DETERMINANTS OF MALARIA RECURRENCE AMONG PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN REFERRAL HOSPITAL IN BELEDDWEYN DISTRICT, SOMALIA

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DECLARATION AND APPROVAL

I declare that this research is original, not submitted elsewhere, ethically approved, and all sources are acknowledged.

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DEDICATION

This thesis is dedicated to my parents, especially my mother, Ubah Dahir Ahmed, whose unwavering support, guidance, and prayers have greatly helped me during my master's journey.

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I would therefore like to start by appreciating the Almighty God for the successful completion of this work and my mother Mrs. Ubah Dahir Ahmed for providing me with the needed moral support during the preparation of this work. I am also deeply grateful to my supervisors, Dr. Juma Joseph and Dr. Teresa Ngonjo, for their invaluable guidance and insight. A special thanks goes to Dr. Owino for their additional support and encouragement.

ABSTRACT

Malaria is a potentially life-threatening disease caused by the *Plasmodium* parasite, transmitted to humans through the bites of infected female *Anopheles* mosquitoes. The disease remains a major global health challenge, particularly in low-resource and conflict-affected regions. In areas such as Somaliland and Puntland, maternal healthcare is underdeveloped, with only 44% and 38% of births, respectively, attended by licensed birth attendants. This shortage of qualified health professionals poses additional risks to pregnant women, who are especially vulnerable to malaria. Malaria remains a major global health challenge, particularly in low-resource and conflict-affected regions. In Somalia, where maternal healthcare is underdeveloped, pregnant women face heightened risks due to limited access to skilled birth attendants and preventive measures. This study examines the factors influencing malaria recurrence among pregnant women in Beletweyn, focusing on malaria awareness, socioeconomic vulnerability, ITN usage, and malaria medicine resistance. Guided by the Health Belief Model, the study employed a mixed-methods approach, using standardized questionnaires and in-depth interviews. A sample of 424 pregnant women attending Beletweyn Hospital's antenatal clinic was selected through stratified random sampling, while 15 nurses were purposively sampled as key informants. Data were analyzed using SPSS version 23, with descriptive and inferential statistics identifying relationships, and thematic analysis applied to qualitative data. Findings revealed that higher malaria awareness was linked to lower recurrence rates (β=0.147, p=0.000), suggesting that informed women adopt better preventive measures. Socioeconomic vulnerability significantly increased recurrence (β=0.342, p=0.000), underscoring the burden on lower-income women who lack access to healthcare and preventive tools. ITN usage was strongly associated with reduced recurrence (β=0.397, p=0.000), reaffirming their effectiveness in malaria prevention. Additionally, malaria medicine resistance (β=0.143, p=0.000) posed a growing challenge, making treatment less effective and increasing recurrence risks. These findings emphasize the urgent need for targeted interventions, including malaria education, improved ITN distribution, and stronger measures to combat drug resistance. Strengthening healthcare infrastructure and enhancing access to quality maternal care in resource-limited settings like Beletweyn are critical in mitigating malaria-related complications. Addressing socioeconomic disparities and investing in community-based malaria prevention programs will be essential in reducing recurrence. Future research should explore additional determinants of malaria recurrence and assess the long-term impact of targeted interventions. Reducing malaria recurrence among pregnant women will require sustained collaboration among policymakers, healthcare providers, and community stakeholders to improve maternal and neonatal health outcomes.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACTs: Artemisinin Combination Treatments

ANC: Antenatal Clinic

API: Asymptomatic Plasmodium Infections

GMIS: Ghana Malaria Indicator Survey

ITNs: Insecticide Treated Bed Nets

LLINs: Long-Lasting Insecticidal Nets

MOP: Malaria Operational Plans

NDHS: Nigeria Demographic Health Survey

PMI: President's Malaria Initiative

WHO: World Health **Education** *(Potential error: "Education" should likely be "Organization")*

CHAPTER ONE

INTRODUCTION

1.0 Introduction

Chapter One introduces the study on malaria recurrence among pregnant women attending antenatal care, detailing its objectives, research questions, and significance. It highlights the impact of malaria on maternal health and the importance of effective prevention strategies. The chapter also provides an overview of the study's methodology and context within current public health challenges.

1.1 Background of study

The Anopheles mosquito, specifically the female, is the vector that transmits the malaria-causing parasite to humans through its bite (Kataria et al., 2022). The severity of malaria illness may range from mild to fatal. The flu-like symptoms and other mild symptoms are common in people infected with uncomplicated malaria. Without treatment, patients risk developing complicated malaria, which may cause organ failure, coma, and death. In malaria endemic areas, malaria is still a major public health concern since it leads to massive sickness, death and a high socioeconomic effect (World Health Organization, 2018). Goals of malaria treatment procedures comprise prevention of the first effects of the disease. However, research is beginning to show that the incidents of relapsing are linked to the build up in sickness and a higher added threat of pre:mature death (Dini, Douglas, Poespoprodjo, Kenangalem, Sugiarto, Plumb & Simpson, 2020).

Malaria recurrence refers to the reappearance of clinical symptoms of malaria in a person who has previously been infected with the disease and has been successfully treated (Dini*et al*., 2020). Recurrence occur due to a number of factors, including incomplete treatment, reinfection from a new mosquito bite, or reactivation of dormant parasites in the liver. Malaria recurrence cases are therefore individuals who have experienced a recurrence of clinical symptoms death from malaria despite receiving treatment (Dini et al., 2020). These cases can be further categorized based on the time of recurrence: early recurrence, which occurs within 28 days of initial treatment and late recurrence, which occurs after 28 days.

According to Dhiman (2019), Relapse cases are a major problem to malaria control and elimination programmes because they may contribute to the transmission and persistence of malaria in areas which are already endemic or an increased risk of malaria. Malaria case management including frequent follow up of those who develop the disease and early management of any relapse is thus important in decreasing the impact of the disease. When a pregnant woman has malaria, it may have devastating effects for her and her unborn child (Gontie, Wolde&Baraki, 2020). When malaria recurs in pregnant women, it exacerbates these risks and lead to further complications.

The greater risk of having a baby with problems is one of the most serious consequences of malaria recurrence in pregnant mothers attending antenatal clinics. Goucher et al (2003) revealed that, women who get malaria repeatedly are likely to deliver a baby with low birth weight and anaemia, premature labour and also foetal loss. Patouillard et al Total, miscarry, intrauterine death, early delivery, LBW, and neonatal mortality rate. At the same time, lots of other adverse outcomes that pregnancy-affected Selling a host of other adverse outcomes that affect pregnant women. Both severe anaemia and maternal mortality are more common in this population. This is due to malaria

infection causing placental damage, impairing foetal growth, and interfering with the development of the foetal immune system. Malaria recurrence in pregnant women increases the risk. According to Dayanand, Achur and Gowda (2018), relapses of antimalarial drugs lead to the development of parasites that will infect more people and are behind emergence of drug-resistant parasites.

Globally, many countries that once had a malaria problem are now reporting declining malaria rates and are likely on the path to eradicating the disease (Dhiman, 2019). Most countries with a malaria problem have implemented comprehensive malaria control programmes, with positive outcomes by lowering total episodes and mortality (Dhiman, 2019). In the United States, malaria is relatively rare, with fewer than 2,000 cases reported annually (Battle et al., 2019). Most of these cases are imported from other countries, particularly sub-Saharan Africa, where the disease is endemic. However, as for the number of the registered cases of malaria in the United States, it has increased slightly within the recent years. This rise has been attributed to factors such as increase in travels to areas with malaria and the coming of a new type of parasite that is resistant to drugs (Caminade, McIntyre & Jones, 2019).

According to Howes et al. (2016) in Europe, malaria is also relatively rare, with only a few hundred cases reported each year. However, the disease remains a concern in some parts of the continent, particularly in southern Europe, where the climate is more conducive to mosquito breeding. The number of imported cases has risen in recent years of malaria in Europe, which has been attributed to factors such as increased travel to malaria-endemic areas and migration from countries where the disease is endemic (Caminade, McIntyre & Jones, 2019). Despite these challenges, recent years have seen dramatic reductions in the worldwide burden of malaria. The worldwide malaria incidence decreased by 27% between 2010 and 2019, while the number of fatalities caused by malaria decreased by 60% over the same time period (World Health Organisation, 2020). The

development of new instruments and tactics for managing the disease, as well as an increase inent. Several factors, including more money for malaria control programmes, easier access to prevention and treatment methods, and the creation of novel tools and strategies for controlling the disease, have contributed to this improvement disease (World Health Organization, 2020).

In Sub-Saharan Africa, malaria burden is the highest globally, greatly affecting pregnant women who seek treatment at prenatal clinics. Pregnant women in Tanzania who were infected with malaria more than once had babies born with a lower birth weight compared to those who had only had one infection (Minja et al., 2013). Studies carried out in Ghana revealed that pregnant women who had relapses were likely to deliver preterm and forth born babies with low birth weight less than 5 pounds (Mohammed et al., 2019). In addition, the increased risk of adverse pregnancy outcomes, malaria recurrence cases can also have significant economic implications for pregnant women and their families. In some settings for instance in Ethiopia, recurrent malaria infections require additional medical attention and treatment, which increase healthcare costs and create a significant financial burden for pregnant women and their families (MehretieAdinew, Abera, Assefa & Mehretie Adinew, 2018).

Malaria remains a significant public health concern in Somalia, particularly among vulnerable groups such as pregnant women and children under the age of five (Kinyoki et al., 2018). The disease exhibits seasonal patterns, with high transmission occurring between April and June and again between October and December. The estimated malaria prevalence among pregnant women in Somalia is approximately 25%, with rural women experiencing a higher burden of infection (Mohamud, 2022).

A study conducted in the Puntland region reported a malaria prevalence of 24.3% among pregnant women, with most cases occurring during the first and second trimesters (Mohamud & Mohamud, 2022). Similarly, research in the Lower Juba region found that malaria was responsible for 20% of maternal deaths, highlighting its severe impact on maternal health (Warsame et al., 2015).

One of the critical complications of malaria during pregnancy is low birth weight. A study conducted in the Afgooye area of Somalia found that newborns of mothers who contracted malaria during pregnancy had an increased risk of low birth weight and neonatal death (Kalid, Osman, Sulaiman, Dykes, & Erlandsson, 2019). This underscores the importance of understanding the factors contributing to malaria recurrence among pregnant women, particularly in high-burden regions like Beledweyn District.

Given the high prevalence and severe consequences of malaria among pregnant women, this study aims to investigate the determinants of malaria recurrence among expectant mothers attending antenatal clinics at Beletweyn Referral Hospital. Understanding these determinants will help in developing targeted interventions to reduce malaria cases and improve maternal and neonatal health outcomes in Somalia.

1.2 Problem Statement

Malaria remains a significant public health concern in Somalia, particularly affecting vulnerable groups such as pregnant women and children under five (Kinyoki et al., 2018). Despite ongoing malaria control efforts, the disease continues to contribute to high morbidity and mortality, especially in regions with poor healthcare access. The World Health Organization (WHO) classifies Somalia as a high-burden malaria country, with unstable transmission and seasonal

outbreaks. Peak malaria transmission occurs between April and June and again from October to December, coinciding with the rainy seasons that create favorable mosquito breeding conditions.

The estimated malaria prevalence among pregnant women in Somalia is approximately 25%, with rural populations disproportionately affected due to inadequate access to preventive measures such as insecticide-treated bed nets (ITNs) and intermittent preventive treatment in pregnancy (IPTp) (Mohamud, 2022). Studies in Puntland have reported a malaria prevalence of 24.3% among pregnant women, with most infections occurring during the first and second trimesters, when maternal immunity is weakened (Mohamud & Mohamud, 2022). Similarly, research in Lower Juba indicates that malaria accounts for 20% of maternal deaths, further underscoring its impact on maternal health outcomes (Warsame et al., 2015).

The consequences of malaria during pregnancy are severe, including maternal anemia, preterm birth, stillbirth, and low birth weight—a leading cause of neonatal mortality. A study in Afgooye, Somalia, found that infants born to malaria-infected mothers had significantly lower birth weights and higher neonatal death rates than those born to uninfected mothers (Kalid et al., 2019). Additionally, growing resistance to commonly used antimalarial drugs, such as sulfadoxine-pyrimethamine (SP), presents an emerging challenge, making treatment less effective and increasing the likelihood of malaria recurrence.

Despite the high malaria burden among pregnant women, research on malaria recurrence in high-risk areas such as Beletweyn remains limited. Beletweyn, the capital of the Hiran region, experiences frequent malaria outbreaks due to its proximity to the Shabelle River, which provides ideal mosquito breeding conditions. The recurrence of malaria among pregnant women

significantly increases the risk of severe maternal complications and places additional strain on already overburdened healthcare facilities.

This study seeks to examine the factors influencing malaria recurrence among expectant mothers attending antenatal clinics at Beletweyn Referral Hospital. It focuses on four key areas: malaria awareness among pregnant women, their socioeconomic vulnerability, the coverage and use of ITNs, and the impact of malaria medicine resistance on their health. The findings will provide valuable insights for strengthening malaria prevention strategies, improving access to effective treatments, and enhancing maternal and neonatal health outcomes in Somalia. Addressing these challenges through targeted interventions will be critical in reducing malaria-related complications and ensuring better health outcomes for pregnant women in Beletweyn and beyond.

1.3: Justification of the study

The selection of Beletweyn Hospital in Beledweyn District, Somalia as the study site for investigating the effects of malaria recurrence among pregnant mothers attending antenatal clinics is well justified for several reasons.

First, Beledweyn District is located in a high malaria transmission region, making it an ideal setting to study the burden and recurrence of malaria among pregnant women. The district experiences seasonal malaria outbreaks, with peak transmission occurring between April and June and again between October and December due to favorable climatic conditions for mosquito breeding. As a result, malaria remains a leading cause of morbidity and mortality among vulnerable populations, particularly pregnant women.

Second, malaria remains a major public health challenge in Somalia, with high reported cases among expectant mothers. According to the World Health Organization (WHO), malaria is the leading infectious cause of death among pregnant women globally, and Somalia is among the high-burden countries where maternal health outcomes are severely affected by the disease. The annual malaria reports indicate persistently high infection rates among pregnant women, leading to complications such as anemia, preterm births, and low birth weight, which increase neonatal mortality.

Third, Beletweyn Hospital is the largest healthcare facility in the district and serves as a referral center for maternal healthcare services, including antenatal care (ANC). Pregnant women regularly seek ANC services at the hospital, making it a strategic location for studying the recurrence of malaria among expectant mothers. Antenatal care (ANC) provides a unique opportunity for malaria diagnosis, prevention, and treatment, as it serves as a single point of contact for screening expectant mothers for malaria and other pregnancy-related complications.

Moreover, the study is expected to have significant practical implications for healthcare providers and policymakers. By identifying the determinants of malaria recurrence among pregnant women in Beledweyn District, the findings will help improve malaria prevention strategies, enhance antenatal care services, and contribute to the reduction of maternal and neonatal mortality rates in Somalia. The results will also provide evidence-based recommendations for strengthening malaria control interventions, such as increasing the use of insecticide-treated bed nets (ITNs), improving access to intermittent preventive treatment in pregnancy (IPTp), and addressing drug resistance challenges.

Thus, Beletweyn Hospital's location in a high-transmission area, its role as a major maternal healthcare provider, and the urgent need for effective malaria interventions justify its selection as the study site. The study's findings will be instrumental in shaping health policies and interventions aimed at reducing malaria-related complications among pregnant women in Somalia.

1.4 Objectives

1.4.1 General objective

To assess the determinants of malaria recurrence among pregnant mothers attending antenatal clinic at Beledweyn referral hospital in Beleddweyn district, Somalia

1.4.2 Specific Objectives

i. To assess the level of knowledge about the recurrence of malaria among pregnant women who visit the prenatal clinic at Beletweyn Hospital in the Beledweyn area, Somalia.
ii. To identify the socio-economic risk factors associated with the recurrence of malaria among pregnant women who visit the prenatal clinic at Beletweyn Hospital in the Beledweyn area, Somalia.
iii. To determine the coverage and use of Insecticide Treated Bed Nets (ITNs) in prevention of malaria recurrence among pregnant women attending the prenatal clinic at Beletweyn Hospital in Beledweyn District, Somalia.

1.5: Research Questions

i. What is the extent of knowledge about the recurrence of malaria among pregnant women who visit the prenatal clinic at Beletweyn Hospital in the Beledweyn area, Somalia?

ii. What socio-economic risk factors are associated with the recurrence of malaria in pregnant women who visit the prenatal clinic at Beletweyn Hospital in the Beledweyn area, Somalia?

iii. What is the level of coverage and use of Insecticide Treated Bed Nets (ITNs) among pregnant women visiting the prenatal clinic at Beletweyn Hospital in the Beledweyn area, Somalia?

1.6 Significance of the study

The findings of the study will be significance to the government, community, researchers and the donors for policy decision making, information and educational planning to prevent malaria resurgence problem by various stakeholders in Somalia and not limited to international development partners.

The study is significant government officials in Beleddweyn District, Somalia, as it showed what factors lead to malaria returning in pregnant women. This knowledge helped in formulating effective policies and measures to reduce the risk of malaria infection during pregnancy. Furthermore, the study's results could be used to guide funding decisions for regional malaria control initiatives. Further, the research may aid in the government's pursuit of the health-related Sustainable Development Goals, such as decreasing maternal mortality and improving child health combating malaria.

The study on determinants among expectant women who went to the Beletweyn Referral Hospital prenatal clinic for a second time with symptoms of malaria in Beleddweyn District, Somalia, is significant to the community as it provided information on the factors contributing to malaria recurrence. This information helped the community to understand the importance of preventive

measures such as bed net use, malaria prophylaxis, and timely treatment of malaria. It also empowered the community to be responsible for their health and to choose their treatment accordingly to protect themselves and their families from malaria.

The study is significant to academics since it added to their understanding of the frequency with which malaria recurs in pregnant women in comparable environments. The research results helped to identify knowledge gaps, refine research questions, and develop appropriate interventions to prevent malaria recurrence among pregnant women. The study may also provide a platform for further research in related areas.

The study is significant to donors as it provides evidence-based insights into the factors contributing to malaria recurrence among pregnant women in Beledweyn District, Somalia. By identifying these determinants, the study will help in designing targeted and effective interventions to reduce the risk of malaria reinfection during pregnancy. Additionally, the findings can be used to support data-driven funding proposals for malaria prevention and control programs in the region, ensuring that resources are allocated efficiently to address the most pressing challenges in maternal health.

1.7. Scope of the study

The area of the research determines where research was carried out so that its geographical setting is clear. In this study, the geographical coverage is Beletweyn referral hospital in Beleddweyn district, in the country of Somalia. This implies that the study targeted pregnant women attending antenatal clinic in this particular place only.

Together with the background information given by the example, the subject scope explains which questions was asked, and which topics was investigated. Determinants of Malaria Recurrence Among Pregnant Women Attending Antenatal Clinics: Understanding Malaria Recurrence, risk Factors linked with Socio-economic status as well as Insecticide-Treated Bed Net are all areas of focus of this study.

According to the time scope of the study, this describes the time period in which the research was done. With regards to the time horizon of the study, it has been defined clearly as six months, starting from February, 2023 to August, 2023. This time scope enabled the study to establish the factors that leads to malaria RPT among pregnant mothers attending antenatal clinic at Beletweyn referral hospital in Beleddweyn district, Somalia within this given period. The temporal dimension helps to understand variations of malaria relapses, and such an influence of interventions.

In this study, the concept scope includes malaria recurrence, which is the dependent variable and the determinants of malaria recurrence, which are the independent variables. Other concepts that may be investigated include access to healthcare services, adherence to malaria prevention measures, and socio-demographic factors. The study does not cover other concepts, such as the effectiveness of specific malaria prevention interventions or the economic burden of malaria on families.

1.8 Study Limitations

Participants, especially health staff, may be hesitant to provide information regarding the status fearing reprimand or conflict from hospital management or those in authority if they provide information that might be seen as negative to the Beledweyn hospital. A warning to participants that the data is being collected for academic reasons solely and is not meant to tarnish the hospital's

reputation would help alleviate this limitation. Also, participants' consent and research approval was acquired before they are included in this study. Since this information is easily accessible, the study focused on the amount of knowledge of Malaria recurrence, socioeconomic risk factors, insecticide-treated mosquito nets. The scope of the investigation was confined to Beledweyn hospital. The study runs from February 2023 to August 2023, indicating the study's time frame. Semi-structured questionnaires were distributed to pregnant women as well as key informant interviews with nurses at Beletweyn Hospital, to gather data.

1.9: Delimitation of the Study

Delimitation of the study refers to the boundaries or limitations that the research faced. The delimitations of this study may include:

i. The study only focused on pregnant mothers attending antenatal clinic at Beledweyn referral hospital in Beleddweyn district, Somalia. It not included pregnant mothers who do not attend antenatal clinic or who seek care from other healthcare facilities.
ii. The study only investigated the determinants of malaria recurrence among pregnant mothers and not included non-pregnant individuals or other diseases.
iii. The study only collected data from the period of February 2023 to August 2023. It not included data from previous years or future periods.
iv. The study only found out the determinants of malaria recurrence among pregnant mothers in Beledweyn referral hospital in Beleddweyn district, Somalia, and not included other regions or healthcare facilities.

By delimiting the study in this way, it was possible to manage the research process more effectively and ensure that the study remains focused on the specific research question.

1.10 Assumptions of the Study

i. It working on the premise that all the information the participants provided over their medical history including the cases of recurrent malaria were factual.

ii. The study assumed that the data collected was a true sample of the population of the pregnant women who attend antenatal care at Beletweyn hospital, Beleddweyn District-Somalia.

iii. The study also supposes that all the healthcare providers and staff of the hospital operate according to a set of protocol for giving out antenatal care and treating malaria.

iv. Last but not the least, the study assumes that the area of study was not involved in any conflict before and after the research is conducted.

1.11 Operational Definition of Key Terms

Antenatal Clinic: is a specialized medical facility that provides care for pregnant women before childbirth.

Malaria Recurrence Cases: refers to the reappearance of clinical symptoms of malaria in a person who has previously been infected with the disease and has been successfully treated (Dini et al., 2020)

Pregnant Mothers: Pregnant mothers are women who are expecting a child and have conceived through sexual intercourse

Socio economic risk: refers to the financial, educational, and living condition-related factors that increase pregnant women's vulnerability to malaria recurrence by limiting access to preventive measures, healthcare services, and proper living conditions.

CHAPTER TWO

LITRATURE REVIEW

2.0: Introduction

The chapter encompasses a comprehensive analysis of various literatures, including theoretical, empirical, critical, and conceptual frameworks, followed by a summary of the latter.

2.1 Theoretical Literature Review

This section delves into the foundational theories and frameworks pertinent to the study. It explores the theoretical underpinnings that inform the understanding of the research topic, providing a critical analysis of key concepts and models. The review includes a discussion of established theories relevant to the subject matter, their evolution over time, and their application

in current research. By examining the theoretical literature, this section aims to establish a solid conceptual base for the study, highlighting the gaps and opportunities for further investigation.

2.1.1 Health Belief Model (HBM)

According to the model, individuals are more likely to take preventive action when they perceive themselves to be at risk, recognize the severity of the disease, and believe that adopting specific behaviors—such as using Insecticide-Treated Bed Nets (ITNs), attending antenatal clinics (ANC), and adhering to malaria treatment—can effectively reduce their vulnerability.

In the context of malaria recurrence among pregnant women in Beledweyn District, the HBM provides a framework for understanding how awareness, socioeconomic status, self-efficacy, and external influences (such as healthcare advice or community interventions) shape their willingness to take preventive action. For instance, if women do not perceive malaria as a serious threat or lack confidence in their ability to prevent it, they may be less likely to use ITNs or seek timely treatment, increasing their risk of reinfection.

Moreover, Schwarzer's emphasis on self-efficacy within the HBM highlights the importance of pregnant women feeling empowered to take preventive actions. If barriers such as cost, accessibility, or misinformation exist, they may hinder their ability to adopt protective measures, leading to continued malaria recurrence. Understanding these factors is crucial for designing effective interventions that address these barriers, promote preventive behaviors, and ultimately reduce malaria cases among pregnant women in Beledweyn District.

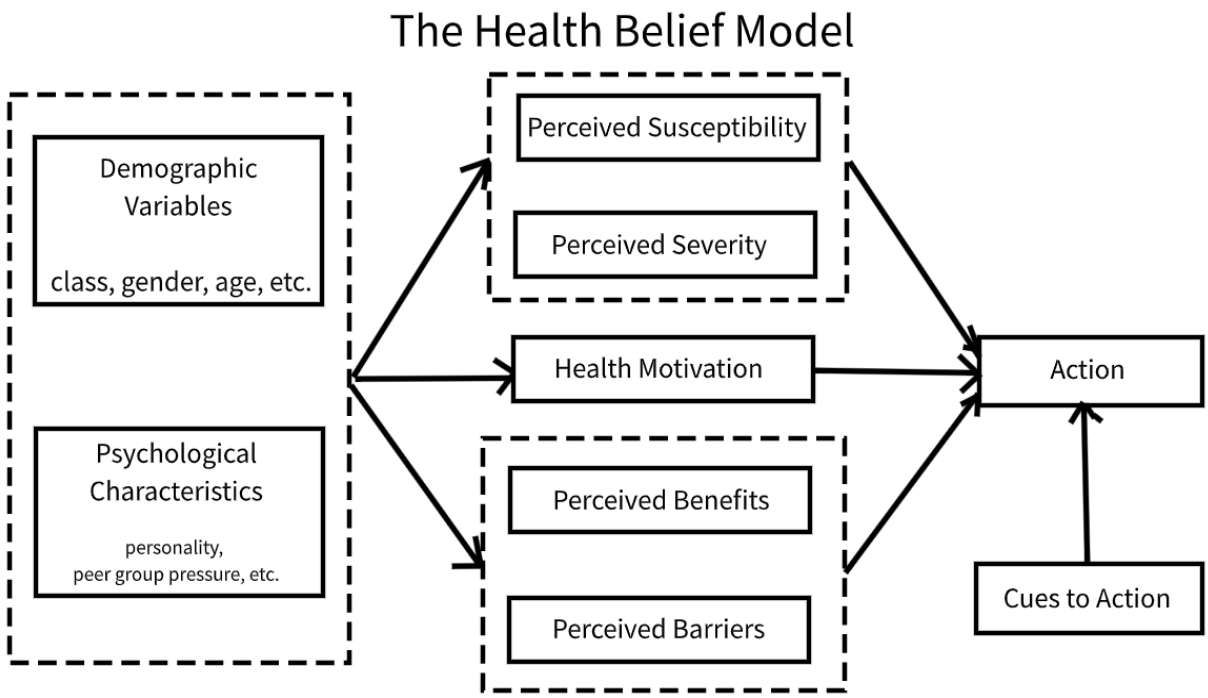

Figure 2 1: Health Belief Model

Source: Researcher (2023)

2.1.2 Behavioral Change Model

The BCM was formulated in accordance with Karen Glanz, Barbara Rimer, and Viswanath and is based on the assertion that changes in health behavior stem from a myriad of interpersonal, environmental, and behavioral factors (Glanz, Rimer, & Viswanath, 2015). The model argues that health behavior change does not follow a single, linear process but is influenced by multiple factors (Verelst, Willem, & Beutels, 2018). According to Thompson (2016), the model suggests that health behavior change occurs when individuals have the necessary knowledge, skills, and motivation, along with access to resources and support. The BCM is structured around three main constructs: the individual, the environment, and behavior. The environmental construct encompasses social, cultural, economic, and physical factors that shape behavior, while the

behavioral construct focuses on specific actions individuals undertake to reach their health goals (Thompson, 2016).

The BCM proposes that health behavior change occurs as individuals transition through several stages, including Precontemplation, Contemplation, Preparation, Action, and Maintenance (Verelst, Willem, & Beutels, 2018). According to Mossière and Serin (2017), each stage is characterized by distinct attitudes, beliefs, and behaviors, with individuals potentially moving back and forth between stages before achieving lasting change. Behavior modification is a central priority in the BCM, which also emphasizes the role of self-efficacy (Baranowski et al., 2017). Individuals with high self-efficacy are more confident in their ability to adopt and sustain a behavior change. The model asserts that those who believe in their capacity to make positive changes are more likely to do so (Baranowski et al., 2017).

Furthermore, the BCM highlights the significant influence of social support in facilitating behavior change. According to recent findings, individuals who are more embedded in their communities are more likely to adopt and maintain health-promoting behaviors over time (Kumar, Kumar, & Darmstadt, 2016).

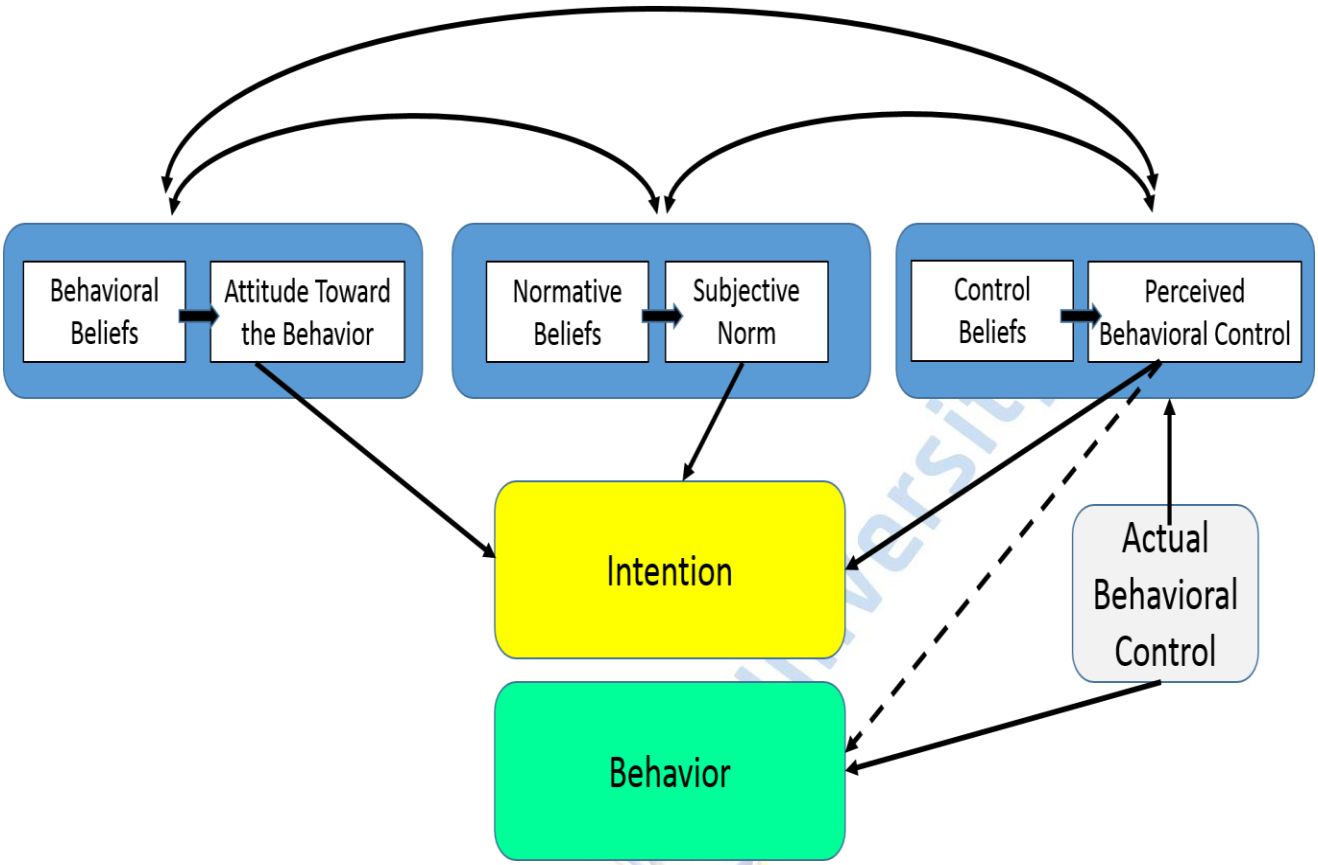

Figure 2.2: Behavioral Change Model

Source: Researcher (2023)

The BCM has been used to help people stop engaging in unhealthy habits like smoking as well as many others, physical activity, and dietary change. It has been used to design and evaluate health behavior change interventions in various settings, including schools, worksites and healthcare settings. The role of the BCM in this particular study can be used to ascertain that which aspects have to be pursued in a bid to bring about behaviour change which is needed when it comes to combating malaria in pregnancy among women of the child-bearing age. As the model focuses a lot of attention on variables such as knowledge of prevention, attitudes, self-efficacy, and environment while designing an intervention that will aim at increasing the use of malaria

chemoprophylactic and insecticide-treated bed among the pregnant women then such a variable as social support in the antenatal clinics may be deemed relevant. (Ernst et al., 2017).

2.1.3: Trans-theoretical Model

The model outlines six stages of behavior change—precontemplation, contemplation, preparation, action, maintenance, and termination—each of which represents a different level of readiness to adopt preventive measures against malaria.

In the context of malaria prevention among pregnant women, the TTM can be applied to assess how women transition through these stages in adopting preventive behaviors such as consistent use of Insecticide-Treated Bed Nets (ITNs), attending antenatal care (ANC) visits, and adhering to malaria treatment protocols. For example, women in the precontemplation stage may not perceive malaria as a serious threat and thus fail to take preventive measures, while those in the contemplation stage may start considering the benefits of malaria prevention but have not yet taken action. Pregnant women in the preparation stage may begin seeking information and planning for malaria prevention strategies, whereas those in the action and maintenance stages actively implement and sustain protective measures.

Additionally, the TTM highlights key factors influencing behavior change, including social norms, healthcare access, and personal beliefs, all of which play a role in malaria prevention and treatment adherence. For instance, women who perceive strong social and community support for malaria prevention may be more likely to adopt preventive behaviors. Understanding these behavioral dynamics can help healthcare providers and policymakers design targeted interventions that encourage long-term malaria prevention practices among pregnant women.

Thus, by applying the TTM framework, this study will explore the factors influencing malaria recurrence among pregnant women and help develop effective, stage-specific interventions to enhance malaria prevention and treatment efforts in Beledweyn District.

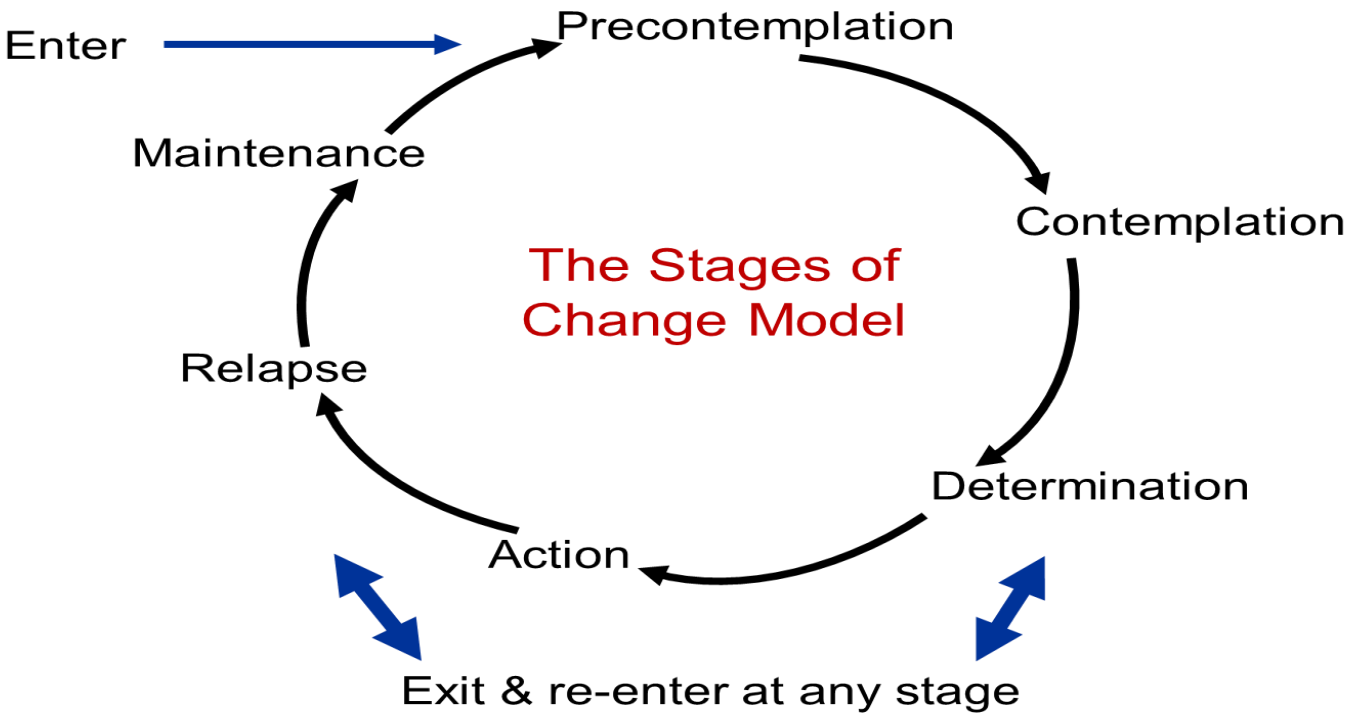

Figure 2.3: Trans-theoretical Model

Source: Prochaska and DiClemente in the late, (1970)

There are mental, emotional, and evaluative steps involved in making a change. These processes result in tactics that enable individuals to accomplish and sustain transformation. There are ten distinct change processes, with some being more important at certain junctures. Such processes include providing information, having catharsis, changing perception of oneself and environment, emotional and behavioural activation, breaking social conditioning, reciprocity, substitution and developing behaviour, progressive containment, application of reinforcement, and control of stimuli. These are all processes, which have to be followed in order to get the intended outcomes.

This is because during the course of this study much attention will have been accorded to the Health Belief Model since it has been found to be applicable to the matter under consideration.

2.2 The Empirical Literature review

This section gives an account of the previous literature in as much as it relates to the variables applied in this study. The section also consists of literature review on: global, African context, east African context and Somalia and Beldwyne state & four Variables; level of awareness, socio economic risk factors, coverage of insecticide treated bed nets among pregnant mothers attending antenatal clinic at Beletweyn hospital Beleddweyn distric Somalia.

2.2.1 Global situation of Malaria, burden, recurrence

America as a whole does not have endemic malaria, however, break-bone fever is prevalent within the country because it has imported and sylvan-borne instances prevalent from travel and immigration. Malaria is not life-threatening in the US as compared to the endemic countries as in recent years there have been less than 2000 cases reported each year (World Health Organization. 2021). A research study was carried out by Collins and Twohig (2020) with the purpose of determining the prevalence of malaria caused by Plasmodium falciparum, also referred to and Plasmodium vivax in low-burden regions. The was done in order to provide us with the necessary information for the research. A comparison of the risk of P. vivax and P. falciparum was carried out using regression analysis and hypothesis testing in order to determine if the former decreases more than the latter. Additionally, a comparison was made between the percentage of P. vivax cases and the incidence rates of malaria.

Specifically, the rate at which malaria decreases in P. vivax was determined to establish if the duration that is taken by malaria to reduce is longer when compared to other species. The research found that the drop-in malaria burden had different effects on the prevalence and Plasmodium falciparum in many countries. Even though P. vivax infection rates were inversely related to overall malaria incidence worldwide, this trend did not hold true in all WHO regions or for individual countries. It was found that different countries had overall very different experiences with the analysis of incidence reduction over time, with some countries taking much longer to achieve the same level of reductions in P. vivax as compared to P. falciparum or the other way around or this difference was absent at all (Collins & Twohig, 2020).

The purpose of the research that Cui et al. (2021) conducted and had published in the SCC was to determine the features of P. V and P. O in RIC areas in China. Individual-level statistics of imported recurring P. vivax and P. ovale were gathered by China's Parasitic Diseases Information Reporting Management System during the years 2013 and 20. Software such as SAS, ArcGIS, NT, and GraphPad Prism were used in order to do an analysis of the demographic, geographic, and time first infected data, as well as the time to recurrence data. Based on the findings of this research, it has been determined that the large number of imports repeat cases in China is the obstacle that China must overcome in order to prevent the resurgence of malaria. During the course of the study, evidence was provided that might be used to assist in the development of effective public health intervention strategies for imported cases of P. vivax and P. ovale that occur repeatedly. It was advised by the research that the radical treatment of prior infections be improved, that targeted interventions be implemented for high-risk groups, and that coordination with other countries be strengthened in order to avoid the importation of malaria cases (Cui et al., 2021).

2.2.2 African continent on Malaria burden, recurrence

Relapse of malaria after treatment is still very rampant in many part of African countries. This is mainly occasioned by the non-adherence to optimal treatment regimens and the development of the new strains of the malaria parasite that is resistant to drugs (Kamau 2021). Frequency rates are influenced by disease parameters including patient's age and immune status, initial disease severity and the type of treatment that the patient is given. In a population health study among some of the affected communities in Kwara state Nigeria, Babamale et al. (2022) for instance. Consequently, for this investigation, a cross-sectional survey approach was adopted. The study participants were 572 from two distant villages in Kwara state Nigeria. Blood samples for all subjects were tested for presence of malaria parasites and all were positive. A cross-sectional quantitative descriptive and standardized questionnaire was employed in collecting information because such a survey gives a clear picture of the whole picture. Both qualitative and quantitative data were collected in this research and descriptive and inferential analysis was employed. This implicates the menace of malaria as a major public health issue in relation to the studied area as the findings reveal increased malaria episodes and parasitaemia. The findings have necessitated the deployment of insecticide treated nets, construction of health facilities and proper drainage system, affordable and highly subsidized malaria treatment in the high risk rural areas (Babamale et al., 2022).

In line with this objective, EboumbouMoukokoet al. (2019) carried out a research study with the following objective: To establish status of the artemisinin-resistant Plasmodium falciparum molecular marker Kelch13 in Cameroon. Three sites of blood sample of Cameroon were collected and air-dried for the experiment. An automated sequencer was also applied to sequence and analyse the nested PCR products of the Kelch13-propeller gene. Antibody data were collected from the patient and the frequency of the K13 mutation was then computed. The research also

determined high positivity of K13 mutation with 2. 9 % (5/175) of the samples being positive. Two were non-synonym: one was the V589I variant which originated from Africa and the other was E612K new mutation. Both the missense changes that were observed took place only in isolates originating from Littoral zone parasites. One sample had two synonymous mutations in the kelch13 gene; four other samples had mixed mutant K13 and wild-type K13 infection. The results indicated that non-synonymous K13 mutations were being spread about in Cameroon. Constant monitoring is required for early discovery of resistance even though no mutations were identified to be linked to delays in parasite clearance. This is crucial because parasites that have developed resistance to *artemisinin* represent a major threat to efforts to reduce malaria transmission across the world, particularly in Africa. The usage and expansion of artemisinin-based combination treatments (ACTs) need for constant monitoring (EboumbouMoukoko et al., 2019).

2.2.3 East African context of malaria Burden, recurrence

Jiang et al. (2021) Malaria is a recurrent problem in East Africa, with seasonal peaks often coinciding with the rainy season. This is because the *Anopheles* mosquito, the primary vector for malaria, breeds in stagnant water, which is more abundant during the rainy season. Also, there is increased humidity during the rainy season and there is high chances of breeding of the mosquitoes and passing on the malaria parasite. Malaria has become one of the leading diseases which poses threat to human health and is a leading killer within the EA region especially amongst the youths and pregnant women; each year, more than 90% of all the malaria related deaths are recorded in sub-Saharan Africa due to factors such as poverty, lack of adequate healthcare facilities and limited or no access to malaria control measures and facilities (Alvar, den Boer & Dagne,2021).

Idris et al. (2022) conducted a research study to learn more about the causes of severe malaria episodes in a subset of South Sudan's basic healthcare facilities. Individuals aged 1 and above who were diagnosed with severe malaria at three primary healthcare centres in South Sudan were included in an unmatched case-control research that used regularly recorded clinic data. Descriptive statistics were used to examine patient characteristics. Also ran some inferential stats. The research discovered that South Sudan has a high frequency of severe recurrent malaria and identified characteristics such as antimalarial medication dose completion impacted by various personal and societal factors including marital status, job status, preventative measure utilisation, and nutritional status. The research's results might be used to better malaria control and prevention efforts in South Sudan's endemic regions. Based on the findings, the study recommended that public health interventions prioritize the provision of comprehensive malaria treatment programs, as well as awareness-raising campaigns to improve the use of preventive measures, nutritional status, and the importance of Antimalarial treatment dosage completion (Idris et al., 2022).

2.2.4 Somalia situation of Malaria recurrence

In particular, Somalia has been experiencing a significantly difficult malaria situation; Warsame et al., (2019) and Giorgi et al., 2018), discussed the unsolved issues of this disease control. Again, in 2019, the country recorded about 4. 7 million malaria cases which were confirmed by the World Health Organization (WHO), 7,039 of the victims eventually died from the disease. This alerts a serious concern towards the need to enhance efficient strategies that will address the issue of malaria in Somalia. Similarly, Mohamed, Mohamed, and Hassan (2020) also stresses on the need for enhancing the usage of ITNs or otherwise the preventive measures against the disease as there is continued prevalence and even re-emergence of malaria in the affected areas.

2.2.5 The Level of awareness of malaria recurrence among pregnant mothers attending antenatal clinic

In Malaysia, KojomFoko et al. (2022) conducted a research study to determine epidemiology, Biology, and Clinical Implications of *Plasmodium cynomolgi* Infections in Humans in Malaysia. Data were extracted and analyzed to summarize the current state of knowledge on *P. cynomolgi* infections in humans, identify knowledge gaps, and highlight potential strategies for controlling and preventing the spread of this emerging *zoonotic* parasite. The study findings indicated that *P.cynomolgi* is an emerging *zoonotic* malaria parasite that is geographically limited to Southeast Asia, with a worldwide incidence rate of between 0% and 1.4% in people. There are no pathognomonic clinical or laboratory patterns associated with this parasite; rather, there are strain-shaped clinical distinctions between cases of asymptomatic carriage and cases of mild to moderate attacks, both of which have been observed in both native SEA people and European travelers. The study concluded that the emergence of *P. cynomolgi* in humans highlights the need for improved surveillance, diagnosis, and management of this emerging *zoonotic* transfer (KojomFoko et al., 2022).

Mills, Holley, Coly and DeJoy (2021) carried out a research study to provide an overview of the detection, care, and avoidance of malaria in pregnant women in the States. To find research on the effects of malaria during pregnancy, especially in the United States, we performed a narrative review of the literature utilisingcomputerised databases. Information was collected and analysed to offer a synopsis of what is currently known about diagnosing, treating, and preventing malaria in pregnant women; identifying obstacles encountered by healthcare practitioners; and highlighting opportunities to enhance care. According to the results, malaria during pregnancy is a major health risk, especially in areas with high transmission rates. The research also found that

U.S. medical professionals aren't very familiar with diagnosing and treating the condition since so few Americans have been to or immigrated from countries where it is common (Mills, Holley, Coly & DeJoy, 2021).

Godfrey (2017) did a study to measure pregnant women's awareness of prophylactic usage in malaria prevention during pregnancy in Nigeraia. The cross-sectional study comprised an estimated 4,294 pregnant women who visited antenatal clinics (ANC) (15-54 years). The study used a structured interviewer-administered questionnaire verified by facial content. Descriptive statistics were used to analyze the acquired data. However, even though the majority of respondents were Christians, the study found that ANC visits were the most frequent source of knowledge, while church trips were the least prevalent. Also, there was a substantial difference in knowledge between respondents from private and public institutions, according to the research (Godfrey, 2017).

Shehu, Mbakwe, Panti and Chapa (2018) conducted a study to analyses the degree of malaria preventive knowledge and behaviours among expectant mothers seeking treatment at the prenatal clinic. This investigation was a descriptive cross-sectional research that relied on a random sample technique. Statistics were used to conclude the data sample. According to the study findings, respondents had adequate awareness of malaria prevention and used malaria-preventative techniques. The study also found a link between excellent knowledge and the educational standing of the pregnant lady and her spouse. The study recommended that midwives and physicians conduct thorough health lectures about malaria and its prevention strategies in pregnancy during the prenatal clinic. The study also recommended that pregnant women visiting prenatal clinics be offered intermittent preventative treatment and insecticide-treated nets (Shehu et al., 2018).

For the purpose of determining the causative linkages between predictive variables and the absorption of the required three doses of sulfadoxine-pyrimethamine (IPTp-SP) for the prevention of malaria in pregnant women in Uganda, Peter (2022) carried out a research. An exhaustive secondary data analysis was carried out with the assistance of the Uganda Department of Health in 2016. There was an evaluation of the predictor-variable relationships using a model that used logistic regression. According to the findings of the study, the recommended dosage of intrapartum immunotherapy (IPTp-SP) was significantly associated with maternal education, knowledge of malaria, maternal age, and the frequency of appointments for prenatal care by the mother. A couple's adherence to the IPTp-SP dose requirements throughout pregnancy was not correlated with the number of cowives they experienced during their pregnancy, since the researchers found no such association. Based on the findings of the research, it was discovered that the likelihood of pregnant women in Uganda receiving all three doses of IPTp-SP is heavily dependent on a number of factors. These factors include the mother's level of knowledge and consciousness regarding malaria, in addition to the mother's age and the frequency that she obtains prenatal medical attention. The findings of the research led the authors to the conclusion that there is a need for increased awareness about the risks of malaria during pregnancy as well as the advantages of IPTp-SP (Peter, 2022).

Ahmed et al. (2021) conducted a research study pregnant women in Mogadishu, Somalia's IDP camps were surveyed to ascertain the rate of anaemia, its severity, and any contributing variables. Mogadishu's most densely populated areas with IDP camps were the focus of a community-based cross-sectional survey of 383 homes. All pregnant women living in households selected at random who agreed to participate were singled out. Blood was drawn from a finger prick and put into a *haemoglobin monitor*. If the *haemoglobinmetre* showed that a person's Hb was below 11 g/dl, a

further 3 cc blood sample was drawn and placed in an EDTA tube for CBC analysis to determine the specific type of anaemia. Interview data on potential risk variables were gathered using a pretested, standardised questionnaire. Pregnancy-related anaemia was shown to be a significant public health issue among IDP camp residents in Mogadishu, Somalia. Several factors were found to increase the likelihood of anaemia developing in a pregnant woman. Risk factors should be targeted with health education and widespread iron supplementation to solve the problem (Ahmed et al., 2021).

2.2.6 The Effect of socio economic risk factors of malaria recurrence on pregnant mothers attending antenatal clinic

Fadila, Ekawardhani, Fauziah and Hutagalung (2021) carried out a research study to determine what causes miscarriages in Eastern Indonesia's malaria-prone areas. There were a total of 77 participants, 37 of whom had experienced a miscarriage in the past, and 74 controls who were similar in age and geographic location. Researchers looked examined how factors including BMI, *glucose-6-phosphate dehydrogenase* insufficiency, and malaria prevalence were linked to an increased risk of miscarriage. Lower socioeconomic position, malaria positivity, anaemia, and abnormal BMI were all associated with higher risk of death in the malaria-endemic area of East Nusa Tenggara, Indonesia were significant risk factors for miscarriage. Taking into consideration the results, the researchers suggested that the efforts that are being made to minimise the number of cases of malaria in the area should be elevated. In addition, it is recommended that interventions be conducted to treat anaemia and abnormal body mass index (BMI), as well as initiatives to enhance the socioeconomic situation of pregnant women (Fadila et al., 2021).

Bondzie (2019) conducted a study to evaluate the malaria preventive and treatment knowledge, beliefs, and behaviours of pregnant women in Chhattisgarh, India's war zones. Pregnant women in

Chhattisgarh, India's war zones had their malaria-related knowledge, attitudes, and behaviours studied using a cross-sectional qualitative study approach. Women expecting children who did and did not make it to the prenatal clinic were included in the research. Qualitative approaches were used to gather information, such as in-depth interviews and focus groups. Pregnant women in war zones in Chhattisgarh, India, have a better grasp of malaria transmission, causes, symptoms, seeking treatment, and prevention according to the study's results. These results contributed to the development of health policies and practices as well as malaria education initiatives aimed specifically at pregnant women in this area. The research concluded that targeted mediation efforts were necessary to successfully reduce and eliminate malaria among pregnant women in Chhattisgarh's conflict zones (Bondzie, 2019).

Ilori, Adewale, Obembe, and Morakinyo (2022) conducted a study to measure the correlation between women's economic independence and the use of ANC services in Nigeria. Women between the ages of 15 and 49 from 42,000 randomly chosen households in 36 states were surveyed on their ANC attendance and economic independence utilizing information from the latest available NDHS (2018). Descriptive statistics and multivariate and bivariate logistic regression analyses were also a part of the research. According to the data, it's more probable that women were financially independent if they lived in a city, and that chance rose with education level and wealth index. The research also revealed that the type of home and employment were important determinants of ANC use. Also, having total financial liberty to make financial choices did not substantially enhance the chance of accessing prenatal health care services throughout pregnancy, according to the research (Ilori et al., 2022).

Edith and David (2020) conducted a research study the effect of socio-demographic factors (such as where people live) on pregnant women's susceptibility to malaria. In this study, researchers

employed a cross-sectional survey approach. Droplets of blood were taken from 589 pregnant women and examined using giemsa-stained thin and thick blood smear preparations at local Antenatal Care (ANC) clinics. Participants were asked a series of questions in order to collect qualitative information. The research found that pregnant women who resided in dwellings made of wood or mud were more likely to get malaria. The research also revealed a significant risk of malaria occurrences among pregnant women in the region of investigation as a result of poor living circumstances (Edith & David, 2020).

Degarege, Fennie, Degarege, Chennupati and Madhivanan (2019) conducted a research study to summarize living conditions, education, employment, income, and wealth as they relate to malaria distribution in SSA. Statistical tests for homogeneity included the chi-square, Moran's I2, and tau2. The summary OR or RR was estimated using a fixed, random, or log-linear dose-response model. The results of the research showed that farmers, those with low levels of education, and those living in substandard housing all had higher rates of Plasmodium infection. Lower income and wealth indexes were also associated with higher rates of Plasmodium infection. Results suggested that persons in SSA were more likely to contract Plasmodium if they were less educated, had lower incomes, less wealth, lived in poorly built dwellings, or earned their livelihood from farming (Degarege et al., 2019).

In 2017, Abdalla, Abdalla, and Eltayeb carried out a research study with the purpose of estimating the number of pregnant women who were getting prenatal care at a health facility in Sudan. The purpose of the study was to establish the prevalence of malaria infection and any risk factors that were associated with it. The study was conducted using a method known as cross-sectional analysis. There were a total of three hundred thirty-two pregnant ladies that participated in the exploration. A structured survey was used for the purpose of data collecting on socio-demographic

parameters. There was a correlation between the existence of malaria and a number of characteristics, including age, level of education, family income, family size, and whether or not individuals slept with intravenous (IV) contraceptives (ITNs) at night, as shown by the findings of the inquiry. Furthermore, the results of the research suggested that there is a relationship between the presence of malaria and certain factors, such as parity, past history, and prior awareness of the illness. It was shown in the findings of the research that pregnant women had a much higher incidence of malaria infection than the general population. The study also discovered that pregnant women had a much higher chance of developing malaria (Abdalla, Abdalla, & Eltayeb, 2017). This was a finding that was quite surprising.

Ojoniyi, Odimegwu, Olamijuwon, and Akinyemi (2019) conducted research on the variables that are associated with mothers and put Tanzanian children under the age of five at risk for developing anaemia. For the purpose of this investigation, researchers evaluated data obtained from two surveys that were carried out in Tanzania between the years 2015 and 2016. These surveys were the Tanzania Demographic and Health Survey and the Malaria Indicator Survey. Adjusted odds ratios were computed, and a proportional odds model was used in order to investigate the risk factors associated with anaemia in mothers. In order to conduct an analysis of the association, various degrees of maternal education were used as stratification variables. Obtaining a mother who was younger than 25 years old, having an adult father who was jobless, living in the poorest families, and not having access to health insurance were all characteristics that were shown to be associated with risk for anaemia in children under the age of five, according to the study. According to Ojoniyi et al.'s 2019 research, when the levels of education of mothers were broken down specifically, it became evident that those moms who had post-secondary degrees were not at a higher risk.

A research study was carried out by Xasan (2019) to investigate the prevalence of malaria at Manhal Hospital in Ceeriagaabo, Somaliland, as well as the prevention of the disease and attitudes towards it. Both cross-sectional and analytical approaches were used in the study methodology. Patients suffering from malaria were chosen from the waiting list at Manhal Hospital in Erigavo, Somaliland, and one hundred of them were chosen. The sample sizes were determined with the use of several formulas. To collect a sample from the population that was being studied, a proportional sampling method was used, and a Slovin's formula was utilised to carry out the sampling process. Based on the findings of the research, it was discovered that there were some misunderstandings about the transmission of malaria. Furthermore, those who had a limited understanding of malaria tended to exhibit poor treatment-seeking behaviour. According to the findings of the research, the techniques used to prevent and control malaria should be inexpensive. This is particularly important in regions that are experiencing difficulties, such as issues with sanitation, water supply, and drainage, which are caused by an excessive population. In spite of the fact that there is some understanding about the transmission and prevention of malaria, the findings of the study lead the researchers to the conclusion that there is a need for more education in order to correct misconceptions and increase treatment-seeking behaviour (Xasan, 2019).

2.2.7 The utilization of coverage of Insecticide Treated Bed Nets on pregnant mothers attending antenatal clinic

Aung, Win, and Show (2022) conducted research in Myanmar to study the variables that influence the utilisation of insecticide-treated nets (ITNs) and the consequences these factors have for the outcomes of pregnancies. This research used a cross-sectional methodology, using STATA Version 15 to undertake an analysis of secondary data derived from surveys that were carried out between the years 2015 and 2016. In spite of the fact that a significant number of pregnant women

had bed nets, the study revealed that their utilisation rates were surprisingly low. Due to this discovery, the researchers advocated for improved promotional techniques to boost the use of intrauterine devices (ITNs) among pregnant women, especially in locations that are classified as delta, lowland, plain, and hill. Additionally, the research brought to light the need of taking into account social and behavioural aspects that have an impact on the utilisation of intravenous (ITN) devices. These factors include persons' self-perceived risk of malaria, their level of comfort and familiarity with ITNs, and their general attitudes towards the prevention of malaria (Aung et al., 2022).

Laino et al. (2021) conducted a study to assess the impact of three neurotoxic insecticides—cypermethrin, imidacloprid, and chlorpyrifos—on the behavior and physiology of Pardosa saltans spiders and their offspring. The research involved exposing juvenile spiders to these pesticides and observing changes in their behavior and physiological responses. The study also examined how spider mothers' foraging behavior was affected by the presence of these chemicals on their egg sacs. Various biochemical assays were employed to measure the impact of the insecticides. The findings indicated that all three pesticides were effective in affecting the spiders, with cypermethrin showing the highest efficacy against spider eggs. While spider mothers did not leave their nests upon encountering the pesticides, they displayed altered behavior, and the developing spiderlings within the egg sacs suffered from increased oxidative stress, with cypermethrin and chlorpyrifos causing more harm than imidacloprid (Laino et al., 2021).

Asumah, Akugri, Akanlu, Taapena, and Boateng (2021) conducted research in Ghana's Kassena-Nankana East Municipality to assess ITN usage among pregnant women. This descriptive cross-sectional study involved 362 participants selected through simple random sampling. While the study revealed a high level of ITN awareness, it also highlighted that many households with ITNs

were not using them effectively. The research emphasized that addressing basic issues related to ITN usage is crucial for improving their utilization among pregnant women, indicating a need for targeted intervention strategies (Asumah et al., 2021).

Using information obtained from the General Malaria Indicator Survey, Klu, Aberese-Ako, Manyeh, Immurana, Doegah, Dalaba, and Ansah (2022) investigated the variables that influence the use of intravenous (IV) contraceptives among pregnant women in Ghana. The researchers used SPSS Version 22 for both qualitative and multilayer logistic regression analyses in the research they conducted, which comprised a weighted sample of 353 women ranging in age from 15 to 49. Women aged 35 and older, those without any sort of formal schooling, and those with high school education were more likely to use intrauterine devices (ITNs), according to the findings, which indicated a negative link between the use of ITNs and the incidence of malaria. This indicates that pedagogical and outreach initiatives that are specifically targeted might potentially increase the utilisation of ITNs among certain populations (Klu et al., 2022).

Ashivira (2021) performed longitudinal research in the Bumula Division of Bungoma County, focusing on pregnant women at Bumula Sub-District Hospital. The study demonstrated a high rate of long-term mosquito net ownership and noted that women using these nets experienced significantly lower malaria rates compared to those who did not. Most of the nets were distributed through prenatal clinics. The study also found that malaria infection rates were notably higher during rainy seasons, underscoring the need for seasonal preventive measures (Ashivira, 2021).

Omar, Son, and Wambalaba (2021) investigated the role of long-lasting insecticide-treated nets (LLINs) in malaria prevention and control in Somalia. Their research, which involved 1,100 pregnant women and 2,200 male household heads in the Belet Hawo area, used straightforward

random sampling and both qualitative and quantitative methods. The study confirmed that LLINs significantly contribute to malaria prevention, improving the government's ability to manage and control malaria. The findings suggest that LLINs are an effective tool in combating malaria, highlighting their importance in public health strategies (Omar, Son & Wambalaba, 2021).

Mohamed, Mohamed, and Hassan (2020) carried out a study in Hodan district, Somalia, to examine factors affecting the use of insecticide-treated nets (ITNs) in households with children under five. The study involved 50 adults (aged 18 and older) from these households, who were surveyed using a structured questionnaire that gathered information on demographics, educational background, malaria awareness, and ITN access and use. The data were analyzed and presented through graphs and frequency tables. The research revealed a notable disparity in knowledge, ownership, and usage of ITNs among these households, highlighting a critical need to enhance local malaria management and prevention efforts (Mohamed et al., 2020).

2.3 Critical review

The study conducted by Collins and Twohig (2020) aimed to determine the malaria parasites *Plasmodium falciparum* and *Plasmodium vivax*: epidemiology malaria in low-burden settings. However, the study did not address the potential reasons or factors that could explain the observed variation in how nations' malaria burdens have decreased has impacted occurrence of Plasmodium vivax and Plasmodium falciparum. Thus, there is a potential conceptual or theoretical gap in the study, as it did not delve deeper into the underlying reasons for the observed heterogeneity. The study conducted by EboumbouMoukoko et al. (2019) aimed to determine *Plasmodium falciparum's* current *Kelch13 molecular* marker status for *artemisinin* resistance in Cameroon. Six

different *K13 mutations* were found, however none of them were linked to a sluggish parasite clearance rate.

The research, then does not provide insight into the potential development of artemisinin resistance in the study population. The literature has revealed three research gaps: the conceptual gap, the contextual gap, and the methodological gap. For instance, Godfrey (2017) studied pregnant women's awareness of *prophylactic usage* in malaria prevention during pregnancy. According to the study findings, pregnant women at private/secondary and public tertiary health institutions demonstrated good understanding, and college education had a positive effect on awareness. Shehu et al. (2018) studied malaria preventive knowledge and behaviors among pregnant women visiting the prenatal care clinic. The study was conducted in Nigeria, whereas the current study was conducted in Somalia, resulting in a contextual gap.

Waiswa et al. (2022) investigated prevalence and variety of Plasmodium species in pregnant women visiting prenatal care clinics. The study did not address issues such as malaria awareness in the region or socioeconomic risk, resulting in a conceptual gap. Reviewing studies, for instance, revealed contextual gaps. Rogerson (2017) investigated malaria management during pregnancy as well. According to the findings, pregnant women are especially vulnerable to malaria infection. There is a lack of context between this research and the present study since the former took place in Kenya and the latter took place in Somalia. Aung, Win and Show (2022) looked at the variables that influence pregnant women's use of ITNs. The study relied on secondary data while the current study utilized primary and the use of structure questionnaires to collect data presenting a methodological gap. Therefore, this study the effect of malaria recurrence cases on pregnant mothers attending antenatal clinic at Beletweyn hospital, Beleddweyn district, Somalia.

2.4 Conceptual Framework

The interrelationships and interactions between the dependent and independent variables are illustrated in Figure 2.4 of the conceptual framework.

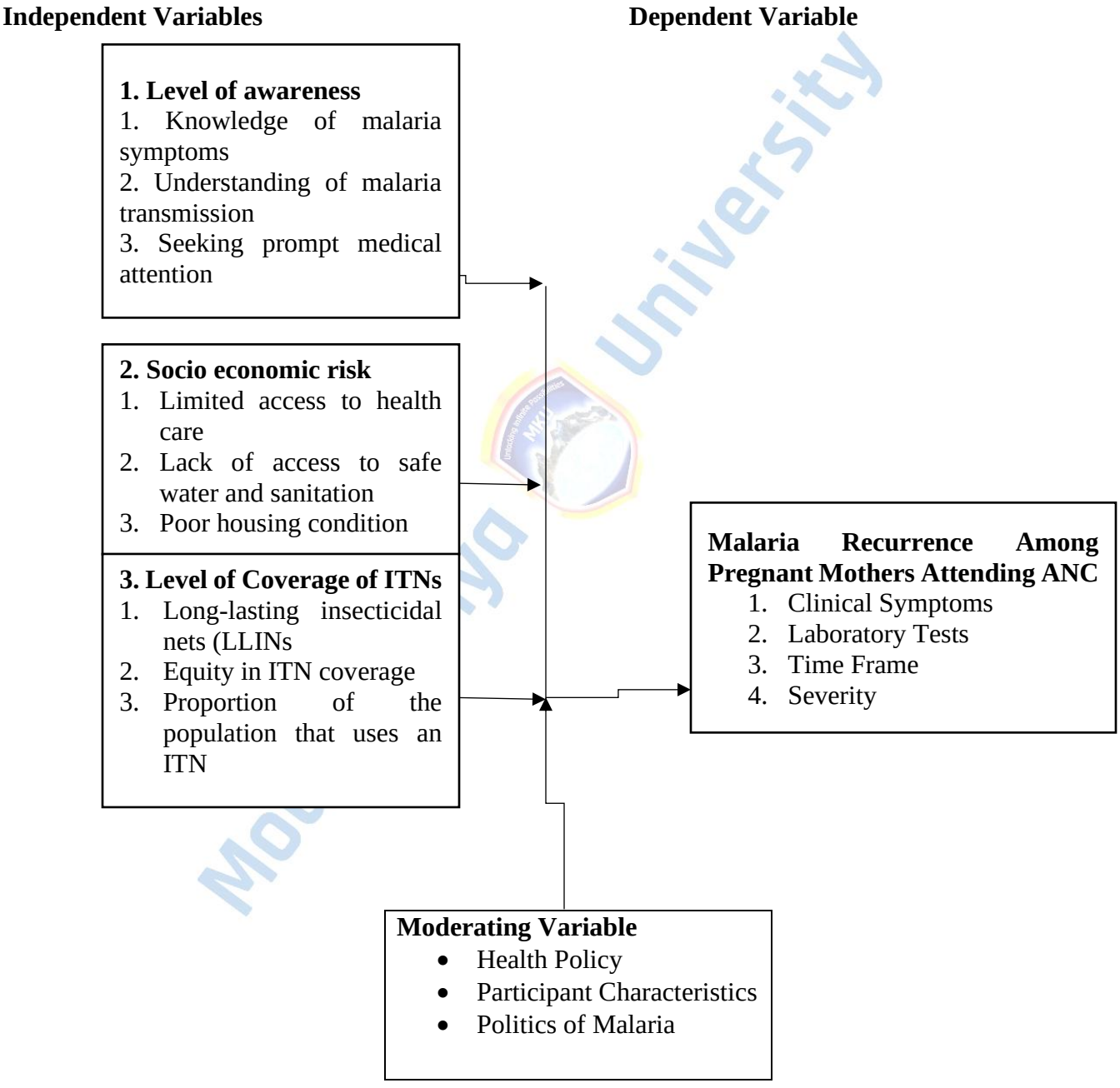

Figure 2.4: Conceptual Framework

2.5 Summary of the conceptual framework.

Independent variables are the factors that influence or determine the occurrence of malaria recurrence among pregnant women attending antenatal clinics at Beletweyn Hospital. These variables provide insights into the key determinants of malaria prevalence and prevention effectiveness.

2.5.1 Level of Awareness

Awareness about malaria is crucial in determining the preventive behaviors and response to malaria symptoms among pregnant women. This variable assesses how well individuals understand malaria and the necessary steps for its prevention and treatment.

1. Knowledge of Malaria Symptoms – The ability of pregnant women to recognize common symptoms such as fever, chills, headaches, muscle aches, and vomiting plays a key role in early detection and intervention. Limited knowledge often leads to delayed treatment, increasing the risk of complications.
2. Understanding of Malaria Transmission – Awareness of how malaria spreads (e.g., mosquito bites, stagnant water, poor environmental sanitation) is essential for adopting preventive measures such as using insecticide-treated nets (ITNs), indoor spraying, and eliminating mosquito breeding sites.
3. Seeking Prompt Medical Attention – The timeliness of seeking healthcare when malaria symptoms appear affects treatment success and the prevention of severe complications. Pregnant women who delay seeking care may experience increased recurrence rates, poor pregnancy outcomes, and heightened maternal risks.

Socio-Economic Risk

Socio-economic conditions play a significant role in malaria vulnerability. Pregnant women from lower socio-economic backgrounds face barriers to accessing healthcare, proper sanitation, and protective interventions, increasing their risk of malaria recurrence.

1. Limited Access to Healthcare – Geographic, financial, and infrastructural barriers can limit a woman's ability to access malaria prevention and treatment services. Rural or economically disadvantaged women may struggle to obtain early diagnosis, antimalarial drugs, and preventive measures.
2. Lack of Access to Safe Water and Sanitation – Poor sanitation and lack of clean water contribute to mosquito breeding and increase exposure to malaria. Pregnant women in areas with stagnant water, inadequate drainage, or poor hygiene are at greater risk of contracting malaria repeatedly.
3. Poor Housing Conditions – Housing with open windows, no mosquito screens, and unsanitary surroundings creates an ideal environment for mosquito breeding and human exposure. Living in crowded or poorly ventilated spaces further exacerbates the risk of malaria transmission among pregnant women.

Level of Coverage of ITNs

Insecticide-treated nets (ITNs) are a primary preventive measure against malaria. The effectiveness of ITNs in reducing malaria recurrence depends on their availability, accessibility, and proper usage among pregnant women.

1. Long-Lasting Insecticidal Nets (LLINs) – These are WHO-recommended mosquito nets treated with insecticides that remain effective for several years. Proper distribution and consistent use of LLINs significantly reduce malaria cases among pregnant women.

2. Equity in ITN Coverage – The distribution of ITNs must be equitable, ensuring that all pregnant women, regardless of socio-economic status, have access to protective nets. Disparities in ITN coverage can lead to unequal exposure to malaria risks.
3. Proportion of the Population That Uses an ITN – The actual usage of ITNs among pregnant women is critical in determining their effectiveness. Despite distribution efforts, some women may not use ITNs due to cultural beliefs, discomfort, or lack of awareness. Monitoring the proportion of women who consistently sleep under treated nets provides insights into ITN program success.

By analyzing these independent variables, the study aims to establish how awareness, socio-economic conditions, and ITN coverage influence malaria recurrence among pregnant women. The findings will be instrumental in designing targeted interventions to enhance malaria prevention strategies and reduce maternal morbidity and mortality in Somalia

2.5.2 Dependent variable

Malaria Recurrence Among Pregnant Mothers Attending ANC

- The proportion of women that go for IPTMi.
- This represents the proportion of woman that get tetanus toxoid vaccination.
- The proportion of women being administered iron and folic acid supplement.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

Detailed processes and methods that were used in order to explore the research questions are described in this chapter, which provides an overview of the approach to research that was utilised in the study. The study design, sample methodologies, data collecting tools, and techniques for analysis are all included in this. Consequently, the technique is intended to guarantee a rigorous and methodical approach to the process of data collection and analysis, which will ultimately result in findings that are dependable and legitimate.

3.1 Study Design

A research design serves as the blueprint that guides the entire study, ensuring systematic data collection, analysis, and interpretation (Polit & Beck, 2010). This study adopts a cross-sectional descriptive research design, which is particularly suitable for investigating malaria recurrence among pregnant women attending antenatal clinics at Beletweyn Hospital in Beledweyn District, Somalia.

The cross-sectional approach is advantageous as it enables the collection of data at a single point in time, allowing for an in-depth examination of patterns, prevalence, and associated factors influencing malaria recurrence among pregnant women. This design also facilitates comparisons between different subgroups, such as women with varying levels of exposure to malaria prevention interventions, healthcare access, and socio-economic factors.

Moreover, descriptive research is beneficial because it provides a detailed account of the phenomenon under investigation without manipulating variables. By employing standardized data

collection tools, such as structured questionnaires and medical records, the study ensures high reliability and minimizes observer bias.

Additionally, survey research is highly adaptable and comprehensive, making it an effective method for capturing a broad spectrum of information related to malaria prevention, treatment adherence, and associated health outcomes. The insights gained from this study will be instrumental in informing healthcare policies and interventions aimed at reducing malaria-related complications among pregnant women in Somalia.

3.2 Study approach

This research included both quantitative and qualitative methodologies. For quantitative data, structured questionnaires were employed, while in-depth interviews were conducted for qualitative data. The quantitative approach attempted to quantify data. The numerical data was evaluated to offer answers to the population being studied who, what, how, where, when, how many, and how questions (Ritchie & Spencer, 2002). The qualitative technique south to evaluate things that cannot be measured (Levy, 2006). Open-ended enquiries, interviews, and focus group discussions was part of the technique. This strategy was utilized to augment the results of the quantitative research method.

3.3 Study Location

Beletweyn Hospital, located in Beledweyne District, Hiiraan region, Somalia, serves as a major healthcare hub in central Somalia. Positioned along the Shabelle River, approximately 330 kilometers north of Mogadishu, the hospital plays a vital role in providing essential medical services to a population exceeding 200,000 residents. As one of the largest and most advanced medical facilities in the region, Beletweyn Hospital is a crucial pillar of the local healthcare system,

offering a comprehensive range of services, including emergency care, maternal and child health, surgical procedures, infectious disease management, and specialized outpatient services. The hospital is also instrumental in the control and treatment of endemic diseases such as malaria, tuberculosis, and respiratory infections, making it a key player in public health interventions.

Due to its strategic location along a major trade and migration route, Beletweyn Hospital often caters to internally displaced persons (IDPs), refugees, and patients from surrounding rural areas, further highlighting its significance in regional healthcare delivery. The hospital operates with support from government agencies, non-governmental organizations (NGOs), and international partners, ensuring access to lifesaving medical interventions, immunization programs, and maternal healthcare services. Additionally, it serves as a training center for medical professionals, contributing to capacity-building efforts in Somalia's fragile healthcare system.

Despite its importance, Beletweyn Hospital faces numerous challenges, including limited medical supplies, inadequate healthcare personnel, and financial constraints. However, through ongoing investments in infrastructure, partnerships with humanitarian organizations, and the dedication of healthcare workers, the hospital continues to play a critical role in improving health outcomes for the people of Hiiraan and beyond.

3.4 Target Population

The target population was pregnant women receiving ANC services as well as the nurses providing those services at Beletweyn Hospital in Somalia. Therefore, the target population approximately was 1000 pregnant women who visit the Beletweyn Hospital on a monthly basis. Pregnant women were interviewed using questionnaires and service providers were KII informants in the study, interviewed using interview schedules.

Inclusion Criteria

Participants must meet the following criteria to be included in the study:

1. Pregnant Women: Only expectant mothers attending antenatal clinics at Beletweyn Referral Hospital will be considered.

2. History of Malaria: Participants must have experienced at least one episode of malaria during their current or previous pregnancies.

3. Residence: Pregnant women who reside in Beledweyne District and have lived there for at least six months before the study.

4. Consent to Participate: Participants must voluntarily provide informed consent before enrolling in the study.

5. Attendance at ANC: Only those currently attending antenatal care (ANC) services at the hospital during the study period.

6. Use of ITNs or Other Preventive Measures: Participants must be able to provide information regarding their use of Insecticide-Treated Nets (ITNs) and other malaria prevention methods.

Exclusion Criteria

Participants will be excluded from the study if they meet any of the following conditions:

1. Non-Pregnant Women: Women who are not pregnant or those attending the hospital for reasons other than antenatal care.

2. Severe Medical Conditions: Pregnant women with severe complications or chronic illnesses (e.g., HIV/AIDS, severe anemia, or uncontrolled diabetes) that could confound malaria recurrence data.

3. Recent Migration: Women who have recently moved to Beledweyne (less than six months of residence) as they may have different exposure risks.

4. Refusal to Participate: Women who decline to provide informed consent or withdraw from the study at any point.

5. Incomplete Medical Records: Pregnant women whose medical history is incomplete or lacks sufficient details on previous malaria episodes.

6. Use of Antimalarial Treatment for Non-Malaria Conditions: Women taking antimalarial drugs for preventive or unrelated treatment purposes without a documented malaria diagnosis.

3.5: Sample Size Determination

To get the required sample size the study adopted simple random sampling technique. A 95% confidence level and P = 0.05 is selected.

$$n = \frac{\mathrm{N}}{1 + N(e)^2}$$

Where n = Sample size

N = Population (10,000)

e = Level of significance

$\frac{10,000}{1+(10,000\ X(0.05)^2}$ = 384.5 pregnant women visiting the hospital for ANC services with additional of (10% X 384.5) to account for possible non-response rate in the sample size totaling 384.5 + 38.45 = 424 participants to be selected. KII informants who were nurses were purposively selected, 15 of them. Therefore, the total sample size was 424 + 15 = 439 participants.

3.6: Sampling techniques

In this study, a multi-stage stratified sampling technique was utilized to ensure a representative and diverse selection of pregnant women attending ANC services at Beletweyn Hospital. The first stage involved stratification of the target population of 424 pregnant women based on key characteristics such as gestational age (first, second, or third trimester), place of residence (urban vs. rural), and history of malaria infection (first-time infection vs. recurrent cases). This stratification ensured that the study captured a broad spectrum of experiences and risk factors associated with malaria recurrence in pregnancy.

In the second stage, simple random sampling was applied within each stratum to ensure that every pregnant woman had an equal chance of being selected, thus minimizing selection bias and enhancing the representativeness of the study. This approach allowed the study to include participants with different levels of vulnerability and exposure to malaria, which was crucial in understanding the determinants of malaria recurrence.

Additionally, purposive sampling was employed to select 15 nurses from Beletweyn Hospital as key informants based on their expertise in maternal healthcare and malaria management. These nurses were chosen because of their direct experience with malaria cases in pregnant women, their knowledge of malaria prevention strategies, and their role in administering treatment and

monitoring patients. Since healthcare professionals often have tight schedules, purposive sampling allowed for the selection of nurses who were both available and well-informed about the subject matter.

This multi-stage technique improved the efficiency, reliability, and validity of the study by ensuring a well-balanced sample while addressing logistical challenges related to participant availability. By integrating both randomized selection for general participants and targeted selection for expert informants, the study was able to capture comprehensive insights into the factors contributing to malaria recurrence among pregnant women attending ANC services in Beledweyn District, Somalia.

3.7 Data Collection

To ensure comprehensive data collection, both quantitative and qualitative methods were employed. A trained research assistant was recruited and thoroughly instructed on how to administer and guide participants through the questionnaire-filling process.

3.7.1 Quantitative Data Collection Tools

Structured questionnaires were the primary tool for collecting quantitative data. The questionnaires were designed based on the study's objectives and divided into sections corresponding to key research variables. These closed-ended questions allowed for standardized responses, facilitating the collection of measurable data from a larger population. The structured questionnaires were administered directly to pregnant women visiting Beletweyn Hospital for antenatal care (ANC) services, enabling the study to assess factors influencing malaria recurrence among them.

3.7.2 Qualitative Data

To capture in-depth insights that could not be quantified, key informant interviews (KIIs) were conducted using structured interview guides. These guides were designed to explore critical themes, including level of awareness, socioeconomic risks, and ITN coverage, which are key determinants of malaria recurrence. The interviews targeted healthcare professionals, particularly nurses, who provided expert perspectives on malaria prevention, treatment adherence, and challenges faced by pregnant women in controlling malaria recurrence. The use of KIIs allowed for a deeper understanding of contextual factors affecting malaria management among expectant mothers in Beletweyn District, Somalia.

3.7.3 Pilot study

The pilot study was conducted in Beledweyne District Referral Hospital, a facility under rehabilitation by the Ministry of Health and UNOPS The results of the pilot study were instrumental in refining the research instruments and methodology before the full-scale study. By testing the survey questions on a small sample of participants similar to those in the main study, the pilot phase helped identify unclear, ambiguous, or redundant questions, leading to necessary revisions that improved the clarity, coherence, and relevance of the questionnaire. Additionally, the pilot study evaluated the effectiveness of data collection procedures, identifying logistical challenges such as response rates, time required for survey completion, and difficulties in administering the instruments.

Findings from the pilot study were used to enhance the reliability and validity of the research tools. Specifically, the reliability of Likert-scale items was assessed using Cronbach's Alpha, ensuring internal consistency and refining poorly performing items. Furthermore, the pilot study tested the

feasibility of the sampling strategy, recruitment process, and ethical considerations, ensuring that the approach was practical and aligned with the study objectives. Any inconsistencies or challenges that arose were addressed through modifications to survey instructions, question phrasing, and data collection protocols, ensuring a smoother process during the main study.

The insights gained also informed the training of research assistants, ensuring they were adequately prepared for data collection. Moreover, preliminary findings from the pilot study provided an opportunity to refine data analysis techniques, ensuring that the selected statistical methods were appropriate for addressing the research objectives. Ultimately, the results of the pilot study helped improve the accuracy, efficiency, and credibility of the main research, ensuring that it effectively captured the determinants of malaria recurrence among pregnant women attending ANC services at Beletweyn Hospital.

3.7.4 Reliability of study tools

The dependability of the research instruments was subjected to a stringent evaluation in order to guarantee that the instruments faithfully measure the things that they are designed to evaluate. This was accomplished by the use of a number of different approaches, one of which was the computation of internal consistency through the utilisation of Cronbach's alpha, which was utilised to analyse the coherence of replies across the various survey questions. There was also an examination of test-retest reliability, which included giving the identical instruments to a subset of individuals at two separate times in time in order to evaluate for consistency in their replies. In addition, the tools were examined by well-known specialists in the industry to verify the accuracy of their content and guarantee that they successfully collect the required information. Individually and together, these methods guaranteed that the research instruments produced findings that were reliable and accurate.

3.7.5 Validity of the Study Tools

The validity of the research instruments was subjected to a stringent evaluation in order to guarantee that they properly measure the targeted constructs and provide findings that are relevant. Subject matter experts were asked to assess the instruments in order to verify that the questions completely cover all important areas of the study subjects. This was done in order to determine the validity of the content of the tools. Through the use of component analysis, construct validity was evaluated in order to guarantee that the instruments properly measure the theoretical constructs that lie behind them. In addition, criterion-related validity was investigated by drawing comparisons between the findings of the research tools and those of known benchmarks or other instruments of a similar kind. This was done to ensure that the study tools provide results that are consistent and dependable. The implementation of these methods guaranteed that the research instruments were not only suitable but also efficient in terms of obtaining the pertinent data.

3.8 Data Analysis

To ensure a thorough understanding of the factors influencing malaria recurrence among pregnant women attending ANC services at Beletweyn Hospital, the study employed both quantitative and qualitative data analysis methods.

3.8.1 Quantitative Data Analysis

Structured questionnaires were the primary tool for collecting quantitative data. Following data collection, the researcher conducted a comprehensive review and evaluation of the dataset to ensure accuracy, completeness, and consistency. This process involved identifying and addressing inconsistencies, missing values, and outliers to maintain data integrity. Additionally, preliminary

statistical tests were performed to confirm that the dataset met the necessary assumptions for further analysis.

Descriptive statistics, including frequencies, percentages, and averages, were used to summarize key findings. To establish relationships and draw inferences, the study employed inferential statistical methods, such as the Chi-Square test and multivariate logistic regression. Statistical significance was assessed using a 95% confidence interval (CI) and a 5% significance threshold ($p \leq 0.05$) to ensure the validity of conclusions drawn from the data.

3.8.2 Qualitative Data Analysis

Qualitative data from key informant interviews (KIIs) were analyzed using thematic analysis to identify patterns, themes, and insights related to malaria recurrence. This approach allowed for a deeper understanding of the awareness levels, socioeconomic risks, and ITN coverage among pregnant women. During interpretation, qualitative findings were integrated with quantitative results, enhancing the study's depth and reinforcing the validity of statistical conclusions. By combining both methods, the research provided a holistic and well-rounded analysis of malaria recurrence determinants in the study population.

3.9 Ethical Consideration

Before initiating the research, the researcher secured approvals from several institutions. Initially, permission was sought from Mount Kenya University to undertake the research. Subsequently, approvals were obtained from the Somali Research Council and the Somali Ministry of Health. Prior to fieldwork, the researcher reached out to the Beledweyne district authority for authorization. Upon arriving at the study location, the researcher coordinated logistics and other

specifics with research assistants and participants, ensuring a seamless flow of activities. In the field, permissions were acquired in a sequential manner: starting from the District Authority of Beledweyne, followed by the Hospital Administration. Informed consent was then procured from the participants. Participants were reassured of the confidentiality of the study and the safeguarding of their anonymity. They were also informed of their right to discontinue answering any question if they felt uneasy or chose to withdraw at any point during the research process.

CHAPTER FOUR

RESEARCH RESULTS AND DISCUSSIONS

4.1 Introduction

The key qualitative and quantitative data acquired according to Chapter 3's approach are presented in this chapter. After the response rate, the chapter presents respondent demographics. This covers their age, employment, marital status, malaria history, and malaria preventive knowledge. The chapter then contains descriptive data on awareness, socioeconomic risk, insecticide-treated net (ITN) coverage.

4.2 Response rate

The percentage response rate of 87% for the questionnaires which was administered and 60% for KII informant interviews (KIIs) reveals that the sample size is valid enough to represent the entire population. A low response rate reduces the validity of the results and the sample collected dataset has low statistic test capability (Jaju & Crask, 1999). With regard to questionnaires, the researcher administered 424 questionnaires to which 369 was responded to and returned. Among the KII informants, the researcher provided 15 interview guides and collected 9 fully complete interview guides.

Table 4.1: Response Rate

Category	Administered Questionnaires	Response Rate
Returned	369	87%
Unreturned	55	13%
Total	**424**	**100%**

4.3 Background of Respondents

The researcher investigated respondents' age, employment, marital status, malaria history, and malaria preventive knowledge.

4.3.1 Age of the Respondents

The study sought to determine the age distribution of the respondents by categorizing them into predefined age groups as outlined in the questionnaire. Participants were asked to indicate their age within the following categories:

Table 4.2: Age of the Respondents

Age Category	Number of Respondents	Percentage (%)
Below 15 years	26	7%
16-25 years	100	27%
26-35 years	125	34%
36-45 years	89	24%
Above 45 years	29	8%
Total	**369**	100

This classification was designed to facilitate the analysis of age-related trends and patterns in the study, providing insights into how different age groups engage with the subject under investigation. The distribution of ages across these categories is illustrated in Figure 4.1.

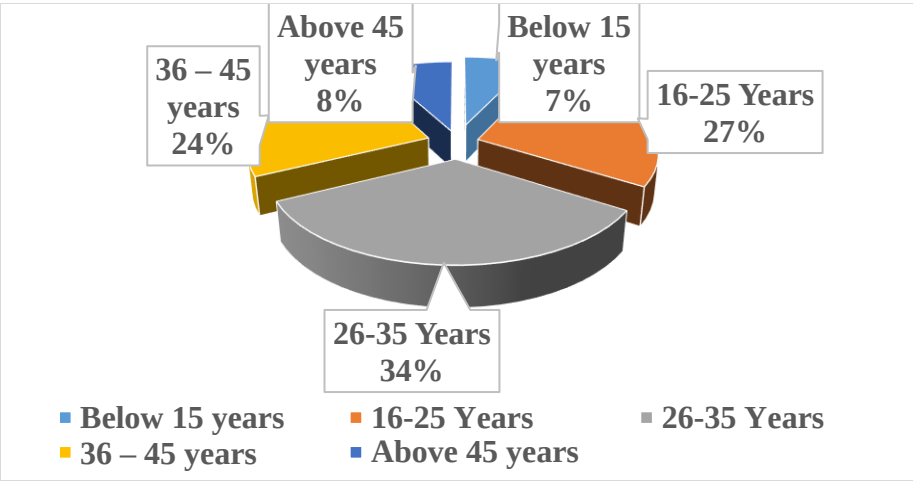

Figure 4.1: Age of the Respondents

The findings on age distribution indicate that the majority of respondents were young and middle-aged adults. The largest proportion, 34%, fell within the 26-35 years age group, followed by 27% in the 16-25 years category. This suggests that individuals within these age brackets were more actively engaged in the study. Additionally, 24% of respondents were in the 36-45 years age range, further reinforcing the presence of middle-aged participants. In contrast, there was a notably lower representation of older adults and children, with only 8% of respondents falling in the above 45 years category and 7% in the below 15 years group. This distribution highlights a trend where younger and middle-aged individuals were more involved, while older adults and minors had limited participation. The findings may reflect demographic patterns of the target population or the relevance of the study's subject matter to different age groups.

4.3.2 Marital Status

Marital status is a critical demographic factor that can significantly influence various aspects of health and well-being. In the context of this study, understanding the marital status of participants provides valuable insights into the social and economic factors that may affect their health behaviors and access to healthcare services

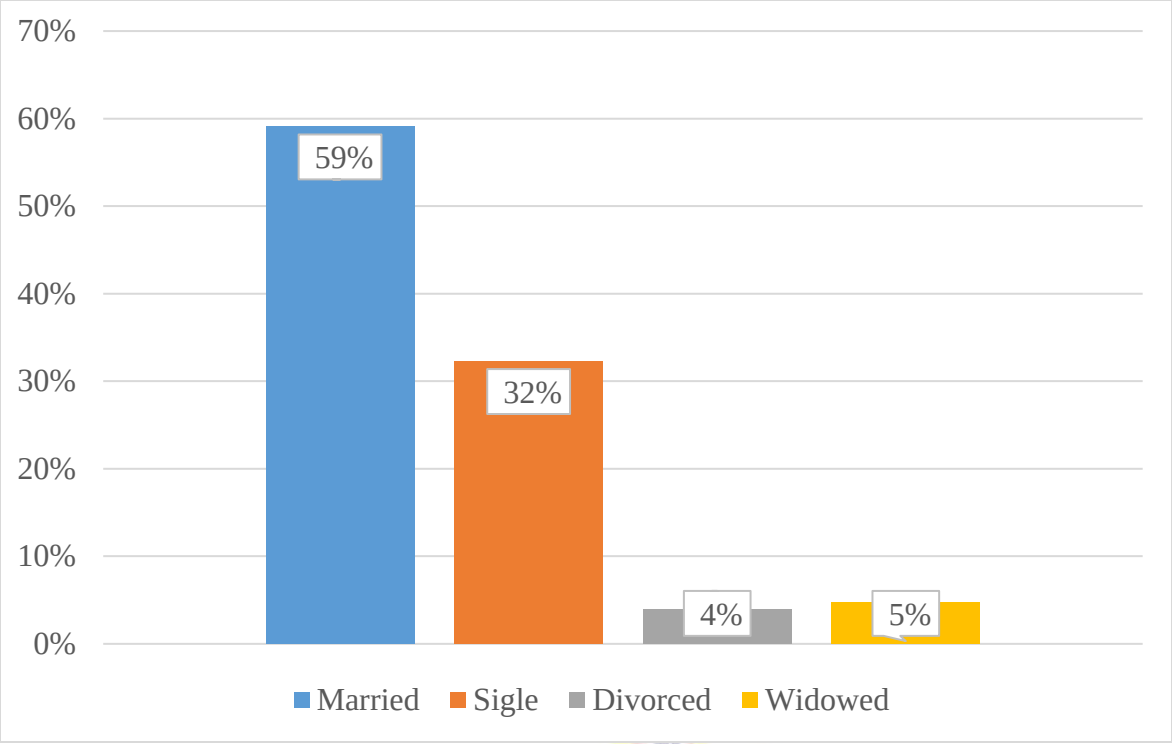

Figure 4.2: Marital Status

The majority of participants were married (59%), followed by single (32%). The fewest participants were divorced (4%) and widowed (5%). The marital status of the participants suggests that the majority were in a relationship. There were fewer single people and people who had been divorced or widowed in the study.

4.3.3 Occupational Status

The researcher asked the participants to indicate their occupation and to categorize their responses based on whether they were employed, unemployed, or students. The results of the survey were shown in Figure 4.3.

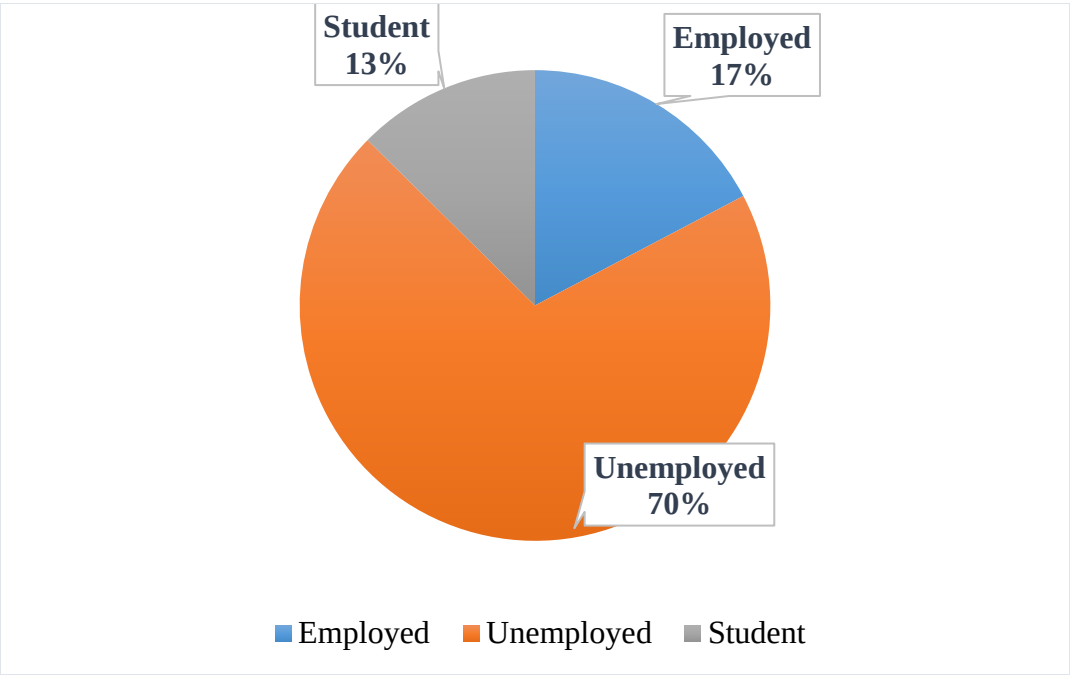

Figure 4.3: Occupational Status

The majority of participants were unemployed (70%), followed by employed (17%), and student (13%). The occupation status of the participants suggests that the majority were not working. There were fewer participants who were employed or students.

4.3.4 Prevalence of Malaria

Concerning malaria during pregnancy, the participants were given a number of questions. The question was whether they had ever had malaria while pregnant, regardless of whether they had gotten any advice on how to avoid getting malaria while pregnant, as well as they had done anything to protect themselves from getting malaria while pregnant, like using a bed net treated with insecticide or taking medicine. Tabulated in Table 4.3 are the findings.

Table 4.3: Prevalence of Malaria

Questions	Yes	No
Have you ever experienced malaria during your pregnancy?	61%	39%
Have you been provided with any information on how to prevent malaria during pregnancy?	58%	43%
Are you currently utilizing any preventive measures against malaria during your pregnancy, such as using insecticide-treated bed nets or taking antimalarial medication?	61%	66%

Table 4.3 presents data on malaria prevalence and prevention among pregnant women. The findings reveal that 61% of respondents have experienced malaria during their pregnancy, indicating a significant burden of the disease among this group. Additionally, 58% of the women reported receiving information on malaria prevention during pregnancy, suggesting that while there is some awareness, a notable proportion of women lack this crucial knowledge. Despite these efforts, only 61% of women are currently using preventive measures such as insecticide-treated bed nets or antimalarial medication. This figure highlights a disparity between the information provided and the actual implementation of preventive practices, with a concerning 66% not utilizing recommended preventive measures. This data underscores the need for improved dissemination of information and more effective strategies to encourage the adoption of preventive measures among pregnant women.

4.4 Descriptive Statistics

Following is a list of the variables involved in the research, encompassing women who are expecting understanding, social and economic status risk factors, the frequency of their visits to prenatal clinics, the amount to which they utilise insecticide-treated bed nets, and more.

4.4.1 Level of Awareness

Women expecting a child at the Beledweyn Hospital prenatal clinic in Somalia's Beleddwey district were asked to rate their level of familiarity with the prevention and treatment of malaria. To gauge the extent to which individuals were cognisant, a Likert scale was used. The replies were assessed using measures of standard deviation and mean. Table 4.4 displays the outcomes.

Table 4.4: Level of Awareness

Statements	Mean	Std. Deviation
1. I have a strong grasp of the symptoms associated with malaria.	2.600	1.223
2. I am knowledgeable about less common symptoms of malaria, including nausea and vomiting.	3.240	1.275
3. I have a comprehensive understanding of how malaria is transmitted.	3.480	1.214
4. I think it is essential to seek immediate medical care if malaria is suspected.	3.260	1.329
5. I believe that implementing preventive measures can significantly lower the risk of contracting malaria.	3.270	1.275
6. I am aware that malaria is usually transmitted through the bites of mosquitoes carrying the infection.	3.480	1.201
7. If malaria is suspected, it is important to see a doctor as soon as possible..	3.320	1.272
Average	**3.236**	**1.256**

Table 4.4 presents the average levels of awareness regarding malaria among respondents, as measured by mean scores and standard deviations for various statements. The data indicates that participants generally have moderate awareness about malaria. Specifically, the mean score for the

statement "I have a strong grasp of the symptoms associated with malaria" is relatively lower at 2.600, with a standard deviation of 1.223, suggesting varied levels of confidence in recognizing malaria symptoms. On the other hand, the highest mean score of 3.480 was recorded for understanding how malaria is transmitted and the transmission through mosquito bites, with standard deviations of 1.214 and 1.201 respectively. This suggests that while respondents have a fair understanding of transmission mechanisms, there is less certainty about recognizing symptoms and the importance of immediate medical care. The statement "I think it is essential to seek immediate medical care if malaria is suspected" has a mean score of 3.260, reflecting a moderate agreement on the need for prompt action. Overall, with an average mean score of 3.236 and a standard deviation of 1.256, the findings indicate that while respondents have a reasonable awareness of malaria, there is room for improvement in their understanding of symptoms and the urgency of seeking medical care.

Table 4.5: Cross-Tabulation of Socio-Economic Factors and Malaria Reoccurrence

Socio-Economic Factor		High Malaria Reoccurrence (%)	Low Malaria Reoccurrence (%)	Mean
Income Level	Low	65%	35%	2.8
	Middle	40%	60%	3.4
	High	20%	80%	3.7
Education Level	No Formal	70%	30%	2.6
	Primary	55%	45%	3.0
	Secondary and above	25%	75%	3.6
Occupation	**Informal Sector**	60%	40%	2.9
	Formal Sector	30%	70%	3.5
Access to Healthcare	**Low**	75%	25%	2.7
	High	30%	70%	3.6

In addition, a service provider 001 respondent that;

> *"the level of awareness of Malaria recurrence has a significant impact on pregnant mothers attending the antenatal clinic. When pregnant mothers are well-informed and aware of the symptoms, transmission, and preventive measures of Malaria, they are better equipped to protect themselves and their unborn child"*

KII informant 002 mention that;

> *"In my view, awareness about malaria recurrence is critical. When pregnant women know about the risks, they are more proactive about taking preventative steps. Those who aren't aware often don't realize the importance of using bed nets or medication until it's too late."*

4.4.2 Socio Economic Risk Factors

Women who frequent the prenatal clinics at Beletweyn Hospital throughout their pregnancies are at increased risk of malaria recurrence, and the researchers wanted to know what the respondents thought about certain claims about the socio-economic risk factors. Their answers were recorded

using a Likert scale, and the average responses were determined by calculating the mean and standard deviation. Table 4.6 displays the results obtained from the participants.

Table 4.6: Socio Economic Risk Factors

Statements	Mean	Std. Deviation
The high cost of malaria treatment presents a significant barrier for pregnant women seeking necessary care	3.740	1.156
Affordable and readily available antenatal care could play a crucial role in preventing malaria from recurring in pregnant women.	3.510	1.284
Lack of access to safe drinking water may elevate the risk of contracting malaria.	3.350	1.354
I recognize that inadequate sanitation and improper waste disposal can create breeding grounds for mosquitoes, thereby increasing the spread of malaria.	3.820	1.101
Limited healthcare access exacerbates the risk of malaria recurrence among pregnant women.	3.650	1.143
Enhancing the economic situation of pregnant women could contribute to a reduction in malaria recurrence.	3.830	1.104
Providing education empowers pregnant women to manage their health more effectively and reduce the chances of malaria recurring.	3.710	1.183
Average	**3.659**	**1.189**

Table 4.6 presents data on various socio-economic risk factors related to malaria and their impact on pregnant women. The high cost of malaria treatment is identified as a major obstacle, with a mean score of 3.740, suggesting significant concern among respondents. Affordable and accessible antenatal care is seen as crucial for preventing malaria recurrence, with a mean score of 3.510. Access to safe drinking water, with a mean of 3.350, is also recognized as important, reflecting its role in malaria risk. Respondents highlighted inadequate sanitation and improper waste disposal as significant issues, scoring 3.820, indicating its impact on mosquito breeding and malaria spread.

Limited healthcare access, scored at 3.650, and economic enhancement for pregnant women, with a mean of 3.830, are both considered essential in reducing malaria recurrence. Lastly, education's role in empowering women and reducing malaria risk is acknowledged, with a mean score of 3.710. Generally, the average score of 3.659 reflects a general awareness of these socio-economic factors and their impact on malaria management.

Service provider 003 mention that;

> *"socio-economic risk factors have a significant effect on the health of pregnant women attending antenatal clinic in my facility. For example, women who comes from humble background have difficulty accessing affordable healthcare, which in most cases leads to delays in diagnosis and treatment of malaria. Additionally, women who are not educated about malaria prevention are more likely to contract the disease."*

4.4.3 Level of Coverage of Insecticide Treated Bed

The participants were asked to fill out an evaluation based on comments on the prevalence of using bed nets treated with insecticide among pregnant women visiting the Beletweyn Hospital prenatal clinic. In order to get the average answers, we calculated the mean and standard deviation from the data collected using a Likert scale. Table 4.7 below displays the replies of the participants.

Table 4.7: Level of Coverage of Insecticide Treated Bed

Statements	Mean	Std. Deviation
Regular use of insecticide-treated bed nets is an effective strategy for preventing malaria.	3.820	1.237
Consistent use of insecticide-treated bed nets during sleep can reduce the risk of contracting malaria..	3.800	1.099
Using insecticide-treated bed nets is a simple and practical measure to control the spread of malaria.	3.850	0.960
Employing insecticide-treated bed nets can significantly lower the mosquito population that spreads malaria in the local area.	3.910	1.035
Utilizing insecticide-treated bed nets is a crucial measure to protect pregnant women and their unborn children from malaria..	3.830	0.941
Investing in insecticide-treated bed nets is a viable method for reducing malaria transmission in high-risk regions.	3.450	1.283
Distributing insecticide-treated bed nets to communities in areas with a high risk of malaria is a cost-effective prevention strategy.	3.570	1.050
Average	**3.747**	**1.086**

The survey results indicate a strong consensus on the effectiveness and practicality of insecticide-treated bed nets for malaria prevention. Respondents generally agree that regular use of these bed nets is a crucial and effective strategy, with a mean score of 3.820, reflecting their confidence in this preventive measure. The belief that consistent use during sleep can lower malaria risk is also high, evidenced by a mean of 3.800. Additionally, the simplicity and practicality of using insecticide-treated bed nets for controlling malaria spread are well acknowledged, with a mean score of 3.850. Respondents recognize that these bed nets can significantly reduce mosquito populations, supported by a mean score of 3.910. The importance of using these bed nets to protect pregnant women and their unborn children is affirmed with a mean of 3.830. Although investing in and distributing these bed nets is seen as a viable and cost-effective prevention method, it scored

slightly lower, with means of 3.450 and 3.570 respectively. The overall average score of 3.747 suggests a strong agreement on the value of insecticide-treated bed nets in malaria prevention efforts, despite some variability in the perceived effectiveness of investment and distribution strategies.

Service provider 004 stated that:

> *"I believe that the coverage of insecticide treated bed nets (ITNs) does affect pregnant mothers attending antenatal clinic. ITNs are a highly effective way to prevent malaria transmission, and they can be especially beneficial for pregnant women, who are more vulnerable to the disease."*

Service provider 005 showed that:

> *"Yes, the availability and use of treated bed nets make a huge difference. When women use these nets, we see fewer cases of malaria. It's as simple as that."*

4.4.4 Malaria Recurrence Among Pregnant Mothers Attending ANC

Section 4.4.4 explores the issue of malaria recurrence among pregnant women attending antenatal care (ANC). This segment focuses on how recurring malaria cases are managed and identified within the context of prenatal services. It examines the role of antenatal care in monitoring and preventing repeated malaria infections, highlights key factors influencing the effectiveness of these interventions, and assesses the impact of ANC services on managing malaria-related risks during pregnancy. By evaluating these aspects, this section aims to provide insights into the challenges and opportunities for improving malaria prevention and treatment for pregnant women within the antenatal care framework.

Table 4.8: Malaria Recurrence Among Pregnant Mothers Attending ANC

Statements	Mean	Std. Deviation
Attending antenatal care services enhances the chances of identifying and treating malaria early in pregnant women.	3.420	1.256
Consistent follow-ups and monitoring during antenatal care are vital for detecting and handling malaria in pregnant women.	3.240	1.185
Administering prompt and effective treatment for malaria during pregnancy is essential to avoid negative consequences for both the mother and the fetus.	3.410	1.243
Offering intermittent preventive treatment is a key component of antenatal care to help avoid the severe effects of malaria infection in pregnant women.	3.250	1.386
The effectiveness of prenatal care services can be measured by the proportion of pregnant women who receive intermittent preventive treatment.	3.340	1.280
The rate at which women receive tetanus toxoid vaccination serves as a significant indicator of maternal health..	3.240	1.355
Regular supplementation of iron and folic acid for pregnant women is crucial in preventing birth defects.	3.400	1.323
Average	**3.329**	**1.290**

Table 4.8 examines perceptions of malaria recurrence among pregnant mothers attending antenatal care (ANC). The data reveals a moderate level of agreement with statements about the importance of ANC in managing malaria. The mean score for the statement "Attending antenatal care services enhances the chances of identifying and treating malaria early in pregnant women" is 3.420, indicating a general consensus on the positive role of ANC in early detection and treatment of malaria. Similarly, "Consistent follow-ups and monitoring during antenatal care are vital for detecting and handling malaria in pregnant women" has a mean score of 3.240, reflecting the belief

in the necessity of regular monitoring for effective malaria management. The statement "Administering prompt and effective treatment for malaria during pregnancy is essential to avoid negative consequences for both the mother and the fetus" scored 3.410, underscoring the importance of timely intervention to prevent adverse outcomes.

Regarding preventive measures, the mean score for "Offering intermittent preventive treatment is a key component of antenatal care to help avoid the severe effects of malaria infection in pregnant women" is 3.250, indicating moderate agreement on the importance of preventive treatments. The effectiveness of ANC services, as measured by the proportion of women receiving intermittent preventive treatment, has a mean score of 3.340, suggesting that this aspect is valued but not uniformly emphasized. The significance of tetanus toxoid vaccination as an indicator of maternal health scored 3.240, highlighting its perceived importance but with some variability in agreement. Finally, "Regular supplementation of iron and folic acid for pregnant women is crucial in preventing birth defects" has a mean score of 3.400, reflecting a recognition of the importance of these supplements in promoting maternal and fetal health. The average score across these statements is 3.329, indicating a general but moderate agreement with the role of ANC in managing malaria and supporting overall maternal health.

Key informant 008 indicated that;

> *"Yes, I have observed some trends in malaria incidence among pregnant women in the area I serve. In recent years, I have seen an increase in the number of pregnant women with malaria, and the cases have become more severe."*

Key informant 009 mention that;

"Yes, I believe there is a need for improved malaria prevention and treatment services for pregnant women in my community. The current services are not adequate to meet the needs of pregnant women, and they are not effective in preventing or treating malaria."

4.5 Correlation Analysis

Level of awareness, socioeconomic risk factors, and malaria recurrence among expectant moms were the research variables that were examined using Pearson correlation analysis. Tabulated in Table 4.9 are the findings from the Pearson correlation study.

Table 4.9: Correlation Analysis

	Mothers	**Level**	**Socio**	**ITNs**
Mothers	1.000			
Level	0.727	1.000		
	0.000			
Socio	0.808	0.527	1.000	
	0.000	0.000		
ITNs	0.766	0.367	0.677	1.000
	0.000	0.000	0.000	

Table 4.9 presents the correlation analysis between various factors related to malaria prevention and management among pregnant mothers. The correlation coefficients indicate the strength and direction of the relationships between these factors. The correlation between "Mothers" and "Level" is 0.727, which is statistically significant ($p < 0.001$), suggesting a strong positive relationship. This implies that as the level of engagement or awareness among mothers increases, so does their overall effectiveness in managing malaria.

The "Socio" variable shows a strong positive correlation with both "Mothers" (0.808, $p < 0.001$) and "ITNs" (0.677, $p < 0.001$), highlighting that socio-economic factors are significantly associated with the outcomes related to mothers and the use of insecticide-treated nets (ITNs). The

correlation between "Socio" and "Level" is moderate at 0.527 ($p < 0.001$), indicating a positive relationship between socio-economic factors and the level of engagement or awareness. The correlation between "Mothers" and "ITNs" is 0.766 ($p < 0.001$), showing a strong positive association. This suggests that higher engagement or awareness among mothers is strongly related to increased use of ITNs. The moderate correlation between "Level" and "ITNs" at 0.367 ($p < 0.001$) indicates a less pronounced but still significant relationship, reflecting that while there is a positive association, the strength of this relationship is lower compared to other correlations.

4.6 Regression Analysis

In this study, the recurrence of malaria in pregnant women was designated as the dependent variable. To explore the relationship between this variable and various influencing factors, such as awareness and socioeconomic status, multiple regression analysis was employed. This analytical approach enabled the identification of key characteristics associated with malaria recurrence. The results of the multiple regression analysis, which provide detailed insights into these relationships, are presented in Tables 4.8, 4.9, and 4.10.

Table 4.10: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.929a	0.864	0.862	0.105492

A measure of the extent to which one variable can explain variation in another is the R Squared value, which is sometimes called the coefficient of determination. This statistical analysis of malaria recurrence in pregnant women found a R Squared value of 0.864, which means that the

independent variables may explain around 86.4% of the likelihood or variance of the incidence of malaria among pregnant women.

Table 4.11: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	27.043	4	6.761	367.552	.000b
	Residual	2.244	122	0.018		
	Total	29.287	126			

Table 4.11 presents the Analysis of Variance (ANOVA) results for the regression model assessing the recurrence of malaria in pregnant women. The table shows that the regression model has a sum of squares of 27.043 with 4 degrees of freedom, yielding a mean square of 6.761. The F-statistic for the model is 367.552, which is highly significant with a p-value of .000. This indicates that the regression model as a whole significantly explains the variance in malaria recurrence among pregnant women. The residual sum of squares is 2.244 with 122 degrees of freedom, resulting in a mean square of 0.018. The total sum of squares is 29.287 with 126 degrees of freedom. The highly significant F-statistic suggests that the model's predictors collectively have a strong impact on malaria recurrence, confirming the model's effectiveness in explaining the variability observed in the dependent variable.

Table 4.12: Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-0.087	0.082		-1.059	0.292
	Level of awareness	0.147	0.035	0.151	4.249	0.000
	Socio economic factors	0.342	0.036	0.372	9.527	0.000
	ITNs	0.397	0.038	0.414	10.453	0.000

Table 4.12 presents the regression coefficients for the model assessing factors influencing malaria recurrence among pregnant women. The constant term, with an unstandardized coefficient of -0.087 and a t-value of -1.059, is not statistically significant (p=0.292), suggesting that the baseline level of malaria recurrence is not significantly different from zero when all predictors are absent. The level of awareness shows a positive and statistically significant relationship with malaria recurrence, indicated by an unstandardized coefficient of 0.147, a standardized coefficient of 0.151, a t-value of 4.249, and a significance level of 0.000. This suggests that increased awareness is associated with higher malaria recurrence. Socioeconomic factors have a strong positive impact on malaria recurrence, with an unstandardized coefficient of 0.342, a standardized coefficient of 0.372, a t-value of 9.527, and a significance level of 0.000, highlighting that socioeconomic vulnerabilities significantly increase the risk of malaria recurrence. Similarly, Insecticide Treated Nets (ITNs) also show a significant positive association, with an unstandardized coefficient of 0.397, a standardized coefficient of 0.414, a t-value of 10.453, and a significance level of 0.000, indicating that higher ITN coverage is related to increased malaria recurrence. Overall, the

regression analysis reveals that awareness, socioeconomic factors, and ITN coverage are all significantly associated with malaria recurrence, with socioeconomic factors and ITNs having the most substantial effects.

4.7 Discussion of the Findings

The purpose of this research was to examine the frequency and aetiology of malaria in pregnant women visiting the prenatal clinic at the Beletweyn referral hospital in the Beleddeweyn area of Somalia. In all, the researcher sent out 138 questionnaires; however, only 117 were returned with full responses, which is 92% and so considered good. The purpose of this study was to examine the level of knowledge about intravenous contraceptives (IVCs), the socioeconomic risks associated with them, and the coverage among pregnant women receiving prenatal care at Beletweyn hospital in the Beleldweyn district of Somalia.

4.7.1 The Level of Awareness on Malaria Recurrence Among Pregnant Mothers

The first aim of the study was to establish the level of knowledge that pregnant mothers have towards re-emergence of malaria in ANC at Beletweyn hospital Beleddweyn district Somalia. Hospitalised pregnant women in the Beletweyn area of Beleddweyn, Somalia, had a poor grasp of the potential for future recurrence of malaria infection, according to the results. With a standard deviation of 1.256, the average score on the awareness questionnaire was 3.236. Thus, it seems that the participants had a broad understanding of the dangers posed by malaria. Literature reviews have shown that in Nigeria, a cross-sectional study by Akaba et al. (2013) estimated that 71.5 percent of pregnant women who took part in the study knew about malaria and how to avoid it. Nonetheless, intermittent preventive treatment was only administered to 15.9% of the women in question. That pregnant women do not take enough precautions against malaria is evidence of a knowledge gap.

As an additional intriguing discovery, the research found that among pregnant women who visit the beleedweyn hospital's prenatal clinic, there is a significant association between the occurrence of malaria and the degree of awareness about the disease. Therefore, a positive linear link between the level of awareness and the chance of malaria recurrence is shown by the correlation value of 0.741. Consistent with previous research, this study lends credence to the idea that postpartum and pregnant women might benefit greatly from learning more about malaria and taking preventative measures. On the other hand, Iriemenam et al. (2011) did find that recurrence risk was lower among female participants with higher malaria knowledge. Similarly, Goshu and Yitayew (2019) discovered that factors such as educational attainment, family income per month, and home location influence the amount of information about malaria.

The results of the regression analysis show that pregnant women in the Beledweyn region of Somalia who visit the prenatal clinic at the Beletweyn referral hospital have a significantly lower risk of malaria compared to those who do not. An increase of 0.147 in the expected recurrence of malaria is equivalent to an increase of 0.147 in the degree of awareness. Malaria is more likely to recur in pregnant women who have greater awareness about the illness, according to these studies. Consistent with previous research, this conclusion suggests that lowering the malaria prevalence may be possible if we learn more about the variables that put women at risk of contracting the disease and how to protect them. For example, Mararu et al. (2018) found that pregnant women who had more information about malaria had a lower risk of experiencing a relapse.

4.7.2 The Socio-Economic Risk Factors on Malaria Recurrence Among Pregnant Mothers

The second objective of the research was to find out how much of an effect socioeconomic risk variables had on malaria cases among pregnant women who visited the prenatal clinic at the Beletweyn referral hospital in the Beledweyn area of Somalia. Participants knew there was a higher

chance of malaria recurrence because of insufficient access to health care, according to the descriptive results, which revealed a mean score of 3.650 on a scale from 1 to 5. The obtained standard deviation of 1.143 indicates that there is variety in the views of fifty people on the level of this hazard. This result agrees with other studies that have shown how socioeconomic variables contribute to the resurgence of malaria. One research that found that age, mother categorisation, and parity in socioeconomic status impact the desire to take malaria medicines is Oladimeji et al. (2023).

Pregnant women who visit the Beledweyn hospital's prenatal clinic are more likely to have a recurrence of malaria if they are socioeconomically disadvantaged, according to this research. This suggests that the likelihood of reinfection with malaria rises in tandem with the severity of socioeconomic risk factors. The obtained value of the correlation coefficient, which is 0.857, further supports this hypothesis. Factors that have been associated to the prevalence of malaria in pregnant women with malaria symptoms include illiteracy, being in the first trimester of pregnancy, living far from health centres, not sleeping under nets, and being in the vicinity of irrigation areas, according to a study done in 2022 by Almaw, Yimer, Alemu, and Tegegne. To establish the association between socio-economic status and malaria recurrence, researchers analysed cross-sectional data from all pregnant patients seen at the Beletweyn referral hospital in the Beleddweyn area of Somalia. The following are the variable coefficients that the analysis revealed: 0.342 for socioeconomic variables The findings show that the projected chance of malaria recurrence increases by 0.342 for every one-unit rise in the socioeconomic variables variable. That is to say, re-infection with malaria is more common among pregnant women in the higher socio-economic risk group. This finding is in line with previous research that has linked the recurrence of malaria in pregnant women who had been to prenatal clinics to a number of

socioeconomic risk factors. Immobility, subsistence farming, and low income were identified by Akogu et al. (2022) as variables that increased the likelihood of malaria infection in pregnant women. Furthermore, Bassey et al. (2007) demonstrated that those without cars, with monthly incomes below $100, and residing in dwellings constructed of vegetable thatched roofs had a high malaria prevalence. Socioeconomic factors are major determinants of the social return of malaria in pregnant women, according to the link between these results with the research data.

4.7.3 Insecticide Treated Bed on Malaria Recurrence Among Pregnant Mothers

Table 4.13: ITN Coverage and Malaria Prevention Among Pregnant Women

Variable	Correlation with Malaria Recurrence	Coefficient (β)	Significance Level (p-value)
Overall ITN Coverage at Beletweyn Hospital	0.868	0.397	0.000
Effectiveness of ITNs in Malaria Prevention	0.868*	0.397*	0.000*
Educational Attainment and ITN Usage	0.868*	0.397*	0.000*
Impact of Media Advertisements on ITN Usage	0.868*	0.397*	0.000*
Fixed Socioeconomic Factors (Income, Work Status, Residence)	0.868*	0.397*	0.000*
Pregnancy-Related Factors (Trimester, Prenatal Care Access)	0.868*	0.397*	0.000*
Awareness Level and ITN Coverage	0.578	-	-

To assess the overall number of pregnant women that received ITNs at the prenatal clinic of the Beletweyn hospital located in Beleddweyn district of Somalia, the third aim of the research was pursued. Subjective survey analysis revealed that all claims on the extent of ITN coverage had a mean score of 3.747, suggesting that participants were in reasonable agreement. The level of dispersion of their responses around the mean, as measured by an average standard deviation, was 1. 086. Additionally, it demonstrates that participants understood ALC, even while their

understanding of instrumental tube networks (ITNs) varied. Intratentinal nets (ITNs) effectively prevent malaria re-infection in pregnant women, according to all the observed investigations. Researchers Gamble et al. (2007) found that in a malaria-endemic area of Africa, using intravenous transfusions (ITNs) throughout pregnancy enhanced pregnancy outcomes, particularly when begun early in the pregnancy. This was true regardless of when the women began taking the ITNs. Similarly, Shonga et al. (2018) conducted research on the same subject in Ethiopia and found that the Allana] In this regard, research among Ethiopians conducted by Shonga et al. (2018) found that pregnant women's awareness of malaria and usage of ITNs were both positively correlated with educational attainment. According to these findings, the usage of intrauterine nets (ITNs) is the best way to protect pregnant women against malaria.

By employing a cross sectional research, this quantitative study conducted an self administered questionnaire of pregnant women who attended the prenatal clinic at Beletweyn referral hospital in the Beleddweyn, Somalia to determine how often malaria was and if the women already used ITNs. More so, the research findings displayed a statistically significant correlation between the two variables. It carried a significance level of p=0. 000 to the hypothesis and the result depicted that out of the four variables considered; ITNs had a coefficient of β=0. 397. Conclusion: ITNs have an incremental effect; the extent of its use by one quantity enhances the patients' expected malaria relapse score by 0. 397. This finding supports the hypothesis that pregnant women who sleep under intratentinal nasopharyngeal nets, (ITNs) do not contract malaria again easily. The results obtained in this analysis concur with those obtained by other scholars like Ankomah et al. , (2014) whose study also revealed that pregnant women adopted to use ITNs following the media advertisements. Tesfaye et al., 2022 pointed out that the ITN usage among pregnant women is significantly affected by fixed variables such as domicile, work status, and monthly income, as

well as by pregnancy related factors, including trimester of pregnancy and access to prenatal care services.

This research therefore also established a high positive relationship between the extent of ITN usage and the incidence of malaria infection among pregnant women attending the beleedweyn hospital's prenatal clinic. The level of ITN coverage and the likelihood of repeated malaria attacks have a strong positive relation (correlation coefficient= 0. 868). These findings are consistent with the existing studies done by different authors including Dun-Dery et al. (2020) who stated that mothers' compliance to wear Insecticide Treated Bed nets during pregnancy is dependent on extent of knowledge about risks involved in Malaria. With a value of 0. 578 it confirms positive direction revealing a decent level of interconnection between the level of awareness and the level of ITN coverage. The amount of awareness, therefore, increases with the coverage that ITN offers any given region. Thus, the findings indicates that the pregnant women are more likely to use the ITNs than the other materials once they are enlightened on the gains of using the contraceptives.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Chapter Five provides a comprehensive summary of the research findings, draws conclusions based on the analyzed data, and offers recommendations for addressing the issues identified. By emphasising the principal findings and the consequences of those outcomes, the purpose of this chapter is to provide a summary of the most important insights that were obtained from the research conducted at Beletweyn Hospital on the recurrence of malaria among pregnant women. It also provides an overview of the conclusions that were taken from the findings of the research and makes suggestions for practical measures that may be implemented to enhance malaria management and prevention efforts in situations that are comparable. Providing a clear understanding of the effect of the study and offering practical suggestions for policymakers, healthcare practitioners, and future research are the goals of this chapter. This will be accomplished by providing a summary of the most important results and explaining the relevance of those findings.

5.2 Summary of the findings

The study examined malaria awareness, socioeconomic influences, and preventive measures among pregnant women at Beletweyn Hospital's prenatal clinic. Findings revealed a moderate to high understanding of malaria symptoms and transmission, though gaps remained in recognizing less common symptoms and preventive practices.

Socioeconomic factors played a critical role in malaria recurrence, with affordability of treatment, poor sanitation, and limited access to antenatal care posing major challenges. Women from disadvantaged backgrounds faced greater barriers in accessing malaria prevention and treatment services.

While insecticide-treated nets (ITNs) were widely recognized as effective, concerns about affordability and accessibility persisted. Regression analysis confirmed that socioeconomic conditions and ITN coverage significantly influence malaria recurrence. The study underscores the need for a comprehensive approach that enhances awareness, improves healthcare access, and strengthens ITN distribution to reduce malaria cases among pregnant women.

5.3 Conclusion

This study highlights the multifaceted nature of malaria prevention and management among pregnant women at Beletweyn Hospital's prenatal clinic. While awareness of malaria symptoms and transmission is generally high, gaps remain in understanding less common symptoms and preventive measures. The mean score for general malaria awareness was 3.236, with knowledge of common symptoms scoring 2.600 and less common symptoms such as nausea and vomiting at 3.240. Targeted education programs are necessary to enhance knowledge and encourage timely medical intervention, particularly given that 34% of participants fell within the 26-35 age range, a group that is more likely to be engaged in healthcare decision-making.

Socioeconomic factors play a significant role in malaria recurrence, with affordability of treatment (mean score: 3.740), poor sanitation (mean score: 3.820), and limited access to healthcare (mean score: 3.510) emerging as key barriers. Women from economically disadvantaged backgrounds face greater challenges in accessing timely malaria care, as confirmed by the correlation coefficient of 0.857 between socioeconomic status and malaria recurrence. This underscores the need for

improved healthcare accessibility and socioeconomic support. Addressing broader determinants such as clean water access (mean score: 3.350) and sanitation can further mitigate the risk, emphasizing the necessity of integrated health and social policies.

The study also reaffirms the importance of insecticide-treated nets (ITNs) in malaria prevention, with an overall mean score of 3.747 for ITN coverage awareness. However, there was variability in perceived ITN effectiveness, with a mean score of 3.820 for its role in malaria prevention and 3.570 for ITN affordability. Regression analysis further confirmed that socioeconomic factors and ITN coverage significantly influence malaria recurrence, with ITNs showing a positive impact coefficient of $\beta = 0.397$. Additionally, the correlation coefficient of 0.868 between ITN coverage and malaria prevention indicates that increasing ITN distribution and use can effectively lower malaria rates.

In conclusion, an integrated approach combining enhanced awareness, improved socioeconomic conditions, and widespread ITN distribution is crucial for reducing malaria recurrence among pregnant women. Strengthening health education, ensuring affordable healthcare access, and addressing socioeconomic barriers will be pivotal in improving maternal health outcomes in the Beletweyn region.

5.4 Recommendations

The study findings suggested that socio-economic factors and level of awareness are important determinants of malaria recurrence among pregnant mothers in Somalia. The recommended that;

Enhance Educational Programs:

i. The Ministry of Health, in collaboration with non-governmental organizations (NGOs) and local health authorities, should implement targeted educational interventions at prenatal clinics. These programs should focus on:

ii. Increasing awareness of malaria symptoms (including less common ones), transmission methods, and preventive practices.

iii. Using interactive, culturally appropriate materials to engage pregnant women effectively.

iv. Encouraging timely medical consultation to reduce delays in diagnosis and treatment.

Improve Socioeconomic Support:

i. The Government of Somalia, through the Ministry of Planning and Economic Development, and in partnership with international donors and NGOs, should:

ii. Subsidize malaria treatment for economically disadvantaged pregnant women.

iii. Invest in clean water and sanitation infrastructure, especially in malaria-prone regions.

iv. Strengthen healthcare systems by improving access, staffing, and medical supplies in rural and low-income communities.

v. Increase ITN Coverage and Accessibility

The National Malaria Control Program (NMCP), supported by the World Health Organization (WHO), UNICEF, and local community health workers, should:

i. Scale up the distribution of insecticide-treated nets (ITNs) to pregnant women, especially in high-risk areas.

ii. Conduct educational campaigns emphasizing the correct and consistent use of ITNs.

iii. Monitor and evaluate ITN coverage regularly to ensure effectiveness and address any barriers to usage.

5.5 Suggestion for Further Research

To determine the study's generalisability, further research is needed in other settings, such other countries in sub-Saharan Africa. Educational and awareness campaigns, intratentinal net (ITN) distribution, and the development of new antimalarial drugs are all potential strategies for reducing malaria recurrence among Somalian pregnant women, but further study is needed to draw firm conclusions.

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APPENDICES

Appendix I: Introduction letter

Dear Sir/Madam

RE: INTRODUCTION LETTER.

I am a student at Mount Kenya University. In partial fulfilment of the requirement for the award of a master's degree, I am conducting a study entitled: ***"EFFECT OF MALARIA RECURRENCE CASES ON PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN HOSPITAL, BELEDDWEYN DISTRIC, SOMALIA"***

You have been selected to participate in this study and I would kindly request your assistance in filling out this questionnaire.

The information you providedwas strictly for academic purposes and was handled with strict confidence. Your assistance and co-operation was highly appreciated.

Yours sincerely,

Zamzam Mohamed Haji

Appendix II : Questionnaire Appendix II : Questionnaire

Section A: Background of Respondents

Kindly tick in the boxes as appropriate

1. What is your age?

i. Below 15 years
ii. 16 – 25 years
iii. 26 -35 years
iv. 36 – 45 years
v. Above 45 years

2.What is your marital Status?

i. Married
ii. Single
iii. Divorced
iv. Widowed

3. What is your occupational status?

i. Employed
ii. Unemployed
iii. Student

4.Have you ever had malaria during your pregnancy?

Yes {} No { }

5. Have you been given any details regarding malaria prevention during pregnancy?

Yes { } No { }

6. Are you actively using any preventive measures against malaria during your pregnancy, such as insecticide-treated bed nets or antimalarial medications?

Yes { } No { }

Section B: Level of Awareness

Statements	**1**	**2**	**3**	**4**	**5**
I am very knowledgeable about malaria symptoms.					
I am familiar with the less common symptoms of malaria, such as nausea and vomiting.					
I have a strong understanding of malaria transmission.					
I believe it is crucial to seek prompt medical attention if I suspect I have malaria.					
I believe that using preventive measures effectively reduces the risk of contracting malaria.					
If I suspect malaria, I should consult a doctor immediately.					
I understand that malaria is typically transmitted through the bite of infected mosquitoes.					

Section C: Socio economic risk

Please indicate the number that best represents your opinion on each of the following statements, using the scale below:

1 = Strongly Disagree
2 = Disagree
3 = Neutral
4 = Agree
5 = Strongly Agree

Statements	1	2	3	4	5
This has always been an issue of affordability because pregnant women are hard put to fund malaria treatments.					
Availability of affordable and skilled ANC may help low income pregnant women avoid contracting malaria again.					
Lack of safe drinking water means I am likely to catch malaria and this is a major burden to me.					
It's common knowledge that diseases like malaria could breed from poor hygiene and inadequate disposal of wastes especially those containing water.					
They conducted a study and proved that pregnant women's economic position should be enhanced with a view to minimising the chances of malaria recurrences.					

Section D: Insecticide Treated Bed Nets

Kindly choose the best number from 1 to 5, where '1' stands for 'strongly disagree,' '2' for 'disagree,' '3' for 'neutral,' '4' for 'agree,' and '5' for 'strongly agree.'

Statements	1	2	3	4	5
The use of insecticide-treated bed nets is an effective way to prevent malaria.					
The use of insecticide-treated bed nets while sleeping can reduce the risk of malaria infection					
Insecticide-treated bed nets are a convenient and easy way to prevent malaria transmission					
The use of insecticide-treated bed nets reduces the number of malaria-carrying mosquitoes in the environment					
The use of insecticide-treated bed nets is an important measure in protecting pregnant women and their unborn children from malaria					
Investing in insecticide-treated bed nets can be a good strategy to prevent malaria infection in high-risk areas					
Providing insecticide-treated bed nets to communities in high-risk areas can be an affordable option for preventing malaria					

Section E: Pregnant mothers attending ANC

Please indicate the most appropriate number that describes your position on the scale of 1-5

1=StronglyDisagree2=Disagree 3 =Neutral 4 = Agree5=Strongly Agree

Statements	1	2	3	4	5
Pregnant women who attend antenatal care services are more likely to receive early diagnosis and treatment of malaria.					
Malaria in pregnant women can be diagnosed and treated through routine check ups during antenatal clinic visits.					
Timely and effective treatment of malaria during pregnancy is crucial to prevent adverse maternal and fetal outcomes					
The provision of intermittent preventive treatment is an essential service for pregnant women to prevent the adverse outcomes of malaria infection.					
The IPT uptake, therefore the ratio of the pregnant women who receive IPT is one of the measures of quality of the ANC services received.					
Tetanus toxoid vaccination administered to women is another aspect that determines health of mothers.					
A preconception care involves giving pregnant women iron and folic acid supplementation regimen to avoid congenital abnormalities.					

Appendix III: Interview Guide for Nurses

i. In your opinion how does the level of awareness concerning the outbreak of Malaria affect pregnant women who attend prenatal clinics? Explain …….

……

……..

ii. What socio-economic factors affect pregnant women that visit the prenatal clinic at your facility?

Explain……

……..

iii. According to you, what are the biggest socio-economic risk factors in relation to the vulnerability of the pregnant females to malaria attack in this hospital? Kindly explain…….

……

iv. How would you rate the effectiveness of Insecticide Treated Bed Nets coverage to pregnant women who attend prenatal clinics? Please Elucidate

……

……

v. Current promotion strategies employed to ensure pregnant women at your institution uses insecticide-treated bed the nets?

.....

……

vi. Has there been any shift in the level of insecticide-treated bed net use among pregnant women who attend prenatal clinic in the past one year?

……

……

vii. Are you aware of general trends or calculated rhythms in malaria incidence in pregnancy among women in the area that you serve?

Yes { } No { }

If yes, can you describe those trends and any potential contributing factors?

……..

viii. Are you of the opinion that there is a need for enhanced malaria prevention and management options for pregnant women within the area you live in?

Yes { } No { }

iv. When so, what kind of specific improvements do you think needs to be implemented and how in practice would that be done?

……

Appendix III: Interview Guide for Nurses

ix. In your opinion, how does the level of knowledge about malaria reemergence affect pregnant women who visit prenatal clinics? Explain…….

……

……..

x. Which socio-economic factors influence the behavior of pregnant women attending the prenatal clinic at your facility?

Explain……

……..

xi. According to you, which socio economic factors are the most risky predisposing pregnant women to malaria in this particular hospital? Kindly explain…….

……

xii. iv. How would you rate the influence of ITNs coverage among pregnant women who attend prenatal clinics? Please Elucidate

……

……

xiii. What measures are currently implemented at your institution to encourage pregnant women to use insecticide-treated bed nets?

.....

……

xiv. Have there been any noticeable changes in the level of insecticide-treated bed net usage among pregnant women attending prenatal clinics over the past year?

……

……

xv. Have you observed any significant trends or consistent patterns in the incidence of malaria among pregnant women in the region you serve?

Yes { } No { }

If yes, can you describe those trends and any potential contributing factors?

……..

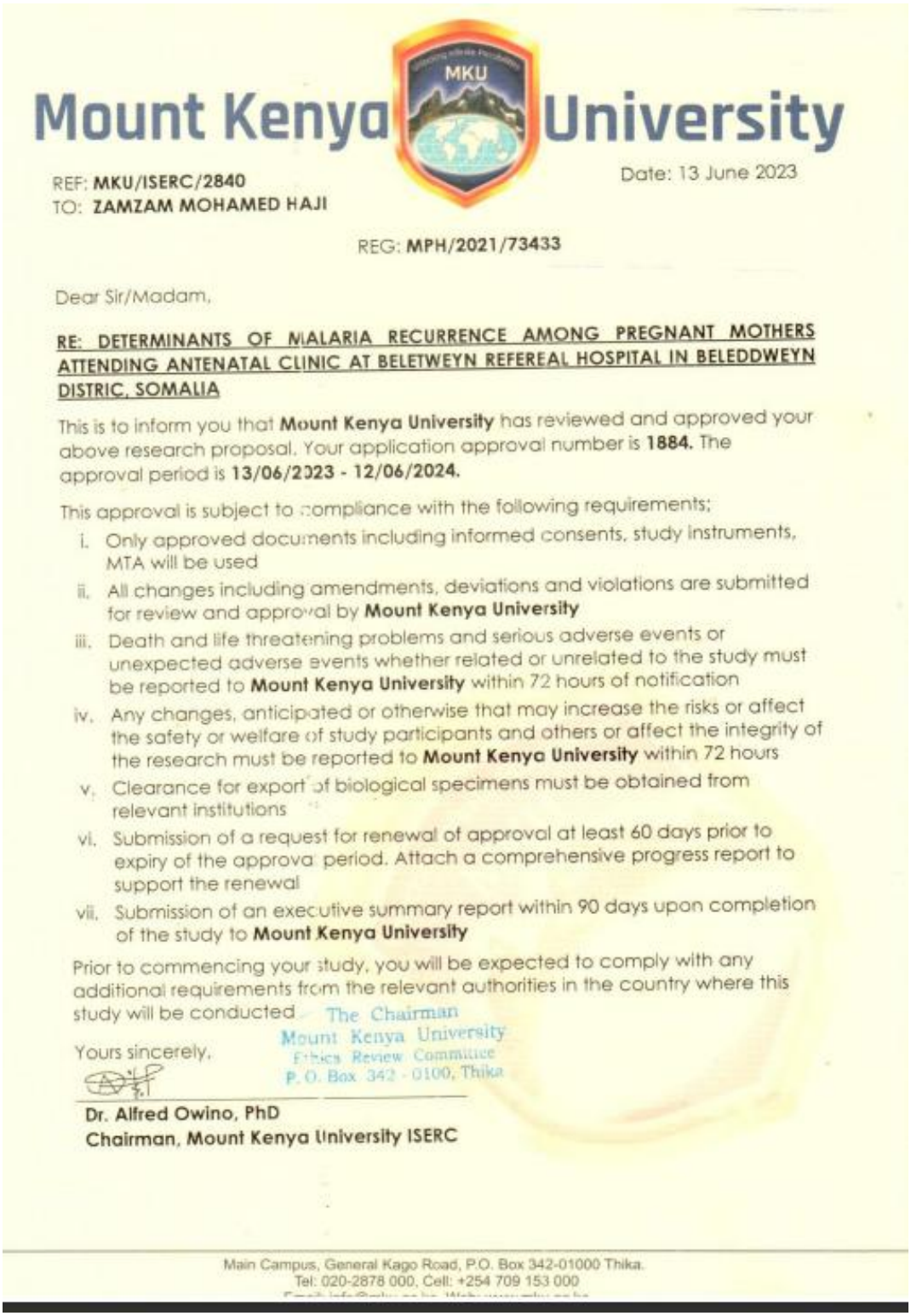
xv. Do you believe that there is a need for improved malaria prevention and management options for pregnant women in your area?

Yes { } No { }

v. When considering this, what specific improvements do you think are needed, and how can they be implemented effectively?

……

Appendix IV: Mount Kenya University ERC Certificate



Mount Kenya University

REF: MKU/ISERC/2840
TO: ZAMZAM MOHAMED HAJI

Date: 13 June 2023

REG: MPH/2021/73433

Dear Sir/Madam,

RE: DETERMINANTS OF MALARIA RECURRENCE AMONG PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN REFEREAL HOSPITAL IN BELEDDWEYN DISTRIC, SOMALIA

This is to inform you that **Mount Kenya University** has reviewed and approved your above research proposal. Your application approval number is **1884.** The approval period is **13/06/2023 - 12/06/2024.**

This approval is subject to compliance with the following requirements;

i. Only approved documents including informed consents, study instruments, MTA will be used
ii. All changes including amendments, deviations and violations are submitted for review and approval by **Mount Kenya University**
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to **Mount Kenya University** within 72 hours of notification
iv. Any changes, anticipated or otherwise that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to **Mount Kenya University** within 72 hours
v. Clearance for export of biological specimens must be obtained from relevant institutions
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal
vii. Submission of an executive summary report within 90 days upon completion of the study to **Mount Kenya University**

Prior to commencing your study, you will be expected to comply with any additional requirements from the relevant authorities in the country where this study will be conducted

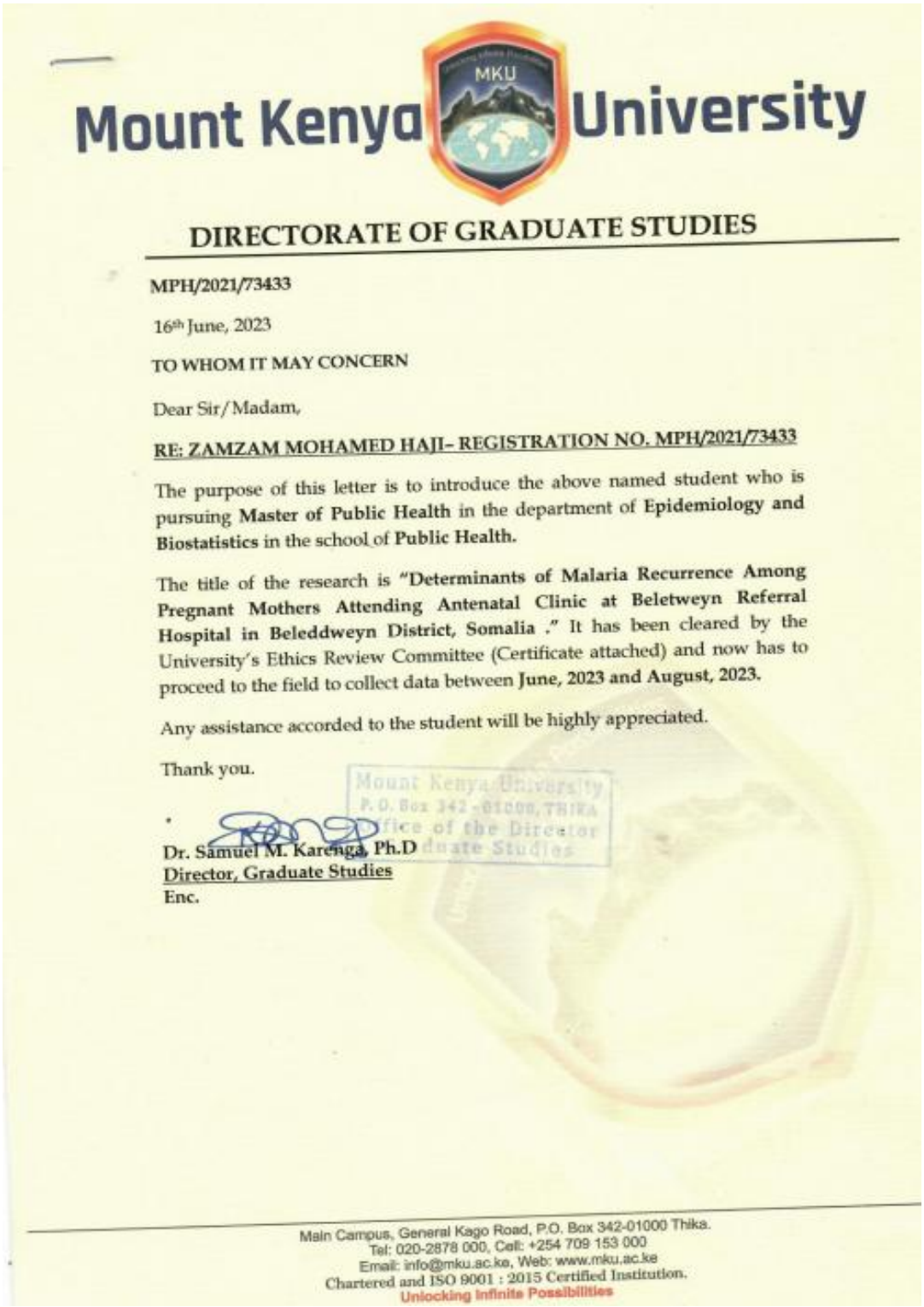
The Chairman
Mount Kenya University
Ethics Review Committee
P. O. Box 342 - 0100, Thika

Yours sincerely,

Dr. Alfred Owino, PhD
Chairman, Mount Kenya University ISERC

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Tel: 020-2878 000, Cell: +254 709 153 000

Appendix V: Introduction Letter from MKU Graduate Studies



Mount Kenya University

DIRECTORATE OF GRADUATE STUDIES

MPH/2021/73433

16th June, 2023

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: ZAMZAM MOHAMED HAJI- REGISTRATION NO. MPH/2021/73433

The purpose of this letter is to introduce the above named student who is pursuing **Master of Public Health** in the department of **Epidemiology and Biostatistics** in the school of **Public Health.**

The title of the research is **"Determinants of Malaria Recurrence Among Pregnant Mothers Attending Antenatal Clinic at Beletweyn Referral Hospital in Beleddweyn District, Somalia ."** It has been cleared by the University's Ethics Review Committee (Certificate attached) and now has to proceed to the field to collect data between **June, 2023 and August, 2023.**

Any assistance accorded to the student will be highly appreciated.

Thank you.

Mount Kenya University P.O. Box 342-01000, THIKA Office of the Director Graduate Studies

Dr. Samuel M. Karenga, Ph.D
Director, Graduate Studies
Enc.

Main Campus, General Kago Road, P.O. Box 342-01000 Thika.
Tel: 020-2878 000, Cell: +254 709 153 000
Email: info@mku.ac.ke, Web: www.mku.ac.ke
Chartered and ISO 9001 : 2015 Certified Institution.
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Appendix VI: Research Aproval from MoH Somalia

Hirshabelle State

Ministry of Health
RESEARCH & ETHICS REVIEW COMMITTEE
ETHICAL APPROVAL

REG NO: MOH/2021/52985 Date: 25 June 2023

This is to certify that the proposal submitted by:

Supervisors:

Dr. Juma Joseph (Mount Kenya University)

Dr. Teresa Ngonjo (Mount Kenya University)

Investigator: ZAMZAM MOHAMED HAJI

Full Project Title

DETERMINATNS OF MALARIA RECURRENCE AMONG PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN REFEREAL HOSPITAL IN BELEDDWEYN DISTRIC, SOMALIA

To be undertaken
somalia

Start Date : 25 June 2023 End date : 25 Sep 2023

For the proposed period of research has been approved by the Researcher and ethics committee at ministry of health.

Dr.Hassan Ahmed Barqadle,
Designation:Hiran Regional Medical Officer (RMO), Hirshabelle State

Ministry of Health Hirshabelle State of Somalia,
Hirshabelle State Somalia, Info@moh.pl.so

Appendix VII: Map of Study Site

Appendix VIII: Similarity Report

DETERMINANTS OF MALARIA RECURRENCE AMONG PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN REFERRAL HOSPITAL IN BELEDDWEYN DISTRICT, SOMALIA

by Zamzam Mohamed Haji

Submission date: 20-May-2025 10:41AM (UTC+0300)
Submission ID: 2680467371
File name: Zamzam_Mohamed_Haji-Revised_Thesis-May_Final_1.docx (2.3M)
Word count: 24294
Character count: 142613

DETERMINANTS OF MALARIA RECURRENCE AMONG PREGNANT MOTHERS ATTENDING ANTENATAL CLINIC AT BELETWEYN REFERRAL HOSPITAL IN BELEDDWEYN DISTRICT, SOMALIA

ORIGINALITY REPORT

14%	%	13%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Submitted to Mount Kenya University Student Paper	1%
2	Kirui, Emily. "Determination of the Prevalence and Associated Factors of Malaria Among Pregnant Women in Kenya, 2022: A Cross-Sectional Study.", University of Johannesburg (South Africa) Publication	1%
3	Submitted to Kenyatta University Student Paper	<1%
4	Alebachew Ferede Zegeye, Enyew Getaneh Mekonen, Deresse Abebe Gebrehana, Berhan Tekeba, Tadesse Tarik Tamir. "Spatial variation and multilevel determinants of malaria infection among pregnant women in Sub-Saharan Africa: using malaria indicator surveys", BMC Infectious Diseases, 2025 Publication	<1%

144	Moussa Lingani, Serge H. Zango, Innocent Valéa, Maïmouna Sanou et al. "Prevalence and risk factors of malaria among first antenatal care attendees in rural Burkina Faso", Tropical Medicine and Health, 2022 Publication	<1 %
145	Yaser Mohammed Al-Worafi. "Chapter 48-1 Infectious Diseases: Overview", Springer Science and Business Media LLC, 2024 Publication	<1 %

Exclude quotes	Off	Exclude matches	Off
Exclude bibliography	On		