Prevalence of Malaria and Associated factors among Febrile Children aged 5years and below at Banadir Hospital, Somalia

Sadia Ahmed Mohamed

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DECLARATION

DECLARATION

I, **Sadia Ahmed** declare that this is my original work and that I have not presented it to any other institution.

Signature: .....Date: 16/11/2023

This research project has been submitted for examination with my approval as University Supervisor

Supervisor:

Dr. Gloria Omosa-Manyonyi

Department of Medical Microbiology and Immunology

Faculty of Health Sciences, University of Nairobi

Signature: .....Date: 16/11/2023

Dr: Atika Abdurahman Dhuhulow

Signature: .....Date: 16/11/2023

DEDICATION

This project is dedicated to my friends and family for their constant prayers and support throughout the course of this project.

ACKNOWLEDGEMENT

I would like to thank the almighty God for energy, skills and good health that has enabled me to carry out this thesis. I also wish to acknowledge my parents for their financial support and believe in my plans. Special appreciation goes to my supervisors for their unmatched academic and research guidance and support during the study. Thank you all.

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LIST OF ACRONYMS

ANOVA: Analysis of Variance

AOR: Adjusted Odds Ratio

CDC: Center for Disease Control

CI: Confidence Interval

COR: Crude Odds Ratio

ITNs: Insecticide-treated nets

KNH: Kenyatta National Hospital

LLINs: Long-Lasting Insecticide-Treated Nets

LLN: Long-lasting insecticide treated nets

SPSS: Statistical Package for Social Sciences

SSA: Sub-Saharan African

UNICEF: United Nations International Children's Emergency Fund

UON: University of Nairobi

WHO: World Health Organization

ABSTRACT

Background: Malaria is a tropical disease which is caused by protozoa plasmodium species. The most vulnerable are children under five in tropical and sub-tropical areas such as Somalia. The frequency of malaria in Somalia has not been extensively researched, however it is anticipated to be significant in low-lying areas. Countries have established goals to effectively manage and eradicate malaria via targeted interventions for vulnerable populations. However, malaria infection continues to pose a significant public health problem in regions where the disease is prevalent.

Objective: To determine the prevalence of malaria and associated factors among febrile children aged 5years and below at Banadir Hospital, Somalia

Methods: A cross-sectional research design was used to examine a sample of 246 children aged five and below who sought medical care at Banadir hospital in Somalia. The research participants were selected using a systematic random sampling. Child aged five and below malaria infection status was the main dependent variable, and it was diagnosed by the examination of thin films' by means of microscopy. To assess the connection between confirmed malaria infection and predictors, a binary logistic regression model was utilized. The bivariate p-value criterion for inclusion in the multivariable logistic regression analysis model was set at 0.2. The degree of significance was set at.05.

Results: The study found prevalence of malaria illustrates a pattern across different age groups, with the highest recorded percentage being in the youngest age group of less than 12 months at 35.7%. This prevalence notably decreases in the subsequent age group of 12-24 months, dropping to 15.2%, which is less than half of the initial group's percentage. As the age increases to 25-36 months, there is a resurgence in prevalence to 31.4%, suggesting an upward trend as age increases. This trend continues modestly in the 37-48 months age group, which sees a slight rise to 32.0%. The prevalence peaks in the 49-60 months age group, reaching 38.1%, indicating the highest susceptibility or exposure to malaria in the oldest age group studied. When other factors were controlled for, the age of the child, whether caregiver knew that headache is a symptom of malaria and preventative measures employed against malaria were associated with the children's infectious status. Children (12-24 months) were about 2.4 times more likely to have malaria infection compared to those aged below 12 months (AOR=2.376; 95% C. I: (3.107, 11.324). Children whose caregiver knew that headache is a symptom were 44% less likely to be malaria infected than those who didn't (AOR=0.560; 95% C. I: (1.027, 1.159). Children whose caregiver used IRS were about 40% more likely to be malaria infected than those using ITN (AOR=1.396; 95% C. I: (1.557,3.494).

Conclusion: The most important risk factors for contracting malaria are the child's age, the parent's familiarity with the disease's symptoms, and the usage of preventative measures. In order to raise awareness of malaria and its symptoms and preventative measures, national and local health administrators should create educational programs. They should also enhance efforts to increase access to insecticide-treated bed nets (ITNs) and other major malaria prevention and control tools especially for children who are under the age of five in order further reduce impact of malaria.

CHAPTER 1. INTRODUCTION

Malaria, a life-threatening disease is caused by parasites that are transmitted to humans through the bites of infected female Anopheles mosquitoes (CDC, 2021). It is most prevalent in tropical countries and poses significant public health challenges, especially in sub-Saharan Africa. Malaria is both preventable and curable, yet it continues to claim a high number of lives, particularly among vulnerable populations (Molla & Ayele, 2015). During 2015, about 212million cases of malaria were reported globally and they claimed 429,000 lives. Most of these deaths took place in sub-Saharan Africa, South Asia, Latin America, and in selected Middle Eastern countries. Worldwide, an estimated 3.2 billion individuals are susceptible to malaria infection (WHO, 2021). The prevalence of malaria is, however, reducing across Africa, but it has increased or remained constant in other places. There were 450,000 recorded deaths worldwide in 2016 and roughly 216 million clinical cases (WHO, 2021). There are five protozoan species that cause malaria, these include *Plasmodium falciparum, P. vivax, P. malariae, P.ovale* and finally the last category which is not well known is called the Monkey Malaria caused by *Plamodium knowlesi*. The deadliest form of malaria is caused by P. falciparum which occurs commonly in sub-Saharan Africa (Gething et al, 2012).

Malaria has a substantial role in perpetuating poverty, especially in resource-constrained contexts, notably in tropical regions worldwide. A statement by the Ministry of Health Federal Republic of Ethiopia (FMOH) made in 2006 indicated that some vulnerable population groupings were more susceptible to a severe bout of malaria which included infants, children less than five years, and adults. Beyond hospitals, the effects of malaria also affect people's homes and daily lives: severe malaria attacks can cause children to experience long-lasting neurological effects, and both mild and severe episodes can cause subtle developmental and cognitive impairments. Families may also experience significant financial hardships (Kitsao-Wekulo, 2004)

Children below the age of five are particularly vulnerable to malaria due to their lack of antibody against the disease. Children may have enduring consequences from malaria, even beyond their recovery. Recurrent fever and instances of sickness hinder development by diminishing appetite, restricting recreation, social interaction, and scholastic prospects. Malaria is acknowledged as a key contributor to a substantial proportion of child fatalities, and it is more widespread in homes with poorer incomes (Mwageni, et al., 2009). Young children, namely those who are under the age of five, are more vulnerable to malaria. According to

Mwageni, et al., (2009), children have a higher likelihood of developing cerebral malaria, severe anemia, and hypoglycemia compared to adults.

Malaria keeps recurring in children, and this increases their chances of getting diarrhoea, respiratory infections and other illnesses. The neurological damage caused by the virus results from cognitive impairments and epilepsy in approximately 2% of children who succumb to cerebral malaria. Malaria has the capacity to cause significant damage to children via three distinct mechanisms: Since children have limited acquired immunity, they are more likely to develop cerebral malaria, which can lead to such clinical indications as convulsions or coma and death (Adino, 2021). In addition, there are additional consequences that arise from recurrent infections, such as anemia. Ultimately, malaria during pregnancy leads to reduced birth weight and heightens the likelihood of mortality during the first month of life Presidents Malaria Initiative, 2019).

However, as at 2019, almost half the whole world was still at risk of malaria infection. The populations most at risk of contracting and getting severe malaria include children under the age of five (WHO, 2021). Such children, according to the CDC, are particularly susceptible to the genus of parasitic protozoa because they have not yet acquired malaria immunity (CDC, 2019). According to the study published in 2019, there were fewer deaths due to malaria infection recorded (410,000 deaths in 2018 compared to 409,000 deaths in 2019), but there were also more cases of malaria reported globally (228 million compared to 229) than the year before, 2018.

In the year 2019, the African continent contributed to an unreasonably large chunk (94%) of malaria cases and deaths across the world. The most affected group with regard to malaria was discovered to be children under the age of five, where 67% or 274,000 deaths in the world might have been prevented and cured (WHO, 2021). Malaria was reported to have a low frequency in Somalia, yet it was responsible for 3% of mortality in post-neonatal infants under the age of five (UNICEF, 2017).

Considerations for treating malaria in children include the type of plasmodium species that has infected the child, the parasites' susceptibility to medications, the severity of the infection (which determines whether the disease is complicated or uncomplicated based on the manifestation of various signs or symptoms), and the accessibility of resources and medications (Stauffer & Fischer, 2003). World Health Organization (WHO) has suggested several preventative and control methods that have made a difference in lowering the number of cases

and fatalities related to malaria that are reported each year. The organization has strongly endorsed preventive chemotherapy, which uses drugs that can be used either alone or in combination, as well as vector control, an efficient method for reducing and eventually eliminating malaria. WHO also suggests that malaria vaccine (RTS, S/AS01) be used in children, especially in areas with high to moderate transmission of P. falciparum malaria (WHO, 2021). One of the Sub-Saharan African (SSA) nations with the highest number of malaria cases is Somalia (Noor et al., 2008). It is challenging for policymakers to develop effective strategies to combat malaria in Somalia due to the lack of data on prevalence and risk factors among febrile children under the age of five.

CHAPTER 2. LITERATURE REVIEW

2.0 Introduction

Somalian population is at risk of malaria whereas 54% of the entire population is at a high risk of getting infected (WHO, 2009). Different parts of the country have varying transmission intensities of malaria for example the Southern zone has higher intensity, the Central zone – has moderate intensity while both Puntland and Somaliland have either unstable or are epidemic-prone (WHO, 2009). For this reason, malaria is one of the diseases that have led to high morbidity and mortality among the malnourished people (Oldfield et al., 1993). Due to a poorly developed immunity partly resulting from malnutrition, children under the age of 5 years are likely to be the most affected when it comes to malaria infection.

2.1 Prevalence of malaria in children

Globally, malaria remains a significant health concern, especially among children. In the United States, malaria is relatively rare, primarily due to effective control and elimination efforts. Cases are mainly found among travelers returning from endemic regions or immigrants (CDC, 2023). Europe, having eliminated malaria by the 1970s, now reports cases almost exclusively in travelers returning from endemic areas (WHO, 2023). In contrast, Asia faces a more substantial burden. Southeast Asia has high malaria prevalence, though significant progress has been made in reducing case numbers in recent years (World Malaria Report, 2022). This variation in prevalence is influenced by factors such as local health infrastructure, climate, mosquito control efforts, and public health initiatives.

In Africa, the prevalence of malaria, particularly among children, is alarmingly high. In 2022, the continent faced an estimated 249 million malaria cases and 608,000 related deaths in 85 countries, with the African Region bearing a staggering 94% of these cases (233 million) and 95% (580,000) of the deaths (WHO, 2023). The impact on children is particularly devastating; those under five years old accounted for approximately 78% of all malaria fatalities in the region. This figure reflects the vulnerability of this age group to the disease. The latest World Malaria Report highlights a slight fluctuation in these numbers, with 249 million cases in 2022 compared to 244 million in 2021, and deaths marginally decreasing from 610,000 to 608,000 in the same period (WHO, 2023). The distribution of malaria deaths is not uniform across the continent. Four countries – Nigeria (26.8%), the Democratic Republic of the Congo (12.3%),

Uganda (5.1%), and Mozambique (4.2%) – collectively account for just over half of all malaria deaths globally, underscoring the uneven burden within the continent (WHO, 2023).

The WHO African Region bore a disproportionately high share of the global malaria burden, with children 5 years and below years old being particularly vulnerable. This age group accounted for around 80% of all malaria deaths in the region (WHO, 2021). The impact of malaria is not limited to health; it also places significant economic burdens on families and communities, trapping them in cycles of illness and poverty (WHO, 2021). Prevention strategies include avoiding mosquito bites using mosquito nets, repellents, and coils. Sleeping under insecticide-treated mosquito nets (ITNs) is one of the most effective ways to prevent malaria transmission (Onyekachi, Abana, & Nwajiobi 2021). Additionally, early diagnosis and treatment are crucial for favorable outcomes. The WHO recommends parasite-based diagnostic testing for all suspected cases.

The prevalence of malaria in East Africa, particularly among children in countries like Kenya, Uganda, Tanzania, and Rwanda, presents a significant public health challenge. In Kenya, areas such as the western and coastal regions experience a higher malaria burden, with children under five being the most affected demographic (Snow et al., 2017). Uganda's situation is similarly dire, with malaria recognized as the leading cause of death in children under five, contributing significantly to the country's overall malaria burden (WHO, 2021). In Tanzania, malaria prevalence varies considerably across different regions, with rural areas facing a greater impact. The country's efforts to combat the disease have been focused on these high-burden areas (Ministry of Health Tanzania, 2020). Rwanda, despite making commendable strides in malaria control, still records substantial malaria cases among children, especially in rural and marshland regions (Rwanda Biomedical Center, 2019). These countries continue to combat challenges such as limited healthcare access, inadequate preventive measures like insecticide-treated nets, and the need for more effective malaria control strategies.

In some regions such as Rwanda, despite the use of various strategies such as vector control as well as use of preventive chemotherapies against malaria, the prevalence of the disease rose by 6% among children 5 years and below years of age since 2007 to 2017. Malaria was less common in this age group compared to those between 5 and 14 (Habyarimana & Ramroop, 2020). This raises concern on whether the measures taken are effective enough or there is room for new approaches to help in prevention and control of malaria in endemic regions. A study among febrile children aged 3 to 5 years revealed that malaria was highly (21%) prevalent in Arba Minch district, in the southern part of Ethiopia (Abossie et al., 2020). This study was

consistent with an earlier study done in Arsi Negele thereby confirming that malaria was a public health problem when considering children (Abossie et al., 2020). The two regions in Ethiopia could be sharing most of the factors favorable for vectors responsible for malaria transmission.

The prevalence of malaria in Somalia is a significant public health concern. Throughout Somalia, the malaria species Plasmodium falciparum has been the predominant cause of infection, accounting for over 92% of cases (WHO, 2023). This poses a complex situation due to the severity of malignant malaria. Furthermore, the invasive mosquito species *Anopheles stephensi,* capable of transmitting both *P. falciparum* and *P. vivax* malaria parasites, was detected in six locations in Somalia between 2020 and 2021, adding to the transmission challenges (WHO, 2023). Unlike other major mosquito vectors of malaria, *Anopheles stephensi* thrives in urban environments, making vector control a top priority for the malaria program (WHO, 2023). Somalia has a high burden of malaria, with an estimated 759,000 cases and 1,942 deaths occurring between 2000 and 2019 (United Nations, 2023). Various control efforts undertaken by the Government, with the support of WHO and UNICEF, and funded by the Global Fund, have resulted in a reduction in incidence from 2.6 cases per 1,000 population in 2014 to 1.8 per 1,000 population in 2020, showing a 25% reduction (United Nations, 2023).

Malaria, a life-threatening disease is caused by parasites that are transmitted to humans through the bites of infected female Anopheles mosquitoes (CDC, 2021). It is most prevalent in tropical countries and poses significant public health challenges, especially in sub-Saharan Africa. Malaria is both preventable and curable, yet it continues to claim a high number of lives, particularly among vulnerable populations (Molla & Ayele, 2015). The symptoms of malaria can range from mild to severe. Common early symptoms include fever, headache, chills, sweating, nausea, vomiting, body aches, and general malaise (WHO, 2021). These symptoms usually start within 10 to 15 days after the infective mosquito bite. The classical malaria attack, though rare, typically lasts 6 to 10 hours and includes a cold stage (shivering), a hot stage (fever, headaches, vomiting), and a sweating stage (sweats, return to normal temperature, tiredness). In severe cases, malaria can lead to more serious issues like cerebral malaria, severe anemia, respiratory distress, abnormalities in blood coagulation, low blood pressure, acute kidney injury, and metabolic acidosis (Peter & Gething, 2012). Severe malaria is particularly dangerous and requires urgent medical attention. Malaria remains a major global health issue. In 2021, there were approximately 247 million cases of malaria worldwide, resulting in around 619,000 deaths (WHO, 2021).

Various medicines are used for treatment, with the choice depending on factors such as the type of malaria, resistance to medicines, and the patient's age or pregnancy status (Habyarimana & Ramroop, 2020). Artemisinin-based combination therapy (ACT) is usually the most effective treatment, particularly for the deadliest parasite, P. falciparum. However, there are disparities in access to testing and treatment, with significant gaps between urban and rural areas, as well as among different socio-economic groups (CDC, 2021). Certain groups, such as infants, children 5 years and below, pregnant women, travelers, and individuals with HIV/AIDS, are at higher risk for severe malaria infection (UNICEF, 2017). For pregnant women in high-transmission areas, malaria can result in complications like anemia and low-birthweight babies. Preventive treatments during pregnancy (IPTp) and the use of ITNs are crucial for protecting this vulnerable group (Zgambo, Mbakaya & Kalembo, 2017).

2.2 Associated Risk Factors for Malaria

In their 2020 study, Ramdzan, Ismail and Zanib (2020) investigated the prevalence of malaria and associated risk factors in Sabah, Malaysia. Analyzing data from health clinics between January and August 2016, they found that 33.6% of 1,222 patients had laboratory-confirmed malaria, predominantly caused by Plasmodium knowlesi (82.9%). The study revealed that males and individuals living in rural areas were at significantly higher risk of malaria infection. These findings emphasize the need for targeted malaria control measures in Sabah, focusing on these high-risk groups and modifiable socio-demographic and geographical factors.

The study by Beavogui et al. (2020) in Guinea focused on the prevalence of malaria and its associated factors among children aged 6 months to 9 years. The cross-sectional household survey, conducted between August 2 and 29, 2014, enrolled 1,984 children across the four natural regions of Guinea. The study revealed a high countrywide malaria prevalence of 44%, with regional variations between 38% to 61%. Key factors associated with malaria infection included living in Forest Guinea, rural areas, and having splenomegaly. The study underscores the continued prevalence of malaria among children in Guinea.

Sultana et al. (2017) conducted a study in Kenya to assess malaria prevalence and associated factors among children aged 6 months to 14 years. Using data from the 2015 Kenya Malaria Indicator Survey, they found that malaria prevalence increased with age, with the highest rates among children aged 11–14 years. Rural residence, anemia, lack of mosquito nets, and lower household education levels were associated with a higher likelihood of infection. This study

highlights the importance of awareness programs, behavior change communication, and interventions targeting vulnerable populations to reduce malaria burden in Kenya.

Malaria is a serious health problem that affects millions of children under the age of 5 every year. For instance, an increase in age of the child is a direct reflection in increase in febrile illness. As a result of continuously being exposed to mosquito bites that are infective, these children might not be able to develop immunity that is age-related (Abossie et al., 2020). The availability of electricity, wall material and main floor material were some of the socio-economic elements that were associated with the risk of getting malaria. For instance, since electricity could be associated to an individual's socio-economic status as it can contribute to a person's way of living unlike the households that lack electricity since they will have to go out more often thereby increasing one's chances of getting bitten by mosquitoes that may ultimately lead to development of malaria (Roberts & Matthews, 2016).

The Malawian government together with its international donor partners invested a huge amount of resources inform of interventions meant to lower the malaria burden among the 5 years and below years old children and other high-risk individuals. The government and other donors also provided 6.7 million long-lasting insecticides treated nets (LLINs) free of charge targeting pregnant women and children from 2012 to 2014 (Zgambo et al., 2017) .

Vulnerable groups like those 5 years and below years, the old, and pregnant mothers are susceptible to malaria infection and mortality in Somalia (Mohamed et al., 2020). People living along rivers and man-made water reservoirs experience higher prevalence of malaria due to the transmission occurring all-year round. Regions around Juba and Shebelle rivers account for 80% of all cases of malaria in Somalia (Mohamed et al., 2020). From the same study, financial factors determined households that could afford insecticide-treated nets (ITNs) to protect themselves from mosquito bites. Most of the respondents (60%) indicated that they had insecticide-treated nets while the rest could not afford the nets (Mohamed et al., 2020). Knowledge on malaria as well as ITNs was also beneficial as it played a critical role people finding a reason to protect themselves against the disease.

2.3 Conceptual Framework

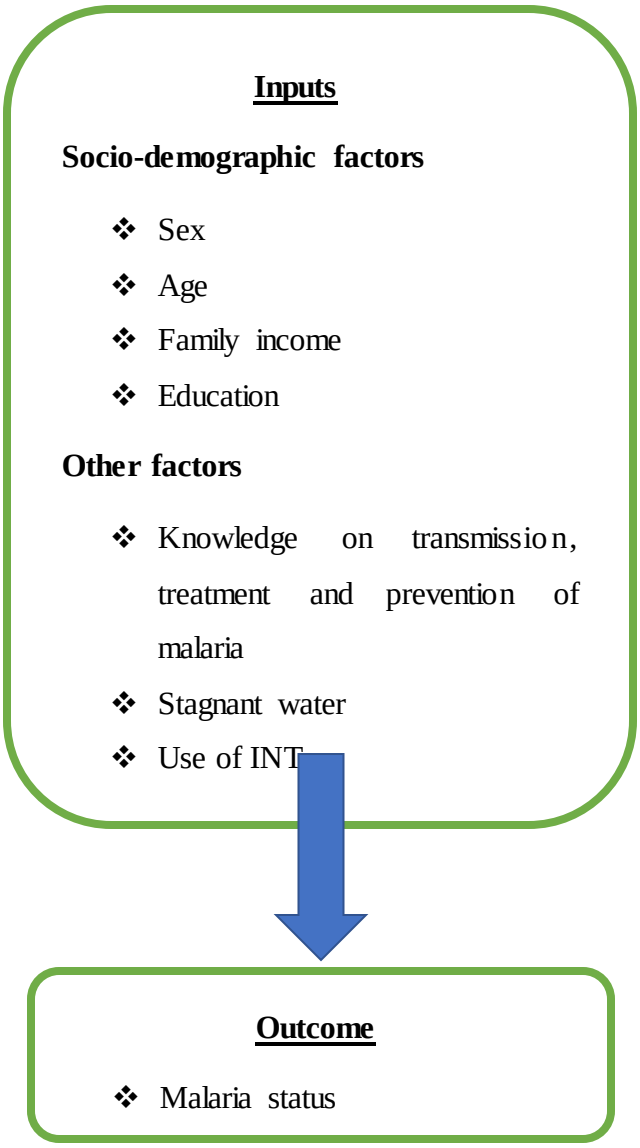

Figure 1: Conceptual framework for the present study

This framework symbolizes the relationship between the input elements and the outcome variable. With the input variables mentioned above, we calculated its prevalence on febrile children of less than five years treated at Banadir hospital. These contributors are included as independent variables in hypothesizing the prevalence of malaria in children.

2.3 Rationale

The condition often impacts children aged five and below, with prevalence rates in the country varying from 16% to 54%. Insufficient allocation of ITN, restricted use of indoor residual spraying, development of medication resistance, Insufficient Insecticidal bed nets and Pharmacist Counterfeit drugs Explosion (SIFCE) among the malaria transmitting mosquito's population, low healthcare access and quick community people migration from malaria to non-malaria areas are all rudiments contributing to high burden of Malaria in Nigeria (UNICEF, 2017). Children living in malaria-endemic regions such as Benadir are more vulnerable to the illness due to their compromised immune systems. The study undertaken in Somalia has primarily concentrated on adult populations, neglecting children, although the substantial frequency of the condition among young persons. Moreover, Benadir lacks data about the frequency, variables that increase the likelihood, and the concentration of parasites causing malaria in children.

Data on prevalence to malaria for the children aged five and below in Somalia are scanty. A study to determine the burden of malaria in the community in rural south-central Somalia revealed that 19.6% of children below five years were infected with P.falciparum (Noor et al.,2008). In another recent study that was conducted to establish the association between falciparum malaria and malnutrition in children aged 0-59 months, the occurrence of malaria was found to be 14% (Kinyoki et al., 2018). In comparison, these two studies show a difference in prevalence by 5% leading to a need to determine whether the fight against malaria Somalia has been progressive or not. Research done in 2017 on prevalence of malaria among pregnant women revealed that 26.7% of the respondents currently have been infected with *P. falciparum* while about 82% of these women who took part in the study suffered from infections caused by *P. falciparum* during their pregnancy thus, putting their unborn children at risk (Mohamed et al., 2020). In order not to lose the battle against malaria in Somalia, there is need to determine the current prevalence of malaria in children 5 years and below years. Identification of risk factors that are associated with the disease will also help the policy makers to form well-targeted and effective interventions that will in turn inform proper channeling of resources in the fight against malaria. This research offers stakeholders input on efficient strategies that may be used to enhance preventative and control efforts.

2.4 Questions

1. What is the prevalence of malaria among febrile children aged five years and below at the Banadir Hospital Somalia?
2. What are the associated factors for malaria among febrile children aged five years and below at the Banadir Hospital Somalia?

2.5 General Objective

To determine prevalence of malaria and associated factors among febrile children aged 5years and below at Banadir Hospital, Somalia

2.6 Specific Objectives

1. To determine prevalence of malaria among in-patient and out-patient febrile children aged five years and below at the Banadir Hospital Somalia.
2. To identify the factors associated with malaria among in inpatients and outpatient febrile children aged 5 years and below at Banadir Hospital Somalia.

CHAPTER 3. METHODOLOGY

3.1 Study site

The study was carried out at Banadir Hospital in Mogadishu, Somalia. It is a public Hospital that is located in a district called Hodan. Banadir hospital is Mother and Child Hospital that has obstetrics and gynecology department, and pediatric department which is the largest of all the departments. The pediatric department has different wards to admit children presenting with various illnesses, for instance, malaria ward, intensive care unit ward, isolation ward, diarrhea ward and malnutrition ward. About 50 children are seen by doctors in this hospital each day. Approximately 33 children among those seen by doctors are aged five years and below.

3.2 Study design

Children aged five years and below presenting with fever were included in cross-sectional research to determine the frequency of malaria and its related variables.

3.3 Study population

Febrile children aged five years and below seen at Banadir hospital during the study period and whose parents were willing to provide written consent

3.3.1 Inclusion criteria

- Children aged ≤ five years.
- Children with fever (temperatures higher than 37.8°C).

3.3.2 Exclusion criteria

- Children who return for review with unresolved malaria to avoid double counting.
- Participants with partially answered questionnaire (<60% of all questions unanswered).

3.4 Sample Size Determination

The study used Fishers' formula to estimate the sample size that was used to determine the prevalence of malaria in children under five years old. To calculate the sample size required, a malaria prevalence of 19.6% based on a prevalence study that was done in rural south-central Somalia was used (Noor et al., 2008).

n = sample size

Z (confidence level) = 1.96

P is estimated prevalence of about ≈ 20%

C is confidence interval = 0.05

$n = \frac{1.96^2 X 0.2(1-0.2)}{0.05^2}$,

n = at least 246 febrile children were used for the study.

3.5 Sampling Technique

Participants were selected for the research using a random selection strategy. From the approximately 990 children who visit Banadir hospital in a month, an interval of selecting a child for the study to reach the sample size of 246 participants using the formula, i = N/n where 'N' is the population, 'n' is the sample size and 'i' is the interval of selecting. Considering the above formula, i = 990/246, where, i = 4. Therefore, to avoid bias and ensure data collected during the study period is representative of the target population, the study randomly selected a starting point 'r' and then select every 4th child who attended Banadir Hospital until the target sample size was reached.

Study Work Flow

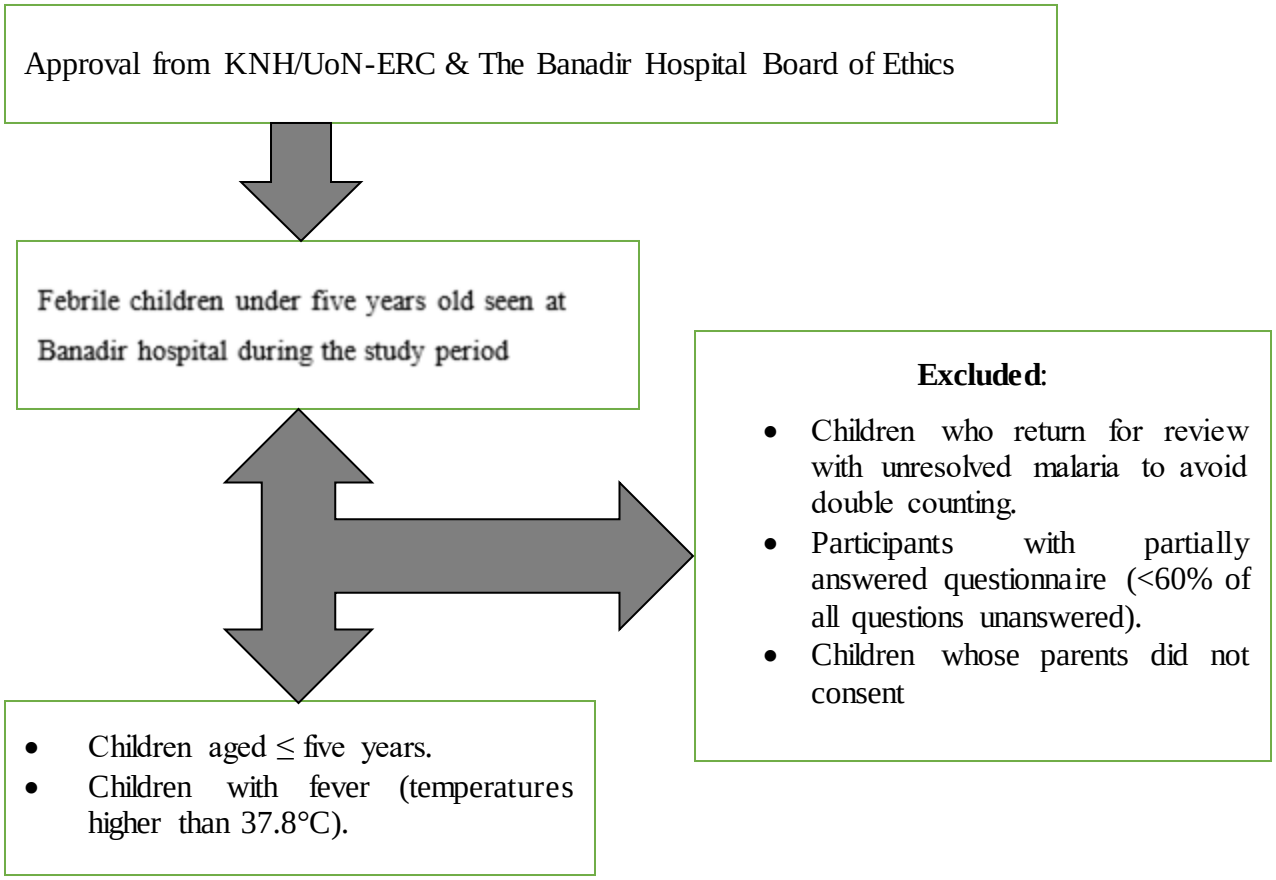

Figure 2: Study Work Flow

3.6 Data collection

3.6.1 Administrative and demographic data collection procedure

The study sought for an approval of the protocol from KNH-UoN Ethical Research Committee. And Banadir hospital board of ethics where the research was carried out. A questionnaire with two sections of close ended questions (socio-demographics and knowledge of malaria on signs, symptoms, transmission and prevention) was used. The questionnaire and the informed consent document were translated to Somali language for the locals to easily understand (Appendix C and D). In the study, parental consent was obtained by having parents sign informed consent forms. Face-to-face interviews were conducted with all participating parents. For those who couldn't read or write, verbal consent was obtained, and a questionnaire was administered orally. Participants were presented with multiple-choice questions, allowing them to select their preferred responses.

3.6.2 Laboratory data collection procedure

Capillary blood was collected from a child's finger by pricking using a sterile disposable blood lancet. Thick and thin blood film smears were prepared to detect malaria from the blood samples of each child. The smears were air dried and fixed with methanol. 10% Giemsa stain was used to stain both thick and thin film for 10 minutes. With the help of Hospital's lab technician so as to foster quality control, all air-dried slides were placed into slide boxes where they were examined by the principle investigator at Banadir hospital laboratory. The study used 100× oil immersion objective at 1000× magnification to increase the resolving power of microscope. To determine whether the blood is positive or negative for malaria, the study observed the thick smear under the microscope for presence or absence of malaria parasites. If the sample test was containing the malaria parasites, we examined the thin smear to identify the species of Plasmodium present. Data obtained from these laboratory tests were recorded into an Excel document awaiting analysis. The results were communicated back to health workers to help manage the patients accordingly.

3.7 Variables

3.7.1 Dependent variable

Malaria status among febrile children aged five years and below was the dependent variable for the present study.

3.7.2 Independent variables

In this study, the independent variables were as follows:

- Sociodemographic characteristics (gender, age, residence, education and family income)
- Children's parents' knowledge on transmission, treatment and prevention of malaria
- Proximity to stagnant water
- Use of insecticide-treated mosquito nets

3.8 Data analysis and management

Data collection included the use of a standardized interviewer-administered questionnaire. After conducting a preliminary test on 5% of the sample size using an English version of the questionnaire, it was further improved. A local language version of the questionnaire was also developed as well as the back translation to verify the consistency and equivalence. A two-day

training session was held for a laboratory technician and a nurse from Banadir Hospital. The training focused on teaching them about the data collecting instrument, interview procedures, and participant recruitment. Subsequently, data entry was performed using Microsoft excel spreadsheet and exported to SPSS, version 22.0. After that, the information was exported, cleaned, and encoded. Prior to conducting the final analysis, the correlation between the independent variables of the data was also measured as well as the fitness of the model using the Hosmer–Lemeshow model fitness test. The descriptive statistics and frequencies were represented by the use of tables and charts. Dependent and independent variables relationship was examined by the use of chi-square test while the Crouse Odd Ratio was estimated using simple logistic regression. We selected variables with a p-value of less than 0.20 in the bivariate analysis to include in the multivariable regression model. Binary logistic regression was employed to identify the factors linked to malaria and compute the adjusted odds ratio (AOR). Effects were deemed statistically significant with a p-value of less than 0.05.

3.9 Ethical consideration

The study started after the UON-KNH Ethics and Research Committee and the Banadir Hospital Ethics Board approved the proposal. This guaranteed that the study complies with the institutions' standards for quality assurance. The ethical committees made sure that during the study, the participants' rights to good care and safety are upheld. Informed consent were developed and approved. They included information on the study, including a description of the goals, importance, and general expectations. The Parent/guardian was needed to willingly sign the consent paperwork. The research assistant thoroughly explained the forms to them in either Somali or English, depending on which language they prefer, to make sure they understand the study's goals and how important they are for patients. After the parent/guardian have consented to participation in the study, assent was sought from the child participating in the study.

There was no harm to the study subjects as a result of this investigation. During the study and during the finding's dissemination phase, privacy and confidentiality ethical norms were strictly followed. In order to prevent any personally identifying information from being connected to the participants, each was given a special set of identification parameters. To prevent data loss and confidentiality breaches, the acquired data was entered into computers that are password-encrypted and periodically backed up. To ensure their protection, the hard copy questionnaire forms were stored in locked drawers. Both the computer password and the

drawer key were only available to the research investigators. Additionally, the volunteers were made aware that there are no additional fees or direct benefits to taking part in the study.

3.10 Study Results Dissemination Plan

The study findings were disseminated during a seminar at the University of Nairobi's Department of Medical Microbiology. This will enable the sharing of the study findings with both the Banadir hospital management in Mogadishu where the study was conducted, and the University of Nairobi journal club. In addition, these findings were presented to the local authorities in Mogadishu for purposes of formulating appropriate policy development frameworks. The feedback obtained from stakeholders within the area under consideration concerning the effectiveness of any intervention which can be useful in reducing the number of malaria cases among febrile children below five years of age in Somalia.

CHAPTER 4: RESULTS

4.1 Introduction

The present study findings have been described in this chapter based on the study objectives. A total of 246 children 5 years and below together with their mothers were enrolled in the study and included in the analysis, out of the 3960 who attended Banadir Hospital during the study period: December 2022 to March 2023. The results are found in the following sections: the description of the study subjects, prevalence for malaria and its associated factors (bivariate analysis and multivariate analysis).

4.2 Description of the Study participants

The study included 246 febrile children. Of the children, 51.2% were males. The majority of the kids there were less than three. Approximately 30% of the moms had no formal education, whereas 41.5% had completed elementary school. Seventy-six percent (76%) of the mothers were housewives, and more than half (63%) had a family size of more than three children. To determine whether the respondents were aware of the different symptoms of malaria, the study found that almost all participants mentioned fever (99.6%) as a symptom of malaria, while headache was mentioned by 61.8%. Regarding mode of transmission and preventive measures, about 83% mentioned that malaria is transmitted through mosquito bites, and 30.1% reported using insecticide-treated nets (ITNs) as a preventive measure.

Table 1: Characteristics of Study Participants

Characteristics	Number of children n = 246	Proportion (%)
Age of child		
Less than 12 months	14	5.7
12-24 months	151	61.4
25-36 months	35	14.2
37-48 months	25	10.2
49-60 months	21	8.5
Gender of the child		
Male	126	51.2
Female	120	48.8
Family Size		
1-3 Children	91	37.0
3-6 Children	70	28.5
Above 6	85	34.6
Education level of Caregiver		
None	71	28.9

Primary	102	41.5
Secondary	42	17.1
University	24	9.8
Master's Degree	7	2.8
Employment Status		
Public Service	12	4.9
Self-Employed	34	13.8
Private Sector	13	5.3
Housewife	187	76.0
Fever present	245	99.6
Headache present	152	61.8
Chills		
Yes	11	4.5
Abdominal Pain		
Yes	22	8.9
Muscle Joint Pain		
Yes	206	16.3
Nausea Vomiting		
Yes	129	52.4
Malaria cured	241(98.0)	98.0
Preventive Measures		
ITN	74	30.1
IRS	75	30.5
Drug	63	25.6
Environmental Management	34	13.8
Malaria is Transmissible		
Yes	52	21.14
Mode of Transmission		
Bite from mosquitoes	205	83.3
Patient Contact	3	1.2
Dirty Water	20	8.1
Weather	18	7.3
Mosquitoes breeding area		
Stagnant Water	210	85.4
Running Water	13	5.3
Soil	12	4.9
Malaria can be prevented		
Yes	214	87.0
Is there Malaria Vaccine		
Yes	235	95.5
Malaria test results		
Positive	55	22.4
Negative	191	77.6

4.3 Prevalence of Malaria

Figure 3 shows the prevalence of malaria among children aged five years and below recruited in the study. The study found prevalence of malaria illustrates a pattern across different age groups, with the highest recorded percentage being in the youngest age group of less than 12 months at 35.7% (5/14). This prevalence notably decreases in the subsequent age group of 12-24 months, dropping to 15.2% (23/151), which is less than half of the initial group's percentage. As the age increases to 25-36 months, there is a resurgence in prevalence to 31.4% (11/35), suggesting an upward trend as age increases. This trend continues modestly in the 37-48 months age group, which sees a slight rise to 32.0% (8/25). The prevalence peaks in the 49-60 months age group, reaching 38.1% (8/21), indicating the highest susceptibility or exposure to malaria in the oldest age group studied. These findings have important implications for malaria prevention and intervention strategies. Understanding the age-related patterns can inform healthcare professionals and policymakers to allocate resources effectively, prioritize interventions, and develop age-specific prevention programs. Additionally, it highlights the need for further research to uncover the underlying factors contributing to this age-dependent variation in malaria prevalence, which could lead to more tailored and effective public health measures. On the other hand, a gender-based comparison shows that male children have a slightly higher prevalence of malaria at 51.2% (126/246), compared to female children, who have a prevalence of 48.8% (120/246). These percentages reveal critical insights into the distribution of malaria prevalence not only by age but also by gender, hinting at underlying biological, environmental, or perhaps socio-behavioral factors that could influence these patterns. The data visually emphasize the need for targeted malaria control interventions that consider both age-specific and gender-specific strategies to address the varying levels of malaria prevalence effectively.

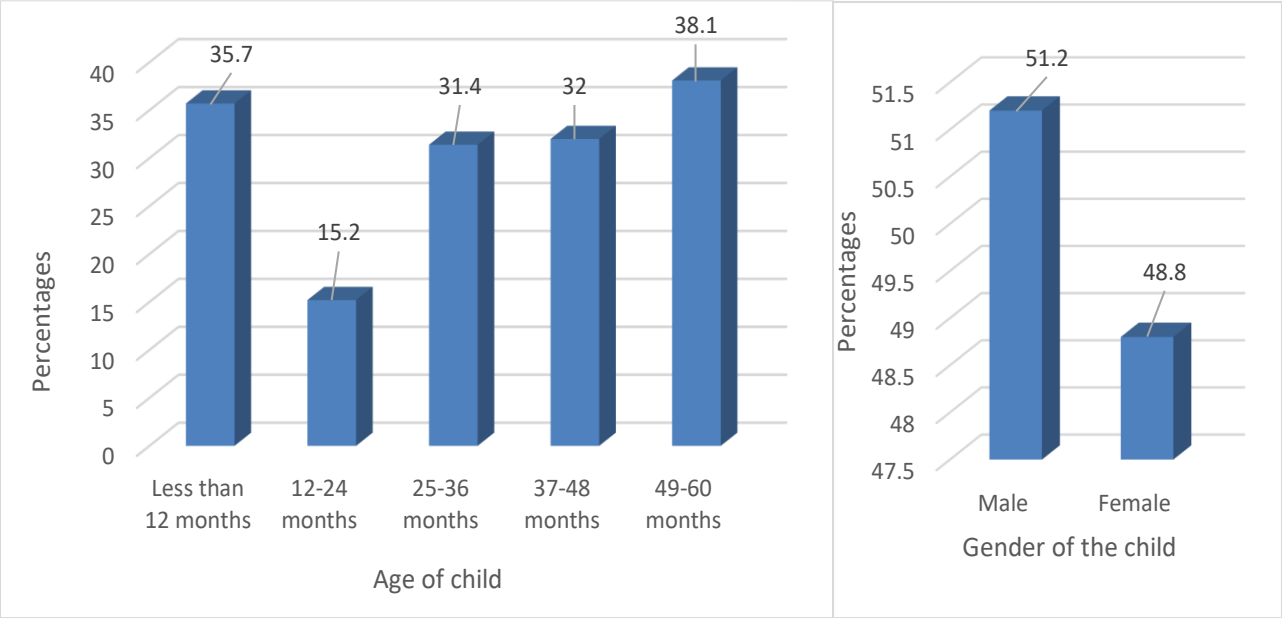

Figure 3: Prevalence of Malaria

4.4 Risk factors associated with Malaria Infection.

4.4.1 Bivariate analysis - $\chi 2$ test of association

A chi-square test was conducted at Banadir Hospital to examine the relationship between participant characteristics and malaria infection status among children aged five years and below, with the results presented in Table 2 as a bivariate analysis test of association. This research indicated that the frequency of malaria varied significantly with age among the children who participated in the study ($p = 0.019$).

Table 2: Bivariate analysis test of association

Characteristics	Total n (%)	Malaria status		p value
		Positive n(%)	Negative n(%)	
Age of child				
Less than 12 months	14(5.7)	5(35.7)	9(64.3)	0.019*
12-24 months	151(61.4)	23(15.2)	128(84.8)	
25-36 months	35(14.2)	11(31.4)	24(68.6)	
37-48 months	25(10.2)	8(32.0)	17(68.0)	
49-60 months	21(8.5)	8(38.1)	13(61.9)	
Gender of the child				
Male	126(51.2)	30(23.8)	96(76.2)	0.575

Female	120(48.8)	25(20.8)	95(79.2)	
Family Size				
1-3 Children	91(37.0)	18(19.8)	73(80.2)	0.270
3-6 Children	70(28.5)	13(18.6)	57(81.4)	
Above 6	85(34.6)	24(28.2)	61(71.8)	
Education level of Caregiver				
None	71(28.9)	15(21.1)	56(78.9)	0.702
Primary	102(41.5)	22(21.6)	80(78.4)	
Secondary	42(17.1)	8(19.0)	34(81.0)	
University	24(9.8)	8(33.3)	16(66.7)	
Master's Degree	7(2.8)	2(28.6)	5(71.4)	
Employment Status of the caregiver				
Public Service	12(4.9)	4(33.3)	8(66.7)	0.320
Self-Employed	34(13.8)	11(32.4)	23(67.6)	
Private Sector	13(5.3)	3(23.1)	10(76.9)	
Housewife	187(76.0)	37(19.8)	150(80.2)	
Knowledge of symptoms				
Fever				
Yes	245(99.6)	55(22.4)	190(77.6)	0.591
No	1(0.4)	0	1(100)	
Headache				
Yes	152(61.8)	25(16.4)	127(83.6)	0.005*
No	94(38.2)	30(31.9)	64(68.1)	
Chills				
Yes	11(4.5)	5(45.5)	6(54.5)	0.06*
No	235(95.5)	50(21.3)	185(78.)	
Abdominal Pain				
Yes	22(8.9)	8(36.4)	14(63.6)	0.098*
No	224(91.1)	47(21.0)	177(79.0)	
Muscle Joint Pain				
Yes	40(16.3)	9(22.5)	31(77.5)	0.981
No	206(83.0	46(22.3)	160(77.7)	
Nausea and vomiting				
Yes	129(52.4)	22(17.1)	107(82.9)	0.036*
No	117(47.6)	33(28.2)	84(71.8)	
Whether Malaria has Cure				
Yes	241(98.0)	53(22.0)	188(78.0)	0.339
No	5(2.0)	2(40.0)	3(60.0)	
Preventive Measures used				
ITN	74(30.1)	12(16.2)	62(83.8)	0.086*
IRS	75(30.5)	14(18.7)	61(81.3)	
Drug	63(25.6)	21(33.3)	42(66.7)	
Environmental Management	34(13.8)	8(23.5)	26(76.5)	
Whether Malaria is Transmissible				

Yes	52(21.1)	13(25.0)	39(75.0)	0.876
No	171(69.5)	37(21.6)	134(78.4)	
I don't Know	23(9.3)	5(21.7)	18(78.3)	
How Malaria is transmitted				
Bite from mosquitoes	205(83.3)	43(21.0)	162(79.0)	0.703
Patient Contact	3(1.2)	1(33.3)	2(66.7)	
Dirty Water	20(8.1)	6(30.0)	14(70.0)	
Weather	18(7.3)	5(27.8)	13(72.2)	
Mosquitoes Breeding area				
Stagnant Water	210(85.4)	48(22.9)	162(77.1)	0.392
Running Water	13(5.3)	2(15.4)	11(84.6)	
Soil	12(4.9)	1(8.3)	11(91.7)	
Don't Know	11(4.5)	4(36.4)	7(63.6)	
Malaria can be prevented				
Yes	214 (87.0)	167(67.9)	47(19.1)	0.725
No	17(6.9)	12(70.6)	5(29.4)	
I don't know	15(6.1)	12 (80.0)	3 (20.0)	
Is there Malaria Vaccine				
Yes	235 (95.5)	182(77.4)	53(22.6)	0.734
No	11(4.5)	9(81.8)	2(18.2)	
n=246 febrile children				

In the logistic regressions (Table 3), children aged 12-24 months were found to have approximately three times greater odds of being diagnosed with malaria than children under 12 months old (crude odds ratio (COR): 3.09, 95% CI: 0.95, 10.061). There was a 10% decrease in the odds of diagnosing malaria in children aged 49-60 months compared to children under 12 months old (crude odds ratio (COR): 0.90, 95% CI: 0.222, 3.675). The study also looked at whether or not there was a connection between the likelihood of a kid being diagnosed with malaria and the level of knowledge their caretakers had about the disease's symptoms, transmission, treatment, and prevention. A significant difference between the proportion of children who tested positive for malaria and those who tested negative was found among caregivers who knew that headache ($p = 0.005$), chills ($p = 0.06$), abdominal pain ($p = 0.098$), and nausea and vomiting ($p = 0.036$) are symptoms of malaria in children under five years old. Participant characteristics that were not statistically significant were not considered for multivariable analysis.

4.4.2 Multivariable Analysis-Binary Logistic Regression

Table 3 shows the results of binary logistic regression modeling of the study respondent characteristics with malaria infection status. After controlling for other factors, age of the child, whether the caregiver knew that fever is a symptom of malaria, and malaria prevention measures retained their association with malaria infection status. In the study, it was observed that children aged 12-24 months had a significantly higher likelihood of having a malaria infection compared to children under 1 year, with an adjusted odds ratio (AOR) of 2.376 (95% confidence interval: 3.107, 11.324), indicating that they were approximately 2.4 times more likely to be infected with malaria. Children aged 25-36 months were about 54% more likely to have malaria infection than children under 1 year (AOR = 1.542; 95% CI: 1.133, 2.209). Regarding knowledge of malaria symptoms, children whose caregivers knew that headache is a symptom were 44% less likely to be infected with malaria than those whose caregivers did not know (AOR = 0.560; 95% CI: 1.027, 1.159). Concerning knowledge of malaria prevention measures, children whose caregivers used indoor residual spraying (IRS) were about 40% more likely to be infected with malaria than those whose caregivers used insecticide-treated nets (ITNs) (AOR = 1.396; 95% CI: 1.557, 3.494). Children whose caregivers used drugs as a preventive measure for malaria were 2.1 times more likely to be infected with malaria than those whose caregivers used ITNs (AOR = 2.098; 95% CI: 1.881, 4.996). Likewise, children whose caregivers used environmental management to prevent malaria were about 1.3 times more likely to be infected with malaria than those whose caregivers used ITNs (AOR = 1.334; 95% CI: 1.461, 13.861).

Table 3: Multivariable analysis of factors associated with malaria infection among children 5 years and below.

Factors	COR	95% C.I.	p value	AOR	95% C.I.	p value
Age of child						
Less than 12 months (ref)	1		0.019	1		0.038
12-24 months	3.09	(1.95, 10.061)		2.376	(1.392, 4.452)	
25-36 months	1.21	(1.017, 3.613)		1.542	(1.133, 2.209)	
37-48 months	1.18	(2.29, 4.687)		1.749	(1.087, 3.519)	
49-60 months	0.90	(0.717, 1.934		0.831	(0.218, 2.781)	
Headache						
Yes	2.38	(1.294, 4.382)	0.005	0.56	(0.068, 1.371)	0.018
No (Ref)	1			1		
Chills						
Yes	0.32	(0.095, 1.10)	0.06	2.717	(0.702, 10.525)	0.148

No (Ref)	1			1		
Abdominal Pain						
Yes	0.47	(0.184, 1.173)	0.098	2.175	(0.805, 5.876)	0.126
No (Ref)	1			1		
Nausea Vomiting						
Yes	1.91	(1.038, 3.518)	0.036	0.89	(0.434, 1.824)	0.75
No (Ref)	1			1		
Preventive Measures						
ITN (Ref)	1		0.008	1		0.015
IRS	0.84	(0.261, 2.158)		1.396	(1.063, 3.285)	
Drug	0.39	(0.12, 0.870)		2.098	(1.881, 4.996)	
Environmental Management	0.63	(0.324, 1.841)		1.334	(1.193, 4.603)	

CI=Confidence Interval= CI is a range of values calculated from sample data that provides a plausible range for a population parameter, indicating the degree of uncertainty around an estimated value.

P-value=Probability Value= The p-value is a probability value that measures the likelihood of obtaining observed results

AOR=Adjusted Odds Ratio=AOR is a statistic used in logistic regression that quantifies the association between two variables while controlling for the effects of other variables

COR=Crude Odds Ratio=COR is a simple statistic that measures the association between two variables without considering the influence of other variables

CHAPTER 5: SUMMARY OF THE FINDINGS, LIMITATIONS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this section, the study findings are discussed in relation to findings obtained from other similar studies and conclusive statements and recommendations are made by the researcher.

5.2 Summary of the Findings

This study measures the prevalence of malaria and determines the associated factors among febrile children aged five years and below in different regions of Africa. It presents varying rates of malaria infection from different studies to illustrate the geographical disparities in prevalence. The section also discusses how age, prevention methods and caregiver knowledge influence the likelihood of malaria, thus examining risk factors alongside prevalence.

5.2.1 Prevalence of malaria in febrile Children aged 5 years and below

The variation in malaria infection rates among children under five across different regions in Africa is quite striking. In some areas, the rates are relatively low. For instance, Eritrea, parts of Ethiopia (such as Jigjiga, Benna Tsemay District, and Dilla District), and Djibouti have shown lower infection rates. This could be attributed to various factors, including effective malaria control measures, geographic characteristics, or socio-economic conditions. Conversely, other regions experience significantly higher malaria infection rates. Arba Minch Zuria District in South Ethiopia and several regions in Nigeria report higher rates, indicating a more substantial challenge in controlling the disease.

The highest infection rates are observed in countries like Tanzania, Burkina Faso, and across sub-Saharan Africa, along with Zambia and Mali. These alarming rates highlight the critical need for enhanced malaria control and prevention strategies in these regions. The reasons for such high infection rates could be multifaceted, encompassing factors like climate suitability for mosquitoes, limited access to healthcare, insufficient prevention measures, and socio-economic challenges. Thus, these disparities in malaria infection rates underscore the importance of tailored approaches to malaria control in Africa, considering the unique challenges and conditions of each region.

The observed differences in malaria prevalence across different areas with varying malarial control and prevention programs suggest that geographical setting may play a role. To reduce malaria incidence in children, it is necessary to implement interventions such as sensitizing communities on malaria signs and prevention, increasing the availability of impregnated mosquito nets, and improving malaria diagnosis and treatment services. Enhanced malaria prevention and controls can lead to better health outcomes for children.

5.2.2 Factors associated for Malaria in Febrile Children aged 5 years and below

The prevalence of malaria was associated with the child's age. Compared to infants, older children were up to twice as likely to test positive for malaria; this association was lost at age 49-60 months old. The association of malaria prevalence and age has also observed by others elsewhere (Zgambo et al., 2017; Eisele et al., 2009). This trend is also observed in the 25-36 months and 37-48 months age groups with AORs of 1.542 and 1.749, respectively. However, for children aged 49-60 months, the AOR is 0.831, suggesting a different outcome compared to the reference group. Symptoms such as headaches have been correlated with a higher likelihood of malaria (COR 2.38), although this association decreases when adjusted (AOR 0.56), as shown by Eisele et al. (2009). The symptoms of chills, abdominal pain, and nausea/vomiting were also examined, with chills showing a non-significant change in likelihood after adjustment (AOR 2.717), and abdominal pain and nausea/vomiting showing varied correlations with malaria likelihood.

Preventive measures adopted by households also influence malaria likelihood. The use of insecticide-treated nets (ITNs) is the baseline preventive strategy. Other measures such as indoor residual spraying (IRS) and drugs showed a significant difference in effectiveness after adjustment, with AORs of 1.396 and 2.098, respectively, suggesting that when other variables are accounted for, these methods may have different outcomes than ITNs (Deressa et al., 2014). This comprehensive analysis indicates that the factors influencing malaria likelihood in children under five are multifactorial, with age, symptomatology, and prevention methods all playing significant roles. The study findings support the need for targeted interventions that consider these varied factors (Roberts and Matthews, 2016; Tassew et al., 2017; Onyekachi et al., 2021).

5.3 Conclusions

Malaria is highly prevalent among children aged 5 years and below as observed in Banadir hospital. This showed the importance of using ITN in preventing malaria infection. The results will guide the national and local health managers to strategically distribute ITN and other malaria preventive and curative interventions with a view of mitigating morbidity associated with malaria among young children. Additionally, the study found out that lack of awareness of malaria symptoms among caregivers increases the chance of the child getting malaria which indicate a need for educational interventions to improve knowledge and understanding of malaria symptoms and prevention measures. The study also identified age of the child as factors that may influence malaria prevalence. Overall, the study provides valuable insights into the burden of malaria among children five years and below of age and offers recommendations for improving malaria prevention and control efforts in the study population and other malaria-endemic areas.

5.4 Recommendations

Based on the conclusion drawn from the study, the following recommendations can be made.

i. There is a need for more health awareness campaigns among caregivers in the target population on symptoms of malaria and preventive measures. This will encourage caregivers whose children are exposed to these risk factors to seek medical attention.
ii. Sleeping with an insecticide treated bed nets is the main mechanism for preventing malaria transmission during the night season. Therefore, ITN should be widely distributed, more so among the populations at risk.
iii. According to this study, increase in age of the child increased the chance of getting malaria. Interventions that target caregivers with children in different age category are recommended.
iv. Since the study was cross-sectional, it was not able to establish causality between the factors and the prevalence of malaria. Longitudinal studies that follow participants over time would provide more robust evidence.

5.5 Limitations of the Study

The limitations of the study were as follows: Firstly, the study questionnaire contained potentially sensitive questions, which led to the withdrawal of some participants. To mitigate this, the questions were framed with cultural sensitivity while maintaining the study's

objectives. Additionally, there was a challenge with incomplete questionnaire forms, which was addressed by making the questionnaire as concise as possible. Furthermore, the study was limited in its generalizability as it focused on a single region, and the reliance on self-reported data introduced the potential for recall bias and social desirability bias. The cross-sectional design of the study hindered the establishment of causal relationships between factors and the prevalence of malaria. Lastly, the study did not collect information on important variables like access to healthcare or travel history, which could have influenced the relationship between the examined factors and malaria prevalence.

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Appendices

Appendix A: QUESTIONNAIRE

Study Title: "Prevalence of Malaria and Associated Factors among Febrile Children under Five Years at Banadir Hospital"

1) What is your (caregiver) child's gender? Male Female

2) What is the age of your child?

A: 1- 2 Years]B: 2-3 Years [ ]

C: 3-4Years [ ]D: 4-5 Years [ ]

3) Where do you live?

4) What is your level of education (caregiver)?

Primary Secondary University Master degree

5) Employment status (caregiver) public service [ ] self-employed. [ ]

Private sector [ ] Housewife [ ]

6) Family size

1-3 children [ ]

4-6 children [ ]

Above 6 [ ]

7) Which of these are the symptoms of malaria?

Fever Headache Chills Abdominal Pain Muscle or joint pain Nausea and vomiting

8) What is the mode of transmission of malaria?

Bite from mosquitoes Patient contact Dirty water Weather

9) Does malaria have a cure? Yes No I don't know

10) Is malaria transmissible? Yes No I don't know

11) Where do mosquitoes breed?

Stagnant water Running water Soil Don't know

12) Can malaria be prevented? Yes No I don't know

13) Which method do you use to prevent yourself from getting malaria?

ITN IRS Drug Environmental management

14) Is there a vaccine for malaria? Yes No

Appendix B: CONSENT FORM

Title: Prevalence of Malaria and Associated Factors among Febrile Children under Five at Banadir Hospital.

Principal investigator: _____Dr. **Sadia Ahmed** Mohamed_____

Above researcher(s) are conducting a study which I would like to talk about. This consent form seeks to provide you with the background knowledge and information on the study. Once you have understood the consent form, you will then be required to indicate if your child should be a part of the study. You have a right to question the principal investigator regarding the objectives of the study, what happens when your child takes part in the study, risks and benefits associated with the project along with any other questions that may be on your mind. When you answer, satisfied, you can decide whether to subject your child to your research or not. Once you understand and consent to your child to partake in the study, please sign your name on this form.

You should understand the general principles which apply to all participants in medical research:

I. Your decision to have your child participate is entirely voluntary
II. You may withdraw from the study at any time without necessarily giving a reason for your withdrawal
III. Refusal to participate in the research will not affect the services your child is entitled to in this health facility or other facilities.

What is the purpose of the study?

We are doing the study to determine the frequency of malaria and associated risk factors among febrile children under five years at Banadir Hospital.

Are there any costs that that will be covered by the participants in this study?

No, none of the participants will incur any expenses associated with the study and for that reason, no reimbursements will be made to the participants.

What will happen if you decide you want your child to be in this study?

If you agree for your child to participate in this study, the following things will happen:

I. You will be questioned by the principal investigator in a private area where you feel comfortable answering questions.

The questions will last approximately 5 minutes. After the questions, we will finger-prick to collect blood specimen from your child for testing.

I. This blood will be analyzed for malaria and we will inform you about the results.
II. We will ask for a telephone number where we can contact you if necessary. If you agree to have your contact information taken, it will not be shared and if need be, you will only be contacted by the principal investigator.

Are there any risks, harms, discomforts associated with this study?

Your child may feel some pain when pricked on the finger by a sterile disposable blood lancet, after a few minutes' child will feel better. You may also feel uncomfortable when answering some of the questions. If there are any questions you do not want to answer you can skip them. You have the right to refuse any questions asked during the conduct of the study.

How will my personal information be protected?

We will do everything we can do to ensure that this is done in private. This will be achieved through the use of a code number to identify you and your child in a password protect computer database and we will keep all of our paper records in a locked file cabinet.

Are there any benefits being in this study?

Your child may benefit by receiving free testing for malaria. In case your child's test turns positive for malaria; we will inform you the results so that the child will be treated immediately. The information that you give will also help us to better understand the distribution of malaria. The information collected from this study will serve as a contribution to science.

What if you have questions in the future?

If you have further questions or concerns about your child participating in this study, please call or send a text message to principal investigator on ……**+252615484431**……

For more information about your child's rights as a research participant you may contact the Secretary/Chairperson, Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ke

Parents/guardian statement

I have read this consent form and have had a chance to discuss this research study with a study counselor. I have had my questions answered by him or her in a language that I understand. The risks and benefits have been explained to me. I understand that I will be given a copy of

this consent form after signing it. I understand that my participation and that of my child in this study is voluntary and that I may choose to withdraw at any time.

I understand that all efforts will be made to keep information regarding me and my child's personal identity confidential.

By signing this consent form, I have not given up my child's legal rights as a participant in this research study.

I voluntarily agree to my child's participation in this research study:

Yes No

I agree to have my child undergo malaria testing: Yes No

I agree to provide contact information for follow-up: Yes No

Parent/Guardian signature/Thumb stamp: _____ Date_____

Parent/Guardian printed name: _____

Researcher's statement

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has knowingly given his/her consent.

Principal investigator's name: _____ Dr. **Sadia Ahmed**_____

Signature: _____ Date: _____

Appendix C: WARQADA OGOLAANSHAHA

Ciwaanka; Baahsanaanta Duumada iyo khatarta la xiriirta ee Caruurta qandheysan ee ka yar Shan sano e Cisbitaalka Banadir.

Baaraha Cilmibaarista: _____ Dr. **Sadia Ahmed_**Mohamed**_____**

Waxa jeclaan lahaa in an kuu sheego wax ku saabsan cilmi baaristaan,

Muhiimada foomkaan waa in lagaa caawiyo inad fahamto cilmi baaristaan , kadib markaa fahamto waxaa u baahantahay inaad goaansato in cunugaaga ka qeybqaato iyo inkale , waxaad xaq uleedahay inad na waydiiso muhiimada cilmi baaristaan , iyo waxa dhici kara haduu cunugaaga ka qeyb qaato cilmi baaristaan . marka lagaaga jawaabo suaalahaaga oo ad ku qanacdo waxaa iqtiyaar u leedahay in cunugaaga ka qeyb qaato iyo in aad diido , marka aad fahantid oo ad ogolaatid waxa kaa codsanaayaa inad magacaaga ku saxiixdid foomkaan.

Waxyaabaha muhiimka ah inad fahantid

1.Goaan ka cunugaaga ka qeybgalkiisa wa mutadawacnimo oo qasab maaha.

2. wuu ka bixi karaa baaritaanka cunugaaga waqti walbo ad rabto.

3. Diidmada ka qeybgalka wax saameyn ah maku yeelan doonto daaweynta cunugaaga.

Waa maxay muhiimada baaritaankan?

Waxaan sameynayaa cilmi baaristaan si an u ogaano

Baahsanaanta Duumada iyo khatarta la xiriirta ee Caruurta qandheysan ee ka yar Shan sano e Cisbitaalka Banadir.

Maxaa dhici kara hadii cunugaaga ka qeyb qaato baaritaanka?

1. Waxaa laguugu waydiina suaalaha meel gaar ah oo ad ku qanacsantahay .
2. Suaalaha waxay qaadanayaan 5daqiiqo kadibna waxa ka qaadi doonaa cunuga dhiig si looga baaro malaariyo.
3. Jawaabta baaritaanka wan kuu sheegi doonaa.
4. Jawaabta baaritaanka qofkale mala wadaagi doono , waxa kuso wici doono baaraha cilmi barista ama ku imaan doono

Wax dhibaato ah miyeey leedahay baaritaankan?

Waxaa laga yaabaa in cunugaaga dareemo xanuun yar marka dhiiga laga qaadaayo , ama adigaba aadan jecleysanin suaalaha lagu waydiinaayo , hadii lagu waydiiyo suaal ad dhibsanaysid wa diidi kartaa inad ka jawaabtid.

Wax faaido ah miyuu leeyahay baaritaankan?

Cunugaaga wuxu helaayaa baaritaan lacag la aan ah , hadii laga helo malaariyana wa laguu daaweynaa , sidoo kale suaalaha ad nooga jawaabtid waxay naga caawin doontaa in an fahamno xanuunkan malaariyada waxayna anfaceysaa guud ahaan wadanka .

Sidee loo ilaalin doonaa aqbaarta ad nasiisid?

Waxaan ku dadaali doonaa in aqbaartaada ay ahaato mid gaar ah , magacaaga ma isticmaali doono , baladalkeeda waxa isticmaali doonaa lambaro , kadibna waxa ku keeydin doonaa meel qofkale uusan arkeynin.

Maxa samaynaysaa hadii ad suaal qabtid?

Suaal walbo oo ad qabtid waxa la xiriiri kartaa baaraha cilmi-baarista ……**+252615484431**……

Si ad u ogaatid xuquuqda cunugaaga sidoo kale waxad la xiriiri kartaa

Xoghayaha jaamacda Nairobi qeybta anshaxa iyo cilmi barista . Kenyatta National Hospital-University of Nairobi Ethics and Research Committee Telephone No. 2726300 Ext. 44102 email uonknh_erc@uonbi.ke

Oraahda waalidka

Waan aqriyay warqadaan waana fahmay , sido kale waxan helay waqti an kula hadlo baaraha cilmi-baarista , waxa la ii sharaxay faaidooyinka iyo qasaaraha cilmi baaristaan waana laygaga jawaabay suaal walbo oo an qabay , anigaa goaansaday in cunugayga ka qeybqaato cilmi baaristaan , qofna ma i qasbin , waqti walbo oo an damco in an ka baxo baaritaankan si xor ah ayan ugu bixi doonaa in an saxiixo warqadaan macnaheeda maaha in an ku xadgudbay xuquuqda sharciga e cunugayga .

Ayadoo leyqasbin Ayaan ogolaaday in cunugayga ka qeybqaato baaritaankan

Haa Maya

Waan ogolahay in cunugayga laga qaado dhiig si looga baaro malaariyo

Haa Maya

Waan ogolahay in laywaydiiyo suaalo baaritaanka kadib si loola socdo cunugayga

Haa Maya

Saxiixa waalida / Suul saarka …… Tariiqda ……

Magaca waalidka

Oraahda baaraha cilmi-baarista

Aniga oo ah baaraha guud waxaan si buuxda u sharaxay faahfaahinta la xiriirta ee daraasaddan/cilmi-baaristan ka qaybgalayaasha kor ku xusan oo aan aaminsanahay in ka-qaybgaluhu uu fahamkay oo uu si ogaal iyo kutalagal ah oggolaanshihiisa u bixiyay.

Baaraha cilmi-baarista: **_____**Dr. **Sadia Ahmed_____**

Saxiixa ……

Appendix D: Minor Assent Document (English)

(To be modified based on the age bracket)

I am **Sadia Ahmed** a postgraduate student at the University of Nairobi, Department of Medical Microbiology & Immunology. I am the principal investigator in the above titled study. I am conducting the study as a partial fulfilment for the award of Master of Science degree of Tropical and Infectious Diseases at the University of Nairobi

What is the purpose of the study?

We are doing the study to determine the frequency of malaria and associated risk factors among febrile children under five years at Banadir Hospital.

Are there any costs that that will be covered by the participants in this study?

No, none of the participants will incur any expenses associated with the study and for that reason, no reimbursements will be made to the participants.

What will happen if you decide you want to be in this study?

If you agree to participate in this study, the following things will happen:

I. You will be questioned by the principal investigator in a private area where you feel comfortable answering questions.
II. The questions will last approximately 5 minutes. After the questions, we will finger-prick to collect blood specimen.
III. This blood will be analyzed for malaria and we will inform you about the results.

Are there any risks, harms, discomforts associated with this study?

You may feel some pain when pricked on the finger by a sterile disposable blood lancet, after a few minutes you will feel better. You may also feel uncomfortable when answering some of the questions. If there are any questions you do not want to answer you can skip them. You have the right to refuse any questions asked during the conduct of the study.

How will my personal information be protected?

We will do everything we can do to ensure that this is done in private. This will be achieved through the use of a code number to identify you in a password protected computer database and we will keep all of our paper records in a locked file cabinet.

Are there any benefits being in this study?

You may benefit by receiving free testing for malaria. In case your child's test turns positive for malaria; we will inform you the results so that the child will be treated immediately. The

information that you give will also help us to better understand the distribution of malaria. The information collected from this study will serve as a contribution to science.

When we are finished with this study, we will write a report about what was learned. This report will not include your name or that you were in the study.

You do not have to be in this study if you do not want to be. If you decide to stop after we begin, that's okay too. Your parents know about the study too.

If you decide you want to be in this study, please sign your name.

I want to be in this research study.

_____ _____

(Signature/Thumb stamp) (Date)

Appendix E: Minor Assent Document (Somali)

FOOMKA OGALAASHAHA ILMAHA

Ciwaanka; Baahsanaanta Duumada iyo khatarta la xiriirta ee Caruurta qandheysan ee ka yar Shan sano e Cisbitaalka Banadir.

Baaraha Cilmibaarista: _____ Dr. **Sadia Ahmed_____**

Waxa an fulinaynaa cilmi-baaris ku saabsan baahsananta duumada e ilmaha ka yar shanta sano. Cilmi baaristaan waxa ogolaasho/ruqsad siiyay Kenyatta National Hospital-University of Nairobi Ethics and Research Committee (KNH-UoN ERC) isbitaalka qaranka Kenyatta iyo jaamacada Nairobi waaxda cilmi barista . Lumber.(_____) .

Cilmi baaristaan waxa kaala qeyb qaadan doono ugu yaraan 246 ilmo . Hadii ad goansatid inad qeyb ka noqoto cilmi baaristaan waxa lagu waydiin doonaa sharaxaadyo inta ey socoto cilmi baaristaan. Waxaa jiro waxyaabo ku saabsan cilmi baaristaan oo ay tahay inad ogaatid sida (habraaca , waqtiga cilmi barista oo dheeraan kara , ama inaadan ku farxin suaalaha ama habraaca qaar) ,

Qofka ka qeyb qaato cilmi baaristan faaido gaar ah maheli doono , Faaidada waxay noqon kartaa in ilmahaaga laguu daaweyo. Hadii aadan rabin in aad qeyb ka noqoto cilmi baaristaan waad heli dontaa adeegyada kale caafimaadka.

Gabagabada cilmi baristaan waxa soo saari doontaa warbixin ku saabsan wixi laga bartay cilmi baaristaan. warbixinta Malagu xusi doono magacaaga iyo inaad qeyb ka ahayd cilmi baaristaan. Maku qasbanid inad ka qeyb qaadatid cilmi baaristaan, Markii an bilowno cilmi baarista kadib hadii ad goansato inad ka baxdo cilmi barista wad ka bixi kartaa, waalidkaaga wu ogyahay xogta cilmi baaristaan.

Hadii ad goansato inad ka qeyb ka noqoto cilmi baaristan fadlan magacaaga ku saxiix.

Qeyb ayan ka ahay …….

Saxiix/suul saar ……

Taariiq ……..

Appendix F: SUAALO

1) What is your child's gender? ( ) Male ( ) Female

Waa maxay jinsiga cunugaaga? ( ) Wiil ( ) Gabar

2) What is the age of your child?

Meeqa sano jira cunugaaga?

A: 1-2 [ ] B: 15-29months [ ]

A; 1-14bil ( ) B; 15-29 bil ( )

C: 30-44months [ ] D: 45-59months [ ]

C; 30-44bil ( ) D; 45-59bil ( )

3) Where do you live?

Intee Dagantahay?

4) What is your level of education (caregiver)?

Waxbarashada ilaa heerkee ka gaartay ? (Waalidka)

Primary Secondary University Master degree

Dugsi hoose Dugsi sare Jaamacad Heerka 2aad e jaamacada

5) Employment status (caregiver)

Maxaa ka shaqeysaa (Waalid ka)

public service [ ] self-employed. [ ]

shaqo dowladeed ( ) iskeed u shaqeesata ( )

Private sector [ ] Housewife [ ]

Meel gaar ah ka shaqeeysa ( ) Guri joogto ( )

6) Family size

Qoyskiina meeqa ka koobanyahay ?

1-3 children [ ] 1-3 caruur ( )

4-6 children [ ] 4-6 caruur ( )

Above 6 [ ] 6 caruur iyo ka badan ( )

7) Which of these are the symptoms of malaria?

Kuwaan so socdo kuwee ah calaamadaha xanuunka malaariyada /Duumada ?

Fever Headache Chills Abdominal Pain Muscle or joint pain Nausea and vomiting

Qandho , Madax xanuun , Jareys/qarqaryo , Calool xanuun , Murqo xanuun , Matag iyo lalabo.

8) What is the mode of transmission of malaria?

Malaariyada see u faaftaa ?

Bite from mosquitoes Patient contact Dirty water Weather

Kaneeco o ku qaniinto , Bukaan in u kugu daarto, Biyo wasaq ah , Cimilada .

9) Does malaria have a cure? Yes No I don't know

Malaariyada mala daaweyn karaa? Haa Maya Ma aqaani

10) Is malaria transmissible? Yes No I don't know

Malaariyada maleesku daaran karaa? Haa Maya Ma aqaani

11) Where do mosquitoes breed?

Kaneecada intee ku tarantaa ?

Stagnant water Running water Soil Don't know

Biyo fadhiisadka Biyo socdo Ciida/carada Ma aqaani

12) Can malaria be prevented? Yes No I don't know

Malaariyada Malaga hortagi karaa Haa Maya Ma aqaani

13) Which method do you use to prevent yourself from getting malaria?

Maxaad sameysaa si ad ugu hortagtid malaariyada ?

ITN IRS Drug Environmental management

Maro ka neeco ( ) waa buufiyaa ( ) daawooyin ka hortag qaataa ( ) daaqaha xeraa wana qaaciyaa guriga ( )

14) Is there a vaccine for malaria? Yes No

Talaal ma leeyahay cudurka malaariyada ? Haa Maya