



**Prevalence of Malaria among Patients Attending Wolkite Health Center, South-Central Ethiopia**

**By:  
DegifieBereka**

**A Thesis Submitted to the School of Graduate Studies of Addis Ababa University in  
Partial Fulfillment of the Requirements for the Degree of Master of Science in  
Biology**

**Supervisor: HassenMamo (PhD)**

**Addis Ababa, Ethiopia  
September, 2017**

## **Acknowledgement**

Primarily, my deepest gratitude goes to my advisor Dr. Hassen Mamo (PhD) for their unserved guidance and encouragement on every stage of this thesis work. I appreciate for their nice approach, constructive comments, willingness to share experience and smooth treatments.

Next, my special thank goes to Wolkite Health Office and Wolkite Health Center for providing me the necessary information, allowing the laboratory facilities and technical supports. I am very grateful to all those who directly or indirectly involved in my thesis work specially Wolkite health center laboratory technicians.

I would like to thank all those who are directly or indirectly involved in my thesis work including my wife Rewda Adem and my daughters Fayza and Hayat for their continuous encouragement of my study.

Study participants are deeply acknowledged for their willingness to participate in the study without them the study would not have been succeeded.

Finally, my thanks goes to the almighty Allah, who did all this things possible.

## Acronyms

ACT	Artemisinin-Combination Therapies
AIDS	Acquired Immuno Deficiency Syndrome
DDT	Dichloro Dipheny Trichloro Ethane
DHS	Demographic Health Surveys
DSS	Demographic Surveillance Site
FMoH	Federal Ministry of Health
FY	Fiscal year
HAD	Health Development Army
HEW	Health Extension Workers
HIV	Human Immunodeficiency Virus
IRS	Indoor Residual Spraying
ITN	Insecticide Treated Nets
LLIN	Long Lasting Insecticide Nets
MCP	Malaria Control Programme
NMSP	National Malaria Strategic Plan
PMI	Presidents Malaria Initiatives
SNNPRS	Southern Nations, Nationalities and Peoples Regional State
SSA	Sub-Saharan Africa
WHO	World Health Organization

# Table of Contents

<b>Contents</b>	<b>Pages</b>
Acknowledgement.....	I
Acronyms .....	II
Table of Contents .....	III
List of Tables.....	V
List of Figures .....	VI
Abstract .....	VII
1. Introduction .....	1
1.1 Global Malaria Burden.....	1
1.2 Etiology and Transmission of Malaria .....	1
1.3 Malaria Diagnosis and Treatment .....	2
1.4 Malaria in Ethiopia.....	4
1.4.1 Health Burden and Epidemiology .....	4
1.4.2 Malaria Control in Ethiopia.....	5
1.5 Malaria in Gurage Zone.....	6
2. Objectives.....	8
2.1 General Objective.....	8
2.2. Specific Objectives.....	8
3. Materials and Methods .....	9
3.1 Study Area.....	9
3.2 Study Design and Population .....	9
3.3 Blood Sample Collection and Analysis.....	10
3.4 Ethics.....	10

4. Result.....	11
4.1 Retrospective Malaria Prevalence .....	11
4.2 Current Cross-Sectional Malaria Prevalence.....	12
5. Discussion .....	15
6. Conclusion and Recommendations .....	16
6.1 Conclusion.....	16
6.2 Recommendation.....	16
References .....	18

## List of Tables

	Pages
Table 1: The total number of slide-confirmed annual malaria cases (2012-2017) at Wolkite health center .....	11
Table 2: Seasonal pattern of malaria suspected and slide-confirmed patients at Wolkite health center (September 2016 –January 2017) .....	13
Table 3: Age and sex distribution of malaria slide-confirmed cases at Wolkite health center (September 2016 – January 2017) .....	14

## List of Figures

	Pages
Figure 1: Yearly profile of malaria positive patients at the Wolkite health center	12
Figure 2: Monthly profile of malaria positive patients at wolkite health center (September 2016- January 2017).....	14
Figure 3: Slide-confirmed malaria cases in the age groups .....	14

## Abstract

Following reports on decreases in malaria cases and deaths recently many countries embarked on malaria elimination and some even succeeded in doing so. Ethiopia is following suit and aims to eliminate the disease in certain localities by 2020. To meet this goal continuous evaluation of malaria-situation nationwide is necessary. This study is part of such an effort. The study assessed the current status and recent past malaria trend in Wok'ite town and its environs, south-central Ethiopia. Finger-prick blood samples were collected from malaria suspected patients visiting Wok'ite Health Center between September 2016 and January 2017 smears were prepared, Giemsa-stained and examined. Retrospective data (2012 - January 2017) in the Health Center was also extracted. Descriptive statistics was used to analyze the data. Out of 16,573 smears screened in the current cross-sectional 1272(7.8%) were positive with 446(35.0%) and 826(65.0%) of the cases attributed to *Plasmodium falciparum* and *P. vivax* respectively. All cases were mono-infections. In the past five-and-half years 32,619 malaria-slide-confirmed cases were recorded (36.02% *P. falciparum*, 63.98% *P. vivax*). Total number of febrile patients examined in the years was missing in the health record system and estimation of malaria prevalence during the target period was not possible. Malaria was rising the first two successive years and then started declining continuously. However, control measures must be upgraded and closer surveillance be in place to achieve the malaria elimination target.

**Keywords:** Malaria, *Plasmodium*, Wok'ite, Cross-sectional, Elimination

# **1. Introduction**

## **1.1 Global Malaria Burden**

According to the latest World Health Organization (WHO) estimates, released in December 2015, there were 212 million cases of malaria in 2015 and 429,000 deaths. Between 2010 and 2015, malaria incidence among populations at risk fell by 21% globally, during the same period, malaria mortality rates among population at risk decreased by 29%. An estimated 6.8 million malaria deaths have been averted globally since 2001 (WHO 2015).

The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2015, the region home to 90% of malaria cases and 92% of malaria deaths. Some 13 countries... mainly in sub-Saharan Africa... account for 76% of malaria cases and 75% deaths globally. In areas with high transmission of malaria, children under five are particularly susceptible to infection, illness and death, more than two thirds (70%) of all malaria deaths occur in this age group between 2010 and 2015, the under-five malaria death rate fell by 29% globally (WHO 2015).

## **1.2 Etiology and Transmission of Malaria**

Malaria is a serious and sometimes a fatal disease caused by a parasite that commonly infects a certain type of mosquito which feeds on humans. People who get malaria are typically very sick with high fevers, shaking, chills, and flu-like illness (Gupto et al., 2015). Four kinds of malaria parasites infect humans: *Plasmodium falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*, in addition, *P. knowlesi*, a type of malaria parasite that naturally infects macaques in Southeast Asia, also infects humans, causing malaria to human (“zoonotic” malaria, Cox-Singh et al., 2008) *P. falciparum* is the type of malaria that is most likely to result in severe infections and if not promptly treated, may lead to death. Although malaria can be a deadly disease, illness and death from malaria can usually be prevented (Darymple et al., 2015).

About 1700 cases of malaria are diagnosed in the United States each year. The vast majority of cases in the United States are in travelers and immigrants returning from parts of the world where malaria transmission occurs, including sub-Saharan Africa and South Asia.

Globally, the World Health Organization estimates that in 2015, 212 million clinical cases of malaria occurred, and 429,000 people died of malaria, most of them were children in Africa. Because malaria causes so much illness and death, the disease is a great drain on many national economies. Since many countries with malaria are already among the poorer nations, the disease maintains a vicious cycle of disease and poverty.

Usually people get malaria by being bitten by an infective female *Anopheles* mosquito. Only *Anopheles* mosquitoes can transmit malaria and they must have been infected through a previous blood meal taken from an infected person. When a mosquito bites an infected person, a small amount of blood is taken in which contains microscopic malaria parasites. About one week later, when the mosquito takes its next blood meal, these parasites mix with saliva and are injected into the person being bitten. Because the malaria parasite is found in red blood cells of an infected person, malaria can also be transmitted through blood transfusion, organ transplant or the shared use of needles or syringes contaminated with blood. Malaria may also be transmitted from a mother to her unborn infant before or during delivery (“congenital” malaria) (Guthmann et al., 2007).

### **1.3 Malaria Diagnosis and Treatment**

Diagnostic tests for malaria include standard thick and thin blood smears, rapid antigen detection tests, PCR, and antibody tests. Thick and thin blood smears remain the most widely available and used tests. Thick blood smears tests for the presence or absence of parasites, and thin blood smears allow speciation and quantification. The sensitivity and specificity of blood smears vary greatly and are influenced by many factors, such as laboratory skill, timing and quality of smear collection, and level of parasitaemia (WHO, 2010).

Rapid antigen tests differentiate between *P. falciparum* and non-falciparum infections through the detections histidine-rich proteins and/or parasite lactate dehydrogenase. These tests have shown mixed results in multiple trails, but several seem to compare favorably with blood smears when performed under laboratory conditions (WHO, 2010).

PCR tests are felt to be at least as sensitive and specific as the traditional blood smear (WHO, 2010) and can detect parasite levels of one parasite ( $\mu$ l) the use of PCR is clinically limited because the tests generally are only available from specialized government sponsored laboratories. Currently PCR is used mainly to confirm positive blood smears and is valuable in identification of malaria species particularly when the results of smears are not definitive or there is a mixed infection (Orish et al., 2016).

Antibody test is not useful in the diagnosis of acute malaria, but this test is used in two common scenarios. First, it is used when the patient is a newly arrived immigrant or refugee with tropical splenomegaly. Second, antibody test is used when the patient is a returned traveler with a history of malaria diagnosis and treatment during recent travels and serologic confirmation is desired (Vesterguard et al., 2007).

Malaria treated with anti-malarial drugs and measures to control symptoms, including medications to control fever, anti-seizure medications when needed, fluids and electrolytes. The type of medications that are used to treat malaria depends on the severity of the disease and the likelihood of chloroquine resistance. The drugs available to treat malaria include: Chloroquine, Quinine, Hydroxychloroquine, Artemether and Lumefontrine, Azovaquone, proquanil, Mefloquine, cleocin and Doxycycline (Bate et al., 2008). People with falciparum malaria have the most severe symptoms and may need to monitored in the intensive care unit of a hospital during the first days of treatment because the disease can cause breathing failure, coma and kidney failure. For pregnant women, chloroquine is the preferred treatment for malaria (Otten et al., 2009).

## **1.4 Malaria in Ethiopia**

### **1.4.1 Health Burden and Epidemiology**

Ethiopia has achieved remarkable progress in the fight against malaria during the most recent decade through strong and case management interventions with large engagement of the Health Extension Workers (HEWs) and the Health Development Army (HAD) volunteers providing community based care at the household level (Barnes et al., 2009). In children under five years of age, malaria admissions and deaths fell by 81% between 2001 and 2011 and 73% respectively. The country is also one of the sub-Saharan countries that have shown progress in the fight against malaria and in attaining the MDG6C, half and begin to reverse the incidence of malaria and other major diseases by 2015 (FMOH 2015).

WHO has been actively supporting the Federal Ministry of Health of Ethiopia (FMOH) in the fight against malaria. Among other contributions, WHO has been providing technical support in building the capacity of health of workers, programme monitoring review and evidence generation, resource mobilization, supportive supervision at all levels, as well as supporting the revision and updating of strategic documents and guidelines. FMOH and WHO have also jointly developed a new stratification map using health facility based surveillance data (WHO, 2015).

About 75% of the land and 60% of the population is exposed to malaria in Ethiopia. Ethiopia is generally considered as a low-to-moderate malaria transmission intensity country. However, the health sector in Ethiopia is greatly affected by climate change which has profound consequences on the transmission cycle of vector-borne infections diseases like malaria. Due to the unstable and seasonal transmission of malaria in the country protective immunity of the population is generally low and all age groups are at risk. Prevalence of malaria is currently estimated to be 1.8% (WHO, 2015).

Malaria is a life threatening caused by *Plasmodium* parasite infection. Malaria is the most deadly, and it predominates in Africa (Abebe TN, 2014). The problem of malaria is very severe in Ethiopia where it has been the major cause of illness and death for many years

(Aregawi et al., 2014). That is more than 50 million people are at risk from malaria (WHO, 2008), and four to five million people are affected by malaria annually (WHO, 2015).

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 (WHO, 2010) involving highland or high and fringe areas of Ethiopia mainly areas 1000-2000 meters above sea level (Darymple et al., 2015).

Malaria transmission peaks biannually from September to December and April to May, coinciding with the major harvesting seasons. This has serious consequences for Ethiopia's subsistence economy and for the nation in general. Major epidemics occur every five to eight years with focal epidemics as the commonest form (Getachew et al., 2007).

#### **1.4.2 Malaria Control in Ethiopia**

Because of problems with drug and insecticide resistance, the National Organization for the control of Malaria and Other Vectorborne Diseases, Ethiopia has embarked on a programme of research on alternative methods, including the use of biological control agents, such as larvivorous fish (Takken et al., 2009).

Insecticide resistance in Ethiopia is a concern and Ethiopia is currently updating its national resistance monitoring and management strategy (Balkew et al., 2010). The goals are to minimize insecticide selection pressure ensure vector control interventions are guided by evidence, develop and implement and national plan for insecticide resistance monitoring and management, and provided timely analysis and interpretation of data from 2014-2016, PMI supported entomological resistance monitoring of 11 (eleven) insecticides from four (4) insecticides classes in eight (8) permanent sites and mosquito behavior studies in three sites (PMI 2016). The insecticide resistance monitoring test results show that local vectors are generally resistant to dichloro diphenyl trichloroethane (DDT) and pyrethroids (Price et al., 2009).

As per the NMSP 2014-2020, the FMoH conducted a mass campaign in 2015, distributing 29.6 million long-lasting insecticidal nets (LLINs) to protect all Ethiopians living in areas with ongoing malaria transmission, representing 60% of the total population (FMoH, 2015). The Global Fund contributed the majority of the LLINs with PM supporting the remaining gap. PMI cumulatively procured over 20 million LLINs between 2008 and 2015 funds, PMI plans to procure 6.2 million LLINs for distribution to high risk communities to replace lost nets and protect new households and new household members. With FY 2017 funds PMI plans to procure an additional four (4) million LLINs for distribution as part of Ethiopia's 2018 universal coverage campaign. PMI also plans to support the development of a LLINs distribution tracking system and ensure all LLINs are reaching their intended users (PMI, 2016).

The FMoH, NMSP aims to provide 100% IRS coverage as a key malaria preventing measure in areas where malaria burden is high and in highland fringe areas with the potential for malaria outbreaks. According to the NMSPs malaria stratification, which is based upon annual parasite incidence, about 17% of the population in the country will be targeted annually for IRS (Yewhalaw et al., 2011). PMI has been implementing IRS in Ethiopia since 2008 and has supported a comprehensive range of IRS related activities, including targeting and enumeration of areas for IRS operations, improved logistical planning and support environmental compliance monitoring, entomological surveillance, and technical assistance and operational support (PMI, 2016).

The PMI supported IRS program protected between 1 million to 2.9 million people annually since its launch in 2015, PMI supported the spraying of 704,945 structures and protected 1,655,997 people from malaria in 36 districts of Oromia Region, achieving a 99.5% coverage rate with FY 2017 funding (PMI, 2016).

## **1.5 Malaria in Gurage Zone**

Gurage zone is a zone in the Ethiopian southern Nations Nationalities and Peoples Region (SNNPR). It is bordered on the southeast by Hadya and Yem special woreda, on the west, north and east by the Oromia region and on the southeast by Silte. Wolkite is the administrative city of the zone and Butajira is the largest city in this zone. According

to the 2007 national census, in 2014 its population is 3,567,377 people, of whom 256,737 are urban dwellers (SNNPR, 2015a).

In 2014/15 totally 103,152 nets were distributed out of 297,650 LLINs required and in 2015/16 out of 206,134 needed 183,202 nets were distributed with a coverage of 91% to malarious woredas and cities (SNNPR, 2015b). More recently (2017), in two woredas a total number of 5600 nets were distributed.

In the Gurage zone, there are 13 woredas and two administrative cities, out of these woredas and administrative cities, eight woredas and the two administrative cities are malarious. In general, 18% of the zone is exposed to malaria. Malaria is one of the leading public health problem in the Gurage Zone. But, little published reports are available on recent malaria impact among the various age groups and their seasonal patterns in this zone (Yimer et al., 2014).

Information on the status of malaria in a locality is crucial for monitoring malaria trend and helps better control malaria. This study was aimed at assessing malaria reported cases in Wolkite Health Center (WHC) in Wolkite town and its surroundings over the last five-and-half years (2012-2017). Also the current situation of malaria burden in the town was studied prospectively (SNNPR, 2016).

## **2. Objectives**

### **2.1 General Objective**

The general objective of the study was to investigate the prevalence of malaria at Wokite Health Center in Wolkite Town.

### **2.2. Specific Objectives**

The study has the following specific objectives. It was to:

- determine the prevalence of malaria in Wolkite Town based on retrospective data.  
determine the prevalence and yearly pattern of malaria at WHC.
- evaluate age and sex distribution of patients attend at WHC.
- assess the seasonal distribution of malaria cases in Wolkite town and at WHC,  
and
- assess *Plasmodium* species in Wolkite town and at WHC.

## **3. Materials and Methods**

### **3.1 Study Area**

This study was conducted in Wolkite town at Wolkite Health Center, which is located about 158 km southwest of Addis Ababa Wolkite Town is found between Addis Ababa and Jimma in Gurage zone in southern nation, nationalities and peoples regional state (SNNPRS) in Ethiopia. Wolkite town has three Kifle Ketemas (the smallest administrative units). More than 75,000 peoples are living in the city 51% of the population are males and 49% are females. The climatic condition of the town is Weyna Dega. The mean monthly temperature is 28-32<sup>0</sup>c. The main rainy season usually occurs from June to September. The city has one university and one health center with many private clinics and pharmacies.

According to the Wolkite town health office annual report, the most common diseases affecting the peoples of the city are typhoid fever, typhus, malaria, diarrhea, acute respiratory infections and intestinal parasites. According to the health office reports, malaria is one of the leading disease in the town and surrounding rural *kebeles*. This is due to the availability to mosquito breeding sites and comfortable climatic conditions for the survival of *Anopheles* mosquitoes.

The main preventive methods underway in the town and surrounding rural *kebeles* are diagnosis and treatment, room management and environmental management, chemical spray, protective clothing and insecticide treated bed nets.

### **3.2 Study Design and Population**

A cross-sectional survey was conducted to determine the prevalence of malaria among various age groups attending Wolkite Health Center from September 2016 to January 2017. Past six years (between 2012 and 2015) malaria trend in Wolkite town was also evaluated using retrospective data from the Wolkite Health Office.

### **3.3 Blood Sample Collection and Analysis**

Blood slides were collected from malaria suspected patients at WHC, thick and thin smears prepared, Giemsa stained malaria parasites detected and species identified. Data analyzed using the chi-squared test with  $p \leq 0.05$ .

### **3.4 Ethics**

The study was presented to and approved by Department of Zoological Sciences of Addis Ababa University and supporting letter was obtained from Wolkite Health Center. The participants were clearly informed about the nature and aim of the study and told that their participation was voluntarily. They gave written consent to take part in the study after adequate explanation about the significance of the study. Blood samples were collected by qualified laboratory technicians and malaria positive participants got appropriate treatment by the health professionals.

## 4. Result

### 4.1 Retrospective Malaria Prevalence

IRS coverage (past 5 months) in Wolkite town was 63%, but LLINs coverage was 92%.

According to the Wolkite Health Center malaria confirmed cases report, the plasmodium parasites that cause the disease malaria are *Plasmodium falciparum* and plasmodium Vivax; however, the dominant parasite is plasmodium Vivax. Among the patients who diagnosed for malaria (between September 2012- January 2017), 32,619 were slide positive. On average 5436 malaria confirmed cases visited Wolkite Health Center each year.

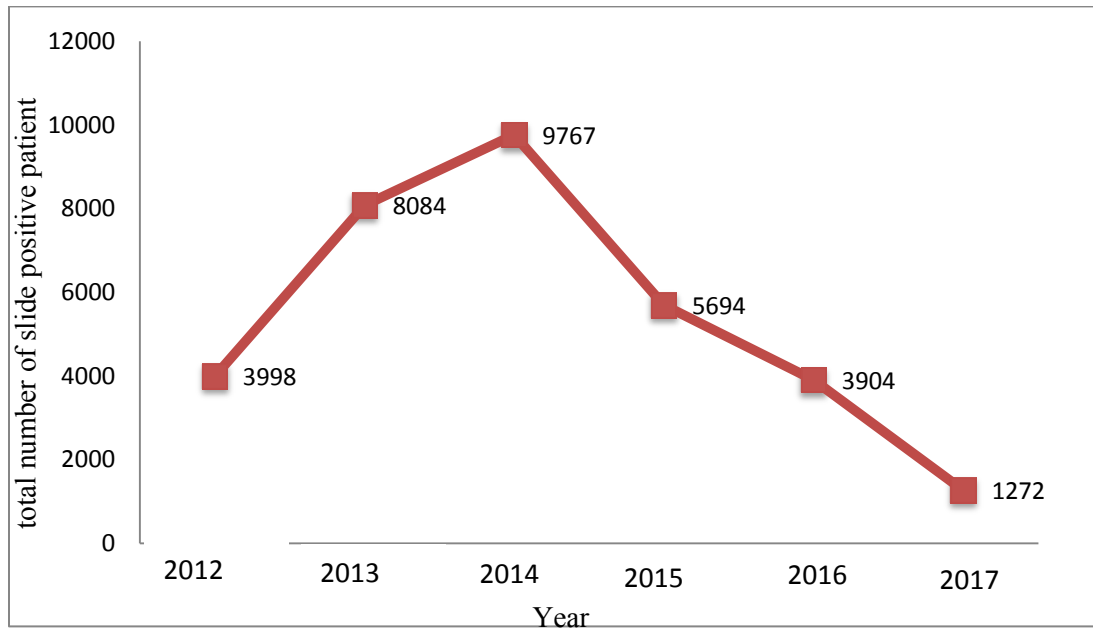
From the health center report, there was a significant increase in the number of malaria confirmed cases between 2012 and 2014, but there was a significant (a successive) reduction in malaria prevalence from 2014-2017. On the whole 11749 (36.02%) of the malaria cases were attributed to *Plasmodium falciparum* and 20,870 (63.98%) of the malaria cases were attributed to *Plasmodium vivax*.

**Table 1: The total number of slide-confirmed annual malaria cases (2012-2017) at Wolkite Health Center**

Year	Total slide-positive*	<i>P. falciparum</i> no. (%)	<i>P. vivax</i> no. (%)	P-value
2012	3998	1403 (36.0)	2495 (64.0)	0.234
2013	8084	2998 (37.1)	5086 (62.9)	
2014	9767	3501 (35.8)	6266 (64.2)	
2015	5694	1976 (34.7)	3718 (65.3)	
2016	3904	1385 (35.5)	2519 (64.5)	
2017	1272	486 (38.2)	786 (61.8)	
Overall	32619	11749 (36.02)	20870 (63.98)	

\*In the health office, the total number of males of females examined each year was not available, only slide-positive were available. So, the proportion indicated here is out of

total. It is not for the proportion of infected individuals in each sex category. Similarly age grouping was not available.



**Figure 1: Yearly profile of malaria positive patients at the Wolkite health center**

## **4.2 Current Cross-Sectional Malaria Prevalence**

According to the Wolkite town health center office report from September 2016 to January 2017, a total of 16,573 malaria suspected people diagnosed for malaria. From these people a total of 1272 (7.7%) were slide positive and on average 254 malaria confirmed cases visited the Wolkite health center each month. The average monthly malaria prevalence was 7.7%, but the number of malaria suspected people who visited the health center were fluctuate in each month (table 2). There was a significant rise in the number of confirmed malaria cases in November 2016 than the October 2016; however, there was a significant reduction in the number of malaria confirmed cases from September 2016 to January 2017.

According to the health center monthly malaria confirmed cases report, 8121 (49%) of the total examined patients were males and 8452 (51%) were females. Of the total number of malaria slide positive, 623 (7.7%) were males and 649 (7.7%) were females. The data (table 3) shows that more number of females were examined than males, but

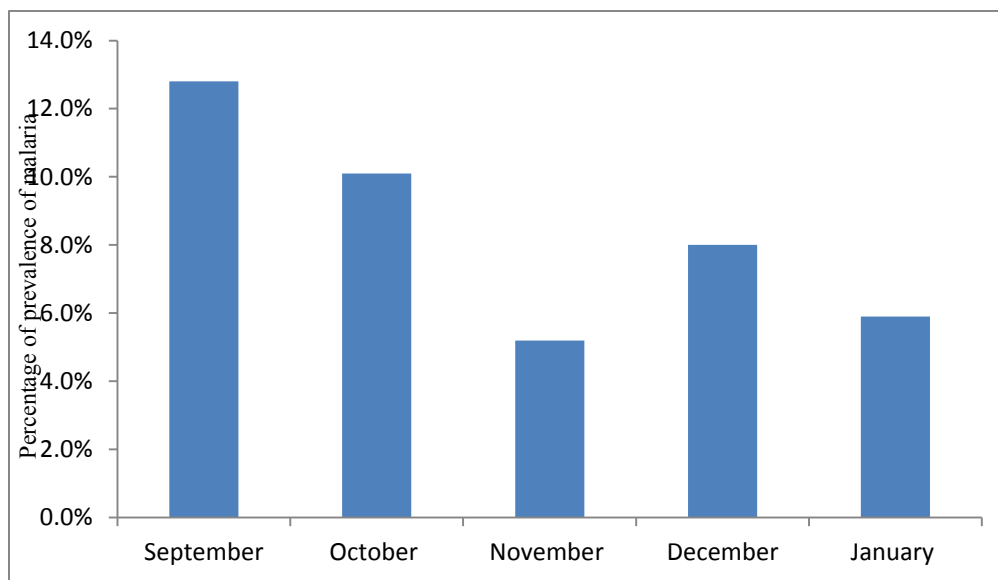
equal number of males and females found to be infected. The difference was statistically significant.

Prevalence of malaria is age groups at the Wolkite health center shows that 515 (7%) were belonged to the age groups less than 5 (five), 472 (10%) belonged to the age groups 5-20 and 285 (6.3%) belonged to the age groups greater than 20. Malaria prevalence was slightly higher in the age groups between 5 and 20 (Table 3). Prevalence of malaria was high from September to November (9.4%) and lower during the dry seasons of the year from December to January (6.95%).

**Table 2: Seasonal pattern of malaria suspected and slide-confirmed patients at Wolkite health center (September 2016 –January 2017)**

Month	Total examined	Slite-confirmed	<i>P. falciparum</i>	<i>P. vivax</i>	
September	2700	345 (12.8%)	114 (33.04%)	231 (66.96%)	
October	2100	213 (10.1%)	75 (35.2%)	138 (64.8%)	
November	5700	297 (5.2%)	104 (35.02%)	193 (64.98%)	
December	2996	239 (8.0%)	88 (36.8%)	151 (63.2%)	
January	3077	178 (5.9%)	59 (33.15%)	119 (66.85%)	
Total	16573	1272 (8.4%)	440 (34.59%)	832 (65.41%)	
			p-value	P=0.007	

- Prevalence of malaria was high from September to November (9.4%) and lower during the dry seasons of the year from December to January (6.95%).

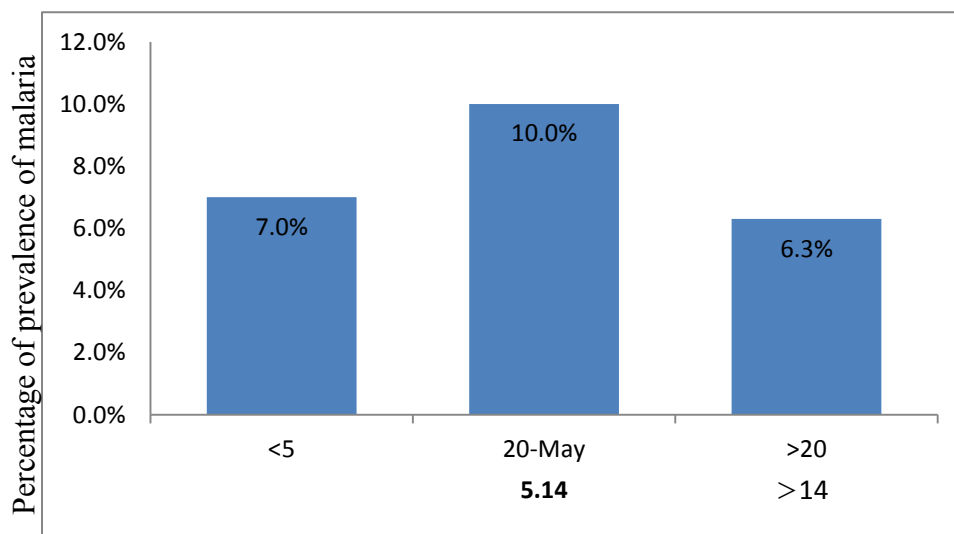


**Figure 2: Monthly profile of malaria positive patients at wolkite health center (September 2016- January 2017)**

**Table 3: Age and sex distribution of malaria slide-confirmed cases at Wolkite health center (September 2016 – January 2017)**

Sex	No. Examined	Slide-positive No. (%)	<i>P. falciparum</i> No. (%)	<i>P. vivax</i> No. (%)
Male	8121	623 (7.7%)	214 (34.3)	409 (65.7)
Female	8452	649 (7.7%)	229 (35.3)	420 (64.7)
Total	16573	1272 (7.7%)	443 (34.8)	829 (65.2)
			p-value	P=0.001
Age (year)	Examined No. (%)	Slide-positive No. (%)	<i>P. falciparum</i> No. (%)	<i>P. vivax</i> No. (%)
<5	7319 (44.2)	515 (7.0)	193(37.5)	322 (62.5)
5-14	3611 (21.79)	363(10.05)	118(32.5)	245(67.5)
>14	5643(24.15)	394(6.98%)	137(34.8)	257(65.2)
Total	16573(100)	1272 (7.8)	448 (34.93)	824(65.07)
			p-value	P=0.01

**Figure 3: Slide-confirmed malaria cases in the age groups**



- From table 3, 446 (35%) of the malaria cases were for *Plasmodium falciparum* and 826 (65%) of the malaria cases were for *Plasmodium vivax*. These shows that *Plasmodium vivax* is more prevalent than *Plasmodium falciparum* in the Wolkite town and surrounding rural kebeles.

## 5. Discussion

Wolkite town is one of the malarious area as it is found between 1600 and 1800 meter above sea level. The prevalence of malaria in this area in 2013 and 2014 were highest as compared to the other three successive years (2015-2017). This may suggest a change in climatic and environmental conditions or may be people's awareness to malaria control strategy is less. From 2014 to January 2017, there were a successive decline in malaria prevalence in the study area. This shows that an increase in people's awareness about the methods of malaria control strategy. In the study area, the plasmodium species that cause malaria are *Plasmodium falciparum* and *Plasmodium vivax*, but the dominant species is *Plasmodium vivax*. This shows that the climatic condition of Wolkite town is more favorable for the breeding of the vivax species than the falciparum species *P. falciparum* is active in dry season and *P. vivax* is more active in rainy season.

The prevalence of malaria in age groups in study area showed that a higher number of *Plasmodium* infection occurred between the age groups 5-14 (10%) compared with the others age groups (table 3). This is because most of the children at this age groups are exposed to the bite of mosquitoes. The prevalence of *Plasmodium* infection reduces in the age groups less than five (<5) because at this stage may suggest that an increase in maternal care, and there is also reduction in plasmodium infection in the age groups greater than 14 (>14) because of awareness of people how the malaria vector controlled.

According to this study, malaria slide-confirmed cases shown that the *Plasmodium* infection is more in females than in males, and the dominant infecting parasite is *Plasmodium vivax*. This is because most of the time females became pregnant (WHO 2010).

Seasonal distribution of malaria in the study area shows that prevalence of malaria is higher in September and October, and lower during the dry season of the year in December and January. Because, the transmission of malaria in Ethiopia depends on altitude and rain fall 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).

## **6. Conclusion and Recommendations**

### **6.1 Conclusion**

From the results prevalence of malaria in the Wolkite town and neighboring rural kebeles shows that in the 2013 and 2014 malaria prevalence rise for two successive years, but from 2014 to January 2017 prevalence of malaria decline for successive years, this suggest that peoples' awareness to plasmodium parasites control strategies such as using Insecticides Treated Nets (ITNs) and knowing about ways of transmission, symptoms and prevention of malaria.

In age groups from the table 2 of this study (research) peoples greater than twenty (>20) years of age have the lowest percentage (6.3%) of the infection followed by the age groups <5(7.0%) and between 5 and 20 (10%). In the study area *Plasmodium vivax* is the dominant malaria causative agent than the others *Plasmodium* parasites.

### **6.2 Recommendation**

- The regional health office should train more health workers 40 teach the society in the cities and rural areas about the causes and control of malaria.
- People wear appropriate clothing (e.g. full-length, loose-fitting and light-colored clothing with sleeves rolled down and pants-tucked into socks or boots).

- The health office should provide insecticide treated nets to those do not afford in the cities and rural areas to reduce the risk of exposure to malaria carrying mosquitoes.

## References

- Abebe TN 2014. Compiled body of works in field epidemiology. MPH Thesis. School of public health, Ethiopia field epidemiology training program, Addis Ababa University, Addis Ababa, Ethiopia.
- Alemu A, Fuehrer H-P, Getnet G, Tessema B, Noed H 2013. *Plasmodium ovale curtisi* and *Plasmodium ovale wallikeri* in North-West Ethiopia. *Malar J* 12:346.
- Balkew M, Ibrahim M, Koekemoer LL, Brooke DB, Engers W, Aseffa A, Gebre-Michael T, Elhassen I 2010. Insecticide resistance in *Anopheles arabiensis* (Diptera: Culicidae) from villages in central, northern and south west Ethiopia and detection of kdr mutation. *Parasit Vector* 3:40.
- Barnes K., Chanda P., Barnabas GA: impact of the large-scale deployment of artemether/lumefantrine on the malaria disease burden in Africa: case studies of Zambia, south Africa and Ethiopia *Malaria J*, 2009. 8 (sup 11): 58-10.
- Bate R., Coticelli P., Tren R., Attaran A: Antimalarial drug quality in the most severely malarious parts of Africa. 2008; 3: e2132-10.
- Cox-Singh J, Davis EMT, Lee KS, Shamsul SSG, Matusop A, Ratnam S, Rahman AH, Conway JD, Singh S 2008. *Plasmodium knowlesi* malaria in humans is widely distributed and potentially life-threatening. *Clin Infect Dis*; 46(2): 165-71.
- Darymple U, Mappin B, Gething PW (2015): Malaria mapping: understanding the global endemicity of falciparum and vivax malaria. *BMC Medicine* 13:140.

- FMoH (2015). Annual Performance Report 2015 (HSDP IV) for EFY 2007 (2014/15) version 1, Addis Ababa, Ethiopia.
- Getachew A., Desta A., Lemma H., Fottrell E.; Tigray malaria study group: deployment of Artemether Lumefantrine (AL) at community level and its impact on malaria specific death rate during an epidemic year [abstract], *Am trop med hyg* 2007; 77: 206 Google scholar.
- Gupta H, Afsal PM, Shetty MS, Satyamoorthy K, Umakanth S 2015. Plasmodium vivax infection causes acute respiratory distress syndrome: a case report. *J Infect Dev Ctries* 9(8):910-913.
- Gupta H, Dhunputh P, Bhatt AN, Satyamoorthy K, Umakanth S 2016. Cerebral malaria in a man with *Plasmodium vivax* mono-infection: a case report. *Tropic Doct* 46(4):241-245.
- Guthmann PJ, Bonnet M, Ahoua L, Dantoine F, Balkan S, van Herp M, Tamrat A, Legros D, Brown V, Checchi F 2007. Death Rates from Malaria Epidemics, Burundi and Ethiopia. *Emerg Infect Dis* 13(1): 140-43.
- Orish NV, Ansong YJ, Onyeabor SO, Sanyaolu OA, Oyibo AW, Iriemenam CN 2016. Over-diagnosis and over-treatment of malaria in children in a secondary healthcare centre in Sekondi-Takoradi, Ghana. *Trop Doct* 46(4):191-198.
- Otten M., Aregawi M., Were W, Karema C., Meten A, Bekele W., Jima D., Gausi K., Komativ R., Low-Beer D. Initial evidence of reduction of malaria cases and deaths in Rwanda and Ethiopia due to rapid scale-up of malaria prevention and treatment, *malar/* 2009; 8: 14-10, 1486/1475-2875-8-14. *P. central view*.

PMI 2015. President's Malaria Initiative Ethiopia Malaria Operational Plan FY 2016.

PMI 2016. President's Malaria Initiative Ethiopia Malaria Operational Plan FY 2017.

Price RN, Douglas NM, Anstey NM 2009. New developments in Plasmodium Vivax malaria: severe disease and the rise of chloroquine resistance. *Curr Opin Infect Dis* 22(5):430-5.

SNNPR 2015a. Southern Nations, Nationalities and People's Region Health Bureau Malaria Annual Report (EFY 2007), Hawassa, Ethiopia.

SNNPR 2015b. Health Bureau Second Round Health Sector Growth and Transformation Plan HSTP 2008-2012 EC, Sept 2015; Hawassa, Ethiopia.

SNNPR 2016. Health Bureau Public Health Emergency Management (PHEM) Core Process weekly PHEM bulletin Epidemiological Week 33, 2016 (09/12/08- 15/12/2008 E.C); Hawassa, Ethiopia.

Sutherland JC, Tanomsing N, Nolder D, Oguike M, Jennison C, Pukrittayakamee S, Dolecek C, Hien TT, do Rosa rio EV, Arez AP, Pinto J, Michon P, Escalante AA, Nosten F, Burke M, Lee R, Blaze M, Dan Otto T, Barnwell WJ, Pain A, Williams J, White JN, Day JPN, Snounou G, Lockhart JP, Chiodini LP, Imwong M, Polley DS 2010. Two nonrecombining sympatric forms of the human malaria parasite *Plasmodium ovale* occur globally. *J Infect Dis*. 201 (10):1544-50.

- Taken W., Knosis BG. (2009). Malaria vector control current and future strategies; Trends Parasitol 2009, 25, 101-104.
- Vesterguard LS, Ringwood PL: responding to the challenge of antimalarial drug resistance by routine monitoring to update national-malaria treatment polices, *Am Trop Med Hyg.* 2007; 77, 153-159.
- WHO (2008). World malaria report 2008 (<http://www.who.int/malaria/wm2008>).
- WHO 2010. Basic Malaria Microscopy. Part I. Learner's guide. Second edition. World Health Organization, Geneva, Switzerland.
- WHO 2015. World Malaria Report 2015. World Health Organization, Geneva, Switzerland.
- Yewhalaw D, Wassie F, Steurbaut W, Spanoghe P, Bortel VW, Denis L, Tessema AD, Getachew Y, Coosemans M, Duchateau L, Speybroeck N 2011. Multiple insecticide resistance: an impediment to insecticide-based malaria vector control program. *PLoS One* 6(1):el6066.
- Yimer F, Animut A, Erko B, Mamo H 2015. Past five-year trend, current prevalence and household knowledge, attitude and practice of malaria in Abeshge, South central Ethiopia *Malar J* 14:230.