

Trends of Malaria Cases (Plasmodium Species) in Gute Health Center, Wayu Tuka District, East Wollega Zone, (2013-2022)

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Abstract

Malaria is one of the major public health issues in Ethiopia that hindered the country's economic growth and development and Ethiopia is on target to reduce the incidence of malaria by 80% in 2025. Therefore, this study was conducted to assess the trends of malaria prevalence in Wayu Tuqa District, Gute Health Center for the last ten years (2013-2022). A retrospective study was conducted to determine the trends of malaria cases by reviewing the malaria registration laboratory logbook in Wayu Tuqa District, Gute health center from 2013 to 2022. All the socio-demographic data, year, month and malaria prevalence were collected using a predesigned data collection sheet recorded from perspective years. In this study, out of the total 15,040 suspected patients, 3,402 (22.50%) of malaria cases were recorded at Gute Health Center. *Plasmodium falciparum* was the most predominant species which accounted 82.84% (2,818) followed by *Plasmodium vivax* 16.00% (547). Males and the individual greater than 15 years old were the most affected categories. In this study, the higher cases of malaria diseases were recorded during the years of 2021 and 2022, respectively. In addition, the higher incidence of malaria cases was reported in autumn season, 40% (1,339) and while the lowest prevalence was observed in spring, 16% (546). The overall trend of plasmodium species of the last ten years (2013-2022) at Gute Health center has not shown inconsistent trends. Therefore, proper planning, implementation and monitor of malaria prevention and control activities should be strengthened at all levels.

Keywords: Malaria prevalence; Plasmodium species; Malaria; Retrospective study

Introduction

Malaria continues to be a major public health issue in the world, contributing significantly to sickness and mortality [1,2]. According to recent WHO reports revealed that, estimated 219 and 241 Million cases of malaria were reported in 2017 and 2020 years respectively. This implies that malaria cases and deaths in 2019 and 2020 were increased as compared to 2017 and 2018 report [3]. In line to these reports, the overall burden of malaria cases and deaths were more frequently distributed in African and *Plasmodium falciparum* took the lion shares and it accounted more than 99.00% cases [2,4,5].

Despite numerous attempts have been made to reduce the mortality and morbidity rates associated with malaria cases, the disease continues to pose a serious concern, in African particularly in Ethiopia [4]. In Ethiopia, more than 65% of the land mass of the country (seasonal variations and rain fall) make the country more endemic to the malaria and put a significant proportion of the community at the risk of malaria diseases [6].

Currently, Ethiopia is working on the WHO Global Technical Strategy which was set to eliminate the malaria cases by year of 2030 by stepping up current malaria control efforts. Furthermore, the country is currently on track to reach the 2030 milestone by halving the prevalence of malaria [2]. However, as the evidence stated by some authors revealed that malaria prevention and control strategy is becoming ineffective due to some challenges like development of pesticides resistance,

especially chloroquine resistance plasmodium species make challenges to eradicate and control the malaria in Ethiopia and throughout the world [4,7].

According to Wayu Tuqa District Health center (Gute Health Center), the district health center was found to have higher malaria prevalence according to East Wollega Zone health center [8]. Currently, investigation of the malaria trends is required in order to create and implement effective malaria control strategy in the studied area. Hence, this study was aimed to investigate the trends of malaria prevalence in Wayu Tuqa District, Gute Health Center for the last ten years from 2013-2022.

Materials and Methods

Study area and study population

The study was conducted at Gute Health Center which is located in Wayu Tuqa District, and East Wollega Zone. Wayu Tuqa District is situated at (8° 56'N and 9° 7'N) and (36° 32'E and 36° 48'E). It is far about 322 km west of Addis Ababa, in the East Wollega Zone of the Oromia National Regional State and 12 Km from the capital city of the Zone, Nekemte town.

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Based on the 2007 census, the population of Wayu Tuqa District is 66,394, with 63325 (95.4%) in the rural, directly living on agriculture and associated activities also by supplying its produce to the neighboring urban dwellers. Gute health center offers diagnosis and treatment for patients that reside in Boneya Molo, Gara Hudha, Gute Badiya, Kichi, Komto, Migna Kura, Haro Chalchis, Gida Abalo, Gida Basaka, Wara Babo Miya, Gaba Jimata and Gute (Figure 1) [8].

Study type and place

In this study a retrospective study from 2013 to 2022 were conducted to evaluate the trends and prevalences of *plasmodium falciparum* East Wollega Zone, Wayu Tuqa District, Gute Health Center (Logbook registered malaria).

Study period

The study period was conducted from January 2013 to December 2022

Study design

To investigate the trends of malaria prevalence at Gute Health Center, a retrospective study was employed by reviewing a malaria registration logbook from 2013-2022.

Inclusion and exclusion criteria

All patients registered on logbooks recorded at health center were included and malaria diagnosis results which were not properly registered were excluded.

Sample size

In this study, totally three health facilities and 15,104 patients from logbooks were used and described as the total sample size.

Source of information

In this study, malaria laboratory registered logbook (available at Gute Health Center) was used as the source of information.

Malaria trend analysis

To investigate the trend of malaria prevalence over the last ten years, laboratory registered logbook includes, malaria diagnosis date, patients gender and age, diagnosis results and parasites

species used as the identification items.

Data quality control

To ensure the data quality control, data collectors and supervisors were trained before the study has been started. The principal investigators monitored the entire process on a daily basis, including data collection and entry, to ensure accuracy and consistency.

Data collection and data analysis

A ten years malaria data were extracted from laboratory logbook by using data collection sheet including year, month, sex, age, residence, total number of BF examined and species type (*P. falciparum*, *P. vivax* and mixed infections) and analyzed using SPSS version 26 version software. Mean analysis was used to determine the association of *Plasmodium* species with age group, sex and residence. Graphs were used to depict the overall trend of malaria prevalence and malaria species distribution with residence and season.

Ethical consideration

The study received ethical approval from Aramuer Hansen Research Institute and Gute Health center and participants, obtained written consent, and conducted research in accordance with the approved Ethical consideration.

Results

Annual trends of malaria cases at gute health center

In the past ten years (2013-2022), a total of 15,104 patients have been diagnosed for malaria cases and about 3,402 (22.50%) cases have been verified by blood tests. The number of malaria cases has fluctuated over the past 10 years, with the lowest number (84 or 2.50%) being reported in 2017 and the highest number (735 or 21.55%) being reported in 2021 (Table 1).

Plasmodium falciparum and *Plasmodium vivax* cases reported at Gute Health center for the last ten years (2013-2022), both *plasmodium* species were reported with the consultative ten years. Hence, from the total confirmed cases, *P. falciparum* and *P. vivax*, were reported as the most dominant parasites, 2,818 (82.60%) and 547 (16.00%), respectively (Figure 2).

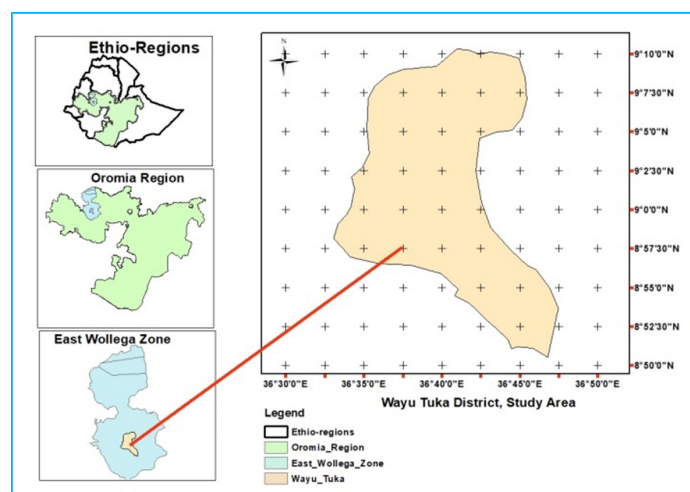


Figure 1: Map of the study area, East Wollega Zone, Wayu Tuka District, 2022.

Table 1: distribution of plasmodium species in sex and ages at gute health center (2013-2022).

Year	Total examined	<i>P. falciparium</i>			<i>P. vivax</i>			Mixed		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
2013	826	127	78	205	34	12	46	1	0	1
2014	931	145	70	215	15	5	20	0	0	0
2015	1300	187	90	277	22	9	31	0	0	0
2016	1203	178	77	255	14	6	20	0	0	0
2017	1400	33	23	56	18	10	28	0	0	0
2018	1000	104	52	156	23	20	43	7	3	10
2019	2154	114	79	193	39	21	60	8	0	8
2020	1949	207	135	342	47	37	84	6	0	6
2021	2243	384	244	628	65	36	101	6	0	6
2022	2098	327	164	491	69	45	114	3	3	6
Total	15,104.00	1,806	1012	2,818	346	201	547	31	6	37

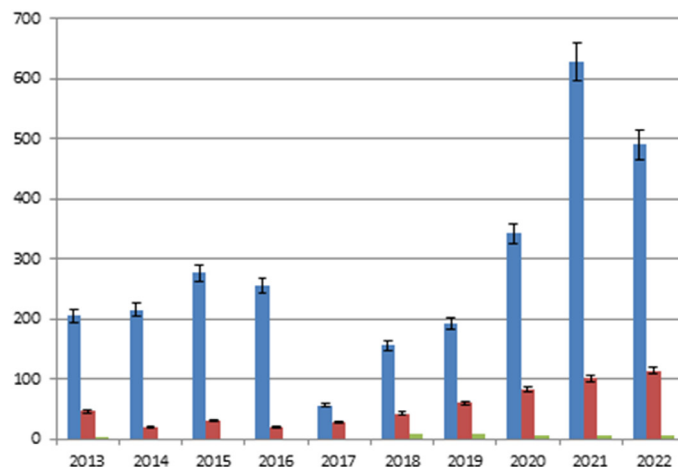


Figure 2: Distribution of plasmodium species composition in last ten years (2013-2022) at Gute Health Center, East Wollega Zone; Note: (■) Pf, (■) Pv, (■) Mixed.

Ten years (2013-2022) trend analysis of malaria

We examined trend analyzes of malaria prevalence over the past decade by referencing laboratory diaries registered from 2013 to 2022. Of these, 3,402 patients were recorded as malaria-positive. This represents approximately 22.50% of the Good Health Center's malaria prevalence. Year-over-year malaria cases showed a gradual decline in 2016-2017, with the highest number of malaria cases in 2020-2021 (Figure 3)

Prevalence of malaria with respect to sex and age groups

According to the record review in the last ten years (2013-2022) in the study area, males were more affected than females by malaria parasites. Out of the 3,402 malaria positive individuals,

2,287 were males and 1,309 were female. Among the age groups, the most vulnerable ones was the age group of greater than 15 years with the overall prevalence of (54.50%) (Table 2).

Seasonal variation of malaria prevalence in Gute Health Center from 2013 to 2022

Seasonal distribution of malaria and infected cases differs in each month and seasons of the last ten years (Table 3).

The highest peak of malaria prevalence was observed during September to December which accounted of 48.50% shortly after the heavy rain season and the lowest number of malaria cases was observed during the months of February to April (20.00%) (Table 3).

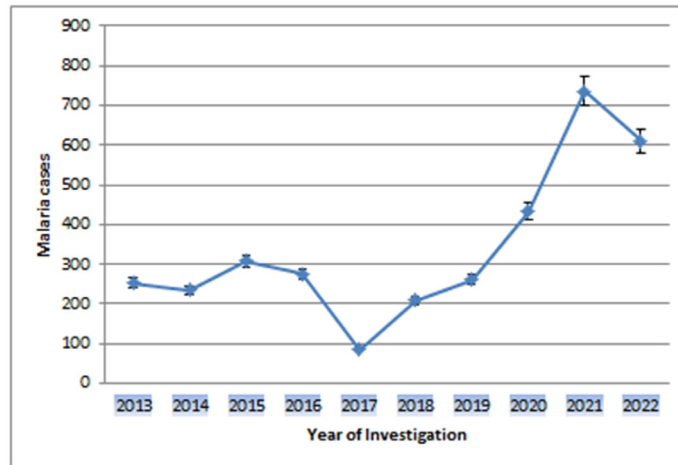


Figure 3: Trends of malaria cases at Gute Health center from 2013 to 2022.

Table 2: Neurological grade (Power), duration of symptom, location and size of tumour.

Parasites	Sex	Ages		
		>5	<6-15>	>15
<i>P. falciparum</i>	Male	89	819	970
	Female	54	475	588
<i>P. vivax</i>	Male	25	146	208
	Female	13	74	103
Mixed	Male	4	11	15
	Female	0	0	2
Total		185	1525	1886

Table 3: Seasonal distribution of Plasmodium species at Gute Health Center from 2013-2022.

Months	Total Positive	<i>P. falciparum</i>	<i>P. vivax</i>	Mixed
September	397	340	54	3
October	439	359	73	7
November	503	421	78	4
December	405	338	66	1
January	374	304	66	0
February	148	128	18	2
March	184	152	29	3
April	168	145	23	0
May	194	164	27	3
June	192	151	37	4
July	294	244	40	0
August	298	248	48	2
Total	3596	2994	559	29

Discussion

In this study, a total of 3,402 (22.50%) malaria cases were reported at Gute Health Center over the last ten years, from 2013 to 2022. In the current study the maximum and minimum prevalence data was observed in 2021 and 2017, respectively. Generally, the current finding is lower than the study conducted at Asossa Hospital is 53.68%, and Walga Health Center, 33.80% [9,10]. In contrast, this finding was higher than that of a study conducted at Motta and Metema Hospitals, where the overall

prevalence of malaria was 11.53% and 17%, respectively [11,12]. In addition, the overall prevalence of malaria infection in this study was 22.50%. This disparity could be attributed to differences in sample size, altitude, and climate.

Furthermore, the trends of malaria prevalence did not show proportional trends, with 2019 and 2021 showing the highest peak for malaria cases, because these cases were more related to a lack of adequate treatment and an overload of COVID-19 cases in the District over the last three years.

In this study, concerning to the malaria prevalence associated with age groups, greater than 15 years old were the most affected, followed by 6-15 years old and children under the age of five. This finding is consistent with other studies conducted in various areas, which found higher malaria prevalence in 15-year-olds [13,14]. Besides to this fact, males were almost two times more likely than females to contract malaria in this retrospective analysis, which corresponded to the gender distribution of malaria cases. This finding is similar to that study conducted, in which the authors reported that males had more malaria cases [1,13-15]. This could be because males are more likely to contract malaria because they participate in outdoor activities such as agricultural and pastoral activities, as well as remaining outside during exophagic mosquito biting hours.

The most common plasmodium species detected were *P. falciparum* (83.20%), *P. vivax* (16.00%), and mixed infection (1%). This finding is consistent with the findings of a study conducted at Metema Hospital, where *Plasmodium falciparum* accounted for 90.7%, *Plasmodium vivax* 9%, and mixed infection 0.3% [11]. However, this study contradicts a study conducted with the study conducted in Jimma zone at Assendabo Health Centre with the prevalence of both parasites was 45.75% and 54.3% for *Plasmodium vivax* and *Plasmodium falciparum*, respectively [16]. This data is consistent with the distribution of *Plasmodium* spp. described in various Ethiopian locations [7,13,17]. The most common parasite found was *P. falciparum*, which fluctuated over the course of the study. *P. falciparum*'s dominance over *P. vivax* may be explained by the fact that it multiplies quickly, infects all ages of red blood cells, and is resistant to antimalarial drugs.

Conclusion

The trend analysis in this study could not fully reveal all of the malaria trends in the study area because some people seeking malaria diagnosis and treatment may visit other health facilities other than those included in the study, preferring to go to local private clinics, health posts, and drug stores, making conclusions based solely on records of patients served at the selected health facilities difficult.

Furthermore, the diagnostic methods used in this study were microscopy and RDTs, which are known for their poor performance when compared to advanced molecular techniques such as Polymerase Chain Reaction (PCR) and Loop-Mediated Isothermal Amplification (LAMP), which produce highly sensitive and specific results. Over the last ten years, the malaria trend has revealed no consistent pattern of cases in different years. Inter-annual and intra-annual variations in malaria transmission patterns have been observed, as have inconsistencies in disease burden distribution across age groups and gender. Understanding disease distribution in time and space is critical for effective interventional planning.

Limitation of the study

The study's limitations include a lack of qualitative data on malaria intervention and control activities over ten years, a lack of case fatality rate and clinical condition, and an incomplete laboratory registration book.

Data availability

The data used and analyzed during the current study are available within the manuscript and supplementary materials.

Conflict of interest

The authors have no any conflict of interest.

Authors' contribution

AD, CT, DD are participating on Data collection, field work and Data conceptualization. DA and TT are the primary and principal investigators, work on Data collection, editing, write up, data analysis and conceptualization.

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