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RETROSPECTIVE THREE –YEAR TRENDS IN THE PREVALENCE OF MALARIA AND ASSOCIATED RISK FACTORS IN TAHTAY ADIABO WOREDA, TIGRAI REGIONAL STATE IN NORTHERN ETHIOPIA

By

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A thesis submitted to the Department of Zoological Sciences of Addis Ababa University in partial fulfillment of the requirements for the degree of Master of Science in Biology.

Addis Ababa, Ethiopia

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Addis Ababa University

Postgraduate Program

Department of Zoological Sciences

DECLARATION

I declare that this thesis entitled "Retrospective three –year trends in the prevalence of malaria and associated risk factors in Tahtay Adiabo woreda, Tigrai regional state in northern Ethiopia'' is my original work and has never been presented in any university and that all the source materials which were used for the thesis have been properly acknowledged.

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DECLARATION

This is to certify that the thesis prepared by Gebremedhn Hailemariam, entitled "Prevalence of Malaria and Associated Risk Factors in Tahtay Adiabo Woreda, Tigrai Regional State, northern Ethiopia", and submitted in fulfillment of the requirements for the Degree of Master of Science in Biology complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ABBREVIATIONS

AOR: Adjusted Odds Ratio

FMOH: Federal Ministry of Health

HMIS: Health Management Information System

IRS: Indoor residual spraying

ITNs: Insecticide Treated Nets

MOH: Ministry of Health

OPD: Out Patient Department

Pf: Plasmodium falciparum

PV: Plasmodium vivax

WHO: World Health Organization

ABSTRACT

In Ethiopia, malaria is a serious public health concern and exerts devastating socioeconomic obstacles. It is one of the main cause for both outpatient visits and hospital admissions in Tahtay Adiabo Woreda. However, the trends and associated risk factors of malaria are lacking in this particular area. Thus, the current study was designed to determine the retrospective prevalence of malaria and its associated risk factors in Tahtay Adiabo Woreda. All malaria cases reported from 2018 to 2020 health center were carefully reviewed from the rapid laboratory diagnostic test to determine the trends of malaria morbidity. *Furthermore, a community-based cross-sectional study was conducted on a random sample of Sheraro town's residents as well as those of neighboring kebeles to assess the risk factors to malaria.*

A standardized questionnaire were employed to determine socio-demographic information. Statistical SPSS version-20 was used to enter, verify the completeness of, and analyze the data. To assess risk factors that were significantly associated, with multivariate logistic regression was employed. A statistically significant P-value was defined as one less than 0.05. In total, 87,612 malaria suspects were diagnosed using microscopy over the last 3 years, of which 15,558 (17.8%) were confirmed positive cases. Plasmodium falciparum and Plasmodium vivax accounted for 78.7% and 21.3% of the cases, respectively, no mixed infections of P. falciparum and P. viax were recorded. Both sexes and all age groups reported having malaria. Malaria was higher in the age group>16 years (73.7%) followed by 6-15 years (13.4%) and 1-5 years (12.4%) In this study, males were more affected (n=2,465; 56.85%) than females (1,871; 43.15%). The findings further identified that working or sleeping outside the home, using malaria net improperly, living in mud-plastered houses, and having stagnant water around were a few of the main risk factors connected with malaria in the study area(P<0.05). Infection with P. falciparum and P. vivax is the predominant cause of malaria, which is a significant public health concern in the Woreda. Thus, to reduce the spread of malaria, health planners and administrators should provide the community with intensive health interventions and education such as vector control measures, environmental management measures and personal protective measures.

Key words: Data; Malaria; Predominance; Questionnaire; risk factors

1. INTRODUCTION

1.1 Background

Human malaria is caused by five different Plasmodium parasite species: Plasmodium *falciparum*, *P. vivax*, *P. ovale*, *P. malariae*, and *P. knowlesi*. Of these, two species—P. falciparum and *P. vivax*—pose the greatest threat to public health in many countries in the tropics and sup tropics (WHO, 2012). Malaria poses a serious threat to public health in 92 countries across the globe. In 2017, it was linked to 435,000 deaths and 219 million cases, 90% of which occurred in sub-Saharan Africa (WHO, 2018). Children under the age of five make up the majority of those affected and account for 78% of all deaths. The population of humans itself has a major impact on the spread of malaria both within and between geographical areas. A person's risk of infection and illness is influenced by a variety of biological factors, including immune response, genetics, socioeconomic status, living and working conditions, exposure to vectors, and human behavior (Zacarias and Andersson, 2010).

Ethiopia is among the African countries most susceptible to the malaria epidemic, where malaria is prevalent in over 75% of the country's area, with 68% of the total population being at risk (Gebreyesus et al., 2006; FMOH, 2011).In Ethiopia, *p.falciparum* and *p, vivax* are the two most common and widely dispersed parasites, constituting 60 and 40% of malaria cases, respectively (FMOH, 2012). In 2009/2010, this protozoan infection accounted for 14% of outpatient visits and 9% of hospital admissions throughout the country (FMOH, 2011). In 2016, there were an estimated 2,927,266 new malaria cases and 4,782 deaths. Ethiopia faces a significant risk of malaria epidemics because of its topography and environment. A broad range of epidemics happens every 5–8 years in some areas due to climatic fluctuations and drought-related nutritional emergencies (PMI, 2012). Anopheles *arabiensis* is the main malaria vector in Ethiopia, while An. *funestus,* An. *pharoensis*, and An. *nili* are secondary ones (Gebreyesus et al, 2006). Malaria remains a major source of morbidity and mortality in Tigrai as it does throughout the country. According to Gebreyesus et al (2006), the dynamics of malaria transmission in Tigrai are comparable to those of the rest of the nation. These dynamics include intensity, distribution, seasonality, kind, and percentage of species involved, and kinds of malaria management strategies. As in the rest of the country, the scale-up of malaria control activities in the past decade has resulted in a significant reduction in malaria prevalence in Tigrai. According to Health Management Information System

(HMIS) data of the Tigrai region, the total outpatient department visits, admissions, and deaths due to malaria decreased from 20.5, 10.5 and 5.1% in 2011/2012 to 11.16, 4.4 and 1.9 % in 2014/15. The occurrence of malaria in the Tigrai Region is 8.1 per100, 000 population at risk without a major epidemic during 2016 for Humera, Asgede Tsimbla, and Tahtay Adiabo areas (HMIS, 2016).

There are many reasons for the influence of the epidemiology of malaria in Tigrai. Environmental factors mostly associated with the ongoing efforts to alleviate the impact of climate change, such as rainwater harvesting, irrigation, and resettlement programs hurt malaria spread in the region (Hagos et al., 2006). Malaria is also more common in some areas of the Region as a result of the development of rainwater harvesting and soil conservation structures meant to conserve water resources (Yohannes, et al., 2010). These factors allow the growth threat of pesticide resistance, outdoor exposure, and early vector biting is anticipated to alter the dynamics of infectious diseases and put the focal communities at serious risk.

Malaria is one of the main causes of hospital admissions and outpatient visits in Tahtay Adiabo Woreda (HMIS, 2016). Information on the prevalence of malaria among suspected malaria patients visiting medical facilities as well as the related personal and environmental factors is scarce. Such information provides important inputs to develop an evidence-based malaria control strategy. Therefore, this study aimed to describe the prevalence of malaria and associated risk factors in Tahtay Adiabo Woreda, in northern Ethiopia.

1.2. Statement of the Problem

Ethiopia has made remarkable strides in the fight against malaria recently. However, it remains a major serious headache in various parts of Ethiopia. The largest area affected by malaria in Tigrai is Tahtay Adiabo woreda which is located in northern Ethiopia (Tesfahunegn et al., 2019). Nevertheless, no comprehensive studies were conducted to ascertain the risk factors and the extent and severity of malaria transmission among patients utilizing the medical facilities. As a result, the following objectives were included in the design of the current study.

1.3. Objectives

1.3.1 General Objective:

The general objective of the study was to assess the retrospective malaria prevalence and associated risk factors in Tahtay Adiabo Woreda, northern Ethiopia.

1.3.2. Specific Objectives:

- To assess the retrospective prevalence of malaria among patients attending health centers in the study area.
- To assess retrospective prevalence of Plasmodium species prevalent in the clinical samples.
- To examine retrospective distribution of malaria cases by sex and age groups
- To identify the possible risk factors of malaria prevalence in the study area

1.4. Significance of the Study

One of the expectations of this study is to enable society, administrators, health centers, and other stakeholders to be aware of the problem of the prevalence of malaria in Ethiopia and Tahtay Adiabo Woreda in particular. Additionally, the study's outcome offers commentary to Tahtay Adiabo health centers, principals, and other concerned parties to recognize the severity of the issue and start making adjustments and struggle toward preventing malaria prevalence. The findings of this study can further assist policymakers and program implementers to be informed on the status of the problem. Importantly, it can also serve as a point of reference to stimulate further research about the topics of the study.

1.5. Limitations of the Study

A given study can indeed have its constraints during its completion. Likewise, certain limitations were available while conducting the study. One constraint of the study was the lack of adequate and complete rapid diagnostic test (RDT) on the retrospective data. Another limitation was the outbreak of corona virus during the study period.

2. LITERATURE REVIEW

2.1. Global epidemiology and geographic distribution of malaria

Malaria affects millions of people worldwide. The disease is potentially fatal and is brought on by parasites that humans contract through the bites of female mosquitoes carrying the infection. *P*. falciparum is primarily responsible for deaths due to malaria, while *P*. *vivax, P*. *ovale,* and *P*. *malariae* typically cause milder cases. Human illness is rarely caused by *P*. *knowlesi,* another species (WHO, 2014). *P*. *vivax* is more prevalent in Central America and Africa, whereas *P*. falciparum is more prevalent in Africa, New Guinea, and Haiti (Nicholas et al., 2008). These two species are nearly equally common in eastern Asia, Oceania, the Indian subcontinent, and South America. Although far less common, *P.malariae* is present in most endemic regions, particularly in sub-Saharan Africa.

Outside of Africa, *p.ovale* is comparatively uncommon and makes up less than 1% of isolates in those regions (Nicholas and Breman H., 2008). The global malaria burden is not evenly distributed with Sub-Saharan Africa accounting for 90% of global malaria cases and a majority of these cases occurring among women and children (Audrey et al., 2008). Malaria continues to be one of the leading causes of death for humans, accounting for approximately 3 million deaths and 300-500 million infections annually despite ongoing global efforts to combat parasitic infections and eradicate the causing organisms (Bero et al., 2009; Tamura et al., 2010). For instance, there were 219 million cases of malaria globally in 2017 and 435,000 malaria deaths (WHO, 2018). This is due to the majority of infections in Africa being caused by *P. falciparum*, the most severe and life-threatening forming of the human malaria parasite, as well as the most efficient and difficult-to-control malaria vector.

The ongoing burden of malaria is also influenced by widespread poverty, a lack of infrastructure, and a lack of resources needed to implement long-term initiatives against the diseases on the continent (Teklehaimanot and Mejia, 2008). Most of the deaths due to malaria occur in African children under the age of 5 years, who have little or no immunity to the disease, and every 40 seconds a child dies of malaria, resulting in a daily loss of more than 2000 young lives worldwide (Tamura et al., 2010). Pregnant women and their unborn children are also at great risk for malaria

because the immune response is suppressed in pregnancy and parasitized red blood cells (RBCs) are sequestered in the placenta (Vangapandu et al., 2007).

An estimated 3.3 billion people worldwide are at risk of contracting malaria and getting sick, and 1.2 billion are at high risk of dying from the disease. The WHO African area bears the brunt of the malaria load; there, 90% of malaria-related deaths are projected to occur, and 78% of deaths involve children under five (WHO, 2014). The parasite burden is also highest in school-age children due to low coverage of interventions, and infections may have consequences on school performance (Stevenson et al., 2013) and indicate school children as a good proxy for transmission in a wide community (Stevenson et al., 2013). Overall, malaria constitutes 10% of the continent's disease burden (TCC, 2011). Aggregated losses over time have resulted in substantial differences in GDP between countries with and without malaria, particularly in Africa (Dharani et al., 2010). Furthermore, it also hampers children's schooling and social development through both absenteeism and permanent neurological and other damage associated with severe episodes of the disease, which have important short and long-term social and economic impacts (Teklehaimanot and Mejia, 2008; TCC,2011). Malaria disease management is therefore an essential part of global health improvement and economic development (Dharani et al., 2010).

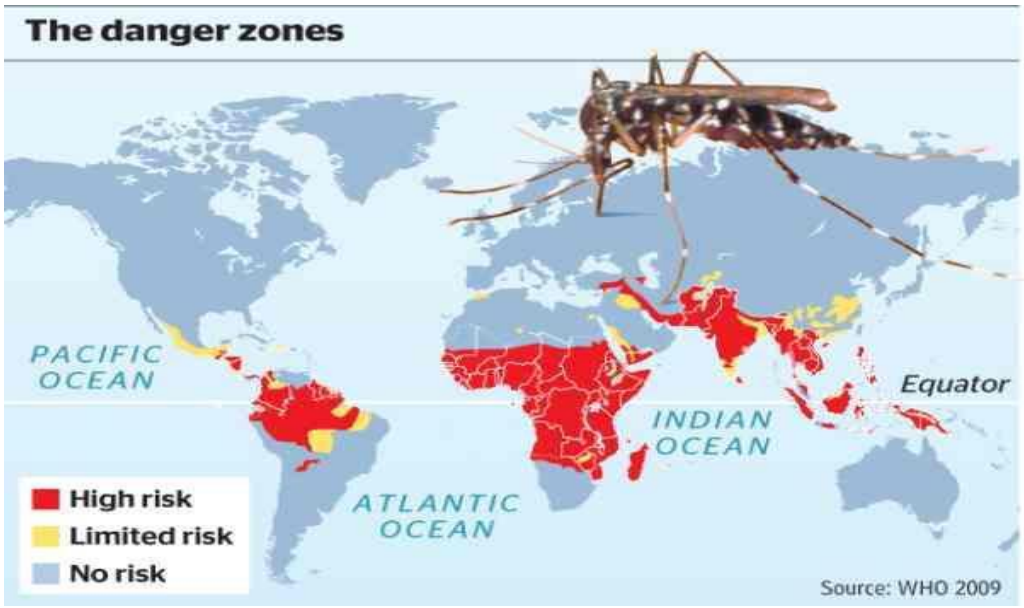


Figure.1: Global distribution of malaria transmission risk (WHO, 2009)

2.2. Malaria Epidemiology in Ethiopia

Ethiopian national documents provide a comprehensive description of the malaria epidemiology, highlighting the threat to a larger number of the population from both *P*. falciparum and *P*. vivax. The two species most typically associated with malaria in Ethiopia are *P*. falciparum and *P*. vivax which account for 60% and 40% of cases, respectively (Ketema, et al, 2011). These regions are home to over 54 million people, who are susceptible to malaria. The transmission is erratic and seasonal, occurring between April and May and September to December, which corresponds with farmers' main planting and harvesting seasons and exacerbates economic loss (Legesse et al., 2007, Betemariam et al., 2002).In our country, main epidemics happen every five to eight years, but focal epidemics used to happen annually.

The spreading of malaria in Ethiopia is mainly determined by altitude. Due to its impact on temperature, altitude influences' the distribution pattern of malaria in Ethiopia (Betemariam et al., 2002). The jeopardy of malaria is highest in the western lowlands of Oromia, Amhara, Tigray, and almost the entire regions of Gambella and Benishangul Gumuz regions.

Seasonal transmission of malaria occurs in Ethiopia's midlands between 1,000 and 2,200 meters above sea level, with occasional epidemics occurring every few years. Malaria is only common along rivers in Ethiopia's eastern lowlands, which are primarily afar and Somali. This is because the region is mainly dry apart from rivers. The low humidity brought on by little rainfall and sparse vegetation, as well as the absence of a water handle for mosquito breeding, is the main barriers to transmission. The absence of malaria in Ethiopia's central highlands can be attributed primarily to the cold temperatures that inhibit the growth of both the parasite and the vector (Tsige, K. et al., 2009).

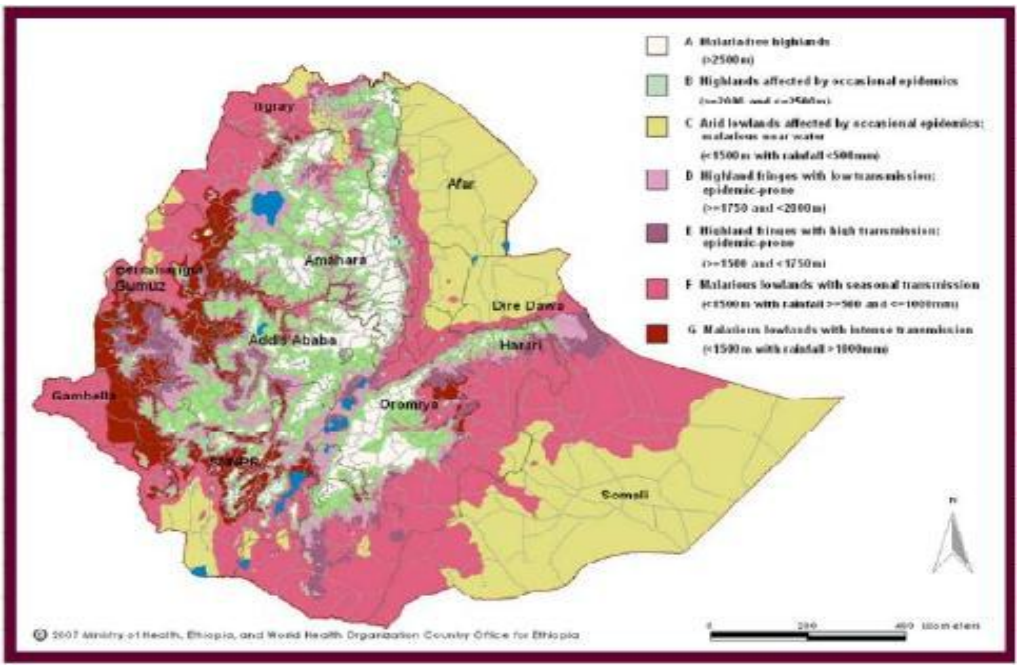


Figure 2: Malaria distribution in Ethiopia (Source: Ayle *et al.*, 2012)

2.3. Prevalence of malaria in Tigrai Region

Malaria remains a major cause of illness and mortality in Tigrai as it does throughout the country. In terms of the intensity, spread, seasonality, sort, and amount of species involved as well as the types of malaria control treatments, According to Gebreyesus et al (2006), the dynamics of malaria transmission in Tigrai are comparable to those of the rest of the nation. As in the rest of the nation, the scale-up of malaria control activities in the past decade has resulted in a significant reduction in malaria prevalence in Tigrai. Data from the Tigrai region's Health Management Information System (HMIS) show that the total number of Out Patient Department (OPD) visits, admissions, and deaths due to malaria decreased from 20.5, 10.5 and 5.1% in 2011/2012 to 11.6, 4.4 and 1.9% in 2014/15. On the other hand, the rate of malaria incidence in the Tigrai region is about 8.1 of the 100,000 at-risk population with outbreaks happening in the Humera, Asgede Tsimbila, and Tahtay Adiyabo areas (HMIS, 2016).

Numerous factors influence the malaria epidemiology in Tigrai. The region's malaria transmissions were negatively impacted by environmental factors, primarily connected to ongoing attempts to mitigate the effects of climate change, these included rainwater gathering, irrigation, and relocation initiatives (Hagos et al., 2006). Malaria is also more common in some areas of the region as a result of the development of rainwater harvesting and soil conservation structures for the

preservation of water resources (Yohannes, et al., 2010). These factors, along with the growing threat of insecticide resistance, outdoor exposure, and early vector bites, are likely to alter the dynamics of infectious diseases and put the local communities at serious risk.

Malaria is one of the main causes of hospital admissions and outpatient visits in Tahtay Adiabo Woreda (HMIS, 2016). Information on the prevalence of malaria among suspected malaria patients visiting medical facilities, as well as the related personal and environmental factors, is lacking. Such data offers crucial inputs for creating an evidence-based malaria control plan. Malaria transmission in Tigrai is strongly seasonal. Most mosquito breeding cases occur below 2200 meters above sea level, with the majority of cases occurring in the northwest and western zones (THB, 2005/2006). Additionally, it is spread to the areas of the region that were previously malaria-free, increasing the risk of malaria infection among non-immune populations (Hadgu Gerensea et al., 2011). In Tahtay Adiabo Woreda, malaria continues to be one of the main causes of hospital admissions and outpatient visits (HMIS, 2016).

2.4. Malaria Risk Factors

Understanding the disease's risk factors is essential to comprehend how the environment changes over time and how various factors, such as the use of therapies, may have an impact (Mauny et al., 2004). This is particularly significant in highland regions with inconsistent malaria transmission and comparable disease risks for all age groups, where immunity to Plasmodium sp. infections is minimal to nonexistent (Woyessa, et al., 2012). Given the associated risk factors, different areas may react differently to interventions because malaria transmission can differ between neighboring households, across ecological zones, seasons, and climates. In Ethiopia, epidemics of malaria affect nearly half of the population that lives between 1,500 and 2,500 meters above sea level (masl) (Abeku et al., 2003). The number of windows and open eaves, age, proximity to breeding grounds, house sharing with animals, and Current studies conducted in high-altitude regions have all been linked to an increased risk of malaria (Alemu, et al., 2011). Furthermore, according to Abeku et al. (2003), environmental variables like temperature, precipitation, and altitude are linked to malaria. Since 2005, Ethiopia has expanded the scope of malaria control programs in endemic areas (above 2000 meters sea level). Important interventions include opportunities for vector control (indoor residual spray and long-lasting insecticidal nets) and effective case management (Artemisia in combination therapy and malaria rapid diagnostic tests).

After that, the initiative was successful in reducing the malaria problem from 2006 to 2008. Furthermore, the 2011–2015 National Strategic Blueprint emphasizes the goal of eliminating malaria in particular regions of the nation with historically low malaria transmission and achieving almost zero malaria fatalities in the remaining malaria-affected areas (MOH, 2009). To improve malaria control efforts and successfully eradicate malaria, it is therefore essential to comprehend the epidemiology of highland malaria, which is reflected as being at high epidemic risk. From high to low altitudes, the prevalence rose, and variations at different stage categories were also evident.

This study also verified that malaria is seasonal. Malaria-endemic places where the number of cases classified as that high epidemic risk varies significantly from year to year. Furthermore, there was a roughly 20-fold difference in malaria prevalence across villages with low and high frequency (Woyessaet al., 2012). More intriguingly, prevalence varied across three altitudes in all strata concerning different age categories (Woyessa et al., 2012). To guide targeted malaria interventions in high-land areas with low malaria incidence and high epidemic risk, it appears necessary to identify factors impacting malaria infection at both the individual and village levels (clusters of households). Furthermore, the Ethiopian Ministry of Health (2012) advised making an evidence-based choice to include high-altitude regions (above 2,000 meters above sea level) in the malaria control program. Therefore, optimizing malaria therapies at high altitudes requires an understanding of the local epidemiology of malaria in small areas with altitudinal heterogeneity.

2.5. Malaria vectors in Ethiopia

Numerous factors related to the parasite, the vector, and the host (human) affect the distribution of malaria. The majority of these are weather and environmental factors, especially those that have an impact on the Anopheles mosquito vectors' habitat and breeding grounds. These include things like temperature, precipitation, humidity, the presence of standing water, vegetation, migration, extensive irrigation, urbanization, and resistance to anti-malaria medications, and human-vector contact (Zacarias and Andersson, 2010).

In Ethiopia, malaria transmission is largely determined by climate and altitude. Most of the transmission occurs between September and December, after the main rainy season from June to August while the second minor transmission period from April to May, following a short rainy

season from February to March. The transmission of malaria in Ethiopia depends on altitude and rainfall with a lag time varying from a few weeks before the beginning of the rainy season to more than a month after the end of the rainy season (WHO, 2008). Epidemics from malaria are relatively frequent involving highland or high and fringe areas of Ethiopia mainly areas 1000-2000 meters above sea level (Dalrymple et al., 2015).

Every two years, during the main harvesting seasons of September to December and April to May, malaria transmission peaks. Ethiopia's subsistence economy and the country as a whole will suffer greatly as a result. Every five to eight years, there are major epidemics, with focused epidemics being the most common type (Getachew et al., 2007).

More than thirty Anopheline mosquito species, including Anopheles gambiae, Anopheles mosquitoes, Anopheles freeborni, and Anopheles quadrimaculatus, are known to transmit malaria in Ethiopia. These mosquito species have different breeding and feeding habits, which lead to different disease spectra in different population target groups and epidemiological settings. Anopheles arabiensis is the primary malaria vector in Ethiopia (WHO, 2012). It is commonly found throughout the nation and typically acts as an epidemic malaria vector. Anopheles pharoensis is the second most common vector species in the nation. Anopheles funestus and Anopheles nilli, which were previously significant malaria vectors in certain regions of Ethiopia, are other less significant vectors (RBM, 2010).

2.6. Prevention and Control of Malaria

Ethiopia’s fight against malaria started more than half a century ago. Initially, malaria control began as a pilot control project in the 1950s and it was launched as a national eradication campaign in the 60s followed by a control strategy in the 70s. Ethiopia developed a five-year National strategic plan for malaria avoidance, control and Elimination (2011-2015). The strategic plan has set goals to achieve malaria elimination in areas with historically low malaria transmission and near zero malaria deaths in all remaining parts of the country by 2015 (FMH, 2010). Combating malaria is among the eight Millennium Development Goals. Early diagnosis and effective treatment, vector control, easy and universal accessibility to ITNs, residual periodic spray of dwellings, environmental management, and continued efforts in epidemic prevention are currently implemented control strategies, as well as expanded use of information technologies,

education, and communication is among the supporting strategies (Sheleme, 2007). Insecticide-treated materials are important in malaria control evidence from several studies shows that the use of insecticide-treated materials reduced severe malaria cases in children by about 45% and all case mortality by about 20% (Sheleme, 2007). In recent years, there has been financial support from global donors to curb the disease in malaria-endemic countries. Moreover, clear operational plans including a long-term vision for malaria control were formulated in which sustained scale-up of proven malaria control tools would progressively lead to malaria elimination in Africa, with the ultimate goal of worldwide malaria eradication by 2040-2050 (PMI, 2015). The proven malaria intervention tools being extensively used in Ethiopia include insecticide-treated mosquito nets (ITNs); in-door residual spray (IRS); and prompt diagnosis and treatment with artemisin-in-based combination therapies (ACTs). Although Ethiopia is still in the malaria control phase, it has set a plan to reduce malaria in selected low-transmission settings by 2020 (PMI, 2016).

Since 2010, payrethroid resistance in Ethiopia has been verified, and DDT resistance was also prevalent (Balkew et al., 2010). Furthermore, at least one malaria vector has been shown to have carbonate resistance, and Ethiopia has been found to exhibit organophosphate resistance (Yewhalaw et al., 2011).

Since 2004 (FMOH, 2004), Ethiopia has embraced ArthemeterLumefantrine (AL), one type of ACT, as the first line of treatment for *P*. falciparum that is not difficult, but chloroquine is still the recommended medication for *P. vivax.* Since 2004, all ages have been free of AL. Additionally, no single dose of primaqunine has been utilized for gametocidal medication against P. falciparum, no radical therapy of *P*. *vivax*, and no directly observed treatment including primaquine has been initiated. Surveillance for active case detection (ACD) for case investigation and ACD of febrile cases at community level, mass screening, have never been there. The therapeutic efficacy of AL remains high in Ethiopia (Nega et al., 2016), with a medium treatment failure rate of less than 10% observed.

3. METHODS AND MATERIALS

3.1. Description of the Study Area

This study was undertaken in Tahtay Adiabo Woreda in Tigrai Regional State, northern Ethiopia from September 2019 to August 2020. Geographically, Tahtay Adiabo Woreda is located (14°23'41" N/37° 46'15" E) in Tigrai Regional State, northern Ethiopia. The study area's administrative center, Sheraro, is located 1,028 meters above sea level . The town is also roughly 402 miles northwest of Mekelle, the regional state capital, and 1,117 km north of Addis Ababa. With 98,934 residents, 1056 of them are Kunama; the district has a total surface area of 384,000 acres (Tahtay Adiabo District Office of Information, 2015).

The region's climate is typically described as tropical semiarid, with nine to 10 months of prolonged dry spells. According to the Ethiopian National Meteorological Agency, the area experiences a unimodal rainfall pattern from July to late September, with an average annual precipitation of roughly 600mm. The warmest months of the year are March through May when the average midday temperature is 39°C, and January, when the average midday temperature is 14.2°C. The primary occupations of the locals are farming various domestic animals, with cattle, sheep, and goats being the most common, as well as producing cereals and oil seeds.

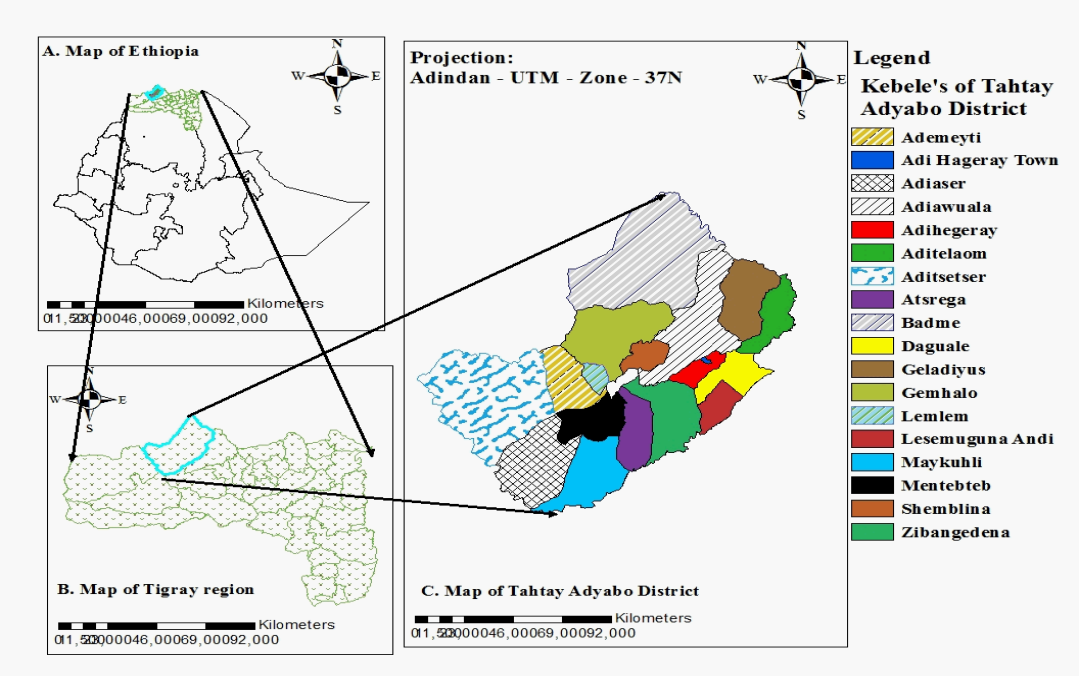


Figure 3: Map of the study region (Tahtay Adiabo Woreda Office of Information, 2015)

3.2. Study Design

Both questionnaires and retrospective methods were employed in this study. Recorded documents of malaria checkups from database informatics of the research area were also used as sources of data for the study.

3.3. Study Population

A health facility-based retrospective study was conducted to determine the trends of malaria from 2018-2020 at Tahtay Adiabo Woreda's seven health centers. All patients who visited the health center between 2018 and 2020 and were suspected of having malaria were the study's target populations. Nevertheless, a large number of febrile cases that might have been treated by health extension personnel or through self-medication were left out. For the risk factor study, the source of population for this study was randomly selected individuals from the total population of the woreda, especially from kebeles of Tahtay Adiabo Woreda nearby to Sheraro Town.

3.4. Sample Size and Sampling Technique

All clinical checkups reported and registered in the database informatics of Tahtay Adiabo Health Bureau in the past three years were examined and incorporated into this study's retrospective to get the proper representative samples from seven health centers. Also, 100 respondents were taken as a sample size to gather the necessary details regarding the risk variables. The sample size of the study participants was determined using a random sampling method with Cochran's Sample Size formula.

$$N = \frac{Z^2 Pq}{e^2}$$

Where:

e, is the desired level of precision (i.e. the Margin of error),p is the estimated proportion of the population that has the attribute in question, and q is 1 – p. The Z-value is found in a Z table.

(https://www.statistics howto.datasciencecentral.com/probability-and-statistics/find-sample-size/) At 95% level of confidence, 0.5 proportions and 6.96% precision (margin of error) the samples were 100 respondents out of the entire population of the field of study.

3.5. Data Collection Method

The data was collected through a questionnaire which was randomly distributed to the residents in the kebeles around sheraro, and cross-sectional retrospective methods. Both open-ended and closed-ended questions were included in the questionnaire. Tigrigna, the primary language spoken in the area, was translated from English, where the questionnaires were created (Annex A). To determine the prevalence of malaria in the study area at Tahtay Adiabo Health Bureau database informatics during the study period, a review of medical history documents for malaria patients was conducted.

3.6. Data Analysis

The collected data were organized, interpreted and expressed in tables, percentages and words. The statistical programmer SPSS version-20 was used to enter the data, verify their completeness, and analyze them. To assess risk factors that were significantly associated, multivariate logistic regression was employed. To analyze the data gathered using the data collection tools, quantitative method of data analysis were used. Eventually, conclusions were made in light of the outcome.

3.7. Ethical Issues

The permission was obtained from the Department of Zoological Sciences, Addis Ababa University. Also, permission to undertake the study was obtained from the Head of the district Health Bureau before the data collection. Similarly, the purpose of the study was explained to the respondents and questionnaires were then distributed after ensuring their willingness to give responses. Likewise, the questions in the questionnaire were designed based on the ethical values of the local community by avoiding any bias related to religion, sex, age, race, etc.

4. RESULT AND DISCUSSION

4.1. Annual trends of malaria prevalence

During the study period (2018 to 2020) 87,612 retrospective data from patients who may have had malaria were examined in seven health centers in the study area. Of these, 15,558 cases (17.76%) had been microscopically confirmed as cases of malaria, with an annual mean case of 5186. Over the three years period of study, the prevalence of malaria increased annually, with a minimum (n=891) and maximum (n=7558) number of annual cases reported in the years 2018 and 2020 respectively (Table 4.1). The highest (n=45070) and lowest (n=6716) numbers of malaria-suspected patients were examined in 2019 and 2018 respectively. Over the previous three years, the prevalence had risen annually, indicating a rising trend in the spread of malaria in the region. P. falciparum was the most frequently reported species of malaria parasite, accounting for 12251 cases (78.7% of cases), whereas 3307 positive results (21.3% of cases) were reported for P. vivax. Between 2018 and 2020, Plasmodium falciparum showed progressively increasing levels. P. vivax, on the other hand, exhibited a cyclical pattern, rising from 2018 to 2019 and then falling from 2019 to 2020 (Table 1).

Table. 1: Annual prevalence of malaria cases in Tahtay Adiabo Woreda from 2018-2020.

Year	**N^{o} of screened**	**N^{o}of positive**		
		p.vivax	***p.falciparum***	**Tota (%)**
2018	6716	205	686	891(13.3)
2019	45070	1589	5520	7109(15.8)
2020	35826	1513	6045	7558(21.1)
Total	87612	3307	12251	15558(17.8)

4. 2 Malaria Prevalence in Tahtay Adiabo Worde Seven Health Centers

The prevalence of confirmed malaria cases was higher in Badme health center 2,925 (18.80%), followed by Zibangedena 2,869 (18.44%), Mykuhuli 2,804 (18.02%) and Gemhalo 2,529 (16.26%) health centers (Table 4.2). The highest prevalence of *P. falciparum* was also reported from Badme (14.83%), Zbangedena (14.55%), and Mykuhuli (14.22%) health centers in decreasing order. There has been no discernible decline in the overall prevalence of outpatient cases specific to malaria

over the years, with rates of 13.3%, 15.8%, and 21.1% in 2018, 2019, and 2020, respectively. The prevalence of malaria rose in every healthcare facility (Table 2).

Table.2: Yearly prevalence of malaria cases in the seven health centers of Tahtay Adiabo Woreda from 2018 -2020.

Health centers	**Years**			
	2018	**2019**	**2020**	**Total**
Badme	210	1310	1405	2925
Zbangedena	162	1321	1386	2869
Mykuhuli	151	1235	1418	2804
Gemhalo	137	1228	1164	2529
Ademiti	115	1206	963	2284
Adihageray	76	555	1150	1781
Adiawalla	40	254	72	366
Total	891	7109	7558	15558

4. 3. Annual Prevalence of Malaria in Relation to Age and Sex of Individuals

From the 15,558 confirmed malaria cases, 9550 (61.38%) were reported in males, while 6008 (38.62%) were recorded among females, representing a 1.58 male to female ratio. Malaria affected every age group during the study period, with the highest prevalence of 7624 (49.00%) among those between the ages of 15 and 65. This age group was followed by those between the ages of 5 and 14 (5104; 32.80%) and <5 years (2547; 16.37%) (Table 3).

Table.3: The yearly prevalence of malaria in relation to age and sex in Tahtay Adiabo Woreda: 2018-2020.

Age group	Year											
	2018			2019			2020			Total		
	M	F	T	M	F	T	M	F	T	M	F	T
<5	90	83	173	640	502	1142	692	540	1232	1422	1125	2547
5-14	139	114	253	1349	979	2328	1508	1015	2523	2996	2108	5104
15-65	299	154	453	2307	1208	3515	2343	1313	3656	4949	2675	7624
>65	8	4	12	77	47	124	98	49	147	183	100	283
Total	536	355	891	4373	2336	7109	4641	2917	7558	9550	6008	15558

4. 4. Annual Prevalence of *Plasmodium* Parasites in Relation to Age

P. falciparum was the most common Plasmodium species across all age groups, and its prevalence rate was highest in those between the ages of 15 and 65, with a prevalence rates of 6168 (39.65%). In a similar vein, a high incidence of *P*. vivax was noted in 1456 (9.36%) of those in the 15–65 age range. However, P. falciparum and *P*. vivax are less common in people over 65, with prevalence rates of 231 (1.5%) and 52 (0.3%), respectively (Table 4). There were no documented mixed *P*. falciparum and *P*. vivax infections.

Table 4: Annual Prevalence of plasmodium parasites in relation to age in Tahtay Adiabo Woreda from 2018-2020.

Age group	Year											
	2018			2019			2020			Total		
	p.falciparum	p.vivax	Total	p.falciparum	p.vivax	Total	p.falcipa	p.vivax	Total	p.falciparum	p.vivax	Total
<5 year	127	46	173	824	318	1142	933	299	1232	1884	663	2547
5-14 years	176	77	253	1770	558	2328	2022	501	2523	3968	1136	5104
15-65 years	372	81	453	2830	685	3515	2966	690	3656	6168	1456	7624
>65 year	11	1	12	96	28	124	124	23	147	231	52	283
Total	686	205	891	5520	1589	7109	6045	1513	7558	12251	3307	15558

4.5 .Survey of sociodemographic characteristics and malaria-related factors

Out of the total 100 participants, 56 of them were males and 44 of them were females. Moreover, 28 of them have an age below 20, 53 of them have an age of 21-40 and the remaining 19 of them have an age of above 40. Out of the total 100 participants, 41 were single, 51 were married, six were divorced and two participants were widowed. Regarding their educational background, six of them cannot read and write, 31 of them joined primary school, 48 of them reached secondary school and 15 of them have diplomas and above. As shown in Table 5 below, 19 of them have two family sizes, 25 of them have a family size of three, 34 of them have a family size of four and 21 of them have a family size of above four.

Table1: Socio demographic characteristics of participants at Tahtay Adyabo Wereda North West of Tigrai Regional State, northern Ethiopia, in 2020.

S.N	Variables	Category	Frequency	Percentage, %
1	Gender	Male	56	56
		Female	44	44
		Total	100	100
2	Age	<20	28	28
		21-40	53	53
		>40	19	19
3	Marital status	Single	41	41
		Married	51	51
		Divorced	6	6
		Widowed	2	2
4	Educational status	Cannot read and write	6	6
		Primary school	31	31
		Secondary school	48	48
		Diploma and above	15	15
5	Occupation	Gov.t employed	17	17
		Farmer	27	27
		Merchants	5	5
		Housewife	24	24
		Other	27	27
6	Family size	Two	19	19
		Three	25	25
		Four	34	34
		Above four	21	22

Study participants (N) =100

4.6. Environmental and Personal Conditions of the Study Participants

Almost all of the residents have similar housing styles. The study participants (63) of the total(100) participants, 'houses are mud plastered, 52 of the total participant's houses have Eave, and the houses of 53 participants have holes in their walls, while 35 of them have stagnant water around their houses. Out of the total participants, the nearest water body distance to 41 participants is 10-20 meters. Furthermore, 62 participants out of the total slept or worked outside their homes at night, while 70 participants out of the total heard Educational messages about malaria from different sources (table 6). The findings clearly illustrated that the majority of those who live in the study area are highly exposed to malaria since their houses are not well constructed.

Table 2: Environmental and personal characteristics of participants in Tahtay Adyabo Woreda North West of Tigrai Regional State, northern Ethiopia in 2020.

S.N	Variables	Category	Frequency	Percentage
1	Housing type	Mud plastered	63	63
		Stone Wall	27	27
		Break Walls	10	10
2	Eave	Yes	52	52
		No	48	48
3	Hole in the wall	Yes	53	53
		No	47	47
4	Kind of water body around	River	10	10
		Lake	5	5
		Pond	15	15
		Swamp	11	11
		Stagnant water	35	35
		None	20	20
		Other	4	4
5	Nearest water body Distance	12-20m	41	41
		21-40m	10	10
		41-60m	14	14
		>60	35	35
6	Sleeping or working outside home at night	Yes	62	62
		No	38	38
7	Access to education about Malaria	Yes	70	70
		No	30	30
8	Malaria Ever contracted	Yes	64	64
		No	36	36
9	Family member malaria contraction ever	Yes	44	44
		No	56	56

Study participants (N) =100

4.7. Malaria Protection Materials of Study Participants

Most of the participants (86) use nets treated with insecticide and 80 percent of them obtain bed nets from health centers. This is encouraging as the poor community can get easy access to the malaria net from the health centers for free. Moreover, out of the total participants, 57 of them use bed nets currently and all (57) of them were insecticide-treated (table 7). Nevertheless, this is

not encouraging because several participants are not using bed nets. As a result, they can be vulnerable to malaria to a great extent.

Table 3: Characteristics about malaria protection materials at Tahtay Adyabo Woreda North West of Tigrai Regional State, northern Ethiopia, in 2020.

S.N	Variables	Category	Frequency(n)	%
1	Type of bed net available	Untreated net	4	4
		Locally Treated net	2	2
		Long lasting insect side Treated net	86	86
		I do not Know	8	8
		Total(N)	100	100
2	Using of insecticide treated net Currently	Yes	57	57
		No	43	43
		Total(N)	100	100
3	Reason for un availability of insecticide treated net	Not Given at all	5	5
		Stolen/lost	2	2
		Used for other purpose	6	6
		Old then thrown	3	3
		Other	3	3
		Total(N)	100	100
4	Number of bed net your family use	0	55	55
		1-2	30	30
		3-4	15	15
		Total(N)	100	100
5	Source of bed net	From health center free	80	80
		From Market or shop	20	20
		From NGO	0	0
		Other	0	0
		Total(N)	100	100

Study participants (N) =100

4.8. Malaria Disease Ever Contracted

Out of the total participants, 64 (40 Males and 24 Females) have had malaria disease in their lives. The most affected age group was 21-40, in which many were farmers (24), with their houses plastered with mud (41 of them) (see Table 8). This implies that the housing style has an impact on the contraction of malaria as those farmers with plastered houses were found to be victims of malaria. Likewise, farmers were highly exposed to malaria as indicated by the respondents.

Table 4: Number of malaria disease ever contracted of study participants in Tahtay Adyabo Woreda North West of Tigray Regional State, northern Ethiopia in 2020.

Variables	Category	Malaria ever contracted out the total (N=100)	
		Yes (%)	No (%)
Gender	Male	40%	16%
	Female	24%	20%
Age	<20	19%	9%
	21-40	34%	19%
	>40	11%	8%
Occupation	Government Employed	11%	6%
	Farmer	24%	3%
	Merchant	4%	1%
	House wife	6%	18%
	Other	19%	8%
Housing type	Mud plastered	41%	22%
	Stone wall	18%	9%
	Breached walls	5%	5%
Eave	Yes	27%	37%
	No	25%	11%
Hole in the Wall	Yes	28%	25%
	No	36%	11%
Kind of water body Around	River	7%	3%
	Lake	4%	1%
	Pond	11%	4%
	Swamp	10%	1%
	Stagnant Water	29%	6%
	None	3%	17%
	Other	0%	4%
Nearest water body distance	10-20 meter	26%	15%
	21-40 meter	5%	5%
	41-60 meter	13%	1%
	>60 meter	20%	15%
Sleeping or working outside home at night	Yes	34%	28%
	No	30%	8%
Hearing of Educational Messages about malaria	Yes	39%	31%
	No	25%	5%
ITN in home	Yes	23%	22%
	No	41%	14%
Current use of ITN	Yes	31%	26%
	No	33%	10%
Chemical spray of bed net in the past 12 months	Yes	24%	24%
	No	40%	12%

Study participants (N) =100

4.9. Binary and Multivariable Analysis for the Factors Associated with Malaria Contraction

From the binary variable analysis, eight variables that have p-value < 0.25 were selected for further analysis in the multi-variable analysis to identify variables associated with Malaria Disease. These Variables were Gender, Availability of eaves, Presence of holes in the Wall, Sleeping or Working outside the home at night, Hearing of Educational messages about malaria disease, presence of ITN in the home, current use of bed net, chemical spray in the past 12 months. Further analysis was performed by multivariable logistic regression by the backward LR method. As a result, four variables (Presence or absence of eave, sleeping or working outside the home at night, hearing of Educational Information about Malaria, Current use of bed net) which have p-values <0.05 with their respective AOR and were selected as the factors associated with Malaria Disease.

By controlling all other variables constantly the likelihood of being attacked or caused by Malaria Disease was Five times higher among those whose homes have not Eave than those who have Eave, seven times higher among those who sleep or work outside home than those who do not sleep or work outside home. In addition, the result also shows malaria Disease is six times higher among those who do not hear Educational Information about malaria disease than those who can hear and four times higher among those who do not use bed net than those who use bed net.

Table 5: Binary and multivariate analysis of factors associated with malaria disease in Tahtay Adyabo Woreda North West of Tigrai Regional State, northern Ethiopia in 2020 G.C.

S.N	Variables	Category	COR(95%CI)	p-value	AOR(95%CI)	P-value
1	Gender	Male	1			
		Female	0.480(0.2-1.10)	0.083	0.32(0.10-0.95)	0.041
2	Eave	Yes	1		1	
		No	3.1(1.3-7.4)	0.010	5.4(1.7-17.3)	**0.004**
3	Holes in the Wall	Yes	1		1	
		No	2.9(1.2-6.9)	0.015	0.83(0.25-2.73)	0.769
4	Sleeping or Working outside home at night	Yes	1		1	
		No	3(1.2-7.8)	0.017	7(2.1-23.2)	**0.001**
5	Hearing of Educational Information about Malaria	Yes	1		1	
		No	3.9(1.3-11.5)	0.011	6(1.5-24)	**0.010**
6	ITN present in your home	Yes	1		1	
		No	2.8(1.2-6.5)	0.017	1.5(0.524.6)	0.428
7	Current use of bed net	Yes	1		1	
		No	2.7(1.1-6.6)	0.023	4.8(1.5-15.3)	**0.008**
8	Chemical spray in the past 12 months	Yes	1		1	
		No	3.3(1.4-7.86)	0.006	2.5(0.87-7.1)	0.086

5. DISCUSSIONS

This research was conducted to determine the malaria prevalence disease and its associated risk factors in Tahtay Adiabo Woreda, northwestern Tigrai Regional State, and northern Ethiopia, based on information obtained from a three-year recorded malaria clinical sample from seven different health centers. A total of 87,612 confirmed malaria cases with an annual slide positivity rate of 17.8% (15,558) were recorded in seven health centers. The present findings are comparable to other research projects carried out in Ethiopia, like Dangla Health Center, 16.6% (Belew, 2017), Dilla, 16% (Molla & Ayelle, 2015), and Aresi Negelle, 11.4% (Hailemariam et al., 2018). Equally, this result is greater than that of comparable studies conducted in Jimma Town (6.3%; Shifaraw, 1994) and Suhul Shire Hospital (6.96%) (Berhe et al., 2019). It was, however, less than the results (51.04%) from the Guba district in the Benishangul Gumuz Regional State in western Ethiopia (Alkadir et al., 2020). This may be caused by variations in the areas that are most suitable for Anopheles vector breeding, primarily in terms of altitude and climate.

P. vivax and *P*. falciparum were both found in the region; *P*. falciparum (78.7%) was the most common species in all health centers, which is consistent with the general nationwide paradigm for the composition of plasmodium species in Ethiopia, which states that *P*. falciparum makes up roughly 60% of *P*. vivax and 40% of *P*. falciparum (FMOH 2004). The study found that malaria affected men (61.38%) more often than it did women (38.62%). This was consistent with other findings from other locations in Ethiopia and other places, including Dangila Health Centre (64%) and Suhul Shire Hospital (68.4%) (Berhe et al., 2019). (Belew et.al 2017). Males may have a higher prevalence rate because they are more likely to be outside during the peak mosquito-biting hours of exophilic Anopheles mosquito vectors, which fall between dusk and dawn. Additionally, this study demonstrated that although malaria is prevalent across all age groups, its prevalence was highest in those aged 15 to 65. These results are consistent with research conducted in the Aysaita woreda Afar region (Binyam, 2018) and Tselemti woreda Tigri (Meresa, et al., 2016). This may be the result of the fact that individuals in this age range work in agriculture, which may need them to spend time outside when mosquito bite activity is at its highest to support their families. Additionally, they would rather give mosquito nets to family members, especially to expectant mothers and children, to protect their well-being.

6. CONCLUSION AND RECOMMENDATIONS

6.1. Conclusions

In summary, Tahtay Adiabo Woreda hospital admissions and outpatient visits are still primarily caused by malaria, as evidenced by the study's results. Although both malaria parasites are found in the region, *P*. falciparum is the most common parasite found in malaria patients. Both sexes and all age groups reported cases of malaria; however, the incidence was highest in the 15–65 age range. More men than women were impacted. The results also showed that residing in mud-plastered homes, working or sleeping outside the house, incorrectly using malaria nets, and having standing water nearby were some of the main risk factors for malaria in the research area.

6.2. Recommendations

Based on the major findings of this study, the following points have been recommended:

- It is necessary to raise people's awareness of diseases. Health education should be incorporated into the community through official education in the school curriculum, various media, and community-based organizations since education is a powerful tool for transforming ideas.
- Given that the study area's active age categories had a very high malaria infection rate, special attention is imperative for those over the age of 15.
- When compared to other malaria parasite studies, Plasmodium falciparum was found to be the most common parasite and to have a highly detrimental effect on community wealth and health.
- Houses and their surroundings should be maintained tidy: waste materials should be disposed of appropriately, weeds should be removed frequently, and standing water in gutters and cans should be kept dried.
- Government agencies and other relevant bodies ought to supply mosquito nets and put policies in place to help children afflicted with malaria.
- To prevent and control the various consequences of malaria, especially during transmission, more research on the disease's prevalence should be conducted.

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APPENDICES

Appendix A: Questionnaire

Title of the study: The prevalence of malaria and associated risk factors in Tahtay Adiabo Wereda, Tigrai regional state, northern Ethiopia.

Principal Investigator: Gebremedhin Hailemariam

Name of organization: Addis Ababa University, Collage of Natural and Compuational Sciences, Department of Zoological Sciences.

Introduction: Hello, how are you? We are doing a research on the The prevalence of malaria and associated risk factors in Tahtay Adiabo wereda, Tigrai regional state, northern Ethiopia. You are cordially invited to participate in a research study undertaken by MSc student, from Addis Ababa University. Please read or listen as the investigator reads this text to you and take your time to decide and to participate in this study.

Purpose of the study: The main purpose of this questionnaire is to know and determine malaria prevalence and associated risk factors in Tahtay Adiabo Wereda, northern Ethiopia. Hence, you are kindly requested to give your genuine responses. The response from you will have a great value up on the success of this research. Your participation in the study is absolutely voluntary and your decision not to participate or to withdraw from the study will not affect the care you will receive at the clinic in any way. Even if you do agree to become a study participant, you can withdraw from the study at any time. In addition, all personal information you give will be kept confidential.

Part I: Socio demographic characteristics of respondents

S/N^{o}	Questions	Alternatives	Skip
1	Gender:	Male	
		Fmale	
2	How old are you?	--------Years	
3	What is your current marital status?	1.single	
		2. Married	
		3. Divorced	
		4. Widowed	
4	What is your Educational status?	1. Cannot read and write	
		2. Primary School	
		3. Secondary school	
		4. Diploma and above	
5	What is your occupation?	1.Government employee	
		2. Farmer	
		3. Merchant	
		4. House wife	
		5.Other specify_____	
6	What is your household family size (permanently live)?	_____	

Part ll: House conditions and environment

S/No	Questions	Alternatives	Skip
1	Housing type	Mud plastered	
		Stone wall	
		Break walls	
	Is eave present?	1. Yes	
		2. No	
2	Is there any hole present in the wall?	1. Yes	
		2. No	
4.	What kind of water body exists in your neighborhood? (you can give more than one answer)	1. River	
		2. Lake	
		3. Pond	
		4. Swamp	
		5. Stagnant water	
		6. None	
		7. Other specify _____	
5	How far (in meter) is the nearest water body located from your house?	_____meters	
6	Do you sleep or work outside your home overnight?	1. Yes	
		2. No	
7	Have heard any education messages concerning to malaria from any source?	1. Yes	
		2. No	
8	Have you ever contracted malaria?	1. Yes	
		2. No	
9	Have your family members ever contracted malaria?	1. Yes	
		2. No	

Part III. Mosquito Nets and Insecticide Spraying

S/No	Questions	Alternatives	Skip
1.	Which type of bed net available in your house?	1. Untreated Net	
		2. Locally Treated Net	
		3. Long-Lasting Insecticide Treated Net	
		4. Don't know	
2.	Is there insecticide treated bed net (ITN) in the house?	1. Yes,	
		2. No	
3.	If No for Q1, what is the reason for unavailability of ITNs?	1. Not given at all	
		2.Lost/stolen	
		3. Used for other purposes	
		4. Old; then thrown away	
		5. Other specify _____	
4.	If yes for 01, how many mosquito nets does your household have?	_____ITN	
5.	Where do you obtain the bed net?	1. From health center free	
		2. From market /shop	
		3. From NGO	
		4.Other specify_____	
6.	Do you use bed net currently?	1. Yes	
		2. No	
7.	If No for Q6??, Reasons for not using the available ITNs	1. Nets do not prevent malaria	
		2. Afraid of its toxicity	
		3. No malaria	
		4. Other specify _____	
8.	How often do you or your child sleep under bed nets?	1. Daily	
		2. Occasionally	

		3. During rainy season	
		4. Once a week	
		5.Other specify_____	
9.	Has anyone sprayed the interior walls of your dwelling against mosquitoes in the past 12 months?	1. Yes	
		2. No	
10.	If yes for Q9?, How many months ago was the house sprayed against mosquitoes?	_____ months ago	

Thank you for your cooperation!

ኣዲስኣበባዩኒቨርስቲ

ፕሮግራምድሕረምረቓ

ክፍሊትምህርቲዚኦሎጅካልሳይነስ

ርእሲመፅናዕቲ፡- ዝርግሐዓሶቀንዲጠንቅታትዓሶንኣብወረዳታሕታይኣድያቦ - ክልልትግራይ - ሰሜንኢ/ያ

ፕሪንስፕልኢንቨስቲጌተር፡-ገ/መድህንሃ/ማርያም

ዝኽበርኩምንዝኽበርክንንኣብወረዳታሕታይኣድያቦኣብኩነታትዝርግሐዓሶንቀንዲጠንቅታቱንመፅናዕቲየካይድስለዘለ ኹነዚዝስዕብቃለ-መሕትት /ሕቶታት/ ብጥንቃቐንክትምልሱለይብትሕትናእሓትት፡፡

ክፍሊሓደ፡- ማሕበራዊኩነታት

ሪ.ጋ	ሕቶታት	መማረፂ	ኣብዝሓረኻዮመልሲምልክትግበር/ሪ
1	ፆታ	1. ተባዕታይ	
		2. ኣንስታይ	
2	ክንደይዓመትካ	---------- ዓመት	
3	ህዚዘለኻዮ/የኩነታትሓዳር	1. ዘእተወ/ት	
		2. ዘየእተወ/ት	
		3. ዝፈተሐ/ት	
		4. ማእምን	
4	ኩነታትትምህርቲ	1. ምዕሓፍንምንባብንዘይኽእል/ል	
		2. ቀዳማይብርኪ	
		3. ካልኣይብርኪ	
		4. ዲፕሎማንልዕሊኡን	
5	ኩነታትስራሕ	1. መንግስቲሰራሕተኛ	
		2. ሓረስታይ	
		3. ነጋዳይ/ት	
		4. ናይግዛሰራሕተኛ	
		5. ካሊእግለፆ/ፅዮ	
6	በዝሒስድራ (ብቀዋሚምሳኻ/ኺዝነብሩ)	----------	

ክፍሊክልተ፡- ኩነታትከባቢኹምንመንበሪገዛኽምን

ሪ.ን	ሕቶታት	መማረሂ	ኣብዝሓረኻዮመልሲም ልክትግበር/ሪ
1	ዓይነትኣሰራርሓገዛኽም	1. ካብሞድቃዝተሰርሐ	
		2. ብእምኒዝተነደቐ	
		3. ዝነቐዐመንደቐ	
2	ገዛኽምቀዝቀዝኣለዎዶ?	1. እወ	
		2. ኣይፋል	
3	ኣብመንደቐገዛኽምነኳላትኣሎዶ?	1. እወ	
		2. ኣይፋል	
4	ኣብጥቓገዛኽምእንታይዓይነትማያዊኣካልኣሎ ?	1. ሩባ	
		2. ቃላይ	
		3. ራህያ/ኩሬ/	
		4. ጀቐጀቐ	
		5. ዘይንቀሳቀስ /ዝረግኣማይ/	
		6. ምንምየለን	
		7. ካሊእእንተሃልዩግለ ፆ/ፅዮ	
5	እቲናብገዛኽምዝቐረበማያዊኣካልካብገዛኽምክንደይ ሜትሮርሒቁይርከብ?	----------ሜትሮ	
6	ለይቲካብገዛኻወፃኢትድቅስ/ሲወይትሰሐ/ሒዲኻ/ኺ?	እወ	
		ኣይፋል	
7	ካብዝኾነይኹንፍልፍልሓበሬታብዘዓባዓሶትምህርታዊ መልእኽቲረኺብካ/ኪትፈልጥ/ጢዶ?	እወ	
		ኣይፋል	
8	ዓሶሒዘካ/ኪይፈልጥዶ?	እወ	
		ኣይፋል	
9	ካብቤተሰብካ/ኪዓሶሒዝዎዝፈልጥሰብኣለካ/ኪዶ?	እወ	
		ኣይፋል	

ክፍሊሰለስተ፡- ብዛዕባዝንዜራንምንያግፀረባዕልን

ሪ.ን	ሕቶታት	መማረፂ	ኣብዝሓረኻዮመል ሲምልክትግበር/ሪ
1	ኣብገዛኻ/ኺኣየናይዓይነትናይዓራትዛንዜራይርከብ?	1. ከሚካልዘይተኣልኸዛንዜራ	
		2. ኣብውሽጢዓዲብኬሚካልዝተኣልኸዛንዜራ	
		3. ናይነዊሕግዘብፀረባልዕኬሚካልዝተኣልኸዛንዜራ	
		4. ዝፈልጦነገርየብለይን	
2	ኣብገዛኻ/ኺብፀረባልዕኬሚካልዝተኣልኸናይዓራትዛንዜራኣሎዶ?	1. እወ	
		2. የለን	
3	ንሕቶቁፅሪ 2 መልስኻ/ኺየለንእንተኮይኑንዘይምህላዉምኸንያትእንታይእዩ?	1. ተዋሂቡናኣይፈልጥን	
		2. ጠፊኡ /ተሰሪቑ/	
		3. ንኻልእዕላማስለዝተጠቐምኩሉ	
		4. ኣሪጉደብርየዮ	
		5. ካሊእምኸንያትግለያ/ፅዮ	
4	ንሕቶቁፅሪ 2 መልስኻ/ኺእወእንተኾይኑኣብገዛክንደይመከላኸሊጣንጡዛንዜራኣለካ/ኪ ?	---------- ዛንዜራ	
5	ናይዓራትዛንዜራካበይትረክብ/ቢ?	1. ካብጥፅናማእኸላትብነፃ	
		2. ካብፅዳጋ /ድንኳን/	
		3. ካብዘይመንግስታዊትካላት /NGO/	
		4. ካብካሊእ /ግለያ/ፅዮ/	
6	ህዚኣብመደቀሲኻ/ኺዛንዜራትጥቀም/ሚዶ?	እወ	
		ኣይፋል	
7	ንሕቶቁፅሪ 6 መልስኻ/ኺኣይፋልእንተኮይኑምኸንያትካ/ኪእንታይእዩ?	1. ዛንዜራካብዓሶስለዘይከላኸል	
		2. መርዝነቱስለዝፈራሕኹ	
		3. ዓሶስለዘየለ	
		4. ካሊእምኸንያትእንተሃልዩኻ/ኺግለያ /ፅዮ	
8	ክንደይዝኣክልግዜንስካ/ኪወይደቅኹምኣብዛንዜራዘለዎመደቀሲትድቅሱ?	1. መዓልታዊ /ኪሉግዜ/	
		2. ሳሕቲ /ሓሓሊፈ/	
		3. ዝናብእንትህሉ	
		4. ኣብሰሙንሓደግዜ	
		5. ካሊእግለያ/ፅዮ	
9	ኣብዝሓለፈ 12 ወርሒውሽጢመንደቕመንበሪገዛኻኹምፀረ-ጣንጡዝነፀገልኩምኣካልኣሎዶ?	1. እወ	
		2. ኣይፋል	
10	ንሕቶቁፅሪ 9 መልስኹምእወእንተኾይኑቅድሚክንደይወርሒተነፂጉ /ተረፋድዩ/?	ቅድሚ ..... ወርሒ	

ንምትሕብባርኹምየመስግን!!

Addis Ababa University

POSTGRADUATE PROGRAM

Department of Zoological Science

Appendix B: Three years Recorded Malaria Clinical Samples of the Study Area

Disease Registration - Tahtay Adyabo

WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**686**	**5520**	**6045**	**12251**
Male, < 1 year	3	62	50	115
Male, 1 - 4 years	62	417	482	961
Male, 5 - 14 years	98	1042	1229	2369
Male, 15 - 29 years	158	1156	1124	2438
Male, 30 - 64 years	88	726	785	1599
Male, >=65 yr	7	62	79	148
Female, < 1 year	13	35	33	81
Female, 1 - 4 years	49	310	368	727
Female, 5 - 14 years	78	728	793	1599
Female, 15 - 29 years	62	525	570	1157
Female, 30 - 64 years	64	423	487	974
Female, >=65 yr	4	34	45	83
B50-200 Malaria (Plasmodium vivax malaria)	**205**	**1589**	**1513**	**3307**
Male, < 1 year	10	11	16	37
Male, 1 - 4 years	15	150	144	309
Male, 5 - 14 years	41	307	279	627
Male, 15 - 29 years	31	296	314	641
Male, 30 - 64 years	22	129	120	271
Male, >=65 yr	1	15	19	35
Female, < 1 year	7	20	15	42
Female, 1 - 4 years	14	137	124	275
Female, 5 - 14 years	36	251	222	509
Female, 15 - 29 years	17	121	136	274
Female, 30 - 64 years	11	139	120	270
Female, >=65 yr	0	13	4	17
Total number of slides or RDT performed for malaria diagnosis	6716	45070	35826	87612

Disease Registration - Tahtay Adyabo(Badme) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**162**	**1022**	**1124**	**2308**
Male, < 1 year	1	11	9	21
Male, 1 - 4 years	14	77	90	137
Male, 5 - 14 years	23	193	228	444
Male, 15 - 29 years	37	214	209	460
Male, 30 - 64 years	20	134	146	300
Male, >=65 yr	2	11	15	28
Female, < 1 year	3	7	7	17
Female, 1 - 4 years	12	57	68	137
Female, 5 - 14 years	18	136	147	301
Female, 15 - 29 years	15	97	106	218
Female, 30 - 64 years	15	78	90	183
Female, >=65 yr	2	7	9	18
B50-200 Malaria (Plasmodium vivax malaria)	**48**	**288**	**281**	**617**
Male, < 1 year	2	2	4	8
Male, 1 - 4 years	3	27	27	57
Male, 5 - 14 years	10	56	52	118
Male, 15 - 29 years	7	54	58	119
Male, 30 - 64 years	5	23	22	50
Male, >=65 yr	1	3	3	7
Female, < 1 year	2	4	3	8
Female, 1 - 4 years	3	25	23	51
Female, 5 - 14 years	8	45	41	94
Female, 15 - 29 years	4	23	25	52
Female, 30 - 64 years	3	24	22	49
Female, >=65 yr	0	2	1	3
Total number of slides or RDT performed for malaria diagnosis	1208	7210	6212	14630

Disease Registration - Tahtay Adyabo(Zban gedena) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**125**	**1030**	**1109**	**2264**
Male, < 1 year	11	12	9	32
Male, 1 - 4 years	11	78	88	177
Male, 5 - 14 years	18	194	227	439
Male, 15 - 29 years	29	216	206	451
Male, 30 - 64 years	16	135	144	295
Male, >=65 yr	1	12	14	27
Female, < 1 year	2	7	6	15
Female, 1 - 4 years	9	58	67	134
Female, 5 - 14 years	14	136	245	395
Female, 15 - 29 years	11	98	105	214
Female, 30 - 64 years	12	79	90	181
Female, >=65 yr	1	5	8	14
B50-200 Malaria (Plasmodium vivax malaria)	**37**	**291**	**277**	**605**
Male, < 1 year	2	2	6	10
Male, 1 - 4 years	3	27	26	56
Male, 5 - 14 years	7	56	51	114
Male, 15 - 29 years	6	54	57	117
Male, 30 - 64 years	4	24	22	50
Male, >=65 yr	1	3	3	7
Female, < 1 year	1	4	3	8
Female, 1 - 4 years	2	25	23	50
Female, 5 - 14 years	6	46	41	93
Female, 15 - 29 years	3	23	25	51
Female, 30 - 64 years	2	25	22	49
Female, >=65 yr	0	2	1	3
Total number of slides or RDT performed for malaria diagnosis	1195	8021	6024	15240

Disease Registration - Tahtay Adyabo(Mykuhuli) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**115**	**963**	**1134**	**2212**
Male, < 1 year	2	11	10	23
Male, 1 - 4 years	10	73	90	173
Male, 5 - 14 years	16	185	230	431
Male, 15 - 29 years	26	201	211	438
Male, 30 - 64 years	15	127	147	289
Male, >=65 yr	1	11	15	27
Female, < 1 year	2	6	6	14
Female, 1 - 4 years	6	54	70	130
Female, 5 - 14 years	13	127	147	287
Female, 15 - 29 years	12	91	107	211
Female, 30 - 64 years	11	74	92	177
Female, >=65 yr	1	6	9	16
B50-200 Malaria (Plasmodium vivax malaria)	**36**	**272**	**284**	**592**
Male, < 1 year	2	2	3	7
Male, 1 - 4 years	3	26	27	56
Male, 5 - 14 years	7	52	52	111
Male, 15 - 29 years	5	51	59	115
Male, 30 - 64 years	4	22	23	49
Male, >=65 yr	1	2	3	6
Female, < 1 year	1	3	4	8
Female, 1 - 4 years	5	24	23	55
Female, 5 - 14 years	6	43	42	91
Female, 15 - 29 years	3	21	25	49
Female, 30 - 64 years	2	24	22	48
Female, >=65 yr	0	2	1	3
Total number of slides or RDT performed for malaria diagnosis	1183	6830	5403	13416

Disease Registration - Tahtay Adyabo(Gemhalo) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**105**	**958**	**931**	**2212**
Male, < 1 year	2	11	8	21
Male, 1 - 4 years	9	72	74	155
Male, 5 - 14 years	15	181	189	385
Male, 15 - 29 years	24	201	173	398
Male, 30 - 64 years	14	126	121	261
Male, >=65 yr	1	11	12	24
Female, < 1 year	2	6	5	13
Female, 1 - 4 years	7	54	57	118
Female, 5 - 14 years	12	126	122	260
Female, 15 - 29 years	9	91	88	188
Female, 30 - 64 years	10	73	75	155
Female, >=65 yr	1	6	7	14
B50-200 Malaria (Plasmodium vivax malaria)	**32**	**270**	**233**	**535**
Male, < 1 year	1	2	2	5
Male, 1 - 4 years	2	25	22	49
Male, 5 - 14 years	6	51	44	101
Male, 15 - 29 years	5	50	48	103
Male, 30 - 64 years	3	22	18	43
Male, >=65 yr	0	2	3	5
Female, < 1 year	1	8	2	11
Female, 1 - 4 years	2	23	19	44
Female, 5 - 14 years	6	43	34	83
Female, 15 - 29 years	4	20	25	49
Female, 30 - 64 years	2	23	18	43
Female, >=65 yr	0	2	1	3
Total number of slides or RDT performed for malaria diagnosis	1106	6732	5360	13198

Disease Registration - Tahtay Adyabo(Ademiti) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**89**	**936**	**770**	**1795**
Male, < 1 year	0	18	6	14
Male, 1 - 4 years	9	78	61	148
Male, 5 - 14 years	13	184	156	353
Male, 15 - 29 years	20	203	143	366
Male, 30 - 64 years	11	130	100	241
Male, >=65 yr	1	18	10	29
Female, < 1 year	2	14	4	20
Female, 1 - 4 years	6	61	47	114
Female, 5 - 14 years	10	130	101	241
Female, 15 - 29 years	8	8	74	90
Female, 30 - 64 years	8	79	62	149
Female, >=65 yr	1	13	6	20
B50-200 Malaria (Plasmodium vivax malaria)	**26**	**270**	**193**	**489**
Male, < 1 year	1	5	2	8
Male, 1 - 4 years	2	25	18	45
Male, 5 - 14 years	5	53	36	94
Male, 15 - 29 years	4	50	40	94
Male, 30 - 64 years	3	22	18	43
Male, >=65 yr	1	2	2	5
Female, < 1 year	1	4	2	7
Female, 1 - 4 years	2	23	16	41
Female, 5 - 14 years	4	43	28	75
Female, 15 - 29 years	2	20	18	40
Female, 30 - 64 years	1	27	15	43
Female, >=65 yr	0	2	1	3
Total number of slides or RDT performed for malaria diagnosis	975	6753	5284	13012

Disease Registration - Tahtay Adyabo(Adi Awalla) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**31**	**188**	**57**	**276**
Male, < 1 year	0	2	5	7
Male, 1 - 4 years	3	14	4	21
Male, 5 - 14 years	4	35	11	50
Male, 15 - 29 years	7	39	10	56
Male, 30 - 64 years	4	25	7	36
Male, >=65 yr	1	3	1	5
Female, < 1 year	1	2	2	5
Female, 1 - 4 years	2	10	3	15
Female, 5 - 14 years	3	25	7	35
Female, 15 - 29 years	3	18	5	26
Female, 30 - 64 years	3	14	4	21
Female, >=65 yr	0	1	1	2
B50-200 Malaria (Plasmodium vivax malaria)	**9**	**66**	**15**	**90**
Male, < 1 year	0	2	0	2
Male, 1 - 4 years	1	6	1	8
Male, 5 - 14 years	2	13	3	18
Male, 15 - 29 years	1	12	3	16
Male, 30 - 64 years	1	5	1	7
Male, >=65 yr	0	2	0	2
Female, < 1 year	0	2	2	4
Female, 1 - 4 years	1	6	1	8
Female, 5 - 14 years	2	10	2	14
Female, 15 - 29 years	1	5	1	7
Female, 30 - 64 years	0	6	1	7
Female, >=65 yr	0	1	0	1
Total number of slides or RDT performed for malaria diagnosis	434	3199	2449	6082

Disease Registration - Tahtay Adyabo(Adi hageray) WorHO - Outcome=Morbidity

Disease	2010	2011	2012	Total
B50-196 Malaria (Plasmodium falciparum malaria)	**59**	**428**	**920**	**1407**
Male, < 1 year	1	5	8	14
Male, 1 - 4 years	5	32	73	108
Male, 5 - 14 years	8	81	187	276
Male, 15 - 29 years	13	89	171	273
Male, 30 - 64 years	7	56	119	182
Male, >=65 yr	1	5	12	18
Female, < 1 year	1	3	5	9
Female, 1 - 4 years	4	24	56	84
Female, 5 - 14 years	7	56	121	184
Female, 15 - 29 years	5	41	87	133
Female, 30 - 64 years	6	33	74	113
Female, >=65 yr	1	3	7	11
B50-200 Malaria (Plasmodium vivax malaria)	**17**	**127**	**230**	**377**
Male, < 1 year	1	1	2	4
Male, 1 - 4 years	1	12	22	35
Male, 5 - 14 years	3	24	42	65
Male, 15 - 29 years	3	24	48	75
Male, 30 - 64 years	2	10	18	30
Male, >=65 yr	0	1	1	2
Female, < 1 year	1	2	1	4
Female, 1 - 4 years	1	11	21	33
Female, 5 - 14 years	3	20	34	57
Female, 15 - 29 years	1	10	21	32
Female, 30 - 64 years	1	11	18	30
Female, >=65 yr	0	1	1	2
Total number of slides or RDT performed for malaria diagnosis	615	6325	5094	12034






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health promotion and diseases prevention case. team
ቢሮ ማናጀር 2
office manager
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development planning case. team
ክይዲ ስራሕ ምሕካምን ክንክንን ኬዝ-ቲም 6
curative and rehabilitative service case. team
ኮልድ ቼይን 7
cold chain
ፋርማሲ ስቶር 8
pharmancy store


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cold chain
ፋርማሲ ስቶር 8
pharmancy store