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ACRONYMS

ACT-	Artemesinin Combination therapies
APH -	Atat Primary Hospital
CCR	Carter Center Report
DDT	Dichlo Diphenyl Trichloroethane
EC	Ethiopian Calendar
FMOH	Federal Ministry of Health
HEP	Health Extension Program
IRS	Indoor Residual Spraying
LLIN	Long lasting insecticidal Net
MIS	Malaria Indicator Survey
MOH	Ministry of Health
PHC	Primary Health Care
PHCV	Primary Health Care Unit
RDT	Rapid Diagnostic Test
WMR	world Malaria Report

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ABSTRACT

Malaria is one of the deadly disease caused by four main species of protozoan: *P.Vivax P.falciparum, P.ovale and P.malariae.* The 5th species *P. knowlesi* also infect human being occasionally. Malaria is transmitted by female anopheles mosquito. The aim of this study was to assess and analyze the trends of malaria prevalence from 2006 to 2015 G.C. at Atat primary hospital and associated risk factor to malaria infection. For this study data were taken from the hospital registration log book for a period of ten years from 2006 to 2015 G.C. Moreover, data for risk factors were collected from randomly selected households to which structured questionnaires were provided.

Among the recorded malaria cases there is no clear trends idea as to which sex is more affected by malaria. In 2006, 2007 and 2011 roughly, 4%, 3%, 5%, , males were, respectively infected by malaria. Conversely in 2008, 2009, 2012, 2013, 2014, 2015 about 3%, 4%,2%, 4%, 1% and 4% females were, respectively infected with malaria. As to which species of *Plasmodium* dominantly infect heman being in the study hospital in 2006, 2007, 2008, 2009, 2010, 2011, and 2013 over 50% of malaria was caused by *P. vivax*, while in 2012, 2014, 2015 the highest proportion was caused by *P. falciparum*. Among malaria cases in different age groups, there is no clear trend as it varies from year to year. The highest record of malaria was in October to December followed April-June and the least was from January to March for all years. The prevalence of malaria with regard to sex, and age are statistically insignificant ($P>0.05$), The prevalence of malaria with seasonal variation is statistically significant $P<0.05$. Improper utilization of long lasting insecticidal bed nets, insufficient indoor residual spraying, the presence of mosquito breeding area were identified as the associated risk factors. All the above risk factors were found to be significantly associated with the risk of getting malaria parasite ($P<0.05$). It can be recommended that proper use of net should be practiced by all members of the households and indoor residual spraying should be done regularly.

key words: Age, Sex, Malaria Prevalence, *Plasmodium falciparum, Plasmodium vivax*

1. Introduction

1.1 Background

Malaria is one of the deadly diseases caused by different species of protozoan *Plasmodium vivax*, *Plasmodium falciparum*, *Plasmodium ovale* and *Plasmodium malariae*. *P. knowlesi* also infect human occasionally. Malaria is transmitted by female anopheles mosquito. The disease is subtropical and tropical countries at altitude below 2000 meters below sea level. Malaria gets its name from the word malarious which associate the disease with foul odour of swamp which is literally mean "bad air". Malaria symptoms is seen from 10-28 days after infection and the symptoms include fever, chill, profuse sweating and anemia. Splenomegaly and hepatomegaly are also seen in patients who are seriously sick (Robert, 1980).

Some population groups considerably at high risk of contracting malaria and developing severe disease than others. These include infant less than 5 years old. More than 70% of malaria death occurs in this age group. Between 2000-2015, the underage malaria death decreased by 65% globally (WHO, 2015).

According to WHO (2015) report, there were 214 million cases of malaria in 2015 and 438000 deaths. Because of WHO effective intervention, malaria incidence among population at risk fell by 37% globally between 2000 and 2015. During the same period malaria mortality rate among population at risk fell by 37% globally. According to carter canter (2013) about 55.7 million people in Ethiopia were exposed to the risk factors of malaria and approximately 80% of the Woredas (736) were malarious. Two malaria peaks were recognized in Ethiopia. These are September-December and April-June. The outbreaks of the disease have a significant social and economic impact on the rural society as well as the whole country (FMOH, 2013).

In the southern nation, nationality and people regions, state (SNNPR) of Ethiopia about 65% of the population is living in malaria endemic area (SNNPR, 2013). According to WHO (2015) WHO developed a technical strategy for malaria (2016-2030) control. The goal of this strategy reduces malaria incident cases by at least 35% and eliminating malaria at least in 35 countries of malarias areas. Ethiopia has achieved remarkable progress in the fight against malaria during the most recent decades through strong preventive and case management intervention with large engagement of health extension workers (HEW) and volunteers. Providing community based care at house hold level through effective intervention, the death of children under five years decreased by 81% between 2001 and 2011 (FMOH, 2010)

Factors contributing to malaria at house hold level include house proximity to mosquito breeding area, lack of sufficient preventive measures such as long lasting insecticidal nets, indoor residual spraying, (IRS), number of nets per house hold and individual knowledge about the disease and proper administration of the drug (Bousema *et al.,* 2012).

The main vector control activities implements in Ethiopia include indoor residual spray (IRS), long lasting insecticidal Net (LLIN'S) and mosquito larva source reduction (WHO, 2012). Malaria diagnosis consists of patient's clinical assessment, microscopic examination of blood slides and the use of multi species rapid diagnostic test (RDT) in accordance with the level of health facility. FMOH (2012) demonstrated that microscopic diagnosis is the standard diagnosis in health center and hospital at different level whereas multi special RDT are the main diagnostic tool at health center (FMOH, 2012)

Artemesinin combination therapy (ACT) is the first line drug for treatment of *P. falciparum* and *P. vivax* (WHO, 2011). For children and pregnant women WHO

recommended intermittent preventive treatment with sulfodoxine pyrimethamine drug (WHO, 2015).

1.2. Statement of the problem

Despite the WHO and FMOH effective and organized intervention to reduce the mortality and morbidity of malaria in endemic area, the disease is still a prominent health problem. High cost of the control program, inaccessibility to very remote area, lack of skilled man power and resistance of the parasite to anti malaria drug are some of the factors that contribute to the high prevalence of the disease. Use of insecticides for the control of malaria mosquitoes are among the options for the control of malaria.

To plan and apply effective intervention program knowledge on the prevalence and risk factors is paramount importance.

To this end, this study tried to assess the prevalence of malaria and risk factors in Atat primary Hospital.

Research questions

1. Is there any difference in the distribution of plasmodium species in the study area?
2. Is there any difference in trend of malaria prevalence among different age groups?
3. Is there any difference in the prevalence of malaria among males and females?
4. Is there any difference in the trend of malaria across months in a year?

1.3 Objective of the study

1.3.1. General objective

To analyze the prevalence of malaria from the hospital registration book and the risk factors of malaria in some selected malaria prone kebeles

1.3.2. Specific objective

1. To assess the prevalence of malaria over a period of ten years
2. To assess the risk factors contributed to the occurrence of malaria

2. Literature Review

1. Burden of Malaria

1.1. Global burden of malaria

Malaria is found in 99 countries throughout the world and the higher burden is found in African countries (WHO, 2012). According to the world Health Organization (2015), globally an estimated 3.2. billion people are at risk of being infected by malaria and around 250 million cases occur annually, leading to approximately 1 million deaths each year. Over 86% of the global burden and 90% of the global death occur in sub Saharan Africa (WHO, 2014). According to the latest estimates 198 million cases and 584,000 death of malaria occur globally in 2013. Of these 82% of cases and 90% of death were in Africa, followed by 12% in south East Asia and 5% in East Mediterranean (WHO, 2015). According to the world Health Organization (2014) the disease is the leading cause of death of African children less than 5 years which accounted for 75% of all the deaths.

Since 1980 malaria steadily decreasing in countries outside Africa (WHO, 2012). The disease is more manifested in poorest countries *(*Dawit Ayele, and Temesgen Sewer (2012). However, inside Africa malaria deaths in 2004 exceeds those reported in 1980 and only a 30% from 2004 reduction was observed in 2010 Which is a dependent massive intervention program launched after 2004 (Murray et al., 2012). According to WHO (2014) between 2000 and 2013 the population at risk of malaria increased by 25% globally and 43% in Africa region. Malaria case reduction was the highest in Europe which is almost 100%. In America the reduction was 76% and in the western pacific region it was 69%. Malaria mortality rates are estimated to have declined by 47% globally between 2000 and 2012 and by 54% in the Africa region.

As of December 2014, 19 Countries was in the pre elimination or elimination phase, while seven countries in the prevention phase (WHO, 2014).

1.2. Burden of malaria in Ethiopia

Malaria is one of the leading causes of morbidity and mortality in Ethiopia. According to Carter Center report (2013) an estimated value of 55.7 million people (68%) of the population are at risk of malaria and approximately 80% of the 736 woreda (district) in Ethiopia are considered to be malarious. Malaria transmission in general is seasonal and unstable. Patterns and intensity of malaria transmission vary throughout the country due to differences in altitude, rainfall and population movement. Protective immunity in Ethiopia population is relatively low due to unstable transmission like large parts of sub Saharan Africa all age group are at risk of infection (CCR, 2013). In 2009/2010 malaria was the leading cause of outpatient visits and health facility administration accounting for 14% of outpatient visit and 9% of admissions (FMOH, 2011). In 2010 the federal ministry of health (FMOH) reported 4,068,764 clinical and laboratory confirmed case of the disease (WMR, 2011). The retrospective study conducted by Abebe Alemu *et al.* (2012) showed that out of a total of 59,208 Blood film diagnosed in Kola Diba Health Center in North Gonder 23,473 (40%) microscopically confirmed malaria cases and an increased in malaria from 2008-2011 With the peak case in 2010. Regarding the age group 15-44 (50%) was highly affected of which males accounted for 53.7% and females for 47.5%. According to Lelisa Sena *et al.* (2014) children in age group of 10-14 years were the most affected followed by age group 5-9 years. Age group less than 5 years and above 15 are the least affected. Male were more affected than females with the male to female ratio of 1.08:1. Regarding *Plasmodium* spp., *P. falciparum* accounted for 65-75% infection, while *P. vivax* accounted for 25-30%. *P. ovale* and *P. malariae* were rare (CCR, 2013). The study conducted by Abebe et al. (2012) showed that for most of the study years *P. falciparum* decreased, while *P. vivax* increased indicating a trend shift from *P.*

falciparum to *P. vivax* in the area. In contrary, the study conducted by Gemechu Beffa *et al.* (2012) indicated that the total malaria cases of 3871 was registered only in May where *P. falciparum* accounted for 87% and *P. vivax* for 11.7% in South West Shoa zone (South west Shoa Zone Health Department, 2012). The study conducted around Gilgel Gibe Hydroelectric dam and control site by Lelisa Sena *et al*. (2014) demonstrated that among the confirmed cases of malaria *P. falciparum* consisted of 54.6%, while *P. vivax* accounted for 41.6%. The mixed infection was 3.8%. According to Eshetu Molla *et al.* (2015) the prevalence of malaria infection in the Dilla town and the surrounding was 16% where *P. vivax* accounted for 62.5% of the infection and *P. falciparum* for 26.8%, while 10.7% for mixed infection.

Regarding to high land malaria transmission there are few repots because the high land area is above the altitude assigned for malaria free area (>2000 above sea level). However, some studies have indicated that in Ethiopia as the result of fear of malaria in fertile lowland areas, overcrowding and ecological degradation resulted at high altitude areas (Adugna Weyessa et al., 2004). According to Adugna Weyessa et al. (2004) a total of 28,906 malaria cases were treated at different health facility in Addis Ababa city from 1993 to 1999. The study showed that there was increasing of malaria cases from 1996 onwards. It reached to the peak in1998. Moreover, number of infants and children aged between 1 and 4 years were also treated for malaria. More than 62% of the cases were due to *P. vivax* followed by *P. falciparum* which is 32.5%. The composition of *P. malariae* was only 5.2%. The recent study by Solomon Tesfaye et al. (2011) who conducted study in the high lands of Butajira at an altitude range of 2100 and 2280 meters above sea level between October and December 2006 demonstrated that the number of *Anopheles christy* was higher than in Mirab Miskan (2280m) than Misrak Miskan (2100m). The parasitological survey showed that out of 48 malaria

infected individuals 32 were *P. vivax* and 16 were *P. falciparum* where the highest prevalence of 39% was observed in age group of 15 years.

Studies in Koka reservoir have demonstrated that malaria incidence in living houses close to irrigation micro-dam was seven times higher than amongst those living far away from the dam (Solomon Kibret et al., 2009). A recent study in south western Ethiopia also showed that a higher prevalence of malaria in village close to the Gilgel Gibe reservoir than in the control village (Lelisa sena *et al.,* 2014)

The peak malaria transmission occurs between September and December in most parts of Ethiopia, after the main rainy season from June to August (Solomon Kibret *et al.,* 2009). The second minor malaria transmission period is from April to June followed a short rainy season from February to March. January and July typically represent low malaria transmission season. Malaria transmission occurred across all months of the year in the irrigation villages unlike the non irrigated village where transmission occurred mainly during post rainy months (Solomon Kibret *et al.,* 2009). The densities of malaria vector mosquitoes were substantially higher in irrigation village than in the non-irrigated village (Solomon Kibret *et al.,* 2009).

2.3. Malaria Vector

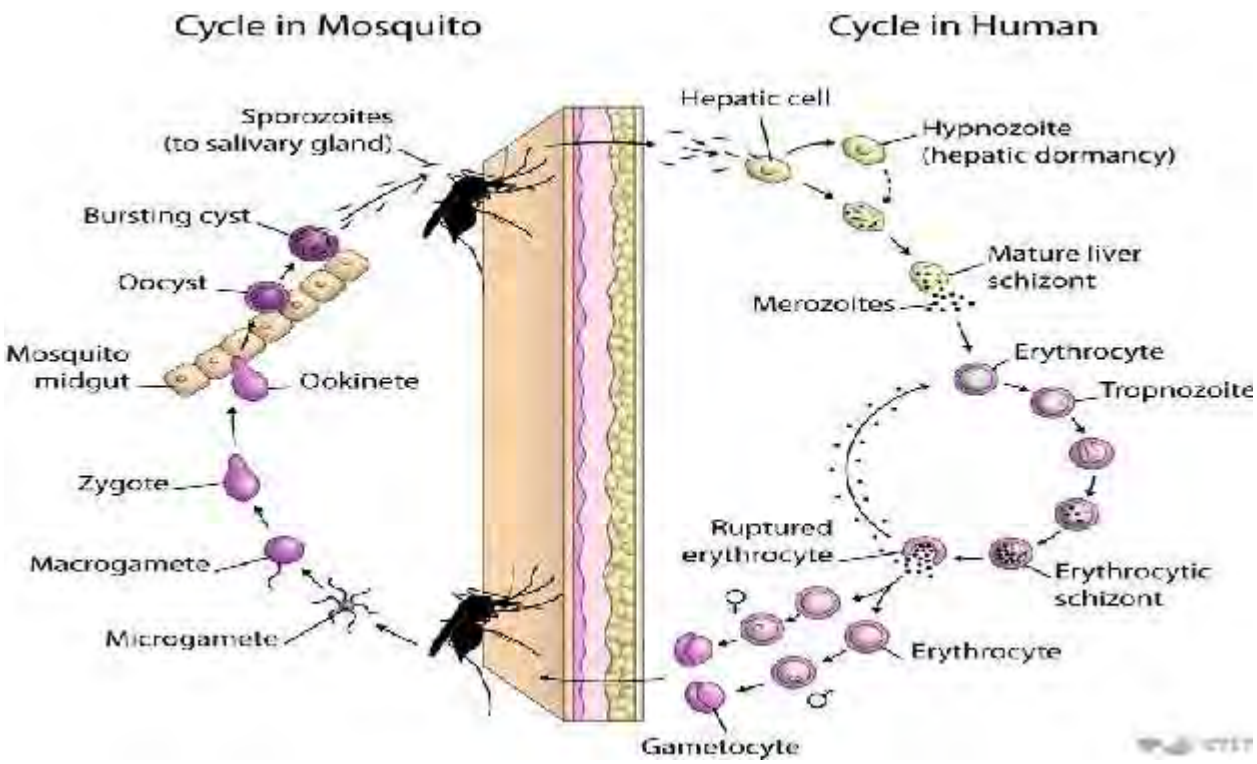
Anopheles arabiensis, *Anopheles funestus*, *Anopheles gambiae*, *Anopheles melas*, *Anopheles moucheti*, *Anopheles merus*, and *Anopheles nilli* have been reported as the dominant vector species of malaria in Africa. Among these *Anopheles gambiae* and *Anopheles arabiensis* are the most efficient vectors in malaria transmission (Sinka *et al.,* 2010). Small temporary, clear sun lit and shallow fresh water are necessary for the breeding of mosquito. *Anopheles arabiensis* is the dominant vector mosquito and higher in the irrigative villages (Solomon Kibret *et al,* 2012).

2.4. Life Cycle of malaria parasite

The life cycle of P*lasmodium* in both human and mosquitoes is shown in figure 1. Various species of anopheles mosquitoes have definitive host of the malaria parasite. When female mosquito bites an infected person she drawn in to her stomach blood that may contain male and female gametocytes. In the mosquito, the blood temperature falls the male or microgametocyte undergoes a process of maturation and result in production of a number of microgamete. The extraction of these delicate spindle shaped gamete has been termed exflagellation At the same time, the female a macro gametocyte mature to become a macrogametocyte after which it may be fertilized by microgamete to form Zygote. The zygote become elongated and active and called an ookinettee. The stomach wall of mosquito and round up just beneath outer covering of that organ to become oocyte. Growth and development of oocyte result in the production of slender treated like haploid sporozoites which break out and wander throughout the body of mosquito. Length of development depends not only in the species of *Plasmodium*, but also on a particular mosquito host and ambient temperature. It may range from 8 days in P. *vivax* to as long as 35 days in *P. malariae*. This sporozoites that enter the salivary gland of mosquito may be inoculated in to the next person when bitted. Sporotozoit injected into the blood stream leave the blood vascular system within 40 minutes and subsequently invade parenchyma cells of the liver. Later development of *Plasmodium falciparum* and *P. malariae* differs from that of *P. ovale*. In all four species asexual multiplication takes place within the liver cells, but with *P. vivax* and *P. ovale* a varying proportion of the infecting sporozoite enter a resting stage before undergoing this multiplication without delay. (David, 2006).

The resting stage of parasite is called Hyphozzoite after a period of weeks or months reactivation of hypnozoite initiate asexual division. These dormant stages now have

been demonstrated in hepatic parenchyma cells of chimpanzee infected by sporozoite of *P. vivax*. A sexual multiplication (Shizogony) in the liver result in production of tinny merozoites in each shizont. Rupture of hepatic cells release the merozoites in to the circulation. The asexual cycle continue in the red blood cell. This stage is called Erythrocytic Shizony which is resulted with in a period of 44 to 72 hours in the formation of from 4 to 36 new parasites in each infected cell. At the end of the Schizogonic cycle the infected blood cells rupture and release merozoites, which inturn infect new red blood cell. Rupture of red blood cell also release metabolism of the parasite and toxic materials thrown in to the blood stream this bring about a malaria paroxysm. Generally in the initial stage of infection rupture of infected cells is not synchronous or so fevers may be continuous or remittent rather than intermittent. It has been theorized that the fever peaks themselves may have a regulatory effect on the development of cycle, speeding up those that are out of phase, so that after number of days the febrile cycle develop 48 or 72 hr periodicity depending on the species of parasite. Sometimes after the asexual parasite first appear in the blood stream but usually not until after the patient has become clinically ill and gametocyte appear in the red blood cells. These forms derived from the merozoites similar to those that continue the asexual cycle grow but do not divide and finally form the male and female gametocyte. Gametocytes cycle continue to circulate in the blood for some time and if ingested by a mosquito transformed into gamets (gametocycle), sexual fusion and subsequently development of sporozoite (Sporogony in mosquito) (David, 2006)


Cycle in Mosquito
Cycle in Human
Sporozoites
(to salivary gland)
Bursting cyst
Oocyst
Mosquito
midgut
Ookinete
Zygote
Macrogamete
Microgamete
Hepatic cell
Hypnozoite
(hepatic dormancy)
Mature liver
schizont
Merozoites
Erythrocyte
Tropnozoite
Ruptured
erythrocyte
Erythrocytic
schizont
Erythrocyte
Gametocyte

for vector breeding and hence an increase in the risk of malaria (Levins and yasuoka, 2007). On the contrary, evidence showed that an increase urbanization was coincident with a reduction in the global malaria burden (Tatem *et al.,* 2013). Studies have indicated that factors including age, sex and socioeconomic condition also play a role in malaria epidemiology (Debeaudrop *et al.,* 2011). Additionally population movement to and from malaria endemic areas also affects the distribution of the disease (Lelisa sena *et al.,* 2014).

2.6 Economic and social impact of malaria

The attempts to measure the direct and indirect costs of malaria have revealed a major economic have a direct and indirect economic impact on the households (Woyessa Deressa *et al.,* 2007). . The majority of malaria burden is among older children and working adults in rural agricultural areas, there is a heavy economic burden in Ethiopia (Woyessa Deressa et al., 2007). Overall evidence has shown that the burden of malaria is inversely related to a country's economic growth (Wayessa Deressa et al., 2007)

2.7. Malaria prevention and control

The WHO recommendations (2012) for malaria prevention and control include insecticide residual spraying (IRS) with Dichlodiphenly trichchloroethane (DDT) which was effective for malaria prevention and control in the pre-eradication era. As a physical barriers from the mosquito bite, the use of bed net has exsisted for many years. The impregnation of a bed net with insecticides made it more effective as a result of address action repelling and/or killing mosquitoes (WHO, 2012).

The board deployment of IRS (Insecticidal residual spraying) and long lasting insecticidal nets in combination is potentially being very effective. Although evidence is lacking regarding the added value of using both tools compared to the application of

each strategy separately. The combined effect of IRS and LLINS remain a subject for further study (Kumu andMoore, 2011).

Larval habitat manipulation (temporary modification long lasting and chemical and biological larviciding have all been used as Larvae source management strategies in certain countries (WHO, 2012).

According to world Health Organization, preventive chemotherapy women and infants in countries with moderate to high stable transmission of malaria. In addition seasonal malaria (chemoprevention) months old is recommended in areas with highly seasonal transmission. (Preventive chemotherapy) is not included in the package of malaria prevention in Ethiopia because of countries unstable malaria transmission as well as a high level of resistance of *P. falciparum* to sulfadoxine pyrimethamine (FMOH, 2014). However, the main vector control activities implemented in Ethiopia include indoor residual spray (IRs) Long lasting insecticidal treated nets (LLIN'S and Mosquito larva source reduction (FMOH, 2012).

2.8. Diagnosis and Treatment

Malaria diagnosis consists of patients clinical assessment, microscopic examination of blood slides and use of multi special rapid diagnostic test (RDT) in according with the level of health facility (FMOH, 2012). Microscopic diagnosis of remains the standard of diagnosis of health centers and hospital of diagnosis of health center and hospitals of different levels, whereas multi species RDT, are the main diagnostic tool at the health post level (FMOH, 2012).

The WHO strongly recommended the use of Artemisine based combination therapy (ACT) for uncomplicatied *P. falciparum* malaria which includes Artemether plus Lumefantrine. Artesumate plus Amodiaquiniue, Artesumate plus mefloquine and Artsumate plus sulfadoxine pyrimethamine for severe *P. falciparum* malaria intravenous

Artesunate is the drug of choice. Chloroquine is affective against malaria infection, caused by *P. vivax*, *P. ovale* and *P. malariae* species and in an area where choloquine resistance *P. vivax* exists. ACT (Artesunate Plus Sulfadoxine pyrimethamine) are recommended (WHO, 2010) Ethiopia adopted ACT (Artimether Plus Lumefantrine) starting from 2004 (WHO, 2012).

In light of the parasite resistance to mono-therapies in most countries of the world the change to ACT was inevitable regardless of the countries inability to afford the new drugs (WHO, 2006).

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3. Materials and Methods

3.1. Description of the study area

The study was conducted at Atat primary Hospital, which is found about 30 km west to the capital town of Cheha Woreda, Endibir, about 17km east to zonal town Wolkitie, 140km South west to the capital Addis Ababa and 210 kms south west to HAWASSA. In the world map, it is located at 8.002^{O}N latitude and 38.74^{O} E longitude and the woreda comprises 32 rural kebeles and two towns. The woreda bordered to the east with Gumer and Geta woreda; to the South west to Yem and Jimma zone; to the south and south east with Enemor woreda and to the north with Eja woreda, to the north west to wolkite and kebena woreda. According to the recent census the total population of the wereda is 32569. The males are 13200 and the females 19369.

Most of the people live by farming and rearing cattle. Cereals like maize, teff, wheat, beans, peas and barely are crops grown in the wereda. Enset is widely grown and used as a staple food. Chat is a cash crop in the area. Among the 32 kebeles, 15 kebeles which are near to the big river Gibe are more exposed for malaria. The disease is less or totally absent in 17 kebeles found in the highland.

3.2. Study Design

A cross sectional study was conducted at Atat primary Hospital and selected malaria exposed Kebeles.

3.3. Data collection

The prevalence of malaria from 2006-2015 were collected from Hospital outpatient pre-formatted registration book which has reported based on the peripheral blood smear examination, clinical RDT and microscopically confirmed malaria cases.

Structured questionnaires were used to collect information about the risk factors of malaria in the study area. The socio economic condition, health service facilities, knowledge about malaria and age were some of the data collected.

3.3.1 Data analysis

After all the necessary data were collected they were coded on pre-arranged coding sheet. Data entry and clearing were done using SPSS computer soft ware. Univariate and maltivariat logistic regression model were used to test the association between dependent and independent variables. *P.value* less than 0.05 was considered as significant.

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4. Results and Discussion

4.1 Results

Microscopically and RDT confirmed malaria cases from blood samples collected from patients at Atat primary hospital between 2006 and 2015 is shown in Table 1. According to the table, the highest percentage (57%) of malaria patients was recorded in 2006, while the least (31%) was recorded in 2014. Malaria patients' percentages were somewhat similar up to 2011 which are more than 50%. There was a significant fall in 2012 (40%) which again jump to 48% in 2013. The jump from 31% to 36% in 2015 looks insignificant. There is no significant difference in the number of malaria patients and is not statically significant (P>0.05)

Table 1. Microscopically and RDT confirmed malaria cases from blood samples collected from patients at Atat primary hospital between 2006 and 2015

Year (G.C)	No. of patients	No. of Patients with malaria case and percentage
2006	2560	1451 (56.68)
2007	2784	1471 (52.28)
2008	2995	1597 (53.32)
2009	2172	1204 (55.43)
2010	2546	1310 (51.45)
2011	2147	1150 (53.56)
2012	2266	900 (39.72)
2013	2573	1246 (48.43)
2014	2348	732 (31.18)
2015	2363	840 (35.55)

Numbers in the parenthesis are percentage of patient .

Malaria prevalence with respect to sex is shown in Table 2. As shown from the table there is no clear trend as to which sex is more affected by malaria. In 2006, 2007 and 2011 roughly 4%, 3% and 5% males were, respectively infected by malaria. Conversely, in 2008, 2009, 2012, 2013, 2014 and 2015, 3%, 4%, 2%, 4%, 1% and 4%, females were, respectively infected with malaria. The prevalence of malaria parasite infection between male and female was not significantly associated (P>0.05)

Table 2. *Effect of sex on malaria cases as demonstrated from blood samples collected from patients visited Atat primary hospital between 2006 and 2015

Year (G.C)	Total No. of patients	%. of malaria Patients with respect to sex			
		Male	Female		
2006	2560	780(30.47)	671(26.21)		
2007	2784	773(27.77)	698(25.01)		
2008	2995	763(25.48)	834(27.85)		
2009	2172	563(25.92)	641(29.51)		
2010	2546	652(25.61)	658(25.84)		
2011	2147	622(28.97)	528(24.59)		
2012	2266	433(19.11)	467(20.61)		
2013	2573	573(22.27)	673(26.16)		
2014	2348	353(15.03)	379(16.14)		
2015	2363	367(15.53)	473(20.01)		

number in the parenthesis are percentages of malaria with regard to sex

Species composition of malaria diagnosed from patients of Atat Primary hospital is shown in Table 3. According to the table in 2006, 2007, 2008, 2009, 2010, 2011 and 2013 over 50% of malaria was caused by *P. vivax*, while in 2012, 2014 and 2015 the highest proportion of malaria was caused by *P. falciparum*. Mixed infection was in significant for all years and non-existent in some years.

Table 3. Species composition of malaria isolated from blood collected from patients visited Atat primary hospital between 2006 and 2015 as confirmed by microscopic investigation and RDT

Year (G.C)	Total No. of positives	*P. falciparum*				*P. vivax*				Mixed			
		Male	Female	Total	Percent	Male	Female	Total	Percent	Male	Female	Total	percent
2006	1451	410	241	651	44.87	368	430	798	54.99	2	0	2	0.10
2007	1471	278	266	544	36.98	495	432	927	63.02	0	0	0	0.00
2008	1597	417	313	730	45.71	346	521	867	54.28	0	0	0	0.00
2009	1204	237	201	438	36.38	324	440	764	63.46	2	0	2	0.10
2010	1310	329	235	564	43.05	322	423	745	56.87	1	0	1	0.10
2011	1150	149	158	307	26.70	473	369	842	73.21	0	1	1	0.10
2012	900	180	47	227	25.22	252	419	671	33.35	1	1	2	0.10
2013	1246	80	24	104	8.35	493	431	924	74.16	0	1	1	0.02
2014	732	48	172	220	30.05	304	206	510	25.32	1	1	2	0.10
2015	840	170	133	303	36.07	197	339	536	26.60	0	1	1	0.02

Malaria distribution across age is shown in Table 4. According to the Table there is no clear trend as it varies from year to Year. In 2006 the highest malaria infection (56.51) was to the older group (>15 year) followed by less than 5 year (28.12%); in 2007 the highest infection (36.17%) was with the age group <5 year followed by older age (>15 year) (35.55%); in 2008 the highest infection (38.82%) was in younger age (<5 year) followed by older age (>15 year) (34.25); in 2009 the highest infection (40.95%) was recorded in younger age (<5 year) followed by older age (>15 year) (39.87%); in 2010 the highest infection (35.88%) was in younger age followed by older age (33.44%); in 2011 the highest infection (37.48%) was in older age (>15 year) followed by younger age (<5 year) (35.82%); in 2012 the highest infection (35.33%) was in older age (>15 year)

followed by younger age (<5 year) (34.44%); in 2013 the highest infection (34.91) was in older age (>15 year) followed by younger age (<5 year) (33.71%); in 2014 the highest infection (39.07%) was in younger age (<5 year) followed by older age (>15 year) (30.74%); in 2015 the highest infection (39.05%) was in older age (>15 year) followed by mid-age group (6-14 year) (25.36). The prevalence of malaria with regard to age group was not significantly association (P>0.05)

Table 4. Malaria distribution in terms of age at Atat primary hospital

Year (G.C)	**Total No. of +ve**	**Age Groups**		
		<5 year	6-14 year	>15 year
2006	1451	408 (28.12)	223 (15.37)	820 (56.51)
2007	1471	532 (36.17)	416 (28.28)	523 (35.55)
2008	1597	620 (38.82)	430 (26.93)	547 (34.25)
2009	1204	493 (40.95)	231 (19.19)	480 (39.87)
2010	1310	470 (35.88)	402 (30.69)	438 (33.44)
2011	1150	412 (35.82)	307 (26.69)	431 (37.48)
2012	900	310 (34.44)	272 (30.22)	318 (35.33)
2013	1246	420 (33.71)	391 (31.38)	435 (34.91)
2014	732	286 (39.07)	221 (30.19)	225 (30.74)
2015	840	299 (14.84)	213 (25.36)	328 (39.05)

Numbers in the parenthesis are percentage of patients with seasonal variation

Seasonal distribution of malaria is shown in Table 5. According to the table the highest record of malaria was in October to December followed by April-June and the least was in January to March for all years. The prevalence of malaria with regards to different season was found to be statically significant (P<0.05)

Table 5. Seasonal prevalence of malaria at Atat primary hospital

year	Seasonal distribution				Total
	July-September	October-December	January-March	April-June	
2006	45 (3.1)	770 (53.06)	66 (4.5)	570 (39.2)	1451
2007	63 (4.2)	771 (52.4)	38 (2.5)	599 (40.7)	1471
2008	58 (3.6)	860 (53.8)	39 (2.4)	640(40)	1597
2009	47 (3.4)	627 (52)	30 (2.4)	500 (41.5)	1204
2010	58 (4.4)	710 (54.1)	44 (3.1)	498 (38)	1310
2011	57 (4.9)	617 (53.6)	47 (4)	429 (37.3)	1150
2012	40 (4.4)	511 (56.7)	31 (3.4)	318 (3.5)	900
2013	62 (4.9)	696 (55.8)	38 (3)	450 (36)	1246
2014	47 (6.4)	375 (51.2)	37 (5)	273 (37.2)	732
2015	44 (5.2)	440 (53.3)	25 (2.9)	331 (39.4)	840
Total	521 (4.3)	6377 (53.5)	395 (3.3)	4608(38.7)	11,901

*Numbers in parenthesis is percentage malaria patients in different season

Summary of patients' response to questionnaires is shown in Table 6. According to the table most patients (60%) live far away from the health centre. The rest of the patients live within the range of 16-30 km. There was no patients who live less than 5 km. About 30% of the patients use insecticide for the control of malaria vector in their house. The use of ITN distributed among parents (40%), the whole family (33%) and lactating mother (27%). The use of nets are rare (33%), sometimes (40%) and always (27%). According to 30% of the respondent there is awareness creation program which could be in a rare case (47%), throughout the year (10%) and during the outbreak season (43%). All associated risk were significantly associated with the risk of getting malaria($p<0.05$).

Table 6. Patients' response to interview

Questions	Response		
	Percentage	Yes	No
Distance to the health centre - Nearby (<15 km) - Intermediate (16-30 km) - Far away (>31 km)	 0.00 40.00 60.00	 - - -	 - - -
Is there any insecticide treatment in the house?	-	30	70
How frequently you use the net? - Rarely - Sometimes - Always	 33.00 40.00 27.00	 - - -	 - - -
Who uses the ITN? - Children - Parents - The whole family - Lactating Mother	 0.00 40.00 33.00 27.00	 - - - -	 - - - -
Is there any awareness creation about the use of net?	-	30	70
How many times health professionals			

teach the patients about malaria prevention? - Rarely - Throughout the year - Only during the outbreak season	47.00 10.00 43.00	- - -	- - -

4.2. Discussion

The aim of this study was to assess and analyze the treads on the prevalence of malaria by sex, age group, quarterly years and the distribution of plasmodium species, within ten years period in Atat health center. The prevalence of malaria almost similar and uniform from 2005-2011 that is for six years but decline for the last two years i.e. 2014 and 2015. The decrease of prevalence in recent years is because of better interventions such as better use of insecticide treated mosquito nets and indoor residue spraying (IRS). Between 2000 and 2015 malaria incident fall by 37% globally and by 66% in African region WHO (2015).

In the study area *P. vivax* was predominate species which accounts for 7584 (63.7%) and *P. falciparum* accounted for 4305 (36.1%). The study conducted in Halaba southern Ethiopia by Girum Tefera *(2014)* showed that out of 169 positive for malaria. species, *P. vivax* accounted for 119 (70.41) followed by *P. falciparum* accounted for 39 (23.08%) and 11 (6.51%) were mixed infection also the study conducted by Eshetu Molla *(2014)*

in Dilla town and surrounding showed that the *P. vivax* was the predominant species accounted for 35 (62.5%) followed by *P. falciparum* 15 (26.8%) and 6 (10.7%) were mixed infection.

In lowland of Ethiopia *P. falciparum* was the predominant species accounting for 65-75% of infection while *P. vivax* 25-35% of the cases CCR, (2013). The contribution of *P. falciparum* (81.2%) was higher than the data of the country as specified by CCR (2013). The *P. vivax* 18(4%) contribution was lower than P.*falciparum. CCR report, (2013).* But, *P. falciparum* rate in the present study was than reported by Gemechu Beffa *et al* (2012) who showed that *P. falciparum* accounted for 87% in south west Shoa district (south west Shoe zone health department report, 2012) However, the contribution of *P. vivax* (18.4%) of the current study was greater than 11.7% the assessment of Gemechu Beffa *et al* (2012). The study conducted in Matama Hospital by (Getachew Ferede *et al.,* 2013). who reported that the predominant plasmodium special detected was *P. falciparum* 8602 (90.7%) followed by *P. vivax* 852(9%). The study conducted in Arba Minch Hospital by Belaynehe Regasa *(2014)* indicated that the *P. falciparum* was predominant Specias than P.vivax with the prevalence rate of 18 (64.3%) and 7 (25%) respectively. The retrospective study in Sibu Sire district east Wollega zone by Temesgen Gemechu et al (2015) showed that *P. falciparum* was predominant species followed by *P. vivax* with the prevalence rate accounted for 3991 (66.1%) and 1842 (30.5%), respectively.

In the study are no of males and females are affected almost in equal rate, the male accounted for 5879 (49.3%) and female accounted 6022 (50.7%) However in studies conducted in other parts of the countries males and more affected than female. The recent retrospective analysis based study finding in Arsi Negele Health center by Mengestu H/mariam and Solomon Gebrie *(2015)* Who reported that the total of 2521 (11.5%) Malaria cases. 1387 (55.5%) were male and 1134 (45%) were females. The study done in South western Ethiopia by Lelisa Sena *et al*. (2014) who reported that slight more males 51.9% were affected than females 48.1% The study conducted in Arba Minich Hospital by Belayneh Regassa (2014) indicated that the males 16 (4%) were more infected than

females 12 (3%) The respospective study in Sibu sira district East Wollega zone by Temesgen Gemechu *et al 2015* showed that malria prevalence rate 56.6% and 46.4% respectively. The study conducted by Dilla Town and surrounding showed that the total of malaria parasites prevalence 58.9% and 41.1% of the parasite occurred in males and females respectively. Also the study conducted in Metema Hospital by Getachew Ferede *et al. (2013)* who reported that the males were more affected than females. The possible reasons for vulnerability different among males and females might be due to priority give the ITN to female because responsible to care their children. This was in line with other findings in SNNPR, where ITN use among females. Consistently greater than males Eskinder loha, *(2013)* the other possible reasons for the higher prevalence rate might be due to the fact that mostly males engage in activities which make them more prone to infective mosquito bites as compared to females counterparts which are mostly at home and protected from infective bites. The present finding was in consisted in Hallaba, southern Ethiopia by Girum Tefera (2014) clearly depicted that the females 97 (57.4%) were more affected than males 72 (42.6%).

All age categories were found to be affected by malaria almost in equal rate. The research conducted by Abebe Alemu *et al.* (2012) in Kolla Diba, who reported that the age group 15-44 (50%) was highly affected. The study conducted in Sibu Sire district, East wollega zone by Temesgen Gemechu *et al. (2012*) indicated that the age group 15-44 years old 50% more affected followed by 5-14 years old and 1-4 years old with prevalence rate 28.2% and 15.4% respectively. The study conducted by Lelise Sena et al. (2014) who reported that age group below 5 was more vulnerable. According to WHO (2016) some population group are at considered by higher risk of contracting malaria and develop severe disease than others. These include infants, children fewer than 5 years age, pregnant women and patients with HIV/AIDS.

Quarterly difference in malaria prevalence was observed in this study area. The highest peaks of transmission of malaria transmission in almost all years were observed major in 2nd (October-December) quarter year after heavy rain in August and September and in 4th (April-June) quarter year after medium rain fall march and April . This is in line with the major malaria epidemic seasons after a heavy rain in August and September, while the minor transmission occurs following the light rain of March and April (MOH, 2010). The study conducted in Metema Hospital by Getachew Ferede *et al.* (2013) who reported that high slide positive rate of malaria occurred during spring (September-November) and the study conducted in Fogera district, Ethiopia by Addisu Workineh and Belay Bezabih *(2014)* who reported that the major malaria transmission was from September to November, following the main rainy season and shorter transmission season from April to May following the short rainy season.

5. Conclusion and Recommendation

5.1. Conclusion

In this study from 2006 – 2015G.C the prevalence of malaria cases recorded in Atat primary hospital and also the associated risk factors of malaria was studied in one kebele where malaria is more prevalent. The prevalence rate is almost similar for six years, but for the last recent years it declines because of a better intervention from health such as a better utilization of long lasting insecticidal nets and establishments of health center at the malarious sites. The two most important plasmodium species found in this study area were *Plasmodium vivax* and *Plasmodium falciparum.* The *P. vivax* was the dominant species in the study area. All age group categories were affected by malaria and almost in equal rate and throughout the study periods. In this study both males and females are equally affected. The highest peaks of malaria were observed major in 2nd (October-December) quarter year and minor in 4th (April-June) quarter year were observed. The associated risk factors were marshy areas like ponds, not proper utilization of bed net, not regular of indoor residual spraying.

5.2. Recommendation

Based on the findings the following recommendations can be made:

- ❖ Health education about the associated risk factors must be given at kebele level.
- ❖ Concerning bodies such as zonal and woreda health bureau should give more emphasis on preventive measures such as teaching about proper utilization of long lasting insecticidal nets and indoor residual spraying.
- Further study is needed in the area about associated risk factors.
- The present finding must be supported by entomological survey.

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Questionnaires for dwellers of Gazanche kebele

I. Socioeconomic status

1. Name of Kebele----------

2. Age of the House hold head----------

3. Sex of the House hold----------

4. Religion ----------

A. Orthodox C. Muslim

B. Protestant D. Catholic

5. Ethnic----------

6. Martial status----------

A. Single C. Divorced

B. Married D. Widowed

7. Educational Status

A. Illiterate C. Primary school

B. Read & write D. High school E. Above High School

8. House hold size----------

9. Number of children----------

10. Age of children A.0-4 B.5-9C.9-13 D.13-17 E. Above 17

11. House hold income per month

A. <100 birr B. 101-300 birr C.301-500 birr D.> 500 birr

12. Educational status of the spouse

A. Not read and write C. primary school

B. Read and write D. High school

E. Above high school

Part II

Malaria Related Questionnaires

1. How long it takes to reach the nearby health center on foot

   A. <15 minutes B.15-30min C.30-45 min D.40-60min E. >1hr

2. Is there insecticide treated bed in the house hold?

   A. Yes B. No

3. If yes how many I T N do you have?

   A. 1 B. 2 C.3 D. >3

4. Who use the I T N?

   A. Children only B. Mother only C. father only

   D. Father and Mother E. The whole family F. Children and mother

5. Is the woreda health bureau have a program of teaching the society about how to utilize the insecticide society about bad net /ITN?

   A. Yes B. No

6. If your answer is yes , How many times they teach

   A. Rarely C. At the outbreak season

   B. Throughout the year

7. Is there anyone who had contracted malaria?

   A. Yes B. No

8. If yes, where did you go for treatment?

   A. Drug vendor B. Health center

   C. Hospital D. Traditional Treatment

9. Which Members of the family most affected by malaria

   A. Children C. Adults

   B. Youths D. Aged

10. In Which season that most people's are infected by malaria

    A. Jan-march C. July-Sep

    B. April –June D. Oct -Nov

11. Distance of the house from the pond or water drain

    A. <1km B.1-3km C.3-5km D.>5km

12. Is the woreda Health bureau have a program of spraying Insecticide DDT

    Yes ☐ No☐

13. If your answer is yes, how many times they spray Insecticide

    A. 1 time B. 2 time C. More than 2

ለቀበሌ ነዋሪዎች የቀረበ ቃለ መጠይቅ

የዚህ መጠይቅ ዓላማ ለወባ በሽታ አስተዋፅዖ በሚያደርጉ ሁኔታዎች ላይ መረጃ ለማሰባሰብ ነው። ስለሆነም የእርሶን መልካም ትብብር እንጠይቃለን።

I. የማህበራዊና ኢኮኖሚያዊ ሁኔታዎች

1. የቀበሌው ስም.....
2. የአባወራው ዕድሜ.....
3. ፆታ.....
4. ኃይማኖት.....
   ሀ) ኦርቶዶክስ ሐ. እስላም
   ለ) ፕሮቴስታንት መ. ካቶሊክ
5. ብሔር.....
6. የጋብቻ ሁኔታ .....
   ሀ) ነጠላ ሐ) የፈታ
   ለ) ያገባ መ) ባል ወይም ሚስት በሕይወት የሌሉ
7. የትምህርት ደረጃ
   ሀ) ያልተማሪ ሐ) አንደኛ ደረጃ
   ለ) ያገባ መ) ሁለተኛ ደረጃ
8. የቤተሰብ ብዛት.....
9. የልጆች ብዛት.....
10. የልጆች ዕድሜ.....
   ሀ) 0-4 ሐ) 9-13 ሠ) ከ17 በላይ
   ለ) 5-9 መ) 13-17
11. የቤተሰብ ገቢ
   ሀ) < 100 ብር ሐ) 301-500 ብር
   ለ) 101-300 ብር መ) ከ500 በላይ
12. የባለቤትዎ የትምህርት ደረጃ
   ሀ) ያልተማረች ሐ. አንደኛ ደረጃ
   ለ) ማበብና መፃፍ የምትችል መ) ሁለተኛደረጃ
   ሠ) ከሁለተኛ ደረጃ በላይ

ክፍልሁለት

ከወባበሽታጋርየተያያዙጥያቄዎች

1. በቅርብ ካለው ጤና ጣቢያ ጋር ለመድረስ በእግር ምን ያህል ጊዜ ይፈጃል?

ሀ) ከ 15 ደቂቃበታች ሐ) 30-45 ደቂቃዎች

ለ) ከ 15-30 ደቂቃ መ) ከ 40-60 ደቂቃዎች

ሠ) > 1 ሰዓትበላይ

2. በፀረ ወባ መድኃኒት የተነከረ አጎበት አላችሁ?

ሀ) አለን ☐ ለ) የለንም ☐

3. ካላችሁ ምን ያህል አላችሁ

ሀ) 1 ለ) 2 ሐ) 3 መ) ከ3 በላይ

4. አጎበሩን የሚጠቀሙበት እነማን ናቸው?

ሀ) ልጆች ብቻ ሐ) አባት ብቻ

ለ) እናት ብቻ መ) አባት እና እናት ሠ. ሁሉም

5. የወረዳው ጤና ቢሮ ማህበረሰቡን ስለ አጎበር አጠቃቀም የሚያስተምርበት መርሃ ግብር አለው?

ሀ) አለው ☐ ለ) የለውም ☐

6. መልሶትአዎንከሆነመቼ?

ሀ) አንዳንድ ጊዜ ለ) ዓመቱንሙሉ ሐ) በሽታው ሲከሰት

7. በቤታችሁ በወባ ተይዞ የሚያውቅ አለ ?

ሀ) አለን☐ ለ. የለንም ☐

8. መልስዎት አዎ ከሆነ የምትታከሙት የት ነው?

ሀ) መድኃኒት መሸጫ ቤት ለ) ጤና ጣቢያ

ሐ) ሆስፒታል መ) የባህል ህክምና

9. ከቤተሰቡ አባላት ብዙውን ጊዜ በወባ የሚያዘው ማነው?

ሀ) ህፃናት ሐ) ጎልማሶች

ለ) ወጣቶች መ) ሽማግሌዎች

10. በየትኛው ወቅት ነው ብዙ ሰው በወባ በሽታ የሚያዘው?

ሀ) ከጥር እስከ መጋቢት ሐ) ከሐምሌ እስከ መስከረም

ለ) ከሚያዝያ እስከ ሰኔ መ) ከጥቅምት እስከ ህዳር

11. የውሃ ኩሬ ወይም የውሃ ፍሳሽ ከቤታችሁ ምን ያህል ይርቃል?

ሀ) < 1 ኪ.ሜ ለ) 1-3 ኪ.ሜ

ሐ) 3-5 ኪ.ሜ መ. ከ> 5 ኪ.ሜ

12. የወረዳው ጤና ቢሮ የፀረ- ወባ መድኃኒት የመርጨት መርሃ ግብር አለው?

ሀ) አለው ☐ ለ) የለውም ☐

13. የወረዳው ጤና ቢሮ የፀረ-ወባ መድኃኒቱን ምን ያህል ጊዜ ይረጫል?

ሀ) 1 ጊዜ ለ. 2 ጊዜ ሐ. ከ2 ጊዜበላይ

14. የፀረ ወባው መድኃኒት የሚረጨው በየትኛው ቦታ ነው።

ሀ) በቤት ውስጥ ብቻ ለ) በቤትና በዙሪያቸው