PREVALENCE OF MALARIA AMONG PATEINTS VISITING WOLKITE HEALTH CENTER, WOLKITE, SOUTH-CENTRAL ETHIOPIA

BY: LEGESE AHMED

PAWOLOS AYAL

TADESE ADEFRS

KEDIR SHERIF

MUBAREK AMAN

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Advisors: Teha Shumbej (Ass. Prof)

Fitsum Bekele (Ass. Prof)

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ABBREVIATION

Ethiopian calendar - E.C

Indoor Residual Spaying - IRS

Insecticide treated net - ITN

Kilo Meter - KM

Ministry of Health - MOH

Plasmodium falciparum - P.f

Plasmodium vivax - P.v

Red Blood Cell - RBC

Southern Nations, Nationality and Peoples Region - SNNPR

Standard Operational Procedure - SOP

World Health Organization - WHO

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Abstract

Background: Malaria is caused by protozoan parasites that belong to the Genus *Plasmodium*, which are transmitted to human by the bite of infected female anopheles mosquito. Malaria is usually restricted to tropical and subtropical areas with climatic conditions suitable for the development of the vector and parasite. Ethiopia is one of the malaria endemic countries with an average 77% *P. falciparum* and 23% *P. vivax* prevalence during peak malaria transmission time.

Objective: To determine the prevalence of malaria among patients visiting Wolkite health center in Wolkite.

Method: Retrospective study was conducted to determine the prevalence of malaria by reviewing the malaria Registration laboratory logbook at Wolkite health center from 2016 to 2020. All the socio-demographic data, year, month and malaria data were collected using a predesigned data collection sheet from 2010 to 2012 E.C.

Result: According to retrospective data obtained from Wolkite health center from 2010 to 2012 a total of 47,193 patients were send for laboratory diagnosis suspected for malaria, 1644 (53.89%) are male and 1406(46.05) are female from the total positive cases. Prevalence of malaria in age groups shows that 139 (4.5%) are belonged to the age groups less than one (1) year, 626 (20.5%) belonged to the age groups 1-4, 738 (24.2%) belonged to the age groups 5 – 14 and 1547 (50.7%) are belonged to greater than 15. Among the patients who Diagnosed for malaria (between September 2010- August 2012 E.C), 3050(6.46%) are Positive. During all the 3 years, in season one (September to November) has the highest malaria prevalence 1509(49.47%), the second is season three (march to May)534(17.5%) the third one is season two(December to February)527(17.27%) and the last is season four (Jun to august)480(15.73%) of malaria positive cases are counted .The maximum number of confirmed malaria cases was reported in spring (September, October, and November) and the minimum was reported during summer (Jun ,July, august) seasons(table 3,figure 2).

Conclusion: from this study we reviled that malaria prevalence rise in 2012, but from 2010 to 2011 prevalence of malaria was less. Overall the prevalence of malaria were varies by age, residence and season. Therefore, malaria intervention should enhanced with stockholders.

1. INTRODUCTION

1.1 BACK GROUND

The word malaria comes from Italian word ''mal''-"aria" which means "bad air" is serious public health problem. It caused by the protozoa parasite belongs to the genus *Plasmodium* and transmitted by the bite of infected female Anopheles mosquito. Plasmodium species are transmitted by anopheles mosquitoes. It can also be transmitted by inoculation of infected blood and congenitally. Anophelines feed at night and their breeding sites are primarily in rural areas.The four species of parasite in human are *P. f, P. v, P. o,* and *P. m*. *P. f* and *P. v* accounted for more than 90% of the causes of malaria worldwide in which the former species is important as a result of fatal in its characteristics and responsible for most of malaria over all deaths (1).

When the infected anopheline mosquito takes a blood meal, sporozoites are inoculated into the bloodstream. Within an hour sporozoites enter hepatocytes and begin to divide into exoerythrocytic merozoites (tissue schizogony). For *P.V* and *P. o*, dormant forms called hypnozoites typically remain quiescent in the liver until a later time. Once merozoites leave the liver, they invade erythrocytes and develop into early trophozoites. Once the parasite begins to divide, the trophozoites are called schizonts, consisting of many daughter merozoites (blood schizogony). Eventually, the infected erythrocytes are lysed by the merozoites, which subsequently invade other erythrocytes, starting a new cycle of schizogony. The duration of each cycle in *P. falciparum* is about 48 hours. After several cycles, some of the merozoites develop into gametocytes, the sexual stage of plasmodium species, which cause no symptoms, but are infective for mosquitoes (2).

Malaria was once transmitted in many parts of the world, for example, as far north as North Dakota in the United States. Due to both environmental changes and to eradication campaigns conducted in the years after World War II, endemic malaria transmission has been eliminated from many areas, including the United States and Europe. The disease is still widely transmitted in the tropics and subtropics. In these areas malaria transmission may be endemic, occurring predictably every year, or it may be epidemic, occurring sporadically when conditions are correct. Endemic transmission of malaria may be year-round or seasonal

It remains one of the most serious global health problems and is not only the major cause of suffering and deaths, but also the cause of many socio economic problems . The greatest disease burden occurs in regions where the disease causing pathogen is continuously present in the

community, and worldwide, 81% of reported cases and 91% of deaths are estimated to occur in sub-Saharan Africa, with children and pregnant women being most severely affected (2,3).

Among the four plasmodium species known to cause malaria in Ethiopia, the two epidemiologically important species are *P. f and P. v* comprising 60% and 40% respectively. *P. f* is the cause of severe and complicated malaria which cause fatality rate of about 10% in hospitalized adults and up to 33% in children <12 years old (3).

Malaria is perhaps even more complicated in order to fight as compared to HIV or even tuberculosis because of its several distinct life-cycle development and genetic intricacy. Four species of plasmodium infects human beings. These are *P. v, P. f, P. o* and *P. m* (4).

1.2. Statement of the problem

According to the latest world malaria report, released in November 2017,there were 216 million cases of malaria in 2016 ,up from 211million cases in 2015.The estimated number of malaria deaths stood at 445000 in 2016 ,a similar number to the previous year (446000).The WHO African Region continues to carry a disproportionately high share of the global malaria burden .In 2016 ,The region was home to 90% of malaria cases and 91% of malaria deaths.Some 15 countries -all in sub- Saharan African ,except India -accounted for 80% of the global malaria burden.(5)

Malaria is a protozoan caused by four species of parasite of the genus plasmodium. Namely: *P. f, P. v, P. m* and *P. o*. Out of the total cause of malarias globally, it is estimated that about 40% are caused by *P. f,* about 50% caused by *P. v* and 7-8 % caused by *P. m* and the rest by *P. o*. The greatest risk of malaria is therefore from dusk to dawn in rural areas. In many malaria-endemic areas, there is little or no risk in urban areas. However, urban transmission is common in some parts of the world, especially Africa (1, 6).

Although drugs are available for treatment, malaria is still considered by many to be the most important infectious disease of humans: there are approximately 200 million to 500 million new cases each year in the world, and the disease is the direct cause of 1 million to 2.5 million deaths per year (1, 2).

It is the major cause of morbidity and mortality in Ethiopia. The economic impact of malaria is very grave, as the country economy is based on agricultural and peak malaria transmission

coincides with the planting and harvesting season. This results in the economic loss due to ill health of family members of farmers that provide much needed labor for farm work. In the past, malaria has forced people to inhabit the less agriculturally productive highland (9).

In Ethiopia malaria is mainly seasonal with unstable transmission in the highland fringe areas and of relatively longer transmission duration in lowland areas, river basins and valleys. *Anopheles arabiensis* is the main malaria vector; anopheles pharoensis, anopheles funestus and anopheles nili play a role as secondary vectors (10, 11).

Malaria epidemics in Ethiopia are relatively frequent (14), involving highland or highland fringe areas, mainly 1,000 to 2,000 meters above sea level (4). Malaria transmission peaks bi-annually from September to December and April to May, coinciding with the major harvesting seasons. This seasonality has serious consequences for the subsistence economy of Ethiopia's countryside and for the nation in general. Early diagnosis and prompt treatment is one of the key strategies in controlling malaria. For areas where laboratory facilities are not available, clinical diagnosis is widely used (3, 15).

Climate changes include alternations in one or more climate variables including temperature, precipitation, wind, and sunshine (17). These changes may impact the survival, reproduction, or distribution of disease pathogens and hosts, as well as the availability and means of their transmission environment. Dealing malaria, the health effects of such impacts tend to reveal as shifts in the geographic and seasonal patterns of the diseases, and as changes in their outbreak frequency and severity (18)

Malaria is one of the main public health challenges in Ethiopia that hinder the productivity and development of the country. In 2018, Ethiopia is on track to minimize the incidence of malaria by 40% as per its 2020 malaria reduction strategy. Currently, Ethiopia is working to eliminate malaria in 2030 by extending the 2020 strategy. (29)

Therefore, to meet this goal continuous evaluation of malaria-situation nationwide is necessary. This study is part of such an effort. The study assesses the recent past malaria prevalence in Wokite town and its surrounding villages, south-central Ethiopia.

1.3. Significance of the study

Malaria is one of the major public health problems in the world, especially in sub-Saharan Africa regions, Ethiopia as a part of sub-Saharan region shares high burden of malaria and as malaria is distributed nationwide. Therefore, this study provide valuable information on the prevalence of plasmodium species in Wolkite health center, Wolkite town and surrounding villages, Gurage Zone, SNNPR health bureau and other stake holder working on malaria prevention. This study will also use as a baseline data for researcher who will conduct further study on malaria in the study area.

2. LITERATURE REVIEW

Globally, an estimated 3.3 billion people are at risk of being infected with malaria and 1.2 billion are at high risk (>1 in 1000 chance of getting malaria in a year).According to the 2014 WHO report, 198 million cases of malaria occurred globally (uncertainty range 124-283 million) and the disease led to 584 000 deaths (uncertainty range 367000-755000).

Although facts showed a decline of malaria burden, decreases in case incidence and mortality rates were slowest in countries that had the largest numbers of malaria cases and death in 2000.The global burden of mortality is dominated by sub-Saharan Africa, where an estimated 90% of all malaria deaths occur, and in children aged under 5 years, who account for 78% of all deaths (6) .

Throughout the course of human history, malaria has been remained as cause of untold morbidity and mortality. To this day, malaria is the world's notorious tropical and sub-tropical parasitic disease threatening some 2.4 billion people accounting for 40% of the world population.

In addition, with rapid means of travel, large numbers of people from non malarious areas are being exposed to infections.Malaria is the major public health problem and cause of suffer and premature death in tropical sub Saharan countries. In many endemic areas it is becoming increasingly difficult to control because of the resistance of the parasite to anti malaria drug and the assessment of the clinical symptoms, particularly diagnosis of the presence of fewer forms the basis of malaria diagnosis at the village level and also at the first referral level in many areas. However, it is very imprecise means diagnosis in and investigation conducted in tropical Africa. The reliable diagnosis of malaria whether in hospital or clinic patients become prerequisite for selecting the correct treatment and consequently for reducing malaria morbidity and mortality (7).

In Africa, the risk of death from malaria is still complex public health problem than any parts of the world. An estimated 74% of the people in Africa live in places that are highly endemic for malaria and 90% in epidemic prone areas. Only 7% of the region's population lives in low risk of malaria free areas. 18 countries accounted for more than 90% the deaths in Africa and the rest in

other seven countries outside Africa in the year 2006, dominated by Sudan and India respectively.

In all malaria endemic countries in Africa, 25-40% of all outpatient clinic visits are due to malaria and between 20% and 50% of all hospital admissions are as a result of malaria (19).

A study conducted on prevalence of malaria and bed net coverage in Oromia and SNNPR regions from January 2006 to December 2007 showed that malaria prevalence differed markedly between Oromia (0.9%) and SNNPR (4.5%) the prevalence was highest in Eastern and North-Eastern parts of SNNPR, the dominant malaria species seen were P. *falciparum* (69.4%) followed by *P. vivax*(1.25%)(24). A study done in SNNPR indicated that a total of 173,138 and 274,841 malaria cases were examined in the year 2002 and 2003/4, respectively. In 2002, positive cases were 78.923(45.6%) of which *P. falciparum* accounts for 54.9% of all cases and in the year 2003/4 98,605(56.4%) were positive of which *P. falciparum*, *P. vivax. malaria* and mixed infection accounted for 69%, 29.75%, 0.10% and 0.97%, respectively (24).

A study conducted in 2004 at Asendabo training health center showed that among 365 out patients the prevalence of malaria was 28.8%, *P. falciparum* was the dominant species followed by *P. vivax*, with their prevalence 54.3% and 45.7%, respectively (25). A similar study was conducted in Jimma town on a total of 804 study participants, where the prevalence of malaria was 5.2% and *P. vivax* was the dominant species seen with prevalence of 71.4% followed by *P. falciparum* 26.2% and mixed infection 2.4%(26).

All the human malaria parasites species are found in Ethiopia However, P. *falciparum* and P.*vivax* are the dominant which accounts 60% and 40% respectively. P. *malaria* and P. *ovule* are rare accounting less than 1% of the case (3)

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3 OBJECTIVE

3.1 General objective

To determine the retrospective prevalence of malaria among patients visiting Wolkite health center, Wolkite, South-Central Ethiopia, from 2010 to 2012 E.C

3.2 Specific objectives

- To evaluate age and sex distribution of Malaria at Wolkite health center.
- To determine the prevalence of malaria in Wolkite Town based on retrospective data.
- To assess the seasonal distribution of malaria cases in Wolkite town and at Wolkite health center,

4. METHODS AND MATERIALS

4.1. Study area

The study will be 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^{0}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 diseases 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.

4.2 Study design and period

A retrospective study was conducted to determine the prevalence of malaria from September 2010 to August 2012 E C. by reviewing laboratory logbook of Wolkite health center.

4.3 Population

4.3.1. Source population

All patients visiting Wolkite Health center.

4.3.2 Study population

All patients visiting Wolkite Health center, examined for blood film and recorded on laboratory logbook during the study period.

4.3.3. Study subjects

All patients, whose blood film examination for plasmodium species and recorded on laboratory logbook during the study period.

4.4 Sample size and sampling techniques

4.4.1 Sample size

All blood film results reported and registered in the laboratory logbook in the period of 2010 to 2012 E C was reviewed and included in this retrospective study.

4.4.2. Sampling technique

All malaria results registered in the laboratory logbook was reviewed.

4.6. Inclusion and exclusion criteria

4.6.1. Inclusion criteria

- Laboratory records with necessary information, i.e. Age, Sex, and Plasmodium species and residence was included in the study.

4.6.2 Exclusion criteria

- Laboratory records which lack the necessary information.
    - Illegible lab records.
    - A positive lab records with undifferentiated plasmodium species.
    - Lab records without age, sex and date.

4.7 Data collection process

Socio-demographic data and laboratory examination result of blood film was collected from laboratory logbook.

4.8. Collection, Preparation and Processing of Data

Malaria blood film results from the laboratory logbook were collected by using predesigned season based tally sheet by age, sex, plasmodium species and residence. All the necessary data from the tally sheet was entered to spss v25. Finally the data wax analyzed using spss v.25.

4.9. Data quality control

To ensure the reliability and validity of the data, clearly stated and seasonaly classified separate tally sheets was used for each year. All necessary precautions was taken not to miss or add mistakenly any data.

4.10. Data Analysis

Socio-demographic and laboratory data was collected from laboratory logbook and result was analyzed using scientific calculator and spss v25 presented by tables and graphs

4.11. Ethical Consideration

Official letter of permission was obtained from Wolkite University, College of health and medical sciences. The purpose, benefit of the study and the procedure involved while collecting the data was thoroughly explained to Wolkite health center. Confidentiality of the data was maintained.

5. Result

According to retrospective data obtained from Wolkite health center from 2010 to 2012 a total of 47,193 patients were send for laboratory diagnosis suspected for malaria.

5.1. Demographic Characteristics of study participants

According to the health center in all year malaria positive cases 1644 (53.89%) are male and 1406(46.05) are female from the total positive cases (*table 2*)

Prevalence of malaria in age groups at the Wolkite health center shows that 139 (4.5%) are belonged to the age groups less than one (1) year, 626 (20.5%) belonged to the age groups 1-4, 738 (24.2%) belonged to the age groups 5 – 14 and 1547 (50.7%) are belonged to greater than 15. Malaria prevalence was slightly higher in the age groups between 5-14 and > 15 (*table 2, figure 1*)

Table 1: Socio-demographic distributions among positive patient in wolkite health center from 2010 – 2012 E.C

Variable		P.Vivax	Percent	P.Falciparum	Percent (%)	Total
Sex	Male	950	31.14%	694	22.75	1644
	Female	840	27.50%	566	18.55	1406
Age	<1 year	97	3.18%	42	1.38	139
	1-4 year	432	14.16%	194	6.36	626
	5-14 year	407	13.34%	331	10.85	738
	>15	854	28.00%	693	22.72	1547

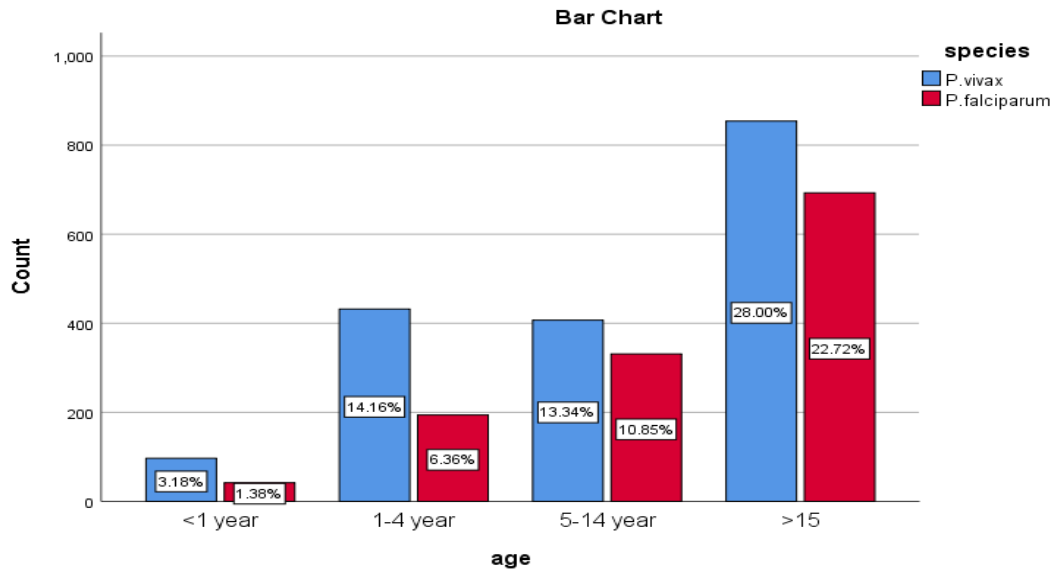

Figure 1: Malaria distribution by age group among positive patient in wolkite health center from 2010-2012 E.C

The predominant species in all residence are P.v except abeshge and a higher prevalence is counted in Wolkite 1044, the second one is Abeshge Woreda 591 ,the third is Kebena woreda 118 And the last is others 37 positive cases of p.v (table 4,fig 3)

Table 2: Malaria species distribution among residence at Wolkite health center from 2010 to 2012

		Result	Positive		Total Positive	Total Case
		Negative	P.Vivax	P.Falciparum		
Residence	Wolkite	31676	1044	552	1596	33272
	Abeshge	9306	591	614	1205	10511
	Kebena	2201	118	70	188	2389
	Other	960	37	24	61	1021
Total		44143	1790	1260	3050	47193

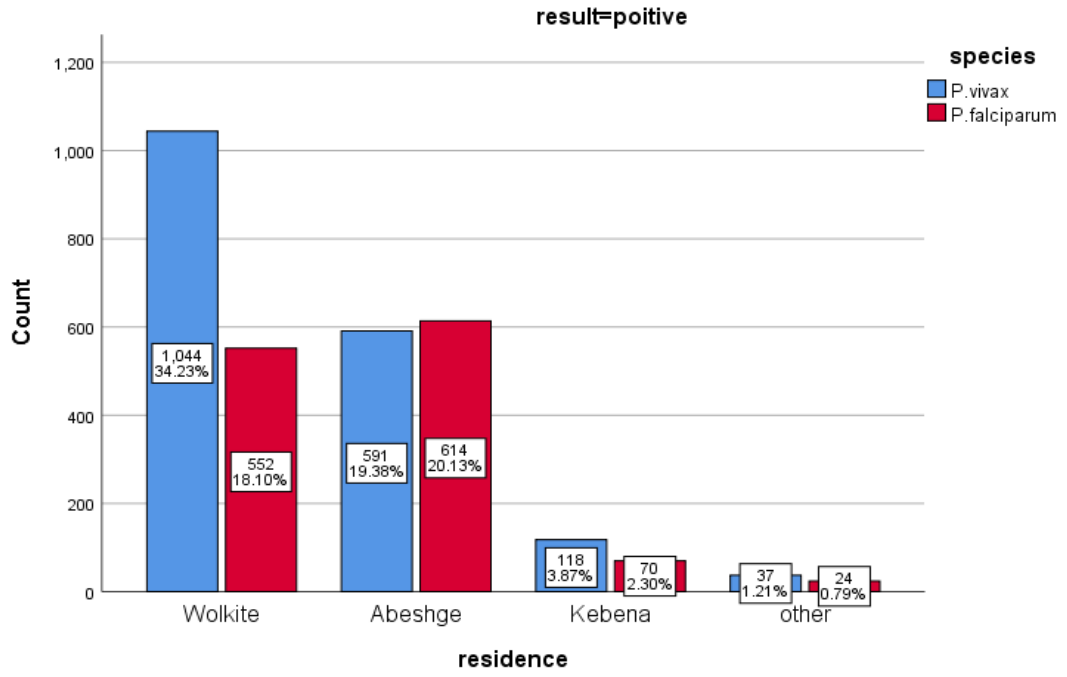

Figure 2: Malaria species distribution among residence at Wolkite health center from 2010 to 2012

5.2 Retrospective Malaria Prevalence

According to the Wolkite Health Center retrospective malaria positive cases, the plasmodium Parasites that cause the disease malaria are P. f and p.v; however, the dominant parasite is p.v. Among the patients who Diagnosed for malaria (between September 2010- August 2012 E.C), 3050(6.46%) are Positive. On average 1016 malaria positive cases visited Wolkite Health Center each Year. According to retrospective data obtained from Wolkite health center, in 2010 a total of 19841 patients 900 (4.54%) are positives. In 2011 out of 9758 patients 588 are positives. In 2012 out of 17594 patients 1562 are positives. From total of 47193 patients (table 1), majority of malaria positive cases (1596) are wolkite residents. The second (1205) malaria positive cases are from Abeshge. The third (188) are from Kebena. The last (61) positive cases are from other areas (table 4).

Table 3: Retrospective prevalence of malaria patients visiting Wolkite health center from 2010 – 2012 E.C

Year	Negative	Positive	Total	Percent (%)
2010	18941	900	19841	4.50
2011	9170	588	9758	6.02
2012	16032	1562	17594	8.80
Total	44143	3050	47193	19.32

5.3 Seasonal difference of malaria at Wolkite health center

The prevalence of malaria for the four seasons in Ethiopia was analyzed. During all the 3 years, in season one (September to November) has the highest malaria prevalence 1509(49.47%), the second is season three (march to May)534(17.5%) the third one is season two(December to February)527(17.27%) and the last is season four (Jun to august)480(15.73%) of malaria positive cases are counted .The maximum number of confirmed malaria cases was reported in spring (September, October, and November) and the minimum was reported during summer (Jun ,July, august) seasons(table 3,figure 2).

Table 4: Seasonal distribution malaria in wolkite health center from 2010 to 2012 E.C

		Negative	P.Vivax	P.Falciparum	Total Positive	Percent	Total
Season	Sep-Nov.	13200	805	704	1509	49.47	14709
	Dec-Feb	10716	326	201	527	17.27	11243
	March-May	9443	314	220	534	17.50	977
	Jun-Aug	10784	345	135	480	15.73	11264
Total		44143	1790	1260	3050	100	47193

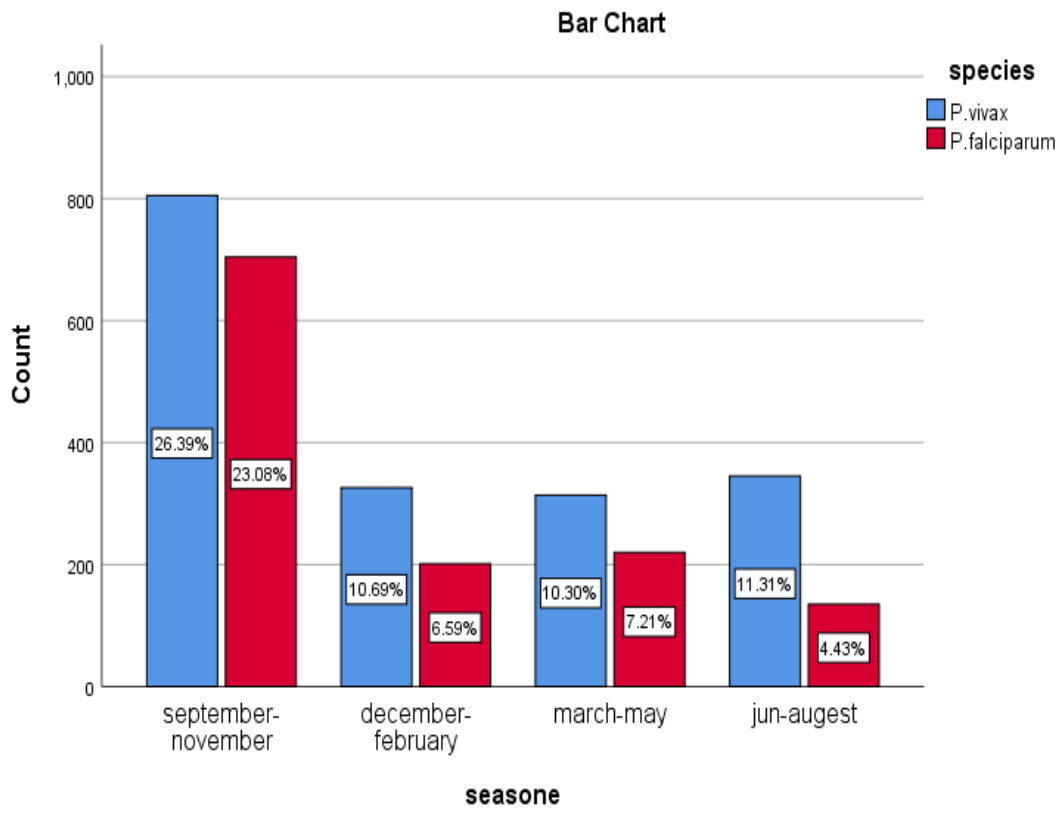

Figure 3: Prevalence of malaria by seasonal distribution in wolkite health center from 2010 to 2012 E.C

6. Discussion

Wolkite town is one of the malarious area as it is found between 1600 and 1800 meter above sea level. the overall malaria cases in Wolkite health center was 3050 (6.46%) from 2010 to 2012. The maximum and minimum confirmed malaria case was reported in 2012 and 2010 respectively. However, the prevalence was lower than reported from other retrospective studies conducted in Adi Arkay health center (36.1%), Halaba special district (9.5%) and [30,32]. This variation might be due to climatic and altitude differences.

The prevalence of malaria in this area in 2012 were highest as compared to the other two successive years (2010-2011). In the study area, the plasmodium species that cause malaria are P.f and P.v, but the dominant species is P.v, According to this retrospective data the climatic condition of Wolkite town is may be more favorable for the breeding of the vivax species than the falciparum species. In this study, Plasmodium infection was high in male(53.89%) than females(46.11%) which was comparable with a study conducted in Wolaita zone [33].

The prevalence of malaria in age groups in study area showed that a higher number of Plasmodium infection occurred the age groups >15 (50.7%) followed by 5-14 age group (24.19%) ,1-4 age group are (20.52%) while the least affected age group was < 1 year in both sexes and the most frequently reported species in all age groups was P. v (*table*-2, fig 1) which was comparable with a study conducted in Wolkite health center [29]

The prevalence and magnitude of malaria transmission are mainly determined by environmental, climatic and seasonal factors, in our study area, malaria transmission is seasonal and depends on altitude and rainfall. Thus, higher malaria transmission is recorded in spring, September to November (49.47%) march april may(17.50%) December January February(17.27%), June July and august (15.73%).this result agree with other studies conducted in wolkite health center [29]

LIMITATION

- ✓ Incompleteness malaria registration laboratory log book
- ✓ Retrospective study period is five year and above this is best for trend analysis but our studied period is three
- ✓ Shortage of time

7. Conclusion and recommendation

7.1 Conclusion

From the results prevalence of malaria in the Wolkite town and neighboring rural kebeles shows that in the 2012 malaria prevalence rise, but from 2010 to 2011 prevalence of malaria was less.

In age groups of this study peoples less than one (<1) years of age have the lowest percentage (4.5%) of the infection followed by the age groups 1-4(20.7%), 5-14(24.2%) and >15 (50.7%). In the study area P. vivax was the dominant malaria causative agent than P.falciparum. Overall the prevalence of malaria were varies by age, residence and season.

7.2 Recommendation

Based on our finding the following recommendations were made:

- Heath office should enhance inter-sectorial collaboration with different stake-holders to create awareness on Bed net utilization.
- Health care workers should enhance counseling, advising and supporting age selective interventions.
- For researchers further study should be conducted with better study design.

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