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Trend Analysis of Malaria Prevalence in Tarcha General Hospital, Dawuro Zone, Southwest Ethiopia

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Abstract

Malaria is one of the major public health problems in worldwide. In Ethiopia, there is a significant decline in disease burden; however, the overall trend of malaria prevalence is not studied or well-documented in different localities including the current study area. The aim of this study was to determine the trend of malaria prevalence in last five years' period from 2014 to 2018 in Tarcha General Hospital. A hospital based retrospective study was conducted by reviewing of blood film of malaria documents. Daily malaria data with the relevant variables was extracted from the institutional malaria registration log book of the last five years' period from 2014 to 2018 (2006–2010 E.C). The data was analyzed manually using scientific calculator and tally sheet method. During the study period of five years, a total of 32390 blood films were examined for malaria diagnosis in Tarcha General Hospital and 17706(54.7%) microscopically confirmed malaria cases were reported with a fluctuating trend. *Plasmodium falciparum* and *Plasmodium vivax* accounted for 10760(60.6%) and 6946(39.4%) of the cases, respectively. All cases were mono-infections. Malaria was reported in all age groups and both sexes. But the ≥ 15 year age group and males were more affected. Despite the apparent fluctuation of malaria trends in the area, the highest peak of malaria cases was reported during September to November within the last five years. Control interventions must be maintained and scaled-up to sustainably control the prevalence of malaria infection and eventually eliminate it in the study area, considering both *Plasmodium falciparum* and *Plasmodium vivax*.

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Malaria trend, Malaria Prevalence, *Plasmodium* sp, Tarcha General Hospital

Introduction

Malaria is caused by a protozoan belong to the plasmodium species and is transmitted by female Anopheles mosquitoes which bite between dusk and dawn. There are five different types of plasmodium parasites that infect humans: *P. falciparum*, *P. vivax*, *P.*

ovale, *P. malariae*, and *P. knowlesi*. Of these, *P. falciparum* and *P. vivax* are the most prevalent, and *P. falciparum* is the most dangerous species and is responsible for almost all of the 1.7-2.5 million deaths worldwide caused by malaria (1). It is a major public health problem for people living in tropical and sub-tropical regions (2).

According to the World Health Organization report, there were 95 countries and territories having ongoing malaria transmission putting about 3.2 billion people - almost half of the world's population at a risk of infection. Sub-Saharan Africa carries a disproportionately high share of the global malaria burden. The Sub-Saharan Africa region was home to 80% and 90% of malaria cases and deaths, respectively (3).

Malaria mostly affects children under the age of five years and pregnant women in developing countries (4). Pregnant women are more vulnerable because they experience depressed immunity during pregnancy, endangering both the lives of mother and the child (1). A similar problem arises with children below the age of five as their immunity systems are not fully developed. It is estimated that every 45 seconds a child dies of malaria worldwide (5).

Malaria is the leading public health problem in Ethiopia where an estimated 60% of the population lives at a risk of malaria infection (6). Humans are infected through the bite of an infected female *Anopheles* mosquito that inoculates spindle shape sporozoites into the bloodstream (7).

In malaria endemic areas, factors such as poverty, poor socioeconomic status, poor education and poor environmental sanitation have been attributed to availability of female *Anopheles* mosquito friendly environmental conditions (8). Malaria risk and disease burden is inequitably distributed, not only at global and regional levels but also different from one household to the other. That is because of differences in types of education and access to healthcare services the vicious cycle of enhanced vulnerability to malaria, high household medical costs, reduced ability to pay for treatment, and so on (9).

Despite several years of research and concerted efforts at control, the realization of a malaria-free world remains a dream. It is one of the leading causes of morbidity and mortality mostly in the developing countries (10). Malaria is an entirely preventable and treatable mosquito-borne illness. In 2013, 97 countries had on-going malaria transmission. In high-risk areas, more than one malaria case occurs per every 1000 population. It is estimated that more than 500 million people become severely ill with malaria annually with more than 1 million people, and most of them in Africa dying from the disease (11).

Fifty million pregnant women throughout the world are exposed to malaria each year. In malaria endemic region 1/4th of all causes of severe maternal anemia and 20% of low birth weight babies linked to malaria (12). More than 8,000 African children under the age of 5 die of malaria each year and it also contributes to malnutrition in children which indirectly causes the death of half of all children (11).

On the other hand, different studies revealed that malaria still remains to be a major health problem of the country with fluctuating trends. So, the temporal analysis of relevant malaria data of health care system gives essential information needed to measure achievements of national malaria programs and scrutinize remaining malaria hot spots. It also gives important insight into the changing malaria situation, which might guide adjustments of malaria Program activities and the prioritization of malaria research (13,14). Hence, estimating malaria incidence and time trends is very important for the expansion of intervention strategies or to design new ones to tackle the disease since this information has significant input for combating malaria (13). Trend of malaria prevalence was done in most hospitals of Ethiopia. As researchers knowledge research on trend of malaria prevalence was not done in study area. Therefore, the objective of the study was to assess the trend of malaria prevalence in last five years' period from 2014 to 2018 in Tarcha General Hospital.

Materials and Methods

Study area

Dawuro Zone is one of the 16 Zones in Southern nation's nationalities and peoples Region (SNNPR). The zone has an area of 5,225.61 km². The capital town of Dawuro Zone is Tarcha. Tarcha is 505 km from Addis Ababa through Jimma road and 325 km through Wolaita Sodo-Chida road from Hawassa, the capital of SNNPR. The town is situated at 7°14' North latitude and 37°05' East longitude and 1200m to approximately 1450m above sea level. The town has one general Hospital and one health center.

Study design and period

A hospital based retrospective study was conducted to assess the trend of malaria prevalence in last five years' period in Tarcha General Hospital by reviewing of blood film of malaria documents, from 2014 to 2018. The study was conducted from April to May, 2019.

Source of population

The total catchment populations of Dawuro Zone were the source population of the study.

Study population

Those individuals who were blood film tested within the last five years (2014–2018) in the Tarcha general hospital were included in the study population.

Inclusive and exclusive criteria

All cases registered by age and sex between 2014 and 2018 were included. Those who were not correctly registered cases were excluded.

Sample size determination

All 5 years data on malaria cases were taken in the period from 2014 to 2018 (2006–2010 E.C.).

Data collection procedure and tools

Daily malaria report data collection form including year, month, total number of BFs seen, and sex, age, and residence with each positive species type (*P. falciparum*, *P. vivax*, and mixed infections) developed for data collection. Review of routine laboratory confirmed malaria cases report taken from the Hospital. Daily malaria data with the above relevant variables were extracted from the institutional malaria registration log book of the last five years' period from 2014 to 2018 (2006–2010 E.C.).

A format was prepared on computer spread sheet (Excel) to collect the secondary data from the Hospital.

Data quality management

The study was used cases that were confirmed at Hospital by the nationally used standard of malaria diagnosis and laboratory examination of blood films and extract these cases from the national malaria registration book of the Hospital. One day training was given for data collectors on data extraction by principal investigator. The overall process of data collection such as accuracy, incompleteness, and inconsistency was daily followed by principal investigator. All completed data was once again rechecked manually just before data entry.

Data processing and analysis

After collection of data, it was analyzed manually using scientific calculator and tally sheet method. The result was presented in the form of table and chart. Simple frequencies and percentages were used to see the overall distribution of the study subject with the variable under study.

Ethical considerations

Official letter was taken from Wolaita Sodo University Dawuro Tarcha Campus, Research and Community Service Directorate and permission to undertake the study was obtained from every relevant authority at all levels, Dawuro Zone Health Department and respective Woreda health offices as well as administrative bodies of respective health facilities.

Results and Discussions

Regarding the annual trends of malaria prevalence in the last five years (2014–2018), a total of 32390 blood films were requested for malaria diagnosis in Tarcha General Hospital and 17706 (54.7%) blood samples were microscopically confirmed as malaria cases. There was a fluctuating trend of malaria within the last five years with the maximum 4635 (65.5%) microscopically confirmed malaria cases being reported in 2014 and the minimum 2701 (48.2%) microscopically confirmed cases of malaria being reported in 2016 (Table 1).

As shown in the (Table 1) *Plasmodium falciparum* and *Plasmodium vivax* are the major causative agents for malaria infection in the study area. Concerning, the identification of plasmodium species, both species of plasmodium were reported in the last five years with *Plasmodium falciparum* being the dominant species in the study area. On the whole, 10730 (60.6%) and 6976 (39.4%) of the cases were attributed to *P. falciparum* and *P. vivax* mono-infections, respectively. There were higher *P. falciparum* mono-infections in 2014 (54.5%), 2016 (81.1%), 2017 (58.9%) and 2018 (60.6%) than *P. vivax* (45.5%, 14.9%, 41.1, 39.4%) respectively, and the reverse was observed in 2015. This shows that there was a trend shift from *P. falciparum* to *P. vivax* between 2014 and 2015, but it gone on the same with 2016, 2017 and 2018 with *P. falciparum* dominating the study area (Table 1).

Prevalence of malaria with respect to sex and age groups, 17,203 of the total examined patients were males and 15187 were females. Out of the malaria slide positive individuals, 51.5% were males and 48.5% were females (Table 2). Malaria slide-positives among males were 9118 (51.5%) and among females were 8588 (48.5%). The data showed that males were more affected than females.

Regarding distribution of malaria prevalence by age groups, Out of 22676 total blood films examined in the age group of 15 and above 15 years (≥ 15), 13341 (75.3%) were tested positive, out of 4869 total examined in the age group of 5-14 years 13341 (75.3%) were tested positive and out of 4845 total blood films examined in the age group of < 5 years 2134 (12.05%) were tested

positive. The data showed that the highest malaria prevalence was observed in the age groups of 15 and above 15 years (Table 3).

Seasonal variation of malaria prevalence was observed in Tarcha General Hospital. Distribution of malaria and infected cases differs in each month and seasons of the year. The highest peak of malaria prevalence was observed during spring (September, October and November) (57.66%) shortly after the heavy rain season and the lowest number of malaria cases was observed during the months of March to May (53.23%). The highest number of *P. falciparum* and *P. vivax* was observed during April (72.96%) and August (51.5%), respectively (Table 4).

Table.1 Slide-confirmed annual malaria cases and distributions of plasmodium species in Tarcha General Hospital, South western Ethiopia

Years	Total Examined	Total Slide Positive	<i>Plasmodium falciparum</i>	<i>Plasmodium vivax</i>
2014	7072	4635(65.5%)	2526(54.5%)	2109(45.5%)
2015	5133	2957(57.6%)	1150(38.9%)	1808(61.1%)
2016	5602	2701(48.2%)	2299(85.1%)	402(14.9%)
2017	7115	3616(50.8%)	2130(58.9%)	1486(41.1%)
2018	7468	3797(50.8%)	2301(60.6%)	1496(39.4%)
Total	32390	17706(54.7%)	10730(60.6%)	6976(39.4%)

Table.2 Distribution of malaria confirmed cases by sex

Sex	No Of Examined	Slide Positive No(%)	<i>P. Falciparum</i> (%)	<i>P. vivax</i> (%)
Male	17,203(53.1%)	9118(51.5%)	5195(56.97%)	3923(43.03%)
Female	15,187(46.9%)	8588(48.5%)	5565(64.8%)	3023(35.2%)
Total	32,390	17706(54.7%)	10760(60.6%)	6946(39.4%)

Table.3 Distribution of malaria confirmed cases among different age groups

Ages	No Of Examined	Slide Positive	<i>P. Falciparum</i>	<i>P. vivax</i>
< 5	4845	2134(12.05%)	1113(52.2%)	1021(47.8%)
5-14	4869	2231(12.6%)	1725(77.3%)	506(22.7%)
> 15	22676	13341(75.3%)	7922(59.4%)	5419(40.6%)
Total	32390	17706(54.7%)	10760(60.6%)	6946(39.4%)

Table.4 Monthly prevalence of malaria slide confirmed cases in Tarcha General Hospital from 2012 to 2016

Month	Total Examined	Total Positive(%)	P. Falcipatium(%)	P. vivax(%)
September	2770	1499(54.12%)	935(62.37%)	564(37.63%)
October	2717	1641(60.4%)	946(54.7%)	695(42.35%)
November	2750	1608(58.47%)	794(49.4%)	814(50.6%)
December	2885	1648(57.12%)	951(57.7%)	697(42.3%)
Jaunary	2215	1256(56.7%)	753(59.95%)	503(40.05%)
February	3405	1692(49.69%)	980(57.9%)	712(42.1%)
March	2477	1192(48.1%)	716(60.06%)	476(39.94%)
April	2322	1339(57.7%)	977(72.96%)	362(27.04%)
May	2908	1547(53.9%)	1086(70.8%)	461(28.8%)
June	2910	1539(52.9%)	1011(65.7%)	528(34.3%)
July	2450	1302(53.14%)	770(59.1%)	532(40.9%)
August	2581	1443(55.9%)	700(48.5%)	743(51.5%)
Total	32390	17706(54.7%)	10760(60.6%)	6946(39.4%)

In this study, a total of 17706 (54.7%) malaria prevalence were reported in the last five years (2014 to 2018). This was higher than the study conducted Abishe district, Walaga Health Center (15), in which the overall prevalence of malaria was (53.68%). This might be due to variation in sample size, altitude and climate.

Our finding also showed that the highest number of malaria slide- positives was in 2014 and then after declining trend continued with the lower number of cases in 2015. This decreasing trend might be due to a better awareness of the people about malaria and implementation of control strategies. From the result of the study, the predominant plasmodium detected was *P.faciparum* (60.6%) followed by *P. vivax* (39.4%). This result is different from the study conducted in Kola Diba health center, in which *Plasmodium vivax* accounted 75% and *Plasmodium falciparum* accounted 25% (4). The study conducted in Metema Hospital reported that *P.falciparum* accounted 90.7% and *P. vivax* 9% and mixed infection 0.3% (1). The current study is differ

from research conducted in ArsiNegele in which the prevalence of *P. falciparum* and *P. vivax* was 19.8 and 74% respectively and mixed infection was 6.2% (16). This current study is concurrent with malaria parasite distribution in Ethiopia which indicates that *Plasmodium falciparum* and *P. vivax* are the two predominant parasites distributed in the country and accounting for 60% and 40% of malaria cases respectively (34).

The data showed that males 9118(51.5%) were more infected than females 8588(48.5%). This is similar with study conducted at Kola Diba Health Center, which showed that males were more affected than females (4). The reason why malaria affected more males might be due to the fact that males engaged in activities outside their residence area. Migration can also make them more prone to infective mosquito bites as compared to female counter parts. Regarding the age groups, malaria infection was recorded from all age groups in the study area. However, the rate of infection was high in the age groups 15 and above years old followed by 5-14 years

old. This might be due to improper usage of bed net. high malaria transmission often overlaps with the planting and harvesting season that increase malaria incidence among working age group and working adults in Agrarian communities. In the study area, seasonal distribution of malaria infected cases differs in each season of the year. The highest prevalence of malaria cases was observed during spring (September to November) and the lowest number of malaria cases was observed during March to May. This is in agreement with other studies done in Metema Hospital and Kola Diba Health center, in which malaria transmission peaks from September to November (14). Generally, this study showed that during the last five years, there was decrease of malaria cases observed in Tarcha General Hospital. The highest peak was in 2014, there after there was decrease in 2015.

In conclusion, the overall prevalence of malaria in the study area was 54.7% and the infection by *P.falciparum* was higher than *vivax*. The patients aged 15 and above 15 years were more infected than other age groups. The clinical data showed that malaria is still a major health problem in the study area. Therefore, in order to get a clear picture of the prevalence of malaria and the distribution of the parasite in particular, proper diagnosis methods should be established.

Abbreviations

AIDS : Accured Immuno Deficence Syndrome
 CHW : Community Health Workers
 DDT : Dichlorodiphenyltrichloroethane
 FMOH : Federal Ministry of Health
 HIV : Human Immuno Virus
 IRS : Indoor Residual Spaying
 ITNs : Insecticide-Treated Nets
 LLINs : Long-Lasting Insecticidal Nets
 MOH : Minister of Health
 NGO : None Governemental Organization
 TB : Tuberclosis
 WHO : World Health Organization

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this research article.

Authors' Contribution

The authors participated in proposal writing, in the study design, in data analysis and in writing the article. All authors read and approved the article.

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