ASSESSMENT OF MALARIA CASES AND ASSOCIATED FACTORS FOR CONTINUED TRANSMISSION IN HOTSPOT SHEHIAS IN MAGHARIBI B DISTRICT, ZANZIBAR

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ASSESSMENT OF MALARIA CASES AND ASSOCIATED FACTORS FOR CONTINUED TRANSMISSION IN HOTSPOT SHEHIAS IN MAGHARIBI B DISTRICT, ZANZIBAR

By

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A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Science (Applied Epidemiology) of

Muhimbili University of Health and Allied Sciences
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CERTIFICATION

The undersigned certify that they have read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled; **‘‘Assessment of Malaria Cases and Associated Factors for Continued Transmission in Hotspot Shehias in Magharibi B District, Zanzibar, 2024’’,** in (partial) fulfillment of the requirements for the degree of Master of Science (Applied Epidemiology) of Muhimbili University of Health and Allied Sciences.

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(Co-Supervisor)

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Date

DECLARATION AND COPYRIGHT

I, **Fatma Moh'd Juma**, declare that this **dissertation** is my original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature……. **Date**……...…….....

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DEDICATION

This work is dedicated to my whole family, for their constant encouragement, love, and inspiration.

ABSTRACT

Background: Malaria is a global health problem, with approximately 247 million cases reported worldwide, 95% of which occur in Africa. Tanzania's malaria prevalence is estimated at 8% while Zanzibar has a significantly lower burden at less than 1%. Despite efforts to eliminate malaria in Zanzibar, hotspot Shehias in Magharibi B District experiences high periodic transmission. This study aims to identify factors associated with persistent malaria transmission in these hotspots Shehias.

Methodology: An explanatory sequential study was conducted in the hotspot Shehias of Magharibi B district using a case-control study with one malaria case matched to three controls. Malaria cases notified from the coconut surveillance system were followed to the households and controls were obtained from neighboring houses. Interviews using a structured questionnaire were conducted to collect data on socio-demographic, socio-economic, behavioral, and environmental factors contributing to persistent transmission. Descriptive analysis was performed to determine the frequencies of categorical variables. A conditional logistic regression model assessed the association between dependent and independent variables, with a p-value of < 0.05 set for significance. Additionally, the Modified grounded theory approach was used for Focus Group Discussions (FGD) to collect data from Magharibi B residents from hotspot shehias which were later transcribed and analyzed to reinforce the quantitative findings.

Results: This study focused on individual aged 15 years or older living in Magharibi B hotspot shehias. A total of 144 participants from case – control and 48 malaria negative individuals from 6 FGDs were interviewed. Findings show that Malaria cases were more common among males (69.4%), individuals aged 15–24 years (44.4%), and those with high knowledge of malaria (94.4%). Significant factors associated with malaria transmission included outdoor night stays (Adjusted Odds Ratio [aOR] = 4.73, 95% CI 1.04 – 23.35), and the presence of breeding sites (aOR = 4.48; 95% CI 1.04 – 19.27). FGDs identified additional factors such as negative attitude regarding Insecticide Treated Nets (ITNs) usage among males, outdoor night activities,

misconceptions about ITN use, poor housing conditions, and unclean environments with discarded cans and bushes around settlements.

Conclusion: Factors contributing to continued malaria transmission in hotspot Shehias in Magharibi B district include outdoor night activities, the presence of breeding sites, negligence, and misconceptions about ITN use. The Zanzibar Malaria Elimination Program should promote behavioral change communication that go in line with entomological monitoring and lava source management.

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ABBREVIATIONS

ACT	Artemisinin-based Combination Therapy
CDC	Centers for Disease Control and Prevention
DMO	District Medical Officer.
DMSO	District Malaria Surveillance Officer
FGD	Focus Group Discussion
IRS	Indoor Residual Spray
ITN	Insect-side Treated Net
LLIN	Long-Lasting Insecticide Nets
MGT	Modified Grounded Theory
MRDT	Malaria Rapid Diagnostic Test
MUHAS	Muhimbili University of Health and Allied Sciences
PMI	Presidential Malaria Initiative
TFELTP	Tanzania Field Epidemiology and Laboratory Training Program
TMIS	Tanzania Malaria Indicator Survey
WHO	World Health Organization
ZAMEP	Zanzibar Malaria Elimination Program

DEFINITION OF TERMS

Case: A case is any individual above 14 years who resides in hotspot Shehias in Magharibi B district who tests positive for malaria through MRDT or Microscope at a health facility.

Control: Is any individual above 14 years who will be tested negative through MRDT who is the neighbor of the index case and who consents to participate in the study.

Coconut surveillance system: This is an electronic system that is used by the Zanzibar Malaria Elimination Program to collect daily malaria cases that are positive and confirmed from all health facilities in Zanzibar.

Coconut surveillance database: A database that provides information on positive confirmed malaria cases that are daily notified from all health facilities in Zanzibar. The system was named "coconut" reflecting the common trees in Zanzibar.

Hotspot Shehias: Are shehias with a significant higher number of malaria index cases compared with the neighboring shehias in any given transmission season (1).

Imported cases: Any case that acquired malaria infections outside the country of Zanzibar.

Local case: Any case that acquired malaria infections within Zanzibar.

Malaria hotspot: Are shehias that constantly report more than five malaria cases per week.

Maskani: A place where a group of men sit together to socialize

Shehia: The smallest administrative unit where all government policies are implemented.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Malaria is an acute febrile illness caused by *Plasmodium* species parasites, which are spread to people through the bites of infected female *Anopheles* species mosquitoes. Five parasite species cause malaria in humans, and two species – *P. falciparum* and *P. vivax* – pose the greatest threat. *P. falciparum* is the deadliest malaria parasite and the most prevalent on the African continent. *P. vivax* is the dominant malaria parasite in most countries outside of sub-Saharan Africa(2). Malaria is a preventable and treatable disease, but control and elimination have become extremely difficult as they continue to cause detrimental impacts on millions of people's health and deaths of thousands around the world (3).

In 2021 Malaria was estimated to cause 247 million malaria cases and 619,000 deaths worldwide, with Africa bearing the heaviest burden; accounting for approximately 95% and 96% of global cases and deaths, respectively. Children below the age of five are the most vulnerable, accounting for approximately 78.9% of all malaria deaths in the African region (2,3). Despite significant progress since 2000 as well as the Global Technical Strategy for Malaria 2016 – 2030 morbidity and mortality milestones for 2020 were not met globally (1). Covid-19 pandemic accelerated malaria cases by 14 million and increased malaria deaths by 10% globally. However, Malaria deaths in the African Region, decreased by 58% between 2000 and 2021 (1,4). Tanzania has been reported to contribute 3.0% of all malaria cases and 4.1% of malaria deaths worldwide (4,5).

As per Tanzania Malaria Indicator Survey (TMIS), Tanzania’s mainland has the highest prevalence of malaria (8%), with Zanzibar having the lowest malaria prevalence at less than 1% (6). Though malaria prevalence is very low in Zanzibar context, prevalence varies from one district to another, Magharibi B has about 0.1%(7). Zanzibar through integrated vector management, the use of artemisinin-based combination therapy and malaria surveillance has successfully reduced malaria burden from 35% in 1995 to less than 1% in 2022 and less than 5

deaths per year (8). Because of the enormous drop in malaria burden, Zanzibar is currently on the verge of malaria elimination (4). However, multiple studies have shown that the importation of malaria cases from nearby areas such as Tanzania's mainland leaves Zanzibar vulnerable to malaria persistence and affects the process of elimination because imported cases have been shown to induce local cases (4,8).

Despite several strategies to combat malaria disease being put in place, in recent years, there has been enormous increase in malaria cases reported from Magharibi B district with some shehias being commonly identified to report the highest number of malaria cases in any given transmission season (1). Therefore this study aimed to identify malaria cases and factors associated with persistent transmission in hotspot Shehias of Magharibi B District and propose evidence based interventions for malaria case reduction.

1.2 Problem Statement

Malaria remains a significant public health concern in Zanzibar. Malaria prevalence in Zanzibar is not equally distributed, findings reveal that out of 387 Shehias, there are 12 hotspot shehias (3.1%) mostly located in Magharibi B and Central districts that have been identified and contributed to 14.5% of all index cases reported for more than four years from 2015 to 2020.

In response to the high increase in malaria cases, the Ministry of Health through the Zanzibar Malaria Elimination Program (ZAMEP) implemented various intervention measures to control the disease. Such interventions include complete IRS to all targeted households, availability and ACT uses to all public and private hospitals, community sensitization on malaria treatments mass distribution of mosquito–treated nets, complete malaria foci investigations and improved mosquito and malaria case surveillance (7).

From 2021 to date, there has been a continuous reporting of malaria cases from Magharibi B district, meanwhile, Zanzibar is currently attempting to eliminate malaria and the struggle to address proper malaria interventions in this area is a continuous challenge (1). Furthermore, focusing on malaria interventions by targeting hotspots (foci) and vulnerable groups is effective in the reduction of malaria transmission (9). This study was therefore designed to assess malaria cases and factors associated with persistent malaria transmission in Magharibi B district hotspot shehias and propose evidence based interventions that will expedite progress toward meeting the elimination targets.

1.3 Conceptual Framework

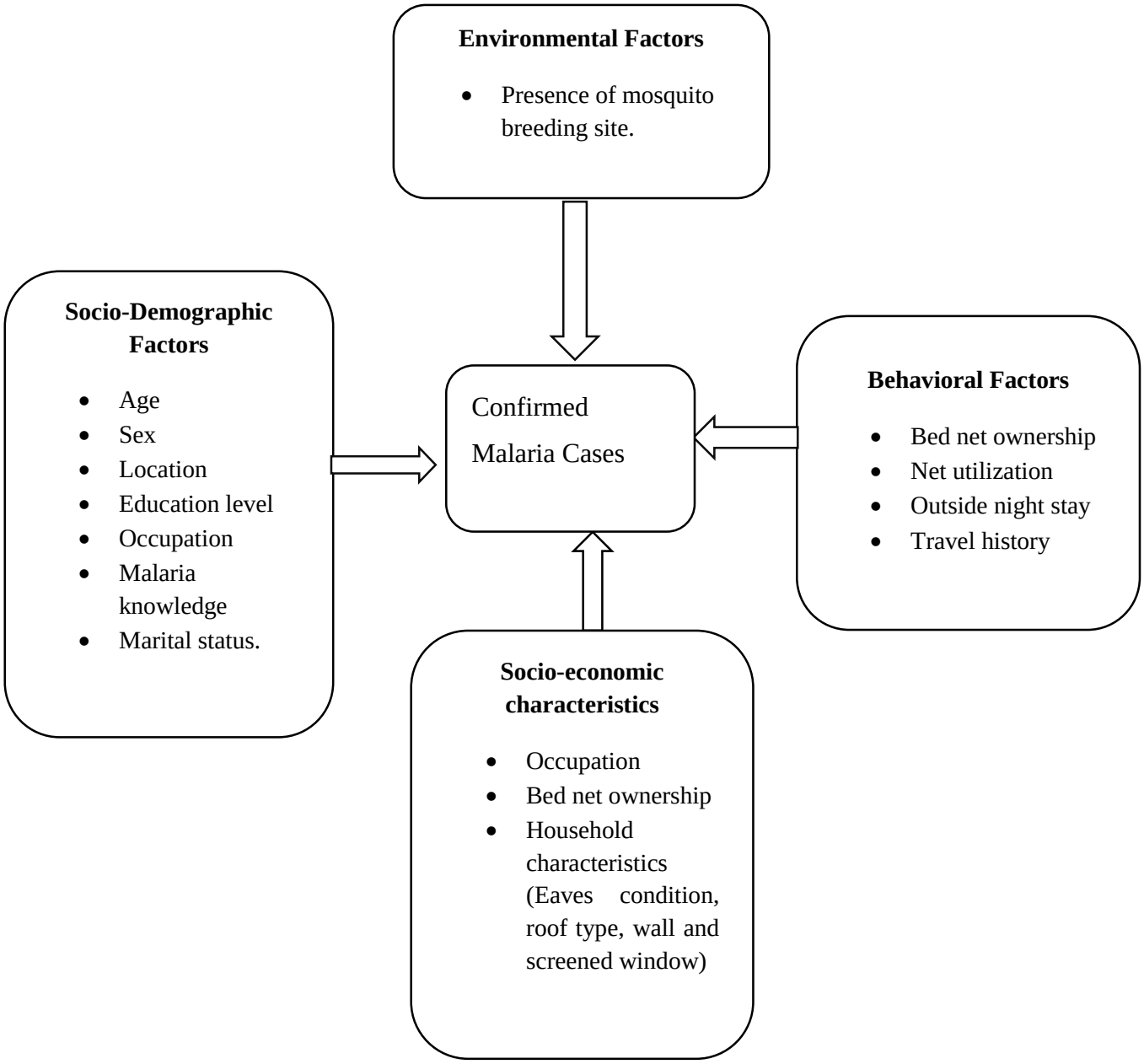


Figure 1: A conceptual framework for risk factors of malaria (designed by Fatma Juma)

Malaria is associated with number of risk factors, including socio-demographic factors, socio-economic factors, behavioral risk factors and environmental risk factors. The occurrence of malaria disease is influenced by socio-demographic factors such as age sex, location, marital status and education. Additionally, socioeconomic characteristics such as occupation, bed net ownership and housing characteristics (presence of eaves, window mesh/ window screen, roof type and wall) which in turn influence the decrease or increase in malaria transmission. Malaria is highly correlated with behavioral risk factors such as bed net ownership, net utilization, staying outside during night and travel history. Also Environmental risk factor such as presence of breeding sites is highly influencing malaria transmissions.

1.4 Rationale

This study was designed to establish key risk factors associated with persistent malaria transmission in Magharibi B district. The risk factors identified will help in planning for the evidence–based interventions in malaria hotspot shehias to reduce malaria incidence. This study was also highlighted on specific interventions based on the risk factors identified in hotspot shehias for effective malaria elimination. Also, the findings will provide insight to ZAMEP and other stakeholders on proper resource allocation to reach malaria elimination.

1.5 Research Questions

Broad Question

What are the factors associated with persistent malaria transmissions in hotspot shehias in Magharibi B district?

Specific Questions

1. What are the socio-demographic characteristics of malaria cases/controls in the hotspot shehias in Magharibi B District?
2. What are the Socio-Economic factors associated with persistent transmission in hotspot Shehias of Magharibi B District?
3. What are the behavioral factors associated with persistent malaria transmission in Magharibi B District hotspot Shehias?
4. What are the environmental factors associated with persistent malaria transmission in Magharibi B District, Zanzibar?

Qualitative research question

Why is persistent malaria transmissions observed in Magharibi B hotspot Shehias?

1.6 Objectives

Main Objective

To determine factors associated with persistent malaria transmission in hotspot Shehias in Magharibi B District in Zanzibar

Specific Objectives

1. To identify the socio-demographic characteristics associated with persistent malaria transmission in hotspot shehias of Magharibi B District Zanzibar.
2. To assess the socio-economic factors associated with persistent malaria transmission in hotspot shehias of Magharibi B District, Zanzibar.
3. To determine behavioral factors associated with persistent malaria transmission in hotspot shehias in Magharibi B District Zanzibar.
4. To assess environmental factors associated with persistent malaria transmission in Magharibi B District hotspot shehias, Zanzibar.

Qualitative Objectives

To explore factors that influences persistent malaria transmission in Magharibi B District hotspot Shehias.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Socio-demographic Factors in Malaria Hotspot Shehias

Location

The research carried out in Zanzibar has highlighted a significant prevalence of malaria cases specifically in the urban western region of Unguja Island. This finding underscores the public health challenges faced in this area, where the incidence of malaria appears to be particularly pronounced (1). Meanwhile, a separate investigation conducted in Uganda has shown a noteworthy association between recent overnight travel and a rise in malaria cases within urban environments. This suggests that individuals who travel frequently, even for short durations, may be at an elevated risk of contracting malaria, thereby contributing to the overall increase in cases observed in city settings (10). Together, these studies shed light on the complex dynamics of malaria transmission in urban areas, emphasizing the need for targeted interventions and preventive measures in regions where the disease remains a pressing concern.

Sex

Male have been found to have a higher proportion of malaria cases compared to women, this fact is found to be associated with travelling behavior among male(11). However, the other study that assessed travel to mainland Tanzania as risk factor for malaria and further transmission in Zanzibar show the number of malaria cases with recent travel among men and women was almost the same (12). These findings contradict the findings obtained from cohort study conducted in Myanmar where female has higher proportion of malaria cases compared to male however the selection of cohort in female sex seemed to dominate the male sex therefore the malaria prevalence seemed higher in females than males.

Age

Additionally, malaria transmission in Zanzibar is higher in age groups from 15 years and above. These findings are supported by the study conducted in Mizoram, Northern East of India

whereby the proportion of malaria cases was found in people from the age of 15 years and above (13).

Malaria knowledge

The findings of the study conducted in Zanzibar indicated that there was no association between being infected with malaria and possessing limited knowledge about the disease (14). This finding contrasts with a previous study conducted in Mexico, where it was demonstrated that individuals with low to moderate levels of knowledge about malaria were more susceptible to contracting the disease (15). In addition to that, a case-control study conducted in China-Myanmar border shows there is no association between having malaria knowledge and malaria transmission however, the proportion of malaria knowledge among cases was lower compared to that of controls (16). Therefore it is very important to address malaria knowledge in high and low malaria endemic areas for effective reduction of malaria transmission.

2.2 Socio-economic factors in malaria hotspots

Socio-economic status of the household is considered as an important factor for malaria transmission. Malaria is a disease known to affect low-income people with poor socio-economic status due to poor access to malaria treatment, preventive measures and living in malaria risk areas (17). Several studies revealed that European countries which are known as developed nations with improved socio-economic status have rare malaria outbreaks and made it possible to sustainable malaria elimination despite being receptive to imported cases, wealth, urbanization, as well as life expectancy, were the significant drivers of malaria elimination in these European Nations. (18). Another study conducted in Hainan China, added that a decline in malaria incidence among farmers was due to socio-economic development that resulted in reduced breading sites (19). Additionally, households of low to moderate economic status were found to be at higher risk of malaria compared to households of highest economic status (20). Poor housing was among the risk factors where houses that were built with mud and thatched roofs were at higher risk compared to individuals with similar socio-economic status but live in better houses (20,21). Also, a study on malaria epidemiology conducted in rural Southern Tanzania found out the highest parasitemia was observed in the poor communities with poor

settlements compared to the least poor communities with improved urban settlements in which the lowest parasitemia was observed (22). Another survey conducted in Tanzania found that livestock, house quality and open eaves were among the contributing factors for malaria infections in children in North Western Tanzania (23). Given these findings, it becomes evident that addressing socio-economic status is crucial for malaria elimination efforts, as it significantly impacts communities with lower socio-economic standing.

2.3 Behavioral factors in Malaria Hotspot Shehias

Travel history

The study conducted in Zanzibar indicated that travelling outside of Zanzibar poses a higher risk of contracting malaria (14). Travelling to Tanzania mainland was found to be associated with increased odds of getting malaria infections. However, travelling within Zanzibar itself was not associated with any increased risk of malaria transmission (24). This may be attributed to the fact that Tanzania mainland has a higher prevalence of malaria transmission compared to Zanzibar. Additionally, a good transportation network established in Zanzibar specifically ferry travel, fishing and trading are likely to be the most risky pathway for importation of malaria infections (25). These findings are supported by a study conducted in China, which demonstrated that an increase in travel to countries with endemic malaria leads to a continuing presence of imported cases of malaria in non-endemic countries (26).

The transfer of malaria parasites from regions where the disease is common to regions where it is not prevalent has been observed in various locations. A recent case-control study conducted in China revealed that the introduction of malaria in China was significantly associated with individual overnight stays in Myanmar one month before health facility visits, where there is high malaria endemicity (16). Additionally, the study conducted on Bioko Island by individuals travelling from mainland Equatorial Guinea, where transmission rates are significantly higher, poses a major obstacle to reducing the malaria burden on the island. The rate of malaria prevalence among boat passengers departing from the mainland was found to be higher than among passengers leaving Bioko Island (27). To successfully eradicate malaria, it is essential to address the importation of cases by promoting the importance of malaria screening and

chemoprophylaxis among individuals who have traveled to areas where the disease is prevalent (1,14).

Outside stay during night

The study conducted on China-Myanmar border revealed that outside stay during night time was significantly associated with malaria transmission (16). This is a study conducted in Bioko Island, Equatorial Guinea, where the *Anopheles gambiae* species, which previously primarily fed indoors, now has a more equal distribution between indoor and outdoor biting. This behavior change occurred after the implementation of mass coverage campaigns using indoor-insecticide interventions. Similar findings were observed in the study conducted in Zanzibar that participating in outdoor activities at night increased the likelihood of contracting malaria (14). This can be attributed to a change in mosquito behavior, as they have begun to bite more frequently outdoors rather than indoors (28).

The results of the study conducted in Zanzibar contradict the findings of a previous study carried out in Bioko (27), which did not find any evidence suggesting that spending time outdoors at night increases the risk of contracting malaria. Interestingly, the research in Bioko did show that more mosquitoes were captured by individuals positioned outside compared to those located inside. Given this discrepancy, it is essential to conduct additional research to obtain a thorough understanding of the connection between outdoor and indoor activities and the transmission of malaria. Further investigation is necessary to offer a conclusive explanation for the association between these factors and the probability of being infected with malaria (14,27).

Bed net ownership

The study conducted in Zanzibar found that, individuals who did not have a bed net were more likely to get malaria, but that net utilization was not significantly associated with malaria (14). This differs from other studies where net ownership and net utilization are associated with malaria reduction. A study done in Ghana revealed that having a bed net influences use which may lead to reduced transmission if all other factors are controlled (29). Bed nets act as a physical barrier, repel and kill mosquitoes when they contact a treated net (30,31).

2.4 Environmental Factors in malaria hotspot

The presence of malaria infections is strongly linked to the presence of breeding sites. Several studies indicated the association of presence of breeding sites and malaria transmission (16). On the other hand removal of mosquito breeding sites protects community with malaria transmission (32,33). Staying or working in environment with mosquito breeding sites such as forest and low altitudes increase the chance of getting malaria (11,16). Alternate weather conditions increases the risk of malaria, in Zanzibar high malaria transmission is observed during high rain seasons in March to July and November to January (1).

Presence of breeding sites around the houses is effective in malaria transmission with significant increase in malaria cases. These findings underscore the importance of context-specific interventions to address the complex dynamics of malaria transmission in hotspot areas.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study Area

Magharibi B district is located in Unguja Island at Mjini Magharibi region of Zanzibar. It is the highly populated district in Zanzibar and is estimated to have about 893,169 people contributing to 47.3% of the total population of Zanzibar as per census data of 2022 (34). There are about 34 shehias located in Magharibi B district. Shehias are the Zanzibar's lowest administrative unit where many of the public services are planned, managed and implemented including health issues. Magharibi B is presented with shehias that are continuously producing more than 5 cases per week, these shehias are commonly known as hotspot shehias (1). These hotspots include Chukwani, Fuoni kibondeni, Kiembe samaki, Kisauni, Mbweni, Mwanakwerekwe, Shakani and Tomondo

The hotspot shehias and the overall Magharibi B's climate are characterized by two main rainfall seasons; the primary season (March – May, called Masika) and secondary season (November-January, called Vuli); rainfall is at its lowest in July. Both rainfall seasons are followed by peak malaria transmission season, with the highest malaria case count typically observed in the March-May rainfall season (7).

3.2 Study Design

An explanatory sequential mixed method study design was conducted in Magharibi B district from April to May 2024. This study involved a matched case – control design in the quantitative part and Modified Grounded Theory at qualitative part of the study.

3.2.1 Case control study

A matched case-control study was conducted where cases were matched with three neighboring houses surrounding the malaria case. The exposure factors (socio-demographic, socioeconomic, behavioral, and environmental) between cases and controls were compared to assess their association with malaria cases in Magharibi B hotspot shehias.

3.3 Case Definition

A case

A case was any individual aged 15 years or older who resides in hotspot shehias in Magharibi B District who tested positive for malaria through MRDT or Microscope at health facility.

A control

Any individual above aged 15 years or older who tested negative through MRDT and is the neighbor of the index case and who opted to participate in the study.

3.2.2 Qualitative study design

A Modified Grounded Theory (MGT) was used in the qualitative part of the study. The Modified Grounded Theory is a method used for studying a particular phenomenon and discover new theories that are based on the collection and analysis of the real world data. In that case MGT was conducted to Magharibi B local residents with the aim of achieving profound information on factors associated with persistent transmission of malaria.

3.4 Study Population

The study population included all people aged 15 years or older who live in the malaria hotspot Shehias in Magharibi B District, Zanzibar 2024. Neighbors aged 15 years or older who agreed to participate were included in the study.

3.5 Sampling Method

3.5.1 Case-control study: Sample Size Estimation

The sample size was calculated in Epi Info 7 for matched case-control, with the ratio of one malaria case to three controls.

The formula for calculating sample size in case-control study used is shown below:

$$n = \left(\frac{r+1}{r}\right)\frac{(p^*)(1-p^*)\left(z_\beta + z_\alpha\right)^2}{(p_1 - p_2)^2}$$

This formula was adopted from reviewed article by Charan and Biswas: Sample size calculations for different study designs (35) .

Where;

n = desired sample size

r = ratio of control to cases, 3 controls for 1 case.

p_1 = Proportion of exposed malaria cases to night activities was = 0.515

p_2 = proportion of exposed controls to night activities was 0.741

p* = average proportion of exposed = $(p_1 + p_2)/2$ = (0.515 + 0.741)/2 = 0.628

z_β = standard normal variate for power. A power of 80% will be selected which is 0.84

z_α = Standard normal variate for level of significance = 95% confidence level

$(p_1 - p_2)$ = Effect size (p_1 = proportion in cases, p_2 = proportion in controls)

The proportion of exposures for cases and controls were adopted from the study of individual risk factors for continued transmission (14). These proportions were selected as they were significant risk factors that provided the higher sample size during sample size calculation compared to other risk factors obtained in that study.

$$n = \left(\frac{3+1}{3}\right)\frac{(0.628)(1-0.62)(0.84\ +0.05)^2}{(0.515-0.741)^2}$$

n = 144.

According to the formula, the total sample size was 144 subjects. The study enrolled participants in a ratio of 1:3, resulting in 36 participants being malaria cases and 108 being controls, making up the total of 144 participants recruited for the study.

All hotspot Shehias from Magharibi B District were included in the study. A purposive sampling method was used to select neighbor controls of the index cases. Any local malaria case notified from a health facility through the coconut surveillance system was followed up with the household and interviewed until the required sample size was achieved.

2.5.2 Sampling in Qualitative study

Participants who did not take part in the case-control study were purposively selected to participate in the Focus Group Discussions (FGDs). The Shehia leaders from the hotspot Shehias were asked to organize approximately 8 to 9 participants from their respective Shehias who were willing to join the focus group discussions. Until data saturation was reached, a total of six FGDs were conducted: five involving residents from hotspot Shehias and one involving District Malaria Surveillance Officers (DMSOs) from Magharibi B District.

To ensure data representation, participants were selected from hotspot shehias including Chukwani, Kiembe samaki, Fuoni kibondeni, Mbweni, and Tomondo. Each FGD comprised both males and females, and discussions continued until key findings were consistently repeated.

Inclusion Criteria

For quantitative study: All individuals aged 15 years or older in Magharibi B hotspot shehias who tested positive for malaria in the health facility were included in the study. Neighbors of the index case who tested negative and consented to participate were also included.

For qualitative study: Any resident from Magharibi B District hotspot Shehia aged 15 years or older was included in the study.

Exclusion Criteria

Any malaria case below 15 years of age or malaria cases aged 15 years or older in Magharibi B hotspot Shehia who was hospitalized, or any malaria case who had traveled from outside Magharibi B District the previous night, and those who did not consent to participate were excluded from the study.

3.6 Variables

Dependent variable

The dependent variable of this study is malaria cases.

Independent variables

i. Socio-demographic variables included age, sex, marital status, education level, malaria knowledge and occupation.
ii. Socio-economic variables included Occupation, bed net ownership and housing condition (type of roof, presence of eaves, presence of window screen and type of walls).
iii. Behavioral variables included travel history, outside night activities, net utilization, and bed net ownership.
iv. Environmental variable included the presence of mosquito breeding sites.

3.7 Data Collection Procedures

Case-control Study

3.7.1 Identifying Socio-demographic Characteristics Associated with Persistent Malaria Transmission in Hotspot Shehias

Socio-demographic characteristics were collected using an interviewer-administered questionnaire. Respondents (cases and their controls) provided information on their age, sex, residence, level of education, occupation, and marital status. Malaria knowledge was assessed through multiple-choice questions covering transmission, signs/symptoms, risk activities, treatment, preventive measures, and awareness. Each correct answer scored one point; incorrect answers received zero points. Scores were added, converted to a percentage, and a mean cutoff of 50% was set: ≥50% indicated good knowledge; <50% indicated poor knowledge (36).

3.7.2 Assessing Socio-economic Characteristics Associated with Persistent Malaria Transmission in Hotspot Shehias

Socioeconomic characteristics were gathered through interviews by asking about the occupation of the study participants, bed net ownership and housing condition. Information on housing condition (window materials, eaves condition, type of roof, type of walls, and presence of window screens) was collected using a checklist (6, 19).

3.7.3 Identifying Behavioral Risk Factors Associated with Persistent Malaria Transmission in Hotspot Shehias

Behavioral risk factors included ownership and use of bed nets, outdoor night stays, and travel history from outside Magharibi B, district in Zanzibar within 30 days preceding data collection, which was collected through interviews.

3.7.4 Identifying Environmental Risk Factors Associated with Malaria Transmission in Hotspot Shehias

Environmental factors were assessed through direct observation using a standardized checklist. The assessment included observing the presence of mosquito breeding sites, with one of the following criteria; stagnant water, presence of tires, swamp, bushes and lakes around the houses of the cases and controls.

3.8 Data Collection in the Qualitative Study

Five FGDs, comprising 8 to 9 participants from hotspot Shehias (including both males and females) and one FGD involving District Malaria Surveillance Officers (DMSOs) from Magharibi B were conducted. FGD venues were arranged by Shehia leaders or residents. Before data collection, participants received a brief introduction to the study's aims and other pertinent information.

During the discussions, an open-ended questionnaire was used, and probe questions were applied based on the participants' responses. Voice recorders captured all responses and Swahili language was used throughout the discussion. Also, participants were arranged in circles to enhance communication. Identification numbers were used to represent participants’ identities during discussions (for example, the first speaker was labeled "participant number one"). Personal information such as age, sex, and education level was recorded in notebooks.

FGDs were held close to participants' homes for convenience, lasting approximately 60 minutes each. Discussions continued until data saturation, characterized by repeated themes in participant responses.

Data collected included socio-demographic characteristics (e.g., sex, occupation, location) of those affected by malaria, perceptions of malaria risk factors, knowledge of malaria causes, transmission modes, and prevention methods. Socio-economic conditions, housing conditions, and behaviors influencing malaria risk were also explored. Participants shared experiences regarding bed net ownership, usage, nighttime activities, and reasons for their behaviors. Environmental conditions such as breeding site availability, mosquito presence, and waste disposal practices were also discussed in relation to malaria transmission from hotspot shehias.

3.9 The Research Tools

A structured questionnaire and observation checklist were utilized for data collection. These tools were developed in Kobo and shared with District Malaria Surveillance Officers (DMSOs) for data collection. Smartphones were used to record voices during FGDs. Additionally, each DMSO responsible for their respective shehia, where malaria case follow-ups were conducted, served as a research assistant during the data collection process.

The questionnaire was initially developed in English and then translated into the participants' mother tongue (Swahili). The same questionnaire and checklist were used to interview both cases and controls. Case questionnaires were coded in relation to their respective controls. A checklist was also developed and used as a guide for direct observation during data collection. The TMIS 2017 served as a guiding tool for developing the study questionnaire and checklist, particularly for socioeconomic characteristics and malaria knowledge.

Cases were identified through daily notifications of malaria cases from health facilities using the malaria case-based surveillance system, known as the coconut surveillance system. This system categorizes malaria cases as either imported or local based on travel history information collected at health facilities. Therefore, local malaria cases located in Magharibi B hotspot Shehias were enrolled in the study. Controls were identified from the next neighboring houses of the local malaria case. One member from each neighboring house of the case who had the eligibility criteria was selected for the data collection.

The researcher accompanied District Malaria Surveillance Officers during routine case follow-ups at the households of index cases. Cases were interviewed, and controls were selected and interviewed subsequently. The household environment was observed for both cases and controls.

Risk factors contributing to persistent malaria transmission assessed in the study included socio-demographic characteristics, socioeconomic factors, behavioral factors, and environmental conditions.

3.10 Validity and Reliability

After being tested for comprehensibility and completeness, the questionnaire and checklist were used for data collection. DMSOs served as research assistants during the data collection process. Prior to data collection, these assistants underwent training on interviewing study participants and familiarizing themselves with the tools through pre-testing and actual data collection.

3.11 Data Analysis

3.11.1 Data Management and Analysis for Case-Control Study

The data were extracted from Kobo Collect and saved in Microsoft Excel spreadsheet (XLS) format. The data were meticulously reviewed in Microsoft Excel to identify inconsistencies, incompleteness, and duplicated entries. Corrective measures were promptly taken upon detection of such issues. Non-essential information for analysis, such as case and control identification, date of data collection, name, and phone number of the research assistant, was promptly deleted. Cases were paired with their controls to form Pair ID. The cleaned data were then imported into STATA statistical software for further analysis. In the STATA software, a multi – collinearity test was conducted to remove any potential variables with multicollinearity. In the Multivariable analysis, variables with a P-value ≤ 0.05 at a 95% confidence interval were considered statistically significant.

Socio-demographic Characteristics of Study Participants

Demographic characteristics were presented as frequencies and proportions for categorical data. Chi-square P-value ≤ 0.2 was set as a cut-off point for socio-demographic characteristics that were included in a bivariate conditional logistic regression model to analyze their association with the study outcome.

Socio-demographic Characteristics of Study Participants associated with Malaria Cases in Magharibi B Hotspot Shehia

Socio-demographic characteristics with a Chi-square P-value ≤ 0.2 were entered into a bivariate analysis. Variables with a P-value ≤ 0.2 in the bivariate conditional logistic regression model were further taken to a multivariate conditional logistic regression model. Socio-demographic characteristics with a P-value ≤ 0.05 at a 95% confidence interval were considered statistically significant.

Socio-economic Characteristics of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia

Socioeconomic characteristics were initially assessed in a bivariate analysis. Variable such as type of wall was dropped due to multicollinearity, and variables with a P-value ≤ 0.2 were included in a multivariate conditional logistic regression model to analyze their association with the study outcome and controlling for potential confounders such as age and sex. Other socio – economic characteristics with a P-value ≤ 0.05 at a 95% confidence interval were considered statistically significant.

Behavioral Factors of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia

Behavioral factors were first examined in a bivariate logistic regression model. Variables with a P-value ≤ 0.2 were included in a multivariate conditional logistic regression model to assess their association with the study outcome and adjusting with other variables and possible confounders such as age and sex. Behavioral factors with a P-value ≤ 0.05 at a 95% confidence

interval were deemed statistically significant for persistent malaria transmission in the hotspot shehia.

3.11.2 Data Management and Analysis for Qualitative Study

Audio-recorded data from FGDs were transcribed verbatim and analyzed using modified grounded theory (37). During the analysis process, data were systematically coded, and codes that were deemed insignificant or imprecise were excluded from the analysis. Memos explaining the concept behind the codes were generated. Codes with similar meanings were grouped to form themes that provided a comprehensive understanding of factors influencing persistent malaria transmission in Magharibi B district, Zanzibar. The findings from FGDs were used to complement quantitative results where applicable, strengthening the study's findings.

3.12 Ethical Issues

This study received ethical approval from the MUHAS Ethical Review Board. Following approval, the proposal was submitted to the Second Vice President's Office of Zanzibar for a data collection permit. Additionally, reviews and permits were obtained from the Zanzibar Health Research Institution (ZAHRI) and the Chief Government Statistician's Office of Zanzibar. Permission to access malaria data was granted by ZAMEP. Letters of permission were also sent to the Magharibi B District Medical Officer's office (DMO) and shehia leaders of the respective areas for the data collection process. Research participants were provided with consent forms to ensure voluntary participation in the study.

Participants did not receive financial compensation but benefited from health education on malaria transmission. Study results provided insights to the government, specifically the Ministry of Health and ZAMEP, regarding risk factors associated with persistent malaria transmission in Magharibi B district, facilitating appropriate intervention planning to curb transmission.

Participants faced no direct or indirect harm or risk and were free to withdraw from the study at any time. To ensure confidentiality, participants' names were not included in data collection tools; instead, tools were coded based on participant identification numbers (IDs). Participant information remained confidential within the data collection team and was not disclosed outside of the study.

CHAPTER FOUR

4.0 RESULTS

4.1 Quantitative Analysis

4.1.1 Distribution of the study participants

A total of 144 participants were recruited for the study. Among them 36 were confirmed malaria cases and 108 controls. Majority 68.1% (98/144) of the participants were males. Almost half 47.2% (68/144) of the participants were between 25 to 34 years. Participant with secondary education or above were 75.0% (108/144). Participants with good knowledge of malaria were 95.1% (137/144) and most of the participants were married 64.6% (93/144). Majority of the study participant were from Kiembe samaki shehia 24.3% (35/144) **(Figure 2).**

Males accounted for 69.4% (25/36) of malaria cases, and the majority of cases 44.4% (16 /25) were found in individuals aged between 15-24 years. Majority of the cases 75% (27/36) reported to have secondary education and above and 94.4% (34/36) had high knowledge of malaria. Employed cases accounted for 72.2% (26/36) and in the marital status, malaria cases who were married were 50% (18/36). **(Table 1**)

Table 1: Socio-demographic distribution of participant's characteristics

Characteristics	Cases n=36 (%)	Controls n=108 (%)	Total N=144 (%)	Chi – square P-value
Age Groups				
15 – 24	16 (44.4)	22 (20.4)	38 (26.4)	
25 – 34	13 (36.1)	55 (50.9)	68 (47.2)	
35 and above	7 (19.4)	31 (28.7)	38 (26.4)	0.018
Sex				
Male	25 (69.4)	73 (67.6)	98 (68.1)	
Female	11 (30.6)	35 (32.4)	46 (31.9)	<0.001
Level of education				
Below secondary	9 (25)	27 (25)	36 (25)	
Secondary and above	27 (75)	81 (75)	108 (75)	1.0
Malaria knowledge				
Poor knowledge	2 (5.6)	5 (4.6)	7 (4.9)	
Good knowledge	34 (94.4)	103 (95.4)	137 (95.1)	0.82
Marital status				
Single	18 (50.0)	33 (30.6)	51 (35.4)	
Married	18 (50.0)	75 (69.4)	93 (64.6)	0.035
Occupation				
Employed	26 (72.2)	67 (62.0)	93 (64.6)	
Students	8 (22.2)	4 (3.7)	12 (8.3)	
Unemployed	2 (5.6)	37 (34.3)	39 (27.1)	<0.001

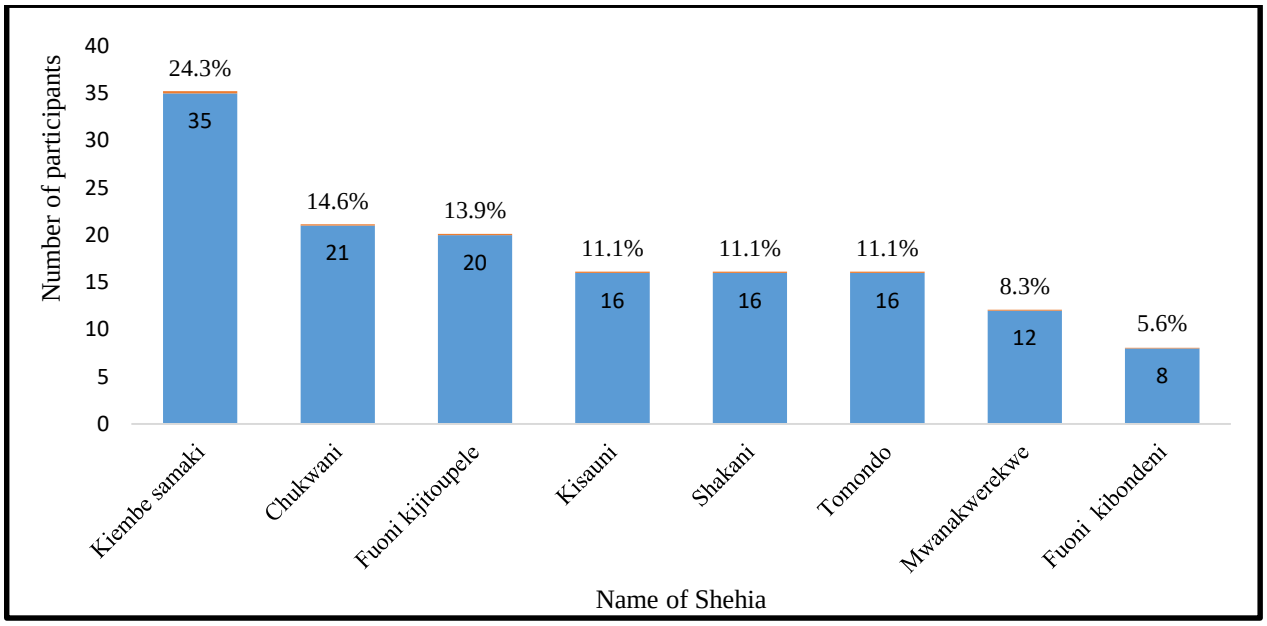


Figure 2: Distribution of the study participants per Shehia

4.1.2 Association of socio-demographic characteristics and the risk of malaria

In the bivariate analysis, age groups between 15 and 24 years were three times more likely to get malaria (cOR=3.15; 95% CI 1.12 – 8.89). Males were seven times more likely to get malaria than females (cOR= 7.37; 95% CI 2.47– 22.04). In terms of marital status, singles were two times more likely to get malaria (cOR=2.18; 95% CI 1.02 – 4.64). Students were seventy-eight more likely to get malaria (cOR=78.42; 95% CI 6.46 – 951.40), and employed individuals were almost six times more likely to get malaria (cOR=5.76; 95% CI 1.33 – 24.93).

After adjusting for confounders and other variables, age groups between 15 and 24 were two times more likely to get malaria (aOR = 2.15; 95% CI 0.37 – 11.62), also age group between 25 and 34 were 1.07 time more likely to get malaria (aOR = 1.07; 95% CI 0.32 – 3.67). Additionally males were almost three times more likely (aOR = 2.62, 95% CI 0.57– 12.07), single individuals were 0.6 less likely to get malaria (aOR = 0.60; 95% CI 0.16 – 2.29). More over employed individuals were almost two times more likely to get malaria (aOR = 1.77; 95% CI 0.31 – 9.85) while students were thirteen times more likely to get malaria (aOR = 13.17; 95% CI 0.73 – 236.32), the associations were not statistically significant (Table2).

Table 2: Socio-demographic Characteristics of Study Participants associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

Characteristics	Cases n=36 (%)	Controls n=108 (%)	Total N=144(%)	Bivariate cOR (95% CI)	P-value	Multivariate aOR (95% CI)	P-value
Age Groups (years)							
15 – 24	16 (44.4)	22 (20.4)	38 (26.4)	3.15 (1.12 – 8.89)	0.03	2.15 (0.39 – 11.62)	0.37
25 – 34	13 (36.1)	55 (50.9)	68 (47.2)	1.09 (0.40 – 2.90)	0.86	1.074 (0.31 – 3.67)	0.91
≥35	7 (19.4)	31 (28.7)	38 (26.4)		REF		
Sex							
Male	25 (69.4)	73 (67.6)	98 (68.1)	7.37 (2.47 – 22.04)	<0.001	2.62 (0.57 – 12.07)	0.21
Female	11 (30.6)	35 (32.4)	46 (31.9)		REF		
Marital status							
Married	18 (50.0)	75 (69.4)	93 (64.6)		REF		
Single	18 (50.0)	33(30.6)	51 (35.4)	2.18 (1.02 – 4.64)	0.04	0.61 (0.16 – 2.29)	0.46
Occupation							
Employed	26 (72.2)	67 (62.0)	93 (64.6)	5.76 (1.33 – 24.93)	0.019	1.77 (0.31– 9.85)	0.51
Students	8 (22.2)	4 (3.7)	12 (8.3)	78.42(6.46– 951.40)	0.001	13.17 (0.73 – 236.32)	0.08
Unemployed	2 (5.6)	37 (34.3)	39 (27.1)	Ref	REF		

4.1.3 Socio-economic Characteristics of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

In bivariate analysis results shows that employed individuals were almost six times more likely to get malaria (cOR = 5.76, 95% CI 1.33 – 24.93) while students were seventy eight times more likely to get malaria (cOR = 78.42, 95% CI 6.46 – 951.40). Also individual who own bed net were almost two times more likely to get malaria (cOR = 1.88; 95% CI 0.70 – 5.03). In terms of household conditions, there were no association in getting malaria and living in a house with no window screen (cOR = 1.0; 95% CI 0.39 – 2.55), additionally, individual with thatched roof were three times more likely to get malaria (cOR = 3; 95% CI 0.19 – 47.96) and individuals with open eaves were less likely to get malaria (cOR = 0.51; 95% CI 0.20 – 1.27).

After adjusting with other variables the employed individuals were almost two times more likely to get malaria (aOR = 1.77; 95% CI 0.31 – 9.85) while students were thirteen times more likely to get malaria (aOR = 13.35; 95% CI 0.73 – 236.32). In term of housing conditions, houses with open eaves were 0.87 less likely to produce malaria cases (aOR = 0.85; 95% CI 0.25 – 2.87) however the likelihood of getting malaria in household conditions were not statistically significant **(Table 3).**

Table 3: Socio-economic Characteristics of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

Variables	Cases n=36 (%)	Controls n=108(%)	Total N=(144)	Bivariate cOR (95% CI)	P-value	Multivariate aOR(95% CI)	P-value
Occupation							
Employed	26 (72.2)	67 (62.0)	93 (64.6)	5.76 (1.33 – 24.93)	0.019	1.77 (0.31– 9.75)	0.51
students	8 (22.2)	4 (3.7)	12 (8.3)	78.42(6.46– 951.40)	0.001	13.17 (0.73 – 236.32)	0.08
Unemployed	2 (5.6)	37 (34.3)	39 (27.1)		REF		
Bed net ownership							
No bed net	19 (52.8)	47 (43.5)	66 (45.8)	1.88 (0.70 – 5.03)	0.209		
Have bed net	17 (47.2)	61 (56.5)	78 (54.2)	REF			
Eaves							
Not closed	13 (36.1)	52 (48.1)	65 (45.1)	0.51 (0.20 – 1.27)	0.149	0.85 (0.25 – 2.87)	0.79
Closed	23 (63.9)	56 (51.9)	79 (54.9)	REF			
Window screen							
Yes	21 (58.3)	63 (58.3)	84 (58.3)	REF			
No	15 (41.7)	45 (41.7)	60 (41.7)	1.0(0.39 – 2.55)	1		
Type of roof							
Iron roof	34 (94.4)	104 (96.3)	138 (95.8)	REF			
Thatched roof	2 (5.6)	4 (3.7)	6 (4.2)	3 (0.19 – 47.96)	0.437		

4.1.4 Behavioral Factors of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

In the bivariate analysis, individuals who spent their night time outdoor were almost eight times more likely to get malaria (cOR = 7.65; 95% CI 2.48 – 23.56). Also individuals who do not have bed net were almost two times more likely to get malaria (cOR = 1.88; 95% CI 0.70 – 5.03) and those who do not sleep under mosquito net were 1.5 times more likely to get malaria (cOR = 1.52; 95% CI 0.62 – 3.76). Moreover, individuals who travelled outside Magharibi B district were two times more likely to get malaria (cOR = 2.05; 95% CI 0.61– 6.90) .

After adjusting with confounders and other variables, individuals who spent their time outdoor were almost five times more likely to get malaria (aOR = 4.73, 95% CI 1.04 – 23.35) (**Table 4).**

Table 4: Behavioral Factors of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

Variables	Cases n=36(%)	Controls n=108(%)	Total N=144(%)	Bivariate cOR (95% CI)	P-value	Multivariate aOR (95% CI)	P-value
Night stay							
Outdoor	23 (63.9)	35 (32.4)	58 (40.3)	7.65(2.48–23.56)	< 0.001	**4.73 (1.04–23.35)**	**0.05**
Indoor	13 (36.1)	73 (67.6)	86 (59.7)	REF		REF	
Having bed net							
No bed net	19 (52.8)	47 (43.5)	66 (45.8)	1.87 (0.70 –5.02)	0.209		
Have bed net	17 (47.2)	61 (56.5)	78 (54.2)	REF			
Net utilization							
Not using	22 (61.1)	58 (53.7)	80 (55.6)	1.52 (0.61–3.75)	0.361		
Using	14 (38.9)	50 (46.3)	64 (44.4)	REF			
Travel outside Magharibi B district							
Yes	5 (13.9)	8 (7.4)	13 (9.0)	2.05(0.61–6.90)	0.245		
No	31 (86.1)	100 (92.6)	131(91.0)	REF			

4.1.5 Environmental Factors of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

In a bivariate analysis the likelihood of contracting malaria were almost six times higher (cOR = 5.85; 95% CI 1.65–20.72) in areas where mosquito breeding sites were observed around study participant's houses. After adjusting with confounders and other variables, the likelihood of contracting malaria were almost five times higher in areas where mosquito breeding sites were observed around study participant's houses (aOR = 4.48; 95% CI 1.04–19.27) **(Table 5)**.

Table 5: Environmental Factors of Study Participants Associated with Malaria Cases in Magharibi B Hotspot Shehia, Zanzibar

Variables	Cases n=36(%)	Control n=108(%)	Total N=144(%)	Bivariate cOR(95% CI)	P-value	Multivariate aOR (95% CI)	P- value
Presence of mosquito breeding site							
Yes	33 (91.67)	73 (67.59)	106(73.61)	5.85(1.65- 20.72)	0.006	**4.48(1.04 – 19.27)**	**0.04**
No	3 (8.33)	35 (32.40)	38 (26.38)	**REF**			

Qualitative Results

Characteristics of the study participants

A total of 48 individuals from five hotspot Shehias in Magharibi B District participated in the study. Six Focus Group Discussions (FGDs) were conducted, comprising five FGDs with local residents from the hotspot Shehias and one group with District Malaria Surveillance Officers (DMSOs) who are responsible for malaria case follow-up in Magharibi B hotspot Shehias. Participants in the FGDs ranged in age from 19-61 years. The majority of study participants were male 64.6% (31/48) with 45.8% (22/48) aged between 15 -24 years, and 87.5% (42/48) having secondary education or higher. The FGDs took place in Chukwani, Fuoni kibondeni, Kiembe samaki, Mbweni, and Tomondo shehias. Each FGD included approximately 9 participants, while the DMSO focus group discussion involved three DMSOs responsible for malaria surveillance in Magharibi B district **(Table 6).**

Table 6: Socio demographic characteristics of the study participant in Magharibi B hotspot Shehias

Characteristics	Frequency (N= 48)	Percentage
Sex		
Male	31	64.6%
Female	17	35.4%
Age		
15-24	22	45.8%
25-34	19	39.6%
35 and above	7	14.6%
Level of education		
Below secondary	6	12.5%
Secondary and above	42	87.5%

Research themes

1. Theme 1: Socio-demographic influence malaria transmission among Magharibi B community
2. Theme 2: Human behaviors contribute to malaria transmission.
3. Theme 3: Socio-economics characteristic influences malaria transmission in Magharibi B District.
4. Theme 4: Environmental contribution to malaria infection in Magharibi B District.

1. Theme 1: Socio-Demographic Influences on Malaria Transmission Among the Magharibi B Community

Malaria transmission was noted to be more prevalent among adolescent and young adult males aged 16 to 35. It was explained that males are often engaged in nighttime activities that keep them outdoors, such as night shift jobs, watching TV, chatting, or using free WiFi. Many participants mentioned these activities as influential aspects for men and young adults to spend time outside at night hours.

"*Adolescents and young adults, especially males aged 16 to 35, are the most affected by malaria. We spend much of our night outside, either watching TV, chatting with friends, or using free WiFi. Some of us work night shifts like security guards, mechanics, or fishermen." (Male, Age 30, Chukwani)*

Additionally, it was mentioned that malaria transmission varies between shehias in Magharibi B district, with some like Chukwani, Mbweni, and Kiembe Samaki reporting higher cases due to mosquito-friendly conditions created by improper waste disposal.

"*Some areas have higher infection rates due to environmental factors like stagnant water in discarded cans, tires, and overgrown bushes which attract mosquitoes." (Male, Age 37, Magharibi B)*

While many participants were knowledgeable about malaria causes, transmission, and prevention, others mentioned malaria is caused by weather changes or overwork. Some believed certain blood groups were more prone to infection.

"*It's not just mosquitoes; some believe changing weather or overworking causes malaria. People from colder areas may get fever when they move to hot climates." (Male, Age 20, Chukwani)*

Moreover, misconceptions about malaria's prevalence in Zanzibar led some residents to neglect prevention measures, potentially contributing to increased transmission.

"*There's a misconception that malaria has greatly decreased in Zanzibar, but even a slight decrease can escalate if precautions aren't taken seriously. That's the real issue." (Male, Age 50, Tomondo)*

2. Theme 2: Human Behaviors Contributing to Malaria Transmission

Addiction to social media, staying out late at Maskani, and watching TV were commonly quoted activities during nighttime. Adolescent and young adult males were particularly famous for late-night TV watch and socializing outdoors until dawn.

"We tend to stay out late, chatting and browsing on social media platforms like TikTok and Instagram until 2 or 3 am. If there's WiFi, we might stay out even longer. If security doesn't kick us out, we'd probably sleep outside." (Male, Age 20, Kiembe Samaki)

Traveling to mainland Tanzania was also identified as a significant factor contributing to malaria transmission. Participants stressed on the need for testing travelers for malaria upon return to prevent local transmission.

"*Many people travel to places with high malaria rates. When they return without proper testing at entry points, they can easily spread malaria if infected mosquitoes bite them." (Female, Age 30, Fuoni Kibondeni)*

3. Theme 3: Socio-economic Characteristics Contributing to Malaria Transmission in Magharibi B District

Participants emphasized that economic status and housing conditions play crucial roles in malaria infections. Poorly constructed or maintained houses with inadequate sanitation facilities were identified as mosquito breeding sites. In Tomondo, houses lacking eaves or with damaged wire mesh allowed mosquitoes easy access.

"Our poorly built houses, with open eaves and damaged wire mesh, provide perfect entry points for mosquitoes. Even if we sleep under nets, mosquitoes still find us in the living room watching TV or chatting." (Female, Age 26, Fuoni Kibondeni)

Low-income earners, often engaged in outdoor occupations like motorcycle taxis (bodaboda), construction, or retail, were highlighted as particularly vulnerable due to their exposure to mosquito bites during night shifts.

4. Theme 4: Environmental Contribution to Malaria Infection in Magharibi B District

Participants noted environmental factors such as dense bushes, discarded tires, and improper waste disposal as significant contributors to mosquito breeding. Water bodies like Ziwa Maboga in Tomondo were identified as breeding sites for mosquitoes, worsened by drains from households.

"Places like Ziwa Maboga and areas with overgrown bushes collect water, creating breeding grounds for mosquitoes." (Female, Age 31, Tomondo)

Other Themes Developed:

Community Perception on Malaria Prevention

Many participants admitted to not using mosquito nets regularly, especially men who often viewed it as unmanly. Some cited laziness or discomfort as reasons for not using Long-Lasting

Insecticidal Nets (LLINs), preferring alternative methods like mosquito repellents or simply covering themselves with bed sheets.

"Men often refuse to use mosquito nets, considering it a woman's thing. Some find it inconvenient or believe a bed sheet offers enough protection." (Male, Age 20, Mbweni)

Misconceptions on ITN Use

Misinformation regarding mosquito nets causing health issues such as impotence or itching frightened some from using them. Hygiene concerns and misconceptions about chemical treatments further discouraged LLIN use.

"Some avoid nets due to hygiene concerns or false beliefs about chemicals causing impotence. Itching after using nets also discourages us." (Male, Age 35, Tomondo)

CHAPTER FIVE

5.0 DISCUSSION

This study assessed socio-demographic factors, socio-economic factors and behavioral factors associated with persistent malaria transmission in Magharibi B district, Zanzibar. Our findings from matched case- control study show that, malaria affects more adolescent males. Also, engaging in outdoors activities during night time and presence of mosquito breeding sites were associated with increased odds of malaria cases for Magharibi B district. Other findings from Qualitative study mentioned housing standard, negligence and misconception of ITN were among the influencers of malaria transmission in Magharibi B district.

5.1 The socio-demographic characteristics associated with persistent malaria transmission

The study found that higher proportion of malaria cases were males, this finding was consisted with other studies conducted in Southern Tanzania, Saudi- Arabia and India that have reported males to be more at risk of contracting malaria infections (22,36,37). The reason for this finding could be due to engagement in night activities such as occupations, or socializing with friends. The FGD revealed that young men spend their evening and early hours at night outside, either using free Wi-Fi available near their house or congregate at Maskani chatting with friends or watching TV before going to bed. Studies conducted in Zanzibar showed that practicing risk behaviors such as staying outdoor during transmission peak hours and inadequate use of ITN were found to be more common in males than females (38)(38). Therefore emphasis should be put on reducing unnecessary outdoor activities and the use personal protective gears such as topical repellant, wearing long dresses and ITN use to this group to reduce malaria transmission among Magharibi B communities.

5.2 The socio-economic factors associated with persistent malaria transmission

The study found that there was no association between malaria transmission and Occupation. This findings indicates that transmission could be due to other activities such as staying outdoor

watching TV, WI-FI usage or chatting with friends/ neighbors. This findings contradict with studies conducted in China-Myenmar border and Thailand- Myenmar border, where by individual with limited financial income individuals were being said to engage in occupational activities away from home during night time at risk areas such as forests (11,16). Although there were no significant differences in malaria cases and controls in household characteristics in the quantitative part of the study, in the qualitative part of the study, the FGDs revealed individuals who live in poor housing conditions increased human exposure to mosquito bites as their house does not provide barrier for mosquitoes to enter the house. Previous studies conducted in Tanzania found higher risk of infection to middle and low socioeconomic status and those whose houses were built with mud wall thatched roofs (21,22). Low socio-economic conditions increase chances for malaria infection as people can't afford LLIN (32). Therefore improved socioeconomic status has impact in reducing malaria transmission (18,19). However, socio-economic characteristics has low influence on malaria transmission in Magharibi B hotspot, this is due to the fact that ZAMEP has a long term strategy of distributing LLIN for free and focal IRS implemented in hotspot shehias (7). This may have covered the gap between high income and low income people to afford malaria prevention measures therefore malaria transmission may be influenced by other factors like staying outdoor and environmental factors.

5.3 The behavioral risk factors associated with persistent malaria transmission

This study found that staying outdoors was a significant factor for persistent transmission of malaria. A retrospective case-control study conducted in China-Myenmar border identified factors like staying overnight away from houses were associated with an increased risk of malaria transmission (16). Several studies revealed outdoor activities contribute to increased malaria infections (11,14,33). Outdoor activities increase human proximity to mosquito bites. About 73 % of mosquito bites were estimated to occur outside the houses in Zanzibar (39). Outdoor activities like Wi-Fi usage, watching TV, or chatting with friends among young adults males have been highlighted to have higher contribution in malaria transmission (38). The finding from this study could be attributed to lack of taking preventive measures such as applying mosquito repellent or wearing long dresses when engaging in night activities to escape

mosquito bites. Although the results of this study did not show significant risk associated with not having or utilizing LLINs, the importance of bed net ownership or utilization cannot be underestimated. Numerous studies have demonstrated the significant impact that bed nets have in decreasing malaria transmission (13, 21, and 39). Travelling outside Magharibi B district was not found a significant factor in malaria transmissions, this finding may suggest that malaria transmission might be occurring within Magharibi B district. However previous studies have shown strong association between malaria transmission and travelling from other localities (27). As Zanzibar focus on malaria elimination, it is important to sensitize the use of topical repellant when staying outdoors that goes parallel to the ITN use to cut off malaria transmission.

5.4 The Environmental factors that are associated with persistent malaria transmission

Across the study areas, presence of mosquito breeding sites was highly significantly associated with malaria transmission in Magharibi B. This could be explained by improper disposal of cans, bottles, presence of bushes and a lot of tires, which provide potential habitat for mosquitoes to lay their eggs. Similar findings were reported in the study conducted in China – Myenmar border where streamlets were strongly associated with malaria transmission (16). During FGDs it was mentioned that high numbers of breeding sites have increased mosquito density in Magharibi B. Several studies found that the absence of breeding sites were found to be protective from malaria (32,33). In that case, the clearance of bushes and removal of potential habitats might reduce the burden of malaria in Magharibi B.

5.5 Limitations

The current study has a number of limitations. Due to limited data collection time the malaria distribution by season was not determined. Malaria transmission is affected by seasons within a year. Usually high malaria transmission occurs after the rainy seasons (1). To mitigate this, during data collection process, all local cases reported from Magharibi B hotspot shehias were recruited. Also, there was possibility of recall bias among controls, therefore a closed ended questionnaire was developed and checklist was used to minimize the recall bias during data collection.

Also, our study could not assess the level of income which may have significant influence on malaria transmission; therefore, we suggest further studies to focus on level of income and its contribution to malaria transmission.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The overall findings reveal that malaria cases were more dominant in males and in the age group of 15–24 years. The behavioral factors associated with malaria transmission was night outdoor activities. The environmental factors associated with malaria transmission included houses surrounded by mosquito breeding sites such as bushes and stagnant water due to improper disposal of cans, tires and bottles. These findings indicate that more effort on lava source management, sensitization on personal protective measures such as using topical repellant and ITN are required to improve malaria intervention and surveillance system.

6.1 Recommendations

Recommendations to Zanzibar Malaria Elimination Program

1. Target High-Risk Groups: Since males, adolescents at the age 15 – 24 and individuals engaging in outdoor activities face higher malaria risk, targeted interventions such as sensitization on ITN use through public health campaign to emphasize the importance of using insecticide-treated bed nets while encouraging proper bed net usage among adolescent male that can significantly reduce mosquito bites during sleep and prevent malaria transmission.
2. Behavior Change Communication: Promoting behavior change communication to prevent unnecessary outdoor activities, keeping surrounding environment clean by applying proper waste management to reduce mosquito habitat and use of topical repellants or long dresses when staying outdoor during transmission peak hours.
3. Since misconceptions and poor attitude on ITN use among adolescents were revealed during FGDs, studies should be conducted to determine the factors that influence use of ITN among adolescents especially males. The findings from those studies could add crucial information that can be used in providing this intervention.

4. Conduct mosquito larvae source management that go together with Entomological surveillance to detect the vectors responsible for the persistent transmission in Magharibi B District.

Recommendation to Magharibi B District Office

1. Improve Environmental Management: Given the fact that houses surrounded by mosquito breeding sites were associated with malaria transmission, efforts should be made to reduce mosquito habitats. This includes proper waste disposal, drainage management and eliminating stagnant water sources where mosquitoes breed. Community-based initiatives can play a crucial role in maintaining clean and mosquito-free environments.

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APPENDICES

Appendix I: Questionnaire

A questionnaire for assessment of malaria cases and associated risk factors for persistent malaria transmission in Magharibi B District, Zanzibar

Case ID No: Date ……

I. Socio-demographic characteristics.

1. Sex :
   1.1 Male
   1.2 Female
2. Age:
3. Occupation:
4. Level of education.
   4.1 No education
   4.2 Primary education
   4.3 Secondary education and above
5. **Shehia of the reported case ……**
6. Marital status:
   6.1 Single
   6.2 Married

II. Malaria knowledge. (Transmission, symptoms, Prevention and Risk factors)

7. Have you ever heard of malaria?
    7.1 Yes
    7.2 No
8. If yes, where did you hear about malaria?
    8.1 From Health worker
    8.2 From Media (radio, Tv, social media)
    8.3 From family /friends.
9. Malaria is transmitted through……
    9.1 Through sharing sharp objects
    9.2 Through mosquito bite
    9.3 Through contaminated food/water
    9.4 Through body contact
    9.5 Not sure
10. The following are the signs/ symptoms of malaria
    10.1Fever, chill and headache
    10.2Flu and rashes
    10.3Prolonged cough and constipation
    10.4Stomach ache, diarrhoea and headache
    10.5Not sure
11. Which of the following activities expose individuals to the risk of getting malaria infections.
    11.1 Eating contaminated food
    11.2 Outdoor activities during night
    11.3 Collecting agricultural procedures
    11.4 Inhaling polluted air
    11.5 Not sure

12. Which of the following is not among malaria preventive measures

    12.1Taking an antimalarial medication

    12.2 Applying mosquito repellent or wearing protective clothing during outdoor activities

    12.3Sleeping under insecticide treated net

    12.4Spraying insecticide on the wall surface

13. It is important to take malaria medication after…

    13.1 Experiencing headache, fever and chill

    13.2Travelling to malaria endemic areas

    13.3Being sure of malaria positive after testing your blood

    13.4 Not sure

III. Socio-economic characteristics

14. Occupation

15. Do you have bed net?

    15.1Yes

    15.2 No

IV. Behavioural factors.

16. Have you travelled/ slept in any shehia outside Magharibi B district?

    16.1 Yes

    16.2 No

17. Where do you stay during night time?

    17.1 Outdoor

    17.2 Indoor

18. If you stay out door during night time, what activity do you do?

    18.1 Business

    18.2 Security

    18.3 Watching TV

    18.4 Talking to neighbours

18.5 Studying

19. Do you have bed net?

19.1 Yes

19.2 No

20. Do you sleep under a mosquito net?

20.1 Yes

20.2 No

Thank you for participating in this questionnaire. Your responses will contribute to a better understanding of malaria risk factors for persistent malaria transmission in Magharibi B district, Zanzibar.

A questionnaire for controls on assessment for malaria cases and associated risk factors for persistent malaria transmission in Magharibi B district, Zanzibar

Control ID No: **Date ……..**

V. Socio-demographic characteristics.

21. Sex :

21.1 Male

21.2 Female

22. Age:

23. Occupation

24. Level of education.

24.1 No education

24.2 Primary education

24.3 Secondary education and above

25. **Shehia of the control ……..**

26. Marital status:

26.1 Single

26.2 Married

VI. Malaria knowledge. (Transmission, symptoms, Prevention, Risk factors)

27. Have you ever heard of malaria?

27.1 Yes

27.2 No

28. If yes, where did you hear about malaria?

28.1 From Health worker

28.2 From Media (radio, Tv, social media)

28.3 From family /friends.

29. Malaria is transmitted through…

    29.1 Through sharing sharp objects

    29.2 Through mosquito bite

    29.3 Through contaminated food/water

    29.4 Through body contact

    29.5 Not sure

30. The following are the signs/ symptoms of malaria

    30.1 Fever, chill and headache

    30.2 Flu and rashes

    30.3 Prolonged cough and constipation

    30.4 Stomach ache, diarrhoea and headache

    30.5 Not sure

31. This is among the activity that expose individual to the risk of getting malaria infections.

    31.1 Eating contaminated food

    31.2 Outdoor activities during night

    31.3 Collecting agricultural procedures

    31.4 Inhaling polluted air

    31.5Not sure

32. This is not among malaria preventive measure

    32.1 Taking an antimalarial medication

    32.2 Applying mosquito repellent or wearing protective clothing during outdoor activities

    32.3 Sleeping under insecticide treated net

    32.4 Spraying insecticide on the wall surface

    32.5 Not sure

33. It is important to take malaria medication after…

    33.1 Experiencing headache, fever and chill

    33.2 Travelling to malaria endemic areas

    33.3 Being sure of malaria positive after testing your blood

33.4 Not sure

VII. Socio-economic characteristics

34. Occupation

35. Do you have bed net?

35.1Yes

35.2 No

VIII. Behavioural factors.

36. Have you travelled/ slept in any shehia outside Magharibi B district?

36.1 Yes

36.2 No

37. Where do you stay during night time?

37.1 Outdoor

37.2 Indoor

38. If you stay out door during night time, what activity do you do?

38.1 Business

38.2 Security

38.3 Watching TV

38.4 Talking to neighbours

55.6 Studying

39. Do you have bed net?

39.1 Yes

39.2 No

Thank you for participating in this questionnaire. Your responses will contribute to a better understanding of malaria risk factors for persistent malaria transmission in Magharibi B district, Zanzibar.

Maswali kuhusiana na tamthini juu ya wagonjwa wa malaria na visababishi vinavyopelekea ugonjwa maambukizi ya malaria katika Wilaya ya Magharibi B, Zanzibar

Nambari ya utambulisho ya mgonjwa …… Tarehe ya utafiti ……..

I. Taarifa za kijamii na Kijiografia.

1. Jinsia
   1.1 Ke
   1.2 Me
2. Umri
3. Kazi
4. Kiwango cha elimu
   4.1 Sikusoma
   4.2 Msingi
   4.3 Secondary na zaidi

5. Shehia ya mgonjwa …….
6. Hali ya Ndoa
   6.1 Sijaoa/sijaolewa
   6.2 Nimeoa/ nimeolewa

II. Elimu kuhusiana na malaria. Maambukizi, dalili, njia za kujikinga, vihatarishi vya maambukizi ya malaria)

7. Je umeshawahi kusikia kuhusu ugonjwa wa malaria?
   7.1 Ndio
   7.2 Hapana
8. Kama jibu ni ndio, je ulisikia kutoka wapi?
   8.1 Kwa mtaalamu wa afya
   8.2 Kupitia vyombo vya habari (radio, televisheni, mitandao ya kijamii)
   8.3 Kwa familia/ marafiki.marafiki

9. Malaria huambukizwa kupitia ……
    9.1 Vitu vyenye ncha kali
    9.2 Kwa kutafunwa na mbu
    9.3 Kwa chakula /maji yaliyochafuliwa
    9.4 Kwa kugusana na mgonjwa wa malaria
    9.5 Sina uhakika
10. Zifuatazo ni dalili za ugonjwa wa malaria
    10.1 Homa, uchovu na kuumwa na kichwa
    10.2 Mafua na upele
    10.3 Kifua cha muda mrefu na kutopata choo
    10.4 Kuumwa na tumbo, kuhariasha na maumivu ya kichwa
    10.5 Sina uhakika
11. Zifuatazo ni miongoni mwa tabia hatarishi zinazopelekea kupata ugonjwa wa malaria
    11.1 Kula chakula kilichochafuliwa
    11.2 Kazi za nje wakati wa usiku
    11.3 Kuvuta hewa iliyochafuliwa
    11.4 Sina uhakika
12. Ifuatayo si miongoni mwa njia za kujikinga malaria
    12.1 Kula dawa za malaria
    12.2 Kupaka dawa za kukimbiza mbu au kuvaa nguo refu ukiwa nje ya nyumba wakatia wa usiku
    12.3 Kulala chini ya chandarua kilichotiwa dawa ya mbu
    12.4 Kunyunyiza dawa ya mbu kwenye ukuta wa nyumba
    12.5 Sina uhakika
13. Ni muhimu kutumia dawa ya malaria baada ya ….
    13.1 Kupata maumivu ya kichwa, homa na uchovu wa mwili
    13.2 Kusafiri katika maeneo yenye maambukizi ya malaria
    13.3 Kuwa na uhakika wa maabukizi ya malaria baada ya kuchunguzwa damu yako
    13.4 Sina uhakika

III. Sababu za kiuchumi

14. Kazi
15. Una chandarua?
    15.1 Ndio
    15.2 Hapana

IV. Sababu za kitabia

16. Uliwahi kutembelea au kulala shehia nyengine nje ya wilaya ya Magharibi B?
    16.1 Ndio
    16.2 Hapana
17. Muda wa usiku unakaa wapi?
    17.1 Ndani ya nyumba
    17.2 Nje ya nyumba
18. Kama unakaa nje ya nyumba wakati wa usiku, je unakuwa unajishughulisha na nini muda huo?
    18.1 Biashara
    18.2 Ulinzi
    18.3 Kuangalia Tv
    18.4 Kuongea na marafiki
    18.5 kusoma
19. Una chandarua?
    19.1 Ndio
    19.2 Hapana.

Ahsante kwa kushiriki kujibu maswali haya. Majawabu yako yatachangia kuelewa vyema visababishi vinavyopelekea kuendelea kwa maambukizi ya malaria katika wilaya ya Magharibi B, Zanzibar.

Maswali kuhusiana na tamthini juu ya wagonjwa wa malaria na visababishi vinavyopelekea ugonjwa maambukizi ya malaria katika Wilaya ya Magharibi B, Zanzibar

Nambari ya utambulisho ya Control …… Tarehe ya utafiti ……

V. Taarifa za kijamii na Kijiografia.

20. Jinsia
    - 20.1 Ke
    - 20.2 Me
21. Umri
22. Kazi
23. Kiwango cha elimu
    - 23.1 Sikusoma
    - 23.2 Msingi
    - 23.3 Secondary na zaidi

24. Shehia ya control

25. Hali ya Ndoa
    - 25.1 Sijaoa/sijaolewa
    - 25.2 Nimeoa/ nimeolewa

VI. Elimu kuhusiana na malaria. Maambukizi, dalili, njia za kujikinga, vihatarishi vya maambukizi ya malaria)

26. Je umeshawahi kusikia malaria?
    - 26.1 Ndio
    - 26.2 Hapana
27. Kama jibu ni ndio, je ulisikia kutoka wapi?
    - 27.1 Kwa mtaalamu wa afya
    - 27.2 Kupitia vyombo vya habari (radio, televisheni, mitandao ya kijamii)
    - 27.3 Kwa familia/ marafiki.marafiki

28. Malaria huambukizwa kupitia ……
    28.1 Vitu vyenye ncha kali
    28.2 Kwa kutafunwa na mbu
    28.3 Kwa chakula /maji yaliyochafuliwa
    28.4 Kwa kugusana na mgonjwa wa malaria
    28.5 Sina uhakika
29. Zifuatazo ni dalili za ugonjwa wa malaria
    29.1 Homa, uchovu na kuumwa na kichwa
    29.2 Mafua na upele
    29.3 Kifua cha muda mrefu na kutopata choo
    29.4 Kuumwa na tumbo, kuhariasha na maumivu ya kichwa
    29.5 Sina uhakika
30. Zifuatazo ni miongoni mwa tabia hatarishi zinazopelekea kupata ugonjwa wa malaria
    30.1 Kula chakula kilichochafuliwa
    30.2 Kazi za nje wakati wa usiku
    30.3 Kuvuta hewa iliyochafuliwa
    30.4 Sina uhakika
31. Ifuatayo si miongoni mwa njia za kujikinga malaria
    31.1 Kula dawa za malaria
    31.2 Kupaka dawa za kukimbiza mbu au kuvaa nguo refu ukiwa nje ya nyumba wakatia wa usiku
    31.3 Kulala chini ya chandarua kilichotiwa dawa ya mbu
    31.4 Kunyunyiza dawa ya mbu kwenye ukuta wa nyumba
    31.5 Sina uhakika
32. Ni muhimu kutumia dawa ya malaria baada ya ….
    32.1 Kupata maumivu ya kichwa, homa na uchovu wa mwili
    32.2 Kusafiri katika maeneo yenye maambukizi ya malaria
    32.3 Kuwa na uhakika wa maabukizi ya malaria baada ya kuchunguzwa damu yako
    32.4 Sina uhakika

VII. Sababu za kiuchumi

33. Kazi
34. Una chandarua?
    34.1 Ndio
    34.2 Hapana

VIII. Sababu za kitabia

35. Uliwahi kutembelea au kulala shehia nyengine nje ya wilaya ya Magharibi B?
    35.1 Ndio
    35.2 Hapana
36. Muda wa usiku unakaa wapi?
    36.1 Ndani ya nyumba
    36.2 Nje ya nyumba
37. Kama unakaa nje ya nyumba wakati wa usiku, je unakuwa unajishughulisha na nini muda huo?
    37.1 Biashara
    37.2 Ulinzi
    37.3 Kuangalia Tv
    37.4 Kuongea na marafiki
    37.5 kusoma
38. Una chandarua?
    38.1 Ndio
    38.2 Hapana.
39. Je unatumia kinga gani kuzuia kuumwa na mbu wakati umelala?
    39.1 Chandarua kilotiwa dawa
    39.2 Dawa za kufukuza mbu
    39.3 Situmii kinga yoyote.

Ahsante kwa kushiriki kujibu maswali haya. Majawabu yako yatachangia kuelewa vyema visababishi vinavyopelekea kuendelea kwa maambukizi ya malaria katika wilaya ya Magharibi B, Zanzibar.

Appendix II: A checklist for investigation on malaria cases

Case ID No …… **Date ……..**

Please observe the condition and fill the observation in the observation column with respect to observed variable.

Variables	**Observation**
III. Socio-economic factor	
40. Roof	
40.1 Iron/ concrete cement/ tiles	
40.2 Thatch / coconut leaves	
41. Eaves	
41.1 All closed	
41.2 Not closed	
42. Screening of windows	
42.1 All window screened	
42.2 Some / No window screened	
43. Wall	
43.1 Mud	
43.2 Bricks and cement	
V. Environmental factors	
44. Presence of Mosquito breeding site	
44.1 Yes	
44.2 No	

Observers name …….

Signature …….

A checklist for investigation for control

Control ID No …… **Date ……..**

Please observe the condition and fill the observation in the observation column with respect to observed variable.

Variables	**Observation**
III. Socio-economic factor	
45. Roof	
40.1 Iron/ concrete cement/ tiles	
40.2 Thatch / coconut leaves	
46. Eaves	
41.1 All closed	
41.2 Not closed	
47. Screening of windows	
42.1 All window screened	
42.2 Some / No window screened	
48. Wall	
48.1 Mud	
43.2 Bricks and cement	
V. **Environmental factors**	
49. Presence of Mosquito breeding site	
44.1 Yes	
44.2 No	

Observers name …….

Signature …….

A Qualitative (Focus Group Discussion) Questionnaire

Socio-economic Factors

1. In your opinion, is there a reason why there is malaria transmission in your shehia?
2. Are some groups of people more susceptible to the spread of malaria because of particular socioeconomic difficulties?

Behavioral Factors

1. What are famous practices exist in the society that aid in the spread of malaria?
2. What widespread precautions and methods does the community follow to prevent mosquitoes?

Environmental Factors

1. Are there any mosquito breeding site?
2. How can they be effectively managed or eliminated?
3. Are some areas more prone to malaria epidemics than others due to particular ecological or geographical characteristics?

Maswali Kuhusiana Na Majadiliano Ya Kikundi

Sababu za Kiuchumi na Kijamii

1. Kwa maoni yako, kuna sababu kwa nini kuna maambukizi ya malaria katika shehia yako?
2. Je, baadhi ya vikundi vya watu vinahusika zaidi na kuenea kwa malaria kwa sababu ya matatizo fulani ya kijamii na kiuchumi?

Sababu za kitabia

1. Ni mazoea gani maarufu yaliyopo katika jamii yako ambayo husaidia katika kuenea kwa malaria?
2. Je, jamii inafuata tahadhari na mbinu gani zilizoenea ili kuzuia mbu?

Sababu za Kimazingira

1. Katika mazingira unayoishi, kuna mazalia ya mbu?
2. Na mazalia hayo anawezaje kutokomezwa?
3. Maeneo mengine yanakabiliwa na magonjwa ya malaria kuliko mengine kwa sababu ya tabia fulani za kiikolojia au kijiografia?

Appendix III: Consent Form to Participate in the Study.

My name is **Fatma Moh'd Juma.** I'm the student at Muhimbili University and Allied

Sciences (MUHAS) in Master of Science in Applied Epidemiology, I'm conducting the study on **Assessment of malaria cases and associated risk factors for persistent malaria transmission in Magharibi B district, Zanzibar.** The aim of this study is to understand the risk factors that results to persistent malaria transmission in Magharibi B district Zanzibar.

Your participation will help Ministry of Health of Zanzibar through ZAMEP to meet the target of reducing malaria transmission through understanding the risk factors in Magharibi B district that result to persistent malaria and plan interventions to reduce malaria transmission Magharibi B district. During the study, we will ask you few questions on socio demographic information, your behaviors and we would like to collect some environmental information inside your house by direct observations.

Through your participation in the study, we do not expect any harm or risk to face you directly or indirectly. No one's name will be included during the study and Identity numbers will be used. All individual's information will remain confidential with in the data collection team and will not be used outside this study. After data collection, all data will be analyzed together so as to understand risk factors to persistent malaria transmission in Magharibi B district.

No payment will be provided to any participant in the study. You have the authority to participate or not to participate. Failure to participate will not affect your residential rights as a citizen of Government of Zanzibar.

Approval to participate.

I have read /read to and understood the aim of this study and I'm willing to participate in this study.

Participant's Signature/ Thumb signature ……..

Date ……..

Interviewer's Name …… Signature …… Date……

CONTACTS

Dr. Dinah Gasarasi

Research Supervisor (MUHAS)

Phone No. +255 715-301-849

Dr. Geofrey Mchau

Research Supervisor (FELTP)

Phone No. +255 754-574-993

Fatma Moh'd Juma

Researcher.

Phone No. +255772275561

Appendix IV: Fomu ya ridhaa ya kushiriki katika utafiti.

Jina langu ni **Fatma Moh'd Juma**. Ni mwanafunzi wa Chuo Kikuu cha Afya na Sayansi Shirikishi Muhimbili (MUHAS). Nafanya utafiti juu ya **tathmini ya wagonjwa wa malaria na sababu zinazopelekea kuenedelea kwa maambukizi ya malaria katika Wilaya ya Magharibi B, Zanzibar.** Madhumuni ya utafiti huu ni kufahamu visababishi hatarishi ambavyo vinapelekea kuendelea kwa maambukizi ya malaria katika wilaya ya Magharibi B, Zanzibar.

Ushiriki wako utaisaidia Wizara ya Afya ya Zanzibar kupitia kitengo cha kumaliza malria Zanzibar (ZAMEP) kufikia malengo waliyojiwekea ya kupunguza maambukizi ya malaria katika Wilaya ya Magharibi B kwa kujua visababishi vinavyopelekea kuendelea maambukizi ya malaria katika wilaya hiyo. Wakati wa utafiti, tutakuuliza maswali kuhusiana na taarifa zako za kijiografia, kijamii, tabia na taarifa za mazingira zinazohusiana na malaria. Pia ukiridhia , tutahitaji kukusanya baadhi ya taarifa za kimazingira zilizomo ndani ya nyumba yako kwa kuona moja kwa moja.

Kupitia ushiriki wako katika utafiti huu, hakutakuwa na madhara ya aina yoyote (madhara ya moja kwa moja au yasiyo ya moja kwa moja). Hakuna jina la mtu ambalo litatumika na badala yake tutatumia nambari kumtambulisha mshiriki. Taarifa zote zitabakia kuwa ni siri na hazitatolewa nje ya timu ya utafiti. Taarifa zote zitakusanywa, kuhifadhiwa na kuchakatwa kwa siri ili kufahamu visababishi hatarishi vinavyopelekea kuendelea kwa maambukizi ya malaria katika Wilaya ya Magharibi B.

Hakuna malipo ya kifedha kwa ushiriki wako katika utafiti huu. Ushiriki wako ni wa hiari na unaweza kujiondoa kushiriki endapo hutoridhia bila kuathiri haki zako za kiraia kwa Serikali ya Mpinduzi ya Zanzibar.

Hiari ya kushiriki

Nimesoma/ nimesomewa na nimeelewa dhumuni la utafiti huu, kwa hiari yangu niko tayari kushiriki katika utafiti.

Sahihi ya mshiriki/ alama ya dole …… Jina la muuliza maswali ……...

Tarehe ……. Sahih……

Tarehe ……..

Mawasiliano

Dr. Dinah Gasarasi

Msimamizi wa Utafiti (MUHAS)

Simu +255 715 301 849.

Fatma Moh'd Juma

Mtafiti Mkuu

Simu +255 772 275 561.

Dr. Geofrey Mchau

Msimamizi wa Utafiti (TFELTP)

Simu +255 754 574 993.

Appendix V: Approval for ethical clearance

UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES

OFFICE OF THE DIRECTOR – RESEARCH, PUBLICATIONS AND INNOVATION

Ref. No.DA.282/298/01.C/2079 Date: 11/03/2024

MUHAS-REC-03-2024-2079
FATMA MOH'D JUMA
MUHAS

RE: APPROVAL FOR ETHICAL CLEARANCE FOR A STUDY TITLED: ASSESSMENT OF MALARIA CASES AND ASSOCIATED FACTORS FOR CONTINUED TRANSMISSION IN HOTSPOT SHEHIAS IN MAGHARIBI B DISTRICT, ZANZIBAR.

Reference is made to the above heading,

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

APPROVAL DATE: 11/03/2024
EXPIRATION DATE OF APPROVAL: 11/03/2025

STUDY DESCRIPTION:
Purpose:

The purpose of this observational case control study is to determine factors associated with persistent malaria transmission in hotspot shehias at Magharibi B district in Zanzibar.

The approved protocol and procedures for this study is attached and stamped with this letter, and can be found in the link provided: https://irb.muhas.ac.tz/storage/Certificates/Certificate%20-%2014554.pdf and in the MUHAS archives.

The PI is required to:

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

Dr. Nahya Salim Masoud,

Chairperson, MUHAS Research and Ethics Committee

Appendix VI: Permission Letter

SERIKALI YA MAPINDUZI YA ZANZIBAR
AFISI YA MAKAMU WA PILI WA RAIS,

22279 Barabara ya Vuga,
Vuga, S.L.P. 239,
70460 Mjini Magharibi, Zanzibar

Tovuti : www.ompr.go.tz
Barua pepe : Info@ompr,go,tz
Faksi : 0242231826

CA.33/411/01-K/48 **28/03/2024.**

MHESHIMIWA,
MKUU WA WILAYA,
WILAYA YA MAGHARIBI 'B',
UNGUJA.

KUH: RUHUSA YA KUFANYA UTAFITI

Kwa heshima, naomba uhusike na mada ya hapo juu.

Serikali ya Mapinduzi ya Zanzibar imemruhusu **Ndg. Fatma Moh'd Juma** mwanafunzi kutoka **Chuo cha Afya na Sayansi Shirikishi-Muhimbili** anaesomea **Shahada ya Uzamili** katika fani ya **Sayansi ya Epidemolojia** kufanya utafiti katika mada inayohusiana na **"Assessment of Malaria Case and Associated Factors for Continued Transmission in Hotspot Shehia in Magharibi 'B' Zanzibar".** Utafiti huo utafanyika katika Shehia za Tomondo, Kiembesamaki, Chukwani, Kisauni, Fuoni Kibondeni, Mwanakwerekwe na Shakani kuanzia tarehe **26/03/2024** mpaka **25/06/2024** Tunaomba asaidiwe ili aweze kukamilisha utafiti huo.

Kwa nakala ya barua hii mara baada ya kumaliza utafiti, mtafiti anatakiwa kuwasilisha nakala (copy) 3 za ripoti ya utafiti huo, Afisi ya Makamu wa Pili wa Rais - Zanzibar.

Naambatanisha na kivuli cha kibali cha kufanyia utafiti.

Wako mtiifu,

Siajabu S. Pandu

SIAJABU S. PANDU,
/KATIBU MKUU,
AFISI YA MAKAMU WA PILI WA RAIS,
ZANZIBAR.

NAKALA: 1. Ndg. Fatma Moh'd Juma (0772275561)
2. Mratibu wa Shughuli za Serikali Wilaya ya Magharibi B, Unguja.

Appendix VII: Digital Receipt

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Digital Receipt

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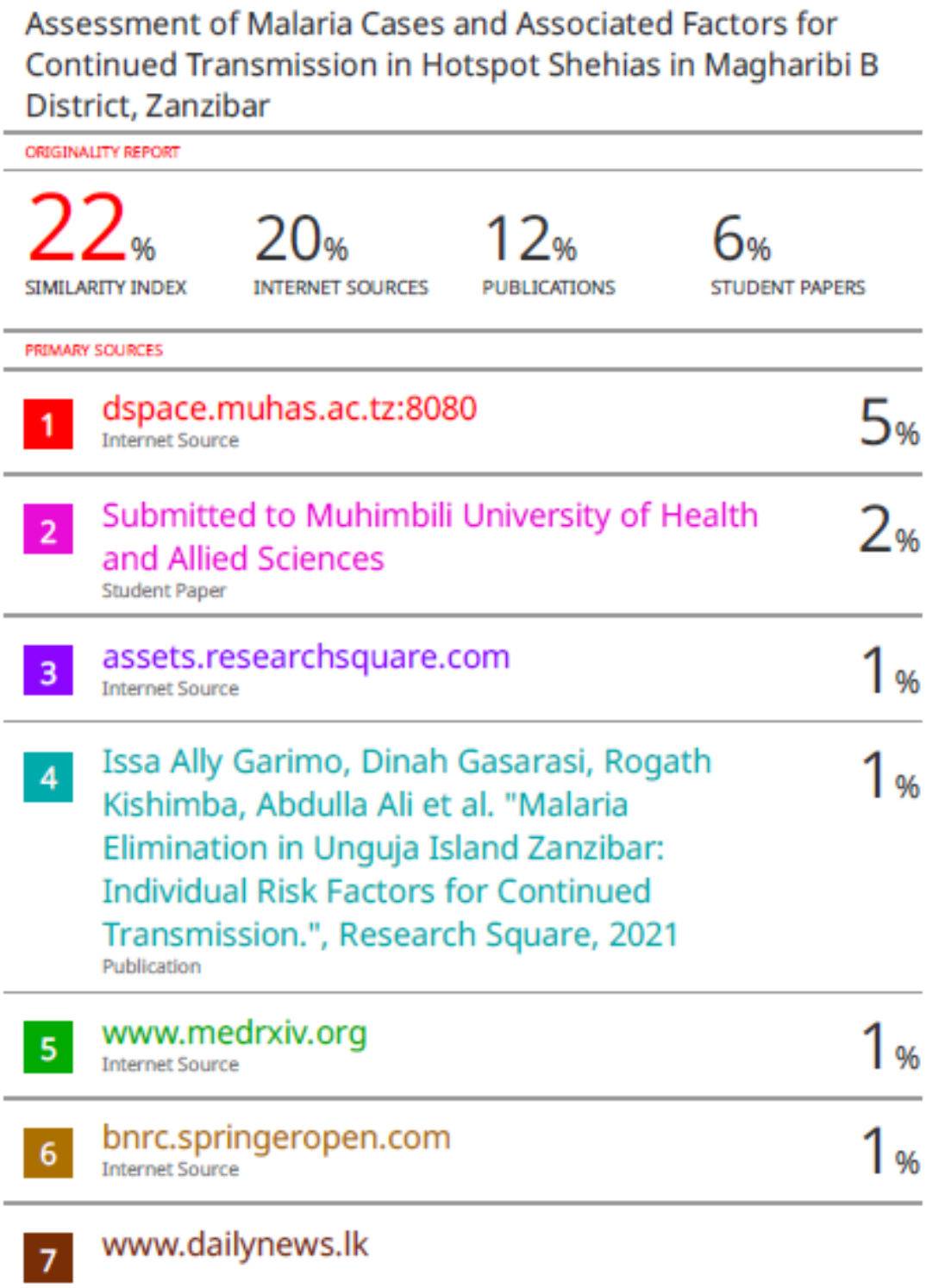
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Appendix VIII: Plagiarism Report



Assessment of Malaria Cases and Associated Factors for Continued Transmission in Hotspot Shehias in Magharibi B District, Zanzibar

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