that countries should coordinate their efforts to address uncontrolled cross-border migration, enhancing surveillance systems and guaranteeing that individuals without permanent residences have access to malaria prevention and treatment services (34). In addition, it was proposed that in order to stop the spread of malaria and eradicate it entirely, efficient migration management and international cooperation are crucial.

c. Favourable environmental conditions

The other theme that can be derived from the responses of participants about factors that influence malaria elimination is the favorable environmental conditions throughout the district. Participants 1,2 and 8 said:

"In actuality, excessive rain may temporarily wash away mosquito breeding grounds, but mosquitoes start to reproduce as soon as the rain stops, In lowland plains, flooding usually has less of an impact on vector breeding habitats than it does in highland and mountainous areas. Not every body of water is suitable for a mosquito's life cycle. As

anopheline mosquitoes favour breeding in freshwater collections created following the rainy season, the Andara District's rainwater collections serve as the most important breeding grounds. These waterways are pure, regardless of how murky or clear they are."

According to the study, the natural vegetation, agricultural crops, and animal watering spots in the Andara District serve as hatching grounds for mosquitoes, while domestic livestock and other animals serve as food sources for Anopheles arabiensis. Other issues were also noted, including the timing of rainfall and the effects of climate change in the Andara District. The interviewees also highlighted how seasonality, geographical expansion, and transmission intensity of the malaria system are all influenced by environmental factors.

The aforementioned results are consistent with recent research-based data from South-East Sulawesi, Indonesia, which observed that the presence of a variety of animal species influences mosquito feeding preferences and the availability of alternate hosts for the malaria parasite, both of which have an impact on the dynamics of malaria transmission (33). This study indicates that different mosquito species have varied needs in terms of environment. Certain animals act as reservoirs for certain types of Plasmodium, keeping the parasite alive in the environment and allowing humans to become infected. These dynamics can be changed by changes in biodiversity brought about by habitat loss or fragmentation, which might affect the patterns of malaria transmission (33). Anopheles mosquitoes prefer to breed in clear, stagnant water sources like ponds, marshes, and rice paddies, as this study also proved. Therefore, efforts to build or destroy these habitats may have a direct impact on mosquito populations, which may change the rate at which malaria is transmitted.

Having stated that, it was suggested that in order to create efficient plans for managing and eradicating malaria in the aforementioned places, it is critical to comprehend how the natural environment affects malaria transmission (33). In order to lessen the prevalence of malaria in Indonesia, the aforementioned Indonesian study also suggested the necessity for integrated approaches that take community involvement, climate adaptation, and environmental management into account (33).

d. **Climate and weather patterns**

The other sub-theme that was derived from the responses of participants about factors that influence malaria elimination is the climate and weather patterns. The participants stated that temperature, precipitation, and humidity in Andara District are mentioned as the main meteorological variables that have a direct impact on the spread of malaria. Below is what the participants said:

The participants 1,2 and 8 added, *"In truth, prolonged rain may temporarily remove mosquito breeding habitats, but as soon as the rain ceases, mosquito reproduction begins. Flooding typically has a greater effect on vector breeding habitats in highland and mountainous regions than it does in lowland plains. Not every body of water is appropriate for the life cycle of a mosquito. The district's rainwater collections act as the most significant breeding grounds for anopheline mosquitoes since they prefer to breed in freshwater collections made after the rainy season. Whether they are clear or murky, these streams are pure. Thus, for mosquitoes to reproduce, the proper quantity of rainfall is frequently required. Different kinds of bodies of water are preferred by different species of anopheline mosquitoes for breeding."*

The participants suggested that higher temperatures in Andara District promoted malaria parasite's life cycle in this organization. The duration needed for the parasite to finish developing in the mosquito's gut is approximately ten days, though the temperature can affect this time.

The participants 1,2 and 8 added, *"In actuality, excessive rain may temporarily wash away mosquito breeding grounds, but mosquitoes start to reproduce as soon as the rain stops, In lowland plains, flooding usually has less of an impact on vector breeding habitats than it does in highland and mountainous areas. The Not every body of water is suitable for a mosquito's life cycle. As anopheline mosquitoes favour breeding in freshwater collections created following the rainy season, the Andara District's rainwater collections serve as the most important breeding grounds. These waterways are pure, regardless of how murky or clear they are. Therefore, it is often necessary to have the right amount of rainfall in order for mosquitoes to reproduce. Different species of anopheline mosquitoes prefer different types of bodies of water to breed in. Another*

obstacle to the eradication of malaria is inadequate surveillance to pinpoint malaria transmission hotspots."

Empirical research indicates that climate and weather patterns impact malaria transmission, corroborating the preceding findings (36). It has been proposed that patterns of rainfall and temperature have an impact on the spread of malaria. Rainfall creates mosquito breeding sites by filling puddles, ponds, and other stagnant water bodies where mosquitoes lay their eggs. Warm temperatures speed up Plasmodium development within mosquitoes, reducing the incubation period required for the parasite to mature and become infectious (36). The geographical distribution and seasonal patterns of malaria transmission can thus be influenced by modifications to climatic patterns, such as rises in temperature or changes in precipitation regimes (36).

e. Resistance of mosquitos to insecticides

The participants suggested that there was reduced sensitivity of anopheles mosquito to insecticides in the district of Andara. There were also some of the declining effectiveness of the malaria insecticides that had the serious impact on mosquito control and malaria transmission. Participants 1 stated as follows:

"There are challenges to confront in order to make the desired progress in Andara District,. The primary obstacles are insecticide resistance, treatment failure, and climate change. The challenges are insurgencies, conflicts, internally displaced people, migration, lack of political will, poor leadership in the fight against malaria, funding, and sufficient local research. To eradicate malaria, it is essential to address these issues. Natural vegetation, agricultural crops, and animal water points, provide potential breeding sites for mosquitoes in this district,"

The aforementioned conclusions have been supported by research indicating that one major obstacle in the fight against malaria is mosquito resistance to pesticides. It has been observed that insecticide-resistant mosquitoes can affect malaria transmission in a variety of ways, including by lessening the efficiency of mosquito control efforts (24). According to published research, mosquitoes may become resistant to insecticides due to genetic alterations that lessen their susceptibility to the substances employed in vector control measures like treated bed nets and indoor residual spraying. These therapies'

ability to kill or repel mosquitoes decreases as resistance grows, lessening its influence on the spread of malaria (24).

According to additional research-based information (33), however, resistant mosquitoes may have an increased chance of surviving insecticide exposure. Based on available data, it may be inferred that mosquitoes persist in spreading the parasite over extended periods of time, hence augmenting the capacity of the vector population to maintain transmission cycles (33). An additional investigation verified that pesticide resistance expanded across other regions due to mosquito migration, posing challenges for the containment and management of malaria in those and other targeted places.

f. Poor surveillance of malaria transmission hotspots

The participants suggested that there was poor surveillance to identify hotspots of malaria transmission in Andara District which were identified as the factor impeding malaria elimination in this district. There were some suggested weak links between research institutes and control programmes in a country create a gap in research.

The participants 1,2 and 8 added, "*Different species of anopheles mosquitoes prefer different types of bodies of water to breed in. Another obstacle to the eradication of malaria is inadequate surveillance to pinpoint malaria transmission hotspots. The effective adaptation and utilization of available resources by rural communities is considered a significant challenge, primarily due to factors such as limited affordability, acceptability, accessibility, equity, and distribution challenges in these rural areas."*

Research indicates that it is challenging for countries to track their progress toward eliminating malaria due to inadequate surveillance of hotspots where the disease is most likely to spread (37). It has been proposed that surveillance is crucial for tracking the effectiveness of malaria control measures over an extended period of time. It is challenging to determine if interventions are successfully reducing malaria transmission or whether more steps are necessary in the absence of comprehensive surveillance (37). Additionally, it has been proposed that in order to enhance efforts to control malaria, surveillance systems should be strengthened by putting in place prompt and dependable

reporting procedures that allow medical facilities and community health workers to report instances of malaria.

It was discovered that delayed detection of malaria outbreaks occurs in a recent empirical analysis on how surveillance of malaria transmission hotspots affects attempts to control and eliminate malaria. This was verified particularly in southern Yunnan Province of China, where many cases of malaria were recognized late and some went unnoticed (38). Due to these delays, the spread of illnesses was permitted to proceed uncontrolled. As per the Chinese study, enhancing surveillance systems through training and resource provision for healthcare personnel and epidemiologists to increase case identification, diagnosis, and reporting nationwide is crucial for improving malaria control efforts (38).

The Chinese situation mentioned above also demonstrated how difficult it is to get resources like insecticide-treated nets, indoor residual spraying, and antimalarial medications to places where they are most needed in the absence of precise data on malaria transmission hotspots. Thus, malaria may continue to exist and spread due to inconsistent coverage and gaps in protection (38). It was suggested that training healthcare professionals and providing them with resources would help them detect, diagnose, and report malaria cases more effectively, which would enhance the efforts to abolish the disease (38).

Theme 2. Barriers to mosquito control and prevention in Andara District

The participants were asked about barriers to mosquito control and prevention in Andara District. After analyzing the data, three themes were generated from the responses of the participants. They are as follow: resistance of mosquitos to insecticides, shortage of resources such as nets and sprays, shortage of healthcare workers and long distance to the hospital. These themes are discussed below:

a. Resistance of mosquitos to insecticides

‘Resistance of mosquitos to insecticides’ was cited as one of the barriers to mosquito control and prevention in Andara District. Participant 1 said:

"Prevention of malaria poses a challenge because vectors have become resistant to insecticides or exhibit low sensitivity to the compounds,"

The results of this study, which are summarized above, are consistent with earlier international research indicating that malaria poses a serious threat to numerous areas spread throughout the world. The ability of insecticides to kill mosquitoes is diminished by resistance development, which lowers the efficacy of insecticide-based mosquito control measures and increases mosquito longevity, according to a recent Ethiopian study (34). Notes have been made that mosquitoes that are resistant to one kind of insecticide can also grow resistant to other types in the same chemical class or even to insecticides with distinct mechanisms of action. The difficulty in handling resistance is increased by this cross-resistance, which also reduces control options (34).

According to the Ethiopian case study mentioned above (34), combating mosquito resistance calls for a multipronged strategy that involves community education, surveillance, international cooperation, research into new insecticide formulations and alternative control techniques, and international collaboration. By implementing these tactics, public health organizations can improve the efficacy and durability of mosquito control initiatives, lessening the impact of malaria on affected areas (25).

Considering the aforementioned, the World Health Organization (WHO) stated that controlling resistance of mosquitos to insecticides requires the use of greater doses or alternative insecticides, both of which might raise the operational costs of control programs (26). Additionally, regular observation of mosquito populations using standardized bioassays and molecular approaches is required to monitor pesticide resistance. It has been observed, therefore, that the execution of effective monitoring programs is hampered by the lack of infrastructure and resources in malaria-prone areas (26).

Previous research suggested that mosquito control programs use integrated approaches that combine chemical control with other techniques like larval source management, biological control, environmental management, and community engagement to address the problem of mosquito resistance to insecticides.

b. Shortage of resources such as mosquito nets and sprays

Another barrier to mosquito control and prevention in Andara District that was mentioned by the participants is the shortage of resources such as mosquito nets and sprays. Below is what Participant 2 and 4 said:

"It is challenging to accomplish goals in targeted areas and communities living in endemic areas due to a lack of resources such as mosquito net distribution, mosquito spraying."

The results mentioned above are consistent with past research that shows the lack of necessary supplies, such as insect repellent and nets, presents serious obstacles to successful efforts to control and prevent mosquito populations (11). For instance, it has been observed in Zambia that people are more exposed to mosquitoes due to a lack of mosquito nets and sprays. Malaria risk rises as a result of this. Additionally, the study discovered that vulnerable groups such as pregnant women, small children, and those with compromised immune systems are especially vulnerable when basic supplies like insect repellent and mosquito nets are scarce. Malaria frequently has greater detrimental health effects on these populations (11).

Lack of mosquito nets and sprays weakens ongoing mosquito control efforts and interferes with planned distribution campaigns, according to empirical evidence from Zimbabwe. This makes it more difficult for public health organizations to meet coverage goals and successfully lower mosquito populations (12).

Considering the aforementioned, it has been proposed that governments, donors, and local communities must work together to address the scarcity of mosquito nets and sprays (35). Funding for the purchase and distribution of mosquito nets and sprays must be increased in order to address these issues, with priority given to regions with high rates of malaria or other mosquito-borne illnesses (26). Involving communities in the development and execution of mosquito control programs is another tactic that may be used to address the issue of shortages in order to guarantee locally relevant and long-lasting solutions (13).

c. Shortage of healthcare workers

The other theme that can be derived from what the participants said regarding barriers to malaria prevention in Andara District is the shortage of healthcare workers. Specifically, Participant 8 said the following:

"It appears there is shortage of health workers in the district. Each and every time we hear this healthcare worker transferred to another area, or moved to urban areas. Sometimes, we hear that the person in question is no longer working in the healthcare sector; he found another job in another sector. Probably these are some of the reasons for shortage of employees in malaria control programs in our district. "

The lack of healthcare workers in malaria control programs poses serious obstacles to managing and reducing malaria transmission. As suggested by recent systematic reviews on the causes of staff shortages in malaria control programs, addressing the shortage of healthcare workers in these programs calls for coordinated efforts like task-shifting and task-sharing, as well as the empowerment of community health workers and other lower-level staff to provide essential malaria services. It also suggests that governments should offer financial incentives and opportunities for career advancement to help lessen the burden of malaria on higher-level healthcare professionals.

d. Long distance to the hospital

Participant 3 also stated that:

"Apart from long distances, it is sometimes difficult for people in some far away areas of the community to get timely treatment of malaria because Andara Hospital is far away."

Previous researches have also demonstrated that the issue of great distances to healthcare facilities exists. Studies conducted, for instance, in Malawi (32), Zambia (31), Indonesia (35) and Ethiopia (37) have shown that attempts to prevent and control mosquitoes are greatly impacted by distance to the hospital. The Ethiopian case study (37) demonstrates that traveling great distances to the hospital causes delays in receiving medical care. It can be difficult for those who live far from medical facilities to get a prompt malaria diagnosis and treatment. Delays in obtaining medical attention so

frequently cause the disease to advance to severe stages, raising the rates of morbidity and death (37).

It is also confirmed by the Indonesian case study (35) which states that healthcare institutions function as central locations for health education, behavior modification, and community involvement. Long travel times to these facilities may have a detrimental impact on community outreach initiatives that support early treatment seeking and malaria prevention measures (35).

It has been proposed that in order to address the obstacle of long travel times to medical facilities in mosquito control and prevention, integrated strategies such as the deployment of outreach programs, mobile clinics, and community-based health workers are needed to bring healthcare services closer to those who live in remote areas (32). According to certain research, telemedicine should be utilized (40). Golden Health Network, International MedioNet of China, and the People's Liberation Army are China's three main telemedicine networks, for instance. Through technological connections, remote hospitals and clinics can provide teleconsultation, telediagnosis, telemonitoring of malaria cases, and other services to larger institutions (40). In order to encourage self-care, early diagnosis of malaria symptoms, and adherence to malaria preventative measures, South Africa calls for empowering communities through training and teaching (36).

Theme 3. The burden of malaria

The participants were asked about the burden of malaria in Andara District. After analyzing the data, three themes were generated from the responses of the participants. They are as follow: increased cost to families and communities, costs to the government and morbidity and high mortality rates.

a. Increased cost to the families and communities

The participants suggested that there were some direct costs for example, illness, treatment, premature death within the residents of Andara District. The participants said that the costs to individuals and their families include the cost of buying medication to treat malaria at home, transport expenses to and from dispensaries and clinics, missed

work days, missed school days, preventative measure costs, and funeral costs in the event of a death.

Participants 4, 5, 8, and 9 made the following suggestion*: "The economic cost of malaria is significant. More so, costs to people and their families include what it costs to purchase malaria medication to treat the illness at home, transportation costs to and from clinics and dispensaries, lost work and school days, costs associated with preventative measures, and funeral expenses in the event of a death. This is because the Namibian government is investing more money in malaria prevention in the Andara District and throughout Namibia."*

Participants 1, 2, and 3: *"Many at-risk populations in the Andara district live in extreme poverty, and malaria is a major cause of poverty. Poor, rural families may reside miles away from the closest medical facility and are the least likely to have access to these preventative measures, which are essential to controlling malaria."*

Prior research has verified that malaria results in immediate medical expenses, including those associated with treatment, hospital stays, and travel (36). Medical consultations, diagnostic testing, including quick diagnostic tests and antimalarial medications, are expensive for families. For instance, hospital entry fees are paid by citizens of the majority of African nations (13). The entry charge increases the out-of-pocket expenses associated with hospital stays, treatments, and prescription drugs.

Additionally, the WHO attests that malaria affects household spending (12). Families may occasionally be forced to take out loans, sell possessions, or deplete savings in order to pay for medical costs due to the high cost of treating and caring for malaria patients. As a result, families and communities may find it challenging to deal with the illness and its aftereffects (12). This was supported by a recent study (39), which indicated that in order to reduce the burden of malaria on families and communities, it is necessary to scale up preventive measures like insecticide-treated nets and indoor residual spraying, ensure prompt diagnosis and treatment of malaria with efficient antimalarial drugs.

b. Costs to the government

The following was said by participants 10 and 7:

"Government expenses include maintaining, staffing, and providing healthcare facilities; purchasing drugs and supplies; implementing public health measures to prevent malaria, such as applying insecticides or giving out bed nets treated with them; missing work days that cost money; and passing up opportunities for joint ventures and tourism."

The burden of indirect costs that the government bears as a result of malaria was also verified in Angola, where malaria frequently hinders the nation's economic growth by decreasing agricultural productivity during the rainy season and, as a result, diminishing economic output, income generation, and overall economic development (41). Additionally, children's scholastic attainment and future possibilities are impacted by malaria-related school absenteeism, which has an effect on the development of human capital and economic growth. This report provides additional evidence that the government funds malaria control and preventive programs at the expense of other health priorities and development objectives. As a result, this affects the nation's overall socioeconomic advancement (41).

The government must pay for malaria treatment, as the Ethiopian case study (37) demonstrates. The cost of diagnosing, treating, and caring for malaria patients is borne by the governments, per this case study (37). This covers costs for hospital stays, outpatient care services, rapid diagnostic tests, and antimalarial medications.

c. Morbidity and high mortality rates

The participants also said that the are some people who dies each and every year through malaria in Andara district. Some deaths are recorded while will not be recorded.

Participants 1, 2, and 3: *"I can say we are all at risk of malaria death in Andara. All the age groups are at this risk. Each year there are deaths, some of which are confirmed while others are suspected to be malaria driven."*

The results mentioned above are consistent with the body of research indicating that malaria continues to be a major cause of death worldwide, with most malaria-related deaths taking place in sub-Saharan Africa, a region with poor access to preventative care and healthcare (12). WHO noted that vulnerable groups, such as small children under five, expectant mothers, and those with weakened immune systems, are disproportionately affected by malaria (12). The World Health Organization states that complications from severe malaria include organ failure, respiratory distress, brain malaria, and severe anemia. Immunocompromised persons and pregnant women are also at high risk from this condition. Some survivors of severe malaria can suffer long-term health effects, including developmental delays and neurological impairments, which can lower their quality of life and potential productivity as they age (12).

High rates of malaria morbidity put a strain on the healthcare system and raise the need for medical services, hospital admissions, and intensive care. For instance, it has been observed in Ethiopia (37), where high rates of illness and mortality sustain malaria transmission cycles because infected people act as reservoirs for the parasite. Therefore, to stop the spread of this disease and lessen its burden, effective control measures are required (37).

According to WHO recommendations, combating malaria morbidity and mortality necessitates a range of approaches, such as community involvement, timely diagnosis and treatment with potent antimalarial medications, efficient mosquito control techniques like insecticide-treated nets and indoor residual spraying, and sustained investment in malaria research and healthcare infrastructure (12).

4.8 Chapter summary

This chapter has focused on data presentation and analysis. The data has been presented using both the qualitative and quantitative techniques. The quantitative methods have

included both the descriptive and inferential statistics while thematic presentation has been employed as a qualitative method of data presentation in this chapter.

Chapter 5: DISCUSION OF THE FINDINGS

5.0 Introduction.

The discussion of the findings will be done in this chapter. A critical analysis of the findings of the study with the available literature review will be made. The discussion will expose the similarities and the differences with the readily available data.

5. 1 Major challenges that are impeding the elimination of malaria

The Andara District faces several significant obstacles to the eradication of malaria, as indicated by the quantitative and qualitative data. These problems include gaps in knowledge, inadequate infrastructure, resource constraints, and environmental concerns. Both approaches highlight barriers such treatment failures, pesticide resistance, and insufficient surveillance, highlighting the intricate difficulties associated with efforts to eradicate malaria.

Both approaches emphasize that a major obstacle to the eradication of malaria is public ignorance. A lack of understanding and the need for improved communication regarding behavior changes are specifically mentioned in the qualitative findings, however the quantitative results indicate that 23% of respondents cited this as a major barrier. While the qualitative findings expand on this by noting poor housing infrastructure as a contributing cause to malaria transmission, the quantitative data show that just 7% of respondents recognized inadequate infrastructure as a key concern. The quantitative evidence showing that effective preventive strategies are lacking is consistent with the qualitative findings, which highlight a shortage of resources.

Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14).

Although not specifically mentioned in the quantitative results, the qualitative data highlights socio-cultural practices as obstacles that may have an impact on public

opinion and behavior. The significance of environmental factors is highlighted by both results. While the quantitative results do not explicitly address this issue, they do allude to environmental difficulties by examining the perceptions of respondents. The qualitative results highlight the role that suitable climate conditions and natural vegetation play as mosquito breeding grounds.

The above findings were supported by different scholars as they suggested that there are different factors that have been identified as the major influence of transmission of malaria in Namibian communities and other Southern African countries (2). These include limited studies on traditional practices in malaria prevention, human dispersion and livelihood, human factors and environmental factors that facilitate malaria transmission. WHO suggests limited studies on traditional practices of malaria are some of the factors that influence the spread of malaria in Namibian communities (12). Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14).

There is a lack of sustainable long-term activities of awareness creation to effect change and less is communicated to the community about behaviors change especially in Namibia (15). There are new cases of malaria that emerge out of a variety of factors such as cross border migration especially with Angola to the north of Namibia and free movement of people which can facilitate the disease transmission because it increases the risk of reception and vulnerability specially where migrants move from endemic areas to those that are less endemic (1). According to the fauna and flora such as the natural vegetation, agricultural crops and animal water points, provide potential breeding sites for mosquitoes while animals, such as domestic livestock provide food for the anopheles arabiensis (15). Therefore, it is very important for public health services to have knowledge of the entomological factors that influence the life of the mosquito and recognize the different species of mosquitos in a specific area in order to customise the

messaging for disease control and prevention (15). Furthermore, this is consistent with many studies conducted worldwide which identify other factors such as the timing of rainfall and climate change, because malaria transmission is associated with rainfall.

WHO suggests limited studies on traditional practices of malaria are some of the factors that influence the spread of malaria in Namibian communities (12). Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14). There is a lack of sustainable long-term activities of awareness creation to effect change and less is communicated to the community about behaviors change especially in Namibia (15). There are new cases of malaria that emerge out of a variety of factors such as cross border migration especially with Angola to the north of Namibia and free movement of people which can facilitate the disease transmission because it increases the risk of reception and vulnerability specially where migrants move from endemic areas to those that are less endemic (1)

5.2 Factors which influence transmission of malaria in Andara District

Findings from both qualitative and quantitative research agree on the key variables affecting malaria spread. Both methods add to a comprehensive understanding of the difficulties in controlling malaria since quantitative data provides quantifiable evidence and qualitative insights offer context.

The results, both qualitative and quantitative, unequivocally point to poor housing, stagnant water, and warm weather as major factors influencing the spread of malaria in Andara District. However, rich context is provided by the qualitative data, which highlights the role that stagnant water plays as a mosquito breeding ground and how unsuitable housing may lead to more exposure to these vectors. On the other hand, the quantitative data measures the influence of these elements and shows that 17% of respondents mentioned standing water, 16% mentioned substandard housing, and 14% mentioned ideal weather. This quantification offers a strong foundation for focused

interventions by enabling a clearer understanding of the degree to which these factors are thought to influence malaria transmission.

Earlier studies proposed that there are different factors that have been identified as the major influence of transmission of malaria in Namibian communities and other Southern African countries (2). These include limited studies on traditional practices in malaria prevention, human dispersion and livelihood, human factors and environmental factors that facilitate malaria transmission.

Both approaches highlight how important low levels of education are in the spread of malaria. The qualitative results go into further detail on how ignorance can result in inefficient preventative measures and heightened susceptibility to the illness. This includes a lack of knowledge regarding the value of environmental management and the application of mosquito nets. These observations are supported by the quantitative data, which shows that 14% of respondents consider low education to be a determining factor.

These findings agree with WHO which suggests limited studies on traditional practices of malaria are some of the factors that influence the spread of malaria in Namibian communities (12). Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14).

In order to successfully eliminate malaria, both sets of findings emphasize the urgent need for stronger preventative measures. The qualitative data emphasizes the significance of community-based initiatives and public health policies by pointing out that insufficient preventive measures and resources are major hurdles. This is supported by the quantitative results, which indicate that 11% of respondents cited inadequate prevention as a major problem.

The findings above were also supported by WHO. WHO suggests limited studies on traditional practices of malaria are some of the factors that influence the spread of malaria in Namibian communities (12). Despite the effectiveness of insecticides used to control malaria, it is regarded as a great challenge for rural

communities to effectively adapt and utilize the available resources due to a lack of affordability, acceptability, accessibility, equity and difficulties associated with its distribution in rural places (13). In addition, little has been done and/or published on sociocultural practices that relate to malaria prevention and control in rural communities (14).

Both quantitative and qualitative results emphasize that one of the main obstacles to efforts to eradicate malaria is a shortage of resources. Effective control of malaria is hampered by inadequate money, medical supplies, and human resources, as indicated by the qualitative data, which specifically addresses this problem. The quantitative results support this viewpoint by showing that resource constraints substantially obstruct the eradication of malaria. They do this by employing inferential statistics. This consensus highlights the need for more funding for health infrastructure, research, and capacity-building programs in order to get beyond these roadblocks and enable a more successful response to malaria.

Both sets of data recognize the role that climate plays in determining the spread of malaria. The qualitative data illustrates how favorable meteorological factors, like rising temperatures and rainfall, foster the growth of mosquitoes and malaria parasites. According to the quantitative data, 14% of respondents believe that climate influences have an impact. This link highlights how important it is to use climate-sensitive malaria prevention methods.

In light of the above, earlier studies confirm fauna and flora such as the natural vegetation, agricultural crops and animal water points, provide potential breeding sites for mosquitoes while animals, such as domestic livestock provide food for the anopheles arabiensis (15). These studies recommend that it is very important for public health services to have knowledge of the entomological factors that influence the life of the mosquito and recognize the different species of mosquitos in a specific area in order to customise the messaging for disease control and prevention (15). This is consistent with many studies conducted worldwide which identify other factors such as the timing of rainfall and climate change, because malaria transmission is associated with rainfall (16).

5.3 The burden of malaria in Andara District

The survey reveals the diverse views on the burden of malaria in Andara District. The findings of this study showed that malaria was a major cause of poverty in the Andara district, with poor rural families often living far from medical facilities. The economic and human costs of malaria were significant, as the Namibian government invests more in prevention. These costs included medication, transportation, lost work, preventative measures, and funeral expenses. Government expenses include maintaining healthcare facilities, purchasing drugs, implementing public health measures, missing work days, and limiting joint ventures and tourism opportunities.

The interviews revealed that malaria prevention was challenging due to vector resistance, lack of resources for mosquito net distribution, and health worker shortages in Andara District. Immigrants, poor surveillance systems, and degraded healthcare infrastructure contribute to the malaria burden in these areas, making timely treatment difficult for communities living in endemic areas.

The above findings suggested that the costs associated with malaria are high for both people and governments. Costs to individuals and their families include the cost of buying medication to treat malaria at home, transport expenses to and from dispensaries and clinics, missed work days, missed school days, preventative measure costs, and funeral costs in the event of a death (40). The upkeep, provision, and staffing of healthcare facilities; acquisition of medications and supplies; public health measures against malaria, like the application of insecticides or the distribution of bed nets treated with insecticides; missed work days that result in lost revenue; and missed prospects for cooperative business ventures and tourism are among the expenses incurred by governments (41).

A number of variables combine to cause Africa to be the most affected. Anopheles gambiae complex, a highly proficient mosquito, is the cause of the high transmission rate (40).Plasmodium falciparum is the most common parasite species and the one that increases the risk of fatal malaria. Year-round transmission is frequently possible due to local meteorological conditions. Effective malaria control initiatives have been hampered by a lack of resources and socioeconomic instability.

The above findings were supported by different scholars as it may costs to individuals and death in many families. Families may include the cost of buying medication to treat malaria at home, transport expenses to and from dispensaries and clinics, missed work days, missed school days, preventative measure costs, and funeral costs in the event of a death (40). The upkeep, provision, and staffing of healthcare facilities; acquisition of medications and supplies; public health measures against malaria, like the application of insecticides or the distribution of bed nets treated with insecticides; missed work days that result in lost revenue; and missed prospects for cooperative business ventures and tourism are among the expenses incurred by governments (41).

5.4 Chapter summary

The discussion of the finding has been presented in this chapter. A critical analysis of the findings of the study with the available literature review was also done in this chapter. The discussion exposes the similarities and the differences with the readily available data.

Chapter 6: Conclusions and Recommendations

6.1 Introduction.

This chapter provides conclusion and recommendations based on the findings of this study.

6.2 Conclusions

The following are the conclusions based on each objective of this study.

6.2.1 The major challenges which are impeding the elimination of malaria

From the questionnaires which were distributed, a survey revealed that 17% of respondents identified lack of resources, 23% lack of knowledge, 26% inadequate prevention methods, 14% favorable climatic conditions, 7% poor infrastructure, and 13% cultural and social practices as major challenges to malaria elimination. The majority (45%) agreed that the culture of the people is an impediment, with 30% strongly agreeing and 10% disagreeing. The remaining 5% were neutral about the view that the culture of the people is an impediment to malaria elimination. The results highlight the need for effective strategies to eradicate malaria.

The findings from the interviews showed that the Andara District faced several challenges in eradicating malaria, including insecticide resistance, treatment failure, climate change, insurgencies, conflicts, migration, lack of political will, poor leadership, funding, and local research. Natural vegetation, agricultural crops, and animal water points provide breeding sites for mosquitoes. Traditional practices, human dispersion, and environmental factors facilitated malaria transmission. Effective adaptation and utilization of resources by rural communities are significant challenges. Less information about changing behaviour was communicated to the community, and there were few sustainable activities to effect change. Climate played a significant role in malaria transmission, with temperature, precipitation, and humidity affecting the spread. Mosquitoes prefer freshwater collections created after the rainy season, and inadequate surveillance is another obstacle.

6.2.2 Factors which influence transmission of malaria in Andara District

A survey of respondents in Andara District revealed that stagnant water in ponds, reservoirs, and ponds, vector breeding, poor housing, favorable climatic conditions, poor education, unprotected water, and poor preventative methods are all factors influencing malaria transmission. A significant number of respondents agreed that a lack of preventative measures and resources in the district is a significant factor, with 40% agreeing and 30% strongly agreeing. However, 5% disagreed and 15% strongly disagreed, with the remaining 5% remaining neutral. The survey highlights the need for improved preventative measures and resources in the area to combat malaria transmission.

The data was also analyzed through the inferential statistics and the regression output showed that lack of resources, poor surveillance systems, poor healthcare infrastructure, inadequate malaria prevention, social and belief practices, lack of knowledge, and climatic conditions were significant impediments to malaria elimination. The R-squared value, which represents the coefficient of determination, explained the variability in the data, with a value of 0.5027 explaining the variability. The Adjusted R Square was used to determine the researcher's accuracy in reporting the data and the output enhanced multiple regression guide.

6.2.3 The burden of malaria in Andara District

A survey of respondents in Andara District revealed that 20% of them believe malaria-related deaths are the main burden of malaria. 25% believe the loss of productive workers is the main burden. 15% believe orphans and high dependency populations are the main burden. 10% believe poverty deepens, while 13% believe high government expenditure and 17% spend on health infrastructure are the main burdens. 35% agree, 40% strongly agree, while 5% disagree. 15% strongly disagree, and 5% remain neutral. The survey reveals the diverse views on the burden of malaria in Andara District.

The findings from the interviews showed that malaria was a major cause of poverty in the Andara district, with poor rural families often living far from medical facilities. The economic and human costs of malaria were significant, as the Namibian government invests more in prevention. These costs included medication, transportation, lost work, preventative measures, and funeral expenses. Government expenses include maintaining

healthcare facilities, purchasing drugs, implementing public health measures, missing work days, and limiting joint ventures and tourism opportunities.

The interviews revealed that malaria prevention was challenging due to vector resistance, lack of resources for mosquito net distribution, and health worker shortages in Andara District. Immigrants, poor surveillance systems, and degraded healthcare infrastructure contribute to the malaria burden in these areas, making timely treatment difficult for communities living in endemic areas.

6.3 Recommendations to the Ministry of Health and Social Services and Andara District

- The government of Namibia should implement different interventions to reduce malaria transmission: mass strategies, targeted strategies and reactive strategies. Mass strategies cover the entire population, such as mass drug administration (MDA), mass testing and treatment (MTaT), and mass relapse prevention (MRP). MDA involves treating existing malaria infections and preventing new ones, but it has a limited beneficial impact on malaria prevalence and incidence. MTaT involves testing the entire population for malaria and treating all positive cases simultaneously. MRP is against mass treatment with medicine alone to reduce vivax transmission, as it has the potential for severe harm without prior testing for diseases deficiency.
- The government should target Andara District in outdoor activities to reduce overall transmission. The effectiveness of these strategies depends on community engagement and the quality of available evidence.
- The government should implement the targeted drug administration (TDA), targeted testing and treatment (TTaT), routine testing and treatment at points of entry and testing and treatment of organized or identifiable groups arriving or returning from Andara District. TDA involves providing a full course of antimalarial medicine to individuals at increased risk of malaria infection, with community engagement being crucial for success. TTaT tests individuals for the disease, only treating those who test positive.

- The people in Andara District and all malaria-prone areas should go for testing for malaria and there should be treating organized groups arriving or returning from malaria-endemic areas to help countries near elimination or prevent re-establishment of transmission.
- There are some strategies that include reactive drug administration (RDA), reactive case detection and treatment (RACDT), and reactive indoor residual spraying (IRS) that should be implemented in Namibia. RDA involves providing antimalarial medicine to every individual living with or near a person with a confirmed malaria infection, aiming to treat all existing infections and prevent new infections over time. RACDT involves testing every individual living with or near a person with a confirmed malaria case, only providing the medicine to those who test positive for malaria. RRS is used in homes of individuals with a confirmed case of malaria and neighbouring houses at approximately the same time. The success of these interventions depends on a strong surveillance system capable of detecting suspected cases and investigating all confirmed cases at their origin. These strategies are also relevant to areas working to prevent re-establishment of malaria, as cases may be identified in post-elimination settings.
- The government of Namibia should implement the bio-environmental strategies such as the opportunistic and need to be carefully adapted to the specific biology of the local vector and ecosystem. These strategies often take advantage of exceptional environmental conditions, such as restricted distribution and easy location of vector breeding sites in Andara District.
- To be efficient, an anti-malarial strategy should be opportunistic, considering local conditions and involving a detailed study of the place to be treated. This multidisciplinary approach requires the participation of entomologists and other scientific specialists.
- The Ministry of Health and Social Services should implement the vector management to avoid infection and limiting disease transmission and is an essential part of methods for controlling and eliminating malaria. Indoor residual spraying (IRS) and insecticide-treated nets are the two main therapies

and should be done by the Ministry of Health and Social Services to reduce the malaria in the prone areas

- The people in nearby countries such as Angola and other local people who wants to visit Andara District should be encouraged to speak with their physician several weeks before to leaving. The doctor will decide which chemoprophylaxis medications are suitable for the destination nation. Certain chemoprophylaxis medications need to be started two to three weeks before to departure. Since parasites may still arise from the liver at this time, all preventive medications should be taken as prescribed throughout the duration of the visit to Andara District and for an additional four weeks following the last potential infection exposure.
- The Ministry of Health and Social Services, private health organisations and nongovernmental organisations should encourage the people in Andara District and other malaria- prone areas to use of medications, either alone or in combination, to stop malaria infections and their effects is known as preventive chemotherapy. Regardless of whether the receivers have malaria or not, it calls for administering an entire course of treatment with an antimalarial medication to susceptible populations at specific times throughout the peak malarial risk.
- The Ministry of Health and Social Services should encourage the people living in Andara District to use the vaccine such as the broad use of the RTS,S/AS01 malaria vaccine among children with moderate to high P. falciparum malaria transmission.
- People living in Andara district and other malaria prone areas in Namibia should visit the clinics and hospitals for early detection and treatment of malaria as this may lower illness, averts fatalities, and helps to lower transmission. It is advised that parasite-based diagnostic testing either by microscopy or a quick diagnostic test be used to confirm any suspected cases of malaria. As a dangerous infection, malaria always needs to be treated with medication. Malaria is treated and prevented by a variety of medications and physicians will select one or more based on the following factors: kind of

malaria, medication resistance of the malaria parasite, age or weight of the patient, and pregnancy status

- The Ministry of Health and Social Services should practice the surveillance in gathering, analysing, and interpreting data linked to malaria and using that information to inform the development, execution, and assessment of public health interventions. Evidence from the literature suggests that malaria surveillance usually enhance monitoring of malaria cases and fatalities, facilitates the identification of the most afflicted demographic groups by health ministries and allows the country to track evolving trends in the malaria-related illness.

6.4 Recommendations for Further study

It is advised that, while this study was limited to the Andara District, further studies should be carried out in all fourteen regions of Namibia in order to obtain findings that may be applied to the entire country.

6.5 Chapter summary

The conclusions have been made based on the following research objectives: to identify the challenges which are impeding the elimination of Malaria in Andara District, to analyse factors which influence transmission of malaria in Andara District and to examine the burden of malaria in Andara District. The recommendations were given to the Ministry of Health and Social Services as well as the Andara community.

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Annexures

Annexure 1: Ethical Clearance Form

UNAM
UNIVERSITY OF NAMIBIA

ETHICAL CLEARANCE CERTIFICATE

Ethical Clearance Reference Number: DEC OSH 0082 **Date:** 02/11 2023

This Ethical Clearance Certificate is issued by the University of Namibia Ethics Committee (REC) in accordance with the University of Namibia's Research Ethics Policy and Guidelines. Ethical approval is given in respect of undertakings contained in the Research Project outlined below. This Certificate is issued on the recommendations of the ethical evaluation done by the ethics committee.

Title of Project: AN INVESTIGATION OF CHALLENGES THAT IMPEDE THE ELIMINATION OF MALARIA IN ANDARA DISTRICT, KAVANGO EAST REGION, NAMIBIA

Principal researcher: SHEREEN KAUEJAO

Staff Number/ Student number: 201127148

Remarks: Low Risk Approved

Centre for Research Services

Take note of the following:

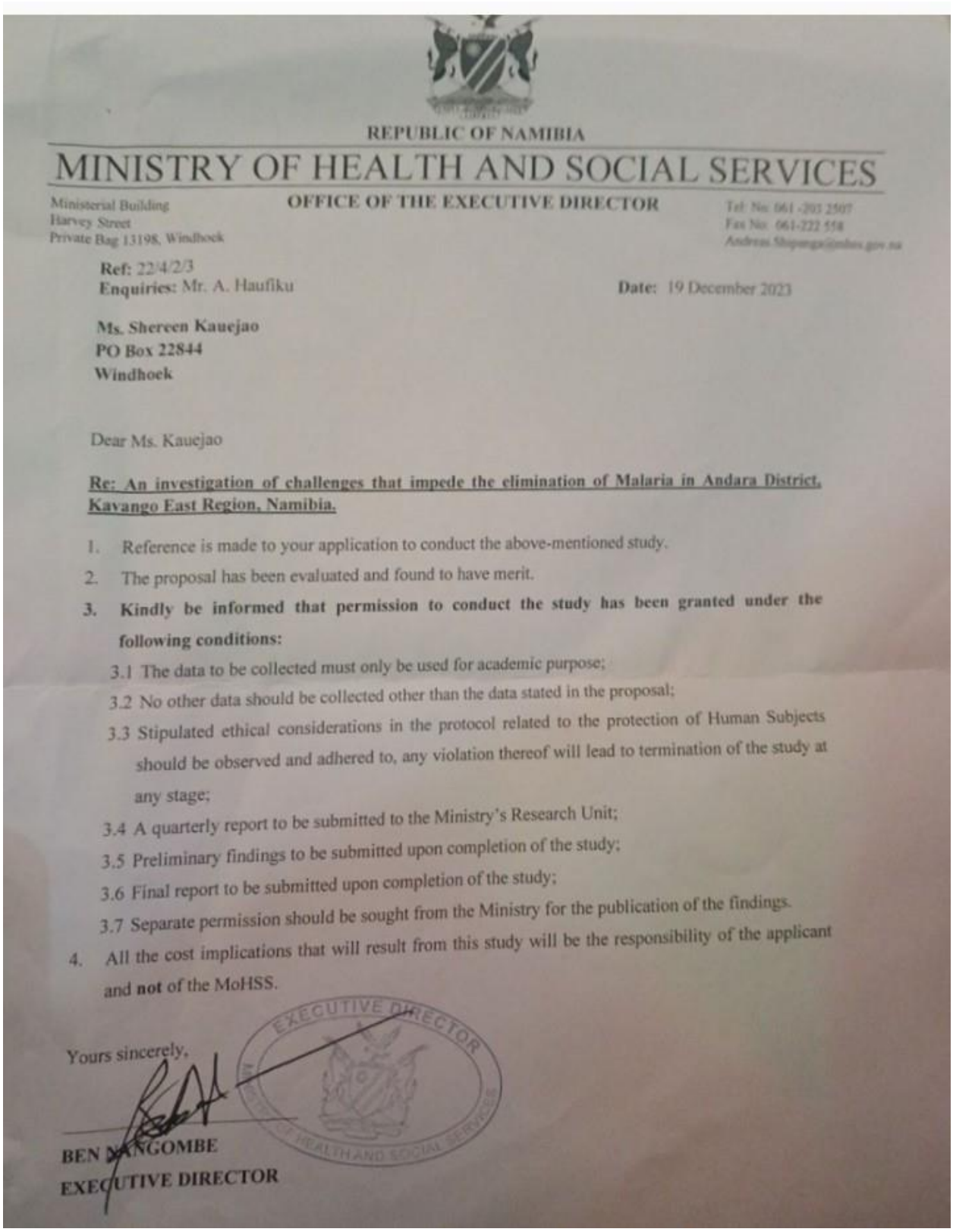
1. Any significant changes in the conditions or undertakings outlined in the approved Proposal must be communicated to the ethics committee. An application to make amendments may be necessary.
2. Any breaches of ethical undertakings or practices that have an impact on ethical conduct of the research must be reported to the ethics committee.
3. The Principal Researcher must report issues of ethical compliance to the ethics committee (through the Chairperson) at the end of the Project or as may be requested by the ethics committee.
4. The ethics committee retains the right to:
   i) Withdraw or amend this Ethical Clearance if any unethical practices (as outlined in the Research Ethics Policy) have been detected or suspected,
   ii) Request for an ethical compliance report at any point during the course of the research.

The ethics committee wishes you the best in your research.

Prof Hans J Amukugo (Oshakati Campus Chairperson Decentralized Ethics Committee)

Prof. Davis Mumbengegwi (Head, Multidisciplinary Research)

Annexure 2: Approval from the Ministry of Health and Social Services



REPUBLIC OF NAMIBIA

MINISTRY OF HEALTH AND SOCIAL SERVICES

OFFICE OF THE EXECUTIVE DIRECTOR

Ministerial Building
Harvey Street
Private Bag 13198, Windhoek

Tel: No. 061 -203 2507
Fax No. 061-222 558
Andreas.Shipanga@mhss.gov.na

Ref: 22/4/2/3
Enquiries: Mr. A. Haufiku

Date: 19 December 2023

Ms. Shereen Kauejao
PO Box 22844
Windhoek

Dear Ms. Kauejao

Re: An investigation of challenges that impede the elimination of Malaria in Andara District, Kavango East Region, Namibia.

1. Reference is made to your application to conduct the above-mentioned study.
2. The proposal has been evaluated and found to have merit.
3. **Kindly be informed that permission to conduct the study has been granted under the following conditions:**
   - 3.1 The data to be collected must only be used for academic purpose;
   - 3.2 No other data should be collected other than the data stated in the proposal;
   - 3.3 Stipulated ethical considerations in the protocol related to the protection of Human Subjects should be observed and adhered to, any violation thereof will lead to termination of the study at any stage;
   - 3.4 A quarterly report to be submitted to the Ministry's Research Unit;
   - 3.5 Preliminary findings to be submitted upon completion of the study;
   - 3.6 Final report to be submitted upon completion of the study;
   - 3.7 Separate permission should be sought from the Ministry for the publication of the findings.
4. All the cost implications that will result from this study will be the responsibility of the applicant and **not** of the MoHSS.

Yours sincerely,

EXECUTIVE DIRECTOR

BEN NANGOMBE
EXECUTIVE DIRECTOR

Annexure 3: Approval from Andara District

Fadwick kudzai Mariwa <kudziemariwa@gmail.com> Feb 16, 2024, 2:25 PM

to me

Dear Shereen,

Thank you for your reminder.

Since you have been cleared by the Ministry, please feel free to come into our district for your research activities.

Best wishes,

Dr Mariwa
SMO
Andara District

Close

Annexure 4: Information to participants

My name is Shereen Kauejao. I am a student at the University of Namibia (UNAM) who is currently studying for a Master's Degree in Public Health. As a student, I am required by our university to conduct an academic research study in partial fulfilment of the Degree program that I am studying. Therefore, I am conducting a research study entitled:

"An investigation of challenges that impede the elimination of Malaria in Andara District, Okavango East Region, Namibia."

This research study is pure academic. Therefore, I am kindly requesting all the respondents to answer the questions provided in this questionnaire truthfully and honestly. The support letter from University of Namibia has been attached as supporting evidence to the Ministry of Health and Social Services as well as all the respondents.

I am assuring you that the data to be collected during this research will be treated confidentially and no information will be published in any other platform without the consent and permission from the Ministry of Health and Social Services.

Your cooperation and commitment is highly appreciated.

Yours faithfully

Shereen Kauejao

Contact number: +264818419041

Annexure 5: Questionnaire

Section A: Demographic information

From the given set of questions below you are kindly requested to choose the suitable answer by ticking in the boxes which are provided or you should write the appropriate answers as well.

2.2 Gender

2.2.1 Male	2.2.2 Female

2.3 Age

2.3.1 20 years and below	**2.3.2** 21 to 25 years	**2.3.3** 26 years to 35years	**2.3.4** 36 years to 50 years	**2.3.5** 51 years and above

2.4 Highest Academic qualification

2.4.1 Grade 10 or 12 certificate	**2.4.2** Academic certificate	**2.4.3** Diploma	**2.4.4** Bachelor Degree	**2.4.5** Other (kindly specify)……

2.5 Employment status

2.5.1 Employed	**2.5.2** Unemployed

2.6 Job role/ Title

2.6.1 Village headman	**2.6.2** PHC staff	**2.6.3** Nurse	**2.6.4** Church leader	**2.6.5** HEW

2.6.6 Other (Specify): …….

Section B: General knowledge about challenges that impede the elimination of Malaria in Andara District

Instruction: Tick appropriate response.

3. What do you think are the challenges that impede the elimination of Malaria in Andara District?

3.1.1 Shortage of Mosquito Nets	**3.1.2** Lack of Education	**3.1.3** Socio-Culture challenges	**3.1.4** Shortage of resources to use	**3.1.5** Favorable climates for mosquitos	**3.1.6** Resistance of insecticide	Poor Infrastructure

3.1.7 Other (specify)…….

4. What factors influence transmission of malaria in Andara District?

4.1.1 Clim	**4.1.2** Level	**4.1.3**	**4.1.4** Employ	**4.1.5** Outd	**4.1.6** Shorta

atic facto rs	of educa tion	Fa mil y size	ment and income levels	oor sleep ing	ge of protec tive device s

4.1.7 Other (specify)……….

5.1 What is the burden of malaria in Andara District?

5 . 1 . 1 H i g h d e a t h r a	**5.1. 2** Hig h Med ical cost s to the gove rnm ent	**5.1 .3** Po ver ty du e to de ath of ke y fa mi ly me mb	**5.1. 4** Hig h depe nden cy ratio	**5.1. 5** Sho rtag e of ma npo wer	**5.1.6** Lack of devel opme nt in infec ted areas	Dec reas e in inve stor s' con fide nce

t e		ers				

5.1.7 Others(Specify)…….

6.1 What do you think the community in Andara District should do to minimise or totally eliminate Malaria in this area?

6.1.1	**6.1.2**	**6.1.3**	**6.1.4**
Apply Mosquito repellent	Close all the potholes which will be the breeding areas of mosquitos	Manage the children on clothes to wear as well as the place to sleep	Use window nets and mosquito nets

6.1.5 Others (Specify)…….

7.1 What do you think the government can do to reduce the prevalence of malaria

7.1.1	**7.1.2**	**7.1.3**	**7.1.4**	**7.1.5**
Building infrastructur e	Educatin g people	Provisio n of Nets	Buildin g better health system	Indoor residua l sprayin g

in Andara?

7.1.6 Others (specify)…….

SECTION C: Likert Scale Questions on malaria elimination

From the given questionnaire below, kindly indicate by ticking on by choosing one of the given options: agree, strongly agree, disagree, strongly disagree or not sure ,with the provided statement below.

Description	Agree	Strongly agree	disagree	Strongly disagree	Not sure
1. Shortage of material and poor infrastructure in Andara District is one the major challenge of eliminating malaria in Andara District.					
2. Educating the community can help to					

reduce the prevalence of malaria in Andara District					
3. The community should help each other to eliminate Malaria in Andara District					
4. Climatic conditions are always a problem as they facilitate the breeding of the mosquito.					
5. Culture and religion in Andara District is one of the major influence of the spread of Malaria					

in Andara District.					
6. The government should frequently conduct the indoor spraying of mosquitoes in Andara District to reduce the spread of Malaria.					
7. Malaria is contributing to deepening of poverty in Andara District.					
8. Prevention of Malaria should be done continuously throughout the year					

9.					
10. Malaria is causing morbidity and mortality in Andara District regardless of the age group.					
11. The health centers in Andara District should educate all the patients about the impact of the deadly disease and they should do this all the time.					

Thank you for your cooperation

Annexture 6. Interview Schedule

Topic: An investigation of challenges impeding the elimination of malaria in Andara District, Kavango East.

Interview duration: 10 minutes

Job role:

Orientation

Malaria elimination is as reducing the rate of malaria cases to zero in a defined geographic area, in this case, it's in Andara district. Continued measures are required to prevent the re-establishment of transmission in that community. There are several reports that confirm new cases of malaria in Andara District, so, this study seeks to investigate challenges that are impeding the elimination of malaria in Andara District.

Question 1. In your understanding, what factors might be contributing to Andara District not reaching the malaria elimination stage.

……
……
…….

QUESTION 2. What challenges are impeding the elimination of Malaria in Andara district.

……
……
…….

QUESTION 3. In your opinion, what may be done to make sure there are no new cases of malaria transmission in Andara District?

……
……
…….

The end