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

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Abstract**:** Malaria recurrence among pregnant women remains a serious public health concern in Somalia, contributing significantly to maternal illness, death, and negative birth outcomes. Despite ongoing malaria control efforts, recurrent infections continue to hinder elimination goals, particularly in high-transmission areas such as Beledweyn District. This study examined the determinants of malaria recurrence among pregnant women attending antenatal clinics at Beledweyn Referral Hospital. Specifically, it assessed awareness of malaria prevention and treatment, explored socioeconomic risk factors influencing recurrence, and evaluated the coverage and utilization of Insecticide-Treated Nets (ITNs) among pregnant women. The research was guided by the Health Belief Model, Behavioral Change Model, and Trans-Theoretical Model, which collectively emphasize how individual perceptions, knowledge, and readiness to adopt preventive practices shape health behaviors. A cross-sectional descriptive design utilizing both quantitative and qualitative methods was employed. Structured questionnaires were administered to 369 pregnant women, while nine healthcare providers participated in key informant interviews. Data were analyzed using descriptive statistics, Pearson correlation, and multiple regression

techniques. Results revealed strong positive associations between malaria outcomes and socioeconomic factors ($r = 0.808$, $p < 0.001$), awareness levels ($r = 0.727$, $p < 0.001$), and ITN coverage ($r = 0.766$, $p < 0.001$). Regression analysis showed that these variables jointly accounted for 86.4% of the variance in malaria recurrence ($R^2 = 0.864$, $F = 367.552$, $p < 0.001$), with ITN coverage being the most significant predictor ($\beta = 0.414$, $p < 0.001$). The study concluded that improving ITN accessibility, strengthening socioeconomic support, and promoting health education are crucial for reducing malaria recurrence. It recommends enhancing ITN distribution systems, implementing community-based education, and integrating malaria prevention with broader maternal health programs.
Keywords: *Malaria recurrence, pregnant women, antenatal care, insecticide-treated bed nets, socio-economic factors, health awareness, Somalia*

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1.0 INTRODUCTION

A. Background of the Study

Malaria is a life-threatening disease transmitted to humans by the bite of an infected female Anopheles mosquito, which introduces Plasmodium parasites into the bloodstream (Kataria et al., 2022). The severity of malaria ranges from mild to fatal, with uncomplicated cases manifesting as flu-like symptoms, while severe cases can cause organ failure, coma, and death. In malaria-endemic regions, the disease remains a major public health concern due to its high morbidity, mortality, and socioeconomic burden (World Health Organization [WHO], 2018). Although treatment and preventive measures aim to curb infections, recurrence of malaria continues to challenge control efforts. Dini et al. (2020) emphasize that recurrent malaria episodes are associated with increased illness, a greater risk of premature death, and the emergence of drug resistance. Malaria recurrence refers to the reappearance of clinical symptoms in an individual who was previously infected and successfully treated (Dini et al., 2020). Recurrence can result from incomplete treatment, reinfection via new mosquito bites, or the reactivation of dormant liver-stage parasites. Such cases may occur within 28 days (early recurrence) or beyond 28 days (late recurrence). According to Dhiman (2019), recurrent malaria poses a significant obstacle to elimination programs, as it sustains parasite transmission in endemic areas. Therefore, proper case management and follow-up are essential in mitigating the disease's long-term impact.

Pregnant women are particularly vulnerable to malaria recurrence due to immunological and physiological changes during pregnancy (Gontie, Wolde & Baraki, 2020). Repeated infections increase the risk of maternal anemia, preterm delivery, low birth weight, and stillbirth (Goucher et al., 2003). Placental malaria disrupts nutrient flow to the fetus, impairs immune development, and contributes to neonatal mortality. According to Dayanand, Achur and Gowda (2018), malaria relapses during pregnancy also promote the emergence of drug-resistant parasite strains,

undermining treatment efficacy. Globally, malaria prevalence has declined over the past decade due to improved control measures. The global incidence dropped by 27% between 2010 and 2019, while mortality declined by 60% (WHO, 2020). Nonetheless, malaria remains a major concern in sub-Saharan Africa, where transmission is intense. Studies in Tanzania and Ghana revealed that recurrent malaria during pregnancy contributes to low birth weight and premature delivery (Minja et al., 2013; Mohammed et al., 2019). Furthermore, recurrent infections increase healthcare costs, creating economic strain on affected families (Mehretie Adinew et al., 2018).

In Somalia, malaria continues to pose a severe public health challenge, particularly among pregnant women and children under five (Kinyoki et al., 2018). Transmission follows a seasonal pattern, peaking between April–June and October–December. The estimated prevalence among pregnant women stands at 25%, with rural populations experiencing higher infection rates due to limited access to preventive interventions (Mohamud, 2022). A study in Puntland reported a prevalence of 24.3% among pregnant women, primarily during early trimesters (Mohamud & Mohamud, 2022), while malaria accounted for 20% of maternal deaths in the Lower Juba region (Warsame et al., 2015). Moreover, Kalid et al. (2019) observed that mothers infected with malaria in the Afgooye area were more likely to deliver low-birth-weight infants and experience neonatal mortality. Given these alarming trends, understanding the determinants of malaria recurrence among pregnant women is critical. This study, therefore, seeks to identify the factors influencing malaria recurrence among expectant mothers attending antenatal clinics at Beletweyn Referral Hospital in Beledweyn District, Somalia. The findings will inform targeted interventions to reduce malaria incidence, enhance maternal and neonatal outcomes, and strengthen malaria control strategies in high-burden regions.

B. Problem Statement

Malaria remains one of the leading public health challenges in Somalia, disproportionately affecting pregnant women and children under five (Kinyoki et al., 2018). Despite national and international malaria control efforts, recurrence of infection among pregnant women continues to undermine progress in disease reduction. The WHO classifies Somalia as a high-burden malaria country characterized by unstable transmission and seasonal outbreaks linked to rainfall patterns that favor mosquito breeding (WHO, 2020). The malaria prevalence among pregnant women in Somalia is approximately 25%, with higher rates observed in rural communities where access to insecticide-treated bed nets (ITNs) and intermittent preventive treatment in pregnancy (IPTp) remains limited (Mohamud, 2022).

Studies indicate that in Puntland, 24.3% of pregnant women experience malaria during early trimesters (Mohamud & Mohamud, 2022), while malaria accounts for 20% of maternal deaths in Lower Juba (Warsame et al., 2015). Recurrent infections increase risks of maternal anemia, low birth weight, stillbirth, and neonatal death (Kalid et al., 2019). Furthermore, the emergence of resistance to antimalarial drugs such as sulfadoxine-pyrimethamine exacerbates recurrence and complicates disease management (Dayanand et al., 2018). However, research on malaria recurrence among pregnant women in high-risk areas like Beletweyn remains limited. This study aims to examine the determinants of malaria recurrence among expectant mothers attending

antenatal clinics at Beletweyn Referral Hospital to inform effective prevention and treatment strategies.

C. Research Objectives

General Objective

The general objective of the study was to assess the determinants of malaria recurrence among pregnant mothers attending antenatal clinic at Beledweyn referral hospital in Beleddweyn district, Somalia.

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.
i. 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.
ii. 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.

2.0 LITERATURE REVIEW

A. Theoretical Framework

Recent attempts to assess the determinants of malaria recurrence among pregnant mothers attending antenatal clinic at Beledweyn referral hospital in Beleddweyn district, Somalia. Since then, several research has been carried out both theoretically and practically.

Health Belief Model (HBM)

The Health Belief Model (HBM) posits that individuals are more likely to engage in preventive health behaviors when they perceive themselves as susceptible to a disease, recognize its potential severity, and believe that specific actions such as using Insecticide-Treated Bed Nets (ITNs), attending antenatal clinics (ANC), and adhering to malaria treatment can mitigate the risk (Rosenstock et al., 1988). In the context of malaria recurrence among pregnant women in Beledweyn District, the HBM explains how perceptions of risk, socioeconomic status, self-efficacy, and external influences, such as health education and community interventions, shape preventive behavior (Janz & Becker, 1984). Schwarzer's emphasis on self-efficacy further underscores the need for women to feel capable of adopting protective measures. Barriers such as cost, limited access, or misinformation may inhibit prevention efforts, emphasizing the importance of interventions that enhance awareness and empowerment (Schwarzer, 1992).

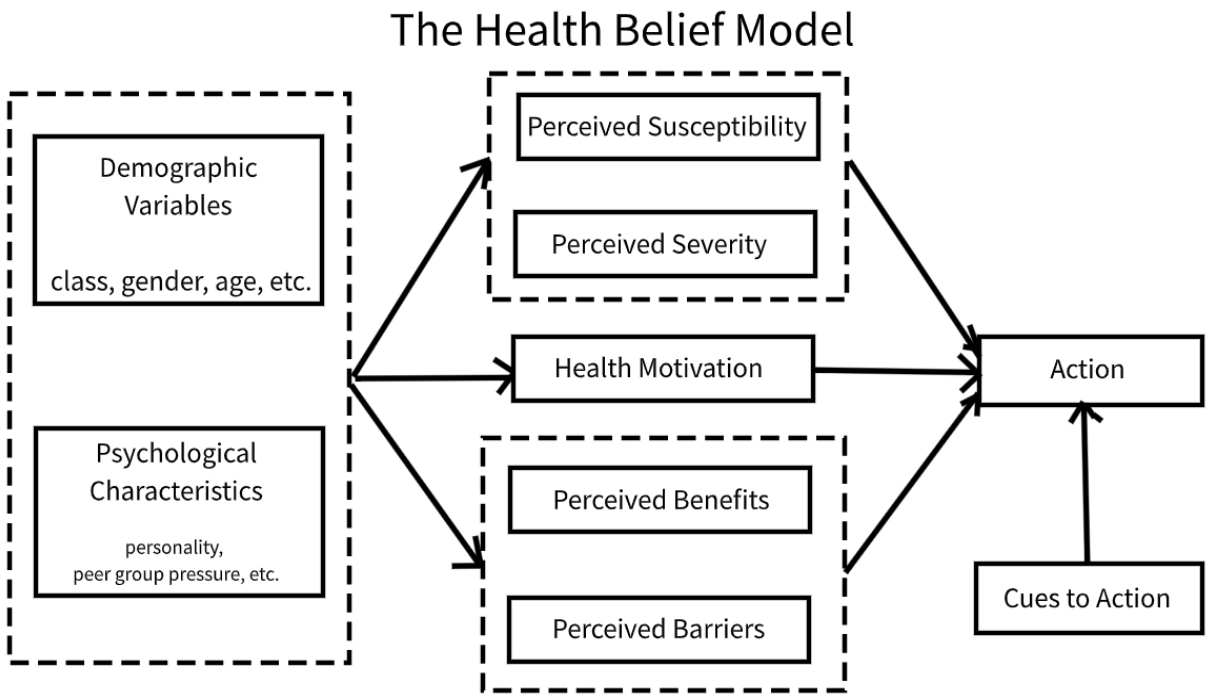

Figure 1: Health Belief Model

Behavioral Change Model

The Behavioral Change Model (BCM), developed by Glanz, Rimer, and Viswanath (2015), posits that health behavior change arises from the dynamic interaction of individual, environmental, and behavioral factors. The model emphasizes that behavior change is not linear but influenced by multiple determinants, including knowledge, motivation, and resource accessibility (Verelst, Willem, & Beutels, 2018; Thompson, 2016). It highlights the significance of self-efficacy, suggesting that individuals with higher confidence are more likely to adopt and sustain healthy behaviors (Baranowski et al., 2017). Social support also plays a vital role, as community engagement fosters long-term adherence to positive health practices (Kumar, Kumar, & Darmstadt, 2016). In this study, the BCM helps identify determinants such as awareness, attitudes, and environmental factors that influence malaria prevention behaviors among pregnant women (Ernst et al., 2017).

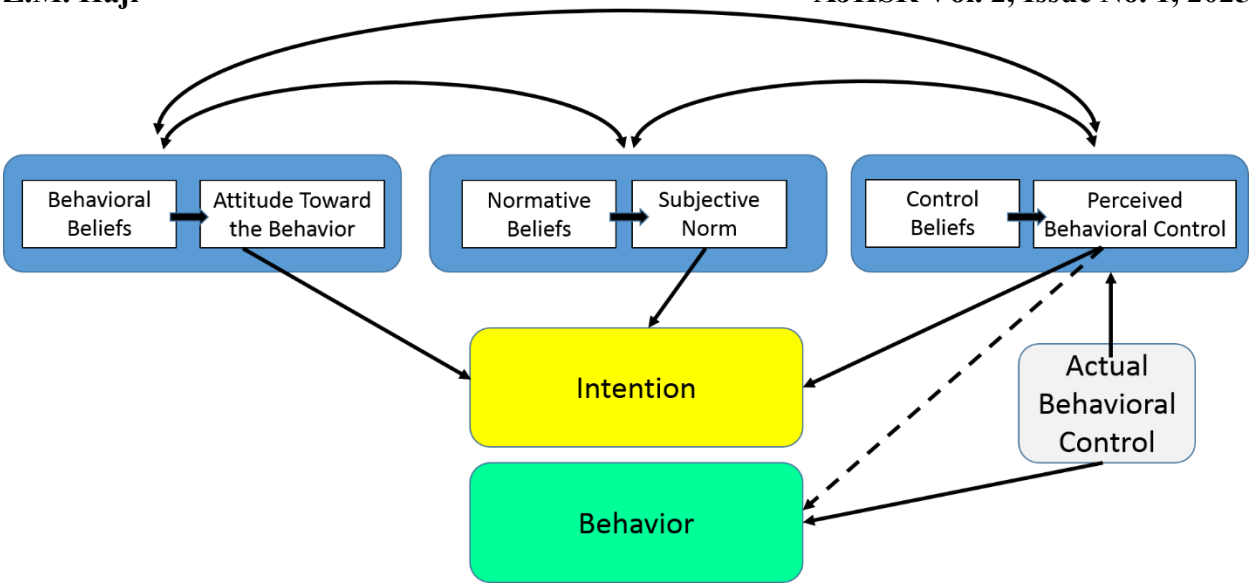

Figure 2: Behavioral Change Model

Source: Researcher (2023)

Trans-theoretical Model

The Trans-Theoretical Model (TTM) describes six stages of behavior change: precontemplation, contemplation, preparation, action, maintenance, and termination, each representing varying readiness to adopt preventive measures (Prochaska & Velicer, 1997). In malaria prevention, the TTM assesses how pregnant women progress through these stages in adopting behaviors such as consistent use of Insecticide-Treated Nets (ITNs), attending antenatal care (ANC), and adhering to malaria treatment (Verelst, Willem, & Beutels, 2018). Factors such as social norms, healthcare access, and personal beliefs influence movement across stages (Mossière & Serin, 2017). Women with strong community and healthcare support are more likely to sustain preventive practices. Applying the TTM in this study facilitates understanding of stage-specific interventions that promote long-term malaria prevention among pregnant women in Beledweyn District.

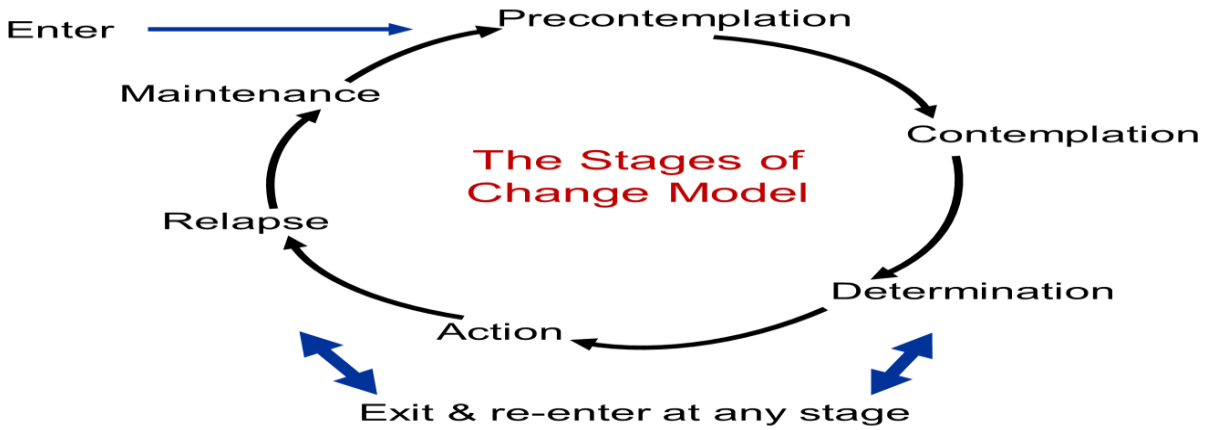

Figure 1: Trans-theoretical Model

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.

B. Empirical Review

The study provides a critical synthesis of previous empirical studies directly relevant to the variables under investigation: malaria recurrence, level of awareness, socio-economic risk factors, and the coverage of insecticide-treated bed nets (ITNs) among pregnant women. The review is structured to present evidence from the global context down to the specific study location in Somalia.

Global Context of Malaria Burden and Recurrence

Globally, the malaria burden is unevenly distributed. While non-endemic regions like the United States experience fewer than 2,000 annual cases, primarily from travel and immigration, the challenge in endemic countries remains severe (World Health Organization, 2021). A pivotal study by Collins and Twohig (2020) employed regression analysis to compare the epidemiological trajectories of Plasmodium falciparum (P. falciparum) and Plasmodium vivax (P. vivax) in low-burden settings. Their research revealed that the decline in overall malaria incidence does not uniformly affect both species; the rate of reduction for P. vivax was often slower and more heterogeneous across World Health Organization (WHO) regions compared to P. falciparum, complicating eradication efforts. Focusing on recurrence, Cui et al. (2021) analyzed imported relapsing malaria cases of P. vivax and Plasmodium ovale in China from 2013 to 2020. Utilizing data from China's Parasitic Diseases Information Reporting Management System and analytical software including SAS and ArcGIS, they identified that such imported recurrent cases pose a significant threat to malaria resurgence. Their findings underscore the necessity of enhancing radical treatment for prior infections, implementing targeted interventions for high-risk groups, and strengthening international coordination to manage case importation (Cui et al., 2021).

African and East African Context

In Africa, malaria recurrence is exacerbated by non-adherence to treatment regimens and the emergence of drug-resistant parasite strains (Kamau, 2021). A cross-sectional survey by Babamale et al. (2022) in Kwara State, Nigeria (n=572), demonstrated a high prevalence of malaria parasitaemia and recurrent episodes, highlighting the disease as a major public health issue. The

study advocated for the deployment of ITNs, improved health infrastructure, and subsidized treatment. The threat of drug resistance is a critical concern. Eboumbou Moukoko et al. (2019) conducted a molecular surveillance study in Cameroon, sequencing the Kelch13-propeller gene to monitor artemisinin resistance. They identified a 2.9% prevalence of non-synonymous K13 mutations, signalling the need for continuous vigilance despite no current association with delayed parasite clearance, to protect the efficacy of artemisinin-based combination therapies (ACTs). Within East Africa, seasonal peaks of malaria coincide with rainy seasons, creating a high disease burden. Idris et al. (2022) conducted an unmatched case-control study in South Sudan, identifying factors such as incomplete antimalarial treatment, marital status, and nutritional status as significant predictors of severe recurrent malaria. Their findings emphasize the need for comprehensive treatment programs and awareness campaigns.

The Situation in Somalia

Somalia faces a severe and persistent malaria crisis. Reports indicate approximately 4.7 million confirmed cases and over 7,000 deaths in a single year, underscoring an urgent need for enhanced control strategies (Warsame et al., 2019; Giorgi et al., 2018). Mohamed, Mohamed, and Hassan (2020) specifically stress the critical role of improving the utilization of ITNs and other preventive measures to combat the continued prevalence and re-emergence of the disease.

Level of Awareness Among Pregnant Women

Awareness is a cornerstone of effective malaria prevention. Godfrey (2017), in a cross-sectional study of 4,294 pregnant women in Nigeria, found that antenatal clinic (ANC) visits were the primary source of malaria knowledge. The study also revealed a significant disparity in awareness levels between women attending private versus public health facilities, linking higher knowledge to better educational attainment. Further supporting this, Shehu, Mbakwe, Panti, and Chapa (2018) found that pregnant women with higher levels of education and those whose spouses were educated demonstrated better knowledge and adoption of preventive practices. In Uganda, Peter (2022) identified maternal education, malaria knowledge, and the frequency of ANC visits as significant predictors for the uptake of intermittent preventive treatment in pregnancy (IPTp-SP). This highlights a consistent theme: awareness, facilitated by education and regular ANC attendance, is crucial for positive health outcomes.

Socio-Economic Risk Factors

Socio-economic determinants significantly influence malaria risk. A study in Eastern Indonesia by Fadila, Ekawardhani, Fauziah, and Hutagalung (2021) found that lower socioeconomic status, malaria positivity, anaemia, and abnormal BMI were significant risk factors for miscarriage in malaria-endemic areas. In sub-Saharan Africa (SSA), Degarege et al. (2019) conducted a meta-analysis confirming that individuals with low education, low income, poor housing, and those engaged in farming were at a higher risk of Plasmodium infection. This is echoed in Somalia-specific research. Ahmed et al. (2021), in a community-based cross-sectional study in Mogadishu's IDP camps, identified anaemia in pregnant women as a severe public health issue, strongly linked to socio-economic vulnerabilities. Similarly, Abdalla, Abdalla, and Eltayeb (2017) found that

factors like low family income, low maternal education, and large family size were correlated with malaria infection among pregnant women in Sudan.

Coverage and Utilization of Insecticide-Treated Bed Nets (ITNs)

The ownership of ITNs does not guarantee their use. In Myanmar, Aung, Win, and Show (2022) analyzed secondary data and found that despite high ownership, utilization rates among pregnant women were low, influenced by self-perceived risk and comfort with ITNs. In Ghana, Asumah et al. (2021) similarly reported a gap between ITN ownership and consistent use, indicating a need for behaviour change communication. Research in Somalia affirms this challenge. A study by Omar, Son, and Wambalaba (2021) in the Belet Hawo district confirmed that long-lasting insecticidal nets (LLINs) are effective for malaria prevention. However, Mohamed, Mohamed, and Hassan (2020), in a study in Hodan district, found notable disparities in knowledge, ownership, and consistent use of ITNs in households with children under five, pointing to a critical area for intervention.

3.0 RESEARCH METHODOLOGY

A cross-sectional descriptive design was adopted, enabling data collection at a single point in time to examine patterns, prevalence, and associated factors. The study applied both quantitative and qualitative approaches structured questionnaires gathered measurable data from pregnant women, while key informant interviews (KIIs) with nurses provided in-depth insights into malaria prevention and treatment challenges. The research was conducted at Beletweyn Hospital, a major healthcare facility serving over 200,000 people in the Hiiraan region. The target population comprised approximately 1,000 pregnant women receiving ANC services monthly and 15 nurses serving as key informants. A sample size of 439 participants was determined using statistical formulas, accounting for a non-response rate. A multi-stage stratified sampling technique was used for pregnant women to ensure representation across different subgroups, while purposive sampling selected knowledgeable nurses. Data collection involved structured questionnaires for quantitative data and interview guides for qualitative data. Quantitative data were analyzed using descriptive and inferential statistics such as Chi-square tests and logistic regression at a 5% significance level. Qualitative data were analyzed thematically to identify major patterns and integrate findings with quantitative results for comprehensive interpretation. Ethical approval was obtained from Mount Kenya University, Somali Research Council, and the Ministry of Health. Permissions were also sought from local authorities and hospital administration. Participants gave informed consent, were assured of confidentiality, and had the freedom to withdraw at any stage. Overall, the methodology ensured systematic data collection, rigorous analysis, and adherence to ethical research standards.

4.0 RESEARCH FINDINGS AND DISCUSSION

A. Response Rate

As shown in Table 1, the study achieved an 87% response rate for the questionnaires that were distributed and returned. This indicates a strong level of participation among respondents.

Table 4.1: Response Rate

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

Source: Survey Data (2025)

The high response rate of 87% for the questionnaires and 60% for the Key Informant Interviews (KIIs) suggests that the data collected were sufficient to represent the target population. According to Jaju and Crask (1999), a low response rate can undermine the reliability and statistical power of a study, while a high rate enhances data validity and representativeness. In this study, 424 questionnaires were distributed to pregnant women, out of which 369 were completed and returned. For the KIIs, 15 interview guides were issued to selected nurses, and 9 were fully completed and returned. These figures demonstrate satisfactory participation levels, ensuring that the findings are based on a credible and adequately representative dataset.

B. Descriptive Analysis

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 Descriptive Statistics

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 cognizant, a Likert scale was used. The replies were assessed using measures of standard deviation and mean. Table 2 displays the outcomes.

Table 2: 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 fewer 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**

Source: Survey Data (2025)

Table 2 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 3: 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

Source: Survey Data (2025)

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."*

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 3 displays the results obtained from the participants.

Table 3: 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**

Source: Survey Data (2025)

Table 3 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."*

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 below displays the replies of the participants.

Table 4: 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**

Source: Survey Data (2025)

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."

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 5: 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**

Source: Survey Data (2025)

Table 5 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."*

C. 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 6 are the findings from the Pearson correlation study.

Table 6: 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	

Source: Survey Data (2025)

The correlation matrix reveals several significant relationships. The strongest correlation observed was between socioeconomic factors and malaria outcomes among mothers ($r = 0.808$, $p < 0.001$), indicating that socioeconomic conditions are the most powerful predictor of malaria vulnerability. This finding underscores the fundamental role of social determinants in disease susceptibility and health outcomes. The relationship between awareness levels and maternal outcomes showed a strong positive correlation ($r = 0.727$, $p < 0.001$), demonstrating that knowledge significantly influences malaria prevention and management behaviors. ITN coverage also demonstrated strong association with maternal outcomes ($r = 0.766$, $p < 0.001$), confirming the protective value of this intervention. Importantly, socioeconomic factors showed substantial correlation with ITN coverage ($r = 0.677$, $p < 0.001$), suggesting that economic resources facilitate access to and utilization of preventive tools. The moderate correlation between awareness levels and socioeconomic factors ($r = 0.527$, $p < 0.001$) indicates that education and knowledge acquisition are influenced by, but not entirely determined by, economic status. The weakest, though still significant, correlation was between awareness levels and ITN coverage ($r = 0.367$, $p < 0.001$), suggesting that knowledge alone is insufficient to guarantee ITN use without addressing access barriers.

D. Regression Analysis

Multiple regression analysis was employed to determine the predictive power of independent variables (awareness, socioeconomic factors, and ITN coverage) on the dependent variable of malaria recurrence among pregnant women.

Table 7: Model Summary

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

Source: Survey Data (2025)

The model summary demonstrates excellent predictive power, with an R-squared value of 0.864, indicating that the independent variables collectively explain approximately 86.4% of the variance in malaria recurrence. The adjusted R-squared of 0.862 confirms model stability, showing minimal shrinkage when accounting for the number of predictors. This high explanatory power validates the theoretical framework and confirms that awareness, socioeconomic factors, and ITN coverage are indeed critical determinants of malaria recurrence.

Table 8: 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			

Source: Survey Data (2025)

The ANOVA results confirm the statistical significance of the overall regression model ($F = 367.552$, $p < 0.001$), indicating that the predictors collectively provide significantly better prediction than would be expected by chance. The large F-statistic reflects the strong relationship between the independent variables and malaria recurrence.

Table 9: 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

Source: Survey Data (2025)

The regression coefficients reveal the individual contributions of each predictor. ITN coverage emerged as the strongest predictor ($\beta = 0.414$, $t = 10.453$, $p < 0.001$), followed closely by socioeconomic factors ($\beta = 0.372$, $t = 9.527$, $p < 0.001$). Each unit increase in ITN coverage corresponds to a 0.397 unit increase in malaria recurrence outcomes, while socioeconomic improvements contribute 0.342 units. Awareness levels showed a significant but smaller effect ($\beta = 0.151$, $t = 4.249$, $p < 0.001$), with each unit increase in awareness associated with a 0.147-unit improvement in outcomes.

The non-significant constant term ($p = 0.292$) indicates that when all predictors are zero, baseline malaria recurrence is not significantly different from zero. These findings collectively demonstrate that comprehensive interventions addressing material access to preventive tools (ITNs), socioeconomic empowerment, and health education are all necessary for effective malaria control among pregnant women, with ITN coverage and socioeconomic improvements having the most substantial impact.

5.0 SUMMARY OF THE STUDY

This study examined the determinants of malaria recurrence among pregnant mothers attending antenatal clinic at Beledweyn Referral Hospital in Beleddweyn District, Somalia. The research investigated three critical dimensions: awareness levels regarding malaria prevention and treatment, socio-economic risk factors, and coverage of Insecticide Treated Bed Nets (ITNs). A cross-sectional descriptive design involving 369 pregnant women and 9 healthcare providers was employed. Correlation analysis revealed that socioeconomic factors exhibited the strongest relationship with maternal malaria outcomes ($r = 0.808$, $p < 0.001$), followed by ITN coverage ($r = 0.766$, $p < 0.001$) and awareness levels ($r = 0.727$, $p < 0.001$). Socioeconomic factors also demonstrated substantial correlation with ITN coverage ($r = 0.677$, $p < 0.001$), while awareness showed moderate association with socioeconomic status ($r = 0.527$, $p < 0.001$). Multiple regression analysis demonstrated that these determinants collectively explained 86.4% of variance in malaria recurrence ($R^2 = 0.864$, $F = 367.552$, $p < 0.001$). ITN coverage emerged as the most significant predictor ($\beta = 0.414$, $t = 10.453$, $p < 0.001$), followed by socioeconomic factors ($\beta = 0.372$, $t = 9.527$, $p < 0.001$) and awareness ($\beta = 0.151$, $t = 4.249$, $p < 0.001$), confirming that multifaceted interventions are essential for effective malaria control.

6.0 CONCLUSION

Malaria recurrence among pregnant women attending antenatal clinic at Beledweyn Referral Hospital is significantly influenced by multiple interconnected determinants. ITN coverage, which emerged as the strongest predictor, demonstrates that access to and consistent utilization of preventive tools substantially reduces malaria vulnerability. Socioeconomic factors, including income level, education, occupation, and healthcare access, play a fundamental role in determining disease susceptibility, with disadvantaged women experiencing disproportionately higher recurrence rates. Awareness levels, while moderately influential, reveal critical knowledge gaps particularly in symptom recognition and urgency of medical intervention. The regression model confirmed that these three determinants collectively account for 86.4% of malaria recurrence variance, validating their critical importance. Sustained malaria control requires comprehensive interventions that simultaneously address material barriers through enhanced ITN distribution, tackle socioeconomic vulnerabilities through economic empowerment initiatives, and strengthen health literacy through targeted community-based education programs tailored to pregnant women's specific needs and contexts.

7.0 RECOMMENDATIONS

Based on the study findings, several recommendations are proposed to reduce malaria recurrence among pregnant women. First, the Ministry of Health and humanitarian agencies should strengthen insecticide-treated net (ITN) distribution through antenatal clinics, ensuring universal coverage and timely replacement to sustain protection. Second, healthcare facilities should implement comprehensive, culturally sensitive malaria education programs that promote awareness of symptoms, prevention, and treatment adherence through community health workers and mobile platforms. Third, addressing socioeconomic barriers is vital by integrating malaria control with

poverty reduction initiatives, including free treatment and income-generating opportunities for vulnerable women. Lastly, antenatal care services should be enhanced through improved preventive treatment, regular follow-up, and staff training in malaria management.

8.0 AREAS FOR FURTHER RESEARCH

Future research should explore the temporal dynamics of malaria recurrence among pregnant women using longitudinal studies. It should also evaluate the effectiveness of ITN distribution, health education, and empowerment programs. Additionally, studies on drug resistance, cultural influences, male partner involvement, and regional comparisons would enhance sustainable, context-specific malaria control strategies.

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