AFRICA UNIVERSITY
(A United Methodist-Related Institution)

PREDISPOSING FACTORS FOR MALARIA AMONG MUTARE CITY RESIDENTS IN APRIL 2023.

BY

MOREEN MUTHONI IRUNGU

A RESEARCH PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF BACHELOR OF MEDICAL LABORATORY SCIENCES HONOURS IN THE COLLEGE OF HEALTH, AGRICULTURE AND NATURAL SCIENCES

2024

ABSTRACT

This study investigates on the pre-disposing factors for malaria among Mutare City residents in a quest to making Mutare City a malaria-free zone again. While the burden of malaria has been declining in many rural areas across Sub-Saharan Africa, urban regions that were previously considered 'malaria-free' have been experiencing a concerning upsurge in the number of malaria cases Mutare city in Zimbabwe, being one of them. Hence, this research aims to understand what are the factors responsible for the increased number of malaria cases in Mutare city in the hope that bridging this knowledge gap will be of importance to not only the Zimbabwean government. A retrospective cross-sectional study was conducted to collect the relevant data from the AUZENTO malaria laboratories. Secondary data was used with the researcher clustering the population. The total sample size used was 96. Both online statistical tools and offline analysis were used in data analysis. Out of the 96 participants, 14 positive cases were reported, 78 negative cases, seven labelled as “missing results” and one labelled as “not done”. More females were positive for malaria compared to men while students were the occupation with the biggest representation. A majority of the participants were adults, 18 and above with a total of 67 including an elderly who was 81 years old while under 18 totalled up to 29. While the numbers of positive cases are still on the low side and with no mortalities reported, it is paramount that effective preventative measures are put in place to prevent the numbers from increasing. It is indeed true that Mutare City is no longer a malaria-free zone. Integration of an online database to help in storing of information regarding the status of malaria as seasons change within Mutare city would be very essential in informing the relevant authorities so that evidence-based interventions can be employed.

Key words: Malaria, Malaria-free zone, Disease burden, Urban areas, Mosquitos, Mutare city, WHO, AU-ZENTO

Declaration

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

Ms. Moreen Irungu

Student's name

Student's signature

Mr G. Malunga

Supervisor's Full Name

Supervisor's Signature

Copyright

Acknowledgements

First and foremost, I sincerely appreciate the Almighty God for His grace, strength, sustenance, and above all, His faithfulness and love from the beginning of my academic journey up to this level. His benevolence has made me excel and succeed in all my academic pursuits and for that, all the Glory is His in Jesus name.

Enormous gratitude to Professor Mharakurwa, Mr. Mudare, Mrs. Charmaine, Scientists Lisa and Trish and the entire AU-ZENTO malaria laboratory fraternity for the help they accorded me from topic search up to this point. It was really inspirational receiving guidance and mentorship from them. My appreciation extends to the AU-ZENTO program too for their commitment in providing full funding to facilitate all the work I will be doing the laboratory

This research project would not have been possible without the exceptional support of my supervisor, Mr. Garikai Malunga. His enthusiasm, experience, and exacting attention to detail has been an inspiration and kept my work on track from the start to the finish. May the Almighty God bless him.

I appreciate my family and friends who, for years now, have been a real pushing power in my life. While the impact may not have been very direct, thank you for leading your lives so well that it radiates a sense of responsibility and inspiration. Your unwavering support, love, and guidance has been invaluable, shaping me into the person I am today. Thank you to my parents Mrs. Racheal and Mr. Jassan Irungu, to my siblings; Ephine, Wilson, Mildred and my lovely grandparents. And to Alexander and Martin, who always gave me a blow in the face whenever I showed signs of laziness.

Lastly, as I sign off, I have a lot of gratitude for Ms. Suzanne Hunter and the entire MCF-ALA team for not only seeing me, believing in my abilities as an aspiring world leader and philanthropist but also supporting my vision and huge dreams for the African continent which included coming to Africa University.

Abbreviations

WHO - World Health Organization

LLINs- Long-Lasting Insecticidal Nets

AU - Africa University

ZENTO- Zimbabwe Entomology

OR - Odds Ratio

IRS - Indoor residual spraying

pfpr - Plasmodium falciparum parasite rate

AUREC- Africa university research and ethical committee

RDT- Rapid Diagnostic Test

Table of contents

List of figures

List of Tables

CHAPTER 1: INTRODUCTION

1.1 Introduction

This chapter will look in depth at the topic of "predisposing factors for malaria among Mutare city residents during the month of April 2023", the background of the study, the problem statement, the rationale of the study, the aim, specific objectives, research questions, study limitations and delimitations, and lastly the summary of the chapter.

1.2 Background of the Study

Malaria, a parasitic disease caused by Plasmodium parasites and transmitted through the female Anopheles mosquitoes, remains a threat to global public health. With over a century of research, countless initiatives, and significant advancements in medicine and healthcare, malaria still continues to claim lives and exact a toll on societies worldwide. In 2020, the World Health Organization (WHO) reported a staggering 241 million clinical episodes of malaria and an estimated 627,000 deaths attributed to the disease. Alarmingly, a vast majority of these fatalities, approximately 95%, occurred within the borders of the WHO African Region. Beyond the devastating human toll, malaria exacts a severe socio-economic burden, straining healthcare systems, reducing labour productivity, and perpetuating cycles of poverty in endemic regions. In this context, understanding the dynamic patterns of malaria transmission, particularly in the ever evolving urban landscape, becomes not only a scientific endeavour but a moral imperative.

While previous research discovered that malaria was primarily a scourge of rural regions, the rapidly increasing urban population in Africa and other parts of the world has triggered notable changes in disease transmission. As urbanization gains momentum, patterns of malaria transmission are evolving, making the investigation of these trends and the predisposing factors to the state all the more essential. This research delves into this evolving landscape, scrutinizing the

intricate relationship between urbanization, human activities, and malaria transmission in urban settings, specifically Mutare City, Zimbabwe. Through this exploration, it aims to shed light on the nuanced factors influencing the resurgence of malaria in areas that were once considered "malaria-free" and, subsequently, to provide insights into mitigating this resurgent threat.

With malaria morbidity and mortality rates declining in major countries and regions due to intensive interventions, changes have been noted whereby famously “malaria-free” regions, mostly the urban areas, are now having increased numbers of malaria cases. Mutare city in Zimbabwe which is one of these scenario regions has reported cases above the threshold. A study by Makuwaza, et al (2021) indicated that malaria transmission in Mutare City was from the manipulation of the natural ecosystem by human modification. These activities have then created a favourable environment for the growth, survival, and thriving of mosquitos which ultimately leads to increased malaria transmission.

Mutare city saw an increased number of deaths from Malaria in the year 2017 with more than 30 cases reported compared to 2016 where only one case was reported according to a study on *“Amid wet weather, Zimbabwe’s Mutare sees hike in malaria deaths - Zimbabwe”,* (2018, January 19). National malaria reports show that Mutare City had the greatest endemic malaria burden among all urban settlements in Zimbabwe. housing construction.

1.3 Problem Statement

In recent years, there has been a notable shift in the epidemiology of malaria within sub-Saharan African countries. While the burden of malaria has been declining in many rural areas, urban regions that were previously considered 'malaria-free' have experienced a concerning upsurge in the number of malaria cases. This shift can be attributed to various human activities that have

altered the urban environment, creating favourable conditions for the proliferation of malaria vectors. Notably, a study by Makuwaza et al. in 2021 identified that in Mutare City, Zimbabwe, the proliferation of larval habitat hotspots was being fuelled by human activities related to livelihoods and housing construction. After a larval sampling of 223 potential hotspots, Anopheline speciation showed that the city was infested with Anopheles funestus (4.9%), An. arabiensis (0.3%), An. pretoriensis (91.3%) An. coustani (0.5%), An. rufipes (2.8%), and An. maculipalpis (0.2%), according to Makuwaza et al. in 2021.

According to the Zimbabwe District Health Information System 2 data of 2016 (unpublished), approximately 82% of all malaria cases in 2016 predominantly originated from three eastern provinces of Zimbabwe namely, Manicaland, Mashonaland East, and Mashonaland Central, with 39% of all cases and 31% of all deaths coming from Manicaland Province which hosts Mutare city. Makuwaza et al. in 2021.

This study, therefore, seeks to investigate the predisposing factors for malaria among residents of Mutare City, Zimbabwe, and to better understand the intricate relationship between human activities and environmental modifications, in Mutare City during the month of April 2023 which forms part of Mutare's rainy seasons.

1.4 Rationale of the study

Since prevention is better than cure, there is an urgent need now more than ever to understand the various factors that greatly facilitate the state of Malaria in the urban area, more specifically Mutare city, in the quest of making the city "Malaria-free" again. The results of the study will have a great impact on policy-decision making in line with decreasing/eliminating the factors contributing to the state of malaria in Mutare city. With the medical practitioners always having the notion that

Mutare city doesn't have malaria cases, this study will test that hypothesis thus enhancing the quality of care patients from Mutare city, having signs and symptoms of malaria, receive from health facilities.

1.5 Research Objectives

1.5.1 Broad Objective

The purpose of the study is to determine the predisposing factors for malaria among residents of Mutare city, Zimbabwe during the month of April 2023.

1.5.2 Specific Objectives

The study specifically seeks to:

- Identify socio-demographic predisposing factors for malaria among Mutare city residents during the month of April 2023.
- Determine the number of malaria cases reported among Mutare city residents during the month of April 2023.
- Identify the vector-preventive measures that were a predisposing factor for malaria among Mutare city residents during the month of April 2023.

1.6 Research Questions

- What were the social-demographic factors associated with malaria cases among Mutare City residents during the month of April 2023?
- What were the number of malaria cases reported among Mutare City residents during the month of April 2023?
- Which vector-preventive measures were a predisposing factor for malaria among Mutare city residents during the month of April 2023?

1.7 Study Limitations

The research will be conducted within a limited timeframe due to the researcher's concurrent undergraduate studies. This may impact the overall depth and breadth of the investigation.

1.8 Delimitation

The study will only involve results' records from Mutare city residents who visited clinics in Mutare city presenting malaria-like symptoms and are within the jurisdiction of AU-ZENTO malaria laboratory located at Africa University for the month of April 2023.

1.9 Summary

The chapter depicted a picture of the heterogeneity in the transmission of Malaria in urban and rural areas with reference to Mutare city, Zimbabwe along with the problem statement, the rationale of the study, research objectives, research questions, study limitations and delimitations.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

Malaria, a perennial public health challenge in sub-Saharan Africa, continues to impose a considerable burden on communities and governments. Mutare City in Zimbabwe is no exception. As we venture into the literature surrounding predisposing factors for malaria, this chapter aims to provide an in-depth understanding of the social-demographic elements, vector-preventative measures, and the current prevalence of malaria in urban cities. By exploring existing research, we strive to unravel the complex web of factors that contribute to the ongoing cases of malaria in urban cities in relation to Mutare city thereby laying the groundwork for effective prevention and control strategies.

2.2 Conceptual Framework for transmission of malaria

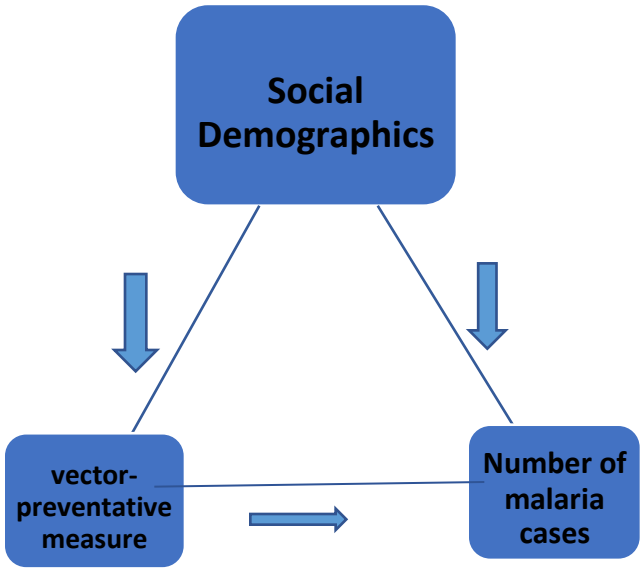

Fig 1: Conceptual framework for transmission of malaria

Uncontrolled factors like demographics and vector control measures can influence the number of malaria cases of malaria in Mutare City. Demographics, such as age, gender, and socioeconomic

status, can affect access to and utilization of vector control measures, like insecticide-treated bed nets and spraying. In turn, these measures directly impact the number of malaria cases reported of malaria.

2.3 Literature review in relation to objectives

2.3.1 Literature review on Social Demographic factors affecting malaria transmission

Malaria infection occurrence is a function of the sociodemographic, cultural and environmental conditions in a particular geographic area (Nwaneli et al, 2020). These factors influence risk status of malaria, level of susceptibility, social interaction as well as behaviours, thereby promoting the disease occurrence by creating a favourable environment for the malaria vectors to thrive (Ernst et al., 2006). According to WHO (2017), sociodemographic determinants play an important role in the health of individuals and the community and require appropriate consideration in public health intervention strategies. The sociodemographic of a population includes the evaluation of variables such as age, gender, race or ethnic population distribution within a region or country (WHO, 2017).

2.3.1.1 Age

A study by Ferrão et al. (2022) noted that half of the malaria cases were observed in children aged 5 to 14 years, with an odds ratio of 3.61. In Ghana, children in this age group accounted for 43.3% of malaria cases, while in Rwanda, the odds of malaria infection were reported to be 1.817 times higher for this age group. A separate study from Kenya indicated that children aged 11 to 14 years had the highest malaria prevalence, and children aged 5 to 18 were identified as the most vulnerable age group. Additionally, research in Chimoio city, Mozambique, found that 52% of malaria cases were among children under the age of five years.

Ibrahim et al. (2022) noted that there was no significant association between age and malaria infection. A study conducted in Congo showed a relationship between malaria infection and age and high prevalence was also observed in the age above 5 years. Malaria Indicator Survey conducted in Mainland Tanzania in 2017 also revealed the age shift of malaria burden from the normal under five to school aged children. Mwalimu (2020).

2.3.1.2 Gender Disparities in Malaria Burden

Gender dynamics play a significant role in malaria prevalence. A systematic review by Guerra et al. (2019) demonstrated gender-related variations in malaria exposure, with pregnant women facing an elevated risk. A study conducted in Uganda discovered that the incidence of malaria diagnosis at the public health facilities was higher among females compared to males and more so especially among females within the child bearing age. The author also noted that, females are more likely to visit health facilities dependent/independent of malaria compared to males which could be a reason as to why less males were diagnosed than females. Okiring et al. (2022)

2.3.1.3 Educational Status and Malaria Knowledge

Educational status is a determinant of malaria knowledge and preventative practices. In a study conducted by Deressa et al. (2019) in Ethiopia, a positive correlation was observed between higher education levels and the adoption of preventative measures. Sixpence et al. (2020) noted in his study that educational status was an important variable which was significantly associated with knowledge on malaria among women of reproductive age. According to Mwalimu (2020), in Rwanda, findings showed reduced odds of malaria infections for the households with parents that had secondary or higher education level while in Burkina Faso findings showed households with mother who had higher education, had low risk of malaria as compared to households with mother with primary education or no education.

2.3.2 Literature review on Vector-Preventative Measures and Malaria Control

While the implementation of vector-preventative measures, such as insecticide-treated bed nets and indoor residual spraying, stands as a cornerstone in malaria control, the effectiveness of these interventions is contingent upon various contextual factors. This section delves into recent studies that shed light on the nuanced dynamics surrounding specific vector-preventative measures, unravelling their inadvertent contributions to the state of malaria within diverse communities. A comprehensive understanding of these dynamics is imperative for optimizing preventative strategies in Urban areas and specifically Mutare City Zimbabwe.

2.3.2.1 Impact of Long-Lasting Insecticidal Nets (LLINs): Insights from Malawi and Burundi

Mathanga et al. (2016) conducted a study in Blantyre, Malawi, addressing the impact of long-lasting insecticidal nets (LLINs) on malaria transmission. Despite the growing concern about malaria in urban and peri-urban areas of sub-Saharan Africa, epidemiologic patterns and transmission drivers in these settings have remained poorly understood. Contrary to expectations, the study in Blantyre revealed that the utilization of LLINs the night before malaria testing showed no significant association with malaria infection.

Malaria transmission in Burundian highlands was clearly seasonal and increased non-linearly over the study period. Further, a fast and steep decline of malaria incidence was noted during the first year after mass LLIN distribution ($p<0.0001$). In years 2 and 3 after distribution, malaria cases started to rise again to levels higher than before the control intervention. Van Bortel et al. (2022)

2.3.2.2 Insecticide-Treated Nets and Indoor Residual Spraying in Ethiopia

In a study by Hassen & Dinka (2022) in Ethiopia, logistic regression analysis uncovered compelling insights into the protective role of vector-preventative measures.

Individuals who possessed insecticide-treated nets demonstrated a significant reduction in malaria infections (Odds ratio [OR] = 0.38, 95% confidence interval [CI] [0.194, 0.743]). Similarly, households subjected to indoor residual spraying with insecticides exhibited a substantial decrease in malaria prevalence (OR = 0.18, 95% CI [0.097, 0.34]). These findings underscore the critical role of both personal and environmental vector control strategies.

2.3.2.3 Vector Control in Zimbabwe

Sande et al. (2017) conducted an extensive study in Zimbabwe, emphasizing the impact of vector control measures on malaria morbidity. The study revealed a substantial decline in overall morbidity (81%) from 2003 to 2015. The success was attributed to the scaled implementation of indoor residual house spraying (IRS) and the widespread use of long-lasting insecticidal nets. Despite this success, the specific impact of these vector-preventative measures on the state of malaria in Mutare City, Zimbabwe, remains unexplored. Understanding the unique epidemiological landscape in Mutare City is pivotal to restoring and maintaining its malaria-free status.

In the pursuit of comprehending the intricate interplay between vector-preventative measures and the state of malaria, these studies collectively underscore the need for context-specific strategies. The following sections will delve into the potential unintended consequences and contextual variations that influence the effectiveness of these measures in the specific urban setting of Mutare City.

2.3.3 Malaria Prevalence in Urban Areas

The traditional perception of malaria as a predominantly only rural disease is evolving, with an increasing prevalence observed in urban centres. Over the last decade, urban areas continue to see a huge influx in settlements which has necessitated the disruption of the natural settings.

Unplanned urbanization will likely result in a malaria disease burden that is disproportionately high among the urban poor; they are at greater risk of becoming infected, less able to access quality health services, and suffer the most from the impact of becoming ill. WHO (2022). A good example was observed in Burkina Faso where *P. falciparum* parasite rate (PfPR) has been estimated at 24.1% in the urban center, 38.6% in its peri-urban surroundings which can be attributed to the fact that, African cities tend to grow outwards with perimeters consisting of relatively underdeveloped, poorly serviced settlements (De Silva and Marshall, 2012).

Wang et al. (2019) noticed that Changes in regional climate, due to urbanization and global greenhouse gas concentrations, may affect the ecology of mosquitoes and mosquito-transmitted pathogens. Nigeria, which accounts for about a quarter of the global burden of malaria, nearly half of the population is already living in urban areas. WHO (2022). Stresman et al. (2023) stated that in Maputo city Mozambique, there were 2,380 patients with confirmed malaria infections reported through case notification forms during January and February 2023.

2.4 Summary

The transition of high malaria incidence and prevalence from rural to urban environments is evident, driven by global factors such as urbanization, socio-economic complexities, and changing environmental dynamics. The prevalence of malaria within urban centres is intricately linked with unique challenges, including vector dynamics influenced by human activities and the adaptability

of mosquitoes. Additionally, socio-demographic factors, such as age, gender, educational status, income disparities, and household dynamics, significantly shape vulnerability to malaria. Vector preventative measures, while crucial, demonstrate varying effectiveness and may have unintended consequences. As Mutare City grapples with the evolving nature of urban malaria, the research objectives derived from this review will guide a focused empirical investigation, aiming to unravel the complexities and inform targeted interventions for effective public health management.

CHAPTER 3: METHODOLOGY

3. 1 Introduction

In this chapter, the researcher will indicate the research design used, data collection tools, methodology of collecting data, study population, sampling method, data analysis, ethics of the study, and summary of the chapter.

3. 2 Research Design

A retrospective cross-sectional study was conducted to collect the relevant data from the AUZENTO laboratories. A retrospective cross-sectional study is an observational (non-interventional) study that is mainly put in use when there's a need to determine the incidence and prevalence of infection among a population**.** A cross-sectional study is a type of observational study or descriptive research that involves analysing information about a population at a specific point in time (Simkus, 2021).

3. 3 Measurement/Data Collection Method

Data was collected from AU-ZENTO malaria laboratories patient's database.

3. 4 Study Population

The population was records within the AU-ZENTO malaria laboratories of patients that attended hospitals within Mutare city the month of April 2023.

3. 5 Sampling

Secondary data collected from the AU-ZENTO malaria laboratories was used. The researcher used cluster sampling which is a type of probability sampling where a widely spread population is arranged into sub-groups (clusters) based on their geographical location. Followed by simple

random sampling within a cluster, the sample size whose data was analysed was selected and the results were generalized for the whole population.

3. 6 Inclusion Criteria

Results records of Mutare city residents who visited the clinics bearing malaria-like symptoms during the month of April 2023.

Results' records were of patients who visited these clinics within Mutare city Suburbs; Hobhouse, Florida, Gimboki, Fernvalley, Dagamvura, Sakubva, Chikanga and City.

3. 7 Exclusion Criteria

Mutare resident's records not within the jurisdiction of AU-ZENTO malaria laboratories.

Patient records whose data on occupation was not complete; their occupation not mentioned.

3. 8 Sample size

A sample size of 96 patient records from the different suburbs in Mutare city, Zimbabwe was used.

Population less than 500

Confidence Interval of 96%

Margin Error 6.9%

Z score- 1.96

P = 0.14

Using the formula $n = \frac{Z^2 P (1-P)}{C^2}$

$$n = \frac{1.96^2 * 0.1375(1-0.1375)}{0.069_2} \rightarrow n = \frac{3.8416 * 0.1375(0.8625)}{0.004761}$$

$$n = \frac{0.455590}{0.004761} = 96.69$$

Sample size = 96 participants

3. 9 Study Settings

The research took place at AU-ZENTO Malaria Laboratories.

3. 10 Data analysis and presentation

Qualitative and quantitative data analysis techniques were used to prepare data for presentation, while incorporating analysis and presentation software like R. The analysed data was then presented in excel sheets/tabular forms, pie charts, and graphs for in-depth understanding.

3. 11 Ethical considerations

The researcher was guided promptly by the guidelines of AUREC. A letter of approval from AU-ZENTO malaria laboratory was presented to the researcher before the research begun permitting the researcher to work with AU-ZENTO malaria laboratories data in conjunction with AUREC's approval letter.

3. 12 Summary

Chapter 3 covers different aspects of the methodology that were applied during the research process. The researcher vividly depicted how the research was carried out stating the study population, sample size, sampling technique as well as ethical considerations related to the research. As noted, data was collected from records in the AU-ZENTO malaria laboratories.

CHAPTER 4: DATA PRESENTATION

4.0 Introduction

This chapter will focus on data presentation, analysis and interpretation of the research findings. The data was collected from Africa University Malaria Laboratories; AU-ZENTO. Presentation of data will be done through narrative explanations, tables, histograms and pie charts.

4.1 Socio-demographic characteristics of study participants

Both female and male patients visited Mutare City health centres presenting with malaria-like symptoms. It was observed that out of the patients, 65 of them were female representing 68 % while male patients were 31 making it 32 %. Below is a pie chart representing the information, the percentages were rounded up to whole numbers.

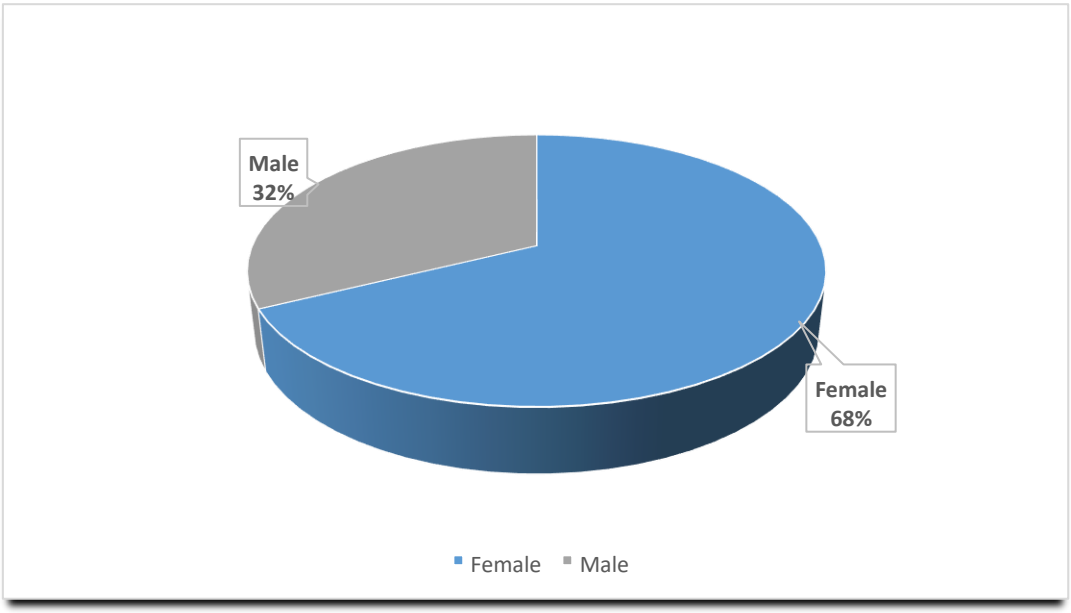

Fig 2: Distribution of sex of study participants

The study encompassed a diverse range of age groups, spanning from infants to the elderly. The table below illustrated the distribution across different age clusters. The youths and children had a representation of 30%, participants above 18 years and below 80 were at 69% and with the elderly; above 80 years old were 1% of the total population.

Table 1: Age distribution of study participants

Age groups	**Frequency N (%)**
0 – 18 (Children)	29 (30)
18 – 80 (Adults)	66 (69)
Above 80 (Elderly)	1 (1)

The occupations of the patients were summarized in the table below. Notably, students across all levels of education had the highest numbers, while the self-employed and the unemployed had a relatively lower count, both tied in representation.

Table 2: Occupation of the study participants

Occupation	**Frequency N(%)**
Students	29 (30)
Self-employed	3 (3)
Unemployed	3 (3)
White collar Jobs	4 (4.2)
Manual Jobs	12 (12.5)

4.2 Vector Preventative Measures

Several vector preventative measures were mentioned to be employed within the homesteads of the study participants. This varied from participant to participant with a majority of them, 95 participants, noting that they did not have any open water bodies in their surroundings, those with their entire houses sprayed were 17 as well as those whose only bedrooms were sprayed at 17 and lastly those sleeping under a treated mosquito net at 12 responses.

Below is a graph representing the different vector-preventative measures used by the patients in their homesteads.

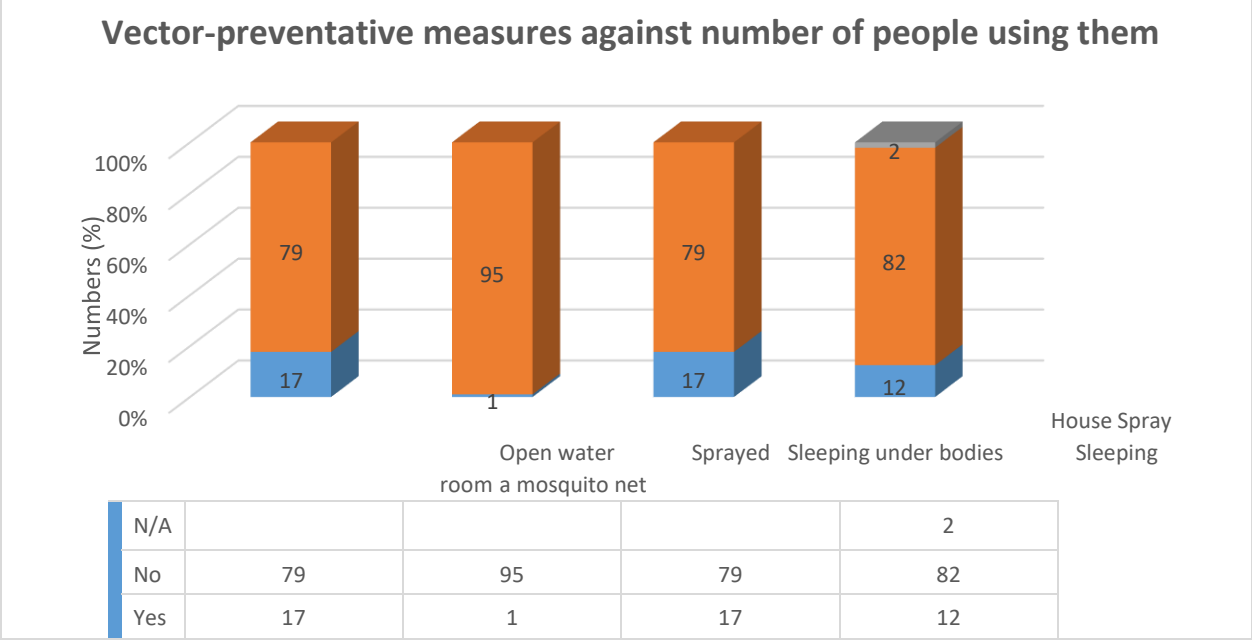

Fig 3: Vector Preventative measures

4.3 Laboratory Findings

4.3.1 Number of Malaria cases reported and confirmed positives - RDT

While patients presenting with malaria-like symptoms such as fever, chills, headaches, malaise and vomiting were 96, on performing a malaria diagnostics test; RDT, only 14 positive cases were confirmed. Of the 96 participants, 78 were negative for Plasmodium *spp*. on carrying out RDT.

Some participants' results were missing totalling to seven while one participant's samples were not diagnosed for malaria.

Below is a chart with the information on the RDT results.

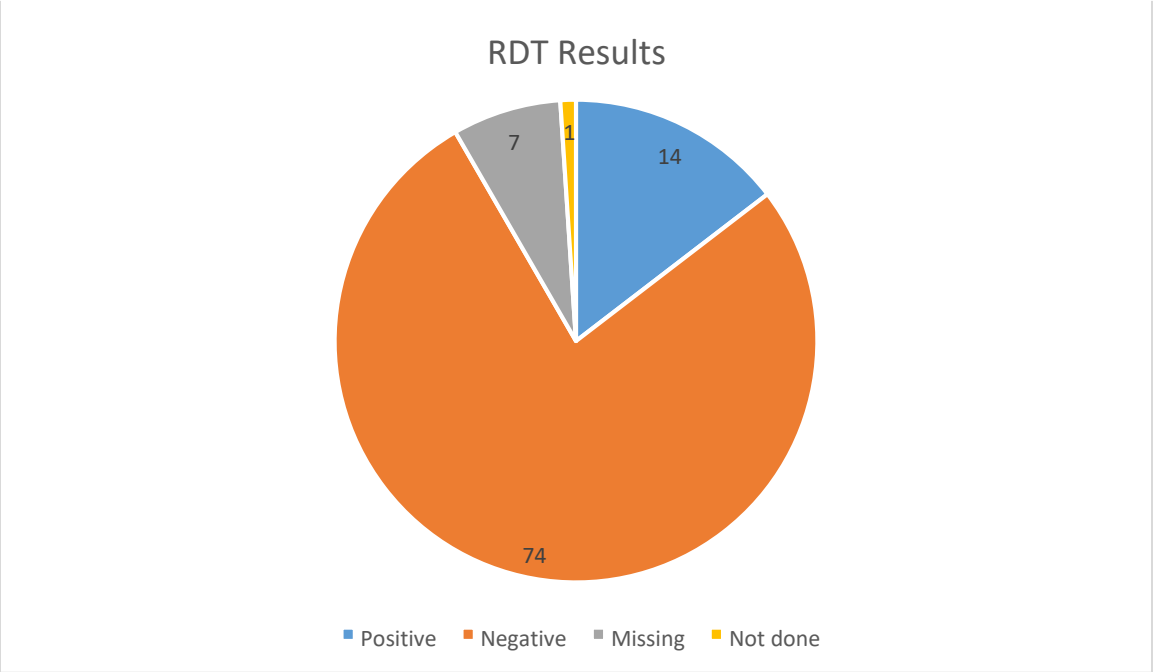

Fig 4: Results of the Rapid diagnostic test

4.4 Gaps Identified

The data available could not fully account for the state of malaria within Mutare City; true positive and negative cases, since some patient's information was labelled as missing or test not done. The migration from one suburb to the other within the city too may be a hindrance to the quality of data on the infectivity rates within specific suburbs.

4.5 Summary

From the data presented above, it can be deduced that Mutare City which was previously termed as a malaria-free zone is experiencing a surge in number of confirmed positive cases. While there

were positive cases, fortunately no deaths due to malaria were reported during the month of April 2023. Some households had incorporated vector-preventative measures such as sprayed houses, sleeping under mosquito nets and eradicating open water bodies near their houses while a majority of the households had not employed those measures.

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter will discuss the research findings from chapter 4 in depth, the conclusions and give recommendations that if taken into consideration, Mutare city would retain its status as a Malaria-free zone.

5.1 Discussion

Findings from the data presented identified the socio-demographics of the participants that visited Mutare City health centres with malaria-like symptoms, the vector preventative measures employed at the different households of the participants and the overall number of positive cases that were confirmed and reported. The researcher observed that some of the participants indicated to have been living in different suburbs all together making it difficult to deduce which Suburb would have accounted for the highest number of malaria cases.

The researcher found out that of the participants that complained of malaria-like symptoms, females were more than males. Figure 1 indicated that females represented 68% of the population while males consisted of 32%. This also correlated with the number of positive cases confirmed with the number of females being more than that of males; females - 64% and males - 36%. Studies have shown that most men tend to shy away from visiting hospitals/seeking medical care when sick and result in buying over the counter drugs hence that would account for the variations in numbers compared to women/females.

Children from all age groups were affected with the majority of positive cases as well as participants presenting with malaria like symptoms being from children within 0 – 9 years of age.

The Age characteristics consisted of infants (below the age of 1), toddlers (2-5) and school going children mainly consisting of students, totalling 29. Adults 18 and above made up a relatively larger number with a total of 67 inclusive of one elderly person; who was 81 years old.

As illustrated in table 1, most of the study participant's occupations were labelled as not mentioned accounting for 47%, a good number of them being toddlers and pre-schoolers. Notably, some adults' information was also missing. Of the participants whose data was well labelled, students were the majority at 30%, followed by those with manual jobs at 12.5%, the white collar jobs at 4.2% and lastly a tie between the self-employed and the unemployed at 3% each. Most students indicated that they travelled every school day to school which may have accounted for the high numbers while it also raised uncertainties to whether the infection began at home or school.

The researcher was able to identify the different vector-preventative measures employed by the study participants in a quest to combat the spread of malaria. Figure 2 showed the measures employed against the total number of participants that had that in place within their residence. Majority of the participants; 95 of them, indicated that they did not have open water bodies/had cleared any open water bodies close to their residences with only 1 participant saying that they had an unidentified open water body nearby. With a tie of 17 each, the participants here indicated that their full houses were sprayed as well as they slept in rooms sprayed with insecticide. 12 participants revealed that they used treated mosquito nets in their homes.

The laboratory investigations; the RTD results, as depicted in figure 4 indicated that there were 14 confirmed positive cases and 74 negative cases. Some of the patient's results as discussed previously were labelled as "missing results" accounting for seven and "test not done" which was for one patient. This totalled up to 96 which represented the researcher's study population. The

lack of results for some patients may have been due to lack of proper communication channels between the scientists and the data entry team or poor labelling of samples.

5.2 Concurrence with previous studies

The study findings provided a comprehensive analysis of the research findings, drawing connections to the specific objectives the researcher set out to achieve. While no other similar studies on Mutare city has been published, the findings form a foundation for many more studies in the future that would inform the governments, public health, NGO's and the general population on better and effective ways to help return the malaria-free status to Mutare city.

5.3 Study Limitations

The limitation of the study was failure to adequately deduce which Mutare city suburb was highly affected with more positive cases due to reasons such as frequent inter-suburb travelling of the study participants for work, leisure or school and inter-suburb migration due to reasons that were not mentioned.

5.4 Conclusion

To conclude, with malaria morbidity and mortality rates declining within many African countries, new evidence suggests that the patterns of transmission have evolved and the previously known as malaria-free zones now have positive cases reported every day. Mutare city in Zimbabwe was one of those cities. This study revealed that during the month of April 2023, there were 14 positive cases reported with females being more than males. There is hence a need for the government, NGO's, public health and any other relevant body to look into the issue of malaria in Mutare city before the residents start experiencing increasing mortality rates.

5.5 Recommendations

To combat parasitic cases in any nation especially ones with different hosts, it is always paramount that the vectors are eliminated. In the case of malaria, elimination of mosquitos would go a big way in helping curb the current upsurge of malaria cases in Mutare City.

There is a preference in receiving help from the governments in accessing treated mosquito nets, mosquito repellents and coils. The relevant bodies should look into ensuring that the schools and its environs are free of malaria-predisposing factors such as bushes and open water bodies while spraying the classrooms with insecticides. As there is already a malaria vaccine that's being administered to infants and children below the age of 5, the governments NGO's should set out funds to purchase the vaccines/ the NGOs should render help to the governments.

More attention on research directed to the vector's resistance to the available elimination measures such as coils and insecticides is needed coupled by a robust system of reporting the findings and deploying effective measure to counteract their activity. This will work in handy with an integrated system/database that would be updated regularly with information on vector-resistance and microbial–resistance.

REFERENCES

Deressa, W., Deressa, T., Abebe, M., & Kebede, Y. (2019). *Determinants of preventive practices against malaria among pregnant women in northwest Ethiopia: a community-based crosssectional study*. BMC Pregnancy and Childbirth, 19(1), 338.

De Silva, P. M., & Marshall, J. M. (2012). Factors Contributing to Urban Malaria Transmission in Sub-Saharan Africa: A Systematic Review. *Journal of Tropical Medicine*, *2012*, 1–10. https://doi.org/10.1155/2012/819563

Ernst, K. C., Amin, A. H., Arib, W. A., & Khatib, R. A. (2006). *Social and behavioral determinants of malaria infection in rural Tanzania. Malaria Journal*, 5(1), 118. Retrieved from https://doi.org/10.1186/1475-2875-5-118

Ferrão, J. P., Lopes, F. C., Moreno, J., Sousa, C. A., & Arez, A. P. (2022). *The burden of malaria in Cabo Verde: understanding the epidemiological trends and risk factors.* Malaria Journal, 21(1), 1-10.

Guerra, M. M., Weaver, D. M., & Walker, M. (2019). The contrasting landscapes of gender and malaria in sub-Saharan Africa. *PLoS Neglected Tropical Diseases*, 13(2), e0007044. Retrieved from https://doi.org/10.1371/journal.pntd.0007044

Ibrahim, M. A., Elkhidir, M. M., Adam, I., Elkhalifa, M. A., & Hassan, R. A. (2022). *Prevalence and associated factors of malaria infection among under-five children attending outpatient clinics in Kassala State, Eastern Sudan*. BMC Public Health, 22(1), 1-9.

Makuwaza, L., Chimbari, M. J., Mukumbira, A. M., Takaruza, K., & Pasi, M. (2021). *Mapping of larval habitats and Anopheles species identification in Mutare City, Zimbabwe.* Malaria Journal, 20(1), 1-9

Mwalimu, R. W. (2020). *Epidemiology of malaria in Tanzania: a review of trends and control measures.* Malaria Journal, 19(1), 1-13.

Nwaneli, F. C., Ikpeazu, A. I., Ogu, C., Peter, J., & Egwunyenga, O. (2020). *Malaria prevalence and associated risk factors among pregnant women attending antenatal care clinics in the Niger Delta region of Nigeria.* PLoS One, 15(1), e0227820. Retrieved from https://doi.org/10.1371/journal.pone.0227820

Okiring, J. O., Omoding, J., Otieno, F. A., Olal, A. A., & Irungu, L. W. (2022). *Factors associated with malaria diagnosis and treatment among under-five children in Uganda: a cross-sectional study*. Malaria Journal, 21(1), 1-11.

Simkus, J. (2021, December 27). *Cross-Sectional Study | Definition, Designs & Examples*. Www.simplypsychology.org. https://www.simplypsychology.org/what-is-a-cross-sectional-study.html.

World Health Organization. (2017). *Social determinants of health.* Retrieved from https://www.who.int/health-topics/social-determinants-of-health

APPENDICES

Appendix 1: Study site approval letter

AFRICA UNIVERSITY
"Journey to Africa's Future"
UNITED METHODIST-RELATED INSTITUTION

AFRICA UNIVERSITY MALARIA INSTITUTE

P.O. BOX 1320, MUTARE, ZIMBABWE – TEL.: (263-20) 60075/60026 – FAX: (263-20) 61785 – Cell: (+263) WEBSITE: www.africau.edu

March 6, 2024

The Administrator
Africa University Research Ethics Committee (AUREC)
Africa University
Fairview Road
Old Mutare
Mutare

Dear Mrs. Chinzou

RE: Permission to carry out a study on pre-disposing factors to malaria in Mutare City – Moreen Irungu BMLS student

This letter serves to confirm that Moreen Irungu, BMLS student at Africa University, has been allowed to conduct a study on pre-disposing factors for malaria among residents of Mutare city. The study is solely based on anonymized samples and is for academic purposes. Feedback is required to the Africa University Malaria Institute (AUMI) before sharing findings.

Thank you

Yours faithfully

Sungano Mharakurwa, PhD
Associate Professor and Director

1

Appendix 2: 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: AU3203/24

20 March, 2024

MOREEN MUTHONI IRUNGU
C/O Africa University
Box 1320
MUTARE

RE: PRE-DISPOSING FACTORS FOR MALARIA AMONG MUTARE CITY

Thank you for the above-titled proposal that 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** AUREC3203/24
  This number should be used on all correspondences, consent forms, and appropriate documents.
- **AUREC MEETING DATE** NA
- **APPROVAL DATE** March 20, 2024
- **EXPIRATION DATE** March 20, 2025
- **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
ASSISTANT RESEARCH OFFICER: FOR CHAIRPERSON
AFRICA UNIVERSITY RESEARCH ETHICS COMMITTEE