AFRICA UNIVERSITY

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FACTORS ASSOCIATED WITH ASYMPTOMATIC MALARIA INFECTION AMONG PATIENTS ATTENDING OUT PATIENT DEPARTMENT AT KAMANGA REFERRAL HOSPITAL IN MWANZA TANZANIA, 2024.

BY

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A DISSERTATION SUBMITTED IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR
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Abstract

This study investigates the factors associated with asymptomatic malaria infections among patients attending the Outpatient Department (OPD) at Kamanga Medics Referral Hospital in Mwanza, Tanzania. Asymptomatic malaria, characterized by the presence of malaria parasites without clinical symptoms, poses significant challenges to malaria control efforts due to its potential to sustain transmission within communities. A cross-sectional quantitative research design was employed, involving 200 outpatients aged five years and above. Data were collected using Malaria Rapid Diagnostic Tests (MRDT) and demographic questionnaires. The study aimed to determine the prevalence of asymptomatic malaria and identify demographic, environmental, and behavioral factors contributing to its persistence. The findings revealed a prevalence of 38.5% for asymptomatic malaria among the participants. Notable factors associated with asymptomatic malaria included gender, age, residential area, and the use of treated mosquito nets. Specifically, females exhibited a higher prevalence (44.6%) compared to males (29.1%), while individuals in rural areas had significantly higher infection rates (71.0%) than those in urban settings. The study also highlighted that a substantial proportion of participants (66%) had not used antimalarial medication in the previous three months. The implications of the study underscore the necessity for targeted interventions aimed at reducing asymptomatic malaria cases, particularly in high-burden areas. Enhanced screening, community education on malaria prevention, and improved access to healthcare services are crucial for effective malaria control. The research contributes to the understanding of asymptomatic malaria dynamics, providing insights for public health policies and future research directions aimed at malaria elimination in Tanzania. This study emphasizes the importance of addressing asymptomatic malaria to mitigate its impact on public health, particularly among vulnerable populations. Future research should explore the genetic factors influencing susceptibility and the effectiveness of interventions in reducing asymptomatic malaria prevalence.

Keywords: Asymptomatic Malaria, Prevalence, Associated Factors, Outpatient Department, Malaria Rapid Diagnostic Test, Mwanza, Tanzania.

Definition of key terms

Malaria - is a life-threatening disease caused by parasites plasmodium species, that are transmitted to people through the bites of infected female *Anopheles* mosquitoes during the blood meal.

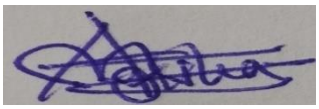
Asymptomatic Malaria - Asymptomatic malaria refers to a condition in which an individual is infected with the malaria parasite but does not display any symptoms of the disease.

Prevalence - is the proportion of individuals in a population or sample who have a particular characteristic, condition, or disease at a given time. It is usually expressed as a percentage or a rate per 100,000 population.

Declaration

I declare that this dissertation is my original work except where sources have been cited and acknowledged. The work has never been submitted, nor it will ever be submitted to another university for the award of degree.

Angelo Mgisha



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Dedication

I dedicate this work to my family for their love and support during the course of my project. To my lovely mother who has been my pillar of strength in my whole academic journey and helped me in every possible way to make this possible.

Acronyms and Abbreviations

AUREC	Africa University Research Ethics Committee
CDC	Centers of Disease Control and Prevention
MRDT	Malaria Rapid Diagnostic Test
MP	Malaria Parasite
OPD	Out Patient Department
PAM	Pregnancy Associated Malaria
SPSS	Statistical Package for Social Science
SSA	Sub-Saharan Africa
WHO	World Health Organization

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CHAPTER 1 INTRODUCTION

1.1 Introduction

Malaria is a mosquito-borne infectious disease affecting humans caused by parasitic single-celled microorganisms belonging to the *Plasmodium* group carried out by female mosquito known as anopheles. *Plasmodium falciparum* is the main source of malaria infection in Tanzania. Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female *Anopheles* mosquitoes during the blood meal, and it is preventable and curable.

Asymptomatic (subclinical) malaria refers to the presence of malaria parasites in the blood without symptoms, usually provides a reservoir for transmission, and is an antecedent to symptomatic malaria. The persistence of the infections could be due to asymptomatic cases. Malaria disease is most common in African countries including Tanzania, that affecting mostly children under the age of 5 years, and pregnant women. This research will be conducted at Kamanga Medics Zonal Referral Hospital in Mwanza Tanzania.

1.2 Background to the study

Malaria Parasite was discovered in 1880 by Charles Louis Alphonse Laveran, a French army surgeon stationed in Constantine, Algeria, was the first to notice parasites in the blood of a patient suffering from malaria in 6th November 1880. The Italian investigator Giovanni Batista Grassi and Raimondo Filetti first introduced the names *Plasmodium vivax* and *Plasmodium malariae* for two of the malaria parasites that affect humans in 1890. Laveran had believed that there was only one species, *Oscillaria malariae*. An American, Wiiliam H. Welch, reviewed the subject and, in 1897, he named the malignant

tertian malaria parasite *Plasmodium falciparum*. There were many arguments against the use of this name; however, the use was so extensive in the literature that a change back to the name given by Laveran was no longer thought possible, in 1922, John William Watson Stephens described the fourth human malaria parasite, *Plasmodium ovale*. *Plasmodium knowlesi* was first described by Robert Knowles and Biraj Mohan Das Gupta in 1931 (Centers for Disease Control and Prevention).

According to the latest World Malaria Report (2023), global malaria deaths reduced steadily over the period 2000–2019, from 897 000 in 2000 to 577 000 in 2015 and to 568 000 in 2019. In 2020, malaria deaths increased by 10% compared with 2019, to an estimated 625 000. Estimated deaths declined slightly in 2021 to 619 000. Between 2019 and 2021, there were 63 000 deaths that were due to disruptions to essential malaria services during the COVID-19 pandemic.

The percentage of total malaria deaths in children aged under 5 years reduced from 87% in 2000 to 76% in 2015. Since then, there has been no change. Globally, malaria mortality rate (that is deaths per 100 000 population at risk) halved from about 30 in 2000 to 15 in 2015. It then continued to decrease but at a slower rate, falling to 14 in 2019. In 2020, the mortality rate increased again, to 15.1, before decreasing slightly to 14.8 in 2021.

About 96% of malaria deaths globally were in 29 countries. Four countries accounted for just over half of all malaria deaths globally in 2021: Nigeria (31%), the Democratic Republic of the Congo (13%), the Niger (4%) and the United Republic of Tanzania (4%).

Malaria deaths in the WHO African Region decreased from 841 000 in 2000 to 541 000 in 2018, then increasing to 599 000 in 2020. Estimated deaths decreased again to 593 000 in 2021. The malaria mortality rate reduced by 62% between 2000 and 2019, from 148 to

56 per 100 000 population at risk, before rising to 60 in 2020 and decreasing again to 58 in 2021. Cabo Verde has reported zero malaria deaths since 2018.

Malaria remains a serious public health problem, In Tanzania more than 26% of all out-patient attendance are attributable to malaria, resulting in an estimated 7.7 million confirmed and clinical malaria cases annually. *Plasmodium falciparum* is the main cause of malaria infection in Tanzania. In 2004, under five mortalities were about 112 deaths per 1000 live births but in 2010, there were 64 deaths per 1000 live births. There is a need to conduct more researches on malaria due to its impact that can lead to death of many people in a short period of time if preventive measures and treatment are not instituted promptly.

1.3 Statement of the problem

Asymptomatic malaria remains a major challenge in malaria-endemic regions, including Mwanza, Tanzania. Unlike symptomatic malaria, where individuals seek treatment due to illness, asymptomatic carriers unknowingly harbor the parasite, contributing to persistent malaria transmission. This silent reservoir of infection complicates malaria control and elimination efforts, as these individuals do not receive treatment and continue to spread the disease through mosquito bites.

Furthermore, the absence of symptoms makes early detection difficult, reducing the effectiveness of targeted interventions. This study seeks to determine the prevalence of asymptomatic malaria and the factors contributing to its persistence, including demographic, environmental, and behavioral influences. Understanding these factors will aid in developing targeted interventions to reduce asymptomatic infections, ultimately contributing to malaria control strategies.

1.4 Justification of the study

Malaria poses a major challenge in the Mwanza region of Tanzania, a tropical area with high transmission rates, especially among children under five and pregnant women, despite some national declines in incidence. This research targets asymptomatic malaria in Mwanza because it is a high-burden area where subclinical infections can act as reservoirs, driving ongoing transmission and complicating eradication efforts. It got attention after comparing between few positive cases from the patients visiting the hospital and the numerous positive cases when doing reach outs of which normally people who has no symptoms are always the ones to show up. There could be factors associated with the asymptomatic malaria, the factors for the absence of symptoms whilst the person is infected by malaria parasites.

The study will benefit local communities by raising awareness of malaria symptoms, transmission, and prevention, while offering free testing and treatment to those with asymptomatic cases to reduce complications. Beyond Mwanza, the findings could inform regional policies and future interventions. Publishing results will also make vital health information accessible, helping residents protect themselves and lowering infection rates and deaths in the region.

1.5 Research Objectives

1.5.1 Broad objective

To determination determine the prevalence and factors associated with asymptomatic malaria infection among patients attending OPD at Kamanga Medics Referral Hospital in Mwanza, 2024.

1.5.2 Specific objectives

1. To determine the prevalence of asymptomatic malaria infection among patients attending the OPD at Kamanga Medics Referral Hospital in Mwanza, 2024.
2. To determine the factors associated with asymptomatic malaria infection among patients attending OPD at Kamanga Medics Referral Hospital in Mwanza, 2024.

1.6 Research Questions

1. How prevalent is asymptomatic malaria infection among patients attending OPD Kamanga Medics Referral Hospital in Mwanza?
2. What factors are associated with asymptomatic malaria infection among patients attending OPD Kamanga Medics Referral Hospital in Mwanza?

1.7 Limitation of the Study

This study could be limited by the study design employed. There is a risk of bias in cross-sectional studies, particularly selection bias. Selection bias might have occurred if certain groups were more likely to be included in the study sample, leading to results that do not accurately represent the entire population.

1.8 Delimitation of the Study

This study was primarily focused on the prevalence of malaria infection among the out patients visiting Kamana Medics Referral Hospital. The aim was to determine the factors associated with asymptomatic malaria infection among outpatients at Kamanga Medics Referral Hospital in Mwanza. The study was carried out only at Kamanga Medics Referral Hospital located in Mwanza, and no other environment and the findings cannot be generalized to other areas outside Mwanza.

1.9 Summary

This chapter provides an introduction to malaria, its causes, and its impact in Tanzania. Malaria is a mosquito-borne infectious disease caused by parasitic microorganisms of the *Plasmodium* genus. The main source of malaria infection in Tanzania, is *Plasmodium falciparum*. It is transmitted to humans through the bites of infected female *Anopheles* mosquitoes during a blood meal. malaria is a life-threatening disease, but it is preventable and curable.

The chapter also discusses asymptomatic malaria, which refers to the presence of malaria parasites in the blood without any symptoms. Asymptomatic cases serve as a reservoir for transmission and can lead to symptomatic malaria. The persistence of infections could be due to asymptomatic cases.

Malaria is most common in African countries, including Tanzania, and it primarily affects children under the age of 5 and pregnant women. The research mentioned in the chapter will be conducted at Kamanga Medics Referral in Mwanza.

The background of the study highlights the discovery of the malaria parasite and the different species that affect humans. It also mentions the global malaria situation, including the reduction in malaria deaths over the years. However, there has been an increase in deaths in 2020 due to disruptions caused by the COVID-19 pandemic.

The chapter emphasizes the significance of studying asymptomatic malaria, as it provides insights into symptoms, transmission methods, treatments, and control measures. High-quality research can contribute to knowledge and have implications for policy and future projects. The study aims to determine the prevalence of malaria infection and the factors

associated with asymptomatic malaria among patients attending the OPD at Kamanga Medics Referral Hospital in Mwanza. The research questions focus on the prevalence of malaria, factors contributing to asymptomatic cases, and the duration of asymptomatic malaria.

The study's justification lies in the importance of understanding and controlling malaria, especially in regions where it is still prevalent. The results can inform policies and interventions to reduce infections and deaths. The study also highlights the need for publication to disseminate information and raise awareness among societies.

The study's delimitation specifies that it was conducted only at Kamanga Medics Referral Hospital in Mwanza, focusing on outpatients. The participants were only the patients attended the OPD at Kamanga Medics Referral Hospital.

CHAPTER 2 REVIEW OF RELATED LITERATURE

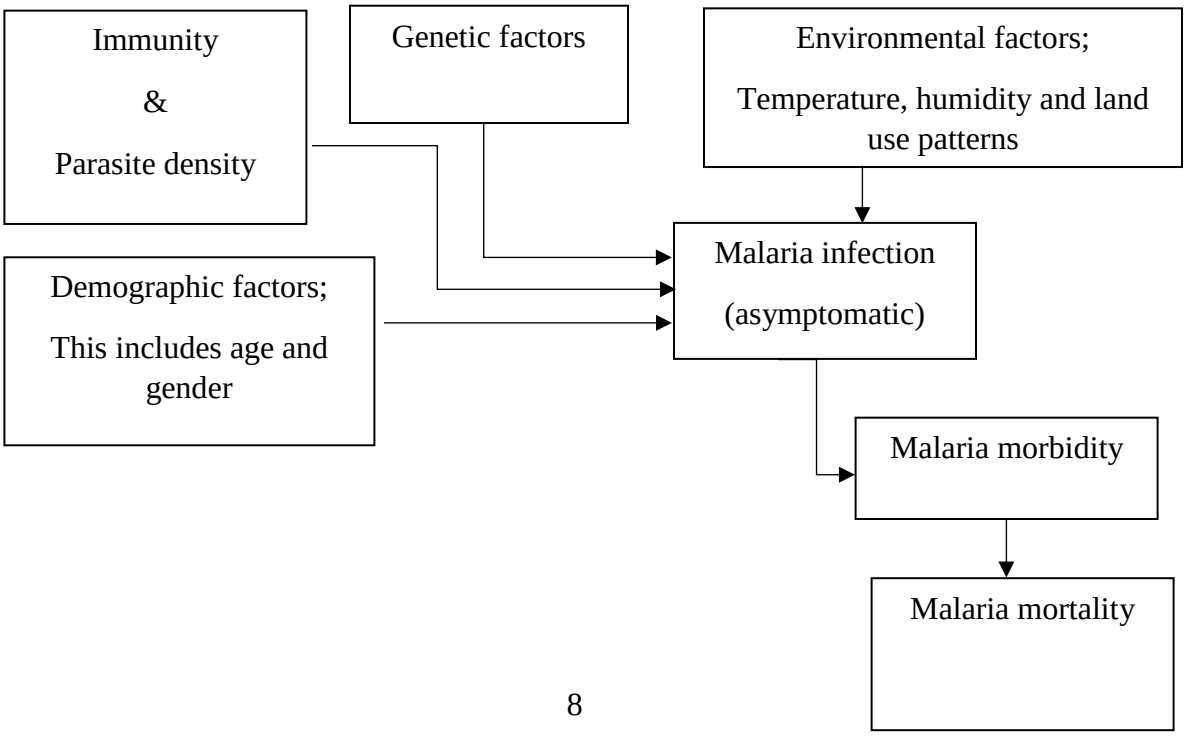
2.1 Introduction

Asymptomatic malaria refers to the presence of malaria parasites in the blood without the typical symptoms of the disease such as fever, chills, and sweating. Several factors are associated with asymptomatic malaria, and they play a crucial role in understanding the transmission and management of the disease.

The prevalence of asymptomatic malaria infection and its associated factors have been extensively studied in the existing literature. Asymptomatic carriers of malaria are individuals who are infected with the malaria parasite but do not display any symptoms of the disease. Understanding the prevalence and factors associated with asymptomatic malaria infection is crucial for effective malaria control and elimination efforts.

2.2 **Conceptual Framework** Figure 1. A conceptual Framework as Modified from

Figure 1. A conceptual framework modified from Barrie Stephens, 2013.



2.2.1 Immunity

One of the key factors associated with asymptomatic malaria is immunity. Individuals living in areas where malaria is endemic can develop partial immunity to the disease over time. This acquired immunity can lead to asymptomatic infections, as the individual's immune system is able to control the parasite levels, preventing the onset of clinical symptoms. Immunity is often linked to repeated exposure to malaria parasites, which allows the immune system to develop a response that limits parasite growth and prevents severe illness (Tadesse et al.,2019).

2.2.2 Parasite Density

The level of parasite density in the blood is another important factor associated with asymptomatic malaria. Individuals with low parasite densities may not exhibit symptoms of malaria, leading to asymptomatic infections. In contrast, individuals with high parasite densities are more likely to experience clinical symptoms of the disease. The threshold at which parasite density leads to symptomatic malaria can vary among individuals and populations (Rugera et al.,2022).

2.2.3 Host Genetics

Host genetics also play a role in determining whether an individual develops symptomatic or asymptomatic malaria. Certain genetic factors can influence an individual's susceptibility to malaria infection and their ability to mount an effective immune response against the parasite. Genetic variations in genes related to immune function and hemoglobinopathies have been linked to differences in malaria susceptibility and disease severity (Raveh, 2012.

2.2.4 Age

Age is a significant factor associated with asymptomatic malaria. Children under five years old are particularly vulnerable to severe forms of malaria due to their developing immune systems. As a result, they are less likely to experience asymptomatic infections compared to older individuals who have had more opportunities for exposure and immunity development (Ghansah et al., 2021).

2.2.5 Antimalarial Interventions

The use of antimalarial interventions such as insecticide-treated bed nets, indoor residual spraying, and antimalarial drugs can impact the prevalence of asymptomatic malaria. These interventions can reduce overall malaria transmission rates, leading to a decrease in asymptomatic infections within populations (Muwanguzi et al., 2023).

2.2.6 Environmental Factors

Environmental factors such as temperature, humidity, and rainfall can influence the prevalence of asymptomatic malaria by affecting mosquito breeding sites and the survival of malaria parasites outside the human host. Changes in environmental conditions can impact mosquito populations and the transmission dynamics of malaria, ultimately influencing the likelihood of asymptomatic infections (Muwanguzi).

2.3 Literature review

In sub-Saharan Africa countries including Tanzania, malaria remains a significant public health challenge. Malaria is caused by *Plasmodium* parasites transmitted via the bites of infected *Anopheles* mosquitoes. Symptomatic malaria is readily diagnosed, managed and well documented but on the other hand, asymptomatic malaria infections pose a unique

challenge for control efforts due to their potential to sustain transmission within the community.

2.3.1 Prevalence of Asymptomatic Malaria.

Asymptomatic malaria refers to cases where individuals are infected with malaria parasites but do not exhibit clinical symptoms. Studies have shown that asymptomatic carriers can significantly contribute to the transmission dynamics of malaria (Miller et al., 2018).

In regions like Mwanza, where malaria is endemic, the prevalence of asymptomatic infections can be high. Research indicates that asymptomatic infections may account for a substantial proportion of total malaria cases; estimates suggest that up to 50% of infections may be asymptomatic in certain populations (Mwandawiro et al., 2019).

The prevalence rates can vary based on several factors including geographic location, seasonality, and demographic characteristics such as age and sex. Children and young adults often show higher rates of asymptomatic infection due to their increased exposure to mosquito bites and lower immunity levels compared to older adults (Kahama-Maro et al., 2020)

Numerous studies have reported varying prevalence rates of asymptomatic malaria infection across different geographical regions. A study conducted by Okell et al. (2012) in sub-Saharan Africa found that the prevalence of asymptomatic malaria infection varied significantly between different communities, ranging from 3% to 70%. Similarly, a study by Lindblade et al. (2015) in Southeast Asia reported varying prevalence rates of asymptomatic malaria among different populations within the region.

2.3.2 Factors associated with asymptomatic malaria,

Different studies have shown and identified several factors associated with asymptomatic malaria infections. These factors can include demographic characteristics such as age, gender, and socioeconomic status, as well as environmental factors such as proximity to mosquito breeding sites and access to healthcare services. A study by Chen et al. (2016) highlighted that age and acquired immunity were significant factors associated with asymptomatic malaria infection in a population-based cohort in Myanmar.

1. **Demographic Factors:** Age plays a crucial role in susceptibility to asymptomatic malaria. Younger individuals often have higher susceptibility rates due to less developed immunity (Mwandawiro et al., 2019). Gender differences also exist; some studies suggest that males may be more likely than females to harbor asymptomatic infections due to behavioral factors such as outdoor activities during peak mosquito biting times (Kahama-Maro et al., 2020).

2. **Environmental Factors**: The local environment significantly influences mosquito breeding sites and thus transmission dynamics. Areas with stagnant water bodies tend to have higher mosquito populations leading to increased risk of infection (Miller et al., 2018). Studies have also shown that, environmental factors such as temperature, humidity, and land use patterns can impact the transmission dynamics of malaria and contribute to the persistence of asymptomatic infections within communities (Gething et al., 2010).

3. **Socioeconomic Status**: Individuals from lower socioeconomic backgrounds may have limited access to preventive measures such as insecticide-treated nets (ITNs) or indoor residual spraying (IRS), increasing their risk for both symptomatic and

asymptomatic malaria (Kahama-Maro et al., 2020). Additionally, lack of awareness regarding malaria prevention contributes to higher prevalence rates.

4. **Health-seeking Behavior**: The tendency for individuals to seek medical care when ill can influence the detection rate of symptomatic versus asymptomatic cases. Those who do not regularly attend health facilities may remain undiagnosed despite being infected (Mwandawiro et al., 2019).

5. **Genetic Factors**: Genetic predispositions may also play a role in susceptibility to malaria infections. Certain genetic traits provide some level of protection against severe forms of malaria but may not prevent asymptomatic carriage altogether (Miller et al., 2018). As well as a study by MalariaGEN (2019) demonstrated that genetic variations in human populations can influence the likelihood of developing asymptomatic malaria following exposure to the parasite.

2. 4 Summary

Chapter 2 examines asymptomatic malaria, where malaria parasites are present in the blood without typical symptoms like fever or chills, and its critical role in transmission and control efforts. The introduction emphasizes the need to understand the prevalence and factors tied to asymptomatic malaria for effective disease management. The conceptual framework highlights several influencing factors: immunity, where repeated exposure in endemic areas builds partial protection, reducing symptoms; parasite density, with lower levels linked to asymptomatic cases and higher levels to symptomatic ones; host genetics, affecting susceptibility and immune response; age, with children under five less likely to be asymptomatic due to weaker immunity; antimalarial interventions, like

bed nets and drugs, which lower transmission and asymptomatic prevalence; and environmental factors, such as temperature and rainfall, impacting mosquito populations and infection rates.

The literature review underscores malaria as a persistent public health challenge in sub-Saharan Africa, including Tanzania, where asymptomatic infections complicate control by sustaining transmission. Studies reveal varying prevalence rates, with surveys in Tanzania and estimates in Mwanza suggesting up to half of infections may be asymptomatic. Prevalence differs by geography, seasonality, and demographics like age and sex. Key associated factors include demographic traits, with younger individuals and males at higher risk due to exposure and immunity levels; environmental conditions, like proximity to breeding sites boosting transmission; socioeconomic status, where limited access to prevention heightens risk; health-seeking behavior, affecting detection; and genetic factors, influencing susceptibility. These findings highlight the complexity of asymptomatic malaria and its significance in sustaining the disease burden, especially in endemic regions like Mwanza

CHAPTER 3 METHODOLOGY

3.1 Introduction

Research methodology in a research proposal refers to the systematic approach or strategy that will be used to conduct the study and gather data. It outlines the methods, techniques, and procedures employed to answer the research questions or achieve the research objectives. This chapter will cover the research design used, the study site where the study was conducted, the population studied, sampling and the instruments used to collect the data.

3.2 Research design

This study is based on quantitative research design as numbers were more used to elaborate data collected in the study. It is hospital based cross-sectional study design that was conducted at Kamanga Medics Referral Hospital. This study design was selected because it allows for the collection of data from a specific population at a single point in time. This design can provide valuable information about the prevalence of asymptomatic malaria infection and the factors associated with it among patients attended the OPD at Kamanga Medics Referral Hospital in Mwanza, Tanzania. It was a relatively quick and cost-effective way to gather data and helped to identify potential relationships between variables. Therefore, it could determine prevalence and factors associated with asymptomatic malaria infection within a short time period, hence less resources for the study were required.

Malaria Rapid Diagnostic Test (MRDT) was used for the assessment of prevalence of asymptomatic malaria.

3.3 Study site

The study was conducted at Kamanga Medics Referral Hospital, which is located in Mwanza region and serves a lake zone.

3.4 Study population

The study targeted 200 outpatients aged five years and above with no malaria clinical symptoms who attended the Outpatient Department at Kamanga Medics Referral Hospital between September and December 2024.

3.5 Exclusion Criteria

Patients with malaria clinical symptoms were selected to participate in this study, as the focus is on the asymptomatic malaria. Patients who have been subjected to malaria drugs for the past two months before the study were also excluded from the study.

3.6 Inclusion Criteria

The study included all malaria asymptomatic patients and those who accompany them to Kamanga Medics Referral Hospital. Only those who consent to undergo the study and have not taken any kind of antimalarial treatments participated in this study.

3.7 Sample size

Sample size was determined with the aid of the following formula

$$SS = \frac{Z^2 P\,(1 - P)}{\dfrac{c^2}{1 + \left[\dfrac{Z^2\,P\,(1-P)}{c^2 N}\right]}}$$

Where;

SS= Sample size

Z= z value (1.96 for 95% confidence level)

P= percentage picking a choice, expressed as decimal (0.5 used for sample size needed)

C= Margin of error; 0.05

N = Population; 493

$$SS = \frac{(1.96)^2 \times 0.5(1 - 0.5)}{(0.05)^2}$$

$$\frac{}{1 + [\frac{(1.96)^2 \times 0.5\,(1\text{-}0.5)}{(0.05)^2 \times 493}]}$$

SS = 200

3.8 Sampling procedure

Simple random sampling is the sampling method of choice used in this study. The participants with the specified characteristics had an equal chance of participating in the study. The patients with no clinical symptoms of malaria infection are the population and a sample of 200 individuals was selected from this population.

3.9 Pilot study

Preliminary testing was carried out at Kamanga Medics Referral Hospital in Outpatient Department. Thirty (30) participants were selected using the simple random method. Data were collected, compiled and analyzed using the SPSS method.

The results of the pilot study were used to assess the feasibility of the study and the reliability and completeness of the record. The pilot study also revealed the resources and time needed to complete the study, which helped with the scheduling**.**

3.10 Study Setting

The patients that participated in this study were recruited in the Outpatient Department at Kamanga Medics Referral Hospital,

3.11 Data collection instruments

An excel spread sheet was used to collect the demographic data and other patients' useful data.

3.12 Data Analysis

SPSS was used to analyze and interpret data collected in this study.

3.13 Ethical considerations

Ethical clearance to carry out the study was sought and granted from the Africa University Research Ethics Committee. Permission to carry out the research was sought and granted from the Hospital management including the Laboratory manager. Codes instead of participant names were used to anonymize the participants and all the information collected in the study were kept in password locked databases that are accessible to the investigator of this study. Those participants who are found infected were administered

to antimalarial treatment for free. The research was conducted in line with the requirements of the Ethics Committee (AUREC).

3.14 Summary

Chapter 3 outlines the systematic approach to studying asymptomatic malaria at Kamanga Medics Referral Hospital in Mwanza, Tanzania. The study adopts a hospital-based, cross-sectional quantitative design to collect data at a single point in time, chosen for its efficiency in determining the prevalence and factors associated with asymptomatic malaria among outpatients. It targeted 200 outpatients aged five and above attending the hospital's Outpatient Department (OPD) between September and December 2024, excluding those with malaria symptoms or recent antimalarial treatment, and including only consenting individuals without symptoms or prior treatment. The study site was Kamanga Medics Referral Hospital, serving the lake zone in Mwanza.

Sample size was calculated using a statistical formula, yielded 200 participants selected via simple random sampling to ensure equal participation opportunity. A pilot study with 30 randomly selected OPD patients tested the feasibility, reliability, and resource needs of the study. Data collection involved questionnaires for demographic and related information, alongside Malaria Rapid Diagnostic Test (MRDT) kits to assess malaria prevalence, with blood samples taken after informed consent. Data were analyzed using SPSS for easy interpretation. Ethical clearance was obtained from the Africa University Research Ethics Committee, with permissions from hospital management, ensuring confidentiality and offering free treatment to participants with asymptomatic malaria. This research aims to inform interventions, lifestyle changes, and health education to reduce

the asymptomatic malaria burden, enhancing community health and supporting elimination efforts.

CHAPTER 4: DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Introduction

This chapter presents the results obtained from the study on factors associated with asymptomatic malaria infection among patients attended the outpatient department (OPD) at Kamanga Referral Hospital in Mwanza, Tanzania. The findings are presented using tables, charts and narrative descriptions to provide a comprehensive understanding of the data. The analysis is structured according to the study objectives, focusing on the prevalence of asymptomatic malaria and the associated factors. The aim is to provide a comprehensive understanding of the study outcomes through various analytical techniques.

4.2 Data presentation

4.2.1 General characteristics of study participants

Table 4.1 presents the demographic characteristics of the study participants, including gender, age distribution, residential areas, use of mosquito nets and when last, they had used antimalarial medication.

Table 1. Frequency distribution table of variables.

VARIABLE	RESPONSE	FREQUENCY	PERCENTAGE
GENDER	MALE	79	39.5
	FEMALE	121	60.5
AGE (Years)	5-10	37	18.5

	11-20	45	22.5
	21-30	43	21.5
	31-40	33	16.5
	41-50	22	11.0
	51-60	17	8.5
	>60	3	1.5
RESIDENTIAL AREA	RURAL	31	15.5
	URBAN	90	45.0
	COAST	79	39.5
USE OF TREATED MOSQUITO NET	YES	113	56.5
	NO	87	43.5
LAST TIME TO USE ANTIMALARIA	2 WEEKS AGO,	0	0.0
	1 MONTH AGO,	26	13.0
	2 MONTHS AGO,	42	21.0
	>3 MONTHS AGO,	132	66.0

From the table above, it is observed that the majority of participants were female 121 out of the total population 200, which makes 60.5%, and 79 males makes 39.5% of the total

population participated in this study. the largest age group among the participants was 11-20 years 45 participants which makes 22.5%, followed by the 21-30 years age group which had 43 participants that is 21.5%. the smallest group was individual aged over 60 years which had only 3 participants, 1.5%.

Regarding residential areas, most participants were from urban areas, 90 participants, 45% followed by coastal areas 79 participants, 39.5% and rural areas 31participants, 15.5%.

A significant proportion of participants 87 out of 200, 43.5% were not using treated mosquito nets, and this may increase the risk of malaria infection.

Additionally, most participants 132 out 200, 66% had not used antimalarial medication in the past three months, which may also contribute to the persistence of asymptomatic malaria cases.

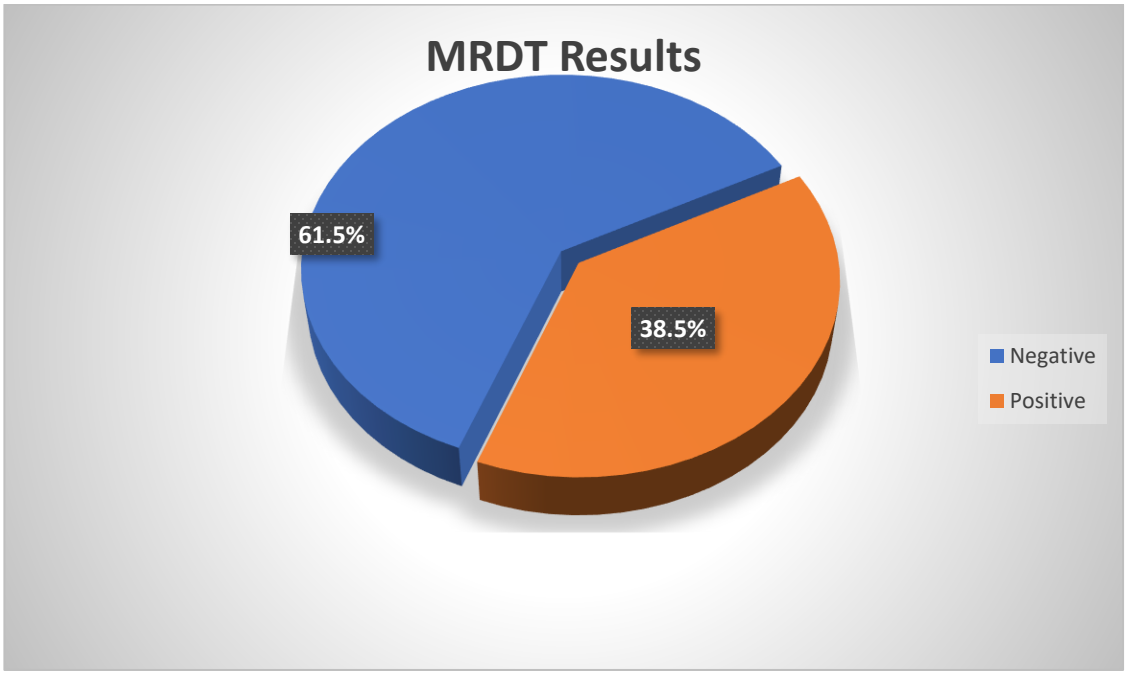
4.2.2 Prevalence of Asymptomatic Malaria

A total of 200 participants were tested using malaria diagnostic test (MRDT). The results are summarized in Table 4.2

Table 2Malaria Rapid Test (MRDT) Results.

MRDT Result	Frequency	Percentage (%)
Positive	77	38.5
Negative	123	61.5
Total	200	100

Figure 2. MRDT results



The findings indicates that 38.5% of the sampled population had asymptomatic malaria infections, as the participants participated in this study showed no malaria symptoms. This suggest that a significant proportion of individuals may act as reservoirs for malaria transmission despite showing no symptoms. The remaining 61.5% tested negative, indicating that they were not carrying malaria parasites at the time of the study.

4.2.2.1 Gender and Asymptomatic Malaria Prevalence

Table 3. Malaria Prevalence by Gender

Gender	Positive Cases	Negative Cases	Total	Prevalence
Male	23	56	79	29.1%
Female	54	67	121	44.6%

The results indicate that malaria prevalence is higher among females (44.6%) compared to males (29.1%). A chi-square test yielded a p-value of 0.040, suggesting a statistically significant association between gender and malaria prevalence. The possible explanation for this observation could be behavioral differences in exposure to mosquito bites or gender-related healthcare seeking behaviors.

4.2.2.2 Age and Asymptomatic malaria prevalence

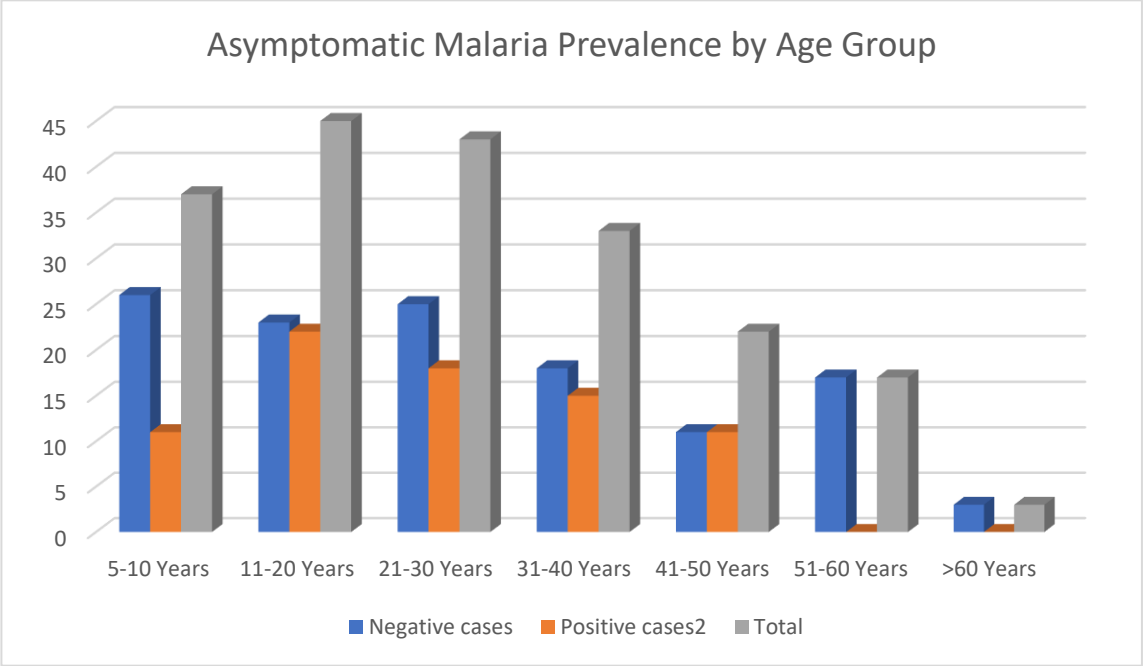
Table 4. Asymptomatic Malaria Prevalence by Age group

Age Group (Years)	Positive Cases	Negative Cases	Total	Prevalence (%)
5-10	11	26	37	29.7
11-20	22	23	45	48.9
21-30	18	25	43	41.9
31-40	15	18	33	45.5
41-50	11	11	22	50.0
51-60	0	17	17	0.0
>60	0	3	3	0.0

The table above displays statistics regarding the distribution of positive and negative cases among various age groups, including the total number of individuals in each category and the computed prevalence of positive cases expressed as a percentage.

A chi-square test showed a p-value of 0.045 which is below 0.05, confirming a significant association between age and malaria prevalence. The highest prevalence was observed in the 41-50 years group (50.0%) and the 11-20 years group (48.9%). The lowest prevalence was found in the older age groups (51 years and above), possibly due to acquired immunity from repeated exposure.

Figure 3. Asymptomatic Malaria Prevalence by Age Group

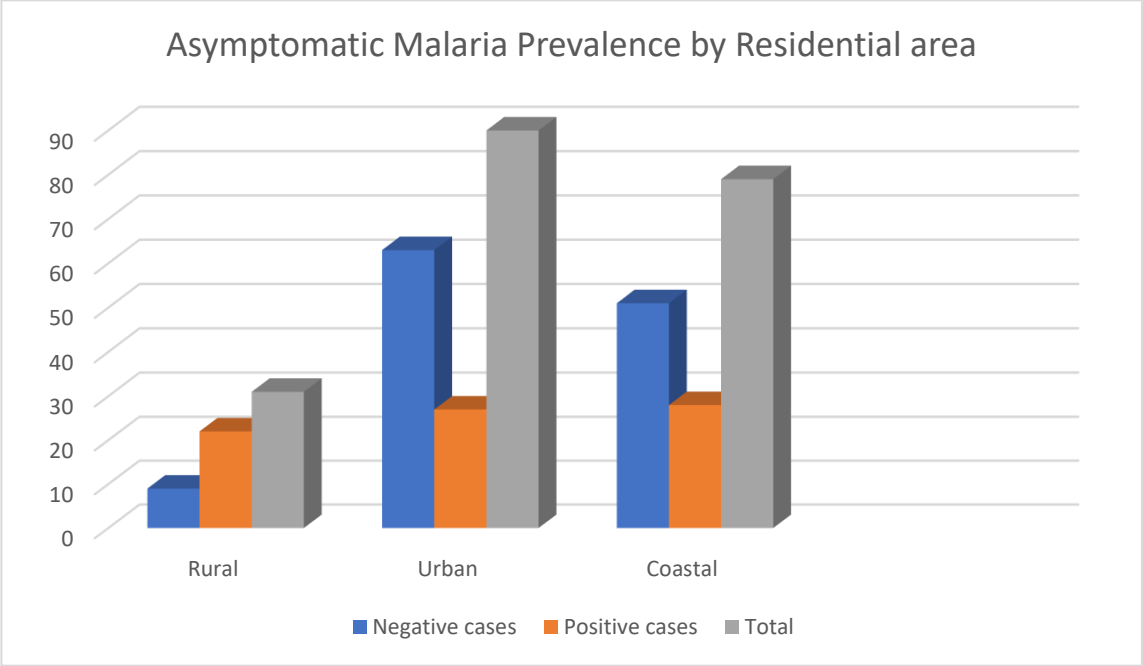


4.2.2.3 Residential Area and Malaria prevalence

Table 5. Asymptomatic Malaria by Residential Area

Residential area	Positive cases	Negative cases	Total	Prevalence (%)
Rural	22	9	31	71.0
Urban	27	63	90	30.0
Coastal	28	51	79	35.4

Figure 4. Asymptomatic Malaria by Residential area



A chi-square test resulted in a p-value of 0.002, indicating a strong association between residential area and malaria prevalence, with rural areas having the highest prevalence (71.0%). This finding aligns with the understanding that rural areas often have limited access to malaria prevention interventions and healthcare facilities.

4.2.2.4 Use of Treated mosquito nets and malaria prevalence

Table 6. Asymptomatic Malaria prevalence by Mosquito Net Usage

Mosquito net usage	Positive case	Negative cases	Total	Prevalence (%)
Yes	27	86	113	23.9
No	50	37	87	57.5

From the table above, it has shown a substantial reduction in prevalence among individuals who reported using mosquito nets. The chi-square test produced a p-value of 0.0013 (<0.05), indicating a highly significant association between malaria prevalence and mosquito net usage. The results demonstrate that individuals who do not use mosquito nets are at a significantly higher risk of contracting malaria (57.5%) compared to those who use nets (23.9%). The individuals reported using treated mosquito nets but still tested positive, could be due to the early morning activities or the late nights activities which may expose them to the female anopheles mosquito bites before they go to bed or after they waking off the bed.

4.2.2.5 Last time to use antimalarial

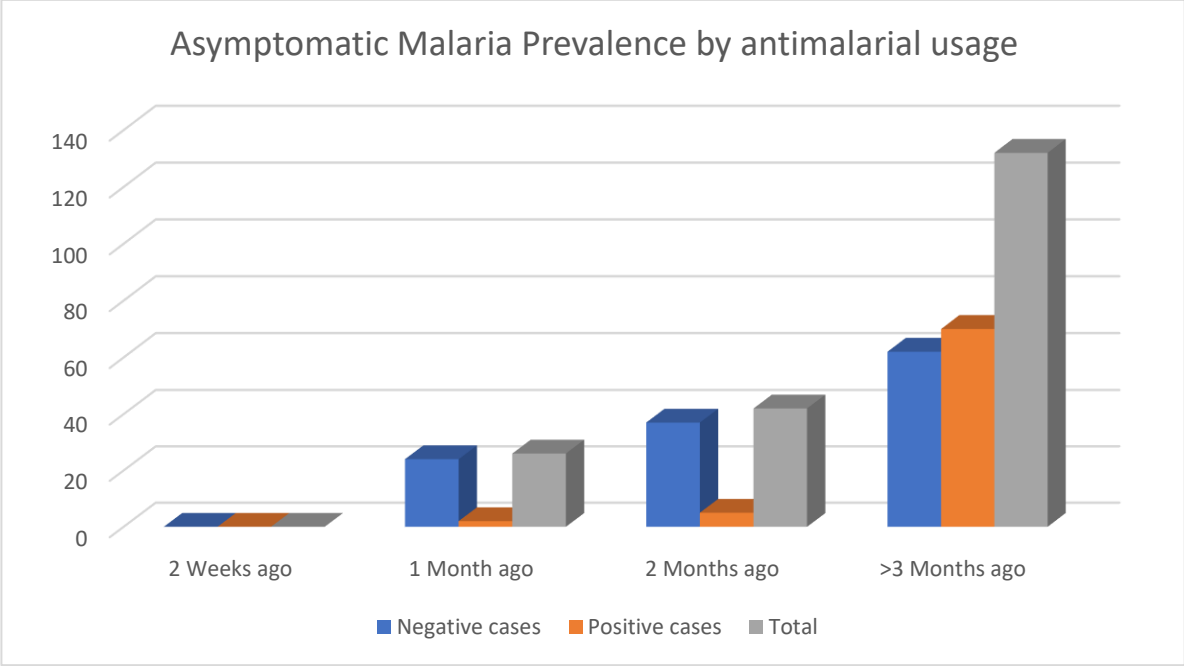
Table 7. Asymptomatic Malaria prevalence by last time to use antimalarial

Last time to use antimalarial	Positive cases	Negative cases	total	Prevalence
2 weeks ago,	0	0	0	0
1 month ago,	2	24	26	
2 months ago,	5	37	42	
>3 months ago,	70	62	132	

Table 7 presents the prevalence of asymptomatic malaria positive cases in relation to the last time antimalarial medication was used. The data reveals a potential trend, as the time since last antimalarial use increases, the number of positive cases also appears to increase. The calculated prevalence for each category allows for a direct comparison, suggesting a

possible decline in protection against positive cases over time following antimalarial treatment

Figure 5. Asymptomatic malaria Prevalence by Antimalarial usage



CHAPTER 5: DISCUSSION, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter synthesizes the key findings from the study on factors associated with asymptomatic malaria infection among patients attending the Outpatient Department (OPD) at Kamanga Medics Referral Hospital in Mwanza, Tanzania. It provides a comprehensive discussion of the results, drawing connections to existing literature and theoretical frameworks. Furthermore, it presents the conclusions derived from the study, discusses their implications for public health policy and practice, and offers recommendations for future research and interventions.

5.2 Discussion

5.2.1 Prevalence of Asymptomatic Malaria

Asymptomatic malaria does not present noticeable symptoms, holds significant medical importance for several reasons, include disease transmission, whereas asymptomatic carriers can still transmit the malaria parasite and complicates the control.

Asymptomatic individuals may not seek medical attention due to absence of symptoms, leading to undiagnosed infections hence the reservoir of malaria within the population. Asymptomatic infections can as well as progress to symptomatic disease, particularly in individuals with weakened immune systems or in vulnerable populations, such as children and pregnant women.

The study revealed a prevalence of 38.5% for asymptomatic malaria among OPD attendees at Kamanga Medics Referral Hospital. This finding underscores the significant burden of asymptomatic malaria in this population, highlighting its potential role in sustaining malaria transmission within the community. The observed prevalence is consistent with previous studies conducted in similar malaria-endemic regions, although variations may exist due to differences in study design, population characteristics, and diagnostic methods.

5.2.2 Factors Associated with Asymptomatic Malaria

Several factors were found to be significantly associated with asymptomatic malaria infection:

- Gender: Females exhibited a higher prevalence of asymptomatic malaria compared to males (44.6% vs. 29.1%, $p = 0.040$). This finding could be attributed to various factors, including differences in exposure patterns, immune responses, or health-seeking behaviors between genders.
- Age: The prevalence of asymptomatic malaria varied across different age groups, with the highest prevalence observed in the 41-50 years group (50.0%) and the 11-20 years group (48.9%). This suggests that age-related factors, such as acquired immunity or exposure levels, may play a role in determining susceptibility to asymptomatic malaria.
- Residential Area: Individuals residing in rural areas had a significantly higher prevalence of asymptomatic malaria compared to those in urban or coastal areas (71.0%, $p = 0.002$). This finding is consistent with the understanding that rural

areas often face greater challenges in accessing malaria prevention and control interventions, leading to increased transmission rates.

- Use of Treated Mosquito Nets: The use of treated mosquito nets was found to be strongly associated with asymptomatic malaria prevalence ($p = 0.0013$). Individuals who did not use mosquito nets had a significantly higher risk of contracting malaria (57.5%) compared to those who used nets (23.9%). This underscores the effectiveness of mosquito nets as a preventive measure against malaria infection.

- Last time to use antimalarial**:** Most participants 66% had not used antimalarial medication in the past three months, which may also contribute to the persistence of asymptomatic malaria cases.

5.3 Conclusions

Based on the findings of this study, the following conclusions can be drawn:

1. Asymptomatic malaria infection is prevalent among patients attending the OPD at Kamanga Medics Referral Hospital, highlighting the need for targeted interventions to address this silent reservoir of infection.

2. Gender, age, residential area, and use of treated mosquito nets are significant factors associated with asymptomatic malaria infection, suggesting that interventions should be tailored to address the specific needs and characteristics of different population subgroups.

3. The high prevalence of asymptomatic malaria in rural areas underscores the importance of strengthening malaria prevention and control efforts in these

settings, including improving access to mosquito nets, diagnostic testing, and treatment services.

4. Promoting the consistent and correct use of treated mosquito nets is crucial for reducing the burden of asymptomatic malaria and preventing onward transmission of the parasite.

5.4 Implications

The findings of this study have several important implications for public health policy and practice:

1. Targeted Interventions: Malaria control programs should prioritize targeted interventions that address the specific factors associated with asymptomatic malaria infection, such as gender, age, and residential area.

2. Community-Based Screening: Implementing community-based screening programs for asymptomatic malaria can help identify and treat infected individuals, reducing the reservoir of infection and preventing onward transmission.

3. Health Education and Promotion: Strengthening health education and promotion activities to raise awareness about malaria prevention and the importance of using mosquito nets can improve community engagement and promote behavior change.

4. Access to Healthcare: Improving access to healthcare services, particularly in rural areas, is essential for ensuring timely diagnosis and treatment of malaria, including asymptomatic infections.

5.5 Recommendations

Based on the conclusions and implications of this study, the following recommendations are proposed:

1. Conduct further research to explore the underlying mechanisms driving the observed associations between gender, age, residential area, and asymptomatic malaria infection.

2. Implement targeted interventions to reduce the burden of asymptomatic malaria in high-risk populations, such as pregnant women, children under five, and residents of rural areas.

3. Strengthen community-based malaria control programs, including promoting the use of mosquito nets, providing access to diagnostic testing, and ensuring prompt treatment of infected individuals.

4. Improve surveillance systems to monitor the prevalence of asymptomatic malaria and track the effectiveness of interventions over time.

5.6 Suggestions for Further Research

To further advance our understanding of asymptomatic malaria and inform the development of effective control strategies, the following areas of research are suggested:

1. Investigate the impact of asymptomatic malaria on long-term health outcomes, including the risk of developing symptomatic malaria, anemia, and other complications.

2. Explore the role of host genetics and immune responses in determining susceptibility to asymptomatic malaria infection.

3. Evaluate the cost-effectiveness of different strategies for screening and treating asymptomatic malaria in various settings.

4. Assess the impact of climate change and environmental factors on the transmission dynamics of asymptomatic malaria.

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APPENDICES

Appendix 1: Excell spread sheet For Data Collection

VARIABLE	RESPONSE	FREQUENCY	MRDT RESULTS	
			POSITIVE	NEGATIVE
GENDER	MALE			
	FEMALE			
AGE (Years)	5-10			
	11-20			
	21-30			
	31-40			
	41-50			
	51-60			
	>60			
RESIDENTIAL AREA	RURAL			
	URBAN			
	COAST			
USE OF TREATED MOSQUITO NET	YES			
	NO			
LAST TIME TO USE ANTIMALARIA	2 WEEKS AGO,			
	1 MONTH AGO,			
	2 MONTHS AGO,			
	>3 MONTHS AGO,			

Appendix 2: Timeline

MONTH ⇨ ACTIVITY ⇩	OCT 2024	NOV 2024	DEC 2024	JAN 2025	FEB 2025	MAR 2025	APR 2025
Project proposal							
Ethical clearance							
Data collection							
Data analysis and report writing							
Finalization and report writing							

Appendix 3: Budget

ITEM	Unit price ($)	Quantity	Total price/US $
AUREC	15.00	1	15.00
PRINTING Project proposal (3copies)	10.00	3	30.00
BINDING Project proposal (3 copies)	5.00	3	15.00
Transport	3	42	126
Food	2	42	84
STATIONERY Books(192COUNTERBOOKS) Pens (BOX)	 4.00 5.00	 2 2	 8.00 10.00
TOTAL			288

Appendix 4: Approval letter to conduct a study from a study site

Kamanga Medics Referral Hospital,

P. O. BOX 5228,

Mwanza Tanzania.

Angelo Mgisha,

Africa university,

P. O. Box 1320

Mutare Zimbabwe.

12th January 2024.

Dear Researcher,

PERMISSION TO CONDUCT A RESEARCH STUDY AT KAMANGA MEDICS REFERRAL HOSPITAL.

This letter is in response to your request for authorization to carry out a study entitled ***"FACTORS ASSOCIATED WITH ASYMPTOMATIC MALARIA AMONG THE PATIENTS ATTENDING THE OUT-PATIENT DEPARTMENT AT KAMANGA MEDICS REFERRAL HOSPITAL 2024."***

The Kamanga Medics Referral Hospital administration would want to let you know that the hospital does not oppose to your request. As the hospital, we hope that you will contribute financially or materially to the study in order to meet your planned overheads. Please provide us with the final results.

Please give credit to the organization and the team that oversaw your research in your article. When you're ready, you can start the study. Permission is given by copy of this letter.

Your faithfully,

Dr. Vaileth Charles.

Acting Medical Officer

Chairperson – KMRH Research Committee

MEDICAL OFFICER IN CHARGE
KAMANGA MEDICS HOSPITAL
P.O.BOX 5228
MWANZA

KAMANGA MEDICS
P.O. BOX 5228, MWANZA, TANZANIA
TEL: (255) 715477968

Appendix 5: Supervisor Support Letter

AFRICA UNIVERSITY
A United Methodist-Related Institution

"Investing in Africa's Future"

COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES
DEPARTMENT OF BIOMEDICAL AND LABORATORY SCIENCES

28 February 2025

Dear Ms Chinzou

RE: FACTORS ASSOCIATED WITH ASYMPTOMATIC MALARIA INFECTION AMONG PATIENTS ATTENDING OUT PATIENT DEPARTMENT AT KAMANGA REFERRAL HOSPITAL IN MWANZA, TANZANIA, 2024

I hope that I find you well. This letter serves to inform you that I am supervising Angelo Mgisha on the above project. I have walked with him during his proposal development and I believe that the proposal is now ready for AUREC review.

Thank you.

Dr S L Mutambu (PhD)
Senior Lecturer (DBMLS)

Appendix 6: AUREC Approval Letter

AFRICA UNIVERSITY
"Investing in Africa's future"
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC)

P.O. Box 1320 Mutare, Zimbabwe, Off Nyanga Road, Old Mutare-Tel (+263-20) 60075/60026/61611 Fax: (+263 20) 61785 Website: www.africau.edu

Ref: AU 3705/25

12 March, 2025

ANGELO MGISHA
C/O Africa University
Box 1320
MUTARE

RE: ***FACTORS ASSOCIATED WITH ASYMPTOMATIC MALARIA INFECTION AMONG PATIENTS ATTENDING OUT PATIENT DEPARTMENT AT KAMANGA REFERRAL HOSPITAL IN MWANZA TANZANIA, 2024***

Thank you for the above-titled proposal you submitted to the Africa University Research Ethics Committee for review. Please be advised that AUREC has reviewed and approved your application to conduct the above research.

The approval is based on the following.

a) Research proposal

- **APPROVAL NUMBER** AUREC 3705/25
  This number should be used on all correspondences, consent forms, and appropriate document
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 12, 2025
- **EXPIRATION DATE** March 12, 2026
- **TYPE OF MEETING**: Expedited
  After the expiration date, this research may only continue upon renewal. A progress report on a standard AUREC form should be submitted a month before the expiration date for renewal purposes.
- **SERIOUS ADVERSE EVENTS** All serious problems concerning subject safety must be reported to AUREC within 3 working days on the standard AUREC form.
- **MODIFICATIONS** Prior AUREC approval is required before implementing any changes in the proposal (including changes in the consent documents)
- **TERMINATION OF STUDY** Upon termination of the study a report has to be submitted to AUREC.

AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE (AUREC) APPROVED P.O. BOX 1320, MUTARE, ZIMBABWE

Yours Faithfully

MARY CHINZOU
FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE