FACULTY OF AGRICULTURE AND ENVIRONMENTAL SCIENCE

DEPARTMENT OF SAFETY, HEALTH AND MANAGEMENT

DISSERTATION

TOPIC

INVESTIGATING THE PREVALENCE OF MALARIA. A CASE OF MANHENGA, BINDURA 2020-2024

By

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ABSTRACT

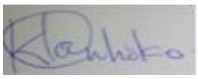
This study investigated the prevalence and persistence of malaria in Bindura District, Zimbabwe, with the aim of evaluating the effectiveness of current control measures and proposing improvements for more sustainable malaria prevention and management. A mixed methods research design was adopted, combining quantitative data from structured questionnaires administered to 80 community members (equally split between urban and rural settings) and qualitative data from semi-structured interviews with 20 health professionals across 10 strategically selected clinics. The findings revealed spatial disparities in malaria burden, with rural clinics particularly Foothills Clinic in a mining zone reporting significantly higher case numbers due to environmental factors such as stagnant water bodies from mining and poor drainage systems. Between 2020 and 2022, a total of 1,747 malaria cases were recorded, with cases peaking in 2020 before declining in subsequent years, suggesting partial success of existing interventions.

Despite high community awareness that malaria is transmitted by mosquitoes (90–95%), the study found significant rural-urban differences in access to malaria control tools and healthcare services. Regular use of mosquito nets and coverage by indoor residual spraying (IRS) were notably higher in urban areas, while rural respondents faced greater barriers including under-resourced clinics, limited outreach, and affordability issues. Health workers highlighted logistical challenges in implementing IRS and larval source management in remote areas, alongside socio-economic constraints that hinder community participation in preventive efforts.

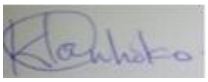
The study concludes that while existing malaria control strategies have had measurable impact, they remain insufficiently targeted and unevenly applied. It recommends a more integrated, proactive approach combining improved distribution of prevention tools, enhanced environmental management in mining and farming areas, and strengthened community engagement. The findings underscore the need for equitable, context-specific interventions to reduce malaria transmission and strengthen public health resilience in Bindura

DECLARATION FORM

I **Blessed Mvembe** declare that this project is my own work and any additional sources which I included in this project have been acknowledged in the references. In essence, I assure that this dissertation has not been submitted by anyone else to this or any other institution in relation to the attainment of a certificate, diploma, degree or other qualifications.

Date: **11/09/2025** Signature:  Supervisor: **P Nhokovedzo**

I, **Polite Nhokovedzo**, declare that I have supervised this thesis and am satisfied that it can be submitted to the Faculty of Agriculture and Environmental Science, Department of Safety, Health and Management

Date **11/09/2025** Signature 

DEDICATION

I dedicate this research to my friends and family who have been there for me throughout my academic journey.

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I want to thank the Almighty Lord for his mercy and kindness during this great academic journey. My sincere gratitude goes to my supervisor for his extra ordinary guidance, for he has been there encouraging and supporting me throughout this research. My gratitude is extended to all lecturers for grooming me to be able to carry out this research. I also want to thank all members of the clinics and hospitals who provided me with quality data and other various stakeholders for their cooperation during my research.

LIST OF ABBREVIATIONS AND ACRONYMS

HBM: Health Belief Model
IPT: Intermittent Preventive Treatment
IRS: Indoor Residual Spraying
ITN: Insecticide-Treated Net
NGO: Non-Governmental Organization
NMCP: National Malaria Control Programme
SADC: Southern African Development Community
WHO: World Health Organization

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CHAPTER ONE
INTRODUCTION

1.1 Background to the study

Malaria remains one of the most significant global public health challenges with millions of cases and hundreds of thousands of deaths reported annually. Despite decades of efforts to control the disease, it continues to exert a considerable burden on health systems particularly in sub-Saharan Africa where the prevalence is highest. According to the World Health Organization (WHO, 2020), approximately 229 million malaria cases were reported globally in 2019, with an estimated 409,000 deaths the majority of which occurred in sub-Saharan Africa. This data shows the persistence of malaria as a global threat despite ongoing efforts to combat the disease.

Across the globe, malaria is endemic in over 100 countries but statistics show that sub-Saharan Africa bears the heaviest burden (Nawa et al.., 2019). The prevalence of malaria in this region is exacerbated by various factors including the prevalence of the plasmodium falciparum parasite which is the most deadly strain and environmental conditions conducive to the breeding of anopheles mosquitoes which are the primary vectors of the disease. According to (Khagayi et al.., 2019), efforts to control malaria have led to significant improvements in some areas particularly with the widespread distribution of insecticide-treated nets (ITNs), the use of indoor residual spraying (IRS), and advances in antimalarial drugs. Nevertheless, the disease remains a leading cause of illness and death especially in young children and pregnant women who are most vulnerable to severe malaria and its complications.

In recent years, malaria control efforts have slowed in many parts of Africa. The emergence of drug-resistant malaria parasites especially the plasmodium falciparum and the development of insecticide resistance in mosquito vectors have posed significant challenges to malaria control programs (WHO, 2020). These developments threaten to undo the progress made in reducing the malaria burden over the past few decades. The socioeconomic impact of malaria is profound mainly in impoverished regions. Malaria not only causes direct health complications but also results in lost productivity due to illness and absenteeism from work and school (Ahmmed & Nassar, 2024). The economic costs associated with treating malaria and implementing prevention measures further strain limited resources in affected countries.

In the southern African, malaria remains a significant public health issue despite ongoing efforts to reduce its prevalence. Countries like Zimbabwe, Mozambique, Zambia, and Angola have made considerable strides in malaria control but still face substantial challenges (Khan et al.., 2023). The Southern African Development Community (SADC) region has adopted a collaborative approach to address malaria, with several countries implementing joint strategies to control the disease. In Zimbabwe, for example malaria transmission is seasonal with the highest incidence occurring during the rainy season (Stuck, 2020). The malaria burden in Zimbabwe is predominantly concentrated in rural areas, where access to healthcare is often limited and environmental conditions are favorable for mosquito breeding (Mundagowa & Chimberengwa, 2020). Despite the introduction of ITNs and IRS programs, malaria continues to affect large portions of the population particularly in rural regions where vector control and prevention measures are not always effectively implemented.

The malaria situation in Zimbabwe has seen fluctuations over the years. The country has made progress in reducing the incidence of malaria, but the disease still presents a significant public health challenge. According to the National Malaria Control Program (NMCP, 2018), there were 4.4 million reported cases of malaria and over 1,000 deaths in 2018 alone. Malaria transmission is concentrated in the northern and eastern provinces of Zimbabwe, areas that are vulnerable to high rainfall and conducive breeding grounds for mosquitoes. The government's efforts to combat malaria have included initiatives such as the distribution of insecticide-treated nets, IRS programs, and rapid diagnostic tests to improve case detection (Maseko & Nunu, 2020). However, despite these efforts, malaria prevalence remains high in rural areas, where healthcare infrastructure is weak, and the population faces significant barriers to accessing effective prevention and treatment.

Socio-political and economic factors also complicate the malaria control efforts in Zimbabwe. Economic instability, insufficient healthcare funding, and disruptions to malaria control programs due to political and social factors have hindered progress (Gwitira et al.., 2020). Moreover, the emerging issue of insecticide resistance in malaria vectors is another growing concern, which complicates the effectiveness of existing vector control strategies. The National Malaria Elimination Strategic Plan (2014-2020) aimed to reduce the malaria burden in Zimbabwe and achieve malaria elimination by 2030, but progress has been slow. The latest reports show that the malaria prevalence rate in the general population stands at 8.7%, with significantly higher rates in

rural areas (Malaria Consortium, 2020). These figures suggest that while efforts to combat malaria are ongoing, there is still much work to be done.

1.2 Statement of the Problem

The prevalence of malaria in Bindura remains a significant public health concern despite various control measures in place. Malaria continues to be a leading cause of morbidity and mortality in the region mainly affecting vulnerable populations such as children under five and pregnant women. According to the World Health Organization (WHO, 2022), malaria remains a major health challenge in Zimbabwe, with thousands of cases reported annually. In Bindura, factors such as inadequate access to healthcare, environmental conditions that promote mosquito breeding and limited public awareness about prevention contribute to the persistence of malaria (Manyangadze et al, 2024). Although efforts like the distribution of insecticide-treated bed nets and indoor spraying have been implemented, the disease burden remains high, primarily due to gaps in timely diagnosis, treatment, and the continued presence of mosquito vectors. This situation is worsened by seasonal increases in malaria cases mostly during the rainy season. Addressing the high prevalence of malaria in Bindura requires a deeper understanding of local contributing factors, gaps in the current malaria control measures and the effectiveness of prevention strategies. This research aims to identify these factors and propose solutions to reduce the impact of malaria in the region.

1.3 Aim of the Study

The aim of this study is to investigate the prevalence of malaria in Bindura and assess the factors contributing to its persistence with the goal of providing recommendations to improve malaria control and prevention strategies in the region

1.4 Research Objectives

- To assess the prevalence of malaria in Bindura, Zimbabwe, and determine the distribution of malaria cases across different demographics.
- To identify and examine the socio-economic and environmental factors contributing to the persistence of malaria in Bindura.

- To evaluate the effectiveness of current malaria control measures in Bindura and propose improvements to strengthen malaria prevention and management.

1.5 Research Questions

- What is the current prevalence of malaria in Bindura, and how is it distributed across various demographic groups?
- What are the key socio-economic and environmental factors influencing the persistence of malaria in Bindura?
- How effective are the current malaria control measures in Bindura, and what improvements can be made to reduce malaria transmission in the region?

1.6 Assumptions of the study

- This study assumes that malaria continues to be a significant public health concern in Bindura and that its prevalence is influenced by factors such as environmental conditions, public health policies and access to healthcare services.
- It is assumed that individuals in Bindura may have varying levels of awareness and knowledge regarding malaria prevention and treatment and that this directly impacts the effectiveness of malaria control measures.
- The study assumes that healthcare facilities and community health programs in Bindura are working to address malaria through prevention efforts but challenges such as resource limitations and access to treatment may still hinder the success of these programs.
- It is also assumed that certain socioeconomic factors such as income, education, and living conditions influence the vulnerability of different communities in Bindura to malaria, with certain populations being more at risk due to these factors.

1.7 Significance of the study

This research holds importance for various groups involved in the fight against malaria and in improving public health in Zimbabwe, particularly in Bindura.

1.7.1 Local Communities:

It is crucial for local communities to understand the prevalence of malaria in their area and the associated risks. This study will provide vital information that can raise awareness about malaria transmission and prevention. By understanding the key factors contributing to malaria in Bindura, local communities will be better equipped to take preventative measures such as using mosquito nets, improving sanitation, and seeking prompt treatment, ultimately reducing malaria-related morbidity and mortality.

1.7.2 Government and Officials:

The findings of this research will be valuable for national and local authorities in Zimbabwe. They will provide insights into the current state of malaria in Bindura highlighting gaps in existing public health policies and programs. This can guide the government in refining its malaria control and prevention strategies including better allocation of resources, targeting high-risk areas, and ensuring that malaria treatment is more accessible. The findings will support the creation of policies aimed at eradicating malaria and reducing its impact on public health.

1.7.3 Development Agencies and Non-Governmental Organizations (NGOs):

Development agencies and NGOs working in Zimbabwe will benefit from this study, as it will offer data that can inform the design of more targeted interventions. NGOs involved in public health campaigns and malaria prevention programs can use the research findings to focus their efforts in the most affected areas of Bindura. The study may also help NGOs in their advocacy for increased government funding and global support for malaria elimination efforts.

1.7.4 Academic Community:

This research will complement the existing body of literature on malaria prevalence in sub-Saharan Africa, specifically in Zimbabwe. The study will provide new insights into the dynamics of malaria in Bindura, contributing to the academic discourse on public health, epidemiology, and malaria control. It may stimulate further research in the field, encouraging scholars, researchers, and students to explore more effective malaria prevention strategies and the role of local communities in disease management.

1.8 Limitations of the study

This study acknowledges several limitations. Sample bias may occur due to challenges in participant availability or logistical constraints. To address this, stratified purposive sampling will be used ensuring that a diverse range of perspectives are represented which helps to reduce any bias in selecting participants. Researcher bias is a potential concern especially during qualitative data analysis. To mitigate this, the study will employ triangulation, cross-referencing data from multiple sources to ensure more balanced interpretations. Critical self-reflection will be maintained to minimize personal bias in the analysis. Data accessibility may also be a limitation particularly when it comes to obtaining accurate malaria statistics specific to Bindura. This will be addressed by collecting both primary data from local sources and secondary data from national reports to ensure the findings are comprehensive and reliable. These strategies will work together to minimize the limitations and enhance the study's overall reliability and validity.

1.9 Delimitations of the study

This study has several key delimitations that define its scope and focus. Geographical delimitation restricts the study to Bindura, Zimbabwe, focusing specifically on the prevalence of malaria within this region. While malaria is a significant issue in many parts of the country and beyond, this study does not extend to other regions, making it specific to the selected geographical area. The study also delimits its focus to malaria prevalence and does not explore other infectious diseases, ensuring a concentrated examination of malaria's impact on the community. Target population delimitation is also defined, with the study focusing on individuals who are at risk of or affected by malaria in Bindura, including health professionals, local residents, and government health officials. Lastly, the study is confined to quantitative and qualitative methods for data collection, not incorporating experimental designs or interventions. These delimitations help provide a focused investigation into the prevalence of malaria, ensuring that the research remains feasible and manageable

1.10 Definition of key terms

Malaria

Malaria is an infectious disease caused by a parasite of the genus *Plasmodium*, which is transmitted to humans through the bites of infected female *Anopheles* mosquitoes" (White, 2022).

Plasmodium

"*Plasmodium* is a genus of protozoan parasites that infect humans and other animals, leading to the disease malaria. There are five species of *Plasmodium* that infect humans, with *Plasmodium falciparum* being the most deadly" (Commons et al.., 2019).

Vector-borne Disease

"Vector-borne diseases are diseases transmitted by vectors such as mosquitoes, which spread pathogens from one host to another. Malaria, dengue, and Zika are all examples of vector-borne diseases" (Rosenberg et al., 2019).

Intermittent Preventive Treatment (IPT)

"Intermittent Preventive Treatment (IPT) refers to the administration of antimalarial drugs at specific intervals to high-risk groups such as pregnant women and infants, as a preventive measure against malaria" (Shaw & Catteruccia, 2019).

1.11 Chapter outline

Chapter One: Introduction and Background of the Study

This chapter provides an introduction to the study on the prevalence of malaria in Bindura, focusing on the global, continental, regional, and national perspectives. It describes the problem of malaria, its impact on health, and the importance of studying its prevalence in Bindura. The chapter also introduces the research aims, objectives, and significance of the study. This section lays the groundwork for understanding the gravity of malaria as a public health issue in Zimbabwe and globally. It defines the key terms and present the problem, objectives, research questions, assumptions, limitations, delimitations, and the significance of the study.

Chapter Two: Literature Review

Chapter Two reviews existing literature on malaria prevalence, focusing on global, continental, and national perspectives. It examines the factors influencing the spread of malaria, including environmental, socioeconomic, and cultural elements. The chapter analyzes the effectiveness of current malaria control measures, such as insecticide-treated nets (ITNs), indoor spraying, and antimalarial drugs. It also covers studies on the challenges faced in eradicating malaria and the health outcomes associated with the disease. This chapter also provides theoretical and empirical

literature on malaria, informing the study's conceptual framework and helping to contextualize the findings from Bindura.

Chapter Three: Methodology

This chapter details the research design and methodology used to investigate the prevalence of malaria in Bindura. It outlines the sampling techniques, data collection methods (e.g., surveys, interviews, focus groups), and the tools employed for gathering both qualitative and quantitative data. The chapter discusses the research design in-depth, including the population sample, ethical considerations, and data analysis methods. It also explains how the research aligns with the study's aims and objectives, providing transparency on the methods used to gather and analyze data.

Chapter Four: Data Presentation and Analysis

Chapter Four presents and analyze the data collected from the research. It includes descriptive statistics, thematic analysis, and the interpretation of the results. This chapter explores the findings regarding the prevalence of malaria in Bindura including trends, patterns, and potential causes. It provides a detailed discussion of the research findings, highlighting any significant associations, variances and potential implications for public health. This chapter also compares the findings with previous studies and highlight areas where the data aligns or deviates from existing literature.

Chapter Five: Summary, Conclusions, and Recommendations

Chapter Five summarizes the key findings of the study and draw conclusions based on the research objectives and questions. It links the findings to the literature reviewed in Chapter Two, highlighting key insights into the prevalence of malaria in Bindura. The chapter also presents recommendations for policy, practice, and future research. It suggests interventions and strategies that could be implemented to address the challenges identified in the study. This chapter concludes by proposing areas for further research mainly in regions with similar contexts to Bindura.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter explores the existing literature on malaria prevalence and its key influencing factors including environmental, socio-economic and health-related determinants. It delves into global and regional studies with a particular focus on Sub-Saharan Africa examining the epidemiology of malaria and the effectiveness of current prevention and control strategies. By reviewing relevant literature, this chapter identifies knowledge gaps and establishes the foundation for this study aiming to contribute valuable insights into malaria control in Bindura.

2.2 Conceptual Framework

The Health Belief Model (HBM),

The HBM developed in the 1950s by Irwin Rosenstock, offers a useful framework for understanding health behaviors in relation to preventive actions. The model suggests that individuals are more likely to engage in health-promoting behaviors if they perceive a health threat as serious, believe they are personally at risk, see the benefits of taking preventive actions, and feel they can overcome any barriers to those actions (Rosenstock, 1974). In the context of malaria in Bindura, the model helps explain why some individuals may or may not engage in malaria prevention behaviors such as using insecticide-treated nets or engaging in environmental management practices to eliminate mosquito breeding grounds.

The model's utility is further supported by environmental health theories, which emphasize the role of environmental factors such as stagnant water, waste management, and poor sanitation in the transmission of malaria (Ezeh et al., 2019). According to the World Health Organization (2021), malaria transmission is closely tied to environmental conditions especially where there is inadequate waste management and poor water drainage. The HBM and environmental health theories complement each other by linking individual behavior with the broader environmental context showing how both personal decisions and the environment influence malaria prevalence.

However, the HBM has its limitations. Anuar et al.., (2020) argue that the model oversimplifies the decision-making process by focusing mainly on individual perceptions without adequately addressing broader socio-economic or cultural factors (Glanz et al., 2018). Individuals may be

aware of the risks of malaria but may not take preventive actions due to factors such as poverty or lack of access to resources (Yastica, 2020). Despite these limitations, the HBM remains a useful tool for understanding how people's perceptions of malaria risk and the benefits of prevention influence their behavior and it provides insights into how community-wide interventions could be developed to reduce malaria prevalence in Bindura. Integrating this model with environmental management and community-based approaches can offer a more comprehensive strategy for malaria control.

2.3 Malaria Prevalence and Epidemiology in Sub-Saharan Africa

Malaria remains a significant burden in Sub-Saharan Africa, with the region accounting for 95% of global malaria cases and nearly 96% of malaria-related deaths (WHO, 2020). The epidemiology of malaria in Sub-Saharan Africa is shaped by a combination of environmental, socio-economic, and healthcare-related factors. Environmental conditions such as high temperatures, seasonal rainfall, and humidity create ideal breeding grounds for the anopheles mosquito, the primary vector of malaria (Kolawole et al.., 2023). These conditions are prevalent in tropical and subtropical regions, which makes Sub-Saharan Africa a hotspot for malaria transmission.

The prevalence of malaria varies within the region, with some countries like Nigeria, the Democratic Republic of the Congo (DRC), and Uganda consistently reporting high levels of malaria transmission (Eze et al., 2019). Nigeria, in particular, remains one of the countries with the highest number of malaria cases globally, with an estimated 25% of the world's malaria cases occurring there (WHO, 2020). Malaria prevalence is often influenced by rurality, with the majority of cases occurring in rural areas, where access to healthcare services, insecticide-treated nets (ITNs), and other preventive measures is limited. Okeke et al., (2020) found that there is a correlation between high malaria prevalence and low socioeconomic status, with poor communities being at greater risk due to inadequate living conditions and limited access to malaria control tools.

The seasonal nature of malaria transmission in many parts of Sub-Saharan Africa means that malaria control efforts must be adapted to local seasonal patterns. For example, transmission peaks during the rainy season when mosquito populations are larger (Obebe & Falohum, 2021). The WHO (2020) emphasizes that effective malaria control measures, such as insecticide-treated bed nets and indoor spraying, must be combined with robust healthcare systems to ensure early

diagnosis and treatment. However, despite these efforts, challenges such as drug resistance, limited healthcare infrastructure, and financial constraints hinder malaria elimination goals in many African countries.

2.3.1 Nigeria's Malaria Burden

Nigeria, as one of the leading contributors to the global malaria burden, faces a unique set of challenges in addressing the prevalence of the disease. With approximately 25% of all malaria cases worldwide occurring in Nigeria, as reported by the World Health Organization (WHO) (2020), the country remains at the epicenter of the malaria crisis in Sub-Saharan Africa. The widespread distribution of plasmodium falciparum, the malaria parasite responsible for the majority of cases in the region, exacerbates the countries already strained healthcare system (Kolawole & Ayeni, 2023). Malaria in Nigeria is influenced by a complex array of factors, including environmental conditions, socio-economic disparities, and health system weaknesses. The country's tropical climate creates an ideal breeding ground for Anopheles mosquitoes, the vectors responsible for malaria transmission, leading to a high endemic burden across much of the nation.

One of the major factors contributing to Nigeria's malaria burden is the lack of adequate access to healthcare. According to Adebayo et al. (2017), millions of Nigerians live in rural areas where healthcare facilities are often either underdeveloped or geographically inaccessible. This has a direct impact on malaria prevention and treatment efforts, as many individuals cannot reach clinics for timely diagnosis or receive prompt treatment. In addition, there is a significant gap in the availability of healthcare personnel and resources, further hindering effective malaria management (Oladipo et al.., 2022). Furthermore, the persistent resistance to antimalarial drugs, especially chloroquine, which has long been the cornerstone of malaria treatment in Nigeria, poses an additional barrier to combating the disease (Okell et al., 2019). The emergence of resistant strains of the parasite is making treatment less effective, contributing to prolonged illness, and higher mortality rates. These issues underscore the urgent need for better healthcare infrastructure, drug efficacy improvements, and increased access to essential malaria prevention and treatment tools.

In Nigeria, the use of insecticide-treated nets (ITNs) remains a key pillar of the national malaria control strategy. However, several studies have indicated that the uptake and correct use of ITNs remain suboptimal in many regions. Adebayo et al. (2017) noted that while ITNs are distributed

as part of national campaigns, their effectiveness is often undermined by poor community engagement and lack of adherence to the recommended usage guidelines. In rural communities, ITNs are sometimes repurposed for other uses, such as fishing nets, due to lack of awareness about their malaria-preventive benefits. Moreover, a lack of consistent monitoring and follow-up by healthcare authorities means that nets often fall into disuse over time, reducing the overall impact of these programs (Oshagbemi et al, 2023). This highlights the need for comprehensive community education campaigns that emphasize the importance of proper net usage and ensure that nets remain effective throughout their expected lifespan.

Nigeria has undertaken significant steps to improve malaria control, with partnerships between the government, international organizations, and donors playing a pivotal role in the ongoing fight. The Global Fund to Fight AIDS, Tuberculosis, and Malaria has provided substantial financial support for malaria control initiatives, enabling the distribution of millions of ITNs and the provision of malaria treatments (Nigerian Ministry of Health, 2019). Additionally, the introduction of intermittent preventive treatment (IPT) for pregnant women has helped to reduce malaria-related maternal and fetal morbidity. However, the success of these interventions has been mixed, and efforts to scale up malaria prevention and treatment programs have faced challenges. Poor healthcare infrastructure, corruption, and logistical difficulties in distributing malaria control tools in remote areas have limited the scope and sustainability of these efforts (Afolabi et al, 2022). Furthermore, despite government and international efforts, the political instability and regional conflicts in some areas of Nigeria complicate the consistent implementation of malaria programs. The spread of malaria in conflict zones, where access to health services is even more limited, remains a critical concern.

2.4 Malaria Prevention Strategies and Health Behaviors

The success of malaria prevention strategies heavily depends on health behaviors and the correct use of preventive measures such as insecticide-treated nets (ITNs), indoor residual spraying (IRS), and chemoprevention (Monroe, 2021). A variety of studies have emphasized the importance of these strategies in reducing malaria transmission rates. The WHO (2020) reports that ITNs have been one of the most effective tools in preventing malaria, reducing the incidence of malaria by 50% in areas where they are widely used. Similarly, IRS can reduce malaria transmission by 60% in endemic areas, particularly when the mosquito population is high (Breman et al., 2018).

However, these measures are only effective if health behaviors align with preventive recommendations, including the consistent and correct use of ITNs and timely access to treatment.

In many malaria-endemic regions, local health behaviors and cultural beliefs can significantly affect the effectiveness of prevention measures. Albedraba et al. (2018) argue that in certain communities, traditional healing practices are preferred over modern preventive measures like ITNs, even when people are aware of the risks of malaria. Furthermore, a lack of awareness about the importance of regular use of ITNs, combined with insufficient education on malaria prevention, can undermine the success of malaria control programs (Turner et al., 2021). This discrepancy between knowledge and behavior is often compounded by logistical barriers, such as the lack of access to preventive tools and inadequate healthcare services.

Kebede et al, (2020) in their study found that community-based education programs are essential for improving health behaviors and promoting the adoption of malaria prevention strategies. For example, a study in Zambia found that educating local communities about malaria transmission and the benefits of using ITNs led to increased net ownership and consistent use (Mwansa et al., 2019). However, the challenge remains that in many rural areas, there is still insufficient education on the proper use of prevention tools, which may lead to improper handling of ITNs, reducing their efficacy.

2.4.1 India's Malaria Prevention Efforts

India has long struggled with malaria, particularly in its eastern and central regions, such as Odisha, Jharkhand, West Bengal, and Madhya Pradesh, where the disease is endemic due to the favorable climate conditions for anopheles mosquito breeding (Rahi & Sharma, 2022). The country has made significant strides in malaria control through the deployment of various preventive strategies, including the widespread distribution of insecticide-treated nets (ITNs) and indoor residual spraying (IRS). According to the National Vector Borne Disease Control Programme (2019) of India, these interventions, combined with early diagnosis and prompt treatment, have led to a notable reduction in malaria cases across the country. However, despite these efforts, the battle against malaria remains a persistent challenge in India.

One of the key challenges in the success of malaria prevention programs in India is ensuring the proper and consistent use of ITNs and IRS. Rajvanshi, et al.., (2021) found that although ITNs are distributed widely, their use is inconsistent in certain regions. Many communities exhibit

reluctance to use ITNs due to discomfort caused by the nets' heat retention or the misconception that they are ineffective. In some areas IRS has been mismanaged with insufficient coverage or irregular spraying schedules that fail to adequately target high-risk areas. The mismanagement of IRS, particularly in remote areas, has been linked to gaps in local health infrastructure and the lack of trained personnel to implement the program effectively (van Ejik et al., 2020). As a result, these factors have reduced the overall effectiveness of these interventions in some regions of India.

In addition to logistical and behavioral challenges, the rapid development and expansion of urban areas in India have also complicated malaria control efforts. Urbanization often leads to the creation of new breeding sites for mosquitoes, such as stagnant water in construction sites, poorly managed drainage systems, and water storage containers that are commonly found in densely populated areas. A study by Sahu et al. (2019) highlighted that urban slums in cities like Delhi and Kolkata, where access to healthcare is limited, have seen a rise in malaria cases due to poor sanitation and inadequate mosquito control measures. This urban malaria problem presents a unique challenge that differs from rural transmission dynamics, necessitating tailored interventions for urban settings.

Despite these challenges, India has undertaken significant efforts to address malaria through public health education and community engagement. Targeted education programs have been implemented to inform communities about the importance of malaria prevention measures, the correct use of ITNs, and the risks of malaria transmission. For example, a study by Agarwal et al. (2020) found that community-led initiatives, where local volunteers and healthcare workers provided door-to-door education on malaria prevention, were instrumental in improving both knowledge and attitudes about the disease. These initiatives helped to address misconceptions about ITNs and increase their usage. Moreover, public health campaigns emphasizing the importance of early diagnosis and prompt treatment of malaria have been successful in reducing the burden of the disease in certain regions, particularly in areas with high malaria incidence.

The continued success of malaria control efforts in India, therefore, depends on the sustained implementation of these measures, the effective management of interventions, and overcoming the socio-cultural barriers to malaria prevention. As malaria transmission remains a significant public health challenge in India, especially in the underserved regions, the focus must shift towards strengthening healthcare systems, enhancing community involvement, and addressing

environmental factors that contribute to the spread of malaria (Awasthi et al.., 2022). These efforts will not only contribute to the reduction of malaria cases but also help India in achieving its goal of malaria elimination by 2030, as outlined in the National Strategic Plan for Malaria Elimination (NVBDCP, 2019).

2.5 Environmental Factors and Their Role in Malaria Transmission

Environmental factors play a crucial role in the transmission of malaria, with specific conditions required for the anopheles mosquito, the primary vector of malaria, to thrive. These conditions include warm temperatures, abundant rainfall, and the presence of stagnant water, which provide ideal breeding sites for mosquitoes. The tropical and subtropical climates prevalent in Sub-Saharan Africa and other regions where malaria is endemic offer such environments, making them high-risk areas for malaria transmission (Liu et al., 2021). The role of climate in malaria transmission is well-documented, with studies indicating that increases in temperature, coupled with rainfall patterns, significantly influence the prevalence and spread of the disease (Abeku et al., 2020). The ideal conditions for mosquito breeding include water-filled containers, stagnant pools, and low-lying areas that trap water, all of which can serve as breeding grounds for mosquitoes. Thus, the epidemiology of malaria is closely linked to seasonal variations, with malaria transmission peaking during the rainy season.

The environmental impact on malaria transmission is further exacerbated by climate change, which has intensified these factors. According to a study by Abeku et al. (2020), global warming and changes in precipitation patterns are expanding malaria transmission zones into areas previously unaffected by the disease. Warmer temperatures allow mosquitoes to survive in areas that were once too cold for them, and erratic rainfall patterns increase the availability of breeding grounds, particularly in regions that experience heavy flooding followed by periods of drought (Okunlola & Oyeyemi, 2019). As a result, regions that were once malaria-free are now seeing an increase in malaria cases, creating new public health challenges. The shifting climate patterns have made it more difficult to predict when and where malaria outbreaks will occur, complicating efforts to control the disease.

In addition to temperature and rainfall, land use changes such as deforestation and urbanization also play significant roles in malaria transmission. As forests are cleared for agricultural purposes or urban development, new habitats are created that are favorable to mosquito breeding.

Deforestation, in particular, has been linked to an increase in malaria transmission in areas that were previously forested but are now cleared for farming or urban expansion. A study by Liu et al. (2021) found that land-use changes, such as deforestation, create pools of stagnant water in construction sites, roads, and other human-made environments, thus providing new breeding sites for mosquitoes. Similarly, according to Breman et al., (2018) poorly drained urban areas which often contain stagnant water due to inadequate infrastructure, have also been identified as high-risk zones for malaria transmission.

Moreover, environmental changes such as the construction of dams and irrigation systems, which are intended to improve agricultural productivity, can unintentionally increase malaria transmission (Kibret, 2019). These man-made modifications to the natural environment can create new mosquito breeding habitats. The construction of irrigation channels and dams has been associated with increased rates of malaria in several countries, including East African nations such as Kenya, Uganda, and Ethiopia. Breman et al. (2018) pointed out that irrigation schemes in East Africa have unintentionally created stagnant water sources where mosquitoes can breed, exacerbating the malaria problem in surrounding communities. These changes have made malaria transmission patterns more complex and harder to control, as they are tied to human intervention in the environment that increases the availability of breeding grounds for mosquitoes.

The role of poor sanitation practices is also a key environmental factor contributing to the prevalence of malaria. In many rural and underserved urban areas, inadequate waste management systems and the lack of proper drainage contribute to the creation of stagnant water sources, which are ideal breeding grounds for mosquitoes (Mafwele & Lee, 2022). Areas with poor sanitation practices, where garbage is improperly disposed of and water drainage systems are insufficient, can become hotspots for malaria transmission. Studies show that inadequate waste management in these areas leads to the accumulation of water in containers, tires, and other debris, providing abundant breeding sites for mosquitoes (Liu et al., 2021). Furthermore, in many informal settlements, where there is little infrastructure for waste removal and water drainage, these issues are particularly pronounced, leading to higher malaria transmission rates.

The role of agriculture in malaria transmission should not be overlooked. The extensive use of water for agriculture, especially in areas with large-scale rice farming or irrigation projects, provides an environment that supports mosquito breeding (Savi, 2022). This is particularly true in

countries like India, where large-scale irrigation has been linked to increases in mosquito populations in certain regions (Dhiman et al., 2017). Such agricultural practices exacerbate malaria transmission by providing ideal conditions for mosquito larvae to develop in fields, canals, and standing water used for crop irrigation. Similarly, in Africa, large-scale agricultural projects often lead to the creation of stagnant water pools in areas previously free from malaria transmission, further contributing to the spread of the disease.

2.5.1 Deforestation and Malaria in Brazil

In Brazil, environmental changes, particularly deforestation in the Amazon rainforest, have been linked to increased malaria transmission. Ruiz et al. (2019) conducted a study in the Amazon Basin, finding that large-scale deforestation increased mosquito populations by providing new breeding sites in areas previously not prone to malaria transmission. The study concluded that deforestation disrupts the natural balance of malaria transmission, highlighting the need for environmental management alongside health interventions to combat malaria. This is because deforestation leads to the creation of stagnant water pools in newly cleared areas, providing ideal breeding grounds for the anopheles mosquito, the primary vector of malaria. These changes in land use have expanded the geographic range of malaria, shifting the disease from its traditional focus in rural and isolated areas to urbanizing regions. MacDonald & Mordecai (2019) argue that deforestation indirectly accelerates the spread of malaria by facilitating human interactions with previously isolated mosquito populations, increasing the likelihood of transmission in areas that were not historically affected by the disease.

The Brazilian government has acknowledged the relationship between deforestation and malaria, particularly in the Amazon region, and has taken steps to address the environmental drivers of malaria (Canelas, 2019). However, despite these efforts, the conflict between economic development, such as logging and agriculture, and conservation efforts remains a significant challenge. A study by Garcia et al. (2020) found that while malaria transmission rates decreased in some areas where deforestation was controlled, the expansion of agricultural frontiers and illegal logging activities continued to contribute to malaria transmission in certain Amazonian regions. This demonstrates the complex interplay between environmental degradation, land use changes, and malaria transmission. Malaria control efforts in Brazil, particularly in the Amazon, are thus hindered by the difficulty of reconciling environmental conservation with economic pressures, such as the demand for land for farming and mining. García et al. (2020) emphasize that a holistic

approach is necessary, one that combines malaria control strategies with strong environmental regulations to limit deforestation and promote sustainable development.

2.6 Socio-economic Determinants of Malaria Vulnerability

Socio-economic factors play a significant role in influencing malaria vulnerability and transmission, especially in endemic regions. Poverty, limited access to healthcare, inadequate housing, and low levels of education are all key factors contributing to higher malaria susceptibility (Sharma et al.., 2021). Individuals living in poverty are less likely to have access to malaria prevention tools, such as insecticide-treated nets (ITNs), and often delay seeking medical treatment due to financial constraints (Kagaba, 2024). As a result, these individuals are at a higher risk of suffering from severe malaria, which can lead to complications such as cerebral malaria or severe anemia (Armando et al., 2023). Poor housing conditions, such as overcrowded living spaces and inadequate sanitation, create ideal breeding grounds for malaria-transmitting mosquitoes, thereby increasing the risk of malaria transmission in these areas.

Malnutrition, which is often prevalent in impoverished communities, also contributes to increased malaria vulnerability. Studies have shown that malnutrition weakens the immune system, making individuals more susceptible to malaria and more likely to experience severe outcomes (Breman et al., 2018). Malnourished children under five years old are particularly at risk, as their developing immune systems are not able to combat malaria as effectively as those of well-nourished children (Liu et al., 2020). Pregnant women in poverty-stricken regions are also more vulnerable to malaria, as malnutrition increases the likelihood of poor pregnancy outcomes, such as low birth weight or preterm birth, when malaria affects the placenta.

In addition to poverty, limited access to healthcare is another crucial socio-economic factor contributing to malaria's high burden in these communities. In many low-income and rural areas, access to healthcare services is severely limited due to infrastructure deficits, long distances to health facilities, and the high cost of medical treatment (Mohan et al.., 2021). In these areas, malaria may go undiagnosed or untreated, leading to severe health complications and higher mortality rates. Inadequate diagnostic tools and a shortage of healthcare personnel in these regions further exacerbate the problem, delaying diagnosis and treatment and contributing to the spread of malaria.

Education plays a vital role in preventing malaria, particularly in low-income communities. Research has shown that individuals with lower levels of education are less likely to engage in preventive practices, such as using ITNs or seeking timely medical care (Akbari et al., 2020). This lack of knowledge about malaria transmission and prevention can be attributed to poor public health education and limited access to health information. Communities with lower levels of education often have a greater prevalence of misconceptions about malaria, which can lead to non-compliance with preventive measures and treatment regimens (Guin et al., 2023). Therefore, increasing educational efforts in malaria-endemic regions is crucial to enhancing awareness and ensuring that individuals understand how to prevent and manage malaria.

Lastly, poor sanitation and waste management are critical socio-economic factors contributing to malaria transmission. Stagnant water in poorly maintained drainage systems, open waste disposal, and improper sewage systems provide perfect breeding grounds for the *Anopheles* mosquito. Liu et al. (2021) found that inadequate sanitation practices increase the likelihood of mosquito breeding, which in turn escalates malaria transmission. The lack of proper waste management infrastructure in impoverished areas further complicates the issue, as it perpetuates conditions that foster malaria transmission (Manyanganidze et al.., 2021). In densely populated areas, where sanitation is particularly poor, the risk of malaria is heightened due to the close proximity between humans and mosquito breeding sites. Improving sanitation and waste management practices in malaria-prone regions is therefore an essential component of malaria control strategies.

2.7 Research Gaps

One important research gap is the lack of comprehensive understanding regarding the impact of socio-economic factors on malaria prevalence in specific areas like Bindura. While poverty, poor housing, and limited healthcare access are often cited as key determinants, there is insufficient research on how these factors intersect and contribute collectively to higher malaria vulnerability in rural areas. This study aims to fill this gap by exploring the combined effects of socio-economic challenges such as poor sanitation, limited access to clean water, and inadequate housing on malaria transmission.

Another significant gap lies in the role of community knowledge and behavior towards malaria prevention. While previous studies focus on biological and environmental factors, the influence of local knowledge, attitudes, and practices on the use of prevention tools like insecticide-treated nets

(ITNs) and indoor residual spraying (IRS) is under-researched. This study will examine how cultural beliefs, misconceptions, and behaviors within the Bindura community impact the adoption of malaria prevention measures and the effectiveness of existing health interventions.

A third gap exists in understanding the effectiveness of localized malaria control strategies. Most malaria control efforts focus on national-level interventions leaving a gap in the literature concerning community-driven or region-specific programs particularly in rural areas. This research will investigate how tailored localized malaria control strategies can effectively reduce malaria prevalence in Bindura, offering valuable insights for similar contexts.

2.8 Summary

Chapter Two reviewed existing literature on the prevalence and epidemiology of malaria focusing on the various factors that influence malaria transmission and control efforts globally. It explored the role of socio-economic, environmental, and behavioral factors, with a particular emphasis on Sub-Saharan Africa, where malaria remains a major public health issue. The chapter also discussed the impact of poverty, poor healthcare access, and environmental changes like deforestation and climate change on malaria transmission. Case studies from countries like Nigeria and Brazil were used to demonstrate how these factors affect malaria control efforts. The chapter concluded by identifying research gaps, particularly in addressing socio-economic and environmental barriers to malaria control, which this study aims to explore further.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the methodology used to investigate the prevalence of malaria in Bindura, focusing on the research approach, design, population, sample, and sampling techniques. It also explains the data collection methods and the process of data presentation and analysis, providing a clear path to ensure that the findings are reliable and valid. Ethical considerations relevant to the study are highlighted, ensuring the protection of participants and the integrity of the research process. Each section of the chapter will guide the reader through the steps taken to ensure methodological rigor and transparency.

3.2 Research Approach

The research approach refers to the overall strategy used to conduct the study, influencing data collection and analysis techniques (Patel & Patel, 2019). This study adopted a mixed-methods approach, combining both quantitative and qualitative methods to gather comprehensive data on malaria prevalence in Bindura. The quantitative aspect allowed for the collection of numerical data facilitating statistical analysis, while the qualitative component offered in-depth insights into personal experiences and contextual factors affecting malaria transmission and management. The combination of both methods enhances the depth, validity, and reliability of the findings.

3.3 Research Design

Research design outlines how the study is structured and the type of data needed to answer the research questions (Sileyew, 2019). This study adopted a descriptive research design, suitable for both quantitative and qualitative data collection. The design enabled the researcher to assess the distribution and underlying factors associated with malaria without manipulating any variables. This design is appropriate for quantifying malaria prevalence and describing contextual factors influencing the disease in both rural and urban Bindura.

3.4 Population

The population refers to the entire group of individuals or items that the study is interested in (Simkus, 2022). In this study, the population included all individuals residing in Bindura who are potentially affected by malaria. This comprised people from different age groups, genders, occupations, and socio-economic backgrounds. The focus was on understanding how malaria impacts various segments of the population, including healthcare workers, residents, and community leaders.

3.4.1 Sample Size

A sample is a subset of the population selected for participation in the study (Creswell, 2019). The sample size included 10 clinics from both rural and urban Bindura. The study sample consisted of a total of 100 participants, drawn from 10 selected clinics in Bindura (5 urban and 5 rural). This included 20 health professionals 2 from each clinic, with an even split of 10 from rural clinics and 10 from urban clinics. 80 community members responded to structured questionnaires 40 from rural clinics and 40 from urban clinics, with each clinic contributing 8 respondents. Questionnaire respondents and interview participants were drawn from clinic staff, patients, community members, and local leaders knowledgeable about malaria trends between 2020 and 2022. This sample size ensured a statistically sound representation and diverse perspectives to enrich the findings.

3.4.2 Sampling Techniques

The study used purposive sampling to select participants. This technique is particularly useful in qualitative and mixed-methods research as it allows the researcher to deliberately choose individuals who are knowledgeable or have experience related to the study topic (Etikan & Babatope, 2019). Participants such as healthcare providers, local leaders, and affected residents were chosen to provide insights on malaria prevalence, its causes, and control measures. This method ensured that both statistical data and lived experiences were adequately represented.

3.5 Data Collection Methods

Data collection methods refer to the techniques used to gather information from participants (Taherdoost, 2021). In this study, both quantitative and qualitative data collection techniques were employed:

- **Structured Questionnaires**: These were used to collect quantitative data regarding the number of malaria cases, demographics, preventive measures, and healthcare access. Closed-ended questions enabled statistical analysis of trends and patterns across clinics.
- **Semi-Structured Interviews**: These captured qualitative insights into personal experiences, perceptions, and local knowledge on malaria transmission and control. Interviews were conducted with healthcare workers, patients, and community members to gain a deeper understanding of socio-economic and environmental factors.

This dual-method strategy ensured a comprehensive understanding of malaria in Bindura from both numerical and narrative perspectives.

3.6 Data Presentation and Analysis

Once data was collected, it was analyzed using both **quantitative** and **qualitative** techniques:

- **Quantitative Data** from questionnaires was analyzed using **descriptive statistics** such as frequencies, percentages, and averages to summarize malaria prevalence and associated factors. This data was presented in tables, graphs, and charts for clarity.
- **Qualitative Data** from interviews was thematically coded to identify key themes and patterns. Coding was conducted manually and by using software tools where applicable to capture insights on community behavior, environmental conditions, and access to healthcare.

This mixed-methods analysis enabled triangulation of data, improving the credibility and richness of the findings.

3.7 Validity and Reliability

Validity refers to the accuracy of the data in reflecting what it is intended to measure, while reliability refers to the consistency of the measurement (Quintão et al., 2020). To ensure validity, research instruments such as questionnaires and interview guides were developed based on existing literature and expert input. Pilot testing was conducted to refine tools before full deployment.

To ensure reliability, data was collected consistently across all clinics, and multiple sources were used to cross-check information. For qualitative data, member checking was conducted with selected participants to confirm that their views were accurately captured.

3.8 Ethical Considerations

Ethical considerations ensure that the study is conducted with respect for the rights and dignity of participants. Key ethical principles observed in this study included:

- **Informed Consent**: Participants were fully informed about the purpose of the study, their role, and their right to withdraw at any time without penalty.
- **Confidentiality**: All personal data was anonymized. No identifiable information was included in any publication of findings.
- **Minimizing Harm**: The study avoided any form of physical or psychological harm. Interviews and surveys were conducted in a safe and respectful manner.
- **Voluntary Participation**: Participation in both interviews and questionnaires was entirely voluntary, with clear communication about the right to opt out at any point.

Ethical clearance was obtained from the relevant authorities prior to data collection.

3.9 Summary

This chapter provided a comprehensive overview of the research methodology used in this study. A mixed-methods approach combining quantitative and qualitative techniques was adopted to ensure a holistic understanding of malaria prevalence in Bindura. The research design, population, sample, and sampling techniques were described, along with the methods for collecting and analyzing both numerical and narrative data. Measures to ensure validity, reliability, and ethical compliance were also discussed. This robust methodological framework lays a solid foundation for credible and meaningful research outcomes.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1 Introduction

The chapter presents data collected from 10 local clinics which are: Bindura Provincial Hospital, Bindura ZRP Clinic, Chipadze Clinic, Chiriseri Clinic, Chiveso Rural Health Centre, Chiwaridzo Clinic, Foothills Clinic, Manga Rural Health Centre, Manhenga Clinic and Mupandira Rural Health Centre. The list has an equal representation of rural and urban clinics. The data is presented thematically with tables and charts used as visual aids. The data is brocken into thematic areas with the first showing the prevalence of malaria in Bindura and the different distribution, the socio-economic and environmental factors contributing to the persistence of malaria in Bindura and an evaluation of the effectiveness of current malaria control measures in Bindura and proposed improvements to strengthen malaria prevention and management.

4.2 Demographic Characteristics

A total of 20 health professionals were interviewed. Two from each of the 10 clinics (10 from the five rural clinics and 10 from then five urban clinics). These participants were selected purposively based on their experience and knowledge in treating and managing malaria cases in their respective clinics. A total of 80 community members responded to the structured questionnaires. 40 from urban clinics and 40 from rural clinics. Each of the ten clinics contributed 8 respondents, offering a balanced rural-urban representation.

Table 1 Demographic data of Study Participants

Variable	Category	Urban (n=40)	Rural (n=40)	Total (n=80)
Gender	Male	19	17	36
	Female	21	23	44
Age Group	18–25	6	4	10
	26–35	12	11	23
	36–45	9	12	21
	46–60	8	10	18
	60+	5	3	8

4.3 Prevalence of malaria in Bindura and the distribution of malaria cases across different demographics.

The first objective of the study was to assess the prevalence of malaria in Bindura, Zimbabwe, and to determine the distribution of malaria cases across different demographics and locations. Data were collected from 10 clinics (five rural and five urban) through interviews with 20 health professionals and supplemented by 80 structured questionnaires completed by community members. Findings from the health professionals reveal that malaria remains a significant health burden in both rural and urban clinics, with varying degrees of intensity depending on local environmental conditions and community practices. Across all clinics, a total of 1,747 malaria cases were recorded between 2020 and 2022, with a notable decline in reported cases over the three-year period. The average number of cases per clinic was approximately 175.

One key observation is that Foothills Clinic located in a mining zone reported the highest malaria prevalence, contributing 453 cases (25.9%) to the total. In contrast, Bindura ZRP Clinic, which serves a controlled population, reported only 16 cases (0.9%) over the same period.

According to one health professional at Foothills Clinic:

> *"Our patient load is heavy, especially during the rainy season. The stagnant water left behind by mining activity is a big factor in the high number of malaria cases we see."*

This supports the general observation that environmental exposure, especially stagnant water from mining or farming, is a major factor driving malaria transmission. Clinics in agricultural rural areas such as Manga Rural Health Centre also reported high case numbers though some have seen a decline due to ongoing intervention efforts. When analyzing the data year-by-year, malaria cases peaked in 2020, which recorded 889 cases, before declining to 550 in 2021, and further to 308 in 2022. This suggests improvements in malaria control and prevention, though certain hotspots like Foothills Clinic remain a challenge.

The table below summarizes malaria case distribution across the 10 clinics from 2020 to 2022:

Table 2 Distribution of Malaria Cases in Bindura Clinics (2020–2022)

Clinic	2020	2021	2022	Total Cases (2020–2022)	% of Total
Foothills Clinic	217	164	72	453	25.9%
Manga Rural Health Centre	269	64	63	396	22.7%
Chipadze Clinic	101	97	67	265	15.2%
Bindura Provincial Hospital	111	81	27	219	12.5%
Chiwaridzo Clinic	89	65	33	187	10.7%
Chiriseri Clinic	31	22	12	65	3.7%
Manhenga Clinic	29	24	19	72	4.1%
Mupandira Rural Health Centre	23	12	5	40	2.3%
Chiveso Rural Health Centre	18	12	4	34	1.9%
Bindura ZRP Clinic	1	9	6	16	0.9%
Total	**889**	**550**	**308**	**1,747**	**100%**

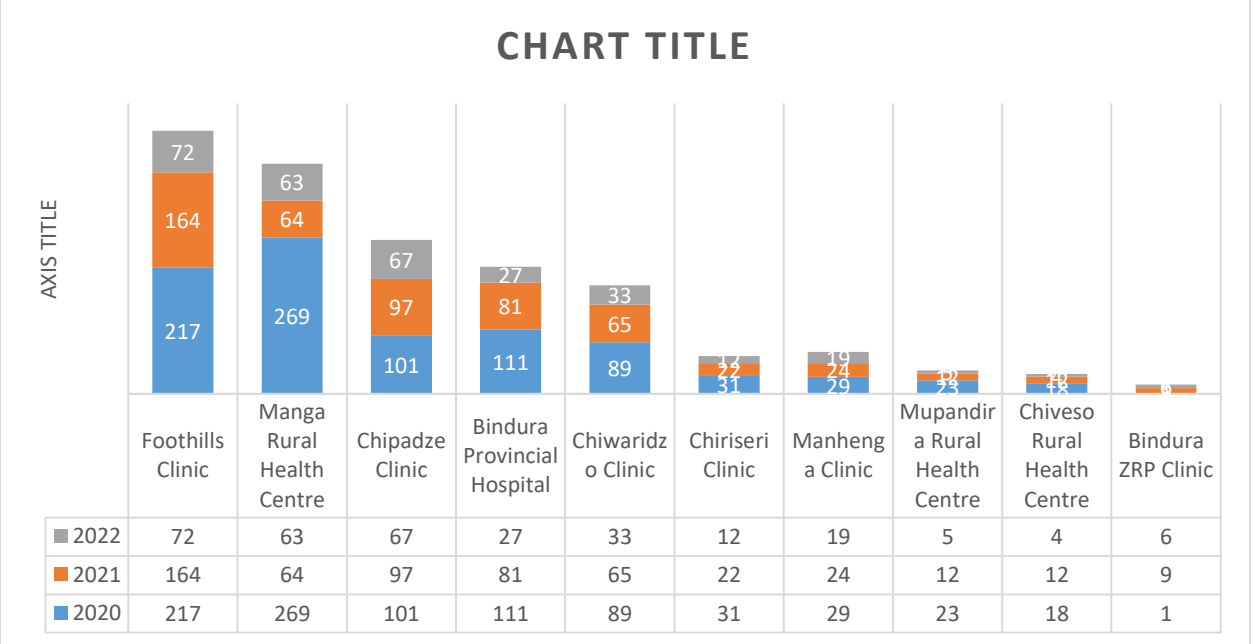

Figure 1 Malaria Prevalence

4.4 The socio-economic and environmental factors contributing to the persistence of malaria in Bindura.

From Chapter One, it is indicated that another key objective of the study was to identify and examine the socio-economic and environmental factors contributing to the persistence of malaria in Bindura. This section presents findings that point to a variety of factors affecting malaria control, with notable differences between rural and urban respondents. The data indicates that while a high percentage of both rural (90%) and urban (95%) participants understood that malaria is caused by mosquitoes, the ability to prevent or respond to infection varied significantly. Only 52.5% of rural participants used mosquito nets regularly, compared to 77.5% in urban areas, reflecting disparities in accessibility and distribution. Similarly, awareness of community health campaigns was higher in urban areas (82.5%) than rural (55%), suggesting limited outreach in the latter. Environmental conditions such as the presence of stagnant water were also reported more frequently in rural areas (82.5%) due to mining and poor drainage systems, which create breeding grounds for mosquitoes. Moreover, economic factors such as transport and treatment affordability showed a major gap, with only 47.5% of rural respondents affording care easily, against 85% in urban areas. These results show that although awareness exists, especially in rural zones, there is still a lack of sufficient infrastructure, access to resources, and environmental management practices to effectively control malaria. Below is a table showing findings on the factors contributing to malaria persistence:

Table 3 Key Socio-Economic and Environmental Factors Contributing to Malaria Persistence in Bindura

Indicator/Question	Rural (n=40)	Urban (n=40)	Insights from Interviews
Uses mosquito net regularly	52.5%	77.5%	Urban residents access free or subsidized nets more easily Rural clinics often understocked.
Home sprayed in the past 12 months (IRS)	45.0%	67.5%	IRS teams miss remote areas due to logistics Urban households better covered.
Aware of community health campaigns on malaria	55.0%	82.5%	Urban clinics supported by NGOs and media Rural outreach limited.

Can afford transport and treatment when malaria symptoms start	47.5%	85.0%	*"Some walk long distances or wait until very sick"* — **Mupandira Health Worker**.
Knows malaria is caused by mosquitoes	90.0%	95.0%	Strong general awareness, but traditional beliefs still exist in pockets.
Stagnant water near home (e.g., mining pits, blocked drains)	82.5%	35.0%	*"Mining pits stay full even in dry season; perfect for mosquito breeding."* — **Foothills Nurse.**
Bush/grass overgrowth or livestock close to home (attract mosquitoes)	72.5%	27.5%	Poor land maintenance in rural areas due to lack of equipment or knowledge.
Participated in clean-up or drainage campaigns	35.0%	47.5%	Urban wards receive better coordination for such programs.
Perceived 2020 as worst malaria year (vs. 2021 and 2022)	67.5%	62.5%	*"More rains in 2020 and poor preparedness worsened cases."* — **Provincial Hospital Nurse.**
Main barrier to net use: Not available or too costly	55.0%	17.5%	*"Some families share one net or sleep without."* — **Manga Nurse.**
Belief that stagnant water from mining/farming contributes to malaria	85.0%	92.5%	High agreement, shows awareness but low ability to act (especially in rural zones).

4.5 Effectiveness of current malaria control measures in Bindura

Survey results revealed varied levels of effectiveness in current malaria control measures between rural and urban communities in Bindura. Regular use of mosquito nets was reported by 77.5% of urban respondents compared to only 52.5% in rural areas, while 67.5% of urban residents had their homes sprayed with insecticides in the past year, as opposed to 45.0% in rural areas. Participation in community health education programs was also more common in urban areas (82.5%) than rural ones (55.0%). Access to free diagnosis and treatment was significantly higher among urban respondents (87.5%) compared to rural counterparts (62.5%). However, awareness of larval source

control initiatives remained low overall, with only 35.0% in rural and 47.5% in urban areas indicating awareness.

Qualitative data from interviews highlighted that the inconsistent use of insecticide-treated nets (ITNs), especially in rural areas, undermines their effectiveness. Health workers reported that nets are sometimes repurposed for non-health-related uses, such as fishing or shelter during rainstorms. Indoor Residual Spraying (IRS) was found to be more systematically implemented in urban areas due to better infrastructure, whereas rural and mining areas are often overlooked due to logistical challenges. Large untreated stagnant water bodies in mining regions pose a major obstacle to effective larval source management, compounded by limited resources and technical capacity. Community education efforts, though prevalent in urban settings, were less impactful in rural areas where socioeconomic hardships restrict the ability to act on prevention messages. Disparities in healthcare access were also emphasized, with rural residents facing barriers such as long distances and transportation costs, leading to delayed or missed treatment.

Table 4 Malaria Control Measures

Question	Rural (%)	Urban (%)	Variance (Urban–Rural)
Regular use of mosquito nets	52.5%	77.5%	+25%
Home sprayed in the past 12 months (IRS)	45.0%	67.5%	+22.5%
Participated in community health/education programs	55.0%	82.5%	+27.5%
Access to free diagnosis and treatment when symptoms appear	62.5%	87.5%	+25%
Awareness of larval source control initiatives (drainage/filling puddles)	35.0%	47.5%	+12.5%
Recognition of stagnant water as breeding risk	82.5%	35.0%	–47.5%
Belief that mining/farming increases malaria risk	85.0%	92.5%	+7.5%

4.6 Integrating the Quantitative and Qualitative Findings

This section brings together both the quantitative and qualitative findings to examine the extent to which they complement or contradict each other. From the preceding sections, it is clear that the quantitative data provided measurable insights into the prevalence of malaria, access to prevention tools, and the socioeconomic conditions shaping the community's response. On the other hand,

the qualitative data offered deeper context, explaining the lived experiences and local dynamics that influence how malaria is managed on the ground.

From both approaches, it can be observed that malaria continues to be a pressing health issue in Bindura, with notable differences between rural and urban settings. The quantitative findings showed that while malaria cases have declined from 889 in 2020 to 308 in 2022, certain hotspots such as Foothills Clinic continue to experience high incidence due to environmental factors like stagnant water from mining operations. This statistical trend was echoed in interviews with health professionals, who consistently pointed to environmental exposure as a key driver of malaria transmission. One health worker at Foothills Clinic stated that "the stagnant water left behind by mining activity is a big factor in the high number of malaria cases," reinforcing the quantitative evidence with qualitative depth.

Both data sets align in highlighting significant disparities in access to malaria prevention and treatment services between rural and urban areas. Quantitative results revealed that only 52.5% of rural respondents used mosquito nets regularly, compared to 77.5% in urban areas, while qualitative findings added that nets in rural areas are sometimes repurposed for fishing or other needs due to economic pressures. Similarly, while quantitative data showed that 67.5% of urban residents benefited from indoor residual spraying (IRS) versus 45% in rural areas, interviews with health professionals further revealed that logistical and infrastructural limitations hinder IRS implementation in remote or mining-affected communities.

Also, the two approaches agree on the issue of health education and outreach. Quantitative data indicated that urban respondents had greater awareness of community health programs (82.5%) compared to rural respondents (55%), and this was supported by health professionals who expressed concern over the limited reach of campaigns in rural zones. Qualitative insights also highlighted that even when information is available, rural residents often lack the financial or infrastructural means to act on it, especially when it comes to accessing clinics or purchasing preventive tools.

However, a key strength of the qualitative data lies in its ability to expose the underlying reasons behind these disparities. For instance, while quantitative findings show that 62.5% of rural respondents had access to free diagnosis and treatment, the qualitative accounts clarified that this figure masks deeper challenges such as long travel distances, unreliable transportation, and hidden costs that discourage timely clinic visits. The integration of both quantitative and qualitative

findings provides a fuller picture of the malaria situation in Bindura. Quantitative data established the prevalence trends and identified gaps in prevention and treatment, while qualitative data provided rich insights into the reasons behind those gaps, particularly in rural and environmentally exposed areas. Both approaches point to the need for more targeted, context-sensitive malaria control interventions ones that not only provide resources but also address the structural and socio-economic challenges faced by vulnerable communities.

4.7 Chapter Summary

This chapter presented key findings on malaria prevalence, contributing factors, and control measures in Bindura, Zimbabwe. Data from health professionals and community members revealed that while malaria remains a significant health concern, cases have declined from 2020 to 2022. The highest prevalence was recorded in mining areas like Foothills Clinic due to environmental factors such as stagnant water. Socio-economic and environmental challenges particularly in rural areas continue to hinder effective prevention, with lower mosquito net usage, limited access to healthcare, and reduced participation in community education. Malaria control measures such as ITNs, IRS, and health campaigns show greater effectiveness in urban areas, highlighting the need for improved infrastructure, resource allocation, and targeted interventions in rural and mining communities

CHAPTER FIVE
DISCUSSION

5.1 Introduction

This chapter discusses the key findings presented in Chapter Four which explored the prevalence, contributing factors and control measures related to malaria in Bindura, Zimbabwe. The discussion integrates both quantitative and qualitative data offering a deeper understanding of how malaria continues to affect different communities across rural and urban settings. The aim is to connect the findings with existing literature and critically examine the implications of the study.

5.2 Discussion of key findings

From the results presented, it is evident that malaria remains a significant public health concern in Bindura, though trends indicate a decline in cases over the three-year period (2020–2022). This supports the notion that current malaria interventions may be yielding results but certain high-risk areas especially those with environmental hazards like mining zones, continue to record high cases. Foothills Clinic reported the highest prevalence (453 cases), highlighting the role of environmental exposure such as stagnant water in sustaining transmission. These findings are consistent with World Health Organization reports (WHO, 2021), which note that malaria prevalence often correlates with poor environmental sanitation and water management.

The data also pointed to significant disparities between rural and urban communities in terms of access to prevention and treatment. Urban respondents were more likely to use mosquito nets and benefit from IRS (Indoor Residual Spraying) than their rural counterparts. Health professionals interviewed from rural clinics emphasized logistical challenges, lack of infrastructure, and limited outreach as barriers to effective malaria control. These observations are supported by studies such as those by Snow et al. (2017), which argue that rural areas in sub-Saharan Africa continue to suffer from structural disadvantages in healthcare delivery.

5.3 Knowledge of malaria and its causes

From the findings, both rural and urban participants demonstrated a fair level of understanding of malaria's causes, with over 90% acknowledging mosquitoes as the primary vector. However, knowledge alone did not always translate into effective prevention. While urban residents were

more likely to act on this knowledge (e.g., using ITNs), rural residents faced more barriers, including economic hardship and limited distribution of resources. This echoes findings by Oshagbemi et al, (2023), who argued that socioeconomic status significantly influences the adoption of malaria prevention behaviors in African communities.

Furthermore, qualitative interviews revealed that some rural community members repurpose mosquito nets for fishing or shelter, suggesting that daily survival needs sometimes take precedence over health considerations. This reflects the complex intersection between poverty and disease control, as identified in the literature by Kolawole & Ayeni (2023).

5.4 Attitudes Towards Malaria Control

The study findings showed that both rural and urban communities recognize malaria as a serious problem and support interventions to reduce its impact. The majority of respondents expressed a willingness to participate in community health campaigns and adopt preventative practices. However, this positive attitude is often hindered by systemic challenges. Health professionals in rural clinics noted that communities are not opposed to interventions but often lack the resources or access to sustain them. This aligns with findings from Obebe & Falohum, (2021), who argued that successful malaria interventions require not just community buy-in, but also continuous support and infrastructural development.

5.5 Practices and Interventions for Malaria Control

The data indicates that communities in Bindura, particularly rural ones have adopted a mix of traditional and formal malaria control practices. These include clearing bushes, draining stagnant water, and attending health talks when available. However, the impact of these practices is limited by inconsistent access to treated nets, insecticides, and proper medical care. Health workers noted that IRS is more feasible in urban areas due to better road access and coordinated efforts, while rural and mining communities are often neglected.

Moreover, larval source management and environmental sanitation efforts were generally low, with less than half of both rural and urban respondents aware of such programs. This suggests a gap in education and public health messaging. Studies by Walker et al. (2018) have shown that integrated vector management combining biological, environmental, and chemical control is more

effective than standalone strategies, highlighting an area where malaria control in Bindura can be improved.

5.6 Chapter Summary

In summary, the findings discussed in this chapter reveal that while there is general awareness and a positive attitude toward malaria prevention, systemic challenges especially in rural areas undermine the effectiveness of control measures. The study reinforces that environmental conditions, socioeconomic status, and healthcare infrastructure are key determinants in malaria outcomes. Therefore, addressing malaria in Bindura requires a multi-pronged approach that combines education, infrastructure development, and sustained community engagement. These conclusions support the existing literature and highlight the need for more targeted, equitable, and sustainable malaria interventions.

CHAPTER SIX
CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

Following the findings presented in Chapter Four and the discussion in Chapter Five, this chapter presents conclusions based on the current status of malaria in Bindura District, Zimbabwe. The research findings indicate that malaria remains a serious public health concern in both rural and urban areas, with rural communities facing greater vulnerability due to environmental exposure, limited access to healthcare services, and socioeconomic constraints.

It can be concluded that while general awareness of malaria is high across both urban and rural communities, significant disparities exist in how that knowledge is translated into practice. Urban communities benefit more from structured prevention programs such as mosquito net distribution and indoor residual spraying, while rural areas are hampered by resource limitations and poor infrastructure.

The study also highlights the importance of environmental and economic factors such as stagnant water from mining and inadequate sanitationin sustaining malaria transmission. Furthermore, the willingness of both communities and health professionals to engage in prevention strategies underscores the need for coordinated and targeted support to strengthen local malaria control efforts.

6.2 Recommendations

- **To the Ministry of Health and Child Care (MoHCC):**
  Distribute malaria prevention tools like treated nets and conduct indoor residual spraying in high-risk areas ahead of peak seasons, using mobile outreach clinics to ensure access.
- **To the Ministry of Mines and Mining Development:**
  Enforce environmental regulations requiring mining companies to eliminate stagnant water and rehabilitate land, with regular inspections and penalties for non-compliance.
- **To Non-Governmental Organizations (NGOs):**
  Implement malaria education programs in local languages using drama and visuals to promote net usage and early treatment in low-literacy communities.

- **To Community Leaders and Members:**

  Organize clean-up campaigns to remove stagnant water and improve sanitation through local health committees and community mobilization.
- **To Local Government and Rural District Councils**

  Upgrade road infrastructure and transport to remote clinics, prioritizing malaria-prone areas in health and development planning.

‘

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LIST OF APPENDICES

Community Questionnaire: Malaria Prevention and Risk Factors in Bindura

Section A: Demographic Information

1. Gender
   ☐Male
   ☐ Female
2. Age Group:

   ☐18–25
   ☐26–35
   ☐36–45
   ☐46–60
   ☐ 60+
3. Residence:

   ☐Urban
   ☐ Rural

Section B: Malaria Knowledge and Awareness

4. Do you know what causes malaria?

   ☐Yes
   ☐ No
5. Do you believe that stagnant water increases the risk of malaria?

   ☐Yes
   ☐ No
6. Do you think mining or farming activities contribute to malaria in your area?

   ☐Yes
   ☐ No

Section C: Prevention Practices

7. Do you sleep under a mosquito net every night?

   ☐Yes
   ☐No
   ☐ Sometimes
8. If not, what is the main reason you don’t use a net regularly?

   ☐Not available

☐Too expensive

☐Too hot/uncomfortable

☐ Other (please specify): _____

9. Has your house been sprayed with insecticide in the past 12 months?
   ☐Yes
   ☐ No
10. Have you ever participated in a malaria clean-up or drainage campaign?
    ☐Yes
    ☐ No
11. Are there stagnant water sources near your home (e.g., mining pits, blocked drains)?
    ☐Yes
    ☐ No
12. Is there bush, tall grass, or livestock close to your home?
    ☐Yes
    ☐ No

Section D: Access to Health Services

13. Can you easily access a clinic for malaria testing and treatment?
    ☐Yes
    ☐ No
14. Can you afford transport or treatment when you or a family member shows symptoms of malaria?
    ☐Yes
    ☐ No
15. Have you seen or heard any malaria awareness campaigns in your community in the past year?
    ☐Yes
    ☐ No

Interview Guide for Health Professionals (Clinics, Hospitals, Environmental Officers)

Section A: Malaria Burden and Trends

1. From your observation, how has the malaria situation in Bindura changed over the past three years?
2. Which age or gender groups seem most affected by malaria in your catchment area?
3. Have you noticed any specific months or seasons with higher malaria cases?

Section B: Prevention and Control Measures

4. How effective do you think the current mosquito net distribution programs are?
5. Are there challenges in implementing Indoor Residual Spraying (IRS), particularly in rural or mining areas?
6. What role do community members play in malaria prevention (e.g., clean-ups, environmental management)?
7. How consistent is the stock of malaria prevention supplies (nets, insecticides) at your facility?

Section C: Access and Equity

8. Do patients from rural areas face barriers to accessing testing or treatment? Please describe.
9. Are there specific socio-economic groups who delay or avoid treatment due to cost or distance?
10. Are malaria outreach services (mobile clinics, health education) regularly conducted in remote wards?

Section D: Knowledge and Perceptions

11. How would you describe the general level of malaria awareness in your area?
12. Are there any misconceptions or traditional beliefs about malaria that affect prevention efforts?
13. What factors do you believe contribute most to the persistence of malaria in Bindura?

Section E: Suggestions for Improvement

14. What improvements would you recommend to strengthen malaria control and management in your area?
15. Are there any partnerships with NGOs or local government that have been particularly helpful or lacking?

BINDURA UNIVERSITY OF SCIENCE EDUCATION

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Dear Sir/Madam

REQUEST FOR PERMISSION TO COLLECT DATA FOR ACADEMIC RESEARCH PROJECT

PROJECT TITLE: ***Investigating the prevalence of malaria in Bindura.***

ACADEMIC SUPERVISORS: MR NHOKOVEDZO

This letter serves to inform you that **Blessed Mvembe, Registration Number (B1646784)** is a fourth-year student at Bindura University of Science Education, in the Department of Environmental Science. During his fourth year of study, he is supposed to do a research project in his area of specialisation.

Please assist in any possible way. Data collected will be used for academic purposes only and will not be published without your prior consent.

Thank you for your assistance.

Yours faithfully.

Mr T. Nyamugure
DEPARTMENT OF ENVIRONMENTAL SCIENCE

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