

COLLEGE OF MEDICINE AND HEALTH SCIENCES

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Trend Analysis Of Malaria Prevalence In Atat Hospital, South-Central Ethiopia

A Retrospective Study

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ABSTRACT

INTRODUCTION: Malaria is caused by the protozoan parasites in the genus Plasmodium. Human malaria is usually caused by four different species; Plasmodium falciparum, Plasmodium malariae, Plasmodium vivax, Plasmodium ovale and occasionally Plasmodium knowlesi. The malaria parasite is transmitted by female Anopheles mosquitoes, which are blood sucking mainly between dusk and dawn. Ethiopia is one of the malaria endemic countries with an average 60% P. falciparum and 40% P. vivax prevalence during peak malaria transmission time.

OBJECTIVE: To determine the prevalence of malaria among patients examined and confirmed to have Plasmodium infection at Atat Hospital in the past five consecutive years, 2008 -2012 E.C

METHOD: The study was conducted at Atat Hospital from February 10/6/2012 to march 12/7/2012 E.C and November 28/3/2013 to December 15 in 2013 E.C. Cross-sectional retrospective record review method was implemented to obtain data from the five consecutive year reports.

RESULT: Retrospective cross-sectional surveys were conducted and 23,452 records were reviewed in Atat Hospital laboratories room from February 10/6/2012 to march 12/7/2012 E.C and November 28/3/2013 E.C, to December 15/4/ 2013 E.C. To determine the trend prevalence of malaria, A total of 2,764(11.7%) positive case records were viewed from the laboratory registration log books. From the total of 2,764 infected individuals 1559(56.4%) were male and 1205(43.6%) were female. The most dominant plasmodium species was Plasmodium vivax and there were no infection with Plasmodium ovale, Plasmodium malarea and Plasmodium knowlesi in all five years.

CONCLUSION AND RECOMMENDATION: There is still need for active health education campaigns and the administration of vector control interventions such as the consistent deployment of insecticide-treated bed-nets(ITN) and indoor residual spraying to interrupt disease transmission and an eventual reduction in the number of malaria cases.

KEY WORD: Ethiopia, Malaria trend, Atat Hospital

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Table of Contents

ABSTRACT ii
ACKNOLEDGEMENT iii
LIST OF FIGURE AND TABLE v
CHAPTER ONE 1
1. INTRODUCTION 1
1.1 Back ground information 1
1.2 Statement of the problem 3
1.3 Significance of the study 5
CHAPTER TWO 6
2. LITERATURE REVIEW 6
CHAPTER THREE 8
3. OBJECTIVE 8
3.1. General Objective 8
3.2. Specific Objectives 8
CHAPTER FOUR 9
4. METHODS AND MATERIALS 9
4.1. Study area and period 9
4.2. Study design 9
4.3. Population 9
4.3.1. Source Population 9
4.3.2. Study Population 9
4.4. Sample size and Sampling technique 10
4.6. Study Variables 10
4.6.1 Dependent Variable 10
4.6.2 Independent 10
4.7 Data collection and processing 10
4.7.1 Data collection 10
4.7.2 Data processing 11
4.8. Dissemination and Utilization of Results 11
4.9. Ethical Consideration 11
CHAPTER FIVE 11

5.1. Socio-demographic characteristics of study subject 13
5.2. Annual trends of malaria cases from 2008-2012, at Attat Hospital, South-Central, Ethiopia 17
5.3. Seasonal prevalence of plasmodium species from 2008-2012 at Atat Hospital 18
CHAPTER SIX 20
6.1 DISCUSION 20
6.2 Limitation of the study 22
CHAPTER SEVEN 23
7. CONCLUSION AND RECOMMENDATION 23
Recommendation 23
REFERENCE 23
ANNEX -1 26

LIST OF FIGURE AND TABLE

Figure 1: Proportion of malaria infection in the last five years from 2008-2012 E.C, Atat Hospital, South-Central, Ethiopia

Figure 2: The trend of Malaria prevalence on male and female from 2008-2012, Atat Hospital South-Central, Ethiopia

Table 1: Annual case of malaria parasite distribution from 2008-2012 E.C, Atat Hospital, South-Central Ethiopia.

Table 2: Age distribution of malaria positive cases by plasmodium species from 2008-2012 E.C, Atat Hospital, South-Central, Ethiopia

Table 3: Age distribution of malaria positive cases by plasmodium species among patient in 2008 in atat hospital, South-Central Ethiopia

Table 4: Age distribution of malaria positive cases by plasmodium species among patient in 2009 in atat hospital, South-central Ethiopia

Table 5: Age distribution of malaria positive cases by plasmodium species among patient in 2010 in atat hospital, South-Central, Ethiopia

Table 6: Age distribution of malaria positive cases by plasmodium species among patient in 2011 in atat hospital

Table 7: Age distribution of malaria positive cases by plasmodium species among patient in 2012 in atat hospital

Table 8: Annual trend of malaria parasite cases by species distribution from 2008-2012 in Atat Hospital, South-Central Ethiopia.

Table 9: Seasonal variation of malaria parasites in blood film positive patients in 2008-2012 E.C in Atat Hospital, South-Central Ethiopia.

CHAPTER ONE

1. INTRODUCTION

1.1 Back ground information

Malaria is an infection of red blood cells caused by a single-celled parasite from the genus *Plasmodium*. More than 100 different species of *Plasmodium* exist. They produce malaria in many types of animals and birds, as well as in humans. Four species of *Plasmodium* commonly infect humans: *Plasmodium vivax, Plasmodium malariae, Plasmodium falciparum, Plasmodium ovale* and occasionally, *Plasmodium knowlesi*. Each one has a distinctive appearance under the microscope, and each one produces a somewhat different pattern of symptoms. Two or more species can live in the same area and infect a single person at the same time [1].

Malaria is transmitted when a competent vector, the female anopheles mosquito, takes a blood meal from somebody already infected with malaria. After being ingested by the mosquito, the parasite finds its way to the mosquito gut, where it undergoes a life-cycle transformation. After this, the parasite migrates back to the mosquito's salivary glands, where it can be injected into another victim [2].

Changes in the environment of the mosquito habitat, such as those taking place in changes in the environment Ethiopia, whether natural or man-made, "… rearranges the ecological landscape in which these vectors breed". Every *Anopheles spp.* occupies a specific "….ecological niche that is genetically determined". Changes in temperature, humidity, altitude, population density of humans, and deforestation are just a few ecological factors that each plays essential parts in the transmission of malaria [3].

Temperature and humidity have a direct effect on the longevity of the mosquito. Each species can thrive at an optimal level as a result of ecological adaptation. The spread of malaria requires that conditions are favorable for the survival of both the mosquito and the parasite. Temperatures from approximately 21°-32°C and a relative humidity of at least 60% are most conducive for maintenance of transmission. In tropical regions temperature and humidity are often mediated by altitude. Altitude is significant in determining the distribution of malaria and its seasonal impact

on many regions of the world. In Africa, for example, altitudes above 1,000-1,500 m are considered safe from malaria. However, it must be cautioned that with continuing global climate change, these figures may change, extending the range of mosquitoes well above those altitudes as ambient temperatures rise. The mosquito density (number of female mosquitoes per human inhabitants) is a critical determinant of the intensity of infection. Transmission is directly proportional to density. Mosquito longevity is also a critical factor. The malaria vector requires water to complete its life cycle: egg, larva, pupa, and adult [4].

Malaria is an acute febrile illness with incubation period of 7 days or longer. Thus, a febrile illness developing less than 1 week after the first possible exposure is not malaria. The most severe form is caused by *P. falciparum*; variable clinical features include fever, chills, headache, muscular aching and weakness, vomiting, cough, diarrhea and abdominal pain. Other symptoms related to organ failure may supervene, such as acute renal failure, pulmonary edema, generalized convulsions, circulatory collapse, followed by coma and death. The initial symptoms, which may be mild, may not be easy to recognize as being due to malaria. It is important that the possibility of falciparum malaria is considered in all cases of unexplained fever starting at any time between 7 days after the first possible exposure to malaria and 3 months(or, rarely, later) after the last possible exposure. Any individual who experiences a fever in this interval should immediately seek diagnosis and effective treatment, and inform medical personnel of the possible exposure to malaria infection. Falciparum malaria may be fatal if treatment is delayed beyond 24 hours after the onset of clinical symptoms. Young children, pregnant women, people who are immune suppressed and elderly travelers are particularly at risk of severe disease. Malaria, particularly P. falciparum, in non-immune pregnant travelers increases the risk of maternal death, miscarriage, stillbirth and neonatal death [5].

Human malaria caused by other Plasmodium species results in significant morbidity but is rarely life-threatening. Cases of severe *P. vivax* malaria have been reported among populations living in (sub)tropical countries with malaria risk. *P. vivax*and *P. ovale* can remain dormant in the liver; relapses caused by these persistent liver forms (“hypnozoites”) may appear months and, rarely, several years after exposure. Relapses are not prevented by current chemo prophylactic regimens, with the exception of primaquine. Latent blood infection with *P. malariae* may be present for many years, but it is very rarely life-threatening. *P. knowlesi* malaria is primarily a

public health problem among populations living or working in forested areas in south-east Asia. In recent years, sporadic cases of travelers' malaria due to *P. knowlesi* have been reported. Humans can be infected with this "monkey malaria" parasite while staying in rainforests and/or their fringe areas, within the range of the natural monkey hosts and mosquito vector of this infection. These areas include parts of Brunei Darussalam, Cambodia, China, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam[6].

P. knowlesi has a life-cycle of 24 hours and can give rise to daily fever spikes occurring 9–12 days after infection. Symptoms may be atypical of malaria. Severe *P. knowlesi* malaria with organ failure may occur, and sporadic fatal outcomes have been described.*P. Knowlesi*has no persistent human infection. *P. Knowles i*infections have been reported should protect themselves against mosquito bites between dusk and dawn to prevent infection and take chemoprophylaxis where indicated [7].

1.2 Statement of the problem

Malaria remains one of the major killers of humans worldwide, threatening the lives of more than one-third of the world's population. It thrives in the tropical areas of Asia, Africa, and Central and South America, where it strikes millions of people. Each year 350 to 500 million cases of malaria occur worldwide. Sadly, more than 1 million of its victims, mostly young children, die yearly [8].

Data from the 2018 World Malaria Report estimates that 3.2 billion people worldwide were at risk of malaria infection in 2017, 215 million cases of malaria were recorded, and 655,000 persons (86% of whom were 2018). While the World Malaria Report suggests a fall in global malaria mortality rates of more than 25% since 2000, SSA continues to record the highest burden of malaria. Of the 216 million malaria cases in 2017, 81% (174 million) were in SSA.

About 91% (596,000) of the 655,000 malaria deaths also occurred in SSA. It is estimated that 40-50% of admissions to healthcare facilities in SSA are malaria-related, which translates into an estimated 40% of healthcare expenditures [2].

Every year, malaria a parasitic disease spread by the bite of a mosquito, results in 300 million to 500 million clinical cases and causes more than 1 million deaths. Mostly it is young children under the age of five in sub-Saharan Africa who are affected, dying at the rate of nearly 3,000 every day. In Africa, malaria causes approximately 20 percent of all child deaths. Some children suffer an acute attack of cerebral malaria that quickly leads to coma and death; others succumb to the severe anemia that follows repeated infections, or to the consequences of low birth weight caused by malaria infection in the mother's womb [9].

It is estimated that three-fourths of the land below 2000 meters is malarias with two-thirds of the country's population at risk. This makes malaria the number one health problem in Ethiopia with an average of 5 million cases a year and 9.5 million cases per year between2001 and 2005 [4]. The disease causes 70,000 deaths each year and accountant for 17% of out patient visits to health institutions. It also accounts for "…15% of admissions and 29% of inpatient deaths" - a figure considered to be too low given that more than a third of the country's population does not have access to health services. A number of contributing factors have been identified [10, 11]

The burden of malaria has been increasing due to a combination of large population movements, increasing large scale epidemics, mixed infections of *Plasmodium vivax* and *Plasmodium falciparum*, increasing parasite resistance to malaria drugs, vector resistance to insecticides, low coverage of malaria prevention services, and general poverty. Outpatient consultations, inpatient admissions and all in-patient deaths have risen by 21-23% over the last five years. Ethiopian adults, unlike their counterparts in more endemic areas, have relatively little protective immunity and are also *vulnerable* to malaria. Epidemics, which traditionally occur every five to eight years, are a hallmark of malaria in Ethiopia. The epidemic of 1950 is estimated to have caused 3 million cases and resulted in 150,000 deaths. Unstable and largely unpredictable malaria epidemiology makes surveillance, information management and logistics for vector control and pharmaceuticals of paramount importance. *Plasmodium vivax* and *Plasmodium falciparum* comprise 40% and 60% of malaria infections respectively [12].

Quantification of the social economic burden of malaria in Ethiopia is problematic since the victims live mostly in rural areas out of sight and out of mind of social scientists and other researchers, but some estimates abound." The social and economic consequences of the disease are sobering, with a large number of people kept from work by debilitating illness resulting in

low productivity. While household malaria burden is likely to be under estimated by institution data, routine health reports clearly reveal the burden of Malaria on the health system. According to annual national health indicator reports, malaria has consistently ranked in the top 10 causes of outpatient visits admissions, and death at health centers and hospitals for the past seven years [12].

This makes malaria in Ethiopia not just a health issue but a food-security and environmental issue as well. The malaria season coincides with peak economic activity in rural Ethiopia when both rainfall levels and temperature are high and conducive for the growing of subsistence crops. Vectors activity peaks in the months often set aside for cultivation, weeding, harvesting and winnowing. Weddings and other culturally important activities also peak at this time. In other words, optimal climatic regimes for socio-economic activities in rural Ethiopia also favor the reproduction, propagation and thereby the preying up human blood of vector mosquitoes[11,14].

1.3 Significance of the study

Up to our information, there is no retrospective study which reviewed the past trend of malaria especially in the study area therefore this study will depict the trend of malaria prevalence in the last five years and its parasite distribution in the study area. The result could indicate the positivity rate among requested malaria examination and can serve as background information to develop appropriate control strategies. It can also be used as baseline information for further studies by other investigators. To enable the government to take control measures on transmission of Plasmodium parasites, by focusing its effort to the area's most affected by malaria.

CHAPTER TWO

2. LITERATURE REVIEW

Globally, an estimated 3.3 billion people in 97 countries and territories are at risk of being infected with malaria and developing disease and 1.2 billion are at high risk (>1 in 1000 chance of getting malaria in a year). According to the estimates, 198 million cases of malaria occurred globally in 2018 (uncertainty range 124–283 million) and the disease led to 584 000 deaths (uncertainty range 367 000–755 000), representing a decrease in malaria case incidence and mortality rates of 30% and 47% since 2000, respectively. The burden is heaviest in the WHO African Region, where an estimated 90% of all malaria deaths occur, and in children aged under 5 years, who account for 78% of all deaths [15].

There is a case study in Ghana which shows the percentage distribution of total malaria cases reported in the health facilities in the twelve districts of the Volta Region for the period of 1999 – 2004. The results this study indicates that 24.7% of cases reported at the health facilities was by women in the Hoboes District in year 2003, this was again followed by women from the Hoboes District with 21.5% in 2000 and 2002. The male population in the Hoboes District for year 2003 also showed a significantly high proportion of reported cases of malaria. The least reported cases (0.9%) each are from the North Tongu District for years 2000 and 2002. This clearly confirms the hypothesis that areas with favorable geographical characteristics to the anopheles mosquito, the vector that transmits malaria, shows predominant transmission of the disease [16].

The study on prevalence, risk factors, knowledge, Malaria in Hadhramout, a southeast province of Yemen: indicate that overall prevalence of malaria was 18.8% with Plasmodium falciparum as the predominant species (99.3%) with a low rate of Plasmodium vivax detected (0.7%). The infection rate was higher in Al-Raydah and Qusyer districts(21.8%) compared to Hajer district (11.8%). Fifty-two percent of the persons positive for *Plasmodium* were a symptomatic with low parasite density. The adults had a higher infection rate as compared to children.

Univariate analysis identifies those whose household's head are fishermen (OR = 11.3, 95% CI: 3.13 – 40.5) and farmers (OR = 4.84, 95% CI: 1.73 – 13.6)as high-risk groups. A higher number of positive smears were observed in people living in houses with uncemented brick walls (OR =

2.1, 95% CI: 1.32 – 3.30), without access to toilets (OR = 1.6, 95% CI: 1.05 – 2.32), without a fridge(OR = 1. 6, 95% CI: 1.05 – 2.30), or without TV (OR = 1. 6, (95% CI: 1.05 – 2.30). People living in houses with water collection points located less than 200 meters away were also at higher risk of acquiring malaria (OR = 1.6, 95% CI:1.05 – 2.30). Knowledge about the importance of using insecticide-treated mosquito nets (ITNs) and indoor residual spraying (IRS) for prevention of malaria was 7% and 2%, respectively [18].

Another research on the prevalence of malaria parasitic infections in cord blood association with some socio demographic profile was carried out in Edo State Nigeria. This study report that, out of the 100 cord blood samples from newly delivered babies examined, the prevalence of malaria parasite in cordblood was found to be 9 (9%). the results on packed cell volume also showed that the prevalence rate was higher in the mean pack cell volume values of 25.5 (15.4%) while the result on species distribution revealed that *Plasmodium falciparum* had the highest prevalence (6%). also the detection of malaria parasite showed a higher prevalence in the microscopic method (9%)over the rapid detection technique (6%) [20].

Another study on the Prevalence of malaria parasites in adults and its determinants in malaria endemic area of Kisumu County, Kenya have reported that the adult prevalence of presence of malaria parasites in Maseno was 28% (95% CI: 25.4–31.0%). And it conclude that, Gender was a significant socio-demographic risk factor in both unilabiate (OR 1.5, p = 0.005) and multivariate (OR 1.4, p = 0.019) analyses. Females were 50% more likely to have malaria than men [21].

A ten year trend analysis of malaria prevalence was carried out in Kola Diba, North Gondar, North-west Ethiopia. According to this study, Within the last decade (2002–2011) a total of 59, 208 blood films were requested for malaria diagnosis in Kola Diba health center and 23,473 (39.6%) microscopically confirmed malaria cases were reported in the town with a fluctuating trend. Regarding, the identified plasmodium species, *Plasmodium falciparum* and *Plasmodium vivax* accounted for 75% and 25% of malaria morbidity, respectively. Malaria was reported in all age groups and both sexes, but the 15–44 year age group and males were more affected.

Despite the apparent fluctuation of trends in the area, the highest peak of malaria cases was reported during spring seasons [19].

There is also the study conducted on prevalence of malaria infection in Butajira area, south-central Ethiopia. According to this study in total, 19,207 persons were examined in the six surveys. From those tested, 178 slides were positive for malaria, of which 154 (86.5%) were positive for *Plasmodium vivax* and 22 (12.4%) for *Plasmodium falciparum;* the remaining two (1.1%) showed mixed infections of Plasmodium falciparum and Plasmodium vivax. This study also indicates that the incidence of malaria was higher after the main rainy season, both in lower lying and in highland areas [17].

CHAPTER THREE

3. OBJECTIVE

3.1. General Objective

- To determine trend of malaria prevalence among patients attended Atat Hospital in the past five consecutive years 2008-2012 E.C.

3.2. Specific Objectives

- To assess the distribution of malaria with regard to sex and age of patients in Atat Hospital in the last five years.
- To determine the trend of Plasmodium species among the patients in Atat Hospital in the last five years
- To assess the seasonal variation with malaria infection among patients in Atat Hospital in the last five years

CHAPTER FOUR

4. METHODS AND MATERIALS

4.1. Study area and period

The study was conducted at Atat Hospital from February 6/10/2012 to march 12/7/2012 E.C and November 28/3/2013 E.C to December 15/3/2013 E.C. The hospital is located at Gurage Zone, SNNPR, Ethiopia, which is 180 Kilo meters South-Central of the Capital city Addis Ababa and has an elevation between 1910-1935 meters above sea level. It was 43 years in operation and owned by the catholic-church in Ethiopia. According to the national population and housing census of 2007 of Ethiopia, the number of population live nearby was 28,866 and from those 15,074 were males and 13,792 were women.

4.2. Study design

Cross-sectional retrospective record review method was implemented to obtain information from the five consecutive year reports of malaria at the hospital.

4.3. Population

4.3.1. Source Population

The source population was those patients who came to the Atat hospital during the past five years.

4.3.2. Study Population

All patients requested for malaria examination and the result of whom recorded on the registration book at Atat Hospital laboratory room at any time between (September 1/1/ 2008 to August 30/12/2012 E.C).

4.4. Sample size and Sampling technique

The sample size was those patients requested for malaria examination and whose results are available and complete in five year.

4.5 Eligibility

4.5.1 Inclusion criteria

All malaria suspected patients that visited to the health centers for malaria examination and registered in the laboratory log books with reliable (complete) results in the last five years.

4.5.2 Exclusion criteria

Incomplete Laboratory records i.e. reports lacking age, sex and result.

4.6. Study Variables

4.6.1 Dependent Variable

- Prevalence of malaria

4.6.2 Independent

- Sex
- Age
- Seasonality

4.7 Data collection and processing

4.7.1 Data collection

Data was collected by reviewing five years malaria report records of Atat Hospital laboratory. Information such as age, sex and month of malaria examination and results was recorded on a systematically prepared data collection format.

4.7.2 Data processing

Data was, coded and checked for completeness and cleaned of any inconsistencies. The data was presented using tables and graphs. Percentage was calculated to show prevalence positivity and different variables such as age, sex, month and year of examination.

- The data collecting format was checked whether all the necessary information is properly fulfilled or not.

4.8. Dissemination and Utilization of Results

- The result obtained in current study was submitted to Department of Medical Laboratory Sciences. Therefore it was a baseline for other studies.
- The study result was communicated with Atat Hospital administrators, Governmental.

4.9. Ethical Consideration

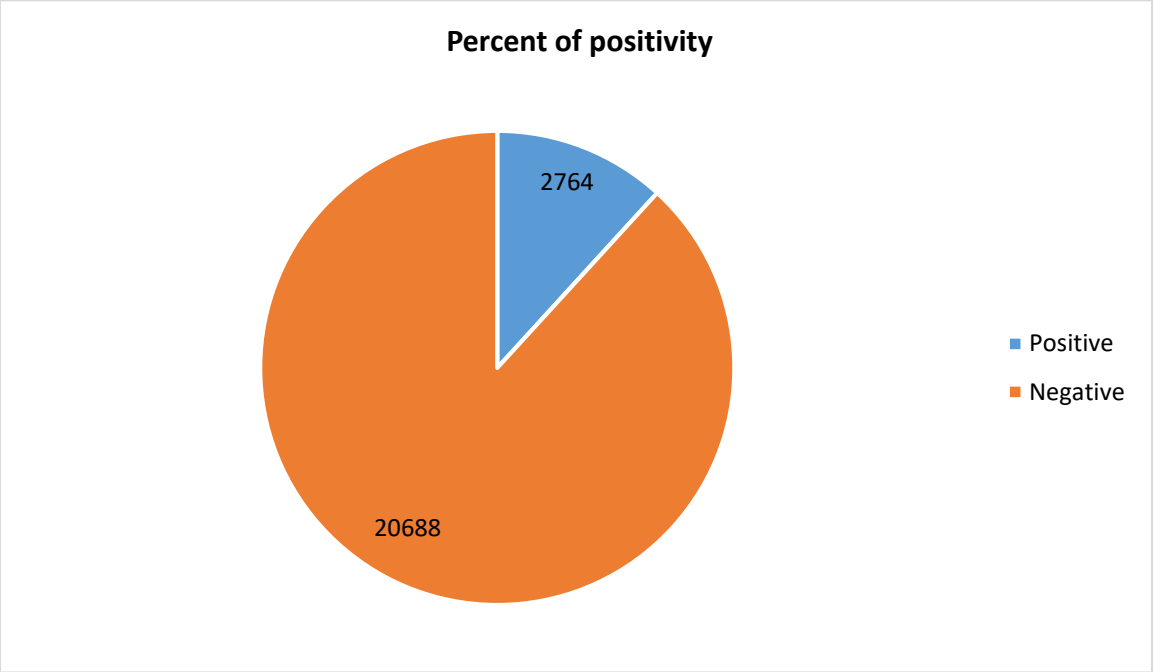
Before data collection, written consent was obtained from department of medical laboratory science and this letter was communicated with the Atat Hospital administrators. Confidentiality of the results was maintained by removing identifiers like name.

CHAPTER FIVE

RESULT

Data was extracted from record in the registration log books for requested blood films of malaria diagnosis and analyzed for a total of 23,452 cases for five consecutive years, of which 2,764(11.7%) were infected with malaria and 20,688(88.3%) were negative. From the total of infected individuals 1559 (56.4%) were male and 1205(43.6%) were female. The highest malarial cases were treated by the year 2009, 706(25.6%). For total malaria cases by seasonal variation maximum cases were observed in Autumn (March, April and May). Malaria was reported in all age groups and both sexes. The most dominant plasmodium species in all five years were *P. vivax* 1487(53.8%) especially in 2009 E.C, there is also 834(30.2 %) *P. falciparum* infection, the rest 443(16%) accounts for mixed infection. There is no infection with *P.malarie* , *P.ovale* and *P.knowlesi*.

Figure 1: Proportion of malaria infection in the last five years from 2008-2012 E.C, in Atat Hospital,South-Central,Ethiopia.



The chart above shows the overall prevalence of malaria in the past five years, 2008 to 2012 is 2,764(11.7%).

Table 1: Annual case of malaria parasite distribution in 2008-2012 E.C in Attat Hospital, South-Central Ethiopia.

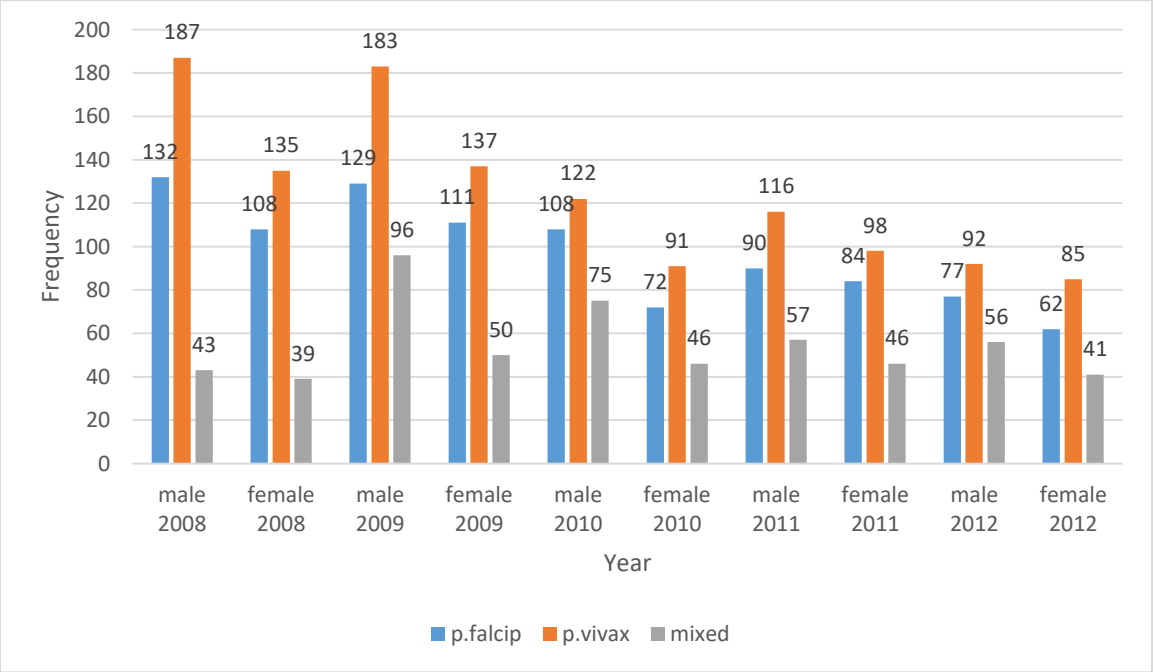
Year	Total no. of malaria blood film examination		
	Positive	Negative	Total
2008	644	4630	5274
2009	706	4386	5092

2010	510	4257	4767
2011	491	3906	4397
2012	413	3509	3922
Total	2764	20688	23452

5.1. Socio-demographic characteristics of study subject

From the total of 2,764 infected individuals,1559(56.4%) were male and 1205(43.6%) were female. Malaria was reported in all age groups but the infection rate was higher in the age groups of >15years, with a prevalence rate of 1384(50%) followed by 5-15 years, with a prevalence rate of 1056 (38.3%) and least in the age groups of <5, with a prevalence rate of 324(11.7%)

FIGURE 2: The trend of Malaria prevalence on male and female from 2008-2012 E.C, Atat Hospital,South-Central,Ethiopia



- It shows the trend of Malaria prevalence on male and female in the past five years. The most commonly prevalent species is *P. vivax* for both sexes in all year.

Table 2: Age distribution of malaria positive cases by plasmodium species from 2008-2012E.C, Atat Hospital, South-Central, Ethiopia

age	Plasmodium species				
	P.falciparum	P.vivax	Mixed	Total	Percent
<5	102(31.9%)	171(52.4%)	51(15.7%)	324	11.7%
5-15	419(39.6%)	478(45.4%)	159(15%)	1056	38.3%
>15	467(33.7%)	543(39.2%)	374(27.1%)	1384	50%
Total	988	1192	584	2764	100%

- The above table shows the prevalence of malaria species in all age groups but the infection rate was higher in the age groups of >15 and least in the age groups of <5 years, with a prevalence rate of 1384(50%) and 324(11.7%) respectively.

Table 3: Age distribution of malaria positive cases by plasmodium species among patient in 2008 in atat hospital, South-Central Ethiopia

Age	Plasmodium species			Total
	p. falciparum	p. vivax	Mixed	
<5	18	55	26	99
5-15	56	94	48	198

>15	105	153	89	347
Total	179	302	163	644

- The above table shows the prevalence of malaria species in 2008 year among different age group with its prevalence high in the age group >15 (53.9%) and least prevalent in age group <5 (15.4%) followed by age group 5-15 (30.7%).

Table 4: Age distribution of malaria positive cases by plasmodium species among patient in 2009 in atat hospital, South-central Ethiopia

Age	Plasmodium species			Total
	P.falciparum	P. vivax	Mixed	
<5	13	24	6	43
5-15	118	157	30	305
>15	123	185	50	358
Total	254	366	86	706

- The above table shows the prevalence of malaria species in 2009 year among different age group with its prevalence high in the age group >15 (50.7%) and least prevalent in age group <5 (6.1%) followed by age group 5-15 (43.2%).

Table 5: Age distribution of malaria positive cases by plasmodium species among patient in 2010 in atat hospital, South-Central, Ethiopia

Age	Plasmodium species			Total
	p.falciparum	p.vivax	Mixed	
<5	8	13	2	23
5-15	62	91	36	189
>15	105	128	65	298
Total	175	232	103	510

- The above table shows the prevalence of malaria species in 2010 year among different age group with its prevalence high in the age group >15 (58.4%) and least prevalent in age group <5 (4.5%) followed by age group 5-15 (37.1%).

Table 6: Age distribution of malaria positive cases by plasmodium species among patient in 2011 in atat hospital,South-Central,Ethiopia

Age	Plasmodium species			Tolal
	P.falciparum	P. vivax	Mixed	
<5	7	10	4	21
5-15	54	97	29	180
>15	92	143	55	290
Total	153	250	88	491

- The above table shows the prevalence of malaria species in 2011 year among different age group with its prevalence high in the age group >15 (59.1%) and least prevalent in age group <5 (4.2%) followed by age group 5-15 (36.7%).

Table 7: Age distribution of malaria positive cases by plasmodium species among patient in 2012 in atat hospital,South-Central, Ethiopia

Age	Plasmodium species			Total
	P.falciparum	p. vivax	Mixed	
<5	6	9	2	17
5-15	62	85	41	188
>15	83	101	24	208
Total	151	195	67	413

The above table shows the prevalence of malaria species in 2011 year among different age group with its prevalence high in the age group >15 (59.1%) and least prevalent in age group <5 (4.2%) followed by age group 5-15 (36.7%).

5.2. Annual trends of malaria cases from 2008-2012, at Attat Hospital, South-Central, Ethiopia

The Maximum cases were diagnosed by the year 2009, with prevalence rate of 706(25.6%) followed by 2008, with prevalence rate of 644(23.3%) and the Minimum malarial cases were diagnosed by 2012, with prevalence rate of 413(15%) followed by 2011, 2010 with prevalence rate of 491(17.7%), 510(18.4) respectively.

Table 8: Annual trend of malaria parasite cases by species distribution in 2008-2012 in Atat Hospital, South-Central Ethiopia.

Year	**Total No. of Positive malaria blood film examination**			
	P. falciparum	P.vivax	Mixed	Total
2008	216(33.5%)	303(47%)	125(19.5%)	644
2009	228(32.3%)	382(54.1%)	96(13.6%)	706
2010	145(28.4%)	295(57.8%)	70(13.7%)	510
2011	130(26.5%)	266(54.1%)	95(19.4%)	491
2012	115(27.8%)	241(58.4%)	57(13.8%)	413
Total	834	1487	443	2764

- The most dominant plasmodium species in all five years were *P. vivax 1487* (53.8%), there is also 834 (30.1%) P. falciparum infection, and the rest 443(16.1%) accounts for infection with *mixed infection.* There is no infection with *P. malariae, P. ovale* and *P. knowlesi*.

5.3. Seasonal prevalence of plasmodium species from 2008-2012 at Atat Hospital

For a total malaria cases by seasonal variation, maximum positive cases were observed in Autumn (Mar-Apr) with a prevalence rate of 10055(38.2) followed by Spring (Sep-Nov) with a prevalence rate of 887(32.1%) and minimum malaria positive cases were observed in winter (Dec-Feb), with a prevalence rate of 386 (14%) followed by summer 436(15.8%)

Table 9: Seasonal variation of malaria parasites in blood film positive patients in 2008- 2012 E.C in Atat Hospital, South-Central Ethiopia.

Season	Year of examination					Total
	2008	2009	2010	2011	2012	
Spring(Sep-Nov)	192(21.6%)	216(24.4%)	183(20.6%)	174(19.6%)	122(12.8%)	887
Winter(Dec-February	74(19.2%)	93(24.1%)	74(19.2%)	86(22.2%)	59(15.3%)	386
Autumn(Mar-May	235(22.2%)	272(25.8)	210(20%)	197(18.7)	141(13.3%)	1055
Summer(Ju-Aug)	143(32.8%)	125(28.7%)	43(9.8%)	34(7.8%)	91(20.9%)	436
Total	644	706	510	491	413	2764

- The above table shows the prevalence of malaria species in all five years within seasonal variation, its prevalence high in the Autumn and least in the Winter season with the prevalence rate of 1055 (38.1 %) and 386 (13.9%) respectively.

CHAPTER SIX

6.1 DISCUSION

A patient record based retrospective study were conducted on 23,452 records to determine the trend prevalence of malaria parasitic infection, variability and complexity in different season, month, sex, age and year of examination. Accordingly 2,764 (11.7%) records were microscopically confirmed positive malaria case which was high when compared with the study conducted in Butajira area, south-central Ethiopia in 2012 which report 0.93% positive case (17).

In this study *P. vivax* was the dominant cause of infection than *P. falciparum.* Climatic conditions have contributed to the dominance. Furthermore, the relapsing cases or nature of *P. vivax* may have increased the prevalence of the species.

Malaria is a devastating vector-borne disease that primarily occurs in the developing world. The results of this study revealed that during the last five years, a fluctuating trend occurrence of malaria cases was observed in the study area. An increase in the number of malaria cases occurred from 2008–2009 and a decrease in the number of malaria cases occurred from 2009-2012, with a minimum number of malaria cases reported in 2012. However, there was an increase in the number of malaria cases by the year 2008-2009. In every year studied the remarkable increment of total malaria cases was mainly due to an increase of *P. vivax* with an increase of *P. falciparum,* which indicates that the deadly plasmodium species is common in the study area.

A ten year trend analysis of malaria prevalence was carried out in Kola Diba, North Gondar, Northwest Ethiopia. According to this study, Within the last decade (2002–2011) a total of 59, 208 blood films were requested for malaria diagnosis in Kola Diba health center and 23,473 (39.6%) microscopically confirmed malaria cases were reported in the town with a fluctuating trend. Regarding the identified plasmodium species, *Plasmodium falciparum* and *Plasmodium vivax* accounted for 75% and 25% of malaria morbidity, respectively. Malaria was reported in all

age groups and both sexes, but the 15-24 year age group and males were more affected. Despite the apparent fluctuation of trends in the area, the highest peak of malaria cases was reported during spring seasons(19). But according to this study the microscopically confirmed malaria case was only 11.7%. And most dominant plasmodium species was *Plasmodium vivax* 53.8% in 2008-2012. Similar to this study male were more affected than female but the highest peak of malaria case was reported in summer season.

In this study, the overall prevalence of malaria in males 1559 (56.4%) were higher than females 1205(43.6%). This result was in line with the study done in Sarbo Health Center, Kersa Woreda in 2009 by Mamo Bekele *et al*. its prevalence for males was [63.8 %(1918/3009 cases)] but for females[36.2 %(1091/3009 cases)] (24). This might be due to the fact that agriculture is the main job and sleeping and staying out door is common during the night time. And hence, males are more exposed to *Anopheles* mosquito bites. However, this result is contradicted with a study done in Kisumu County, Kenya which reported Females 50% more likely to have malaria than men (25). This difference may due to environmental factor and in study period differences.
The predominant *Plasmodium* species detected was *P. vivax*, followed by *P. falciparum*. This was in contradict with other previous studies in Sarbo Health Center, Kersa Woreda Plasmodium falciparum constituted the most pre dominant [64.6 %(1946/3009) cases, while plasmodium vivax confirmed with 34.9% (1946/3009) and in Kola Diba health center, North Gondar, from the total of 23,473 malaria cases, 17605 (*75*%) were *Plasmodium falciparum* and the remaining 5868 (25%) were *Plasmodium vivax* (25). and in agree with the study conducted in Butajira area, south central Ethiopia by Adugna Woyessa *et al*. most prevalent species was *P. vivax* followed by *P. falciparum* (26). This difference might be due to climatologically differences and altitude variation.

The season with the highest average total malaria cases was observed during Autumn (March–May) with prevalence rate of 1055(38%) followed by Spring (September–November), 887(32%) while low slide positive rate occurred during winter (December–February) followed by Summer (June–August) with the prevalence rate of 386(13.4%) and 436(17%) respectively. This contradict with a seven years retrospective study done in Metema hospital, Northwest Ethiopia High slide positive rate of malaria were occurred during spring (Sept.–Nov.) 3118 (20.7%),

followed by summer (June–August) 2385 (16.6%), winter (Dec.–Feb.) 2130 (16%), and autumn (Mar.–May) 1853 (14.2%) (20). the occurrence of malaria depends on adequate rainfall and temperature.

Regarding the age groups >15 years were highly affected 1384(56%) followed by 5-15 years 1056(38.7%), at species level, P. vivax were more prevalent in all age groups. This might be associated with their daily activities. Farming is extensive in surrounding Attat due to the fact that young daily laborers move to harvesting site, from different areas for application of herbicide, for gathering of crops and for learning process. But the reason why malaria affects under 5 age groups might be due to the fact that children below the age of five immunity systems which are not yet developed. This result different with the WHO report it indicated that less than five children's more affected (27). This difference may to our study is focused on the study area but WHO report is in the whole of the country.

6.2 LIMITATION OF THE STUDY

Patient data not recorded without complete information was not included in the study. The other limitation of this study was that we used microscopy having lower sensitivity rather than polymerase chain reaction (PCR) to identify *Plasmodium* species in the study area.

CHAPTER SEVEN

7. CONCLUSION AND RECOMMENDATION

Malaria is still the major problem in developing countries. It is a diagnostic challenge in sub Saharan Africa, including Ethiopia. Moreover, being male was at higher rate of positivity than female. The highest frequency of malaria positivity was among the productive age group (>15), which may result low income affecting the economy of the working class of the population

RECOMMENDATION

Based on the above conclusion the following recommendations are forwarded:

Attention should be given to strengthen the laboratory services for malaria investigation and diagnosis in Atat Hospital in particular and in the country in general. Health education about malaria transmissions and prevention should be given and large scale study on the prevalence of malaria infection using more sensitive methods could maximize and determine the exact prevalence of malaria infections. Also the respective health bureau and other stake holders should still need to strengthen their effort to control it.

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ANNEX -1

WOLKITE UNIVERSITY

COLLEGE OF MEDICINE AND HEALTH SCIENCE

DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Checklist for data collection for the trend of malaria prevalence among patients attended AttatHospital's laboratory in the past five years

Code number_____

Year examined_____ Month_____

Sex: Male_____ Female_____

Age:_____

Malaria examination result

Positive_____Negative_____

Plasmodium species

P. *falciparum*_____

*P.vivax*_____

*P. malariae*_____

*P.ovale*_____

*Mixed infection*_____

We, the undersigned, declare that this research paper is our original work, has not been presented for a degree in any other universities. We also declare that all sources of materials used for the research paper had been duly acknowledged.

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