College of Natural and Computational Sciences

Department of Zoological Sciences

Community Knowledge, Attitude and Practice towards Malaria in Enebsie Sarmidir Woreda, East Gojjam, Amhara Regional State, Ethiopia

By: Lageru Tilahun

August, 2024

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Approval sheet for submitting thesis

Community Knowledge, Attitude and Practice towards malaria In Enebsie Sarmidir Woreda, East Gojjam Zone, Amhara Regional State, Ethiopia.

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Declaration

The researcher hereby declares that the thesis entitled; "Community Knowledge, Attitude and Practice towards malaria In Enebsie Sarmidir Woreda, East Gojjam Zone, Amhara Regional State, Ethiopia," Submitted to department Zoological Sciences of Addis Ababa University in Partial Fulfillment of the Requirements for the Degree of Masters of Science in Biology is his original work and has not been submitted earlier. All sources that have been referred to and quoted have been indicated and Acknowledged with complete references.

Name: Lageru Tilahun Asmogne Sign _____ Date _____

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List of abbreviations/acronyms

ACT	Artemisinin Combination Therapy
CDC	Centers for Disease Control and Prevention
FMOH	Federal Ministry of Health
ITN	Insecticide Treated Net
KAP	Knowledge, Attitude, Practice
MIS	Malaria Indicator Survey
MOP	Malaria Operational Plan
PMI	President's Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid Diagnostic Test
SPSS	Statistical Package for Social Sciences
USAID	United State

Abstract

One of the most serious public health issues facing the world today is malaria. It is a significant health and economic challenge in many tropical and subtropical regions. This study was conducted to determine the knowledge, attitude, and practice of the community towards malaria in Enebsie Sarmidir woreda, East Gojjam, Amhara regional state, Ethiopia. From February 2024 to July 30, 2024, a cross-sectional study based in the community was carried out. Through the use of questionnaires and observation, information from 280 randomly chosen people was gathered. After their knowledge scores were evaluated, it was found that 160(57.1%) of study participants had good knowledge about malaria, while the remaining 120(42.9%) had poor knowledge. About half of the study participants 149 (53.2%) had a positive attitude about malaria whereas the rest 131 (46.8%) had a negative attitude. The practice scores of the research participants about malaria were also computed, and the degree of practice was assessed by contrasting an individual's score with the mean practice score. As a result 75% of research participants had good practice for malaria, while 25% had poor practice scores. Educational level was found to have a significant association with an individual's knowledge of malaria. In this regard, illiterate participants were 2.6 times less likely to have good knowledge of malaria as compared to those who could read and write (Exp (B) =0.380, 95% CI.0.183-0.187, Sig. =0.009) . Family number and age were statistically significant with the practice of the study subjects. The practice level of respondents was likely to increase with increasing age. Participants aged 50 and above were 4.25 times more likely to have good practice when compared to those found within the range of 18-28. Overall respondents' levels of knowledge, attitude and practice about malaria were comparatively good. Despite relatively good KAP scores about malaria, there is still a need for dissemination of information through community-preferred channels to enhance preventive and control measures. Key Words: Malaria, Community, Knowledge, Attitude, practice

1. Introduction

1.1. Background of the study

Plasmodium protozoan parasites are the cause of the feverish sickness malaria. Particularly in tropical and subtropical regions, the illness continues to rank among the most serious global public health issues (WHO, 2017). Malaria is naturally caused by *P. falciparum*, *P. vivax*, *P. malarae*, *P. ovale*, and *P. knowlesi* infections in humans. But, the most common malaria parasites worldwide are *P. falciparum* and *P. vivax*, with the former being the most dangerous (WHO, 2019).The most recent global malaria study estimates that there would be 619,000 malaria-related fatalities and 247 million cases worldwide .It has a significant negative health effects, but it also has a significant negative economic impact on people, households, and the economy as a whole. Roughly 95% of all malaria cases and deaths occurred in Sub-Saharan African nations, which also bore a disproportionately large percentage of the global malaria burden (Alelign and Dejene, 2016).

In Ethiopia, malaria continues to be the biggest public health issue (FMOH, 2017). Approximately 68% of the population is thought to be at risk for the illness, and as of 2018, the nation reported 2,362,979 cases and 4,757 fatalities (WHO, 2019). The two predominant species of malaria in Ethiopia are *P.falciparum* and *P. vivax,* which account for 60% and 40% of cases, respectively, and are found in all malaria endemic locations. But, the ratio differs depending on the season and the location. *P. vivax* is more prevalent at higher elevations and during the dry season, whereas *P. falciparum* is more prevalent in lowlands and during the main malaria transmission season (FMOH, 2017).

In the nation, malaria is mostly seasonal and spreads mostly at elevations of less than 2,000 meters above sea level (Garcia, 2007). The disease is mostly spread via the bite of a female Anopheles mosquito (WHO, 2017), and the parasite's asexual blood stages are what produce the clinical symptoms (Bucsan and Williamson, 2020). Malaria's non-specific rest signs and symptoms include headache, fatigue, and abdominal pain, which are followed by fever, chills, sweat, and rigors. Severe malaria, including reduced consciousness, respiratory distress, metabolic acidosis, hypoglycemia, acute renal injury, circulatory collapse, and pulmonary edema, can occur if treatment is not received (FMOH, 2004). *P.falciparum* is the source of the

majority of severe and complex symptoms as well as nearly all malaria-related deaths (FMOH, 2017).

Within 24 hours after the onset of symptoms, patients suspected of having malaria should have their diagnosis confirmed by a laboratory and treated with effective anti-malarial medications (Legesse *et al.,* 2007). The first-line treatments for uncomplicated *P.falciparem* and *P. vivax* malaria are artemisinin combination therapy and chloroquine, respectively; intravenous articulate or quinine therapy is recommended for severe malaria (Garcia, 2007). One of the key tactics in the prevention, control, and elective case management of malaria is early detection and prompt treatment (Legesse *et al.,* 2007).Furthermore, environmental management, indoor residual spraying (IRS), and the use of long-lasting insecticide-treated nets (ITNs) are among the malaria intervention measures that have significantly reduced the incidence of malaria (WHO, 2017).

Current information on the incidence of malaria in the area is useful for informing the community and healthcare providers as well as for assessing how local control and prevention efforts are being implemented. However, a large number of the epidemiological studies that have been published recently concentrate on asymptomatic participants by taking into account their potential as sources of infection. On the other hand, information regarding the percentage of malaria patients in the community is useful for planning ahead and determining the disease's impact on morbidity. Likewise, it is vital to comprehend the degree of awareness, attitudes, and actions that communities take in relation to malaria to guarantee that the right intervention strategies are implemented (Shimaponda *et al.,* 2017).

Various reports on malaria awareness in Africa and globally have shown that communities have a knowledge, attitude, and practice (KAP) gap that prevents people from actively participating in the current intervention programs (Mazigo, 2010). It is thought that those with high KAP are better able to fend off malaria (Fuge *et al.,* 2015). The purpose of this study was to ascertain the community's knowledge, attitude, and practices regarding malaria in the East Gojjam zone of Enebsie Sarmidir woreda.

1.2. Statement of the problem

The government’s long-term goal is completely eradicate malaria in all of the endemic regions o f the country; hence, numerous internal and external financing sources have been use to support the aforementioned cause. There were numerous ways to raise awareness about malaria and

prevent the disease, including teaching people and families to sleep under insecticide-treated nets, controlling vectors with insecticide-treated spraying (IRS), removing breeding grounds, and lowering infection rates with ACT treatment and prophylaxis. Additionally, the government has carried out a number of initiatives, including integrated community case management (ICCM), integrated management of childhood illness (IMCI), and educating village health teams (VHTs) to provide community-level curative malaria therapy (Roberts and Mathews, 2016).

Despite all these efforts, malaria cases continue to remain high and one of the leading causes of ill-health and deaths in Ethiopia.

1.3. Significance of the study/justification

Even with the availability of methods for preventing, controlling, and completely eliminating malaria, the community's morbidity and mortality rate remain intolerably high. Therefore, by providing pertinent information complements as a community-based malaria data source, this study will help to determine knowledge, assess attitude, and evaluate practice of the community regarding malaria and will add to the growing KAP of the community needed for malaria programming for Enebsie Sarmidir woreda and the Ministry of Health. Additionally, the study will assist the relevant authorities in organizing and raising community awareness to improve KAP. It is also an effort to lower the prevalence of malaria and implement measures to lower the number of cases and fatalities of malaria in the community. Additionally, this will lower community death rates, inpatient admission rates, referrals, and overcrowding in health institutions. Additionally, it will play a crucial role in the efficacy of malaria prevention, control, and elimination in the currently implemented techniques that are being scaled up, hence realigning the efficacy of malaria control measures. Completing this study is mandatory for my MSc program, and it will benefit future researchers by providing valuable information for their literature reviews.

1.4 Objectives

1.4.1 General objective

The general objective of this study was to determine the KAP of the community towards malaria.

1.4 2. Specific objectives

1. To determine the knowledge of the community.
2. To assess community's attitude towards malaria.
3. To evaluate community's practice towards malaria.

1.5. Research questions

1. How can the knowledge of the community be determined?
2. How can the attitude of the community be assessed?
3. How can community's practice be evaluated?

1.6. Scope of the study

The knowledge, attitude, and practice of the people in Enebsie Sarmidir woreda, East Gojjam Zone, Amhara Regional State, Ethiopia, about malaria would be the main emphasis of this study. Of the total 37 kebeles (4 urban and 33 rural) (Woreda health office, 2023), only four (Yibsana, Debremedhanit, Dibo, and Tenta) kebeles that reported the highest malaria cases were selected. As a result, the study's conclusions and generalizations about several of its findings were limited to these particular domains.

1.7. Strength and limitation of the study

Despite complete internet shutdowns, a lack of mobility due to conflicts, and insufficient electricity, the researcher conducted the current study. In order to obtain accurate data and results, the researcher additionally pretested the questionnaires and obtained nearly all of the information through in-person interviews. The study's cross-sectional methodology may introduce bias, such as recall bias, and it reflected data that was gathered at one particular point in time and may have changed at a later date. To reduce this recollection bias, the investigation was carried out during the malaria transmission season. Furthermore, because some of the data gathered for the study was self-reported by the participants, the estimations may have been inflated or underestimated. For example, the participants may have overstated the social desirability of bed net use based on self-reporting.

The two most significant additional restrictions were a lack of funding and a laboratory space that prevented the researcher from doing experimental research. Furthermore, the cross-sectional survey should have been better designed in conjunction with direct observation of ITN usage in all households to help the researcher identify some incorrect and improper ITN usage, such as checking or repairing holes in the nets and using them for other purposes (such as making ropes, containing grains, carrying hay, or basking malts).Another drawback of the study in the study region was the failure to examine the community's environmental management practices (cleaning bushes, draining stagnant water, and removing broken pots that contained water so that mosquitoes might reproduce).

2. Literature reviews

2.1. Malaria parasites

Plasmodium is a genus that comprises around one hundred species. They infect humans, as well as a variety of animals and birds, with malaria (WHO, 2007). Humans are infected by four main species of Plasmodium*: P. falciparum*, *P. vivax*, *P. malariae*, and *P. ovale*. Molecular techniques, however, have suggested that other species, *P. knowlesi* may have morphological variations (Macao *et al.,* 2016).

The four main Plasmodium species that infect humans are distributed worldwide in tropical and subtropical areas, and their geographic distributions overlap (Escobar *et al.,* 2022). Even though all four species are members of the same genus, they differ somewhat in their symptom patterns and have unique microscopic appearances. In tropical and subtropical regions of Africa, Asia, Central and South America, *P.falciparum* is widely distributed. In sub-Saharan Africa, it causes the majority of severe infections and accounts for almost 90% of malaria-related deaths (Jackson *et al.*, 2010). *P. vivax*, on the other hand, predominates in more temperate locations, whereas is more common in warmer regions near the equator. *P. vivax* is more geographically widespread than *P.falciparum* because it can withstand colder temperatures, but because it is season-dependent, transmission is often modest (Jackson *et al.,* 2010). *P. malariae* is widely distributed, although its range is restricted, and it ranks third in terms of prevalence. Typically, it poses no hazard to life (Jackson *et al.,* 2010). Of the four species, *P. ovale* is the rarest and is primarily found in tropical West Africa (WHO, 2007).

In Ethiopia, all four plasmodium species are known to exist. But *P.falciparum* and *P. vivax*, which account for 60% and 40% of malaria cases, respectively, are the most common malaria parasites in the nation (WHO, 2007). Less than 1% of cases are *P. malariae*, while *P. ovale* is hardly ever documented (Ruche *et al.,* 2014). *P. falciparium's* juvenile ring forms are minuscule and are typically observed in peripheral blood. Two chromatin granules may be present in many ring shapes, and marginal forms are somewhat common. Except in extreme, harmful situations, subsequent developmental stages of the asexual erythrocytic stage do not typically occur in the blood (Josling and Linas, 2015). Although *P. falciparium* undergoes erythrocytic schizogony in 48 hours, and as a result, its periodicity of development is typically of a certain type, this species

frequently produces two or more parasite broods, the segmentation of which is not synchronized, resulting in irregular periodicity of symptoms in the patient (Sinden and Gilles, 2017).

Malaria is sometimes categorized as either simple or severe. All four species can cause simple malaria, which is characterized by splenomegaly, moderate anemia, and sporadic fever and chills. Unless illness worsens and becomes untreated, uncomplicated malaria rarely results in death (Moriya and Kevin, 2009). *P. falciparium* Infections are nearly always the cause of severe or complicated malaria (though *P. vivax* and other species can also cause infections on occasion). Severe or complicated malaria is linked to higher parasite burdens and vital organ dysfunction, such as coma, seizures, and acute renal failure, as well as pulmonary compromise, anemia, and metabolic acidosis. This is more frequently observed in cases of severe infections with (Moriya and Kevin, 2009). *P. falciparum* infections are linked to the majority of malaria mortality. The maturing forms of these parasites cause red blood cells to express PfEMP-1, which is a parasite protein linked to morphological structures called "knobs" that allow the parasites to adhere to endothelial cells lining blood vessels and cause the infected red blood cells to be sequestered within the vascular bed of essential organs. This can result in cerebral malaria, which can put a person in a coma or even cause death. There may also be gastrointestinal, lung, and renal issues. Prenatal mortality, low birth weight babies, and stillbirths can be caused by congenital malaria and placental infection (RBM, 2003).

2.2. The parasitic malaria vectors

The majority of mosquito species' females need a blood meal in order for their eggs to mature. Species classified as anthropophagic are those that typically consume people. Anopheles gambiae, the vector of African malaria, primarily functions as an anthropophagic, endophilic, and endophagic. When organizing control efforts, the sleeping and eating habits of malaria vectors must be taken into account (Mike, 2000).

Relative humidity of at least 60% and temperatures between roughly 21°C and 32°C are ideal for maintaining transmission. Altitude frequently acts as a mediator between temperature and humidity in tropical environments. Malaria is thought to be harmless in Africa at elevations higher than 1,500 meters (Mike, 2000). It is important to note that these numbers could alter due to ongoing global climate change, which would cause mosquitoes' range to expand well above those heights as ambient temperatures rise. One important factor in determining the severity of

illness is mosquito density, or the quantity of female mosquitoes per thousand human residents. Water is necessary for the malaria vector to grow through all stages of development, including the egg, larva, pupa, and adult. Typically, blood-feeding begins at twilight and lasts until daybreak (Jaston, 2004).

2.3. The malaria parasite life cycle

Humans were bitten by mosquitoes carrying malaria. Both human hosts and vector mosquitoes are involved in the life cycle of the Plasmodium species. Sporozoites are injected into the bloodstream of humans and then make their way to the liver. Merozoites are released into the bloodstream when sporozoites replicate in the liver. Afterwards, through a receptor-ligand interaction, the merozoites attach to the surface and penetrate the red blood cells (Weiss *et al.*, 2015). After then, the parasite matures through the ring and trophozoite stages, eventually giving rise to schizonts that have many merozoites (erythrogenic cycle). Red blood cells are destroyed by mature schizonts, who then release merozoites into the circulation to re-invade fresh red blood cells (Figure 1). Every now and again, when a parasite matures, gametocytes are produced. These can enter the circulation and be ingested by mosquitoes through bites. After that, gametocytes in mosquitoes go through the saprogenic cycle, which is the sexual stage of development. The mosquito can re-infect a human host ten to fourteen days after her previous blood meal (Lamb *et al.*, 2006).

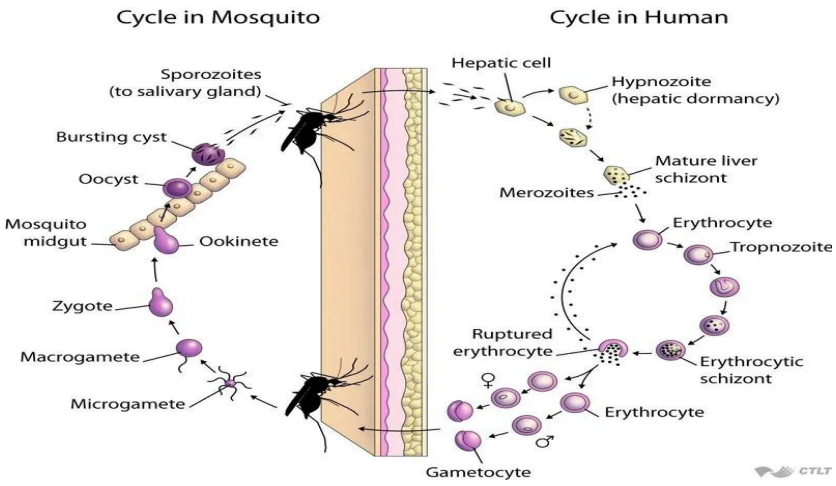

Figure 1The malaria parasite life cycle (Lamb *et al.*, 2006)

2.4. Global epidemiology of malaria

After tuberculosis, malaria is the second most prevalent infectious disease-related cause of mortality worldwide. It is thought to impact 350–500 million individuals annually and be the cause of one–three million fatalities (Nnamonu *et al.*, 2020). The majority of malaria-related deaths worldwide occur in Sub-Saharan Africa, which bears the brunt of the disease. The World Health Organization (WHO) reports that malaria causes about 10,000 maternal and 200,000 newborn deaths annually, putting 25 million pregnant women at risk for the disease (WHO, 2009).

According to Moriya and Kevin (2009), the global comeback of malaria is caused by a combination of factors such as increasing treatment resistance to the parasite and political, economic, and ecological change. An increasing number of tourists are at risk of catching malaria due to the combination of rising medication resistance and increased international travel. Up to 30,000 tourists from developed nations are thought to have malaria every year (Moriya and Kevin, 2009). But given the frequency of underreporting, this incidence is probably underestimated. Travel to Africa is currently on the upswing, with Africa accounting for 85% of *P. falciparum* cases imported into North America and Europe.

Malaria epidemiology is largely influenced by the parasite's mode of transmission. According to WHO (2000), an area with active malaria transmission is referred to as endemic, while areas with intermittent outbreaks are classified as epidemic. There is no restriction on the diversity in malaria epidemiology among countries or continents. Within a single nation, there are differences in Plasmodium distribution as well. Malaria is widely spread throughout the tropical belt, into subtropical areas, and even to the borders of the temperate zones (Oyewole and Ibidago, 2007).It still has a high degree of geographic variety and is indigenous to the majority of tropical and subtropical ecosystems globally. Along with the widespread variability in the genes producing antigenic protein zones, this diversity is manifested in ecological and epidemiological traits (Oyewole and Ibidago, 2007).

In many poor nations, it is the primary cause of illness and mortality; the most vulnerable populations are small children and expectant mothers (Ally, 2013). Travelers lacking immunity, refugees, internally displaced people, and laborers entering endemic areas are additional risk factors. Due to their comparatively immature immune systems and the waning of passively

acquired protection, children, especially those under five, are susceptible to severe malaria (Ally, 2013).

2.5. Ethiopia's current malaria situation

Ethiopian national records provide a comprehensive description of malaria, highlighting the threat posed to a greater population by the primary *A. arabiensis* vectors, and *P. vivax*, as well as the considerable heterogeneity across different transmission strata. This variability is a result of recent scaling up of control measures as well as geography and climate. Although this unpredictability necessitates that the nation use instruments for prevention and control in a variety of conditions, it also presents an opportunity to aggressively establish and expand malaria-free zones (Alelign and Dejene, 2016). Ethiopia is rife with malaria; according to Legesse *et al*. (2007), malaria affects 75% of the areas below 2000 meters above sea level, which are rich lowland areas ideal for agriculture. These regions are home to almost 54 million people who are susceptible to malaria (Legesse *et al.,* 2007).

Although focused epidemics were happening annually, large epidemics in Ethiopia happened every 58 years. Two species that are frequently linked to malaria in Ethiopia are *P. falciparum* and *P. vivax*, which account for 60% and 40% of cases, respectively (Ketema *et al*., 2011). The lack of water for mosquito breeding and the low humidity brought on by little rainfall and sparse vegetations are the main barriers to transmission. The absence of malaria in Ethiopia's central highlands can be attributed mostly to the cold temperatures that inhibit the growth of both the parasite and the vector (Ketema *et al*., 2009). Malaria is absent from a large portion of the Woina Dega zone (Altitude of 1500-2500 meters), particularly the zone between 2000 and 2500 meters above sea level. In Ethiopia, malaria is most common below 2000 feet, and it spreads quickly during rainy seasons. However, during times when higher temperatures and sufficient precipitation are favorable for both vector survival and parasite development within the vector, malaria epidemics have been documented as high as 2400 meters (Adhanom *et al*., 2006).

Infection prevalence in U5 children was 0.9%. 37 (87.0%) of the 45 positive test subjects were under the age of fifteen. RDT results showed that 134 (2.0%) of the questioned people had a positive Plasmodium infection; 1.8% and 0.2% of these cases were caused by *P.falciparem* and *P. vivax*, respectively (Jima *et al.,* 2010). According to a study done in Ethiopia's Oromia and SNNPR areas, the total prevalence of malaria parasites was 2.4% (95% CI 1.6–3.5). Cluster-

specific prevalence ranged from 0% to 25%, with no positive cases found in 55% of the 64 clusters. The prevalence of malaria parasites varied significantly ($p < 0.001$) across the Oromia, 0.9% (95% CI 0.5–1.6), and SNNPR, 5.4% (95% CI 3.4–8.5) regions. The SNNPR's Eastern and North-Eastern Zones have the highest frequency. *P. falciparum* was the most common species of malaria observed; according to Shargie *et al*. (2008), 30.6% of positive slides contained *P. vivax* and 69.4% contained. *P. vivax* was confirmed with 34.9% (1052/3009) cases Karunamoorthia and Bekele, D. (2009), but constituted the most predominant (64.6% (1946/3009 cases) in a retrospective study conducted at the Serbo Health Center in Kersa Woreda, Jimma, Ethiopia.

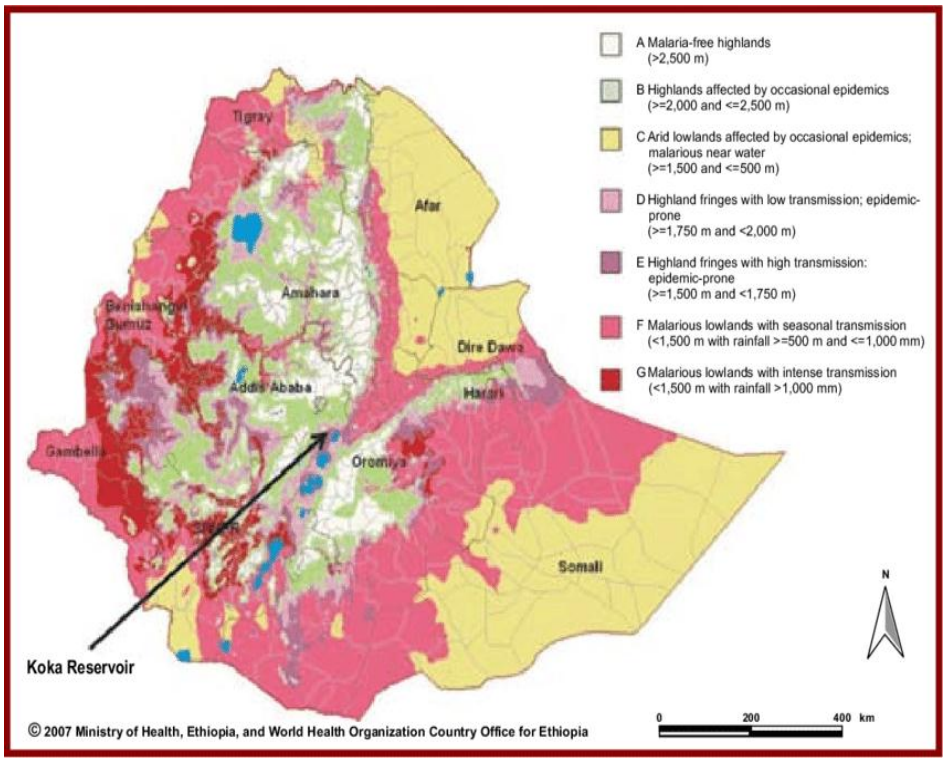

Figure 2Distribution of Malaria in Ethiopia (Dawit et *al*., 2012)

2.6. Socioeconomic consequences of malaria

Malaria has a huge socioeconomic cost: (1) the high adult population morbidity and mortality rate significantly reduces production activities; (2) the malaria prevalence in many productive regions of the country prevents people from moving to resource-rich, low-lying river valleys and settling there, leaving a large portion of the population vulnerable to recurrent droughts, famine, and overall extreme poverty; (3) increased school absenteeism during malaria epidemics

significantly reduces students' capacity to learn; and (4) managing malaria epidemics significantly raises public health expenditures (Jemal and Abagero,2023).

Large population movements, more frequent large-scale epidemics, mixed *P. vivax* and *P. falciparum* infections, growing parasite resistance to antimalarial medications, vector resistance to insecticides, low uptake of malaria preventive services, and overall poverty have all contributed to an increase in the burden of malaria (MOP, 2008). Over the previous five years, there has been a 21-23% increase in outpatient consultations, inpatient admissions, and all inpatient deaths (MOP, 2008). Because most malaria patients in Ethiopia reside in rural regions, it is difficult to quantify the social and economic cost of the disease. Social scientists and other studies don't focus on the illness, but estimates of its negative social and economic effects are startling, with many people being prevented from working (Adhanom *et al.*, 2006).

The major harvesting seasons of September to December and April to May coincide with the biannual peak of malaria transmission, which has detrimental effects for Ethiopia's rural subsistence economy and the country as a whole (Jemal and Abagero, 2023). According to Gabriel and James (2005), the months designated for cultivation, weeding, harvesting, and winnowing are when vector activity peaks. During this season, weddings and other significant cultural events reach their peak. Stated differently, ideal climate conditions for socioeconomic endeavors in rural Ethiopia also encourage vector mosquito multiplication, spread, and consequently, human blood hunting (Gabriel and James, 2005).

2.7. Control and prevention of malaria

Key *et al.* (2006) found that bed net use was statistically higher among those with higher and more years of education. A community-based study about preventive measures carried out in Nigeria revealed that 17 (4.2%), 37 (9.2%), 55 (13.8%), 39 (9.8%), 26 (6.5%), 26 (6.5%), and 45 (11.3%) of the study population reported sleeping under a net, door and window screening, cover cloth, mosquito repellent/ insecticide spray, environmental hygiene, herbal decoction, and chemoprophylaxis, respectively. Anopheles spp. is the malaria vector, and medication used for self-treatment accounted for 267 cases. Inadequate dosages, improper medication, delayed diagnosis, and ignorance of the malaria episode all hinder the prevention and good care of the illness (Oyewole and Ibid. Apo, 2007).

In the Mwanza-Neno district of Malawi, a study on the socio-cultural predictors of health-seeking behavior for feverish under-five children reveals that most caregivers could identify fever and associate it with malaria. Delays in obtaining appropriate treatment for fever were linked to a number of factors, including traditional beliefs about the causes of fever, the lack of antimalarial medications in the community, obstacles to accessing the formal health care system, and trust in traditional medicine(Chibwana *et al*., 2009). The FMOH's Communicable Disease Prevention and Control Department, along with the Malaria and Other Vector Borne-Diseases Team, are responsible for overseeing the implementation of national policies regarding malaria and other vector-borne diseases, identifying implementation capacity gaps for Regional Health Bureaus (RHBs), providing training, formulating and disseminating national policies and technical guidelines, monitoring and evaluating the impact of operational program activities, and advocating for malaria as a priority disease (Sheleme, 2007). 24 hours after the commencement of the fever (166 (65.7%) of the pregnant women, 1,891 (60.9%) of the women aged 15 to 49, and 1,564 (60.1%) of the children under five had all slept under an ITN the night before, according to a national representative malaria indicator survey (MIS) carried out in Ethiopia on 5,083 households, of which 3,282 (65.6%) owned at least one ITN (Jima *et al*., 2010). In total, 131 (16.3%) children who reported having a fever in the two weeks prior to the survey sought medical assistance within 24 hours, and 906 (20.0%) households reported having IRS in the previous 12 months. 86 (11.9%) of the feverish individuals took an anti-malarial medication, and 41 (4.7%) did so within (Jima *et al.*, 2010).

According to Yared *et al*. (2007), a cross-sectional survey carried out in three urban areas in the Asossa zone, Western Ethiopia revealed the following findings: approximately 48% of the sample population was aware that mosquito bites might spread malaria. Thirty percent (30%) of those surveyed knew that mosquitoes can transmit disease-causing microorganisms; ninety-five percent knew that mosquitoes bite at night, and sixty-one percent knew that mosquitoes hide in dark areas of houses. Major malaria preventive strategies were named by roughly 58% of respondents as sleeping beneath a mosquito net and 52% as getting rid of mosquito-breeding places, respectively. Comprehensive knowledge of malaria preventative strategies was correlated with respondents' health status and educational background (Largesse *et al*., 2007).

A different survey carried out in the Samre Saharti district in Tigray, Northern Ethiopia, revealed that the majority of respondents (92.7%) could name at least one malarial symptom. Approximately 50% of the participants acknowledged that mosquitoes can transmit malaria (48.8%). 85.9% of the houses possessed a bed net. Knowledge about malaria was linked to having a radio at home, being from the lowland stratum, having gotten some kind of health education, and having a literate household member. Residency in the lowland stratum, radio ownership, and proximity to the health post persisted as significant predictors of ITN utilization. In rural Tigray, Ethiopia, living more than sixty minutes' walk from the health post, being a housewife, and not having received health education were associated with a delay in treatment (Paulander *et al*., 2009).

According to a study conducted in Butajira, Ethiopia, the most commonly reported symptoms of malaria were fever, headaches, chills, and shivering, which were reported by 89.7%, 87.5%, and 81.3% of the study subjects, respectively.43.7% of the study participants thought that malaria could spread from person to person through mosquito bites, and almost 66% of them linked the route of transmission to the bite of an infective mosquito. Most people think that mosquitoes bite people at night (73.2%), reproduce in still water (71%), and spend the day in dark areas of houses (44.3%). Eighty-seven percent of respondents believed that malaria could be prevented. Of these, 25 suggested removing breeding sites as a preventive measure, 39.6% noted indoor residual spraying, and 62.4% reported chemoprophylaxis (Amare *et al*., 2010).

2.7.1. Vector control

Despite a long history of over 50 years of vector control, malaria continues to be a leading cause of morbidity and mortality in Ethiopia (Ketema *et al*., 2009). Reducing the transmission of malaria is currently the primary objective of vector control in Ethiopia. The primary goals are to: Improved locality targeting for indoor residual spraying coverage and quality; introduce, expand, and increase the usage of ITNs; and apply chemical larval control and environmental management where it may be more economical (Legesse *et al*., 2007). Wearing long sleeves and pants during the dark to dawn period is one example of a public and individual measure. Other hygienic improvements, like filling and draining areas with pond water; setting up screens and using bed nets using impregnated bed nets, in particular, maximizes the effectiveness of the bed

net larvicides and biological control, like employing fish larvae; and regularly applying insecticides to screened living and sleeping areas at night (Dawit *et al*., 2012).

The Ethiopian Federal Ministry of Health defines malaria as occurring at an altitude of less than 2,000 meters. 3,282 (65.6%) of the 5,083 households polled had at least one ITN. 53.2% of all people in households with ITNs had slept under one the night before, including 65.7% of pregnant women, 60.9% of women aged 15 to 49, and 60.1% of children under the age of five. In all, 20.0% of households said they had dealt with the IRS within the previous year. 131, or 16.3%, of the 747 kids who had reported having a fever in the two weeks before to the poll went to the doctor within a day. 4.7% of those with fevers took an antimalarial medication within 24 hours of the commencement, while 11.9% of those with fevers took one (Jima *et al*., 2007).

2.7.2 .Parasite case management

One element of programs and tactics for malaria prevention and control is the appropriate handling of cases. As early as July 2004, Ethiopia began using artemetherlumefantrine, also known by the brand name Coartem, as the first line of treatment for falciparum malaria. Full implementation of this drug at all health institutions began in 2005 (FMOH, 2012; President's Malaria Initiative PMI, 2009). It is implied by this treatment that all it takes to cure a malaria attack is one medication for the patient. Clinical, rapid diagnostic tests (RDTs) and microscopy are the main methods used in healthcare institutions to diagnose malaria. While microscopy is available at higher level healthcare institutions like health centers, hospitals, or private clinics, RDTs are offered at health posts.

Ethiopian health institutions' management of malaria patients still faces numerous obstacles in putting the early diagnosis, treatment, and prevention of malaria plan into practice. Comparably, it was said that less than 10% of Mali's patients had access to services for test confirmation of malaria. Only 31.4% of children under five who were suspected of having malaria had received any antimalarial medication in the same nation, and only 15.1% of those children had gotten treatment within 24 hours of the commencement of fever bouts (PMI, 2008).

Furthermore, Lettenmaier (2003) has documented that anti-malarial drug vendors in numerous underdeveloped nations offer anti-malarial medications under various brands with differing degrees of effectiveness. Another setback to the RBM plan could come from some of these medications not meeting quality standards, which could lead to anti-malaria drug resistance.

Inadequate diagnosis of malaria patients compromises the efficacy of clinical services provided by medical facilities. With the exception of one initiative in the Amhara region, Ethiopia lacks an efficient nationwide and systematic review of the quality of microscopy for malaria diagnosis (PMI, 2009).

2.8. Symptoms of malaria

After infection, the signs and symptoms of malaria usually appear 8–25 days later. However, people who have taken antimalarial medication as a preventive measure may experience symptoms later. All malaria species have initial symptoms that are comparable to flu-like symptoms and can be mistaken for other illnesses such viral infections and gastroenteritis. Hemolytic anemia, jaundice, headache, fever, shaking, joint pain, vomiting, hemoglobin in the urine, retinal impairment, and convulsions are possible presentations (Beare *et al.*, 2006).

The typical sign of malaria is paroxysm, which happens every two days in cases of *P. ovale* infection and every three days in cases of *P. malariae* infection. It is characterized by an abrupt drop in temperature, shaking, fever, and sweating. *P. falciparum* infection might result in either a milder, nearly constant fever or recurrent fever every 36–48 hours (Ferri, 2009). *P. falciparum* is responsible for almost all severe cases and fatalities from malaria; *P. vivax* or *P. ovale* are rarely responsible for major complications, crippling relapses, or even death. Severe anemia, cerebral malaria, pulmonary edema, abrupt renal failure, and bleeding are the main side effects. Among metabolic problems, acidosis and hypoglycemia are the most prevalent (Bartoloni, 2012).

According to Bear *et al.* (2006), a number of studies have shown that age over 65, female sex (particularly when related to pregnancy), non-immune status, concurrent medical disorders, lack of antimalarial prophylaxis, and treatment delays are risk factors for severe malaria and death. Malaria symptoms can return after varied intervals of time without symptoms. Recurrence can be categorized as recrudescence, relapse, or re-infection depending on the underlying reason (WHO, 2010). Recurrence can be caused by any of the following: a) therapeutic failure from treatment non-adherence, parasite drug resistance, or subpar medication; b) hypnozoites reactivation; and c) exposure to fresh infection by mosquito vector contact. Recurrence of symptoms occurs when they do not go away for a while. It is brought on by parasites that survive in the bloodstream as a result of insufficient or inefficient medical care. This is more common when or *P. vivax* causes malaria, and less common when *P. malariae* causes malaria (White, 2011). Relapse is the return

of parasitemia and its clinical manifestations brought on by merozoites from dormant hypnozoites in the liver invading the erythrocytes. Relapses are thought to happen 180–420 days after treating the temperate strain and 21–140 days after treating the tropical strain. Treatment failure is the primary cause. It is exceedingly difficult to identify relapse from re-infection or recrudescence from relapse based alone on clinical observation. In certain cases, a parasite genotype that is the same in the relapse as it was in the first infection can be used to distinguish between the two. *P. vivax* and *P. ovale* infections frequently result in relapse (White, 2011). Re-infection occurs when a new parasite enters the body after the original parasite was removed from it. Re-infection in genotyping is characterized by the discovery of a parasite that differs genetically from the original infection-causing parasite (Markus, 2011).

P. falciparem is the culprit behind nearly all severe cases of malaria and its fatalities. *P. vivax* or *P. ovale* can sporadically cause fatalities or extremely severe side effects, including crippling relapses. Severe malaria is primarily associated with bleeding and anemia. Among metabolic problems, acidosis and hypoglycemia are the most prevalent. Any of these conditions has the potential to worsen quickly, leading to mortality in a matter of hours or days (WHO, 2000).Many individuals have multiple of these issues coexisting or developing quickly over the course of a few hours. In the context of clinical practice, patients who exhibit any of these warning signs or symptoms which indicate a higher risk of complications must be evaluated and treated very away. Age over 65, female sex (particularly when related to pregnancy), non-immune status, coexisting medical conditions, lack of malarial prophylaxis, treatment delay, and severity of illness at admission (coma, acute renal failure, shook, pulmonary edema, coagulation disorders) are risk factors for severe malaria and death, according to a number of studies (Bruneel *et al*., 2003).

In tropical nations where malaria transmission is high (hyper-endemic area), severe malaria primarily affects young children, typically between the ages of one month and five. According to Gento *et al*. (2001), the majority of potentially fatal complications in developed nations arise from immunological travelers returning from endemic areas. When adults contract severe malaria, cerebral malaria is the most prevalent clinical manifestation and cause of mortality. The onset might be abrupt, resulting in a widespread convulsion, or it can be progressive, starting with initial disorientation and sleepiness and ending in a coma that lasts for several hours to days. According to Warrell *et al.* (1982), the presence of *P. falciparem* parasitemia and an

unreadable patient with a Glasgow coma scale score of 9 or less are necessary for the formal definition of cerebral malaria. Other possible causes, such as hypoglycemia, bacterial meningitis, and viral encephalitis, must also be ruled out. Acute lung injury often happens a few days into the course of the illness. Even after the initial reaction to anti-malarial treatment and the clearing of parasitemia, it may still progress quickly. Tachypnea and dyspnea are the initial signs of approaching pulmonary edema, which are followed by hypoxemia and respiratory failure necessitating intubation. Acute respiratory distress syndrome (ARDS) can develop from pulmonary edema, which is typically non-radiogenic and has heightened pulmonary capillary permeability.

According to Gauchot *et al*. (1995), acute lung damage is characterized by the sudden development of bilateral pulmonary infiltrates, pulmonary artery wedge pressure of 18 mmHg or less, arterial oxygen tension/fractional inspired oxygen ratio of 300 mmHg or less, and signs of left atrial hypertension. Usually oliguric (< 400 ml/day) or anuric (< 50 ml/day), acute renal failure is infrequently non-oliguric and may necessitate short-term dialysis. Typically, urine sediment is not very interesting. Acute tubular necrosis may arise as a result of renal ischemia in extreme situations. The passage of dark red, brown, or black urine as a result of severe intravascular hemolysis and the ensuing hemoglobin urine is referred to as "black water fever." Typically, renal failure is not present with this illness, which is transitory (Mehta *et al*., 2001). Patients with severe malaria often have hypoglycemia. The fact that all of the clinical signs of hypoglycemia, dyspnea, tachycardia, anxiety, sweating, coma, aberrant posturing, and generalized convulsions are also common to severe malaria itself raises the possibility that it is being overlooked (Mehta *et al*., 2001).

There are two stages to the development of malaria infection: the exoerythrocytic phase, which includes the liver, and the erythrocytic phase, which involves erythrocytes or red blood cells. Sporozoites from an infected mosquito's saliva enter the bloodstream and travel to the liver when they penetrate a person's skin to feed on blood, infecting hepatocytes and reproducing asexually and asymptomatically for eight to thirty days (Bledsoe, 2005). These organisms undergo a possible latent phase in the liver before differentiating to produce hundreds of merozoites, which break free from their host cells and enter the bloodstream to infect red blood cells and start the erythrocytic stage of the life cycle (Bledsoe, 2005). By encasing itself in the cell membranes of the infected host liver cell, the parasite leaves the liver undetected. The parasite reproduces

asexually within the red blood cells, periodically emerging from their host cells to infiltrate new red blood cells. There are several of these amplification cycles. Therefore, the simultaneous wave of merozoites fleeing and infecting red blood cells gives birth to the traditional descriptions of fever waves. Certain *P. vivax* sporozoites create hypnozoites instead of the exoerythrocytic phase merozoites that grow into exoerythrocytic phase merozoites right away. These hypnozoites can lay dormant for a number of months, usually seven to ten months, or even years. Following a hibernation period, they reawaken and generate merozoites. Long incubation periods and tardy relapses in *P.vivax* infections are caused by hypnozoites (White, 2011).

Since the parasite spends the majority of its human life cycle inside the liver and blood cells, where it is largely undetectable to immune surveillance, it is comparatively immune system shielded from attack. Nonetheless, the spleen eliminates blood cells that are contaminated and circulating. In order to prevent this outcome, the parasite attaches itself to the surface of infected blood cells by displaying adhesive proteins. This causes the blood cells to adhere to the walls of small blood vessels, preventing the parasite from passing through the Living in the lower echelons of society, owning a radio, and being close to the health post continued to be important indicators of ITN use. Residency over sixty minutes by foot from the health post, being a housewife, and lacking health education were linked to treatment delays in rural Tigray, Ethiopia (Paulander *et al*., 2009).

2.9. Diagnosis of malaria

Because each of the four main parasite species has unique characteristics, microscopic examination of blood films is the most cost-effective, favored, and reliable method of diagnosing malaria (Warhurst and Williams, 1996). Traditionally, two types of blood films are used: thin films, which resemble regular blood films and enable species identification due to the best preservation of the parasite's appearance in this preparation. Thick films are approximately eleven times more sensitive than thin films, enabling the microscopist to screen a greater amount of blood. Therefore, it is simpler to detect low infection levels on the thick film. However, because the parasite's appearance is more deformed, it can be more challenging to identify between various species. When trying to get a final diagnosis, it is necessary to use both thick and thin smears, taking into account their respective advantages and disadvantages (Garcia, 2001). An expert microscopist can identify parasite levels, or parasitemia, from the thick film at

as low as 5 parasites/micro liter of blood. A single ring form is never sufficient to diagnose a species; instead, many trophozites are always used to identify a species (Garcia, 2001). This makes the diagnosis of species challenging. The early trophozoites ("ring form") of all four species have a similar appearance.

2.10. Treatment of malaria

Malaria is treated with anti-malarial drugs and symptom-management strategies such electrolytes, fluids, fever-control drugs, and ant-seize drugs when needed. The types of medications used to treat malaria are determined by the severity of the disease and potential for chloroquine resistance.. Among the drugs used to treat malaria are chloroquine, quinine, Hydroxychloroquine (coartem), Atovaquone (Mepron), proguanil (generic), mefloquine, clindamycin (cleocin), and doxycycline (Watrs and Edstein, 2012).

Falciparum malaria patients have the most severe symptoms, and as the illness can result in respiratory failure, coma, and renal failure, they may need to be closely watched in a hospital critical care unit on the first day of treatment. Chloroquine is the recommended malaria treatment for expectant mothers. When treating pregnant patients with malaria who are resistant to chloroquine, the usual treatments include quinine, proguanil, and clindamycin (Waters and Edstein, 2012). Currently, the most often used medication for treating severe falciparum malaria is intravenous quinine, which is typically prepared as a dihydrochioride salt. The only accessible intravenous anti-malarial drug in the United States is quinidine gluconate, which is the dextrorotatory optical diasteroisomer of quinine and can be used in place of quinine. Quinidine is more cardiotoxic than quinine and requires ECG monitoring, although it has two to three times the anti-malarial action (White, 1999).

With the exception of infections from Papua New Guinea, Sumatra, Irian Jaya, Myanmar, Vanuatu, India, and the Brazilian Amazon region, Parenteral chloroquine is the recommended treatment for severe infections caused by *P. falciparem* that are susceptible to chloroquine as well as for extremely rare cases of life-threatening malaria caused by *P. ovale*, *P. malariae*, and *P. vivax* (Hatz, 2001). Compared to quinine or quinidine, chloroquine may reduce parasitemia more quickly, but it also has a more severe hypotensive side effect. Only in parts of south-east Asia where quinine resistance is known to exist do artemisinin derivatives show higher survival rates. They remove parasites from blood 20% faster than quinine dihydrochlorids. In addition,

compared to quinine dihydrochloride, there was a greater incidence of seizures and a possible delay in coma recovery. Currently, mefloquie, doxycycline, or clindamycin are suggested in addition to artemisinin derivatives to treat quinine-resistant *P. falciparem* infections and avoid recrudescence (Pittler, 1999).

3. Materials and methods

3.1. Study area and design

A community-based cross-sectional study was conducted in Enebsie Sarmidir Woreda from February 2024 to July 30, 2024, to determine the levels of community knowledge, attitude, and practice towards malaria. The East Gojjam Zone of Amhara Regional State is home to the study area. The Woreda's administrative hub is Mertule Maryam Town. The town is located 180 kilometers southeast of Bahir Dar, the seat of the Amhara regional state, and 365 kilometers northwest of Addis Ababa, the capital of Ethiopia, according to Enebsie Sarmidir Woreda Agricultural Office (2015). The research region is situated at 1300-3664 meters above sea level at latitude and longitude of 100 52' N and 380 17' E. The typical annual temperature and rainfall are 22.5-25 degrees Celsius and 900–1200 millimeters, respectively. With a total area of 1065.33 km2, the Woreda is divided into three unique agro-ecological zones: "Dega" (14%), "Woinadega" (33%), and "Kola" (53%).

In the 2007 national population census, there were 174,651 people on the woreda with 50.34% of them being women and 49.66% being men. Of this, the remaining 13,485 (7.72%) live in the town of Woreda, and 161,166 (92.28%) are in rural areas. There are an estimated 30,934 household heads (HHs), of which 28,265 reside in rural regions and the rest 2,669 in towns. Mixed agricultural activities employ the bulk of the Woreda's inhabitants (Enebsie Sarmidir Woreda Finance and Development Office, 2010). The primary rainy seasons, which run from June to August and from April to June, are followed by the months of September through December, when malaria transmission peaks.

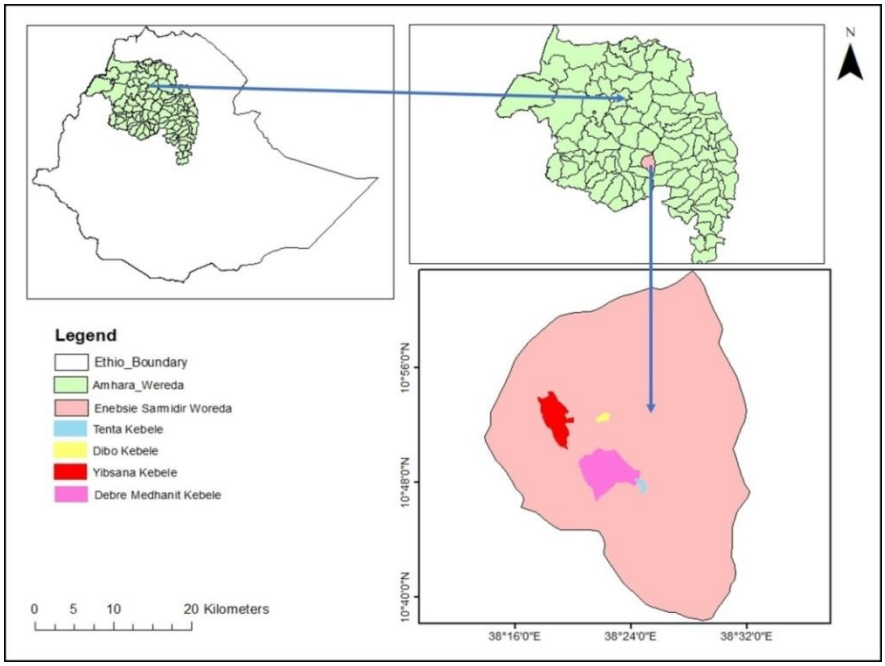

Figure3A Map of the study area (ArcGIS, 2024)

3.2. Sample size determination and sampling techniques

The sample size of the study was determined using single population proportion formula by taking the proportion with confidence interval at 95% and alpha at 5% (Naing and Winn, 2006). Accordingly, $n=\frac{z^2q(1-p)}{d^2}$, where n is the sample size, z is the z statistic for a level of confidence (z=1.96 at 95% CI), d is the precision (if 5%, d =0.05), and P = 0.78 (78% proportion of population who had good knowledge towards malaria was taken from a study done in Amhara regional state (2013). Thus, the sample size of the study was $\frac{3.8416\times0.78\times0.22}{0.0025}$ =263.

In addition, 10% non- response rate was added for individuals who would fail to participate in the study. Then, the final sample size of the study would be 289.

Based on these presumptions, a simple random and purposive sampling strategy were used to purposefully recruit study participants from four of the 37 (4 and 33 rural) kebeles that reported having the highest number of malaria cases (Woreda health office, 2023). Using a lottery, only adults who were at least 18 years old were chosen from each chosen kebele. In light of this, Tenta 44 (5934), Debremedhanit (17180), Yibsana (5928), and Dibo (9996) kebeles were chosen. Each Kebele's share of the study participants was distributed proportionately. The total number of individuals chosen from every Kebele was computed in the manner shown below. N

is the number of people drawn from a single household; it is equal to (sample size)/ (total population of four kebeles) = 289/39,051 = 0.0074. The proportion (0.0074) was then multiplied by the total population in each chosen kebele to get the number of participants chosen from each kebele once more. Next, 44 respondents from the Yibsana, 127 from Debremedhanit, 74 from Dibo, and 44 from Tenta were chosen to make up the study's sample population.

3.3. Inclusion and exclusion criteria

Respondents in this study were those who gave their consent to participate; those who were not willing to provide their consent or who were too ill or mentally ill to cooperate were not included in the study.

3.4. Data collection and measurement

In order to gather information about the socio-demographic traits, knowledge, attitudes, and practices of the study participants regarding malaria transmission, symptoms, control and preventative measures, and field observation, questionnaires adapted from comparable prior studies were used. The surveys were created in English, translated into Amharic, the native language, and then back into English to ensure that complex ideas were explained consistently. Almost all questionnaire data were collected via in-person interviews in order to avoid confusion, collect all possible surveys, and make the study's goal clear. Preliminary information regarding the water drainage system, mosquito breeding grounds' environmental hygiene, and the distribution and use of ITNs was also gathered through field observation.

The participants' knowledge scores about malaria were calculated as follows. Every right answer to a knowledge question received a score of 1, while incorrect or unclear answers received a score of 0. The median knowledge score for all research participants was determined by summing the responses from each respondent on all the questions to determine an individual's overall knowledge score. By comparing a study participant's knowledge score to the median (9.0) knowledge score, the participant's knowledge level was ascertained. If a person's knowledge score is higher than or equal to the median knowledge score, they are considered knowledgeable; if not, they are said to be poorly knowledgeable.

Attitude was assessed by Likert's scaling technique. The questions on Likert's scaling had positive and negative responses that ranged from strongly agree(score1),agree(score2), neutral(score3), disagree(score4), strongly disagree(score5) for positive statements and the reverse scale, strongly disagree(score1), disagree(score2), neutral(score3), agree(score4) to strongly agree(score5) for negative statement was used.. Each respondent's overall score was determined by summing up all of their responses. After calculating the mean score, respondents were deemed to have a positive attitude if their score was greater than or equal to the mean (7.38). Conversely, those who scored below the mean were deemed to have a negative attitude about malaria. The participants' practices were also ascertained through the application of Likert's scale. According to the respondents' responses, a Likert-type scale scoring method was employed, with scores ranging from always (score 1), sometimes (score 2), and never (score 3). After adding up all of the responses, each respondent's total score was determined, and the study's overall mean practice score was calculated. When a person's total practice score was higher than or equal to the mean practice score (1.63), it was said that they had good practice. However, if a person's total practice score was lower than the mean practice score, that person was deemed to have poor practice.

3.5. Data analysis

The collected data were loaded into IBM SPSS version 26 for analysis, and their accuracy was verified twice. To calculate the relative frequencies and percentages of the variables, descriptive statistics were used. The presentation of socio-demographic factors, respondents' knowledge, attitudes, and practices about the symptoms, causes, transmission, preventive, and control measures of malaria was done through the use of frequency distribution tables. The data was presented using figures and tables. Additionally, binary logistic regression analysis was carried out utilizing odds ratios to investigate relationships between particular independent and dependent variables. Variables with a P value of less than or equal to 0.2 in univariate test were selected and entered into a multivariate binary logistic regression model to identify the most important predictors of malaria risk. Odds ratios (ORs) were calculated with a 95% confidence interval (CI). According to Tazebew and Munshea (2021), statistical significance was defined as P values less than 0.05.

3.6. Data quality control

In order to ensure the validity of the data collection tool and the ease of use by respondents, the questionnaires, which were compiled and adapted from similar previous malaria indicator survey studies, were pretested prior to being distributed to individuals (5% of the calculated sample size) who were not part of the study's sample population. Following comments from the pilot study, the questionnaires were modified once the responses were gathered. Professionals also assessed the questionnaires prior to their use in gathering the desired data.

3.7. Ethical consideration

The Ethical Review Committee, housed under the research and community service coordinating office of Addis Ababa University's college of natural and computational sciences examined and approved the study protocol on 31/08/2023, Minute Number.IRB/06/25/2023. After outlining the purpose of the study, the Enebsie Sarmidir woreda health office also gave approval for it to be carried out among the target population. Every research subject was politely requested to participate in the study after being fully informed of its goal. The study participants also provided their written and verbal consent.

4. Results

4.1. Observational data

This study revealed that there were still some misconceptions on the usage of ITNs among the community in the study area. In this regard, the researcher took three sample (representative) photographic images resulted from his field observation. Of those, the first image demonstrated that communities used ITNs for containing (carrying) hays on the carts. Likewise, image two revealed that grains (malts) contained in the bidet were covered with ITNs to be protected from birds and other animals while being dried with sunshine and the third image showed that ITNs were also allowed to be washed by rainfall during the summer season.

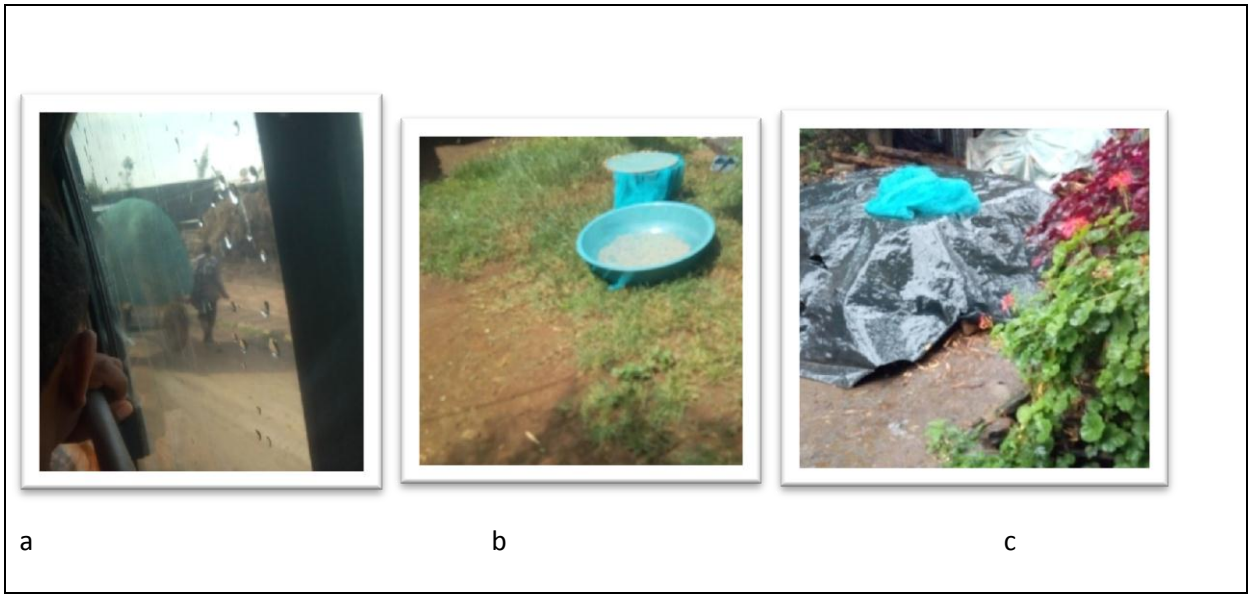

Figure 4.Misuse of ITNs

4.2. The Socio-demographic Features of the Research Participants

A total of 289 questionnaires were prepared; of these, 280 people (97% of the respondents) agreed to participate in the study, and the remaining 9 people declined to do so. Of the participants, 177 (63.2%) were males, while the remaining 103 (34.8%) were females. Out of all the respondents, 193 (68.9%) had a family size of less than or equal to five, while 87 (31.1%) had a size larger than five. Participants were aged over 18 years and grouped into age group decades (Williams *et al*.,2022).The majority of participants 94 (33.6%), fell between the ages of 18 and 28, while the remaining 81 (28.1%), 50 (17.9%), and 55 (19.5%) fell into the ages of 29–

39, 40–50, and >50, respectively. Of the participants, 83 (29.6%) were single while the majority, 173 (61. 8%), were married. The remaining 19 people (6.8%) and 5 people (1.8%) had divorced or had different preferences. The study participants ranged in educational background from 132 (47.1%) who were illiterate to 43 (15.4%) who completed secondary school and above. The remaining 74 (26.4%) could read and write, and the remaining 31 (11.1%) had only completed primary school. The majority of responders, 175 (62.5%) and 77 (27.5%), were farmers and businessmen, in that order; the remaining students, retried individuals, and housewives made up 2 (0.7%), 7 (2.5), and 19 (6.8%), in that order (Table 1).

Table 1. Respondents' socio-demographic features in relation to malaria

Variables(n=280)	Category	Frequency	Percent
Gender	Male	177	63.2
	Female	103	36.8
Family number	5 or <5	193	68.9
	>5	87	31.1
Age	18-28	94	33.6
	29-39	81	28.9
	40-50	50	17.9
	>50	55	19.6
Marital status	Married	173	61.8
	Single	83	29.6
	Divorced	19	6.8
	Others	5	1.8
Level of education	Illiterate	132	47.1
	can read and write	74	26.4
	primary level	31	11.1
	secondary school and above	43	15.4
Occupation	Farmer	175	62.5
	Merchant	77	27.5
	Student	2	7
	Retired	7	2.5
	Housewife	19	6.8

4.3. Knowledge of respondents towards malaria

All of the respondents had heard of malaria. Majority 122(43.6%) of the participants correctly identified that malaria is a transmissible disease and few 58(20.7) of them did not know. Most 99(35.4%) and 71(25.4%) of the respondents mentioned shivering and fever as the main symptoms of malaria respectively while the remaining 54(19.3%) and 48(17.1%) identified that

backache and headache were the main malaria symptoms orderly. On the other way, 8(2.9%) of the participants mentioned other malaria symptoms.

With regard to malaria transmission, 137(48.9%), 43(15.4%), and 37(13.2%) of the respondents associated mosquito bite to night, day and day and night time respectively while the rest 63(22.5%) did not know when mosquitoes bite. Most 176(62.9%) of the respondents knew that malaria is transmitted from person to person through mosquito bites and 68(24.3%) of them associated to drinking dirty water. Other respondents 21, 12 and 3 also linked malaria transmission to body contact with patients, bad season and dirty environment respectively. The majorities (65.0%) stated malaria as a preventable disease, while 18.2% considered the opposite and 16.8% did not know how malaria is transmitted.

In response to malaria treatment, many 182(65.0%) of the study subjects went to health center while seeking treatment, and others 57(20.4%), 36(12.9%) preferred to traditional healer and simply taking tablets respectively. The remaining5 (1.8%) of the respondents chose other means of treatment. Nearly twice 195(69.6%) of the participants recognized malaria as a curable disease, while 85(30.4%) considered the opposite.

Considering ITNs ownership and use, most 172(61.4%) participants had no ITNs, while the rest 30 (10.7%), 48 (17.1%), 19(6.8%), and 11(3.9%) owned 1, 2, 3, and 4 ITNs respectively. The study indicated that almost two folds 184(65.7%) of the respondents had information about INTs from different sources. Of which, most 127(45.4%) of them received information through radio, 48(17.1%) from health workers, 6(2.1%) school, 2(0.7%) from mosque/church, 1(0.4%) kebele / peasant representative, and 2(0.7%) from news paper. Four folds 224(80.0%) of the study subjects thought that sleeping under ITNs has benefits, and 145(51.8%), 72(25.7%), and 21(7.5%), of them slept under ITNs daily, during transmission time, and weekly respectively while the remaining 42(15.0%) slept at a different time .

Table2. Respondents' knowledge of malaria

Variables (n=280)	Frequency	Percent
Have you ever heard of malaria in your area?		
Yes	280	100
No		
Is malaria a transmissible disease?		
Yes	122	43.6
No	100	35.7
I do not know	58	20.7
What are the main symptoms of malaria?		
Fever	71	25.4
Shivering	99	35.4
Headache	48	17.1
Backache	54	19.3
Others	8	2.9
When does mosquito bite most?		
Day time	43	15.4
Night time	137	48.9
Day and Night	37	13.2
I do not know	63	22.5
How is malaria transmitted?		
Mosquito bite	176	62.9
Bad season	12	4.3
Body contact with patients	21	7.5
Drinking dirty water	68	24.3
Dirty environment	3	1.1
Is malaria a preventable disease?		
Yes	182	65.0
No	51	18.2
I do not know	47	16.8
Where do you go to seek treatment of malaria?		
Traditional healer	57	20.4
Health center	182	65.0
Simply take tablet	36	12.9
Other	5	1.8
Can you be cured of malaria?		
Yes	195	69.6
No	85	30.4
Do you have ITNS in your home?		
Yes	108	38.6
No	172	61.4
How many ITNS do you have in your family?		
1	30	10.7
2	48	17.1
3	19	6.8

4	11	3.9
Have you ever heard education about ITNS?		
Yes	184	65.7
No	95	33.9
What were the sources of information?		
Radio	127	45.4
Health workers	48	17.1
News paper	2	0.7
Mosque/church	2	0.7
Kebele/peasant representative	1	0.4
School	6	2.1
Do you think that sleeping under ITNS has benefits?		
Yes	224	80.0
No	56	20.0
When do you sleep under ITNS?		
Daily	145	51.8
During transmission time	72	25.7
Weekly	21	7.5
Other	42	15.0

4.4. Attitude towards malaria

From the total respondents, 213(76.1%) agreed on seriousness and threat posed by malaria. Majority, 194(69.3%) of participants agreed that avoiding mosquito bites is the best way to prevent themselves from getting malaria. Due to this, 197(70.3%) of the study participants agreed to sleep under a mosquito net during the night as a method of preventing oneself from getting malaria. More than half 169(60.4%) of the respondents believed that children and pregnant mothers are at a greater risk of getting malaria. However, 156(56.8%) disagreed on the statement only children and pregnant women are at risk of malaria while some 87(31%) of them had misconceptions, and 37(13.2%) were neutral. Some 74(36.1%) of the respondents had wrong belief about malaria transmission, and they claimed that people should avoid having close contact with infected individuals while majorities164 (58.6%) contradicted to the statement.

With regard to malaria diagnosis, and treatment, most 187(66.8%) of the participants agreed to go to the health center to have their blood tested as soon as they suspected that they had malaria. However, few 61(21.8%) of them thought that one could recover from malaria without any medical treatment while 165(58.9%) of respondents agreed on risks encountered when malaria medicine is not taken properly and completely. However, 65(23.2%) and 50(17.9%) of the study participants disagreed and remain neutral to this statement, respectively. About forty percent of

the respondents agreed they could buy and took anti- malaria drugs from the drug shops /pharmacy to treat themselves when they got malaria without any medical prescription, while139 (49.6%) of them contradicted to statement, and the rest 27(9.6%) remained neutral .More than half 171(61%) the study subjects believed that checking the expiry date of the drug is very important, while other 65(23.2%), and44(15.7%) respondents disagreed and remained neutral respectively.

Table 3 Respondents' Attitude towards Malaria

Variables (n=280)	Frequency	Percent
I think malaria is a serious, life threatening diseases.		
Strongly agree	147	52.5
Agree	66	23.6
Neutral	31	11.1
Disagree	21	7.5
Strongly disagree	15	5.4
I think the best way to prevent myself from getting malaria is to avoid mosquito bites.		
Strongly agree	124	44.3
Agree	70	25.0
Neutral	40	14.3
Disagree	29	10.4
Strongly disagree	17	6.1
I believe sleeping under mosquito net during the night is one way to prevent myself from getting malaria.		
Strongly agree	128	45.7
Agree	69	24.6
Neutral	34	12.1
Disagree	25	8.9
Strongly disagree	24	8.6
In my opinion, children and pregnant mothers are at greater risk of getting malaria.		
Strongly agree	99	35.4
Agree	70	25.0
Neutral	52	18.6
Disagree	38	13.6
Strongly disagree	21	7.5
I think that one can recover from malaria without any treatment.		
Strongly agree	22	7.9
Agree	39	13.9
Neutral	43	15.4
Disagree	76	27.1
Strongly disagree	100	35.7
I think that it is dangerous if malaria medicine is not taken completely.		
Strongly agree	100	35.7
Agree	65	23.2
Neutral	50	17.9

Disagree	34	12.1
Strongly disagree	31	11.1
I think that I should go to the health center to have my blood tested as soon as I suspect that I have malaria.		
Strongly agree	100	35.7
Agree	87	31.1
Neutral	40	14.3
Disagree	31	11.1
Strongly disagree	22	7.9
In my opinion, only children and pregnant women are at risk of malaria.		
Strongly agree	41	14.6
Agree	46	16.4
Neutral	37	13.2
Disagree	71	25.4
Strongly disagree	85	30.4
If someone has got malaria, people should avoid having close contact with him/her.		
Strongly agree	30	10.7
Agree	44	15.7
Neutral	42	15.0
Disagree	61	21.8
Strongly disagree	103	36.8
I can buy and take anti malaria drugs from the drug shops /pharmacy to treat myself when I get malaria without any medical prescription.		
Strongly agree	65	23.2
Agree	49	17.5
Neutral	27	9.6
Disagree	49	17.5
Strongly disagree	90	32.1
In my opinion, it is very important to check for an expiry date of the drug before taking it.		
Strongly agree	108	38.6
Agree	63	22.5
Neutral	44	15.7
Disagree	37	13.2
Strongly disagree	28	10.0

4.5. Practice towards malaria

Remarkably, half of the 280 survey participants (50.0%) said they routinely cleaned off standing water from damaged pots, containers, and ditches near their home to prevent Anopheles mosquitoes from breeding there. Of the survey participants, 112 (40.0%) never checked their mosquito nets, while less than half, 115 (41.1%), occasionally checked for holes or made repairs to prevent mosquito bites. On the other hand, 58 (20.7%) of the participants occasionally used mosquito repellent oils to protect themselves from mosquito bites, compared to 18 (6.8%) of the respondents who used them always. But the greatest quantity of the participants, 73% never used oil repellent for mosquitoes. In a similar vein, 16.4% of participants occasionally used anti-

mosquito spray in their homes to eradicate the malaria vector, Anopheles mosquito, which lands on walls, while the majority of respondents, 206 (73.6%), never used it. On the other hand, just 28 (10.0%) of the research participants reported that they always used ant-mosquito repellent at home.

Table 4 Respondents' practices regarding malaria

Variables (n=280)	Frequency	Percent
Do you usually clear stagnant water in broken pots, containers and ditches around your house?		
Yes	140	50.0
No	140	50.0
How often do you check for holes/repair mosquito nets?		
Always	53	18.9
Sometimes	115	41.1
Never	112	40.0
How often do you use mosquito repellent oils?		
Always	18	6.4
Sometimes	58	20.7
Never	204	72.9
How often do you use anti- mosquito spray in your house?		
Always	28	10.0
Sometimes	46	16.4
Never	206	73.6

4.6. Study participants' overall knowledge, attitude, and practice (KAP) scores regarding malaria

After their knowledge scores were evaluated, it was found that 160(57.1%) of study participants had good knowledge about malaria, while the remaining 120(42.9%) had poor knowledge. About half of the study participants 149 (53.2%) had a positive attitude about malaria whereas the rest 131 (46.8%) had a negative attitude. The practice scores of the research participants about malaria were also computed, and the degree of practice was assessed by contrasting an individual's score with the mean practice score. As a result, 210(75%) of research participants had good practice for malaria, while 70(25%) had poor practice scores.

Table 5Knowledge, attitudes, and practices of the study participants with respect to malaria

Variables(n=280)		Frequency	Percent
Knowledge level	Good knowledge	160	57.1
	Poor knowledge	120	42.9
Attitude	Positive attitude	149	53.2
	Negative attitude	131	46.8
Practice	Good	210	75.0
	Poor	70	25.0

4.7. Selected demographic parameters' correlation with study participants' knowledge

Binary logistic regression analysis was performed to identify factors associated with one's knowledge of malaria. Educational level was found to have a significant association with an individual's knowledge of malaria. In this regard, illiterate participants were 2.6 times less likely to have good knowledge of malaria as compared to those who could read and write (Exp (B) =0.380, 95% CI.0.183-0.187, Sig. =0.009) .

Table 6 logistic regression analysis of the variables linked to the participants' knowledge with regard to malaria

Variables(n=280)	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Marital status of	1.459	1.155	7.768	3	.051	4.300	.447	41.366
respondents	1.179	1.162	1.595	1	.207	3.252	.334	31.693
Single	-.464	1.362	1.030	1	.310	.629	.044	9.064
Divorced			.116	1	.733			
Retried								
Level of education	-.968	.372	10.51	3	.015	1.000	.183	.787
Can read and write	-.217	.400	1	1	.009	.380	.368	1.763
Primary level	-.930	.506	6.777	1	.588	.805	.146	1.064
Secondary school			.294	1	.066	.394		
and above			3.376					

4.8. Association of socio-demographic factors with one's practice

Family number and age were statistically significant with the practice of the study subjects. The practice level of respondents was likely to increase with increasing age. Participants aged 50 and above were 4.25 times more likely to have good practice when compared to those found within the range of 18-28 (table 7).

Table 7. Logistic regression analysis of the variables linked to the participants' practice with regard to malaria

Variables(n=280)	B	S.E.	Wald	Df	Sig.	Exp(B)	95% C.I. for EXP(B)	
							Lower	Upper
Number of family >5	-.817	.329	6.158	1	.013	.442	.232	.842
Age of respondents	1.194	.542	6.830	3	.078	3.301	1.141	9.556
29-39	1.119	.545	4.851	1	.028	3.061	1.051	8.917
40-50	1.448	.573	4.207	1	.040	4.254	1.382	13.090
>50			6.373	1	.012			

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5. Discussion

Similar to a study from Shewa Robit town where every study participant had heard of malaria, the current study found that all of the respondents had heard of the disease (Abate *et al*., 2011).Less than half 122 (43.6%) of the participants correctly identified that malaria is a transmissible disease, but the rest had poor knowledge about its transmissibility. In this regard, more than half 176 (62.9%) of the study subjects implicated anopheles mosquitoes in the transmission of malaria. This observation was lower than the findings of another study conducted in Tanzania, which reported that more than 80% of schoolchildren had knowledge on malaria transmission (Sumari *et al*., 2016). This finding was also less than the report from the study in Northwest Tanzania (Mazigo *et al*., 2010) and India (Mahesh *et al*., 2014). About 37% of respondents indicated that poor seasons, direct patient contact, contaminated water, and unclean environments might all be potential means of malaria transmission, even though the majority of respondents still believed that mosquito bites were the origin of the disease. The lack of or inadequate access to house-to-house health extension services, which concentrate on information, appropriate health education, and communication to improve respondents' knowledge in the current study region, may be the cause of these misconceptions among respondents. These false beliefs may have an impact on the study participants' actual preventive strategy. Research has shown that communities with increased awareness of the disease due to health education have a better understanding of the causes of malaria (Dickson *et al*., 2011).

In contrast to these findings, research conducted in Ethiopia's Shashogo District revealed that respondents' knowledge of the mode of malaria transmission was extremely low, only 15.6% of mothers linked mosquitoes to the disease (Fuge *et al*., 2015). In the Assosa zone in Western Ethiopia, less than half (47.5%) of study participants mentioned mosquito bites as a mode of malaria transmission, and research conducted in the Amhara region of Ethiopia by Aderaw and Gedefaw (2013) revealed that 32.3% of respondents there believed mosquito bites to be the vector for malaria transmission. In addition to the respondents' awareness of the reasons and modes of transmission, it is crucial to understand when mosquitoes bite different societies. Regarding this, the study's findings showed that 137 respondents (48.9%) were aware of the best times for mosquito bites (they recognized that mosquitoes attack at night). This was less than the Assosa Zone in Western Ethiopia, where 95% of respondents indicated that mosquitoes feed at

night, and 61% acknowledged that mosquitoes rest in dark areas of homes (Legesse *et al*., 2007). In contrast to a study by Mahesh *et al*. (2014), where 56.5% of participants understood that mosquito bites occur frequently at night, this finding was positive. According to the results of the current study, 195 participants (69.6%) knew that malaria was a curable illness. Additionally, this survey revealed that 65.0% of participants understood malaria as a condition that can be prevented, which less than the results of a study were done in Shewa Robit, Ethiopia, where 90.58% of respondents thought the same (Abate *et al*., 2013). The community's awareness about the timing of transmission and prevention can make it difficult to carry out malaria intervention efforts. In order to dispel these myths in the community, the local woreda health office or disease prevention and control agency must therefore increase public awareness-raising efforts.

Shivering, fever, and headaches were cited by the majority of respondents 218(68.9%) as common symptoms of malaria. This figure was less than that of other studies carried out in Karachi, which reported that 99% of patients had fever from malaria and that 97% of patients experienced headaches and shivering correspondingly in malaria (Bilal *et al*., 2013). This was also less than the results of the Ethiopian study (Abate *et al*., 2013). This percentage was somewhat higher than that of Nigeria, where 65.2% of respondents identified fever and shivering as typical malaria symptoms (Singh *et al*., 2014).

To lower the incidence of the disease in the rural community, it is crucial to analyze the population's knowledge about malaria vectors, modes, and times of transmission in addition to properly understanding malaria prevention and control strategies and the vector itself. Given that different groups and households have varying levels of awareness on preventative and control measures, it is imperative that KAP be used in conjunction with appropriate ITN utilization in rural settings. Respondents understood that the most effective way to prevent malaria was to use insecticide-treated bed nets 224(80.0%) when it came to intervention strategies for vector control and indoor prevention. This result was in line with a finding from Bahir Dar zuria, where 120 participants (81.9%) understood ITN as a malaria preventive method (Dejazmach *et al.,* 2021). It also outperformed the results of a study conducted in Myanmar, where 65.6% of respondents mentioned sleeping under a bed net as a method of preventing malaria (Shoe and Shewa, 2013).. It was, nevertheless, less than in two earlier Ethiopian studies, when 95.4% of respondents (Hamza *et al*., 2017) and 97.55% (Tomass *et al.,* 2015) agreed that using an ITN can prevent malaria.

Of the 83 survey participants (29.7%) who did not use ITN, some stated they were unaware of its use, the majority stated it was unavailable in local markets and was not used year-round, and the remaining individuals stated it was only used during the peak mosquito season. Similar to another study from Amhara National Regional State, Ethiopia, where only 26.4% of study participants used ITN as a malaria prevention and control method, other villagers also saw bed nets as a means of protecting against mosquito bites and did not associate them with the prevention of malaria (Aderaw and Gedefaw, 2013).

Many 182 (65.0%) of the study participants visited a health center while receiving therapy for malaria. This was in line with findings from other African nations and India, where using medical facilities is the most common option when suspected of having malaria (Lora *et al*., 2010). This number, however, was low in comparison to studies from an endemic area of Ethiopia, where 81.6% of respondents seek treatment from healthcare facilities for a febrile disease (Karunamoorthia and Kumera, 2010), and a rural community of Ethiopia, where 91.9% of respondents reported using only modern antimalarial drugs (Deressa *et al*., 2003). Conversely, it was noted that a few participants stated they had utilized conventional medications and either explored alternative choices or took no action to cure their malaria. This number was significantly higher than a study from a rural community in Ethiopia, where only 6.8% of respondents used both modern and traditional medicine, and 1.3% only used traditional medicine to treat malaria (Deressa *et al*., 2003). In fact, this number was lower than the figure reported from a study conducted in Nigeria, where 47.6% of respondents reported having been practicing antimalarial home remedies (Singh *et al*., 2014). When compared to the national malaria guidelines, which state that 100% of cases of confirmed malaria must be treated in accordance with national guidelines, the treatment-seeking behavior of the participants in this study was discouraging. Ethiopia aims to achieve 100% of patients' access to cost-effective and effective malaria treatment through the use of highly effective artemisinin-based combination therapies (ACTs), which are available at health facilities throughout the nation (Ministry of Health, 2012).

.The majority of respondents to the survey, 213 (76.1%), believed that malaria posed a severe threat. This was greater than the finding reported in the Tigray region, where 65.9% of respondents concurred (Paunder *et al*., 2009).It was, however, less than the results of a study conducted from Bahir Dar zuria, which indicated that 130 respondents (87.6%) agreed that malaria was a severe concern and that this finding (Dejazmach *et al.,* 2021) was consistent with

data from the Raya Azebo district 90.8% (Tesfaye *et al.*, 2017). Conversely, yet it was greater than the Tigray region study results (65.9%) (Paunder *et al*., 2009).This result was less than that of different research from Shewa Robit town, where over 90% of respondents said that malaria was one of the most significant health issues facing the community, impacting people of all ages and both sexes.

The majority of participants 194(69.3%) believed that the greatest defense against malaria is to stay away from mosquito bites. As a result, 197 (70.3%) of the survey participants thought that sleeping under a mosquito net at night could help one avoid contracting malaria. It was less than in another Ethiopian study where 97.55% of participants believed that using ITN as a malaria preventive strategy was a good idea (Tomass *et al.*, 2011). This result was also less than that of another survey, which found that 325 respondents (83.3%) had a habit of using bed nets, while 65 respondents, or 16.7%, had never used an ITN (Tazebew and Munshea, 2021).

In the current study, 169 respondents (60.4%) thought that pregnant women and children were more likely to contract malaria. This was more than the results of a study done in Bahir Dar zuria, where low awareness was noted, with only 50 participants (33.6%) and 26 participants (17.4%) correctly identifying pregnant women and children under five as the most susceptible groups for malaria infection, respectively (Dejazmach *et al.*, 2021).It was consistent with another study (Tazebew and Munshea, 2021), in which approximately 65% of survey participants accurately identified children and pregnant women as the population category most susceptible to malaria. Other surveys conducted in Ethiopia, however, revealed a high degree of awareness, with 85.1–90.3% and 59.0%–62.3% of respondents, respectively, knowing that expectant moms and those with less than five children are the most vulnerable categories (Henok, 2015). Another study conducted in Ethiopia revealed a high degree of awareness among community members, with the majority knowing that children under five are more affected (85.1%), followed by pregnant women 62.3% (Haile *et al*., 2015). This was mostly because pregnant women have a semi-compromised immunity, making them very susceptible to malaria, and children under the age of five have a weaker and less developed immunity, making them more susceptible to infections than adults.

In order to prevent malaria, 140 (50.0%) of the participants cleared stagnant water from broken pots, containers, and ditches surrounding their home. The study conducted at Mekaneeyesus

Primary Hospital in South Gondar revealed that 265 (67.9%) of the respondents drained stagnant water as a preventive measure against malaria, which was a considerably lower result than this one (Tazebew and Munshea, 2021). However, compared to another Ethiopian study, fewer study participants, roughly 27%, used mosquito repellent oils and anti-mosquito spray in their homes to protect themselves from mosquitoes while they slept and to kill malaria vector mosquitoes when they landed on walls. This is because approximately 206 (73%) of participants never used these products. This resulted from the fact that the majority of respondents were unaware of the significance and applications of these substances, and even more so when they were being interviewed. The community's information gaps may facilitate the spread of malaria. In terms of the distribution and functions of these oils and chemicals, it was yet another crucial sign of the gaps in community knowledge and perception. This information helped community health workers and local health agencies design effective intervention strategies.

According to the results of the current study, 160 participants (57.1%) had good knowledge, while 120 individuals (42.9%) had poor knowledge of malaria. This result was greater than that of the Areka town report, which found that 201 study participants (49.6%) had poor knowledge of malaria and 204 (50.4%) had good knowledge (Kebele *et al.*,2017). This result was encouraging when compared to studies conducted in Champasack Province, Lao PDR, which revealed 59.1% of respondents had good knowledge (Thanabouasy *et al.*, 2009), and a report from Bahir Dar zuria, where a total of 44 (29.5%), 50 (33.6%), and 55 (36.9%) participants had good, satisfactory, and poor knowledge about malaria respectively (Dejazmach *et al.*, 2021). In contrast, 74.3% of respondents in a survey from Southern Ethiopia had strong knowledge, while the remaining 25.7% had inadequate knowledge (Abate *et al.*, 2013).

After conducting an overall assessment, the study found that 149 participants (53.2%) had positive attitude about malaria, while 131 participants (46.8%) had a negative attitude. It was in agreement with research done in the town of Areka, which found that 182 (44.9%) respondents had negative attitude toward malaria and 223 (55.1%) respondents had positive attitude (Kebele *et al*., 2017). However, this was less than studies conducted in Karachi, where 97% of participants reported having a positive attitude toward malaria (Bilal *et al*., 2013), and in the Amhara National Regional State of Ethiopia, where 78.1% of participants reported having a positive attitude toward malaria (Aderaw and Gedefaw, 2013).

The study's findings demonstrated that 210 participants (75.0%) had good practices regarding malaria. This result was higher than studies from Southern Ethiopia, where 274 study participants (67.7%) had good practice towards malaria (Kebede *et al*., 2017), Karachi, where 59% of study participants had good practice (Bilal *et al*., 2013), and the Lao PDR, where only 5.7% of study participants had good practice (Tazebew and Munshea, 2021). Practice scores of respondents were relatively better than their corresponding knowledge and attitude scores .This could be due to the fact that knowledge and attitude questions were more detailed and required a higher level of understanding than practice questions and differences in residence where most of the study participants were rural dwellers. This was supported by a study conducted in south Gondar which reported urban dwellers had good knowledge score about malaria than their rural counterparts while poor knowledge score was more evident among rural residents (Tazebew and munshea, 2021).

Working out associations, educational level was found to have significant association with individual's knowledge of malaria. In this regard, illiterate participants were 2.6 times less likely to have good knowledge of malaria as compared to those who could read and write (Exp (B) =0.380, 95% CI.0.183-0.187, Sig. =0.009) .This was similar with a report from Areka town where study participants with educational level of college and above were 6 times more likely to have good knowledge of malaria as compared to their illiterate counterparts (Kebede *et al*., 2021). This finding was also consistent with reports from similar studies conducted in different parts of the country. For instance, according to the study conducted in Pawe district, Northwest Ethiopia, persons who were 9th grade or above were 4.9 times more likely to report a high score of malaria knowledge compared to those who had no formal education (Beyene *et al*., 2015), whereas in the study conducted in Assosa zone, western Ethiopia, it was revealed that comprehensive knowledge about malaria preventive measures was significantly higher among those who completed college/university (Legesse *et al*., 2007). This could be explained by the fact that better educated individuals have better access to information and have the opportunity of better learning and understanding when compared to those with lower educational level or illiterates. However, the odds ratio showed that there was no large difference between them. This could be due to differences in residence where most of the study participants were rural dwellers. This was supported by a study conducted in south Gondar which reported urban dwellers had

good knowledge score about malaria than their rural counterparts while poor knowledge score was more evident among rural residents (Tazebew and munshea, 2021).

Family number and age were statistically significant with the practice of the study subjects. The practice level of respondents was likely to increase with increasing age. Participants aged 50 and above were 1.4 times more likely to have good practice when compared to those found within the range of 40-50(table 7).

6. Conclusion and recommendation

In general, the Overall respondents' levels of knowledge, attitude and practice about malaria were comparatively good. The results of this study, however, showed that due to a lack of access to house-to-house health extension services which concentrate on information, appropriate health education, and communication to enhance respondents' knowledge in the current study area were still some misconceptions about malaria in the community. These false beliefs may have an impact on the study participants' actual preventive strategy. Lack of knowledge about the illness, its accessibility or correctness, and other related characteristics were found to have an impact on the KAP ratings of the community in the research area.

The present study's findings led to the formulation of the following recommendations aimed at optimizing the KAP of the community.

- It is advised that the disease prevention and control department, community health workers, and the local woreda health office step up their efforts to create a comprehensive public awareness campaign about the causes, symptoms, treatment, and prevention and control of malaria.
- It ought to concentrate on enhancing awareness of and accessibility to efficient malaria prevention techniques, early detection of malaria, timely treatment before the illness worsens, and involvement in health education for this demographic.
- Through community engagement efforts, it is also advised to concentrate on dispelling prevalent misconceptions regarding the etiology, modes of transmission, and clinical manifestations of malaria.
- When distributing ITNs, health extension workers ought to educate the community to dispel common misconceptions and increase the general knowledge about ITNs and malaria in the community.
- To optimize the intervention's benefits, further efforts in expanding ITN coverage and environmental management within the research area are recommended.
- It is advised that more research be done on the community's KAP with a larger sample size.
- Researchers, health professionals, educators, and students are recommended to use this study as a baseline for their own future (further) researches.

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Appendix I

Addis Ababa University College of Natural and Computational Sciences Department of Zoological Sciences

Subject information sheet (English version) Questionnaire

Consent form

Dear, respondents

My name is Lageru Tilahun. I am a student of Addis Ababa University. Currently, I will be conducting a research on a topic entitled; Community Knowledge, Attitude and Practice towards Malaria in Enebsie Sarmidir Woreda, East Gojjam, Amhara Regional State, Ethiopia. I would like to interview you a few questions about your knowledge, attitude and practice regarding with malaria. The objective of this study is to **determine community knowledge, attitude and practice (KAP) towards malaria** in Enebsie Sarmidir Woreda, East Gojjam, and Amhara Regional State, Ethiopia which is important to improve the health of the community related to malaria. I hope you will help me to complete this study. None of your answers will be available to anyone at any time. All the information you give me will be kept private. I will not put your name anywhere on this questionnaire. If you decide not to participate or complete the form, you may end filling the questionnaire anytime you want to. However, I really need your honest response to better understand the impact of the level of knowledge, attitude and practice towards malaria. The results of the study would hopefully serve as an important input to intervention programs that aim at improving awareness and health of community in the study area. It will take you 15-20 minutes to complete the whole questionnaire. I thank you in advance for taking your time to respond to my questions! I have been briefly informed about the study and I clearly understood the objective .Since it doesn't affect my personal life, I agreed to take part in the study. Consequently, I here approve my consent to take part in the study as an interviewee with my signature.

Instruction: please select the appropriate answer you wish to give and circle your answer letter.

Socio – Demographic characteristics of households

1. Gender of respondent A/ male B/ female

2. What is the number of your family? A/ ≤ 5 B / > 5

3. What is your age……....?

4. What is your marital status? A/ Married B / single C/ Divorced D/ Other

5. What is your highest level of education? A/ Illiterate B / can read and write C /Primary Level D/ secondary school and above

6. What is your occupation? A/farmer B,/merchant C / student D/ retried E/Housewife

Questions related to malaria knowledge

7. Have you ever heard malaria in your area? A/ Yes B/ No

8. Is malaria a transmissible disease? A / Yes B/ No C/ I don't know

9. What are the main symptoms of malaria disease you know? A/fever B/ shivering C/ headache D/ backache E/ others

10. When dose Mosquito bite most? A/ Day time B/ Night time C/ day & time D/ I do notknow

11. How is malaria transmitted from person to person**? A /** by mosquito bite B/ by bad season C / through bodily contact with patient D/ by drinking dirty water F/ from dirty environment

12. Is Malaria a preventable disease? A / Yes B /No C/ I don't know

13· where do you and your family go to seek treatment for malaria? A/ traditional healer of Village B/ health centers of Village C/ simply take tablet D/ Other

14. Can you be cured of malaria? A/ Yes B/ No

15·Do you have ITNs in the home? A /yes B/ No

16. If you say yes for question number 15, how many ITNs do you have in your

family? A/1 B/ 2 C/ 3 D/ 4 E/ More than4

17. Have you ever heard education about ITNs? A/ Yes B/ No

18. If your answer for question 17 is yes, what were the sources of information? A / radio B / health workers C/ newspaper D/ mosque/church E/ kebele /peasant representative F/school G/friends H/other

19. Do you think that sleeping under ITNs has benefits? A/ Yes B/ No

20. When do you or your family sleep under ITNs? A/ daily B/ during transmission time C/weekly D/other

Questions Related to Attitudes towards Malaria:

21. I think malaria is a serious, life-threatening disease.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

22. I think the best way to prevent myself from getting malaria is to avoid mosquito bites.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

23. I believe sleeping under a mosquito net during the night is one way to prevent myself from getting malaria. 1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

24. In my opinion, children and pregnant mothers are at greater risk of getting malaria.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

25. I think that one can recover from malaria without any treatment.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

26. I think that it is dangerous if malaria medicine is not taken completely.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

27. I think that I should go to the health center to have my blood tested as soon as I suspect that I have malaria. 1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

28. In my opinion, only children and pregnant women are at risk of Malaria.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

29. If someone has got Malaria, people should avoid having close contact with him/her.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

30. I can buy and take anti-Malaria drugs from the drug shop/pharmacy to treat myself when I get Malaria without any medical prescription. 1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

31. In my opinion, it is very important to check for an expiry date of the drug before taking it.

1. Strongly agree. 2. Agree. 3. Neutral 4. Disagree 5. Strongly disagree

Practice Related Malaria Questions

32. Do you usually clear stagnant waters in broken pots, containers and ditches around your house?

1. Yes 2. No.

33. How often do you check for holes/repair mosquito nets? 1. Always 2. Sometimes 3.Never

34. How often do you use mosquito repellent oils on your house? 1. Always 2. Sometimes 3.Never

35. How often do you use anti-mosquito spray in your house? 1. Always 2. Sometimes 3.Never

Thank you for your participation.

Appendix II

የጥናት መጠይቆች

የተከበሩት·ተሳታፊዎች

ጤናይስጥልኝ !

ላገሩ ጥላሁን እባላለው፡፡የአዲስ አበባ ዩኒቨርስቲ ተማሪ ነኝ፡፡

በአሁኑ ወቅት· እውቀት,አመለካከትና ተግባር በሚል ርዕስ ከወባ ጋር በተያያዘ የተወሰኑ· ጥያቄዎችን ብጠይቀዎት፡፡የጥናቱ አላማ፡ ስለወባ የህብረተሰቡን እውቀት፣አመለካከትና ተግባር መመዘን ነው፡፡ይህም ጥቅሙ· ጤናን ማስጠበቅና ከበሽታ· ማዳን ነው፡፡ በዚህ የፈቃደኝነት· ቅፅም ለጥናት· እንደምትሳተፉ· ተስፋ· አለኝ፡፡ ማንኛውንም ሚስጥር የተጠበቀ ይሆናል፡፡ ውጤቱም ጤናን ለማሻሻል በማህበረሰቡና በቀበሌው· ጥሩ· ግብዓት· ነው፡፡ሁሉን ጥያቄዎች ለመመላት· ከ15-20 ደቂቃ ሊወስድ ይችላል፡ ስለጥናቱ በሚገባ አብራረው፡ አላማውንም በሚገባ አስረዳው፡ ለዚህም በህይወት· ላይ ምንም ተፅዕኖ· ስለማይኖረው· የጥናቱ አካል ለመሆን እስማማለው፡፡ በዚህም ቅፅ በፊርማዬ አረጋግጣለው፡፡

የጥናቱ ባለቤት፡ ላገሩ ጥላሁን

ስልክ፡0918330696

በዚህ መረጃ ከተስማማችሁ· ወደ ቀጣይ?

1. አዎ፡ወደቀጣዩ ገፅ ይቀጥሉ·

2.አይደለም፡ተሳትፎውን ያቁሙ·

ፊርማ.....ቀን.....

ለእውነተኛ ምላሽዎ አስቀድመው እናመሰግናለን! መመሪያ፡ እባክህ መስጠት የምትፈልገውን ተገቢውን መልስ ምረጥ እና የመልስ ደብዳቤህን ክበብ አድርግ።

ሶሺዮ - የቤቶች ሥነ-ሕዝብ ባህሪያት

1. የተመላሽ ጾታ ሀ/ ወንድ ለ/ ሴት

2. የቤተሰባችሁ ቁጥር ስንት ነው? ሀ/ ≤ 5 ለ / > 5

3. እድሜህ ስንት ነው .....?

4. የጋብቻ ሁኔታዎ ምን ያህል ነው? ሀ/ ያገባ ለ/ ነጠላ ሐ/ የተፋታ መ/ ሌላ

5. ከፍተኛ የትምህርት ደረጃዎ ምንድነው? ሀ/ መሃይም ለ /ማንበብ እና መፃፍ ይችላል

ሐ/ የመጀመሪያ ደረጃ መ/ ሁለተኛ ደረጃ ትምህርት እና በላይ

6. ሥራህ ምንድን ነው? ሀ/አርሶ አደር ለ/ነጋዴ ሐ/ተማሪ መ/የኢ/ቤት ሚስትን በድጋሚ ሞከረ

ከወባ እውቀት ጋር የተያያዙ ጥያቄዎች

7. በአካባቢዎ የወባ በሽታ ሰምተው ያውቃሉ? ሀ/ አዎ ለ/ አይ

8. ወባ ተላላፊ በሽታ ነው? ሀ/አዎ ለ/ አይ ሐ/ አላውቅም

9. የሚያውቁት የወባ በሽታ ዋና ዋና ምልክቶች ምንድን ናቸው? ሀ/ትኩሳት ለ/ መንቀጥቀጥ ሐ/ ራስ ምታት መ/የጀርባ ህመም ኢ/ሌሎች

10. የትንኝ ንክሻ መቼ ነው? ሀ/ የቀን ሰዓት ለ/ የሌሊት ሰዓት ሐ/ ቀን እና ሰዓት መ/ አላውቅም

11. ወባ ከሰው ወደ ሰው የሚተላለፈው እንዴት ነው? ሀ / በወባ ትንኝ ለ/ በመጥፎ ወቅት ሐ / ከታካሚ ጋር በአካል ንክኪ መ/ ቆሻሻ ውሃ በመጠጣት ረ/ ከቆሸሸ አካባቢ

12. ወባ መከላከል የሚቻል በሽታ ነው? ሀ / አዎ ለ / አይ ሐ/ አላውቅም

13· እርስዎ እና ቤተሰብዎ የወባ ህክምና ለማግኘት የት ይሄዳሉ? ሀ/ የመንደር ለ/ ጤና ጣቢያዎች ሐ/ የባህል ሀኪም በቀላሉ ታብሌት መ/ሌላ ይውሰዱ

14. ከወባ መዳን ይችላሉ? ሀ/ አዎ ለ/ አይ

15·በቤት ውስጥ ITN አለህ? ሀ/አዎ ለ/ አይ

16. ለጥያቄ ቁጥር 17 አዎ ካሉ፣ በቤተሰባችሁ ውስጥ ስንት አይቲኤን አሉዎት? /1 ለ/ 2 ሐ/ 3 ዲ/ 4 ኢ/ ከ 4 በላይ

17. ስለ ITNs ትምህርት ሰምተው ያውቃሉ? ሀ/ አዎ ለ/ አይ

18. ለጥያቄ 22 መልስዎ አዎ ከሆነ፣ የመረጃ ምንጮች ምን ነበሩ? ሀ / ሬድዮ በ / ፖስተሮች ሐ/ የጤና ባለሙያዎች መ/ ጋዜጣ ረ/ መስጊድ/ቤተክርስትያን ሰ/ቀበሌ /የገበሬ ተወካይ ገ/ትምህርት ቤት ኃ/ጓደኞቼ እኔ/ሌሎች

19. በአይቲኤን ስር መተኛት ጥቅሞች አሉት ብለው ያስባሉ? ሀ/ አዎ ለ/ አይ

20. እርስዎ ወይም ቤተሰብዎ በአይቲኤን ስር የሚተኛው መቼ ነው? ሀ / በየቀኑ ለ / በማስተላለፍ ጊዜ ሐ / ሳምንታዊ መ / ሌላ

ከወባ አመለካከት ጋር የተያያዙ ጥያቄዎች፡-

21. ወባ ከባድና ለሕይወት አስጊ የሆነ በሽታ ይመስለኛል።

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

22. ራሴን ከወባ በሽታ ለመከላከል ከሁሉ የተሻለው መንገድ የወባ ትንኝ ንክሻን ማስወገድ ነው።

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

23. በሌሊት በወባ ትንኝ መረብ ስር መተኛት እራሴን ከወባ በሽታ የመከላከል አንዱ መንገድ ነው ብዬ አምናለሁ። 1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

24. በእኔ አስተያየት ህጻናት እና ነፍሰ ጡር እናቶች ለወባ በሽታ የተጋለጡ ናቸው.

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

25. አንድ ሰው ከወባ በሽታ ምንም ዓይነት ህክምና ሳይደረግበት ይድናል ብዬ አስባለሁ.

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

26. የወባ መድሃኒት ሙሉ በሙሉ ካልተወሰደ አደገኛ ነው ብዬ አስባለሁ.

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

27. ወባ በሽታ እንዳለብኝ እንደጠረጠርኩ ወደ ጤና ጣቢያ ሄጀ ደሜን መመርመር ያለብኝ ይመስለኛል። 1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

28. በእኔ አስተያየት, ህጻናት እና እርጉዝ ሴቶች ብቻ ለወባ የተጋለጡ ናቸው.

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

29. አንድ ሰው ወባ በሽታ ካለበት ሰዎች ከእሱ/ሷ ጋር የቅርብ ግንኙነት እንዳይኖራቸው ማድረግ አለባቸው።

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

30. ያለ ምንም የህክምና ማዘዣ ወባ ሲያዝ ራሴን ለማከም ከመድኃኒት ሱቅ/ፋርማሲ ውስጥ የፀረ ወባ መድኃኒት ገዝቼ መውሰድ እችላለሁ። 1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

31. በእኔ አስተያየት መድሃኒቱን ከመውሰዱ በፊት ጊዜው የሚያበቃበትን ቀን ማረጋገጥ በጣም አስፈላጊ ነው.

1. በጠንካራ ሁኔታ ይስማሙ. 2. እስማማለሁ. 3. ገለልተኛ 4. አልስማማም 5. በጣም አልስማማም

ከወባ ተግባር ጋር የተያያዙ ጥያቄዎች፡

32. ብዙውን ጊዜ የተበላሹ ውሀዎችን በተሰበሩ ማሰሮዎች፣ ኮንቴይነሮች እና ቦይ ውስጥ በቤትዎ ዙሪያ ያጸዳሉ?

1. አዎ 2. አይደለም.

33. ከወባ ትንኝ መረቦችን ለመጠገኑ ምን ያህል ጊዜ ይፈትሻል? 1. ሁሌም 2. አንዳንድ ጊዜ 3. በጭራሽ

34. በቤትዎ ላይ ምን ያህል ጊዜ የወባ ትንኝ መከላከያ ዘይቶችን ይጠቀማሉ? 1. ሁልጊዜ 2. አንዳንድ ጊዜ 3.በጭራሽ

35. በቤትዎ ውስጥ ፀረ-ወባ ትንኝ ምን ያህል ጊዜ ይጠቀማሉ? 1. ሁልጊዜ 2. አንዳንድጊዜ 3. በጭራሽ

ለተሳትፎዎ እናመሰግናለን።