
# ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCE

## SCHOOL OF PUBLIC HEALTH

## ETHIOPIAN FIELD EPIDEMIOLOGY AND LABORATORY TRAINING PROGRAM(EFELTP)

Compiled Body of Works in Field Epidemiology

By Ebsa File

Submitted to Addis Ababa University School of Public Health in Partial Fulfillment for the degree of Master of Public Health in Field Epidemiology

**June 2023**

**Addis Ababa, Ethiopia**

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June, 2023

Addis Ababa, Ethiopia

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Approval by Examining Board

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Chairman, School Graduate Committee

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Advisor

_____ _____

Examiner

_____ _____

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I also want to warmly thank the workers of the Ethiopian Public Health Institute, Regional Health Bureaus, District Health Offices, and the community for their assistance with the outbreak investigation, health profile, and surveillance system evaluation.

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## Abbreviations

| | |
|---|---|
| AAU | Addis Ababa University |
| AFI | Acute febrile illness |
| AIDS | Acquired Immunodeficiency Syndrome |
| ANC | Ante Natal Care |
| AOR | Adjusted Odds Ratio |
| API | Annual parasitic Incidence |
| AR | Attack Rate |
| ART | Ant-Retroviral Therapy |
| ARRA | Authority for Refugee and Returnee Administration |
| AURTI | Acute Upper Respiratory Truck Infections |
| AWD | Acute Watery Diarrhea |
| BCG | Bacilli Calmette Guerin |
| BoFED | Bureau of Finance and Economic Development |
| CDC | Center for Disease Control and Prevention |
| CDs | Communicable diseases |
| CFR | Case Fatality Rate |
| CHP | Community Health Profile |
| CI | Confidence Interval |
| CMAM | Community Management of Acute Malnutrition |
| COR | Crude Odds Ratio |
| COVID | Corona Virus Disease |
| CQ | Chloroquine |
| CSA | Central Statistical Agency |
| DHIS | District Health Information Software |
| EDHS | Ethiopian Demographic Health survey |

| | |
|---|---|
| EFY | Ethiopian Fiscal Year |
| EFELTP | Ethiopian Field Epidemiology and Laboratory Training Program |
| EHSDP | Ethiopia Health Sector Development Programme |
| EPHI | Ethiopian Public Health Institute |
| EPI | Expanded Programme Immunization |
| ETB | Ethiopian Birr |
| FP | Family Planning |
| FMoH | Federal Ministry of Health |
| GAM | Global Acute Malnutrition |
| GC | Gregorian Calendar |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GTS | Global Technical Strategy for Malaria |
| HC | Health Center |
| HCW | Health Care Worker |
| HEW | Health Extension Worker |
| HH | House-Hold |
| HIV | Human Immunodeficiency Virus |
| HMIS | Health management information system |
| HP | Health Post |
| HSDP | Health Sector Development Plan |
| IDP | Internally displaced population |
| IDSR | Integrated disease surveillance and response |
| IgM | Immunoglobulin M |
| IRS | Indoor Residual Sprayings |
| ITN | Insecticide-treated bed nets |
| LLIN | Long lasting insecticidal nets |
| MAM | Moderate Acute Malnutrition |

| | |
|---|---|
| MCH | Maternal and child health |
| MHNT | Mobile Health and Nutrition Teams |
| MIS | Malaria Indicator Survey |
| MoE | Ministry of Education |
| MoLF | Ministry of Livestock and fishery |
| MUAC | Mid-Upper Army Circumference |
| NCD | Non-Communicable diseases |
| NDRMC | National Disaster Risk Management Commission |
| NGO | None Governmental Organization |
| NHP | National Health Profile |
| NNP | National Nutritional program |
| NSP | National Strategic Plan (Same as NMSP) |
| NTD | Neglected Tropical Disease |
| OPD | Out Patient Department |
| OR | Odds Ratio |
| OTP | Out-patient treatment program |
| PCR | Polymerase Chain reaction |
| PHEM | Public Health Emergency Management |
| PLW | Pregnant and lactating women |
| PNC | Post Natal Care |
| RDT | Rapid Diagnostic Test |
| RRT | Rapid Response Team |
| RDT | Rapid Diagnostic Test |
| RHB | Regional Health Bureau |
| RRT | Rapid Response Team |
| RUTF | Ready to Use Therapeutic Food |

| | |
|---|---|
| SAM | Severe Acute Malnutrition |
| SBA | Skilled Birth Attendance |
| SC | Stabilization Center |
| SIA | Supplementary Immunization Activity |
| SITREP | Situational Report |
| SNNPR | South Nation Nationalities people region |
| SOP | Standard operating procedure |
| SRS | Simple Random Sampling |
| SPR | Slide Positivity Rate |
| SPSS | Statistical package of Social Science |
| TFP | Therapeutic Feeding Program |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |
| UNICEF | United Nations International Children's Emergency Fund |
| WASH | Water Sanitation and Hygiene |
| WFP | World Food Program |
| WHO | World Health organization |

## Executive Summary

The Ethiopia Field Epidemiology and Training Programme (EFETP), which was inspired by the Centers for Disease Control and Prevention (CDC) in the United States, is a two-year in-service training program in field epidemiology. The program's goal is to recruit promising healthcare professionals and develop their competencies through on-the-job mentoring and training in order to help the Ministry of Health establish or strengthen health systems. The program is divided into two primary parts: classroom instruction (25%) and practical application or field placement (75%). The residency culminates in a final output of works that is equivalent to a thesis for the graduate school of public health in order to meet a portion of the requirements for a master's degree in field epidemiology.

Eight chapters make up these outputs of work, which include a report on outbreak investigations, an analysis of surveillance data, an assessment of a surveillance system, a description of a health profile, scientific manuscripts for peer-reviewed journals, abstracts for scientific presentations, a proposal for an epidemiological research project, and yet another output report.

Different approaches were used to complete these work products. In chapter one, two outbreaks were looked into: a malaria outbreak in the Loma district of the Dawro zone, in the SWEP region of Ethiopia, in June 2022; and a measles outbreak in the Raso district of the Afder zone, in the Somali region of Ethiopia, in May 2022. Chapters 2, 3, and 4 contain: Surveillance Data Analysis: National Malaria Surveillance Data Analysis, Ethiopia, 2016-2020 GC, Evaluation of the Malaria Surveillance System in Gambella Region, Gambella Zuria Woreda, Western Ethiopia and Health Profile Description of Bosat district, Oromia Regional State, Ethiopia 2021 included respectively.

Chapters seven and eight of the document, Summary of Disaster Situation on Health and Nutrition Emergency Needs Assessment Report for the South West Ethiopia Region, Dawro Zone, June 2022, and Protocol/Proposal for Epidemiologic Research Project, which titled “Distribution of Malaria and Mosquito Species along Pagag Point of Entry in Lare Woreda, Gambella, Ethiopia: Cross Sectional Study. Finally, chapter nine includes one additional output of National Weekly epidemiological bulletin of Week 16: April 18 – April 24, 2022.

# Chapter One- Outbreak Investigation

## 1.1. Malaria Outbreak Investigation in Loma District of Dawro zone, SWEP Region, Ethiopia, 2022


### Abstract

**Background**: Malaria is a significant public health problem that still results in disease and fatalities. Ethiopia is a Sub-Saharan African nation with a high annual malaria case count because the geography of the vast majority of the country favor's vector breeding. The objective of this study was to assess the scope, describe amount of morbidity and mortality and potential causes of the malaria outbreak in the Loma District of the Dawro Zone, SWEP Region, Ethiopia, between May 19 and June 11, 2022.

**Methods**: From May 19 and June 11, 2022, a descriptive and 1:1 unmatched case-control study was conducted in the Loma district. There were 340 instances used in total for the descriptive study. 199 cases and 199 controls were chosen using a computer-generated basic random approach with a line list as a sampling frame in order to find the factor linked to the outbreak. Malaria positive patients who presented to a health facility with symptoms were recognized as active cases, and controls were chosen from the patients' neighbors. We gathered information using a standardized questionnaire; cases were described in terms of the time, place, and person. logistic regression was then used to determine the factors associated to malaria.

**Results**: A total of 340 cases were found, with an attack rate of 3.6 per 1000 people and a case fatality rate (CFR) of zero. Children under the age of 59 months had the highest attack rate (4.8/1000). Being close to stagnant water increased the risk of contracting the malaria parasite compared to living farther away (AOR = 2.1, 95% CI: 0.96-4.56 and P value = 0.046). Other factors which statistically linked to the development of malaria include: lack of education (AOR = 0.4, 95% CI (0.24-0.72 P-value 0.008), sleeping outside at night (AOR = 3.96, 95 CI (1.96-8.1), not using an ITN (AOR = 0.81, 95% CI: 0.1-0.9), and not using an IRS at home (AOR =8.9, 95% CI (5.23-14.32m), P=0.001).

**Conclusion**: Over all during this outbreak 3.6/1000 people were affected. Residents of Zima Waruma kebele were most affected kebele and children of <15 years were more affected by this malaria outbreak.



**Key Words**: Malaria, Loma, Outbreak and Case control.

## Introduction

The World Health Organization (WHO) estimates that 3.3 billion people are at risk of malaria, with 1.2 billion of those individuals having a high risk. Globally, in 84 countries with endemic malaria (including French Guiana), there were an estimated 247 million cases in 2021, up from 245 million in 2020, with most of this increase coming from the WHO African Region. There were an estimated 230 million cases of malaria in 2015, the baseline year for the Global Technical Strategy for Malaria 2016-2030 (GTS).(1) Malaria is endemic in all tropical regions of the world, with sub-Saharan Africa, India, and Southeast Asia having the highest prevalence rates. In 2018, there were an estimated 23 million fewer cases of malaria than in 2010, due to the global community's funding and implementation of malaria control measures. During the course of these efforts, millions of malaria deaths have also been prevented. However, from 2014 to 2018, the number of cases worldwide remained consistent, and in 2020, the number of cases rose in comparison to earlier years, partially as a result of the COVID-19 pandemic's impact on health services and interventions. The World Health Organization suggested the first malaria vaccine in October 2021 to protect newborns and young children living in areas with moderate-to-high transmission who are 5 to 24 months old.(2)

Almost 68% of Ethiopia's population lives in locations with a high risk of malaria.(3) Malaria affects more individuals in Ethiopia's lowlands (below 2000 meters of elevation) than in its highlands (above 2000 meters of altitude).(4) Due to typical human and mosquito behavior, the majority of parasite transmission in Ethiopia happens indoors during the night in rural households in the lowlands and in the intermediate elevations. Additionally, malaria transmission may occur outside during social or professional nighttime activities, or it may be related to brief overnight travel to other districts in malaria-prone areas. Recent research suggests an increase in the frequency of malaria among migrant daily lab

er’ in several areas of the country, most notably in the northwest development corridors of the country bordering South Sudan and Sudan. These findings are both published and unpublished.(5)

Annually, there are about 2.9 million cases of malaria and 4,782,00 fatalities that are associated with it. During epidemics, the rate of morbidity and mortality substantially rises.(6)

It is becoming more vital to develop reliable, cost- and time-effective methods to assess and monitor changes in transmission intensity as malaria transmission levels continue to drop in

many malaria-endemic areas. The problem is especially important to national malaria control programs because they are primarily in charge of malaria surveillance and because more

extensive methods (such as extensive population surveys and long-term entomological surveillance) are likely to be logistically and financially challenging for them.(7)

Malaria is an intraerythrocytic disease brought on by Plasmodium parasites that are spread through the bite of an infected Anopheles mosquito. An intraerythrocytic infection known as malaria can range in severity from mild or asymptomatic to fatal. Four separate Plasmodium species, P. falciparum, P. vivax, P. ovale species (which includes P. ovale curtisi and P. ovale wallikeri), and P. malariae, are responsible for human sickness. Simian malarias, particularly P. knowlesi in Southeast Asia, can also infect humans. P. falciparum is the most typical cause of infections worldwide, predominating in Africa and responsible for 95% of cases, according to estimates.(8) Anopheles arabiensis is the primary malaria vector in Ethiopia, and Plasmodium falciparum (PF) and Plasmodium vivax (PV) are the two most common malaria parasites.(9)

Ethiopia declared to achieve national-level malaria elimination in 2030, by prioritizing elimination in targeted low transmission settings and preventing the reintroduction of malaria into districts reporting zero indigenous malaria cases.

As a result, the purpose of this study was to look into what caused the epidemic in the Loma District of the Dawro Zone, SWEP Region, Ethiopia. The focus was on risk factors for malaria, with the epidemic being described by the person, place, and time that it occurred. The findings were then used to implement control and preventive measures.

## Statement of the problem

Majority of Ethiopia's population are at risk for contracting malaria, which is endemic in 68% of the country's districts. These are low-lying regions of the country, primarily in the western lowlands, where malaria transmission is stable and high. These regions include parts of the Gambella], Benishangul Gumuz, Western Oromia, Amhara, and some of the South Nations, Nationalities and Peoples and Tigray Regions. With a mean annual temperature of 25.4°C (range: 22-28°C) and a mean annual rainfall of 935mm (range: 503-1,643mm), these regions have a hot, humid, tropical environment that fosters malaria transmission a year-round. These areas are home to roughly 4.9 million individuals, or 4.8% of the population, and transmission there typically occurs all year long.

In Ethiopia Although major scale-up of malaria control initiatives, such as case diagnosis and treatment, distribution of long-lasting insecticidal nets (LLINs), and indoor residual spraying of houses with insecticides (IRS) are targeted in most malarious areas, as a substantial challenge, cross-border malaria and outbreak becoming a problem. Border malaria can spread up to a certain distance from an international boundary, or through nearby administrative areas along the international border. Border malaria is frequently thought to be a transmission hotspot that crosses international borders.

## Objectives

**General Objective**

- To assess the and describe amount of morbidity and mortality and potential causes of the malaria outbreak in the Loma District of the Dawro Zone, SWEP Region, Ethiopia, between May 9 and June 11, 2022**.**

**Specific Objectives**

- To confirm existence of Malaria outbreak in the district
- To characterize Malaria outbreak in terms of Person, Place and Time in the District
- To assess the risk factors for the Malaria outbreak in the district
- To identify Malaria species that causes outbreak in the district

## Method and Materials

### Study setting and Period

Loma is one of the woredas in the South West Ethiopia Peoples' Region of Ethiopia. Loma, which is a part of the Dawro Zone, has the Gamo Gofa Zone to its south, Isara to its west, Mareka to its northwest, Gena Bosa to its north, and the Wolayita Zone to its east. The eastern and southern border of Loma is marked by the Omo River. Towns in Loma include Loma Bale. Loma was part of former Loma Bosa woreda. this woreda has a total population of 96,149 of whom 47,021 are men and 49,128 women; 3,999 or 4.1% of its population are urban dwellers. Protestantism was practiced by the majority of the population, 64.35%, followed by Ethiopian Orthodox Christianity (24.06%), Catholicism (8.31%), and traditional beliefs (2.35%).

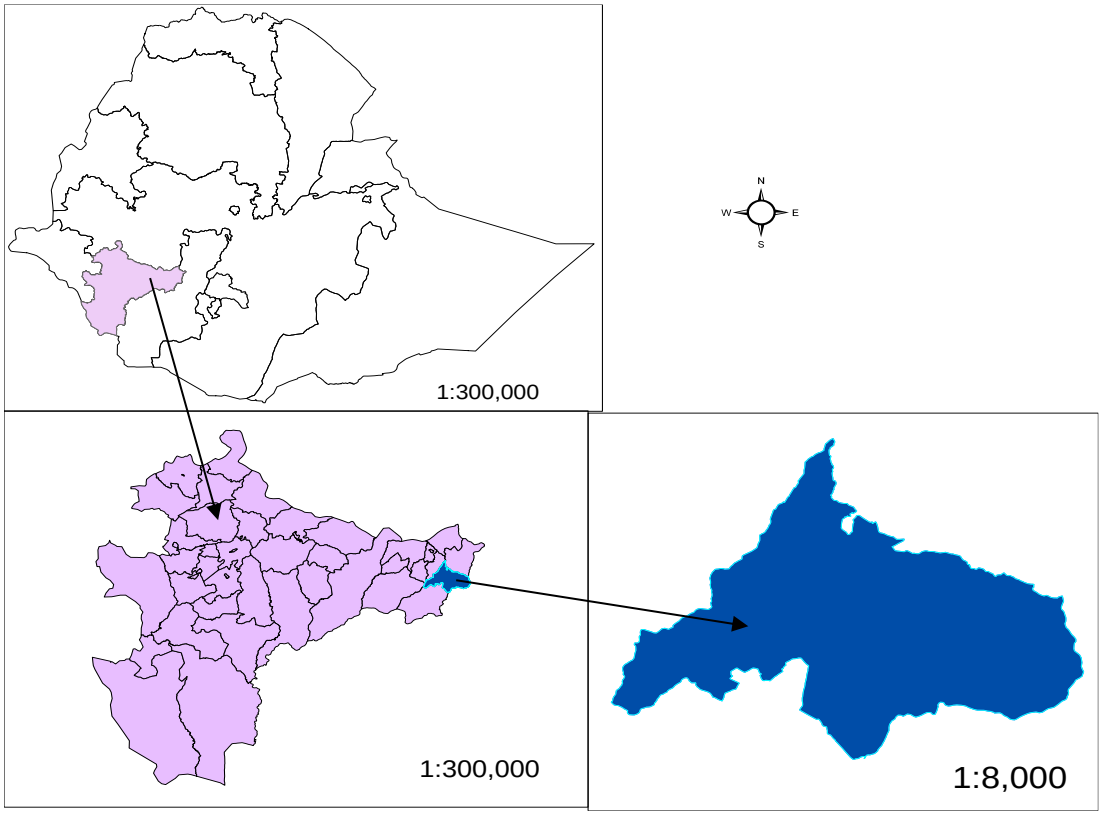


*Figure 1: Study area (Loma district) administrative map*

## Study Design

### Descriptive Epidemiology

During this outbreak, malaria was characterized and recognized as an acute febrile sickness with slide positive for the parasite. We looked at malaria data from cluster health offices and health institutions from the prior year of 2021 in order to create an epidemic threshold level and compare it to a comparable week this year in 2022. Malaria cases was gathered on a daily and weekly basis from health facilities. By person, location, and time, the outbreak's magnitude was described. The RDT positivity rate was computed as the proportion of people who tested positive for malaria. Attack rates were determined by person and location. An epidemic curve was developed.

### Analytical Epidemiology

To determine the risk factors related to malaria, we conducted an unmatched case-control study. For patients with newly confirmed malaria cases (within two weeks of the interview), a community control group was chosen. Controls were those who had been free of malaria symptoms and signs for the previous three months. Risk factors such as places to sleep and remain at night, insecticide-treated bed nets, indoor residual sprays, and the presence of standing water or any other mosquito breeding grounds were evaluated using a standard checklist.

### Source population

All population living in Loma District of Dawro Zone in 2022

### Study population and study subjects

Population who resides in the Loma district, where malaria outbreaks occur, are the study populations. The specific study subjects for cases were febrile patients who were positive for malaria parasites microscopy. Study participants for the control group were otherwise healthy, non-febrile individuals who resided in the same village as the study's active case patient.

### Sample size determination and sampling method

We calculated the sample size using the statistical software calculation of Epi-info taking the power of 80%. We used literature done on Prevalence of Malaria and Associated Risk Factors among the Community of Mizan-Aman Town and Its Catchment Area in Southwest Ethiopia. percentage of exposed controls of 24.1%, and case to control the ratio of 1:1 with odd ratio of 0.46%. The total sample size yields 398.

### Laboratory method

At the hospital and health center levels, a microscope (slide) is used to determine the species of malaria.

### Techniques data Collection and Analysis

Quantitative data was collected using standardized face-to-face interviewer administered questionnaires that addressed socio-demographic characteristics, clinical manifestation, potential exposures, discussing with relevant bodies (task force), reviewing of weekly integrated disease surveillance and response at different levels (District Health office and Health facilities), and visiting of the affected village. The associated risk factors were examined using Epi Info version 7.3.1. Bivariate and multivariate analysis was used to establish the importance of risk factors for the epidemic by computing the adjusted odds ratio and 95% Confidence Interval**.**

#### Data Quality Management

The standardized questionnaire was used to ensure quality. To verify internal validity, the questionnaire was examined and amended. For 5% of the estimated sample size, we conducted a pre-test. During three days, supervisors and data collectors received instruction on data gathering methods and tools. 5% of the data were evaluated for completeness, and the investigators kept track of the quality of data gathering as a whole. To describe malaria cases in terms of time, place, and person, we used line lists

## Study variables

### Dependent Variables

- Malaria infection status

#### Independent Variables

- Age
- Sex
- Occupation
- Marital Status
- Family size
- Ethnicity
- Educational Level

- Religion
- Travel History
- Housing Condition
- Use of Insecticide Treated Bed Nets (ITNs)
- Indoor Residual Sprayed home (IRS)
- Sleeping outdoors at night
- Awareness about malaria
- Sleeping in a poorly constructed house

## Environmental Assessment

Information was mainly gathered based on the presence of possible mosquito breeding places. Regarding the presence of mosquito breeding places in their compound and within 500 meters or less of their residence, a sample of case-patients and controls were interviewed. Also, the presence of old tires, broken glasses, and unprotected plastic water containers within or outside of the property were all carefully evaluated.

### Case definitions

**Suspected**: Patient with fever or history of fever in the last 48 hours and lives in malaria endemic areas or has history of travel within the past 30 days to malaria-endemic areas.

**Probable**: Any person with fever and one or more of major sign such as headache, rigor, back pain, chills, sweats, myalgia, nausea, and vomiting diagnosed clinically as malaria.

**Confirmed**: Any suspected case that confirmed by microscopy or RDT for plasmodium parasites.

#### Study participants (Enrolment of cases and controls)

**Case:** A participant or respondent of Loma District with a history of malaria symptoms had a confirmed diagnosis of malaria by RDT or microscopy

## Inclusion and exclusion criteria

### Inclusion Criteria

For Cases: Individuals who tested positive for malaria and were discovered at home during the study period were enlisted as a case group and invited to participate

For Controls: Any Loma District and outbreak village residents who volunteered to participate in the study and who lived close to a case but did not experience malaria symptoms during the trial.

**Exclusion criteria**

The survey did not include anyone who travelled from another woreda or district or who had not been in the villages for the previous two weeks. Both the cases and controls groups were exempt from the critically sick, psychiatric patients, and those who were unconscious at the time of the interview.

## Operational definitions

**Good knowledge:** peoples who scored above mean of knowledge questions otherwise poor.
**Mosquito breeding site:** availability of mosquito breeding material, stagnant water, and availability of dungs and tick grass in their dwelling house.
**Outdoor overnight:** peoples who stay outdoor more than 6 hours during the night time.
**Housing condition:** Housing components were grouped into two categories according to potential for mosquito entry and resting.
**Poor housing:** Houses constructed with materials such as external walls, internal walls, and roofs that were composed of only natural materials and had no windows or doors that were kept open to maintain ventilation were classified as low quality.
**Good housing:** Houses constructed with materials like external walls, internal walls, and roofs were classified as high quality if they were composed of modern materials.

## Ethical Consideration

Ethiopian Public Health Institute and South West Ethiopian region health bureau wrote a letter of support for the study. The Loma district health office provided us with a letter of approval. The study's aims were explained to the participant/respondent, and their desire to participate was then gauged. All study participants and respondents provided verbal informed consent, and anonymity was guaranteed.

### Dissemination of the findings

The Loma District, Dawro Zone, and SWEP regional health bureau were debriefed. The department of public health at Addis Ababa University will get the final report. If there is a

chance, it will also be presented in a scientific conference. I will then complete the manuscript and make publication-related efforts**.**

# Results

## Descriptive Epidemiology

### Distribution of Malaria Cases by Person

The Loma District of the SWEP region reported 340 suspected malaria cases between May 19 and June 10, 2022. Of the total laboratory-tested cases (70%) of them were found to be positive for malaria. According to this study, 167 men and 173 women out of 340 suspected cases of malaria were found to be affected. The most common clinical signs were a fever, headache, and chills. Less frequently occurred diarrhea and cough also seen in some of the patients. Median age of cases was 24 years and approximately half were in the age group of 15–59 years). The most affected age group was above 15 years age group 138 (41%) followed by 6-14 age groups 129(38%) and <=5years age group (21%) of all notified suspected malaria cases. The highest and lowest positivity rate was reported in the age group above 6- 14 years (81%) and >=15 (54.3%) respectively

*Table 1: Age specific malaria attack rate and case fatality rate by age group in Loma district of Dawro zone, SWEP region, Ethiopia.*

| Age group | Total population | Number of cases | Number of deaths | Attack rate (Per 1000 population) | Case fatality rate (%) |
|---|---|---|---|---|---|
| ≤5 years | 14999 | 73 | 0 | 4.8/1000 | 0 |
| 6-14 years | 32248 | 129 | 0 | 4/1000 | 0 |
| ≥15 years | 48902 | 138 | 0 | 2.8/1000 | 0 |
| **Total** | **96149** | **340** | **0** | **3.6/1000** | **0** |

Of the confirmed malaria cases, the result by species shows that 83.2% of the cases were Plasmodium falciparum, 13.8% of the cases were Plasmodium vivax and 2.9% of the cases were mixed cases of both P. falciparum and Vivax.

*Table 2: Distribution of malaria cases by age and plasmodium species*

| Age Group | Total Tested | Total positive | Positivity rate | Plasmodium Species | | |
|---|---|---|---|---|---|---|
| | | | | PF | PV | Mixed (PF + PV) |
| ≤5 | 73 | 57 | 78.1 | 50 | 7 | 0 |
| 6-14 | 129 | 105 | 81.4 | 83 | 19 | 3 |
| ≥15 | 138 | 77 | 54.35 | 66 | 7 | 4 |
| **Total** | **340** | **239** | **69.71** | **199** | **33** | **7** |

Plasmodium falciparum accounts for 83.2% of the 239 positive cases overall, followed by Plasmodium vivax at 13.8%. The 340 febrile cases that were initially identified underwent lab testing, and the outcome was a 70.2 positive rate. These findings confirmed the outbreak, which met the national guideline's 50% positive threshold.

*Table 3: Distribution of malaria cases by sex and plasmodium species Loma woreda, June 2022*

| Gender | Total tested | Total Positive | Positivity rate (%) | Plasmodium species | | |
|---|---|---|---|---|---|---|
| | | | | PF | PV | Mixed |
| Male | 167 | 117 | 70.1 | 94 | 20 | 3 |
| Female | 173 | 122 | 70.5 | 105 | 13 | 4 |
| Total | 340 | 239 | 70.2 | 199(83.2%) | 33(13.8%) | 7(2.9%) |

**Distribution of Malaria Cases by Place**

Zima Waruma village accounted for 340/157 (46.2%) of the total malaria cases, followed by Hailan kebele (340/72; 21%), Dodi (54; 15.8%); Bodari (39; 11.5%); and Yello Lala (18; 5.3%). Plasmodium vivax was the second most prevalent species in all of the kebeles that was responsible for this outbreak, after plasmodium falciparum**.**

*Table 4: Distribution of malaria cases by village and plasmodium species in Loma district malarias' Kebeles June 2022*

| 0Kebele | Total tested | pf | Pv | mixed |
|---|---|---|---|---|
| Zima Waruma | 157 | 85 | 18 | 3 |
| Halian | 67 | 51 | 5 | 1 |
| Dodi | 54 | 37 | 4 | 0 |
| Yello Lala | 20 | 10 | 2 | 0 |
| Bodari | 38 | 13 | 3 | 3 |
| Afuki | 4 | 3 | 1 | 0 |
| **Total** | **340** | **199** | **33** | **7** |

More people were afflicted by the malaria outbreak in Zima Waruma and Dodi kebeles than in Halian and Bodari kebeles, which had attack rates of 35.6, 16.6, and 13.8 and 11.3 per 1000 people, respectively.

*Table 5: malaria attack rate by sex, village and age group Loma district Dawro zone SWEP region, Ethiopia, June 2022*

| Kebeles | Total Population | Sex | | Age Group | | | Total Case | AR per 1000 |
|---|---|---|---|---|---|---|---|---|
| | | *Male* | *Female* | *<=5* | *6-14* | *>=15* | | |
| Zima Waruma | 4410 | 2161 | 2249 | 397 | 926 | 3087 | 157 | 35.6 |
| Hailan | 4857 | 2380 | 2477 | 437 | 1020 | 3400 | 67 | 13.8 |
| Dodi | 3248 | 1592 | 1656 | 292 | 682 | 2274 | 54 | 16.6 |
| Bodari | 3377 | 1655 | 1722 | 304 | 709 | 2364 | 38 | 11.3 |
| Yello Lala | 3401 | 1667 | 1734 | 306 | 714 | 2381 | 20 | 5.9 |
| Afuki | 3738 | 1832 | 1906 | 336 | 785 | 2617 | 4 | 1.1 |

**Description of Malaria Cases by time**

By comparing the new cases with the doubled number of previously reported cases from previous years, the malaria outbreak was identified in our study area. As a result, as shown in figure (2) below, the threshold line (the second-largest report of the previous five-year weekly report) was crossed at the start of WHO epidemiological week 18 and reached its peak in week 19.

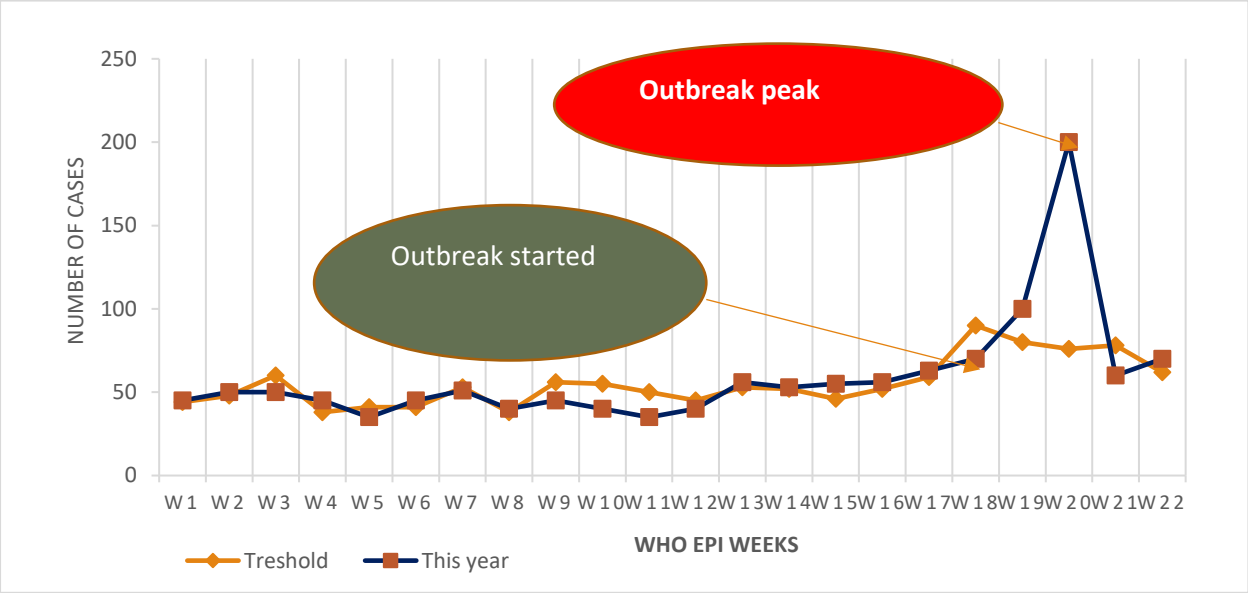


*Figure 2: Trends of malaria cases crossing the number of threshold (the second largest report of the last five year weekly report the same week) Loma District, Dawro zone, SWEPR region, Ethiopia, 2022*

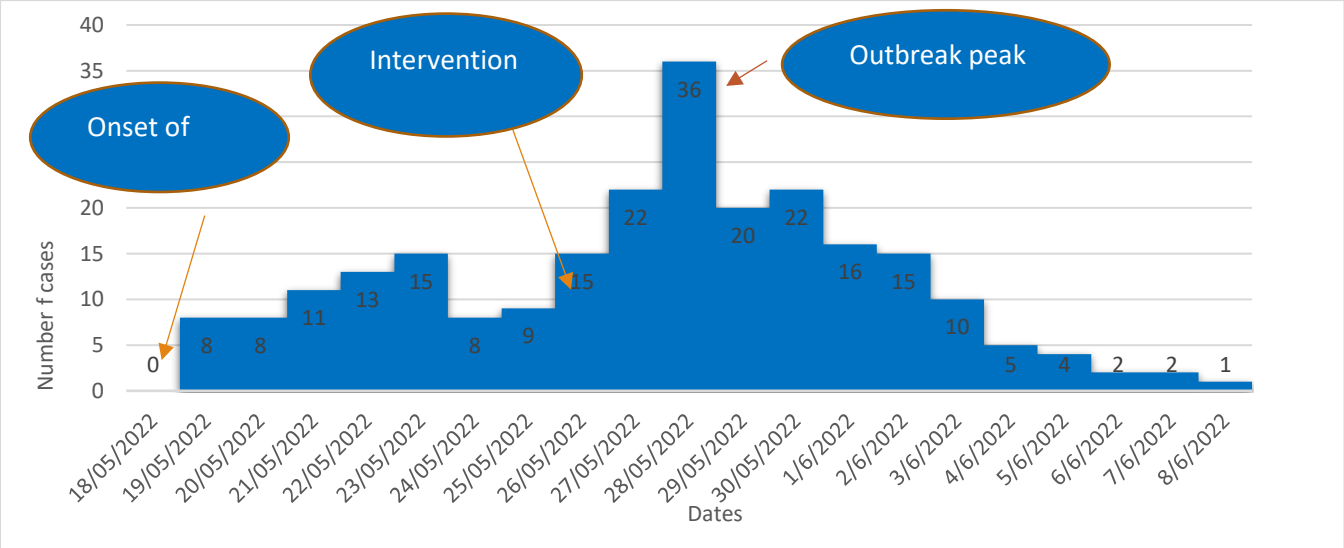


*Figure 3: Epi-curve showing confirmed malaria cases by date of onset in Loma district, Dawro Zone, SWEPR, Ethiopia, from May 19/2022 to June 08/2022.*

The district health office departed for the site of the outbreak a week after the disease begun in accordance with an epic curve. The Epi-curve showed that the outbreak had multiple peaks and the potential for transmission from person to person (Figure 3) Outbreak was started on May 19, 2022. But the district health department was informed on May 25, 2022. The peak numbers of malaria patients were on May 29, 2022. Infections with Plasmodium falciparum were more common than those with Plasmodium vivax.

## Risk Factor Analysis

To evaluate associated factors, 199 malaria case-patients and 199 community controls were selected and interviewed from the Loma District villages of Zima Waruma, Halian, Dodi, Bodari, and Yello Lala. There were 93 (46.2%) females among the 199 case-patients and 87 (44%) of the 199 controls.

According to our findings from the bivariate analysis, malaria did not correlate with sociodemographic factors like sex or age group. In bivariate analysis, the presence of mosquito breeding sites (irrigation, stagnant water), recent travel history, IRS, and ITN use have significant associations with ((0.001) OR= 1.97 95%CI (0.89-3.92)), ((p=0.001), OR= 2.11(1.52- 6.81], (p=0.001) [OR= 0.18(0.12-2.12)], and (P=0.001) 0.2(0.01-0.91) respectively.

*Table 6: Bivariate analysis of socio-demographic and environmental factors associated with malaria infection in Loma district, Dawro zone, SWEP region, Ethiopia, 2022*

| **Variables** | **Classification** | **Cases** | **Controls** | **COR (95% CI)** | **P value** |
|---|---|---|---|---|---|
| Age | <=5 | 31 | 22 | | |
| | >5 | 168 | 177 | 1.48(1.21-3.78) | 0.186 |
| Sex | Male | 112 | 106 | | |
| | Female | 87 | 93 | 1.13(0.59-2.84) | 0.546 |
| Education level | Formal Education | 107 | 115 | | |
| | No formal education | 92 | 84 | 0.84(0.25-1.96) | **0.002*** |
| presence of man-made or natural water holding bodies close to the home | Yes | 66 | 40 | | |
| | No | 133 | 159 | 1.97(0.89-3.9) | **0.001*** |
| Travel History | Yes | 90 | 56 | | |

| | | | | | |
|---|---|---|---|---|---|
| | No | 109 | 143 | 2.11(1.52-6.81) | **0.000*** |
| Sleeping out door at night | Yes | 105 | 41 | | |
| | No | 94 | 158 | 4.3(1.91-12.35) | **0.001*** |
| Awareness on transmission, prevention and control of malaria | Yes | 130 | 191 | | |
| | No | 69 | 8 | 0.78(0.52-1.96) | **0.001*** |
| ITN utilization | Yes | 128 | 181 | | |
| | No | 71 | 18 | 0.18(0.12-2.12) | **0.001*** |
| Sleeping in poorly constructed house | Yes | 128 | 43 | | |
| | No | 71 | 156 | 6.54(2.35-24.12) | 0.194 |
| IRS Last year | Yes | 19 | 166 | 0.47(26.08-87.056) | |
| | No | 180 | 33 | 0.2(0.01-0.91) | **0.001*** |

## Factors independently associated with malaria infection.

Five variables were revealed to be substantially linked with malaria infection in the multivariable regression model after controlling for confounding effect. In multivariate analysis Education level (AOR = 0.4, 95% CI (0.24-0.72 P-value 0.008), the presence of mosquito breeding sites close to residence areas (AOR = 2.08, 95% CI (0.96-4.56), P= 0.046), sleeping outside at night (AOR =3.96, 95% CI (1.96-8.1), not using ITN (AOR = 0.81, 95% CI: 0.1-0.9) P value 0.001, and not using IRS at home (AOR =8.9 (5.32-14.23), P= 0.001) are statistically associated with development of the malaria.

*Table 7: Multivariable logistic analysis of factors independently associated with malaria infection in Loma district, Dawro zone, SWEP region, Ethiopia, 2022*

| Variables | Classification | Cases | Controls | AOR (95% CI) | P value |
|---|---|---|---|---|---|
| Education level | Formal Education | 107 | 115 | 0.4(0.24-0.72 | |
| | No formal education | 92 | 84 | | 0.008** |
| presence of man-made or natural water holding bodies close to the home | Yes | 66 | 40 | 2.08(0.96-4.56) | 0.046** |
| | No | 133 | 159 | | |
| Sleeping out door at night | Yes | 105 | 41 | 3.96(1.96-8.1) | 0.001** |

| | | | | | |
|---|---|---|---|---|---|
| | No | 94 | 158 | | |
| Travel History | Yes | 90 | 56 | 5.61(0.95-33.3) | 0.057 |
| | No | 109 | 143 | | |
| Awareness on transmission, prevention and control of malaria | Yes | 130 | 191 | 0.064(0.18-0.56) | |
| | No | 69 | 8 | | 0.001** |
| ITN utilization | Yes | 79 | 181 | | |
| | No | 120 | 18 | 0.81(0.25-1.23) | 0.001** |
| IRS Home last year | Yes | 19 | 166 | 8.9 (5.32-14.23) | |
| | No | 180 | 33 | | 0.001** |

## Environmental Assessment

A zone received bed net distribution four years ago, which is after the suggested time frame. Due to a lack of social skills and the absence of bed net distribution in most kebeles, the use of bed nets was low in Malarious woredas. Only 50% of the 100 randomly chosen and inspected households have bed nets, and only 10% of those who do use bed nets properly. Special environmental management was advised for certain areas since the Omo Dam proximity to the inhabitants had a negative impact. Last year, IRS did not cover every kebele in every hot spot woreda due to a scarcity of chemicals. Case reports from the kebeles that had been sprayed were considerably higher, suggesting that it would be better to switch the pesticides used the year before. There are no partners for Woredas who are particularly interested on malaria. Health education for the community is difficult to deliver in some kebeles because they are too remote from woredas and are challenging to access. In the affected areas, we observed poor use of bed nets, improper hanging of bed nets, and malaria breeding grounds (stagnant water, irrigation canals, and exposed plastic containers).

*Figure 4: Some of Visited Potential mosquito breeding sites around home, in Loma district, Dawro Zone, SWEP region 2022*

## Public health intervention

Health professionals received technical assistance in case management, recording, and reporting situations. Health promotion and education about malaria infection, transmission, preventive and control methods, active case-finding from house to house, and treatment of cases to stop further spread as well as the morbidity and death linked to malaria infections. Regular surveillance was increased, and the situation was constantly monitored at every level. One of the elements of eliminating malaria is environmental management (draining or treating) of breeding places. The crew found malaria breeding areas, which the community either drained or treated with qualified personnel. Every kebele needs to conduct regular environmental cleaning programs in order to prevent other infectious diseases in addition to malaria. Distribution of LLITN and IRS was boosted throughout the entire kebele of the Loma Woreda. The Woreda health office, staff members of the health facilities, and HEWs were informed about on-site training on enhancing surveillance activity, fostering a culture of health-seeking in the community, and transmission, control, and prevention strategies for malaria infection. HWs, HEWs, and kebeles administration delivered important messages to the community regarding malaria infection prevention and control techniques. To help, follow, and direct HWs, HEWs, and kebeles administrative in delivering crucial messages, RRT personnel at the woreda health office were given this task.

## Discussion

The study's findings supported the existence of a malaria epidemic in the study area based on five years' worth of epidemiological records of malaria cases. In terms of the time period when more malaria cases were reported, the area's malaria outbreak started around the same time as other regions of Ethiopia and according to national data. In many locations of Ethiopia, malaria epidemics frequently occur from May to July.(10) Unusual temperatures and heavy rain in the middle of June in the affected village may also enhance mosquito breeding sites, due to some stagnant water bodies, which is consistent with literature.(11)

Following surprising rises in malaria cases found and reported from various health centers, the existence of the disease was confirmed. Our research revealed a three-week-long malaria outbreak in the Loma district. The epidemic curve features many peaks that are indicative of a spreading outbreak (propagative type) and indicate transmission from person to person. In comparison to the previous year during WHO epidemic week, there were more than double as many malaria cases reported. On week 19 of 2022, malaria cases peaked in severity. The threshold graph and index case of the Epi-curve indicated that the epidemic response had been delayed.

There were numerous mosquito breeding sites found in the area that may be the cause of the outbreak. The stable water at the dam's edge, which occasionally rises, severely impacted Zima waruma Kebele, which shares a long boundary with the Omo dam. Due to recent numerous road construction projects, which result in many portions of the kebele having standing water, Halian kebele was the second most affected kebele of the district. Moreover, interior residual spraying of homes in infected kebeles was delayed. After the outbreak started, spraying was initiated in a small number of rural kebeles, but not all of the district's maladjusted kebeles were affected. Study done in Duke University, Durham, North Carolina revealed that one of the most promising solutions for reducing the burden of malaria worldwide is indoor residual spraying. IRS greatly reduces the prevalence of malaria parasitemia in the community.(12)

Children of <15 and females were more affected with AR of 4.3 and 2.5 per 1000 population. Research in India,(13) Ethiopia,(14) and Zimbabwe (15) found that children and women were more likely to contract malaria than adults. This may be due to Children may have low immune systems than adults, and inappropriate ITN use, not prioritizing children and women's use of ITNs at home, and spending more time outside in the evening conducting household tasks. The district's overall attack rate was 36 cases per 10,000 population. This finding was significantly

lower than those from studies conducted in the Tanqua Abergelie (331 per 10,000 population) and Afar (367 per 10,000 population) regions of northern Ethiopia, but at a higher attack rate than those from the Laelay Adyabo district (12.1 per 10,000). (16)(17)(18).

Other findings of the analytical epidemiological investigation demonstrated that exposure to the malaria parasite was primarily influenced by stagnant water. Those who live close to man-made or natural water holding bodies are 2.1 times more likely to contract malaria than those who do not. A result that is in line with earlier studies in the literature from Sri Lanka and India indicate that being close to vector breeding grounds increased exposure risk to the malaria parasite compared to living farther away.(19) (20) The other triggering factor for anopheles mosquito breeding was the Omo River Dam. This might be caused by a shift in the climate; a lack of rain leading to water bodies breaking up, which would increase the population of breeding vectors. As a result, the majority of the population that were affected lived at and around irrigation sites of the dam. However, due to the district's decrease in malaria cases over the past four years, proper vector control measures, such as the use of LLINs, IRS performance, and environmental control management, were not taken. When compared to the nationally registered proportions of Plasmodium falciparum and Plasmodium Vivax, which are 60% and 40% respectively, the high proportion of Plasmodium falciparum cases demonstrates a difference.(21) 83.2% of those affected by this outbreak had Plasmodium falciparum, 13.8% had Vivax, and 3% had both species together.

Use of insecticide-treated nets (ITNs) was substantially related with malaria infection, according to our study. Cases had 65% fewer chances of utilizing ITNs than controls, which raised the likelihood of contracting malaria. This result is in line with a study carried out in Kenya that shown the use of mosquito nets (ITNs) was linked to a lower likelihood of malaria impact and transmission.(22) In most households of the cases observed, LLIN bed nets were improperly put and poorly used, yet in a study conducted in Prion, Mali, also indicates that using LLIN considerably reduced the burden of malaria. (23) Moreover, in this district's poor performance in the areas of early warning surveillance, environmental management, and absence of IRS spray in some kebeles for the last three years may have caused seasonal peaks to rise above the epidemic threshold.

According to the study, treating homes with chemicals (IRS) was linked to a lower risk of contracting malaria. Not using IRS increases the odd of contracting malaria 8.9 times more than those who used IRS in the previous year.

This outcome is comparable to a study conducted in Uganda, which found that using IRS at home greatly reduced the incidence of malaria.(24) This is due to community acceptance of IRS has been impeded by Insecticide odour, mess caused by sprayers, trouble of having to remove home goods before spraying, rise in the frequency of other insects, perception of ineffectiveness, and side effects have all hindered community adoption of IRS. It is necessary to remove these obstacles in order to enhance the use of IRS for malaria prevention.

## Study limitations

- Some kebeles lack a road, making them challenging to easily reach to conduct investigations into the surrounding environment and certain situations.
- The chosen disease-free controls can be in the malaria incubation phase

## Conclusions

3.6/1000 people were affected by malaria overall during this episode, which had a high attack rate. Residents of Zima Waruma and female populations were disproportionately affected by this malaria outbreak. The Plasmodium falciparum species is the most frequent reason for the outbreak. Even if there are efforts to stop malaria from spreading in the region, the elements that keep malaria from spreading are not adequately managed. Predictors of the infection include the availability of mosquito breeding grounds close to the house (Different Road construction projects, the Omo River dam), sleeping outside at night, not using an ITN, and not having IRS at home.

Thus, it is necessary to put malaria prevention and control measures into place, beginning with environmental safeguards and hygienic practices. Malaria outbreaks may be decreased through improved environmental management at irrigation sites, the elimination and treatment of stagnant water bodies, animal disturbance of mushy water lands and vector breeding sites, distribution of bed nets, provision of diagnostic and therapeutic materials to each risk area, community awareness of malaria mode of transmission and prevention modalities, and community empowerment on environmental cleanliness.

## Recommendations

- Encourage people to stay away from potential mosquito breeding grounds or Avoid breeding sites. (District Health office and HEW)
- Replacement of ITNs in the malarious kebeles on time (FMOH and SWEP region Health office)
- When sleeping outside at night, use bed nets with insect protection (Community)
- Appropriate chemicals must be used in timely indoor residual spraying operations that are planned in accordance with the required standard (twice per year) and sprayed prior to the rainy season. (Loma District and Dawro zone Health bureau)
- Maintains community health education regarding disease transmission mechanisms and preventative measures (HEW and district Health office)
- To reduce the rate of false positives, further study is required to assess the validity and reliability of fast diagnostic tests.

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## 1.2. Measles Outbreak Investigation in Raso District of Afder zone, Somali Region Ethiopia, 2022


### Abstract

**Background**: Measles is a viral illness that is extremely contagious. Globally, over 207 000 people died from the measles in 2019, which was the greatest number of cases documented in 23 years. A measles epidemic was reported from Raso district in Somali Region, Ethiopia, on March 27, 2022 (4th WHO week). Thus, we investigated into the outbreak's existence and the contributing factors.

**Method**s: From March 27 to April 29/2022, a descriptive and 1:2 unmatched case-control study was conducted in the Raso district. There were 85 cases used in total for the descriptive study. 58 cases were chosen by computer-generated simple random approach employing line list as a sampling frame, and 116 controls were analyzed in order to find the factor linked to the outbreak. Home-to-home searches in the affected kebeles were used to find active cases, and controls were chosen from cases' neighbors. To confirm cases, an IgM test was performed on five serum samples. Cases were defined as anyone who experienced a fever, maculopapular rash, cough, coryza, or conjunctivitis, whereas controls did not have these symptoms. We gathered information using a standardized questionnaire, and cases were described in terms of the person, place, and time they occurred. Logistic regression was then used to find factors linked to measles cases. P-value 0.05 was used in the multivariable analysis to denote statistical significance.

**Results:** Totally 85 cases were found, with an attack rate of 1.7 per 1000 people overall and a case fatality rate (CFR) of 2.3%. Children under the age of 59 months had the highest attack rate (6.5/1000). Being unvaccinated (adjusted odds ratio/AOR with 95% confidence interval [CI]:0.39(0.026-1.256), contact with patients (AOR=3.22, 95% CI: 1.05-11.17), moderate malnutrition (AOR=1.156, 95% CI: 1.085-1.210), family size greater than five (AOR = 1.32, 95% CI: 0.03-3.56), and being younger than five years of age (AOR=22.8, 95% CI: CI: 1.69-309.2) were shown significant associated with measles infection.

**Conclusion:** Investigation attack and fatality rates were high. The outbreak was linked to immunization status, Age, malnutrition, family size and previous contact with measles cases. To prevent further measles outbreaks, we advise implementing vaccination campaigns, nutritional interventions, and strengthened routine immunization program.



**Keywords:** outbreak, measles, Raso, case control, Somali Region Ethiopia 2022

## INTODUCTION

### Background

Measles is a highly contagious viral disease caused by the measles virus which causes blindness, encephalitis, conjunctivitis, a fever, rash, and also can result in death. This highly contagious virus is primarily transmitted by respiratory droplets or airborne spray to mucous membranes in the upper respiratory tract or the conjunctiva. There have been documented common source outbreaks associated with airborne transmission of the measles virus.(1)

It is one of the world's top five causes of vaccine-preventable morbidity and mortality.(2) According to the World Health Organization (WHO), approximately 535,000 children died of measles worldwide in 2000, with the majority dying in developing countries, accounting for 5% of all under-five mortality. At its 59th session in 2009, the Regional Committee for Africa adopted a regional measles elimination goal for 2020. It urged member states to invest in strengthening immunization and health systems, citing the importance of routine immunization in the elimination effort. The World Health Assembly set a 2015 target of 95% reduction in measles deaths from 2000 levels in 2010. Global measles mortality had dropped by 74% by 2010, from 535,300 deaths in 2000 to 139,300 in 2010.(3)

In 2007, an estimated 197,000 people died from measles worldwide, with Southeast Asia accounting for 136,000 (69%) and Africa accounting for 45,000 (23%). In general, the measles case fatality rate in Africa ranges from 3 to 5%, reaching up to 30% during severe outbreaks and outbreaks in closed communities such as refugee camps. Measles remains a major public health problem in Africa, killing an estimated 28,000 people each year.(4)

Measles vaccine (MCV1 and 2) coverage must reach and remain above 95% in a nation to prevent the disease, however in Ethiopia and other GAVI-supported nations, MCV1 vaccination rates have plateaued at 81% and second dose coverage is only at 54%.(5) Accelerated measles control activities began in 2001 in WHO African Region countries. In the African Region, reported measles cases had decreased by 93% and estimated measles mortality had decreased by 92% since 2000. As part of the regional measles elimination goal, the WHO African Region established the following targets: achieving measles vaccination coverage (VC) of 90% nationally and exceeding 80% VC in all districts; and achieving at least 95% coverage with measles vaccines during Supplementary Immunization Activities nationally and in at least 80% of districts.(3) MCV1 and MCV2 were administered to 85% and 67% of

children worldwide in 2017, preventing 110,000 measles-related deaths. 167 nations routinely immunize their citizens against MCV2.(6)

Because the patient is frequently infected by someone in the pre-rash prodromal stage, the exact source of transmission is frequently unknown. Measles can infect people of any age, but the majority of the disease's global burden is still borne by children under the age of five. During 2018-2019, all WHO regions saw at least one large-scale measles outbreak, necessitating response efforts by affected national governments and partners to contain and end the outbreaks. Despite concerted efforts and progress toward measles elimination goals, global measles first dose immunization coverage remained unchanged (85%) in 2010.(7) Measles continues to be a public health issue in many developing countries, particularly in Africa and Asia. According to the World Health Organization (WHO), measles affects more than 20 million people each year, with more than 95% of measles deaths occurring in countries with low per capita incomes and inadequate health infrastructure.(8)

Despite the availability of an effective, safe, and inexpensive measles vaccine licensed since 1963, more than 140,000 people died from the disease in 2018. Sub-Saharan Africa accounted for the vast majority of these fatalities. Children under the age of five, people who live in crowded settings, people who are malnourished and have vitamin A deficiency are at an increased risk of developing severe measles. Depending on the age and the predisposing factors, complications from measles occur in roughly 30% of cases. The measles case fatality rate is 3-6% in areas where malnutrition, such as vitamin A deficiency, and exposure to other infectious diseases are widespread, but it can reach 30% among isolated populations.(9)

Case fatality rates among young children in developing countries may reach 5-10%. Infection complications, such as severe diarrhea, protein-energy malnutrition, respiratory infection, and encephalitis, are frequently the leading causes of death in developing countries.(10) African countries adopted the WHO and UNICEF-recommended measles mortality reduction strategies in 2001. Following a significant reduction in measles cases and deaths as a result of the strategies' implementation, the African Region adopted a measles elimination goal for 2020 in 2011. To assess progress, estimates of the first dose of measles vaccine in routine immunization (MCV1), reported coverage for measles supplementary immunization activities (SIAs), and surveillance data were used. Regional MCV1 coverage remained stable at around 74% between 2011 and 2013, with approximately 215 million children reached in measles SIAs in 43 countries. Regional measles vaccination coverage has not increased in the last three years, and

measles incidence has remained high. Intensive efforts are needed to ensure that routine immunization and SIAs provide high population immunity and that measles surveillance becomes more sensitive.(11)

Ethiopia adopted the African regional accelerated measles morbidity and mortality reduction goal in 2002, including the pre-elimination goal, which expired in 2012. Since the beginning of routine immunization in 1980, infants in the United States have received measles vaccination at the age of 9 months. Furthermore, at the start of the accelerated control program, measles catch-up campaigns were conducted for all 15-year-olds in a phased manner, and supplemental immunization activities were conducted at 2–3-year intervals. Despite these efforts, the estimated measles first dose (MCV1) coverage in Ethiopia was 56% in 2010 and 57% in 2011, with woredas, the lowest administrative units, reporting 80% MCV1 coverage at 45%. As a result of low population immunity and a build-up of the susceptible population, widespread measles outbreaks occurred throughout the country in 2015, with more than 280 districts affected by the measles epidemic, according to the weekly measles report.(12)

The epidemiology of measles has changed in both developed and developing countries since the introduction of effective measles vaccines. There has been a significant reduction in measles incidence as vaccine coverage has increased, and as measles virus circulation has decreased, the average age at which infection occurs has increased. Measles severity varies greatly depending on a variety of host and environmental factors. The risk of developing severe or fatal measles increases in children under the age of five, those living in overcrowded conditions, those who are malnourished, and those who have immunological disorders such as advanced HIV infection.(13)

Globally, there were 254,928 measles cases reported in 2015, with an estimated 134,200 deaths (i.e., 367 deaths per day). Measles outbreaks were reported in a number of African, European, and Eastern Mediterranean countries in 2015. For every 1,000 reported measles cases, approximately one case of encephalitis and two to three deaths may occur.(2)

In Somalia, measles is endemic, with cases reported year after year. Between epidemiological weeks 1 and 9, 3509 suspected measles cases were reported from 18 regions of the country in 2022. WHO is continuing to provide technical assistance in the areas of surveillance, vaccination, laboratory, case management, training of care health workers, and risk communication. Given low vaccination coverage and a high prevalence of malnutrition and vitamin A deficiency among children under the age of five, the overall risk for measles at the

national level is considered very high. This risk is exacerbated by a complex humanitarian crisis caused by conflict, drought, and displacement. (1)

## Statement of the problem

Despite the availability of immunization, measles remains a highly contagious, vaccine-preventable disease that kills nearly 100,000 people each year. In all World Health Organization regions, tremendous progress has been made toward eliminating measles by 2020. (2) Unfortunately, due to insufficient immunization coverage and insufficient control of emerging clusters, this goal has not yet been met. Childhood immunization programs have significantly reduced global measles morbidity and mortality over the last several decades. However, measles remains one of the leading causes of death in developing countries, with outbreaks occurring on an annual basis. Herd immunity, or population immunity greater than 95%, is required to halt the spread of the measles virus. To prevent major measles epidemics, both high vaccination coverage and vaccine efficacy are required. (6) Every year, the Somalia region of Ethiopia reports a measles outbreak. Currently, a Measles outbreak has been reported in Afder zone, and Raso woreda, Somalia Region, Ethiopia.

## Significance of the study

Measles is an immediately reportable disease in Ethiopia and a leading cause of death in children under the age of five. Even though measles vaccines are routinely provided as part of an expanded program of immunization with two doses and a supplementary dose by campaign given to children under the age of five, outbreaks occur every year, resulting in high morbidity and mortality in the outbreak area. Currently, a Measles outbreak has been reported in Somalia's Raso Woreda Afder Zone. This requires further investigation and risk assessment to determine the cause of the reported outbreak and whether the key intervention for measles control and elimination was implemented within the outbreak area. The magnitude of the disease and the risk factors for contracting the disease were not well known in the study area prior to the investigation and response. As a result, this study was carried out to assess the existence of a measles outbreak, describe its magnitude, and identify risk factors contributing to the disease's occurrence in Raso district Afder zone of Somalia Region, Eastern Ethiopia.

## Objective

**General Objective**

To describe the magnitude of the measles outbreak, identify risk factors associated with the outbreak, and implement appropriate public health controls in Raso woreda, Afder Zone of Somali region, Ethiopia, in April 2022.

**Specific objectives**

- To establish the presence of a measles outbreak in Raso woreda.
- To describe an outbreak in the woreda in terms of person, place, and time.
- To identify risk factors linked to the measles outbreak.
- To put in place appropriate prevention and control measure

## Methods and Materials

### Study Area

Raaso district/Region in Ethiopia) is a district in Ethiopia's Somali Region. Located in the Afder Zone. Raaso's population is estimated to be around 941,000 people. The Sheekhaal clan lives in the Raaso district. Raaso is located along the Imi-Ginir Road, in the Raaso Woreda, woreda of Afder Zone, approximately 40 kilometers north-west of West Imi (or Mirab Imi) village, at 6°32′N 41°47′E. The sheekhal clan gave the town the name Raaso. Buundada, which is located on the Shabelle River, Dhaley and other settlements or smaller towns surround Raaso. The area is characterized by thick, hilly bush land, seasonal rivers nearby that may carry water after rains, and shallow wells that are easily dug to provide water all year.

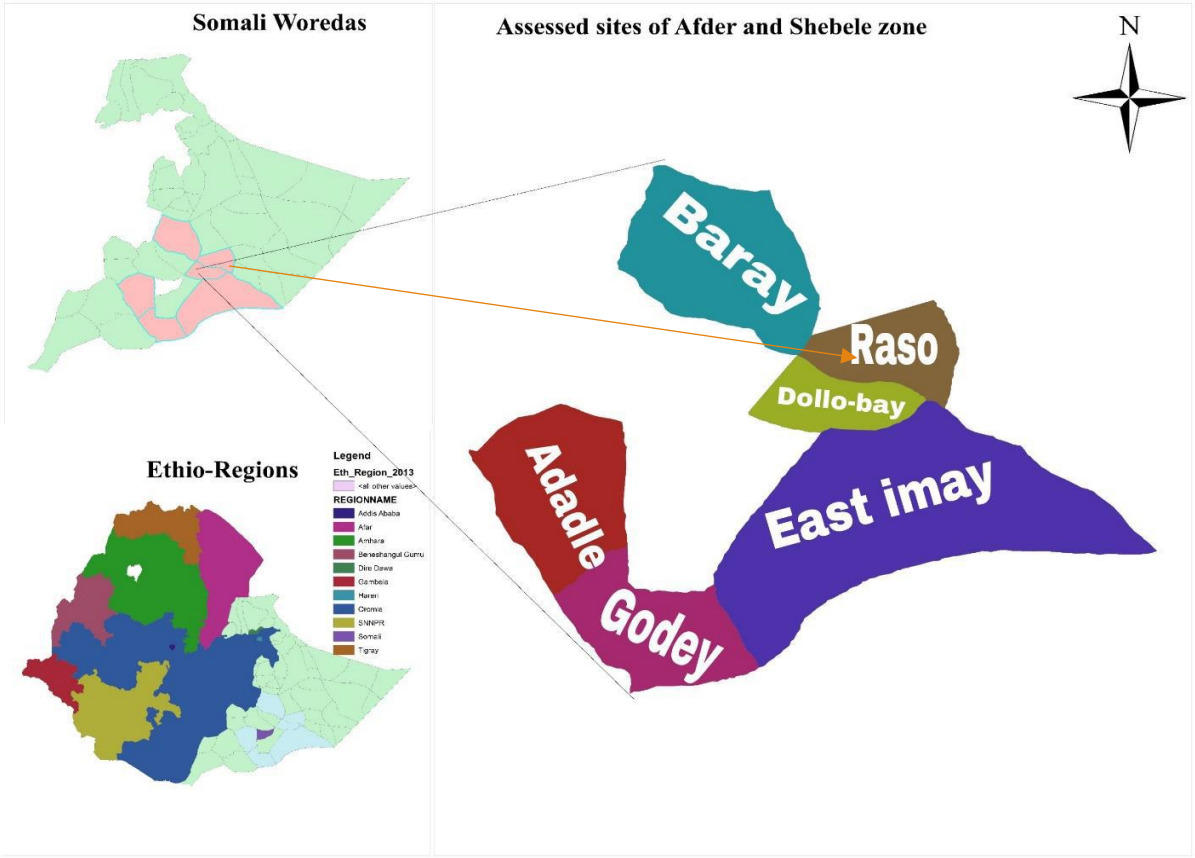


*Figure 5: Assessment region area map Somali region, Afder zone, Raso Woreda.*

**Study period**

The study was carried out between March 20 and April 30.

**Study Design**

In order to identify the potential risk factors of the outbreak, we used a descriptive analysis of the collected line list of cases, followed by an unmatched case control study with a case to control ratio of 1:2.

**Source /Target population**

The source population was the entire Raso district population.

**Study population**

The study population was made up of people who were sampled from the source population.

**Sample size and sampling procedure**

To describe the magnitude of the measles outbreak, we used a descriptive cross-sectional study, and we used a 1:2 unmatched case-control study design to identify the risk factors associated with measles infection. The descriptive study included all suspected measles cases recorded on the line-list. A total of 174 samples (58 cases and 116 controls) were included in the case-control study. We discovered the cases on a line-list and then went to their home for an interview. For each selected case, two controls from the same kebele as the cases were recruited. Cases with a history of contact with other confirmed measles cases, the presence of a measles case (s) in a neighboring household or within the household, or within the household and not vaccinating children from measles virus were used to calculate the sample size.

A control to case ratio of 2:1 was chosen for practical reasons). For 80% power, Z=.84 for 0.05 significance level, Z=1.96 (1:2 ratio of cases and controls), P1 = proportion of cases exposed, P2 = proportion of controls exposed, there were a total of cases and control respondent pairs. Data from case control respondents was collected in total. Using the Epi-info statistical software package, a survey of 174 total cases and controls was conducted in the Dagahbur. district of Somali regional state Ethiopia, with a 95% confidence interval (CI), a control to case ratio of 2:1, and an odds ratio (OR) of 3.5.

**Sampling Method**

Cases with a history of contact with other confirmed measles cases, the presence of a measles case (s) in a neighboring household or within the household, or within the household and not vaccinating children from measles virus were used to calculate the sample size. We included 58 reported cases randomly from the line list and 116 controls randomly from the same village where cases were identified.

**Case Definition and Selection of Cases and Controls**

The WHO adopted national integrated disease surveillance case definition was used.

**Suspected case** - Anyone with a fever and a maculopapular (non-vesicular) generalized rash, cough, coryza, or conjunctivitis (red eyes) OR anyone who a clinician suspects has measles.

**Confirmed cases** - A suspected measles case that is investigated and has serological confirmation of recent measles virus infection (IgM positive).

**Case** - Are individuals who meet the aforementioned criteria, and all reported cases have been recorded in the line list

**Control** - Individuals who do not meet the above criteria and are chosen from a similar village where cases have been identified.

**Community case definition of measles**: - Any person with fever and rash starts from face.

**Data collection method**: Simple random sampling was used to select the first case of study participant from the line list and the control from the neighboring by a 1:2 case to control ratio. Then, similar standard questions were used to collect data from case and control interview participants.

# Variables:

**Dependent variable**: Number of measles cases reported

**Independent variable**: Factor contracting for measles outbreak.

## Tools and Procedures for Data Collection

**Case and Control Interviews:** Two data collectors interviewed case and controls using a structured and semi-structured questionnaire (annexed**)**

**Discussion with Key Informants**- Using a semi structured checklist we interviewed and discussed with key informants who includes health professionals which attended medical care of cases, Woreda health officials and families or care givers of cases.

**Document review**- We reviewed the outpatient medical logbooks and medical record of cases at Raso 03 health posts. We also reviewed the laboratory findings of the first five cases at the national reference laboratory at Ethiopian public health institute (EPHI).

**Operational definition**

**A suspected measles case**: Anyone who has a generalized maculopapular rash, fever, and one of the following symptoms: Cough, coryza, or conjunctivitis.

**A laboratory confirmed case:** is a possible case with laboratory findings indicating infection (IGM positive or isolated for a measles virus).

**Malnourished**: Children with a MUAC measurement of less than 11.5 cm were classified as having severe malnutrition, while those with a measurement between 11.5 and 12.5 cm were classified as having moderate malnutrition. Furthermore, those with oedema but no MUAC measurement are considered malnourished.

**Death from measles:** is the death of a person with confirmed (clinically, laboratory, or epidemiologically) measles who died within 30 days of rash onset and was not caused by other unrelated causes.

**Data Processing and Analyzing**

Data was entered into EPI info 7 and analyzed using SPSS 26 and Microsoft Excel. Figures and tables were used to present the epi-curve, magnitude, and frequency of a disease.

Measles attack rate and case fatality ratio were calculated from total cases and deaths. Bivariate and multivariate logistic regression were used as statistical tests, with the significance level determined by adjusted odds ratios (AORs) with their corresponding 95% confidence intervals (CIs) to assess the strength of associations between the outcome and predictor variables at P-value 0.05.

**Ethical Consideration**

Ethiopian Public Health Institute (EPHI) requested technical and logistical assistance for the Somali region. Then EPHI issued the directive and approval to investigate and respond to this outbreak. Before the field investigation, EPHI wrote a formal letter to the Somali region, and the region also wrote a letter to the Raso Woreda health office to obtain permission and facilitate the investigation process. Participants or mothers/caregivers of cases provided verbal informed consent to participate in the study, and any information related to personal identification was not used in the report. Cases were also referred to nearby health facilities for medical treatment.

**Dissemination Plan**

This study report was submitted to the Ethiopian Public Health Institute, Addis Ababa University's School of Public Health, the Ethiopian Field Epidemiology Program, the Somali region, the Afder zone, and the Raso woreda. The report's manuscript would be published in peer-reviewed journals to reach the scientific community.

## Results

### Laboratory Investigation

Five blood samples were collected to determine the etiologic agent and confirm the outbreak. As a result, all (five) of their samples tested positive for measles IgM using the conventional polymerase chain reaction (PCR) at the Ethiopian Public Health Institute's national reference laboratory (EPHI). The remaining cases were linked to confirmed measles cases via epidemiology.

### Descriptive Epidemiology

### Description of cases by person

Raso district reported 85 measles cases and two deaths between March 23, 2022 and April 25, 2022. The disease's overall attack rate was 177 per 100,000 people, and the CFR was 2.3%. 54 (63.5%) of total measles cases were unvaccinated, and only 31 (36.4%) had a history of measles vaccination. Only 20 of the vaccinated cases received two doses of vaccination. Two deaths were reported. Both deaths were admitted to a hospital. The cases range in age from 11 months to 38 years. Females made up 47% of the cases, while males made up 53%.

The disease had a greater impact on children under the age of five. 40 (47%) of the total case All reported deaths occurred in children under the age of five. All patients who died as a result of measles were not immunized.

*Table 8: Measles common signs and symptoms, Raso woreda in Afder zone, Somali region, Ethiopia, 2022. N = 58 enrolled cases*

| Sign and symptoms | frequency | Percentage |
|---|---|---|
| Fever | 58 | 100% |
| Rash | 58 | 100% |
| Cough | 46 | 79% |
| Vomiting | 15 | 25.80% |
| Conjunctivitis | 58 | 100% |
| Diarrhoea | 29 | 50% |
| Runny nose | 46 | 79% |

*Table 9: Measles common Complications, Raso woreda in Afder zone, Somali region, Ethiopia, 2022. N = 58 enrolled cases*

| Complications | yes | No | Percentage |
|---|---|---|---|
| Pneumonia | 16 | 42 | 9.20% |
| Ear discharge | 5 | 53 | 2.90% |
| Corneal ulcer | 6 | 52 | 3.40% |
| Diarrhea | 14 | 44 | 8% |
| Blindness | 0 | 58 | 0.00% |
| Convulsion | 0 | 58 | 0.00% |

*Table 10: Attack rates of measles (per 1000) during an outbreak in Raso District, Somali, April 2022*

| **Characteristics** | **Frequency** | **Population** | **AR/1000** |
|---|---|---|---|
| Age Group | | | |
| ≤5 | 50 | 7870 | 6.35 |
| >5 | 8 | 40030 | 0.25 |
| Case reported kebeles | | | |
| Raso 01 | 28 | 4615 | 6.15 |
| Raso 02 | 12 | 4100 | 2.92 |
| Raso 03 | 22 | 4010 | 5.48 |
| H/Kodwana | 19 | 3910 | 4.85 |
| Humbowayne | 4 | 4200 | 0.95 |
| Sex | | | |
| Male | 44 | 23950 | 1.83 |
| Female | 41 | 24429 | 1.67 |

**Description of cases by place**

The epidemic in Raso district affected five kebeles. Nearly 32.9% of cases originated in the district's Raso 01 town, which is home to Internally Displaced Populations as a result of the drought and exhibits malnutrition. From those afflicted kebeles, Raso 0 kebele reported the highest attack rate at 6.15 per 1,000 persons, followed by H/Kodwana at 5.48 per 1,000 populations and 4.85 per 1,000 populations. Humbowayne Keble had the lowest attack rate (1 per 1000 populations). Five urban kebeles out of the 20 in the Raso district were affected by the measles case.

*Table 11: Case fatality rate of measles per kebeles during an outbreak in Raso District, Somali, April 2022*

| Name of kebeles | Number of cases | Population | AR/1000 | CFR% |
|---|---|---|---|---|
| Raso 01 | 28 | 4615 | 6.1 | 3.51 |
| Raso 02 | 12 | 4100 | 2.92 | 0 |
| Raso 03 | 22 | 4010 | 5.48 | 0 |
| H/Kodwana | 19 | 3910 | 4.85 | 5.26 |
| Humbowayne | 4 | 4200 | 0.95 | 0 |

**Description of cases by time**

The 33-day outbreak began during the 4th WHO epidemiologic week of 2022 and terminated during the eighth week of that year. The 3-year-old male child from Raso town in the district who served as the outbreak's index case was examined at the medical facility on March 27, 20202, and the rash first appeared on March 25, 2022. Between March 27, 2022, and April 30, 2022, a total of 85 measles cases and 2 fatalities were reported. The number of instances peaked in the 5th WHO Epidemiologic Week of 2022, and they then began to fall that same months

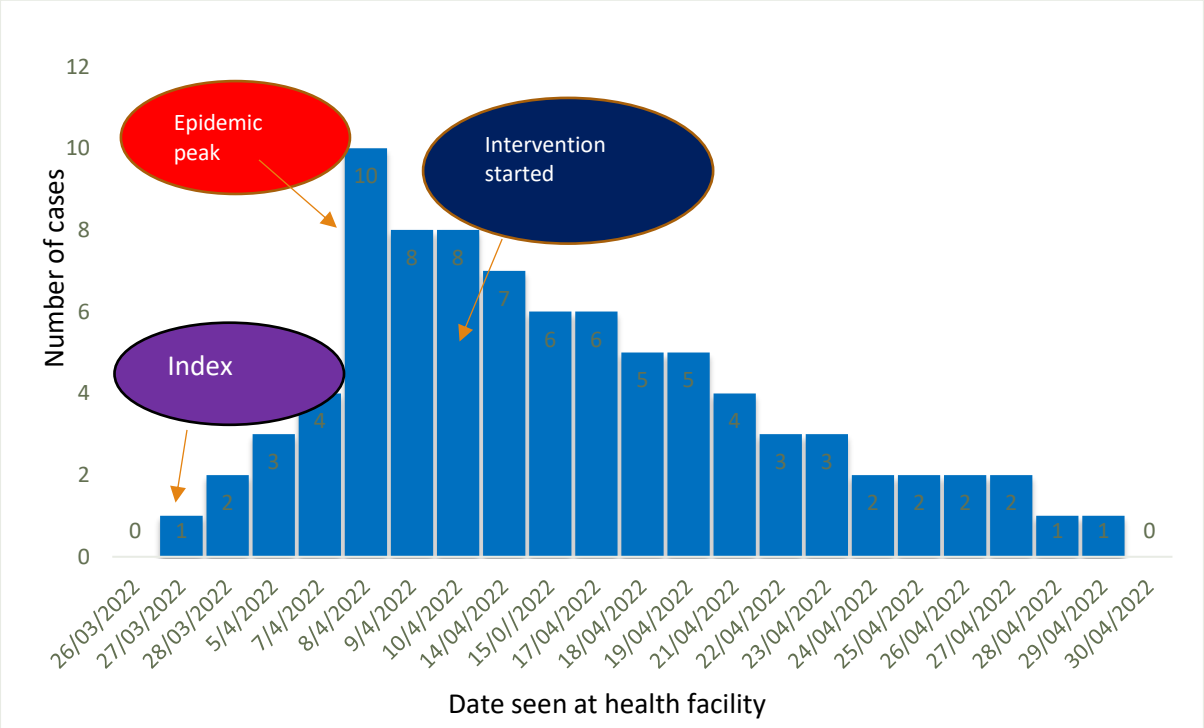


*Figure 6: Number of measles cases by date seen at Health facility Raso District, Afder zone of Somalia Region, Ethiopia, 2022*

**Management of the cold chain, vaccination coverage, and a pool of susceptible people**

There are 20 health posts and three health centres in the woreda. These functional health posts lack a functional refrigerator for a variety of reasons, including a lack of fuel, a lack of spare parts for the fridge, and a lack of technical skill. Every health centre has a functional refrigerator. As a result, the majority of kebele send vaccinations from the three-health centers in their catchment area in order to carry out regular EPI and supplemental immunization activities.

**Risk factors identified for measles outbreak (case control study)**

The study included 58 cases and 116 neighborhood controls in Raso district, Afder zone of Somali regional state, to identify risk factors for measles infection. Of the total participants, 98 (56%) are males of cases and 76 (44%) are females.

On bivariate analysis, the variables that were statistically significant were, being vaccinated as a protective factor; COR 0.25 (95%CI: 0.102-1.40, p value:0.001), family size above five; COR 0.14(95%CI :0.09-1.05, p value: 0.006), being malnourished COR 0.88(95%CI (0.048-1.85), p value: 0.001, knowing mode of transmission of measles; COR 0.220(95%CI: 0.108-0.446), p value:0.002, having contact history with measles case; COR = 6.58(1.76-11.305), P value 0.006.

*Table 12: Bivariate analysis for different measles exposures, 2022 Raso Woreda, Somali Region, Ethiopia.*

| **Variables** | **Category** | **cases** | **Controls** | **Total** | **OR (95%CI)** | P value |
|---|---|---|---|---|---|---|
| Sex | Male | 32 | 66 | 98 | 1.23(0.569-2.023) | 0.829 |
| | Female | 26 | 50 | 76 | | |
| Age | ≤5 | 47 | 65 | 122 | 3.45(1.92-7.485) | 0.001 |
| | >5 | 11 | 51 | 62 | | |
| Educational status of family | Literate | 14 | 44 | 58 | 0.52(0.256-1.06) | 0.071 |
| | No formal education | 44 | 72 | 116 | | |
| Vaccination status | Vaccinated | 18 | 80 | 98 | 0.25(0.102-1.40) | 0.001 |
| | Unvaccinated | 40 | 36 | 76 | | |
| Family size | <5 | 22 | 96 | 118 | 0.14(0.09-1.05) | 0.006 |
| | >=5 | 36 | 20 | 56 | | |
| Contact History | Yes | 38 | 26 | 64 | 6.58(1.76-11.305) | 0.006 |
| | | | | | | |
| | No | 20 | 90 | 110 | | |
| Nutritional status | Normal | 18 | 97 | 115 | | 0.001 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Malnourished | 40 | 19 | 59 | 0.08(0.048-0.185) | |
| Housing condition | Ventilated | 22 | 58 | 80 | 0.63(0.26-3.113) | 0.133 |
| | Nonventilated | 36 | 58 | 94 | | |
| knowing mode of transmission of measles | Yes | 14 | 68 | 82 | 0.22(0.108-0.446) | 0.002 |
| | No | 44 | 48 | 92 | | |
| Travel history to o measles affected area 7-18 days prior to onset of rash | Yes | 33 | 67 | 100 | 0.52(0.38-1.92) | 0.864 |
| | No | 25 | 48 | 132 | | |

I investigated whether associations between possible risk factors for the measles were caused by confounding factors, effect modification, or actual associations for exposures that were significant on the basis of bivariate analysis. Variables with a p-value of less than or equal to 0.25 in bivariate analysis were chosen for multivariate analysis to determine the importance of the variable.

There were five factors that were significantly linked to measles infection. Statistically significant variables on multi-variate analysis were; family size above five increase the odds of contracting measles (AOR: 1.32, 95% CI: 0.03-3.56; P: 0.004), times more likely compared to those who have family size less than five. Being unvaccinated increases the likelihood of contracting measles (AOR:1.039, 95%CI: 1.026-1.256; P: 0.001), times more likely, compared to those who had vaccination history. Being malnourished increases the likelihood of contracting measles (AOR: 1.156, 95% CI: 1.085-3.210; P:0.001) times more likely to be infected with measles compared to the normal ones. Having contact history with measles case raise the likelihood of getting the measles (AOR: 3.22, 95% CI: 1.05-11.17; P:0.001) times more likely compared to others who do not have contact history with a measles case.

*Table 13: Multivariable analysis of factors associated with measles outbreak in Raso woreda, Afder Zone, Somalia region, Ethiopia, 2022*

| **Variables** | **Category** | **cases** | **Controls** | **Total** | **AOR (95%CI)** | P value |
|---|---|---|---|---|---|---|
| Age | ≤5 | 47 | 65 | 122 | 22.8(1.69-309.2) | **0.018*** |
| | >5 | 11 | 51 | 62 | | |
| Vaccination status | Vaccinated | 18 | 80 | 98 | 0.39(0.026-1.256) | **0.001*** |
| | Unvaccinated | 40 | 36 | 76 | | |
| Contact History | Yes | 38 | 26 | 64 | 3.22(1.05-11.17) | **0.001*** |
| | No | 20 | 90 | 110 | | |
| Nutritional status | Normal | 18 | 97 | 115 | | **0.000*** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Malnourished | 40 | 19 | 59 | 1.156(1.085-3.210) | |
| Family Size | <5 | 22 | 96 | 118 | 1.32(0.03-3.56) | **0.004*** |
| | ≥5 | 36 | 20 | 56 | | |
| knowing mode of transmission of measles | Yes | 14 | 68 | 82 | 0.220(0.108-0.446) | 0.68 |
| | No | 44 | 48 | 92 | | |

**Measures undertaken to stop the outbreak**

Searches for active instances of the disease were conducted in every affected kebele of the woreda in order to manage difficult measles patients with drugs and treat active cases. Community mobilization and awareness-raising for measles prevention and control techniques were carried out. Community members received health education to encourage health-seeking behavior, stop the disease's spread, and treat patients who have measles symptoms and signs. Mostly in kebeles where measles infection was seriously common did malnutrition screening and treatment. The Woreda Health Office and Health Center's staff members got instruction on the detection and management of measles cases. increasing awareness among local citizens, health educators, and community leaders to improve the surveillance system. During a nine-day Mass Campaign that took place from February 10, 2022, to February 18, 2014, every kebele in the woreda took part. The woreda health office collaborates with interested parties and NGOs (Save Children, WHO, and PHC project) to carry out measles interventions from the beginning of an outbreak until a significant campaign is launched and the outbreak is brought under control.

## Discussions

On March 23, 2022, a measles outbreak was announced in Raso district of Somali Region. In 28 days, a total of 85 cases—including two (2.3%) fatalities—were reported. Five samples were sent, and all five tested measles IgM positive at Ethiopian Public Health Institution National Laboratory. 53% of the instances included men, while 47% involved females. The results of the descriptive analysis show that the measles outbreak had an effect on individuals from 11 months to 38 years of age, a wider age range. Attack rates were highest in children under five, 6.35 per 1000, and in adults over five, 0.25 per 1000. This Age specific attack rate investigation's findings are consistent with those of inquiries carried out in Sudan, India, and Nepal, which is high in under five years.(14)(15) Over all Attack rate was 177/100,000 which was found to have a higher attack rate than the measles outbreak investigation's Kabridehar district of Somali Region.(16) Measles symptoms, including fever, a maculopapular rash, and cough, appeared in 100% of cases. The district's vaccination rate was just 74.4%, which is extremely low.

Measles complications are primarily the cause for measles deaths. The risk of death is highest for infants and young children, particularly those who are undernourished. Case fatality rate was 2.3% which is less than the expected case fatality rate in Ethiopia (3%-6%). The aria is one of the high-risk areas for less than one (< 1), due to less vaccination coverage and malnutrition. Both deaths recorded were in under 1 years old and both were severe malnourished. Infant case fatality rates of up to 30% in high-risk populations have been documented in under the age of one year. The high case-fatality rates seen in many parts of the world are caused by malnutrition (particularly vitamin A deficiency), underlying immunodeficiencies, and a lack of access to healthcare. Within the first month following the development of the rash, complications may result in death if not treated promptly and aggressively. In impoverished nations, the case fatality rate for measles is believed to be between 3 and 6 percent, but during outbreaks, it may exceed 10 percent, particularly when malnutrition is present. (17) (18)(19)

Case fatality rate of this study which was 2.3% is greater than those of comparable studies carried out in Kebridehar town, Jarar zone, Abaya woreda of Borena Zone, Guji1 zone, and study conducted in Sudan which found CFR of 1.8%, 1.2%, 0.4%, 0.2%, and 0.9%, respectively (12)(20)(21)(22). This high CFR may be the result of late diagnosis and reporting, inadequate interventions covering all affected kebeles, security issues, a lack of logistics and supplies, and a lack of health services within the prescribed distance range.

Five kebeles in this epidemic were affected by the measles outbreak. A case search and contact tracing were actively pursued. This assists in locating the infection's origin and determining whether or not other locations have been exposed. The index case, a 3-year-old unvaccinated male, was seen in Raso 01 on March 27, 2022. Vaccination coverage of 2021 in the district was 77%, which is low compared to WHO standards, a routine immunization program that includes two doses of the measles vaccine and is complemented by additional immunization activities can achieve and maintain 95% vaccination coverage.(23) Outbreaks of measles that might be prevented by vaccination commonly occur in these districts due to the coverage, which is less than 95%.

Regarding MCV vaccination, out of 58 recorded cases, 40 (68.5%) were unvaccinated, which was higher than the result of an inquiry conducted in Kerala, where 48% of patients are unvaccinated (24). Research done in Nepal, however, reveals that 64% of cases were protected with a measles-containing vaccine.(14) It is essential to enhance routine immunization, SIAs, and monitoring of the accumulation of susceptible people in order to protect both target and non-target age groups. Observation and record review findings at the district indicate inadequate vaccine storage, poor access to electricity, inadequate cold chain maintenance at the district and health center, high environmental temperature, and absence of conveyance to kebeles. When vaccines are not kept in the correct compartment or are kept at temperatures above 2 to 8 degrees Celsius or below 15 degrees Celsius, their efficacy can be reduced.(23)

When compared to people who have not had contact with a confirmed measles case, having a history of contact with one raises the risk of getting the disease by 1.1 times. The results of this inquiry confirm those of earlier ones carried out in Artuma Fursi, Oromia, Ethiopia.(14) Contact with any infected individual enhances the spread of measles transmission and infection since the measles virus is very infectious. This is because the secondary attack rate of measles is greater than 90% when susceptible persons are present, and that measles is spread by respiratory droplets or by direct or indirect contact with nose and throat secretions of infected individuals. (17)(19)(25) According to a study conducted in Zimbabwe, the chance of catching the disease increased by 41 times if a person had previous contact with a measles case.(26) For the transmission of measles cases, there was a greater correlation between the number of family members in the home exceeding four and the disease. Moreover, ventilation in the home is highly linked to the spread of the measles virus. Families with more than five members of the household reported getting the measles more frequently than families with fewer than five members. This can signify a higher likelihood of contracting the disease, a more severe case,

or both.(27) As a result, someone who lives in an unventilated home has a higher risk of contracting the measles than someone who lives in a ventilated home.

It was discovered that being under the age of five was a separate risk factor for contracting the measles. Compared to children older than five years, children under five were 99% more likely to contract the measles. According to our findings, under-five children are the most impacted age group in Ethiopia, according to an examination of measles case surveillance data from 2006 to 2016.(28) This may be because measles-specific T-cell responses persisted at ages 5 to 10 independent of age at the time of the initial vaccine.(25)

Children who are already underweight are more severely affected by the measles illness. Being malnourished increase the odd of contracting measles by 1.2 times, compared to those who are normal. The measles outbreak in the Gurdhamole district of the Bale zone of Oromia regional state of Ethiopia revealed that malnutrition raises the chance of catching the virus by 4.34 times.(29) Furthermore, measles may make malnutrition worse due to decreased food intake brought on by malaise, higher metabolic needs brought on by fever, or incorrect beliefs held by parents and medical professionals that a kid should not be given food when suffering from an acute illness. After measles outbreaks, inadequate nutrition may cause or worsen vitamin A deficiency and keratitis, leading to a high incidence of childhood blindness.(30) My findings demonstrated a clear correlation between underweight children and measles cases. According to a study done in India, there is a link between measles and malnutrition, being undernourished, including having vitamin A deficiency, increases the risk of getting measles and dying from it.(10) Children that are undernourished are more susceptible to measles, so whenever outbreaks arise, effective public health prevention measures must be done to stop the disease's spread.

We found that knowledge about measles transmission among caregivers helps to prevent infection. If a person's mother or other primary caregiver knew how the disease spread, they were 86.6 percent less likely to get the measles. Research conducted in the Arbegona district in southern Ethiopia and the In Lay Armachiho district in northwest Ethiopia supports our conclusion, finding that some households with limited knowledge exhibit poor health seeking behaviour for measles cases and believe modern medicine worsens the illnesses.(31)(32)

## Study Limitations

When collecting data on characteristics like immunization status, vaccination dose received, and others recall bias may occur since its common in case control study.

We utilized asymptomatic controls in the case-control trial and did not screen them for measles IgM antibodies, which could have resulted in a bias in the classification of controls. Nonetheless, using the aforementioned case definition as a guide, control individuals were carefully chosen.

## Conclusion

Children under the age of five showed the highest attack rate. 2.3% of epidemic cases die, which is a fairly high percentage. In 2017–2020, the district's pooled MCV1 coverage was only 74%, well below the required 95% for the development of herd immunity. Being unvaccinated, malnutrition, contact with measles cases, age (younger than five), low community awareness on measles transmissions, and having more than five family members discovered to be the independent predictors of measles outbreaks. This indicates how reasonably effective the case management was. Unfortunately, the community mobilization efforts made and the essential massages given to the community to control and avoid the spread were ineffective. The storage of vaccines, transfer to healthcare facilities, and cold chain indicated were not carried out.

## Recommendations

- It is necessary to strengthen cold chain management at the district's vaccination sites and storage facilities in order to address the causes contributing to low vaccine effectiveness
- In order to manage vaccines when people move between districts, the district health office must identify pastoralists who should register all eligible children with their local appointment exchanges and cooperate with neighboring districts.
- Social media campaigns should be launched to educate parents and local authorities about the significance of getting vaccinated against the measles as soon as possible before the age of one.
- The woreda's active surveillance efforts need to be strengthened in order to increase active case search.
- Health professionals should encourage mothers' counselling and health education on the measles vaccine, vaccine-preventable diseases, and the schedule of vaccinations for their children on a timely basis
- The district's vaccination rate was extremely low, indicating the need for additional research to pinpoint the potential determinants—such as lack of vaccination knowledge and exposure to diseases that can be prevented by vaccination—that prevent the district's eligible children from receiving their recommended vaccinations.

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# Chapter Two - Surveillance Data analysis

## National Malaria Surveillance Data Analysis, Ethiopia, 2016-2020 GC

**Abstract**

**Background:** Malaria remains an important cause of morbidity and mortality in children and adults in countries where it is epidemic. In 2015, an estimated 212 million cases and 429 000 deaths of malaria were reported worldwide, of which 90% were in the WHO Africa region. Ethiopia is one of the malaria-endemic counties where 75% of the landmass is considered malaria risk. The Ethiopian government has been investing in preventing and controlling malaria with multiple and intensive interventions. Approximately 52 million people (68%) live in malaria risk areas in Ethiopia. This study aimed to describe the distribution of malaria by person, place, and time; to assess clinical malaria and slide positivity rate in Ethiopia.

**Methods**: A retrospective surveillance data analysis was performed on malaria surveillance data from 2016-2020. The malaria incidence rate was calculated by dividing the number of annual malaria cases (confirmed and clinical) by the corresponding population each year at different levels and multiplying by 1,000. The case fatality rate was calculated by dividing the number of deaths associated with malaria by the total malaria cases (Confirmed and Clinical). ArcGIS version 10.1 was used to show the distribution of malaria cases by district and zonal levels.

**Results:** Nationally, during the last five years, about 7 million malaria cases 6742606(95.9%) laboratory-confirmed and 285474(4.06%) clinical malaria cases and 527 deaths were reported. Among the total cases, PF contributes 5027284 (74.55%), followed by PV =1715322 (25.4%). The highest report was in 2016, 1740148(24.7%) of the last five years. In most cases, 6984363(99.4%) were treated as an outpatient. 74% P. Falciparum and 26% P. Vivax were observed. Every year malaria trends increasing in September and reached a peak in October and November.

**Conclusion:** Malaria infection and incidence have been fluctuating for the last five years. The significant decrement of malaria incidence rate in the country might be attributed to the strong malaria prevention and control intervention investment and during week prevention strategy increments of malaria cases in recent years. The incidence rate mainly decreased in low malaria transmission districts. As surveillance is one of the key interventions in malaria control and prevention and elimination strategies, useful indicators like age and sex need to be included in the surveillance system.

# Introduction

## Background

Malaria is a serious public health problem that has an impact on every country in the globe and is a significant cause of morbidity and mortality. Plasmodium parasites are the cause. Plasmodium falciparum and Plasmodium vivax pose the most pervasive and serious threat to the general public's health. After two decades of steady declines, malaria has recently started to climb once more. There were 435,000 fatalities and 219 million recorded cases of malaria worldwide in 2017. 2 million more cases were reported compared to the 2016 data, however fewer deaths occurred. In 17 countries, the most of which are in Africa, malaria-related deaths accounted for about 80% of all deaths; of these, 53% occurred in 7 additional African countries plus India. The World Health Organization (WHO) reports that 200 million, or 92 percent, of all malaria cases worldwide occurred in Africa in 2017. Sub-Saharan Africa was the area most severely affected, with a higher percentage of malaria cases and fatalities. (1)

Around 75% of Ethiopia's landmass has malaria, which is endemic and largely connected with altitude and rainfall. The primary monsoon season (July to September) is typically when malaria incidence peaks each year. However, many regions in the south and west of the nation either lack a distinct rainfall season or have one that starts earlier in April and May. Transmission has a tendency to be very geospatially variable both within each year and across years depending on these rainfall patterns. Additionally, large outbreaks of malaria occur in Ethiopia every 5-8 years, with the most recent one occurring between 2003 and 2005. Malaria was the leading factor in outpatient visits, hospital admissions, and inpatient fatalities in 2007/2008 (2). Malaria transmission is primarily seasonal, with highland edge areas experiencing unstable transmission and lowland areas, river basins, and valleys experiencing somewhat longer durations of transmission. In the past, there have typically been 10 million clinical cases of malaria per year. Cases have, however, significantly decreased since 2006. (3)

The incidence rate of malaria declined globally between 2010 and 2018, from 71 to 57 cases per 1000 population at risk. However, from 2014 to 2018, the rate of change slowed dramatically, reducing to 57 in 2014 and remaining at similar levels through to 2018. Most malaria cases in 2018 were in the World Health Organization (WHO) African Region (213 million or 93%), followed by the South-East Asia Region with 3.4% of the cases and the Eastern Mediterranean Region with 2.1%. (7)

Malaria morbidity and mortality have significantly decreased during the past ten years in Ethiopia and throughout the world. In Ethiopia, the fight against malaria has long been continuing, and since 1959, there has been a notable decline in the spread of this contagious disease. But malaria is still a serious public health problem in Ethiopia. (4). Since the 1990s, Ethiopia has used a one-page form for Integrated Disease Surveillance (IDSR) reporting from all hospitals and health centres. The majority of diseases were reported on a weekly basis, but certain high-priority signs had to be informed right away. The initial phase did not technically include health centers and health posts. While IDSR data are available on paper at the district level, they were also electronically accessible at the zone and Regional Health Bureau levels in an Epi Info database entered in Addis Ababa. This database was formerly housed under the Disease Prevention and Control Department, but is now located at the Public Health Emergency Management (PHEM) center at the Ethiopian Health Institute. (3). Ethiopia implemented Integrated Disease Surveillance (IDSR) reporting from all hospitals and health centers using a one-page form. (5). On Monday till noon, health posts and facilities submit their weekly surveillance data report to the woreda health office. The zonal health office receives weekly surveillance data from woreda health offices on Tuesdays by noon. The regional health office should receive the zonal health offices' weekly surveillance data report by Wednesday at noon. The EPHI PHEM center should receive the regions' weekly surveillance data on Thursday around noon (3). The IDSR data collection has a all of information for categorizing malaria risk locations in Ethiopia by Zones using reported data as opposed to predictions based on various factors. (5)

In Ethiopia, where an estimated 52 million people (68%) live in malarious environments, primarily at altitudes below 2,000 meters, and where 75% of the country's landmass is considered to be malarious, it is a major public health concern. Despite being treatable and avoidable, it nonetheless claims the lives of some 881,000 individuals annually. 90% of them are in Africa, and 85% of them are young children. More than 50 years ago, the majority of western nations eradicated malaria; today, only five African nations—Nigeria, the Democratic Republic of the Congo, Ethiopia, the United Republic of Tanzania, and Kenya—account for more than half of the world's estimated malaria cases. Rural and underprivileged groups are primarily affected by malaria and have limited or no access to modern preventative and treatment methods. Due to the severe impact on rural communities, it is estimated that malaria costs Africa more than $12 billion in lost GDP annually.(6)

In 2018, an estimated 228 million cases of malaria occurred worldwide (95% confidence interval [CI]: 206–258 million), compared with 251 million cases in 2010 (95% CI: 231–278 million) and 231 million cases in 2017 (95% CI: 211–259 million). In 2018, there were an estimated 405,000 deaths from malaria globally, compared with 416,000 estimated deaths in 2017 and 585,000 in 2010. Children aged less than five years were the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272,000) of all malaria deaths worldwide. (7)

According to estimates, malaria affects 250 million people annually and was the most common parasite disease worldwide in 2011. The tropics, sub-Saharan Africa, South East Asia, the Pacific islands, India, Central America, and South America are all regions where the disease is prevalent. Plasmodium falciparum malaria predominates in Africa, where it is responsible for 90% of the world's malaria burden and has a fatality rate of close to 1 million per year. Most of these fatalities are among youngsters under the age of five. As a result, 3000 children per day in Africa tragically die from malaria, or one child every 30 seconds. Many children who survive a severe malaria episode experience brain damage and cognitive impairment, which makes it difficult for these families to cope with the disease's devastating effects. (7)

## Significance of the study

For determining which regions or population groups are most affected by malaria and directing resources to the populations that need them the most, effective surveillance and analysis of malaria cases and deaths are crucial. Additionally, this type of surveillance notifies health ministries of epidemics, allowing for the necessary escalation of control actions. The third pillar of the GTS is the transition of surveillance into a primary intervention, and the WHO has released guidelines for setting up efficient surveillance systems (8).

Due to a number of factors, surveillance systems do not always identify cases of malaria. First of all, not all malaria patients seek care, or if they do, it's possible that they do not seek care at medical facilities that are part of a country's surveillance system. Second, not all patients who seek medical attention undergo a diagnostic test. The surveillance system's recording and reporting are also not always complete (9)**.** To allocate public health resources and employees in the most suitable and effective manner, this information is required. Additionally, this ongoing data collection and analysis is particularly beneficial for determining the incidence and prevalence of malaria cases (both outpatient and inpatient), as well as malaria-related deaths across time, place and affected populations over the course of five years. (10)

# Literature review

## Malaria situation in Ethiopia

### Malaria transmission cycle: vector, parasite and human host interactions, and seasonality (weather, geography, and climate)

The primary malaria vector in Ethiopia is Anopheles Arabiensis, a member of the An. gambiae complex, with An. funestus, An. pharoensis, and An. nili as secondary vectors. Anopheles Arabiensis is the predominant vector with An. Pharoensis, An. coustani, An. funestus, and An. Nili having a minor role in transmission. An. Pharoensis is widely distributed in Ethiopia and has shown high levels of insecticide resistance, but its role in malaria transmission is unclear. An. Nili can be an important vector for malaria, particularly in Gambella Regional State. Malaria transmission in Ethiopia occurs mainly at altitudes < 2000 m, although endemic regions > 2000 m have been reported (11)**,** (12). However, malaria risk and transmission intensity levels marked seasonal, inter-annual, and spatial variability, except southwestern international border low land area where transmission is year-around (13)**,** (14). In most countries, the major transmission season is from September to December, following the main rainy season from June to September (15). There is a short transmission season from April to May following the short rainy season in some regions (15).

The interaction of mountainous terrain with variable winds, seasonal rains, and ambient temperatures creates diverse micro-climates. Ethiopian weather is also influenced by tropical Indian Ocean conditions and global weather patterns, including El Niño and La Niña. When a micro-climate creates local puddles, flooding conditions and warm ambient temperatures persist for several weeks within a malarious area with low population immunity. (6). Generally, the diverse ecology of the country supports a wide range of transmission intensities ranging from low-seasonal to high-perennial transmission. For planning purposes and targeting of intervention strategies, the Federal Ministry of Health (FMoH) of Ethiopia has stratified the country's malaria transmission burden using 'woreda'(district)-level transmission intensity according to annual parasite incidence per 1000 population (API) and elevation (16) (17). Accordingly, the FMoH and World Health Organization (WHO) malaria-free, low, moderate, and high transmission (16).

Many areas of the nation have an endemic case of Plasmodium falciparum. The majority of confirmed cases of malaria are caused by P. ovale and P. malarie infection, which are rare and

makes up less than 1% of cases. (16), (18). Chloroquine (CQ) is currently the recommended first-line drug to treat Vivax malaria (18). The CQ is generally effective, according to in-vivo monitoring of patients of uncomplicated Vivax malaria, but treatment failures have been documented. (19), (20). An. Arabiensis has a variety of host-seeking behaviours, with the human blood index measured in various locations varying from 7.7% to 100%. In Tana in the North and the Rift Valley region, An. Funestus, a mosquito that likes to feed only on people, is present in the swamps of the Baro and Awash rivers and on the beaches of lakes. Although An. Pharoensis is widely dispersed throughout Ethiopia and has significant levels of pesticide resistance, its contribution to the spread of malaria is unknown. An. Nili may be a significant malaria vector, especially in Gambella Regional State. Recent reports—both published and unpublished—indicate an increase in the prevalence of malaria among migrant daily labourers in a number of regions of the nation, but most significantly in the northwest development corridors of the nation bordering Sudan and South Sudan. Low host immunity and a considerable chance of developing clinical malaria disease after malaria are two consequences of the "low" and "unstable" malaria transmission pattern that risks many Ethiopians. (6)

In 2005, a nationwide survey estimated that 6.5% of households in Ethiopia owned an insecticide-treated net (ITN), 17% of households had been sprayed with insecticide, and 4% of children under five years of age with fever were taking an anti-malarial drug. Similar to other sub-Saharan African countries scaling-up malaria interventions, the Government of Ethiopia set an ambitious national goal in 2005 to (i) provide 100% ITN coverage in malarious areas, with a mean of two ITNs per household; (ii) to scale up indoor residual spraying of households with insecticide (IRS) to cover 30% of households targeted for IRS; and (iii) scale-up the provision of case management with rapid diagnostic tests (RDTs) and artemisinin-based combination therapy (ACT), particularly at the peripheral level. (21)

**The annual parasite incidence (API) and prevalence of parasite**

The data presented pertains to homes in malarious environments, which are those that are less than 2,000 meters above sea level, according to the Ethiopian Federal Ministry of Health. Of the 5,083 houses investigated 3,282 (65.6%) had at least one ITN. In ITN-owning households, 53.2% of all persons had slept under an ITN the previous night, including 1,564/2,496 (60.1%) children <5 years of age, 1,891/3,009 (60.9%) of women 15 - 49 years of age, and 166/266 (65.7%) of pregnant women. Overall, 906 (20.0%) households reported having had IRS in the past 12 months. Of 747 children with reported fever in the two weeks preceding the survey,

131 (16.3%) sought medical attention within 24 hours. Of those with fever, 86 (11.9%) took an anti-malarial drug, and 41 (4.7%) took it within 24 hours of fever onset. Among 7,167 surveyed individuals of all ages, parasitemia, as estimated by microscopy, was 1.0% (95% CI 0.5 - 1.5), with 0.7% and 0.3% due to Plasmodium falciparum and Plasmodium Vivax, respectively. Moderate-severe anemia (hemoglobin <8 g/dl) was observed in 239/3,366 (6.6%, 95% CI 4.9-8.3) children <5 years of age**.** (2)**.**

Malaria indicated survey done in 2011 shows that around 1.3% and 4.5% were positive for malaria using microscopy and RDTs respectively below 2,000 meters and above 2000 meters the prevalence was only 0.1%. About 77% of infections detected below 2,000 meters elevation were due to plasmodium falciparum. The 2011 MIS indicated a clear demarcation of malaria risk at an altitude of 2,000 meters, with a 13-fold higher malaria prevalence at lower altitudes relative to higher elevations. Plasmodium Falciparum was not detected by microscopy among persons surveyed within households measuring elevations above 2,000 meters in the 2011 MIS. In 2014, the FMOH updated the country's malaria risk strata based upon malaria API, calculated from recent routine surveillance data from more than 800 districts. Malaria transmission risk by API classified as High (>100 cases/1,000 population), Medium (5-99.9), Low (0.1-4.9), and Malaria-Free (~0). Areas with the highest malaria transmission risk as stratified by district API appear to be largely in the lowlands and midlands of the western border with South Sudan and Sudan, with additional high transmission areas in or near the Rift Valley, which extends from the southwest of the country to the northeast. Many densely populated highland areas were newly classified as malaria-free (API=0), including the capital city of Addis Ababa. Ethiopia is also one of the most malaria epidemic-prone countries in Africa. Rates of morbidity and mortality increase dramatically (i.e., 3-5-fold) during epidemics. Since 2005, Ethiopia has scaled up one of the largest and most ambitious malaria control programs in Africa, designed to support the country's Health Sector Development Plan (HSDP), the NSP, and the national child survival strategy, to reduce under-five mortality rates by two thirds by 2015 (6)**,** (3)**.**

## Objectives

### General objective

- To describe the distribution of malaria morbidity and mortality by place, person, and time and assess clinical malaria and slide positivity rate in Ethiopia from 2016 to 2020.

### Specific objectives

- To describe patterns of malaria by time, person, and place in Ethiopia from 2016 to 2020
- To determine the trends in case and death that requires additional intervention.
- To assess clinical malaria and malaria positivity rate in Ethiopia from 2016 to 2020

## Methods and Materials

### Study population

All Ethiopian population residing in the malaria endemic area is included in the study since malaria affects both sexes and all age groups more people living or traveling to endemic locations.

### Databases used

National weekly surveillance data database from Ethiopian public health Institute Public health emergency management center was used

### Sources of information

Both clinical and laboratory sources of information for weekly surveillance data are health facilities and health posts.

### Study Area

Ethiopia is one of the largest countries in Africa with Approximately 114,963,588 population and covering 1,104,300 square kilometers (with 1 million square km land area and 104,300 square km water. The country's topography shows various contrasts ranging from high peaks of 4,550m above sea level to a low depression of 110m below sea level. The climate varies with the topography, from as high as 47 0c in the Afar Depression to as low as 10 $^{0}$C in the highlands. There are topographic-induced climatic variations broadly categorized into three: the "Kolla," or hot lowlands, below approximately 1,500 meters, the "Wayna Degas" at 1,500-2,400 meters, and the "Dega" or cool temperate highlands above 2,400 meters. Its geographical coordinates are between 8 00 N and 38 00 E. (22) According to the EPHIs database, and there are 113 Zones/ Special woredas including Towns, 914 woredas including current Addis Ababa woredas, 223 Hospitals, 3,593 Health centers, 16,190 Health posts.

### Study period

The 2016-2020 malaria surveillance data collected from the Ethiopian Public Health Institute (PHEM) center database analyzed and interpreted from April 1 to April 29/2020.

**Study Design**

A retrospective document review was conducted to analyze malaria surveillance data regarding a person, time, and place.

**Analysis Procedure**

Five years (2016-2020) weekly surveillance data from the Ethiopian public health Institute Public health emergency management center was collected. Before analysis, data were cleaned and checked for consistency, missing value, and miscoded value. Using Microsoft office excel 2010 to show malaria trends, data analysis was carried out to describe malaria by place, person, and time.

**Dissemination of result**

This national malaria surveillance data analysis was submitted timely to AAU/School of public health/Department of EFETP, EPHI/FMoH, and respective regional Health Department by hard copy and electronic soft copy.

**Ethical Consideration**

A concept note was submitted to the EPHI PHEM Early warning and response team leader and data manager to access the data. As this study used secondary data, consent latter and other ethical measures were not applicable.

## Results

Through the regular weekly monitoring method, a total of 7,028,080 confirmed and clinical malaria cases with 527 deaths were recorded from nine regional states and two administration cities between 2016 and 2020. There were 2,056345 cases (29.25%) from Amhara regional state, 1,281,774 cases (18.23%) from SNNP, 949943 cases (13.52%) from Tigray, 727738 cases (10.35%) from Oromia, 405721 cases (5.77%) from Gambella, 381608 cases (5.43%) from Afar, 240451 cases (3.42%) from Somalia, 24879 cases (0.35%) from Harari regional states, 18460 cases (0.26%) from AA, 16627(0.23%) from Sidama and 5442 (0.077%) from Dire Dawa city administration. Among the total cases, PF contributes 7,696,541 (54.1%) followed PV 3,946,590 (27.7%) and the rest 2,591,802 (18.2%) were other malaria (clinical and other malaria parasite). An inpatient case contributes 113,203 (0.8%).

*Table 14: Distribution of total malaria suspected febrile cases, positive cases by species, inpatient and deaths by region, 2016-2020, Ethiopia.*

| Regions | Fever examined | PF | PV | Confirmed and clinical | Inpatient | Death |
|---|---|---|---|---|---|---|
| Addis Ababa | 121619 | 6331 | 12383 | 18460 | 187 | 13 |
| Afar | 1080993 | 318733 | 49900 | 381608 | 258 | 20 |
| Amhara | 9489730 | 1499216 | 553769 | 2056345 | 4664 | 36 |
| B/Gumuz | 2855546 | 781461 | 100956 | 919092 | 7472 | 48 |
| Dire Dawa | 114582 | 4236 | 1192 | 5442 | 56 | 3 |
| Gambella | 785940 | 329109 | 28084 | 405721 | 10684 | 38 |
| Harari | 75566 | 18191 | 4942 | 24879 | 119 | 63 |
| Oromia | 5843373 | 485350 | 226733 | 727738 | 5180 | 63 |
| Sidama | 122041 | 9702 | 6924 | 16627 | 8 | 0 |
| SNNPR | 7903572 | 817357 | 444484 | 1281774 | 9790 | 59 |
| Somali | 164757 | 82694 | 18841 | 240451 | 316 | 95 |
| Tigray | 3916588 | 674904 | 267114 | 949943 | 5031 | 89 |
| **Grand Total** | **32474307** | **5027284** | **1715322** | **7028080** | **43765** | **527** |

It was found out that the annual case rate varies and fluctuating across regional states over the years. Malaria cases and incidence rates decreased from year to year for some regions and fluctuated in other regions. Accordingly, malaria cases decreased by 25.08% from 1,740,1487

in 2016 to 1303597 in 2017, by 21.4% from 1,303,597in 2017 to 1,024,003 in 2018, then increased by 30% from 1,024,003 in 2018 to 1478296 in 2019 and again slightly increased by 0.3% from 1478296 in 2019 to 1,482,036 in 2020. Overall, malaria cases decreased by 14.73% from 1,740,1487 in 2016 to 1,482,036 in 2020 over the last five years (table 2).

A similar trend was observed for some regions and the reverse for other regions. Accordingly, malaria cases increased by 7.57% from 512997 to 555015 in the Amhara region, by 25.5% from 70931 to 94766 in the Afar region, by 38.7 from 39929 to 65137 in Somali Region. On the other hand, other regions show a similar trend of with national. Accordingly, malaria case decreased by 88.8% from 10986 to1228 in Harari Region, by 57.7% from 296909 to 125564 in the Tigray region, by 25.1% from 196451 to 147313 in Oromia Region, by 63.45% from 5263 to2106 in Addis Ababa by33.6% from 217357 to 144284 in Benishangul Gumuz 2016 to 2020 respectively.

*Table 15: Distribution of malaria cases by region, 2016-2020, Ethiopia*

| Regions | 2016 | 2017 | 2018 | 2019 | 2020 | Grand Total | percentage |
|---|---|---|---|---|---|---|---|
| Addis Ababa | 5763 | 4789 | 3047 | 2755 | 2106 | 18460 | 0.26% |
| Afar | 70931 | 64375 | 74496 | 77040 | 94766 | 381608 | 5.43% |
| Amhara | 512997 | 301594 | 249154 | 437585 | 555015 | 2056345 | 29.25% |
| B/Gumuz | 217357 | 218506 | 157110 | 181835 | 144284 | 919092 | 13.07% |
| Dire Dawa | 732 | 690 | 640 | 1021 | 2359 | 5442 | 0.07% |
| Gambella | 99049 | 100213 | 64692 | 67515 | 74252 | 405721 | 5.77% |
| Harari | 10986 | 8674 | 2239 | 1752 | 1228 | 24879 | 0.35% |
| Oromia | 196451 | 140526 | 92129 | 151319 | 147313 | 727738 | 10.35% |
| Sidama | | | | | 16627 | 16627 | 0.23% |
| SNNPR | 289044 | 240047 | 181707 | 317591 | 253385 | 1281774 | 18.23% |
| Somali | 39929 | 34683 | 43273 | 57429 | 65137 | 240451 | 3.42% |
| Tigray | 296909 | 189500 | 155516 | 182454 | 125564 | 949943 | 13.52% |
| **Grand Total** | **1740148** | **1303597** | **1024003** | **1478296** | **1482036** | **7028080** | 100% |

## National malaria morbidity and mortality trend by Place and Time

Nationally, during the last five years, about 7.1 million malaria cases (6,742,606 or 95.9% laboratory-confirmed and 285474 or 4.1% clinical malaria cases) with an average annual incidence of 23.3 cases per 1000 population. Among these, 43765(0.62%) admissions & 6984363(99.4%) outpatient cases with 578 deaths were reported. On average, 1.5 million cases

were reported each year during the past five years. Annually about 1.7 million cases (24.7%) were reported only in 2016, but this decreased by 10% after two years in 2018. But in the last two years, it increased to 1.4 million per year (14%) of the total five-year report. Malaria CFR is calculated as dividing inpatient malaria deaths by inpatient malaria cases. The highest case fatality rate was observed during 2018(2.12%) and the lowest in 2017(0.5%). The overall CFR was 1.28%.

*Table 16:* ***Annual reported malaria cases and death, average monthly report, annual CFR, 2016-2020, Ethiopia***

| Year | # of cases | percentage | # of death | # of inpatient case | Average monthly report | CFR (%) |
|---|---|---|---|---|---|---|
| **2016** | 1,740,148 | 24.70% | 138 | 12,935 | 297,517 | 1.10% |
| **2017** | 1,303,597 | 18.50% | 49 | 8,398 | 335,823 | 0.50% |
| **2018** | 1,024,003 | 14.10% | 107 | 5,040 | 390,615 | 2.12% |
| **2019** | 1,478,296 | 21.20% | 114 | 8,056 | 389,509 | 1.40% |
| **2020** | 1,482,036 | 21.30% | 119 | 9,336 | 418,207 | 1.30% |
| **Total** | **7,028,080** | 100% | 527 | 43765 | 1,831,670 | |

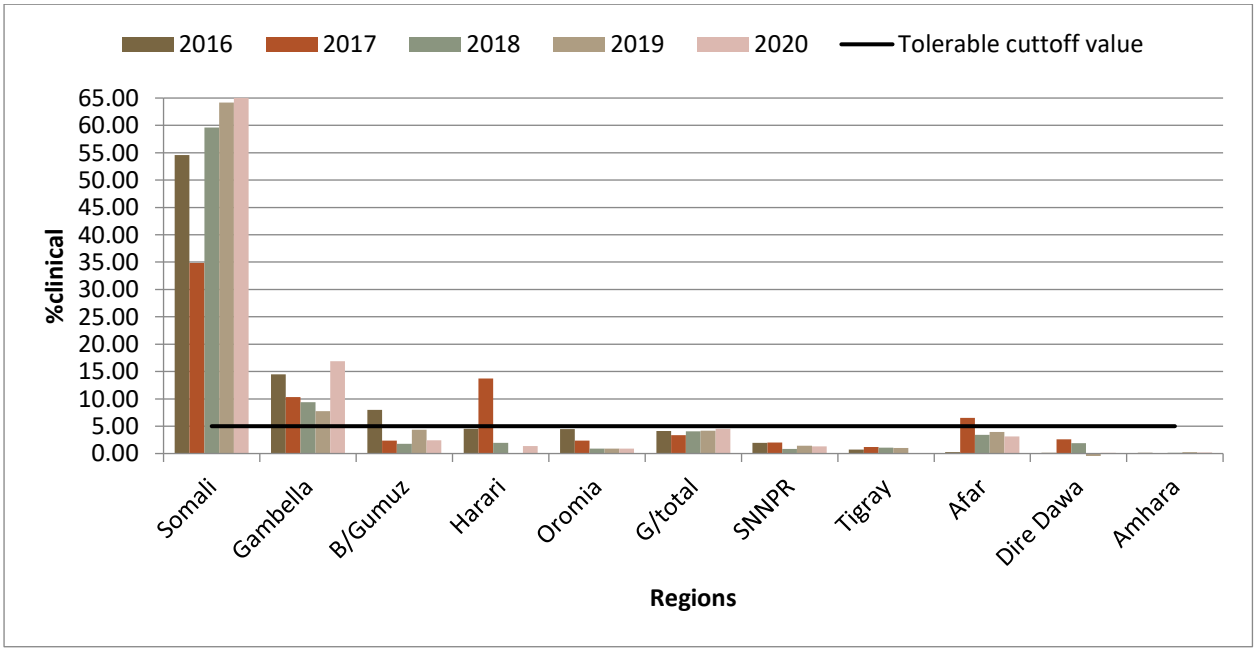



*Figure 7: Clinical malaria cases trend by year of regions 2016 -2020, Ethiopia.*

The above figure shows that clinical malaria ranges from (-7.7% to 65%) during the past five years. The highest clinical malaria was reported from the Somalia region, ranging from 34.8% in 2017 to 65.03% in 2020. The other highest clinical malaria reported was Gambella which is 16.08% in 2020. All other regions reported below 5%, except B\Shangul Gumuz in 2016, which reported 7.97% and Harari in2017, which was 13.5%. The negative report indicates that the confirmed number of malaria cases is greater than the total of clinical plus confirmed cases, which is impossible and against the guide line.

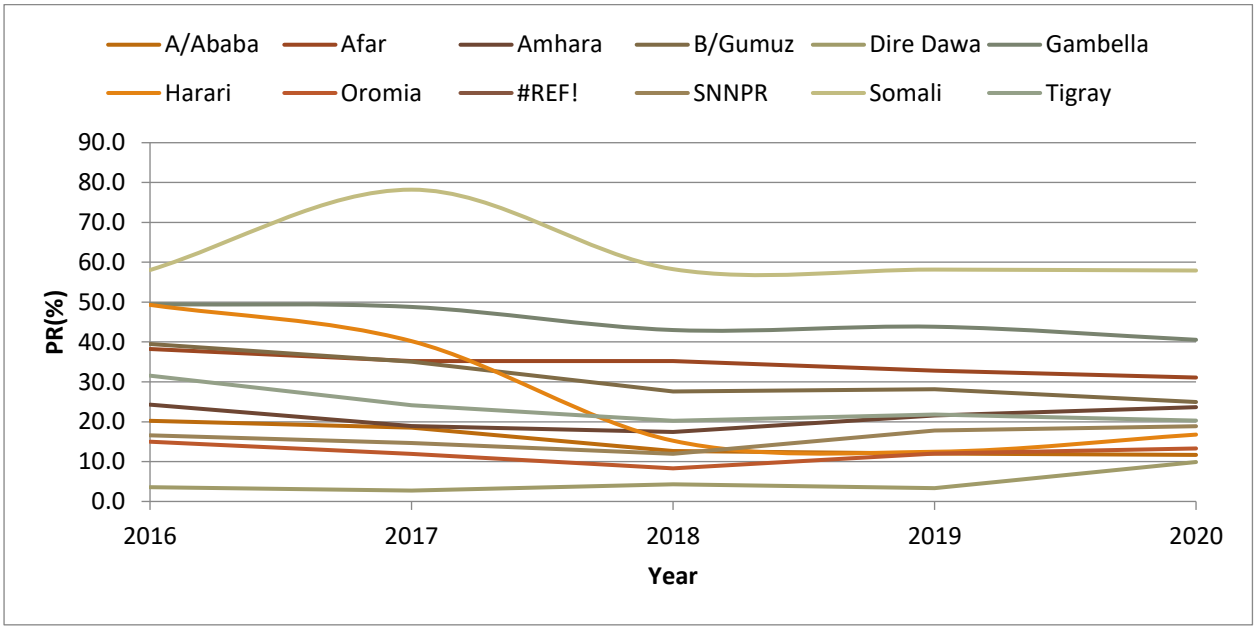



*Figure 8: Malaria positivity rate by time and place, 2016-2020, Ethiopia.*

Overall, from the above line graph, we conclude that the malaria positivity rate was decreased year to year from 2016 to 2020 for some regions and fluctuating for others. In Tigray and Gambella regions, there is almost all constant positivity rate though out five years. The highest positivity rate was recorded in 2017 from the Somali region, which was around 80%.

Malaria positivity rate is calculated as total confirmed malaria cases divided by total fever examined multiplied by 100%. Over all Malaria positivity rate was decreased year to year from 2016 to 2020 as both confirmed malaria cases and total fever examined decreased. In 2016 only 22.7% of woredas reported less than 10% Positivity rate, but in 2020 33.3% of malarious

woredas reported less than 10% positivity rate, which indicates decrement of malaria positive cases in last Five years. (Table 4)

*Table 17: Distribution of Malaria positivity rate by woredas, 2016-2020, Ethiopia*

| Positivity rate | 2016 | | 2020 | |
|---|---|---|---|---|
| | #of woreda | Percentage | #of woreda | Percentage |
| < 10 | 220 | 22.7 | 449 | 33.3 |
| 10 to 20 | 221 | 22.8 | 273 | 20.3 |
| 20 to 30 | 161 | 16.6 | 183 | 13.6 |
| 30 to 40 | 125 | 12.9 | 108 | 8.0 |
| 40 to 50 | 67 | 6.9 | 54 | 4.0 |
| 50 to 60 | 44 | 4.5 | 34 | 2.5 |
| 60 to 70 | 35 | 3.6 | 30 | 2.2 |
| 70 to 80 | 26 | 2.7 | 15 | 1.1 |
| 80 to 90 | 8 | 0.8 | 18 | 1.3 |
| 90 to 100 | 11 | 1.1 | 9 | 0.7 |
| Invalid data | 52 | 5.4 | 175 | 13.0 |
| **Grand Total** | **970** | 100.0 | **1348** | 100.0 |

*Table 18: Woredas with highest malaria positivity rate, 2016 – 2020, Ethiopia*

| Name of Woreda | Confirmed | Tested | Positivity rate (%) |
|---|---|---|---|
| Bie Awale | 58 | 43 | 134.9 |
| Akaki Kaliti Woreda04 | 181 | 176 | 102.8 |
| Kededuma | 516 | 519 | 99.4 |
| Yoxob | 109 | 111 | 98.2 |
| Dolo Bay | 1042 | 1087 | 95.9 |
| Mubarak | 274 | 287 | 95.5 |
| Mayamuluqo | 211 | 225 | 93.8 |
| Sagag | 411 | 443 | 92.8 |
| Salahad | 363 | 397 | 91.4 |
| Raso | 158 | 174 | 90.8 |
| Erer | 659 | 731 | 90.2 |

| | | | |
|---|---|---|---|
| Maeso | 608 | 684 | 88.9 |
| Kubi | 298 | 337 | 88.4 |
| Hamaro | 249 | 284 | 87.7 |
| Filtu | 243 | 279 | 87.1 |
| Bodaley | 770 | 888 | 86.7 |
| Fik | 159 | 184 | 86.4 |
| Wangay | 150 | 174 | 86.2 |
| Lagahida | 287 | 334 | 85.9 |
| Dagahbur City | 309 | 363 | 85.1 |
| Fik Hosp | 143 | 172 | 83.1 |
| Elkare | 274 | 339 | 80.8 |
| Melka Soda Hospital | 1075 | 1331 | 80.8 |
| Shinile | 938 | 1169 | 80.2 |
| Hadhagala | 342 | 438 | 78.1 |
| Qoxle | 298 | 382 | 78.0 |
| Cayuun | 205 | 266 | 77.1 |
| Boqolmayo | 835 | 1090 | 76.6 |
| Siraro Badawachoq | 556 | 737 | 75.4 |
| Xaraarey | 129 | 174 | 74.1 |
| N. Jigjiga | 57 | 77 | 74.0 |
| Jarati | 911 | 1244 | 73.2 |
| Birkot | 164 | 226 | 72.6 |
| Hargele | 821 | 1146 | 71.6 |
| Hadeleala | 5300 | 7481 | 70.8 |
| Godgod | 175 | 248 | 70.6 |
| Dolo Odo | 275 | 390 | 70.5 |
| Hudet | 333 | 475 | 70.1 |

## National malaria morbidity trend by Place and Time

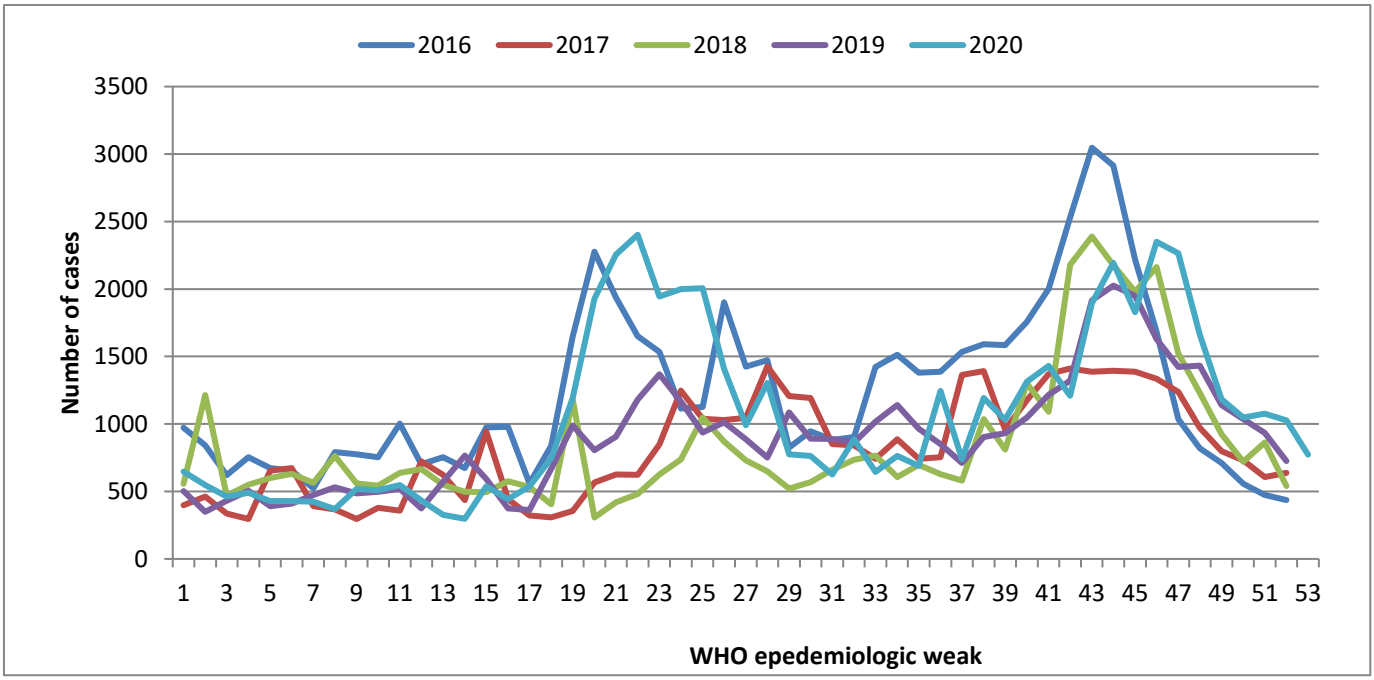



*Figure 9: Total suspected and confirmed cases trend by week, 2016-2020*

As depicted in the above figure number of malaria caseload were fluctuating year to year, 2016s' cases trend was highest of the entire five-year trend and that of 2018s' was lowest. In 2016, the national weekly caseload ranged from 20218-49169 with a weekly incidence rate (3.2-10.7 cases per 10,000 populations). In 2018 national weekly caseload ranges from 12137-38,714.

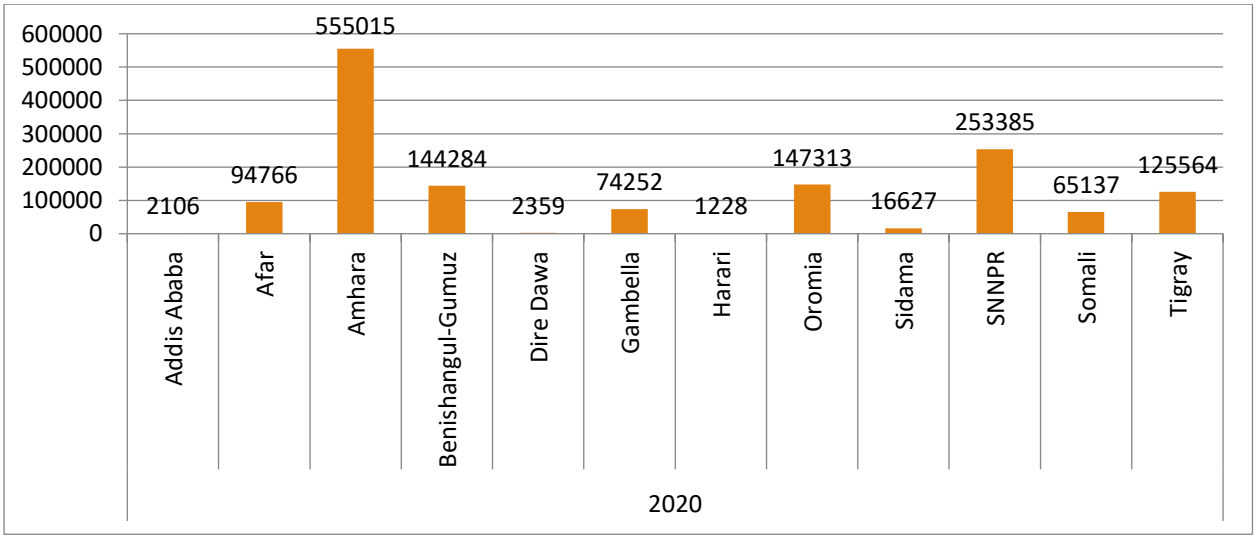



*Figure 10: Total weekly suspected and confirmed malaria cases by region, 2020, Ethiopia*

As shown in figure 4, in the recent year 2020, similar to the last five year, the highest report is from Amara Region, which covers 37.44%*(5,55,015), followed by the SNNP, which was

17.1% (253385), Oromia 9.93%, Benishangul Gumuz, 9.73%, Tigray 8.47%. Although the number of cases shows a certain decrement between 2016 -2018, in recent years, it's almost all the same as the last four years.

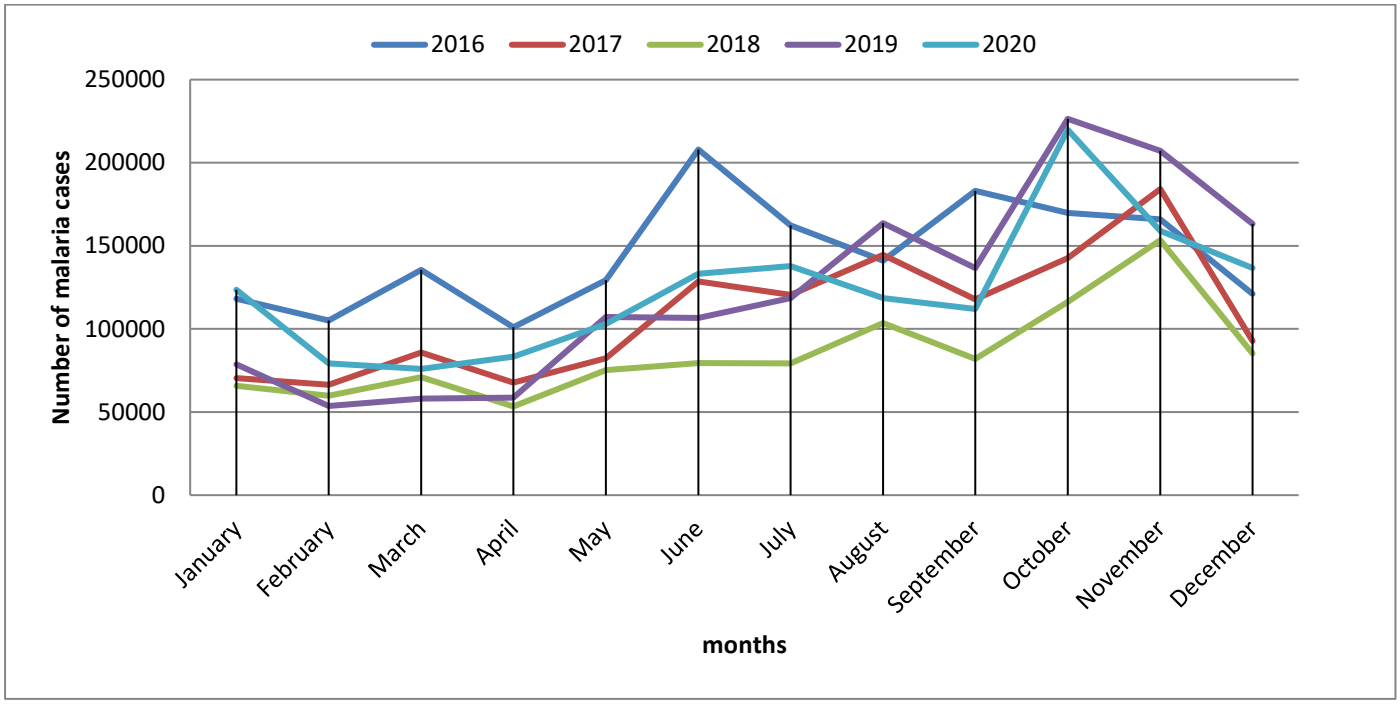



*Figure 11: Total suspected and confirmed malaria cases by month, 2016-2020, Ethiopia*

In certain years, the monthly malaria caseload fell in a manner similar to the weekly caseload, whereas it fluctuated in other years. In the past five years, October 2019 saw the largest monthly malaria caseload ever recorded (226,361 cases), whereas April 2018 saw the lowest monthly caseload (53365 cases). The graph above demonstrates how the trend for malaria grew significantly between April and June, reduced between June and September, rose sharply between September and November, and fell again up until April to finish the cycle.

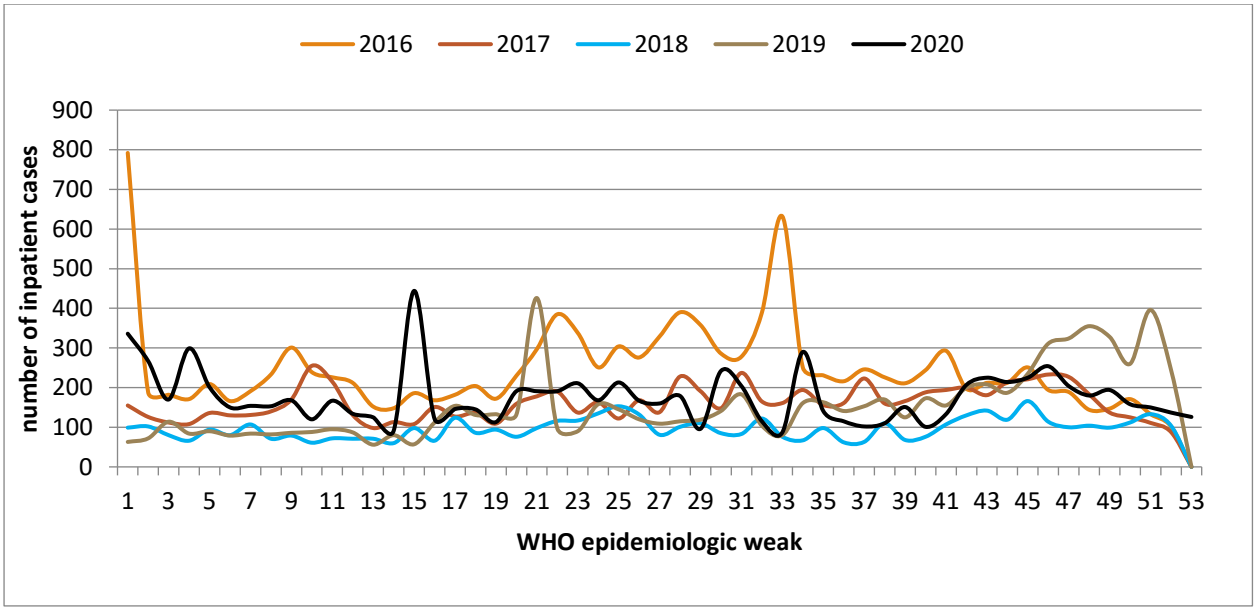
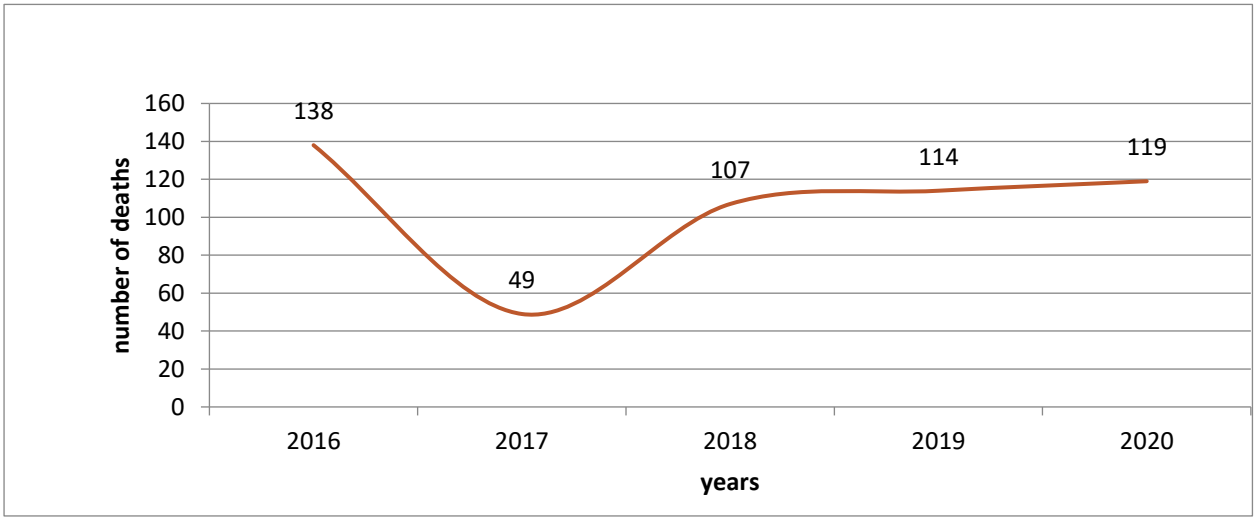



*Figure 12: Total malaria inpatient cases trend by week, 2016-2020 Ethiopia.*

The outpatient and inpatient case trends for malaria were both at their greatest in 2016 and subsequently fell for two years before increasing once more in more recent years. The most cases (792 cases) were admitted in the second week of 2016. On week 33 of 2016, there were 632 additional high inpatient cases.




*. Figure 13: Annual malaria death trend, 2016-2020, Ethiopia.*

Figure 7 shows that the trend in malaria deaths is almost identical to the rise in malaria cases. From 2016 to 2017, it was declining; from 2018 to 2020, it was increasing. 2016 was the highest reported rate of malaria mortality (138 deaths). But as said previously, in 2018 the highest CFR were reported.

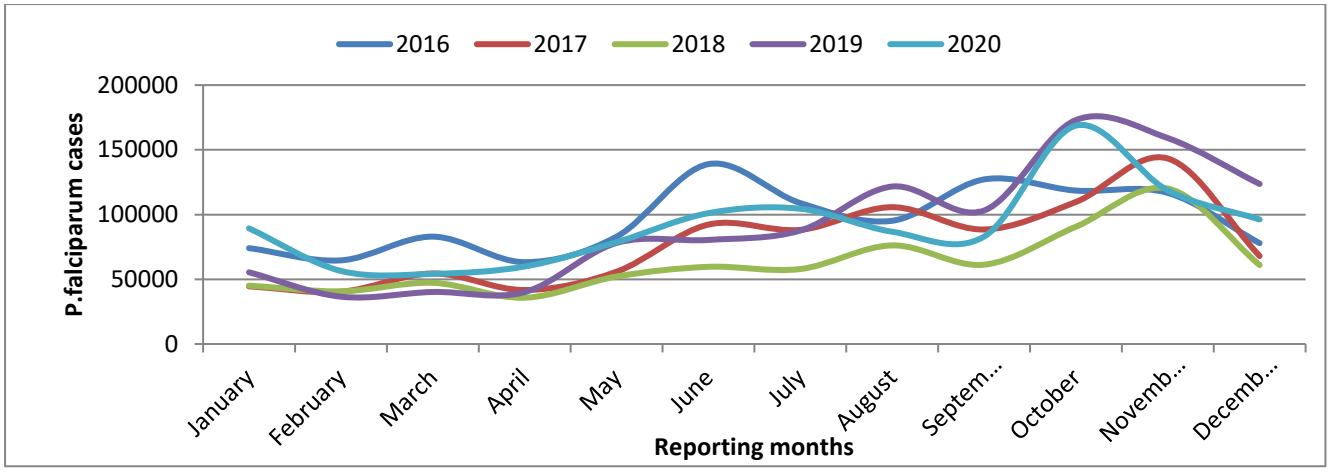



*Figure 14: P. falciparum malaria cases trend by month, 2016-2020 Ethiopia*

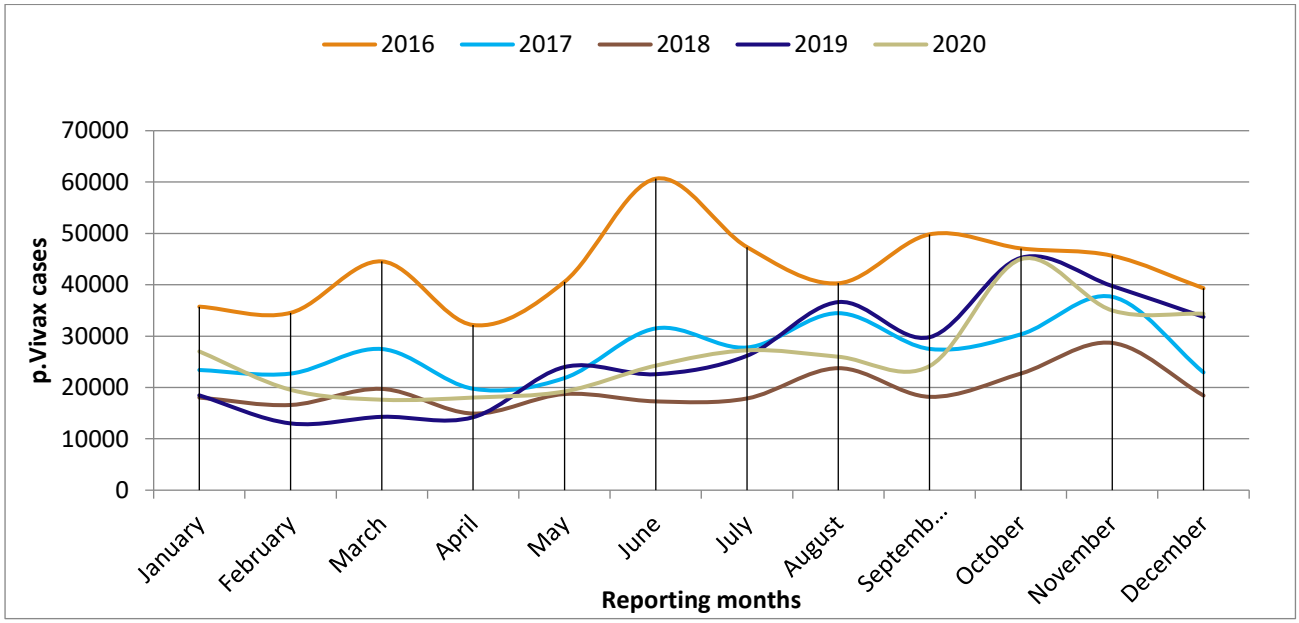



*Figure 15: P. Vivax malaria cases trend by month, 2016-2020, Ethiopia*

As is evident from the graphs above, both P. falciparum and P. vivax malaria case trends show that malaria in Ethiopia is seasonal, with the major transmission season occurring from September to December after the summer rainy season, with the peak occurring in October. The second transmission season, which runs from April through June with a peak in June, follows little rain. The cumulative prevalence of Plasmodium falciparum was 74.6% (5027284), while P. Vivax specious coved 25.4% (1715322) over the previous five years.

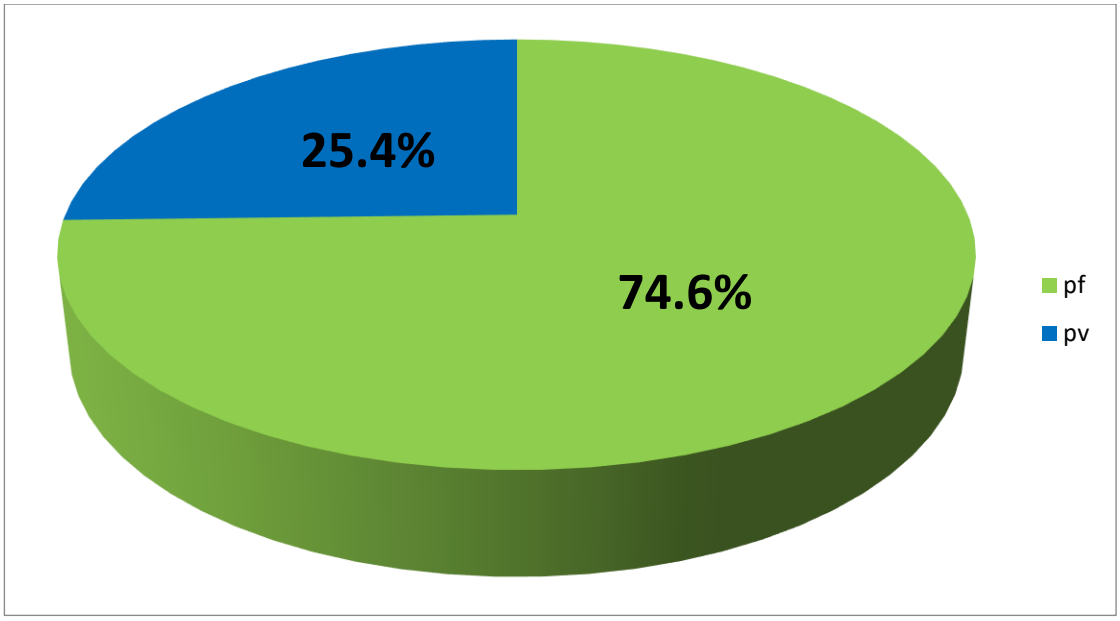



*Figure 16: Proportion of P. falciparum and P. Vivax malaria cases, 2016-2020 Ethiopia.*

The above graph illustrates the dominance of Plasmodium falciparum specious (74.6%) over P. Vivax specious (25.4%) throughout the last five years.

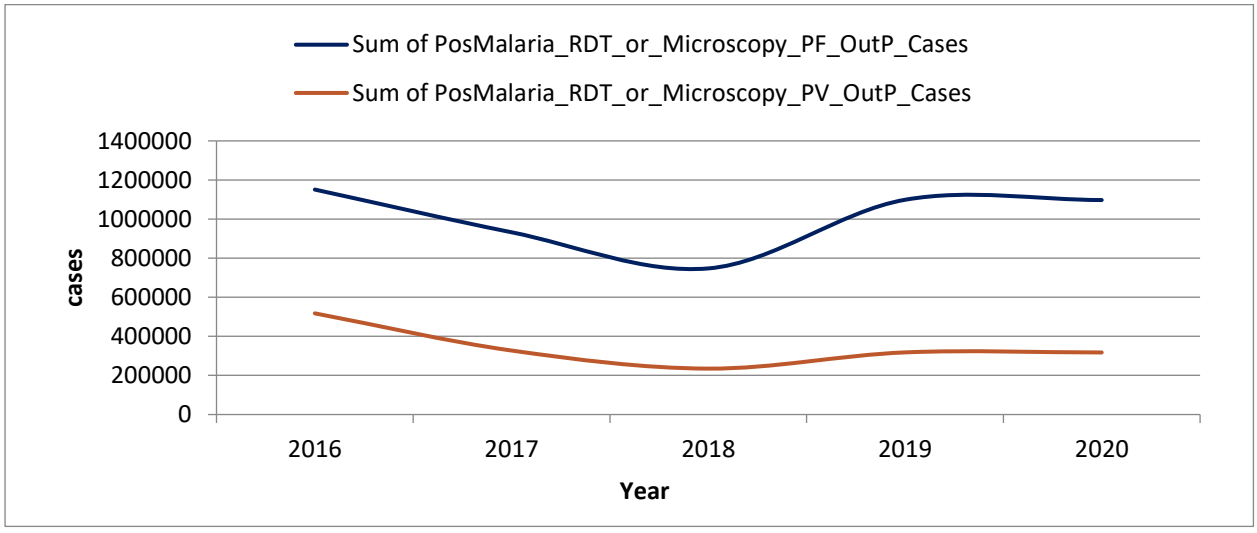



*Figure 17: Trend of P. falciparum and P. Vivax malaria cases 2016-2020 Ethiopia*

As depicted in figure 11, the trend of change for both specious is similar, which is high in 2016 and decreased for the next two consecutive years (2017 and 2018), and then became increased during the recent two years, 2019 and 2020 Malarious regions' morbidity trend.

**Amhara regional state malaria cases trend**

From 2016 – 2020 the total of 2,056,345 cases and 36 deaths were reported from Amhara regional state. 512997(32.1%) of cases and 7(68.4%) of deaths were reported in 2016, Which

decreased to 2,49,154 cases in 2018 and again became more increased to 555015 cases per year in 2020.

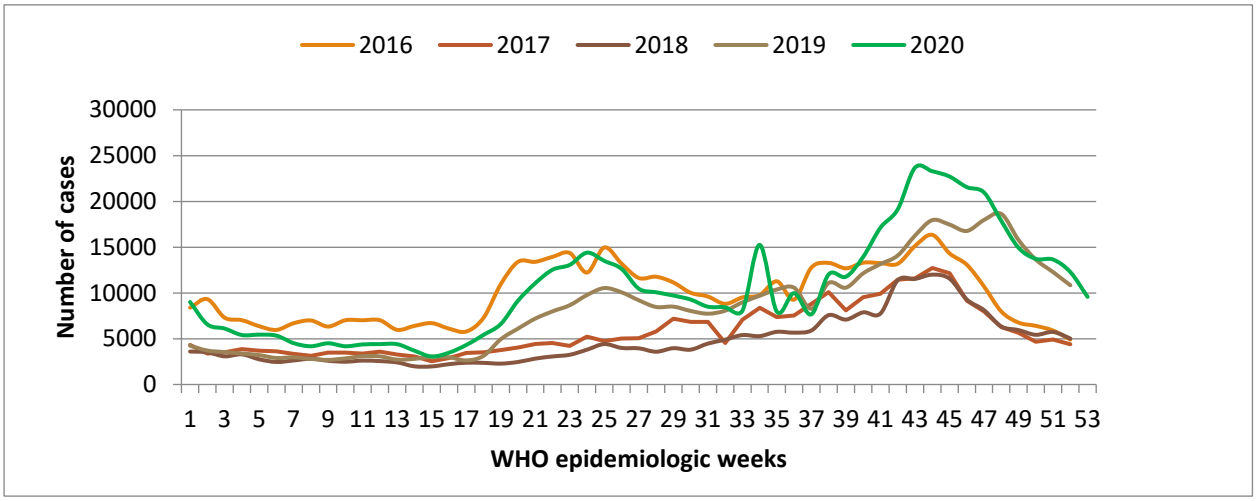



*Figure 18: Trend of the total suspected and confirmed malaria cases by week, in 2016-2020, Amara regional state*

The above figure indicates that Similar to the national malaria case trend, Amara regional states' malaria case trend shows decrement from 2016 to 2018 and then reincreased in the recent two years as shown in figure 15 (512997, 301594, 249154, 437585, and 555015) annual caseloads in 2016, 2017, 2018, 2019 & 2020 respectively.

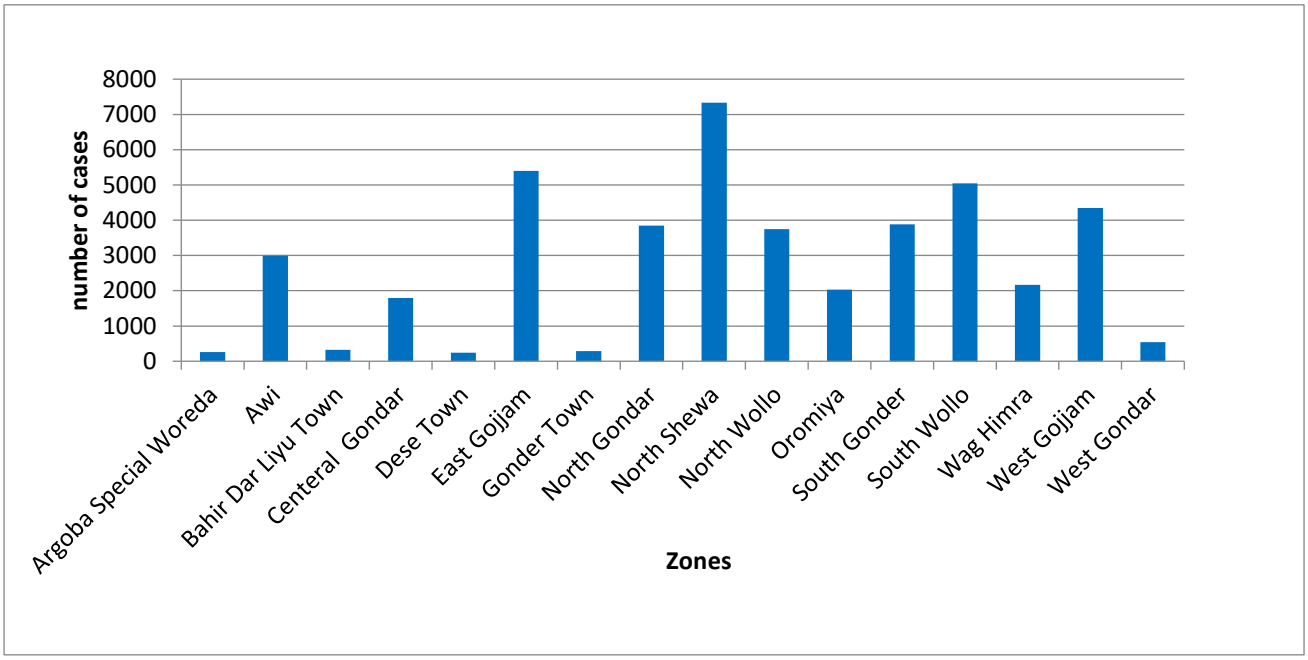



*Figure 19: Five-year Malaria cases reported from Zones of Amhara Region 2016- 2020, Ethiopia.*

The trend of malaria at the zone level is also similar to national and regional fluctuation from year to year. North Gonder Recorded the highest confirmed malaria cases with 408206(19.85%), South Gonder, Central Gonder, West Gojjam, Awi, West Gojjam, West-East Gojjam had recorded the respective rank and among malarious Zones of Amhara region next to North Gonder. Generally, 19 zones have been reporting malaria cases for the last five years.

**Malaria Morbidity trend of SNNPR**

The peak weekly incidence rate in the past five years was observed on week 31 of 2019 with 9429 cases per week reported, and the lowest weekly reported sum of malaria cases was in the first week of 2019 with 1989 cases per week from a total of 7903572 suspected fever cases examined by RDT or Microscopic, 1281774 patients were positive for Plasmodium species from January 2016 to December 2020. The highest reported case was in 2019 with 317591, then 289044, 253385, 240047, 181707 in 2016, 2020, 2017, 2018, respectively.

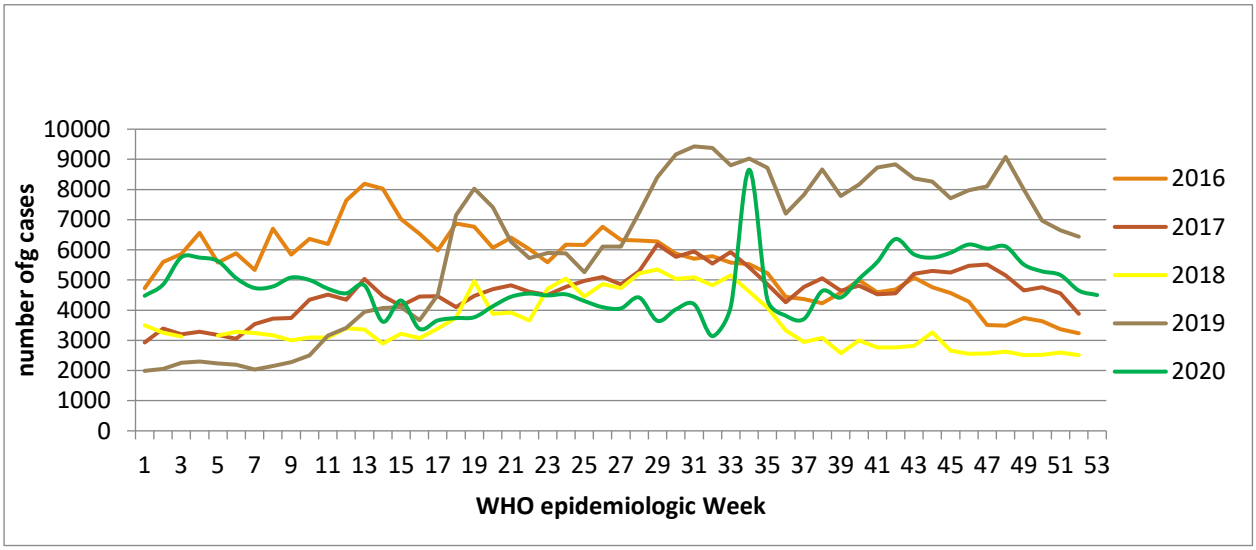



*Figure 20: Trend of total suspected and confirmed malaria cases by week 2016-2020, SNNP Region.*

Similar to the national trend, the malaria caseload was fluctuating from year to year. In 2019 the highest number of cases were reported with a weekly caseload of 1989 to 9429 during week one and week 31, respectively. The lowest case report was reported during 2018, with a weekly caseload of 2512 to 5350 during weeks 53 and 28.

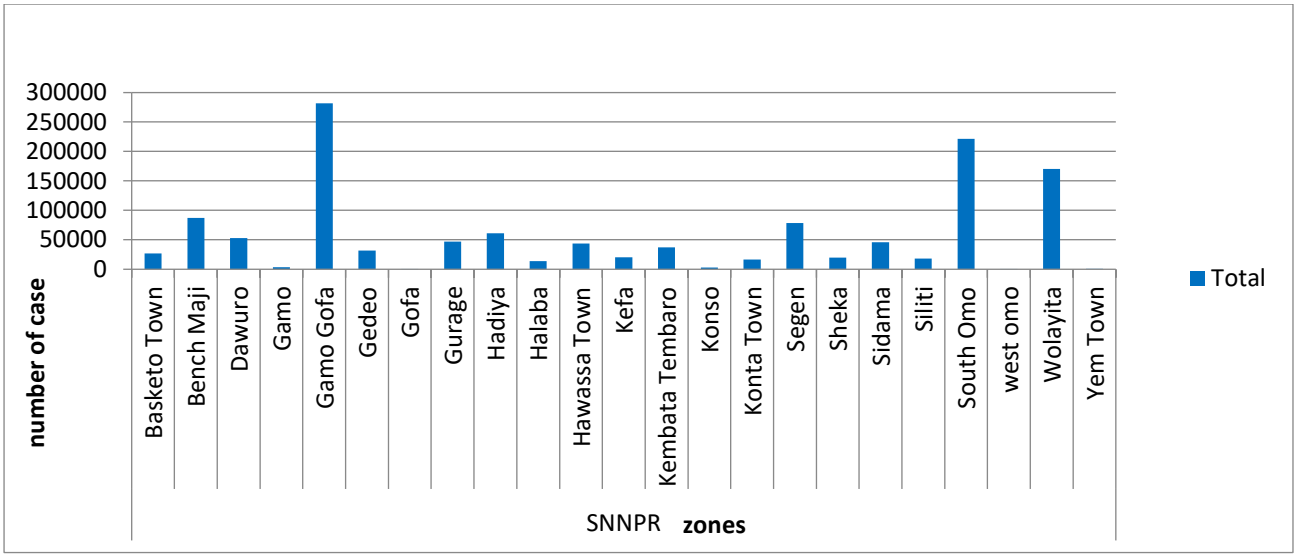



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*Figure 21 : Five-year Malaria cases reported from Zones of SNNP 2016- 2020, Ethiopia.*

Gamo Gofa, South Omo, and Wolayita Zones are the highly malarious Zones of the region with 281844(21.98%),221566(17.26%), and 170505(13.3%), respectively. Bench Maji 87080(6.79%), Segen 78339(6.11%), Hadiya 61222(4.77%), and Dawro with 52785(4.12%) are the other zones of the region which are relatively malarious area.

**Oromia regional state malaria cases trend**

Oromia regional state five years malaria surveillance data were systematically analyzed and verified that 583373 malaria suspected cases were reported in the region from January 2016 - December 2020 GC Among the reported cases, 727738 were a total of both (clinical 15655(2.2%) + parasitological confirmed cases 712083 (97.8). Even Though malaria cases occurred in all seasons, the incidence had to fluctuate across four seasons over the last five years. The highest malaria cases were observed during two seasons; the first was in Spring by 249902 (35%), and the second was in Summer by 205477 (28.8%). On the other hand, the lowest cases were observed during winter by 125001(17.5%).

When we describe species, a higher number of cases of P. falciparum and P. Vivax were observed during Spring 177787(36.6%), 72115(30.1%), and Summer 142845 (29.7%), 62632 (27.6%), respectively. However, the minimum numbers of P. falciparum 78424 (16%) in Spring) and a slight decrement of P. Vivax cases by 45409 (20.1%) was observed during autumn.

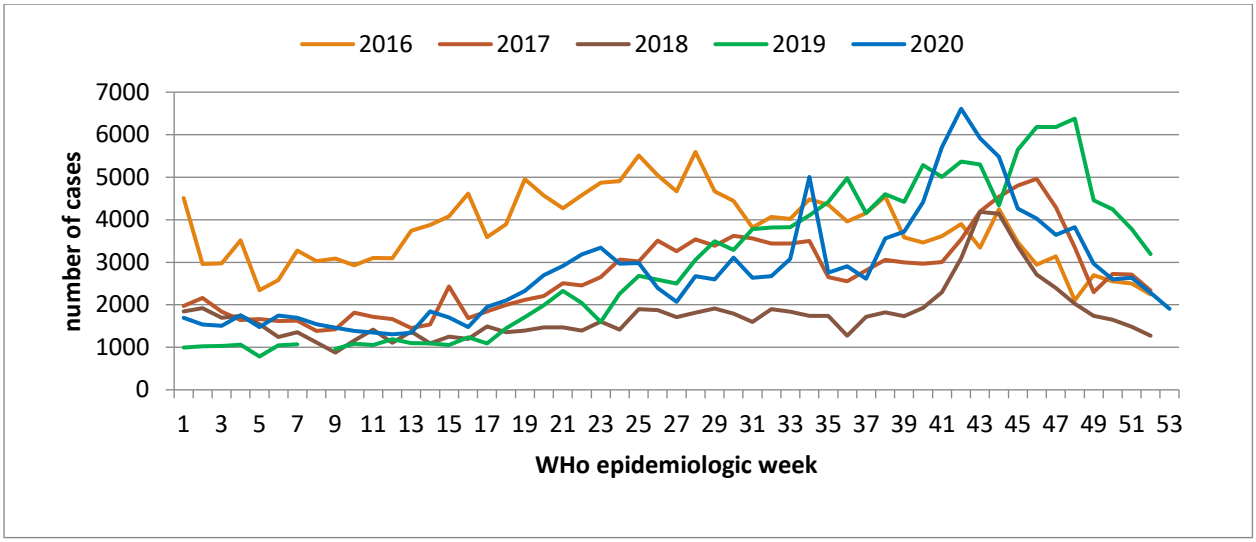


*Figure 22: Trends of malaria in WHO Epidemic Weeks at Oromia Regional State, (January 2016 – December 2020*

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As clearly indicated in the above figure, the 2016 malaria trend was the highest of all the remaining years oscillating over them and reached its' peak in the same year with 5594 cases/week on week 28$^{th}$. The trend decreased in 2017 and 2018 for two consecutive years and again became increased, similar to the national trend in the recent two years. The lowest report was during 2018, which contribute 12% in the last five years.

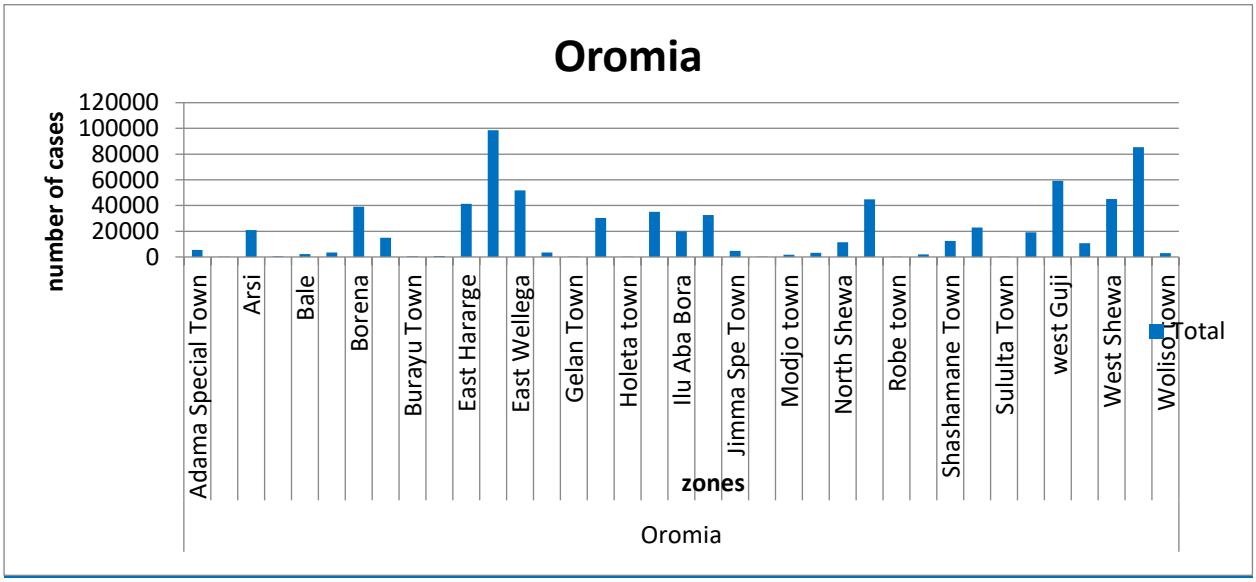


*Figure 23: Total confirmed malaria cases of Oromia regional sate Zones January 2016 - December 2020*

East Shewa recorded the highest total confirmed malaria case with 98223, West Wellega, West Guji, East Wellega, West Shewa, Qellem Wellega, East Hararge, Borena, Horro Guduru, and Jimma are had recorded the respective rank next to East Shewa with 85491, 59349, 51757, 44946, 44744, 41213, 36336, 33591, 32566 respectively.

**Malaria Case trend of Tigray Regional State**

From 2016 - 2020 the total of 949,344 cases and 89 deaths with a CFR of 0.009% were reported from Tigray regional state. 296,909(31.25%) of cases were reported in 2016.

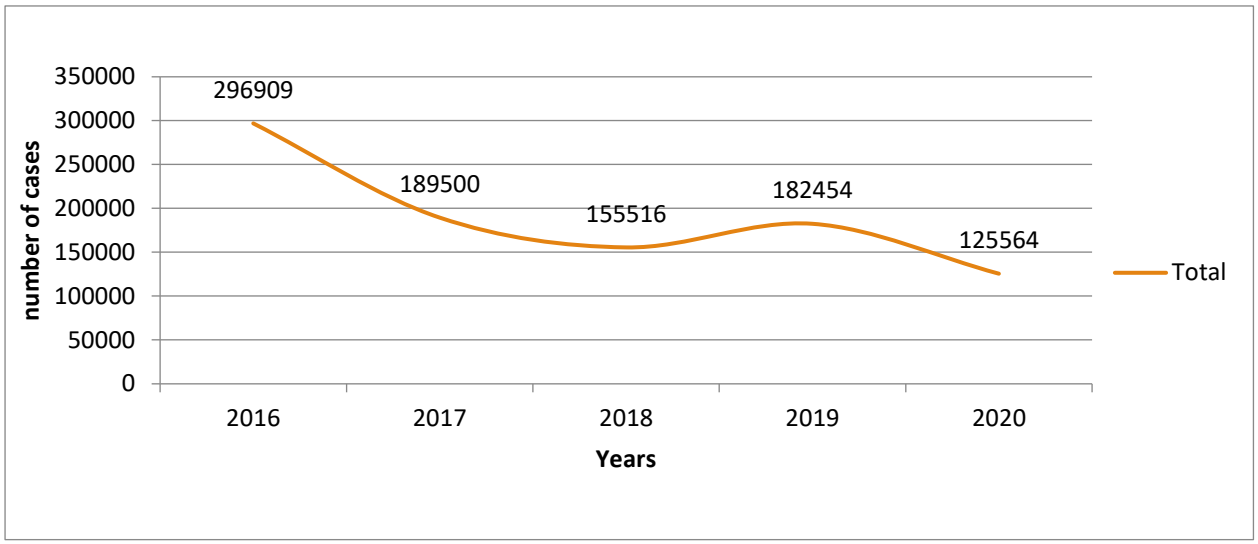


*Figure 24: Total suspected and confirmed malaria cases trend by year, 2016-2020 Tigray regional state*

The last five-year Malaria case trend in Tigray differs from national and other regions malaria case trend in that the 2020s' trend was the lowest of all years because of some report interruption. 2016 Report was the highest similarity to the national trend. The highest weekly case reached its' peak in the same year from 42th to 45$^{th}$ weeks with 11880, 14313, 13861 12128 cases per week respectively.

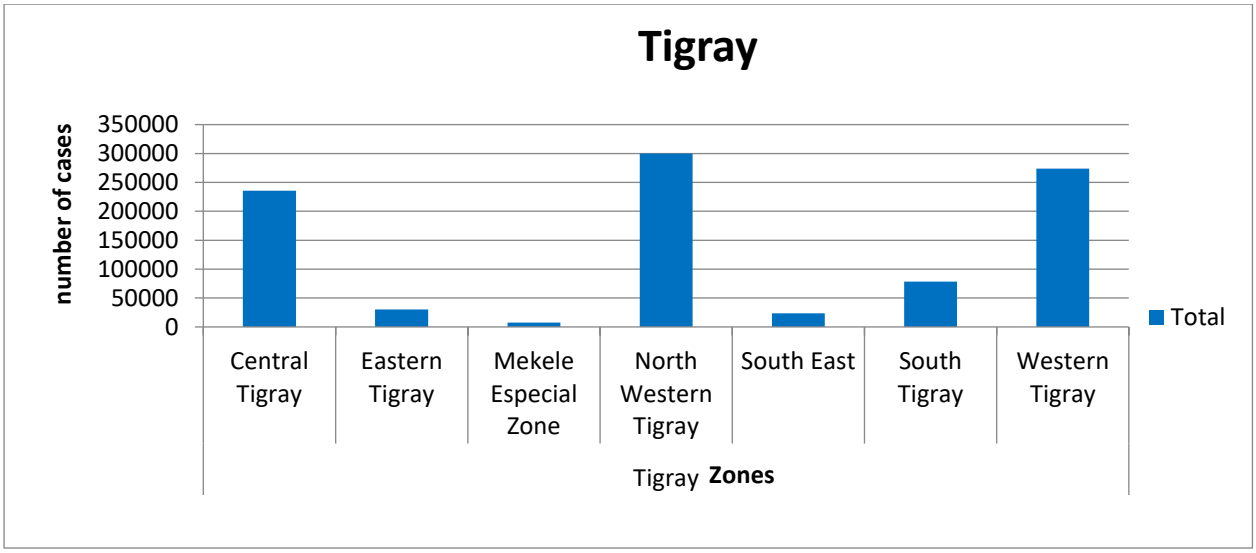


*Figure 25: Total confirmed malaria cases of Tigray regional State Zones January 2016 - December 2020.*

North Western Tigray, Western Tigray, and Central Tigray are highly malarious areas of the region with 299,954, 273,940, and 235,793 cases per year, respectively, in the last five years.

**Gambella Region Malaria Case trend**

The last five-year Malaria case trend in the Gambella region shows that 405721 confirmed and clinical cases and 38 deaths were reported. Similar to that of the national case trend, there are fluctuating cases from year to year. Unlike national, the highest numbers of cases were reported during 2017, 24.7% of cases (100213) reported in the last five years from the Gambella region. The lowest report documented in 2018 similar to national, which accounts for 15.9% of the previous five years.

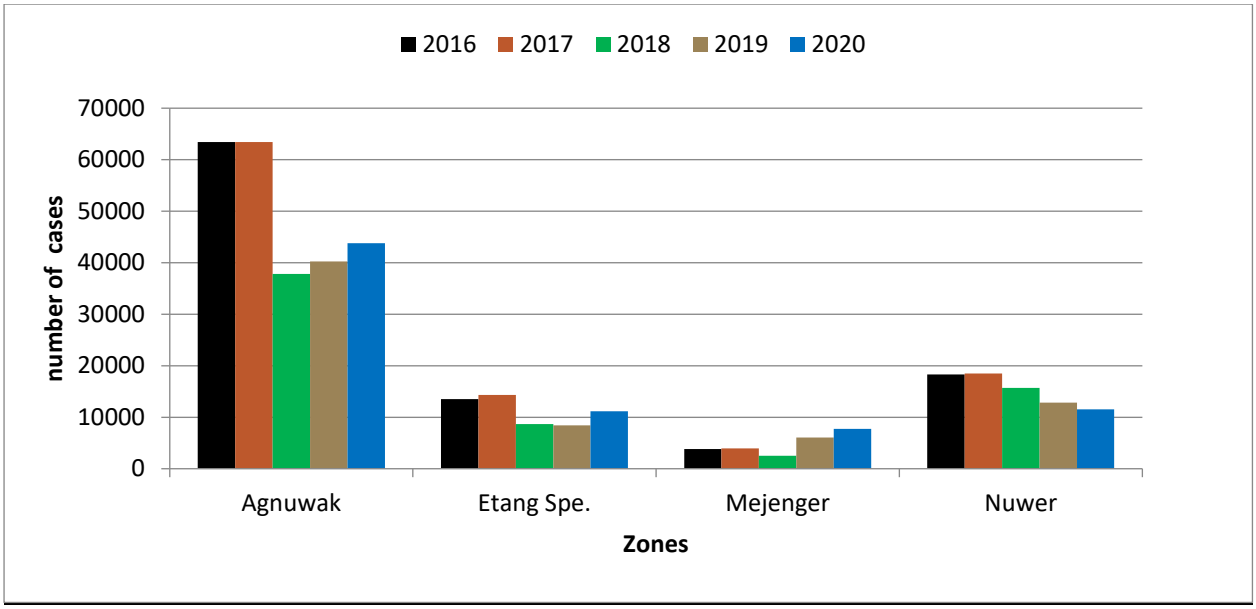


*Figure 26: Total confirmed malaria cases of Gambella regional state Zones January 2016 - December 2020*

Agnuwak is a highly malarious area of the region which holds 61.28% of the report in the five years, followed by Nuwer, Etang, Spe, and Mejengir from where 76835(18.94%), 56128(13.83%), 24074(5.9%) cases reported respectively.

**Benishangul Gumuz Region Malaria Case trend**

Totally from the region, 919092 cases and 48 deaths were reported, with an average of 183,818 cases per year. The case fatality rate (CFR) was 0.005%. The highest number of cases were reported during 2017 with 218506cases per, year or 23.77% of the 2016-2020 report, followed by 2016 with 217,357(23.6%), 2019 with 181,835(19.78%), 2018 with 157,1109(17.09%), and 2020 with 144,284(15.69%).

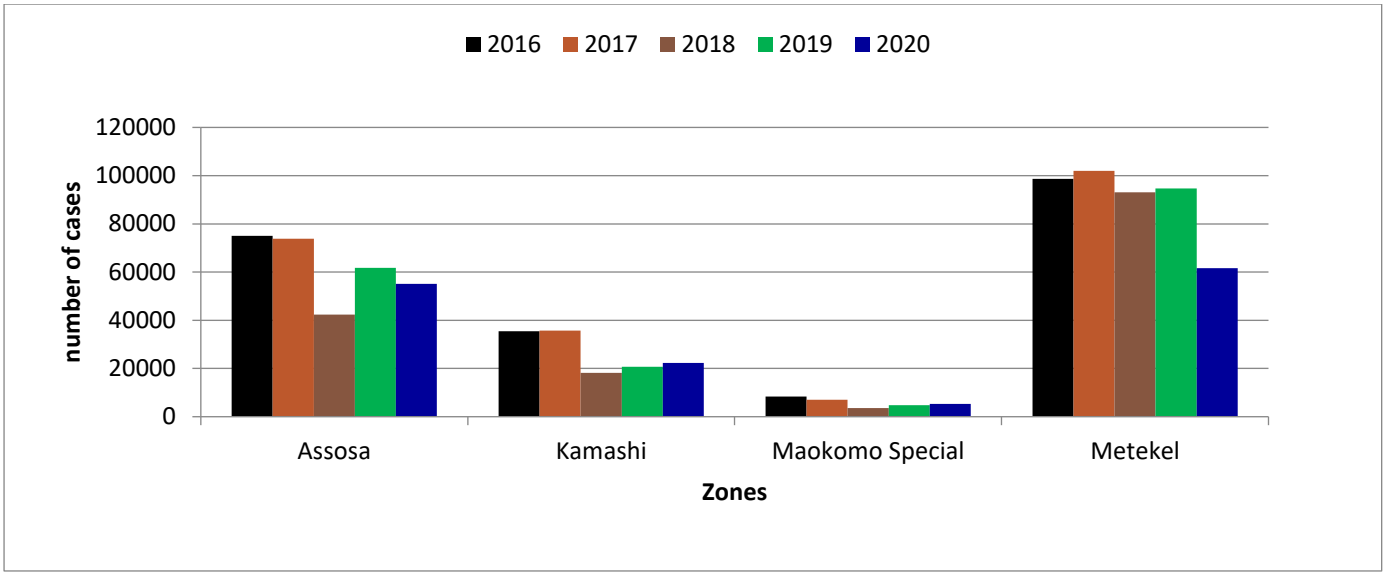


*Figure 27: Total confirmed malaria cases of Benishangul Gumuz regional State Zones January 2016 -December 2020*

Metekel and Assosa zones are the most malarious areas of the region with 48.94% and 33.5% of the whole five-year report, respectively, from 2016-2020.

## Discussion

In this study, nationally, 7,028,080 confirmed and clinical malaria cases and 527 deaths were reported within the last five years from January 2016-December 2020 or 2008-2012 according to the Ethiopian calendar, a mean annual occurrence 1,405,616 cases per year. Since there has been a significant expansion of Health posts that diagnose and treat a large proportion of outpatient cases, this could lead to earlier and more effective care-seeking and effective treatment with consequently reduced incidence of severe malaria cases and mortality at the health centre and hospitals.

Forty-three thousand seven hundred sixty-five malaria inpatient cases and 527deaths were reported for the last five years from January 2016 - December 2020. The case fatality rate (CFR) from 2016-2020 was fluctuating. It was high in (2018) with 2.12% CFR showed consistent increment from 2016-2018, by 1.1%, 0.5%, and 1.12% respectively. It was 1.4%, 1.3% during 2019 and 2020, respectively. Other studies in the Bale zone from 2010-2017 also support our findings, which describes that an annual number of malaria deaths fluctuates by 0%,1%,2% in 2010,2011, and 2012, respectively, and 0% from 2013-2016 6% in 2017. (23)

The study in 2014 by the Federal Ministry of Health reported on PHEM data stated that "Out of the total malaria cases reported from July 2013 to June 2014, 84.1% were confirmed either by microscopy or RDT, out of which 64% were Plasmodium Falciparum and 34% were Plasmodium Vivax. By improving the malaria surveillance system, most of the report was confirmed cases except few regions like Somalia and Gambella. High clinical malaria was reported highly more than expected in the last five years, against the national guideline (16). It could be an important indicator for malaria burden in the study area, which seems to need due attention concerning malaria intervention during this critical period of the national striving towards malaria elimination in the year 2030 (24). According to the WHO report, in 2016, malaria causes 70,000 death each year and 17% of outpatient visits. (8) In 2005, Ethiopia scaled up one malaria control program in Africa, which supports the health sector Development Plan and national Child Survival Strategy to reduce mortality due to malaria, especially in under five by two-thirds. Generally, in sub-Saharan Africa, the President of Malaria initiatives designed many goals to reduce mortality due to malaria in 15 highly burden countries through four effective malaria control and prevention measures; Indoor residual spray, treated mosquito net, accurate diagnosis, and treatment, and treatment preventive treatment of pregnant women. (6). The highest annual report was in 2016, which accounts for 24.7%, which decreased by

14.3% in 2020. HMIS data indicate that even though malaria remains one of the causes of outpatient OPD visits, inpatient mortality decreases, especially in under five years of age from year to year. The numbers of inpatient cases were decreasing by a large number when compared to the previous five years. Admission number was 0.62%, and very high outpatient cases of 99.38% have been reported. Since Health posts do not accept inpatient cases, this report could be biased. (5) HMIS report from mid-2013 to mid-2014 received 2,383,010 malaria cases including 1,256,611 outpatient P. falciparum malaria illnesses; 16,326 malaria admissions from P. falciparum; and fewer than 450 malaria deaths from these public health facilities that respectively represented 5%, 2.4%, and <2.5% of outpatient visits, inpatient admissions, and inpatient deaths from all causes for all age groups. PHEM indicates that more than 80% of Ethiopia's outpatient and inpatient malaria burdens among adults and children who are at least five years of age (6). Species wise Plasmodium Falciparum and Plasmodium Vivax were the dominant cause of malaria in Ethiopia from 2016-2020, accounting for 74.6% and 25.4%%, respectively, in the last five years. Plasmodium falciparum is the most prevalent malaria parasite in the WHO African Region, accounting for 99.7% of estimated malaria cases in 2018, as well as in the WHO South-East Asia Region (50%), the WHO Eastern Mediterranean Region (71%), and the WHO Western Pacific Region (65%). (25) Study Conducted on the Current Status of Malaria in Ethiopia: Evaluation of the Burden, Factors for Transmission and Prevention Methods 2016 showed the same phenomena, which is P.falciparum is the leading cause of malaria in Ethiopia by 60% while P. Vivax causes 40% of malaria in Ethiopia. (26) Malaria epidemiology and interventions in Ethiopia from 2001 to 2016" shows Plasmodium falciparum and P. Vivax co-exists, accounting for 60 and 40% of all malaria cases, respectively. (27) It is known that not all of Ethiopia is at risk for malaria since some areas are too high and other areas are too dry for transmission. It is impossible to adjust the incidence estimate for reporting units by a common factor of the population at malaria risk because the proportion of each zone at risk was highly variable. The overall incidence by the reporting unit is affected by the proportion of zone at risk and the intensity of transmission in the area. (28)

Malaria transmission in Ethiopia has an irregular and seasonal pattern. In Ethiopia, a number of variables, such as various ecoclimatic conditions, largely impact the strength of the transmission and its temporal and regional distribution. The most significant elements impacting the transmission of malaria are climatic factors, which include temperature, rainfall, and humidity. These factors exhibit substantial variability, mostly as a function of altitude. (29) Malaria transmission also varies among communities largely due to environmental factors, such as proximity to breeding sites. Many water resource development and management

projects result in local malaria outbreaks and other vector-borne diseases such as schistosomiasis, lymphatic filariasis, and Japanese encephalitis. These outbreaks can be attributed to an increase in the number of breeding sites for mosquitoes, an extended breeding season and longevity of mosquitoes, relocation of local populations to high-r reservoir shorelines, and the arrival of migrant populations seeking a livelihood around the newly created reservoirs. Malaria transmission peaks during the harvesting seasons bi-annually, the first from September to December and the second from April to May. The season has severe consequences for the subsistence economy of the nation. The overall trend was a progression for about four-fifths of a million confirmed cases a year in 1990, and it is almost a million and a half in 2005/06. The fact represents an increase of about 80 percent. The turn of the century (1999-2000) marked the worst decade of malarial infections in recent history, with the number of confirmed cases exceeding one and a half million a year. Approximately 4-5 million malaria cases are reported annually in Ethiopia and put over 50 million people at risk. Malaria accounts for seven percent of outpatient visits and represents the largest single cause of morbidity. It is estimated that only 2 percent of children under five years contract malaria are treated at existing health facilities, (30).

## Conclusion

Although the trends of total confirmed and clinical malaria cases fluctuated from year to year and from region to region, the overall malaria case decreased from 2016 to 2020 by 14.83%. The regional trend was also almost similar to the National trend except in Gambella and Benishangul-gumuz. The report of 2017 was the highest, although the 2020 data from Tigray was not included, and the number of cases reported in this year is the least. The highest peak of malaria cases was observed for all regions during the Spring (September to December) Season and peak in October. The second transmission season after little rain in April to June, with a rise in June. Malaria is an important public health problem in the study area, with a predominance of P. falciparum and p. Vivax infection. It could be an important indicator for malaria burden in the study area, which seems to need due attention concerning malaria intervention during this critical period of the national striving towards malaria elimination in 2030. The reported clinical malaria case is still high during the past five years in different regions. Somali and Gambella were the two far high clinical malaria reporting regions followed by Oromia and Benishangul–Gumuz regions. In recent years, the national clinical malaria trend (2020) still shows a very high report, mainly from Somalia Region. Generally, the burden of malaria is still high even though the country is struggling for an elimination target in 2030.

## Recommendations

- Useful personal characteristics like age, sex, and pregnancy-related indicators need to be included in the surveillance system.
- Ministry of Health and all concerned bodies should strengthen malaria control and prevention interventions and investments to realize malaria elimination.
- Strong emphasis should be given to malaria prevention and control at the country level and regional level, with an effort to avert the incidence of malaria in the study area; performance plans and achievements should be regularly and strictly reviewed and evaluated at each level.
- The report of Clinical malaria is still very high in some regions, so it's better if at least RDT is done for any suspected malaria cases at the health post level and microscopy at the health center/hospital level.
- The Regional health bureau and the district should plan to do further study to know the cause of high incidence of plasmodium P. falciparum malaria species, Malaria inpatient, and malaria case fatality (MCFR) rate for prevention and control of malaria.

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# Chapter Three- Evaluation of Surveillance System

## Evaluation of the Malaria Surveillance System in Gambella Region, Gambella Zuria Woreda, Western Ethiopia, January 2022


## Abstract

**Background:** Surveillance is the ongoing, systematic collection, analysis, and interpretation of data, with prompt dissemination to those who need to know in order to take appropriate action. Malaria is a highly contagious febrile illness caused by Plasmodium parasites. There were an estimated 229 million cases of malaria worldwide in 2019. The African Region of the WHO bears a disproportionately large share of the global malaria burden. In 2019, the region accounted for 94% of malaria cases and deaths. A malaria surveillance system consists of the people, procedures, tools, and structures required to collect data on malaria cases and deaths. The evaluation of surveillance systems should promote the best use of public health resources by ensuring that only important problems are monitored and that surveillance systems are properly maintained.

**Objective:** To evaluate the malaria surveillance system in Gambella Zuria District, Gambella Region, South East Ethiopia, 2014.

**Method**: We used a cross-sectional, descriptive research design. Structured questionnaires used to collect information, as well as surveillance documents. The study area was chosen with the Ethiopian Public Health Institute's (EPHI) interest in the need for surveillance system evaluation of the district health office and health facilities in Gambella Zuria woreda in mind, and study units were chosen using simple random sampling. The woreda health office, two health centers, and five health posts provided data. Tables and narration were used to present the results of descriptive statistics.

**Result**: Most health facilities have surveillance guidelines for detecting malaria cases, but standard case definitions are not posted. During the last six months of the period, there was a dearth of weekly reporting formats. Only the zonal health bureau analyses data by time, Place, and person. Of the visited sites only woreda health office had written epidemic preparedness and response plans in place for priority diseases. 75% of PHEM focal persons had received training in surveillance and epidemic management. Supportive supervision is scheduled at all visited sites to supervise the lower levels, but it is not done on a regular basis. Although feedback was provided, it was not always provided on time.



**Key words**: surveillance, Gambella, Ethiopia

## Introduction

### Background

Public health surveillance the on-going, systematic collection, analysis, interpretation, and dissemination of data about a health-related event for use in public health action to reduce morbidity and mortality and improve health.(1)

In 2019, an estimated 227 million malaria cases were reported in 85 malaria-endemic countries worldwide (including the territory of French Guiana). The expected number of malaria cases grew to 241 million cases in 2020, one year after the COVID-19 epidemic and service delays, an increase of 14 million cases over 2019. The WHO African Region accounted for the majority of the increase in case numbers in 2020. This situation exemplifies the repercussions of even minor service disruptions. In a population at risk that is quickly growing, nearly doubling in Sub-Saharan Africa since the turn of the century.(2)

The trajectory in malaria case incidence, which fell from 81 per 1000 people at risk in 2000 to 56 in 2019, before rising slightly to 59 in 2020 - a 5% increase. Despite the rise in cases, the findings imply that governments' and partners' efforts have prevented the worst-case scenario predicted at the outset of the pandemic.(2)

Ethiopia is one of the malaria-endemic countries in Sub-Saharan Africa, with malaria affecting 75 % of the landmass and 60 % of the population. Malaria is a major public health issue in Ethiopia, despite the country's low malaria prevalence when compared to other African countries. In most places of the country, it is only available during certain times of the year and a large expansion of malaria control interventions, such as case diagnosis and treatment. Indoor residual treatment, distribution of long-lasting insecticidal nets (LLINs), and treatment Insecticide spraying of households (IRS) has mostly targeted these households' areas, according to the 2015 Ethiopian National Malaria Indicator Survey (EMIS). By rapid diagnostic test (RDT), the malaria prevalence was 1.2% and 0.5 % respectively. (3)

The transformation of malaria monitoring into a key intervention is the third pillar of the worldwide technological strategy for malaria 2016–2030. This entails the construction of optimally performing passive case detection systems that are supplemented in the elimination process to ensure that possibly all malaria cases are detected in situations with active case detection. Effective malaria case and death surveillance is critical for determining which areas or population groups are most affected by the disease and directing resources to the most

vulnerable communities. As a result of this surveillance, ministries of health are alerted of epidemics, allowing control measures to be ramped up as needed.(4)

The data from monitoring systems is then used to improve the system and impact of measures to hasten elimination and, eventually, elimination ensure that the communication has been interrupted. The surveillance system has uncovered cases and deaths. The majority of the data reported by countries comes from the public health sector. The transformation of malaria monitoring into a key intervention is the third pillar of the worldwide technological strategy for malaria 2016–2030. This entails the construction of optimally performing passive case detection systems that are supplemented, in the elimination process.(5)

Disease surveillance necessitates epidemiological, statistical, and computer abilities, as well as experience in monitoring and assessment at the district and higher levels. In order to conserve money and make better use of health professionals' time, it's usually a good idea to combine malaria surveillance training with other training activities. When possible, malaria surveillance training should be delivered concurrently with HMIS or malaria case management training, particularly in the application of diagnostic testing. (6)

## The evaluation's justification

Effective malaria surveillance is critical for determining which areas or population groups are most afflicted, as well as directing resources to the most vulnerable communities.

The evaluation of a surveillance system encourages the most efficient use of data collecting resources while also ensuring that systems function properly. The evaluation of surveillance systems allows us to determine whether a system is appropriate for a certain public health endeavour and whether it is meeting the program's overarching goals and data gathering objectives.(3) Furthermore, a review of the malaria surveillance system may help to improve the information provided, ensuring that malaria is successfully and efficiently monitored.

## Objectives

### General objective

- To evaluate the malaria surveillance system in Gambella Zuria District, Gambella Region, South East Ethiopia, 2014.

### Specific Objectives

- To assess core surveillance activities such as: case detection, reporting, analysis, and response in Gambella Woreda, Gambella region
- To describe the malaria surveillance system in Gambella district
- Identifying gaps in the malaria surveillance system and recommending improvements.

# Methods

## Study design and setting

From November 10 to 25, 2021, a facility-based cross-sectional study was done in Gambella District, which is one of the most malarious districts in Gambella Region. Gambella district is divided into 13 kebeles for administrative purposes (2 urban and 10 rural kebeles). The district's catchment population was 17,716 people, and all of the kebeles are malarious. There are two health centers, 13 health posts, and three private health facilities in the district.

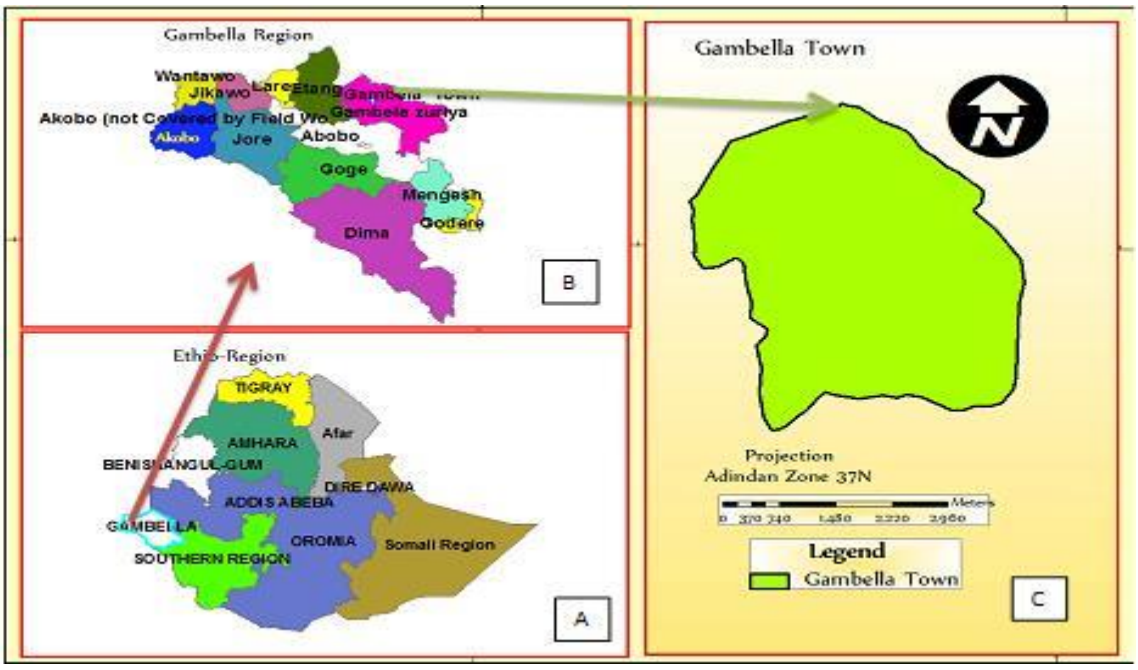


*Figure 28: Map of Study Area (Gambella Zuria district) 2021*

### Study population and selection

The study's subjects were government-run health care facilities. Gambella District was chosen purposively because of the high prevalence of malaria in the area with the interest of the Ethiopian public health institute (EPHI) for the need for surveillance system evaluation. This study includes the available two health centers, and 5 randomly selected health posts, and the district health office.

### Study units

District health offices and public health facilities (health clinics and health posts) in Gambella zuria Woreda served as study units.

**Data Extraction and management**

The information was gathered through document analysis and face-to-face interviews utilizing checklists derived from the Centers for Disease Control and Prevention's new recommendations for evaluating public health surveillance systems. The information was gathered and entered into an Excel spread sheet**.**

**Analysis Tools**

Microsoft Excel software was used for quantitative data entry and analysis.

**Dissemination of findings**

The findings were distributed to all relevant parties, including the AAU department of Public Health, the Gambella Regional Health Bureau, the Gambella Zuria District Health Bureau, and health facilities. It will also be presented at various meetings and conferences. Finally, the investigator will prepare and submit the manuscript for publication.

**Ethical consideration**

Addis Ababa University, the Ethiopian Public Health Institute, the Gambella Region, and the Gambella Zuria Woreda Health Office all provided legal letters. The health facilities gave their permission.

**Operational Definitions**

**Case detection**: is the process of identifying cases and outbreaks.

**Case registration**: is the process of recording the identified cases.

**Case/outbreak**: Confirmation: refers to the epidemiological and laboratory capacity for confirmation.

**Reporting**: Refers to the process by which surveillance data moves through the surveillance system from the point of generation.

**Epidemic preparedness**: Refers to the existing level of preparedness for potential epidemics.

**Stakeholders**: The organizations or individuals that generate or use surveillance data for promotion of health, prevention and control of diseases.

**Usefulness:** Relevance of the system in terms of feeding information for action.

**Simplicity**: Simple to set up and run as a surveillance system.

**Flexibility**: capacity to adapt to changing information needs or operating systems with minimal additional time, personnel, and funding.

**Data quality:** The completeness, timeliness, and validity of surveillance data determine its quality and simple and easy way to assess is to look for the percentage of "unknown" or "blank" responses on surveillance forms.

**Stability:** The reliability and availability of the public health surveillance system.

**Acceptability**: The willingness of individuals and institutions to participate in the surveillance system.

**Sensitivity**: The capacity of the system to detect true cases or outbreaks through trends in the surveillance data.

**Representativeness:** The ability of the system to describe health events accurately in terms of time, place and person.

**Timeliness:** The ability of the system to trigger appropriate action in time.

**Completeness:** The proportion of all expected data reports that were submitted to public health surveillance.

## Results

For this surveillance system evaluation, a total of seven health institutions were evaluated. The woreda health office, two health centers, and five health posts are included. Gambella Zuria Woreda is home to all of the selected health institutes.

**Participation of Stakeholders in the Evaluation System**

Prior to evaluating the surveillance system, discussion was held with the Regional Public Health Emergency case team on how to select sites. It is well known that stakeholders can provide input to ensure that the evaluation of a public health surveillance system addresses relevant questions and assesses relevant attributes, resulting in more acceptable and useful findings.

**Malaria surveillance system description**

Effective surveillance of malaria cases and deaths is critical for determining which areas or population groups are most affected by malaria and directing resources to the most vulnerable communities. This type of surveillance also alerts ministries of health to epidemics, allowing control measures to be stepped up when necessary.(4)

Although malaria is among the major public health problems of the priority diseases under surveillance in Ethiopia, for a variety of reasons, surveillance systems do not detect all malaria cases. First, not all malaria patients seek treatment, and even if they do, they may not seek treatment at health facilities covered by a country's surveillance system. Second, not all patients seeking medical attention are given a diagnostic test. Finally, the surveillance system's recording and reporting are not always complete.

**Description of the Public Health Importance and over view of Malaria Surveillance**

It is obvious that surveillance cannot be conducted for all diseases and conditions. As a result, priority should be given to diseases that are of national and international interest. This surveillance evaluation attempted to assess diseases in our region that have the potential to become epidemics**.**

Public Health Emergency Management is intended to ensure rapid detection of any public health threats, logistical and financial preparedness, and prompt response to and recovery from various public health emergencies.

## Population under Surveillance

All of the people in the selected health facilities were under surveillance. Through a health extension program, the community was involved in the surveillance system and disease detection.

*Table 19: Gambella zuria woreda Health office Total Population*

| S. N | Kebele | Male | Female | Total |
|---|---|---|---|---|
| 1 | Abol town | 763 | 795 | 1558 |
| 2 | Abolkir | 483 | 502 | 985 |
| 3 | Pimoli | 480 | 499 | 979 |
| 4 | Gnikow | 1022 | 1063 | 2085 |
| 5 | Pinykew | 1294 | 1346 | 2640 |
| 6 | Upagna | 652 | 679 | 1331 |
| 7 | Pugang | 210 | 218 | 428 |
| 8 | Solan | 138 | 144 | 282 |
| 9 | E/Echwey | 739 | 770 | 1509 |
| 10 | Jawi | 181 | 189 | 370 |
| 11 | Bonga | 969 | 1009 | 1978 |
| 12 | Kobon | 719 | 749 | 1468 |
| 13 | Siri Majang | 1030 | 1073 | 2103 |
| | Total | 8680 | 9036 | 17,716 |

## Core surveillance activities

### Case Detection

The standard case definition of malaria was available in all health facilities visited. They wanted to emphasize that they need the standard case definition although they had the guidelines. Furthermore, except at the hospital, the line list was not present at all of the sites visited. Surveillance guidelines for the detection of malaria cases are in place in 75 percent of health facilities.

### Case Registration

The clinical registration log book correctly recorded identified malaria cases, and monthly reports of cases submitted to the next level coincided with the clinical register log book.

**Data Reporting**

There were no private or NGO health facilities reporting to the woreda PHEM; only public health facilities did. For health facilities, the reporting rate in the previous 12 months was 100%. On time, reports were sent to the next level via paper, phone, and mobile texting.

**Case Confirmation**

All health centers visited have the ability to confirm cases through smear microscopy and RDT at Health posts. This can be explained by the fact that both health centers and health posts have trained personnel.

## Materials required for a malaria surveillance system

At the district, there were resources for data management, communication, and logistics. The necessary registers and report formats were available in all of the district's health facilities. Only two (50%) of the health centers, one health post, and the district health office had a rumour log, and none of the health facilities had an emergency response and preparedness plan. RRT was implemented in both health centers and the district health office. However, none of the previously established RRTs were operational. All surveillance focal points who worked in health centers were integrated into another department and they are full time workers.

*Table 20: Number of health facilities that had necessary materials for malaria surveillance in Gambella Zuria Woreda, Western Ethiopia 2014 EFY*

| Materials | *Health centers N=2* | Health post N=7 | District Health office N=1 |
|---|---|---|---|
| HFs that had the national/Regional PHEM guideline | *2* | 4 | 1 |
| HFs that had the national malaria guide line | *2* | 0 | 1 |
| HFs that had standard case definition | *2* | 5 | 1 |
| HFs that posted the case definition | *2* | 4 | 1 |
| HFs that had rumour log book | *1* | 1 | 1 |
| HFs that had OPD/IPD register | *2* | 5 | NA |
| HFs that had epidemic report form | *2* | 1 | 1 |
| HFs that had Case based reporting forma | *2* | 0 | 1 |
| HFs that had functional computer | *2* | 0 | 1 |
| HFs that had Microscope | *2* | 0 | NA |
| HFs that had RDT | *2* | 7 | NA |

| | | | |
|---|---|---|---|
| HFs that had emergency response & preparedness plan | *0* | 0 | 0 |
| HFs that had established rapid response team (RRT | *2* | 0 | 1 |
| HFs that had functional rapid response team (RRT) | *1* | 0 | 1 |

HFs – Health facilities NA- Non-Applicable

*Table 21: The presence of resources for PHEM activities (at all visited sites) in Gambella Zuria woreda, Gambella Region West Ethiopia*

| S. No | Materials/Items | Woreda (N=1) | HCs (N=3) | HPs (N=2) | Total |
|---|---|---|---|---|---|
| 1 | **Electricity** | 100% | 100% | 50% | 83.30% |
| 2 | **Bicycles** | 0% | 0% | 0% | 0% |
| 3 | **Motor cycle** | 100% | 100% | 0% | 66.70% |
| 4 | **Vehicle** | 100% | 0% | 0% | 33% |
| 5 | **Computer** | 100% | 67% | 0% | 55.60% |
| 6 | **Printer** | 100% | 100% | 0% | 66.70% |
| 7 | **Fax** | 0% | 0% | 0% | 0% |
| 8 | **Telephone** | 100% | 100% | 0% | 66.70% |
| 9 | **Internet service** | 100% | 0% | 0% | 33% |

## Surveillance system operations and reporting

Surveillance data is typically transferred from one reporting location to the next, all the way up to the national level. The primary sources of information about the occurrence of health-related events are the community and health facilities at the lowest level, particularly health posts.

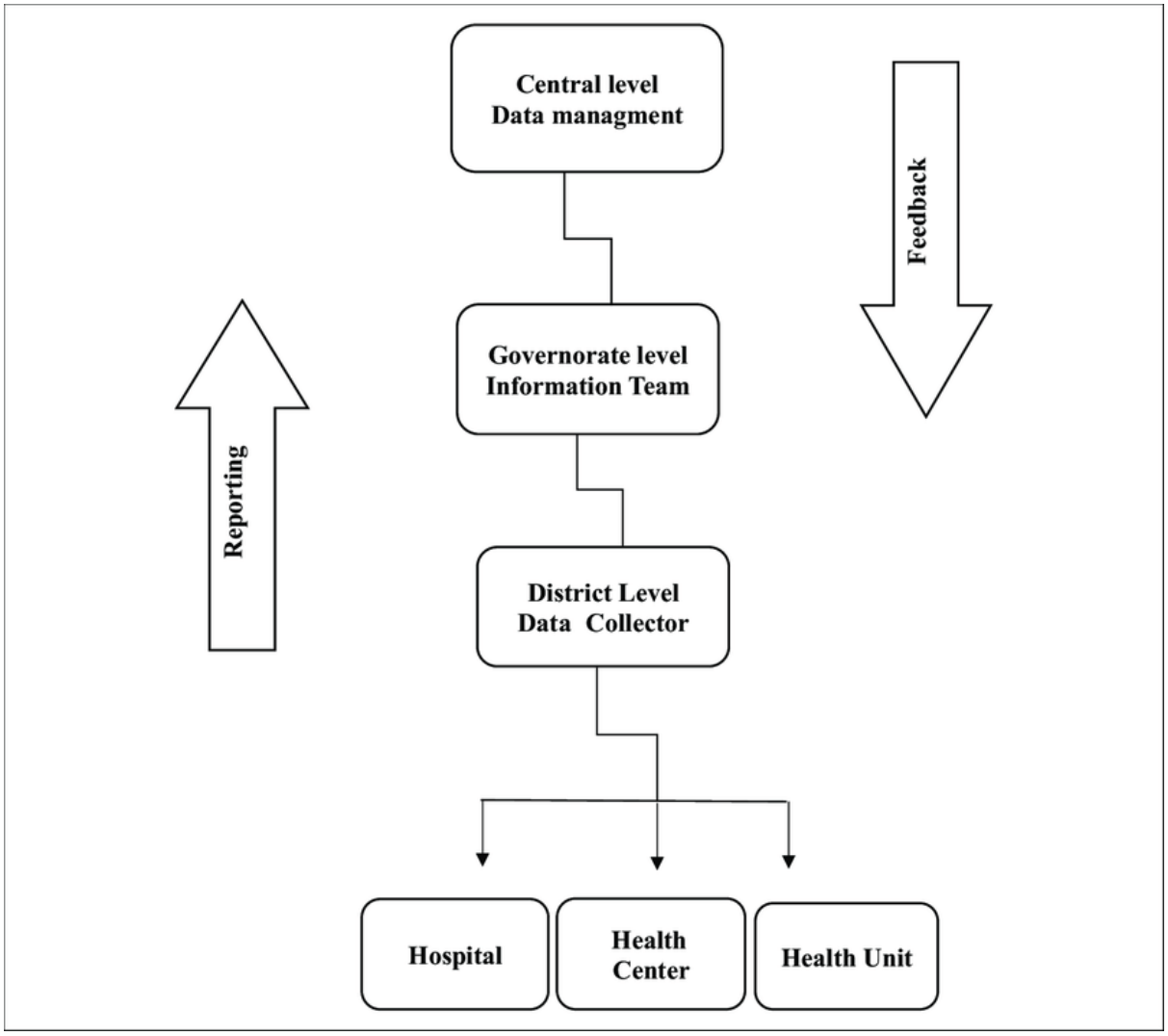


Figure 29: Flowchart of surveillance data and information sharing

**Data analysis and interpretation**

The PHEM officer at the district level was trained in basic surveillance data analysis, but the focal persons and health extensions received no training in this area. The data analysis at the district level was done through cluster level disaggregation. There was no emergency response or preparedness plan in place at any level. Epidemic management committees or rapid response teams (RRT) were formed at the health centre and district health office levels from various disciplines, but there was no evidence that the committees were functional. All health facilities are lacking in trained personnel for epidemic investigation and management, as well as an active rapid response committee. A weekly malaria monitoring chart was available and used in every health facility and they are also performing trend data analysis by time and place.

## Training, supervision, and feedback

Training refers to the need for capacity building to improve the surveillance system's quality through knowledge and skill transfer. Prior to being assigned as a PHEM focal person, 75 percent of those polled had received training in surveillance and epidemic management. Regardless of those focal points, health facilities (health centers and health posts) and woredas responded that all staff working on surveillance units received a brief orientation to the surveillance system at each level. However, disease surveillance and malaria-trained personnel experience a high turnover rate.

There was a plan in place for supervision at all levels. However, supervisors from the district health office only visited each health facility twice. However, there was no documented evidence of feedback provision from the District Health Office to health facilities or from health centers to health posts on the malaria surveillance system. Except for the District PHEM office, no health workers at the health facility level were trained on the surveillance system.

## Epidemic Preparedness and Response

In the previous year, there was a malaria outbreak at Woreda and other health facilities in the district. During the COVID-19 outbreak, all epidemic preparedness and response teams were activated. Only Woreda PHEM had a written epidemic preparedness and response plan. However, the availability of emergency drugs and supplies was unknown to woreda PHEM officers and health center surveillance focal persons. All evaluated health facilities established an epidemic preparedness and response plan for priority diseases. They had an epidemic management committee, similar to an RRT, and a task force in their area, as evidenced by minutes taken during the visit. Woreda's health office and health facilities did not have an outbreak management budget line. There was available budget for epidemic response in the assessed health facilities; however, in the event of an emergency, the Region mobilizes budgets for response activity.

## The laboratory's function

Malaria testing is available at both health centers and the 13 health posts. The laboratories in health centers were outfitted with a microscope, and the health posts used RDT to diagnose malaria.

## Attributes of Surveillance system

Malaria surveillance is integrated with all other priority diseases and includes laboratory support as well as passive surveillance that become active during outbreaks. The usefulness, simplicity, flexibility, data quality, sensitivity, acceptability, timeliness, stability, and representativeness of the surveillance system were all evaluated.

### A. Usefulness

The data from the malaria surveillance system was analysed and interpreted by cluster rather than kebele at the district level. However, there was no evidence that this data analysis and interpretation resulted in any actions. Malaria surveillance data analysis and interpretation were limited at the health center and health post levels, with no evidence for using the data to make decisions and take actions. This suggests that the malaria surveillance system was ineffective in the district. Despite this, all respondents believe that the surveillance system aids in the timely detection of an epidemic of a specific disease, estimating the magnitude of morbidity and mortality, as well as factors associated with those diseases, and allowing assessment of the prevention and control program.

### B. Simplicity

Case definition was used to identify cases, which were then confirmed at the health facility level using RDT and microscopy. The system's structure and ease of implementation make it simple to set up and run as a surveillance system. Although the forms are simple to fill out, data is sent in hard copies to all levels, with delays at each level, making timely surveillance data difficult to obtain. Furthermore, manual data entry of reports from multiple registers at the health facility level and multiple reporting sources at the district level, as well as the use of multiple forms for reporting, complicates the malaria surveillance system.

### C. Flexibility

The eHMIS reporting format is less flexible at the district and health facility levels for accommodating changes when additional information or modes of operation are required. however, the PHEM weekly report format can be easily modified to include other variables to report other newly occurring health events. In general, the malaria surveillance system is adaptable and capable of accommodating changes when additional information on malaria forms is required. However, the system is heavily reliant on donors, and the loss of funding and support is a concern for its long-term viability.

## D. Data Quality

Data quality reflects the completeness and validity of data recorded in the public health surveillance system, which is the amount of unknown or blank responses on weekly reporting formats filled or not reflects data quality. Copies of weekly reports obtained from visited sites indicates that, the reporting format at some health facilities and health offices lacks a number of weekly reporting facilities, and critical factors such as age and gender are omitted from the weekly reporting forms. The main reasons were a lack of experience or a failure to recognize the significance of some of the variables. Furthermore, data and feedback were not cross-checked on a regular basis.

### D. Acceptability

The vast majority of participants stated that they believed the reports were accepted by agents and that they were actively involved in surveillance operations. One of them, however, admitted that there was a lack of input from higher bodies, as well as a lack of awareness of the importance of the data that needed to be collected and transmitted. We discovered that several reports were missing information, such as blank fields. The reported health facilities did not receive timely input from the Zonal level.

### E. Sensitivity

We defined sensitivity as the surveillance system's ability to accurately detect cases of malaria in the district (sensitivity = cases detected/cases existing 100). Independently, the sensitivity of the malaria surveillance system in detecting cases and outbreaks was investigated.

### F. Timeliness

The timeliness and completeness of health post reports at the health center level were difficult to measure because the date of receipt of the report was not recorded, and there was no way of measuring the following timeliness and completeness. The increased use of telephone data collection from reporting sources and telephone data interchange by surveillance systems may contribute to improved timeliness. Depending on the type of health-related event being tracked, the most appropriate time interval may differ. The Gambella Zuria district's weekly report timeliness to the Gambella Region was 100 percent. Moreover, during the assessment week, the timeliness rate was 95 percent. The assessed areas' weekly reporting rate (completeness) was 97 percent. The average zone completeness of the reporting sites delivered to the woreda was 98 percent.

### G. Stability

Based on the availability of a standard reporting format at the region, zone, woreda, and health facility levels, the surveillance system was stable. Furthermore, the malaria system is easily integrated with other diseases. The surveillance system in the visited woreda health office and health center was capable of collecting, managing, and providing data without fail. The availability of PHEM focal persons at the Sub City and woreda levels provides an excellent opportunity for running a surveillance system with limited resources. The greatest challenge in health centers, however, was the high turnover of focal persons. As a result, there were delays in data collection and reporting to the next level. Budget and logistics constraints are impeding supervision and capacity building activities at the Sub City and woreda levels. However, supportive supervision was carried out in conjunction with the integration of other programs. Despite the fact that many woredas' PHEM units lacked data management resources such as computers and printers, they relied on other departments' resources for data entry, compilation, analysis, and dissemination. Approximately 55% of respondents reported that the surveillance system was not fully operational for some time due to a lack of resources such as computer, electricity, and transportation shortages.

### H. Representativeness

A representative public health surveillance system accurately describes the occurrence of a health-related event over time as well as its distribution in the population by place and person. The representativeness of the routine surveillance report indicates how far the health service delivery system covers the report and how many facilities report to the offices. The representativeness of the surveillance system was determined by health-care coverage and disease-related health-seeking behaviour. The community's health seeking behaviour has improved as a result of development armies' involvement with HEWs in raising awareness, according to 96 percent of all study participants. All malaria surveillance data were reported from all government health facilities in the district, which has 96% primary health care coverage. As a result, the information obtained from this surveillance system is representative

## Discussion

The evaluation of a public health surveillance system focuses on how well the system performs in terms of meeting its purpose and objectives.(7) All of the interviewees agreed that early detection of disease under surveillance is beneficial. The value of a public health surveillance system in ensuring population health cannot be overstated. As a result, in order to improve early detection and response to public health threats, the system should be evaluated on a regular basis. Depending on the disease type, surveillance data was collected weekly and/or on an as-needed basis. In order to detect cases quickly and take appropriate action, it is critical to have a standard case definition for priority diseases.(8)

Most health facilities have surveillance guidelines for the detection of malaria cases, but they are out of date, which may result in case mismanagement.(7) Malaria cases were correctly documented in the clinical registration log book. During the last six months of the period, however, both health facilities and the woreda health bureau experienced a lack of weekly reporting formats. This could be due to a lack of planning or a delay in requesting the report format from the appropriate entity.

According to data quality monitoring and surveillance system evaluation, the data reporting flow from the lower to the upper levels is well organized, with unidirectional data flow and clear roles and responsibilities for each reporting entity.(9) However, there are a number of challenges, such as a lack of computers for data management and analysis in the reporting process. Furthermore, the reporting entities were only public health facilities; there were no private or non-governmental health facilities that reported to the woreda PHEM, which contradicts the FDRE's policy. However, all governmental health facilities should report any examined cases discovered on their premises, as this can aid in deducing information about the woreda. The percentage of completed reports from the total number of reports was 95%, which met the country's national target. (10)

Complete data aids in the analysis of various variables that are critical for monitoring and evaluating the surveillance system. Data is analysed by time, place, and person by both the zonal health bureau and the district. This may contribute to the ease with which an outbreak can be identified quickly and efficiently. There was a skill gap in the data management system, a weak supervision and feedback system, little or no legal enforcement of surveillance activities, a lack of incentives, a lack of on-going capacity-building training, and a lack of a sense of ownership.

In the Gambella Zuria Woreda health office, there is no specific budget line for epidemic preparedness and response, zonal health departments, or health facilities. In the event of an emergency, the woreda and zonal PHEM mobilize budget for response activity in collaboration with the regional health bureau. Before being assigned as a PHEM focal person, 75% of the staff had received training in surveillance and epidemic management, and the rest had received short-term orientation. However, due to high turnover among disease surveillance and malaria-trained personnel, the number was reduced.

Although all surveillance unit staff had received short-term training, 75% of PHEM focal persons had received surveillance and epidemic management training. Despite the fact that disease surveillance and malaria-trained workers were in short supply. Supportive supervision is scheduled at all visited sites to supervise the lower levels, but it is not done on a regular basis. Although feedback was provided, it was not always provided on time. There was a lack of resources and logistics in all visited sites, such as computers, internet access, phones, and vehicles, which could make the surveillance system, run smoothly and efficiently.

A public health surveillance system is useful if it contributes to the prevention and control of adverse health-related events as a result of evidence based decision making.(11) The analysis and interpretation of data from the malaria surveillance system, as well as the use of information for decision making, were, however, limited to the Gambella Zuria District. This demonstrates how ineffective the district's malaria surveillance system is. Usefulness may be influenced by the other features of a public health surveillance system.

Increased sensitivity may provide a better opportunity for identifying outbreaks and understanding the natural course of a negative health-related event in the population under surveillance; improved timeliness allows control and prevention activities to begin earlier; and increased predictive value. A representative surveillance system will better characterize the epidemiologic characteristics of a health-related event in a defined population, allowing public health officials to more accurately focus resources for control and prevention measures.(11)

Sustained supervision was organized at all of the visited sites to supervise the lowest levels. The majority of participants, on the other hand, did not receive regular supportive supervision; instead, supportive supervision was provided as needed. Feedback was sent to those supervised sites, but it was not always provided on time. Having a trained staff, conducting regular supervision, and providing timely feedback can allow the system to demonstrate visible progress or strengthen surveillance.

The overall performance of the surveillance system, however, may be hampered by a lack of feedback, supervision, and training. The performance of screening and diagnostic tests for the health-related event, the clarity of hard copy or electronic surveillance forms, the quality of training and supervision of persons who complete these surveillance forms, and the care exercised in data management all have an impact on data quality. A look at these aspects of a public health surveillance system can provide an indirect measure of data quality. Acceptability is a highly subjective characteristic that encompasses the willingness of those on whom the public health surveillance system relies to provide accurate, consistent, complete, and timely data.

## Conclusion

The malaria surveillance system in the Gambella Zuria District was inadequate. The malaria surveillance system had limited utility. Overall, the malaria incidence was moderate. The analysis, interpretation, and utilization of surveillance data for evidence-based decision making were limited.

Surveillance systems enable early detection of diseases and outbreaks, as well as timely response to cases or events. Most health facilities (Health Centres) have surveillance guidelines for detecting malaria cases, but standard case definitions are not posted. The identified malaria cases were successfully recorded in the clinical registration log book. During the last six months of the period, there was a scarcity of weekly reporting formats. Only the zonal health bureau analyses data by time, location, and individual. In the woreda, there was no separate budget line for emergency preparedness and response. When an emergency occurred, the woreda and zonal PHEM mobilized funds for emergency response in collaboration with the regional health bureau. Only Woreda Health offices of the sites visited had written information about epidemic preparedness.

## Strength and Limitation

**Strength**

- ✓ All PHEM officers and focal persons interviewed were cooperative in this system evaluation;

**Study limitations**

- ✓ In some health facilities, the surveillance/PHEM system was not fully operational.
- ✓ Information is difficult to obtain due to the high turnover of professionals.

## Recommendations

- The district health office is expected to improve the malaria surveillance system by increasing the use of insecticide-treated nets, case detection, and surveillance data analysis, interpretation, data, and application.
- At all levels, an emergency preparedness and response team should be established.
- In terms of preparedness and response to health-related events, all rapid response teams in visited facilities and woredas should be alerted at all times.
- The zonal health bureau should provide sufficient weekly reporting formats as well as updated manuals for both health facilities and the woreda health bureau.
- The zonal health bureau should provide stationery and materials such as computers, electricity, and wired phones to at least one health center.
- It is also important to conduct additional research to identify factors associated with malaria case detection and the use of insecticide-treated nets.
- A budget for surveillance activities at all levels of health care should be secured/allocated.

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# Chapter four – Description of Health Profile Assessment

## Health Profile Description Report of Bosat District, East Shewa Oromia Regional State, Ethiopia 2020.


### Abstract

**Background**: A community health profile comprises indicators of socio demographic characteristics, health status and quality of life, health risk factors, and health resources relevant for most communities; these indicators provide basic descriptive information that10can inform priority setting and interpretation of data on specific health issues. As evidenced from the East Shewa Zonal Health office report, there was no health profiled description done in recent five years for Bosat district. The main aim of this study was to assess & describe health and health-related data of Bosat district Oromia regional state, Ethiopia 2020.

**Methods**: A descriptive cross-sectional study design was conducted in the Bosat district from May3-20/2021. From July 8, 2019, to July 7, 2020, health and health-related data was collected and reviewed from district health information 2 (DHIS2), reports at the district health office, and other relevant sectors. After checked for completeness, data were described using Excel 2010 software.

**Result**: The district's total population was 202,666, of which males account for 51% with 1:1.1 ratios with females. The highest population group was the 15-64 age group. The proportion of women receiving ANC1 was 5078 (72.2%), and ANC4 was 3238 (40%). About 40% of pregnant women have attended skilled delivery at a health facility. In Bosat District, only 67% have latrine out of which 40% of them are improved. AURTI is the leading cause of morbidity in Adults and Diarrhea in children. TB case detection rate was very low which only 56.7%.

**Conclusion and Recommendation**: There was a low performance of MCH indicators like SBA, early PNC, GMP, which plays a significant role in reducing maternal and child mortality. The coverage of improved latrine and TB detection rate was low. Generally, there was a huge gap in overall health package implementation which requires exhaustive endeavors to bring back to track by the district health office. All government sectors and stakeholders in the district should focus on implementing communicable and non-communicable diseases prevention and control service protocol.



Key Words**:** Health profile, Bosat district, East Shewa, Oromia regional state.

# Introduction

## Background

A health profile description report compiles all of the available data in one location. It includes information on several population indicators for the local community. A CHP is a public health report that compiles important data on health and its determinants in the city and then interprets and evaluates the data. It is intended as 'conversation starters' to highlight local issues and priorities for members and discuss Health and Well-being Boards. The health profile is intended to be a set of indicators of basic demographic and socio-economic characteristics, health status, health risk factors, and health resource use, which are relevant to most communities. Community profiling is used to identify the strengths, weaknesses, needs, and problems of a community, make decisions about health services and justify resource allocation. (1). A good profile describes a city and factors affecting its' citizens health through they can easily understand. It gives a focus on community participation and political support (2).

Health profile includes both indicators and other health-related measures with an analysis of information by writing and graphing health problems with their potential solutions. It helps areas in many ways; cement alliance for health, high lights health problems, and partners to find solutions. The presentation of profiles can stimulate public and media interest to improve general understanding of health issues (2).

Our country's health profiles provide an overview of the situation and trends of priority health problems and the health systems profile, including a description of institutional frameworks, trends in the national response, key issues, and challenges. They promote evidence-based health policymaking through a comprehensive and rigorous analysis of the dynamics of the health situation and health system in the country (3). National Health Profile (NHP), published annually since 2018, brings together all health-related information in a single platform. It has six chapters covering Demographic, Socioeconomic, Health Status and Health Finance Indicators, Human Resources in Health Sector, and Health Infrastructure. Importantly, it is a major source of information on various communicable and non-communicable diseases not covered under any other major programs (4). Component of the framework used for the profile, wellbeing, health condition, health behavior, accessibility, appropriate, effectiveness, safety, and environmental factors. Health Profile is now an established part of planning for health improvement. Data was collected, analyzed, and disseminated for decisions on the best information available (5).

The main aim of this assessment is to describe health. Health-related issues in the Bosat district (woreda) and communication of the local burden of morbidity, mortality, any disaster, and other public health-related information. It is a very important document to be utilized by any stakeholders in general and public health professionals in specific.

In the previous time in Bosat woreda health office, the health profile description was not prepared. The health status of the woreda was not documented and known in compiled and organized way. So, this health profile describes the health and health-related information of Bosat woreda, of East Shewa zone of Oromia regional state. It encompasses compilation and interpretation of Demographic, Education and services like: water, Transport, economy, Agricultural information ‘s and also health status information of the woreda on the perspective of health. It gives health and health-related information to stakeholders and different actors involved in the health system.

## Rationale of the Study

Health profile description enables us to identify and prioritize health and health-related problems of the community at any level of the health system. Describing the health profile of the district is helpful to address the current challenge of community health and many aspects of the community's life that influence it for stakeholders of health and health-related issues priority setting. It is important to understand the determinants of health in terms of socio-demographic characteristics, availability of infrastructure, human resource, health service scanning of the health system, problem identification, prioritization of identified problems by using prioritization criteria; public health importance, the magnitude of the problem, severity of the problem, community and political concern and feasibility of the interventions. The appropriate attention to preventing disease and injury and the provision of high-quality health care is crucial for accessible and affordable health care services. Therefore, the description of the health profile in the sub city is help to increase understanding of the current health care service quality and provide evidence-based information for prioritizing and instituting appropriate public health interventions for public health planning and decision-making. Health Profiles aim to help local authorities produce their local community plans. Health Profiles can also be used to enable Health and Wellbeing Boards to identify their priorities for action.

## Objectives

### General Objectives

- To describe health and health-related profile of Bosat district, East Shewa, Oromia State, Ethiopia 2020

### Specific Objectives

- To describe demographic characteristics of Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020
- To identify health and health-related problems of Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020
- To describe health service infrastructures in Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020
- To describe health care coverage for relevant public concern in Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020.
- To identify the morbidity/mortality status of the CDs in Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020.
- To identify the morbidity/mortality disease/illness Bosat District East Shewa Zone, Oromia regional state, Ethiopia 2020.
- To describe health sector budget of primary health care units in Bosat district, health office, East Shewa Zone, Oromia regional state.

## Method and Materials

### Study Area

The health profile assessment was conducted in Bosat District East Shewa Zone Oromia regional state, Ethiopia 2020.

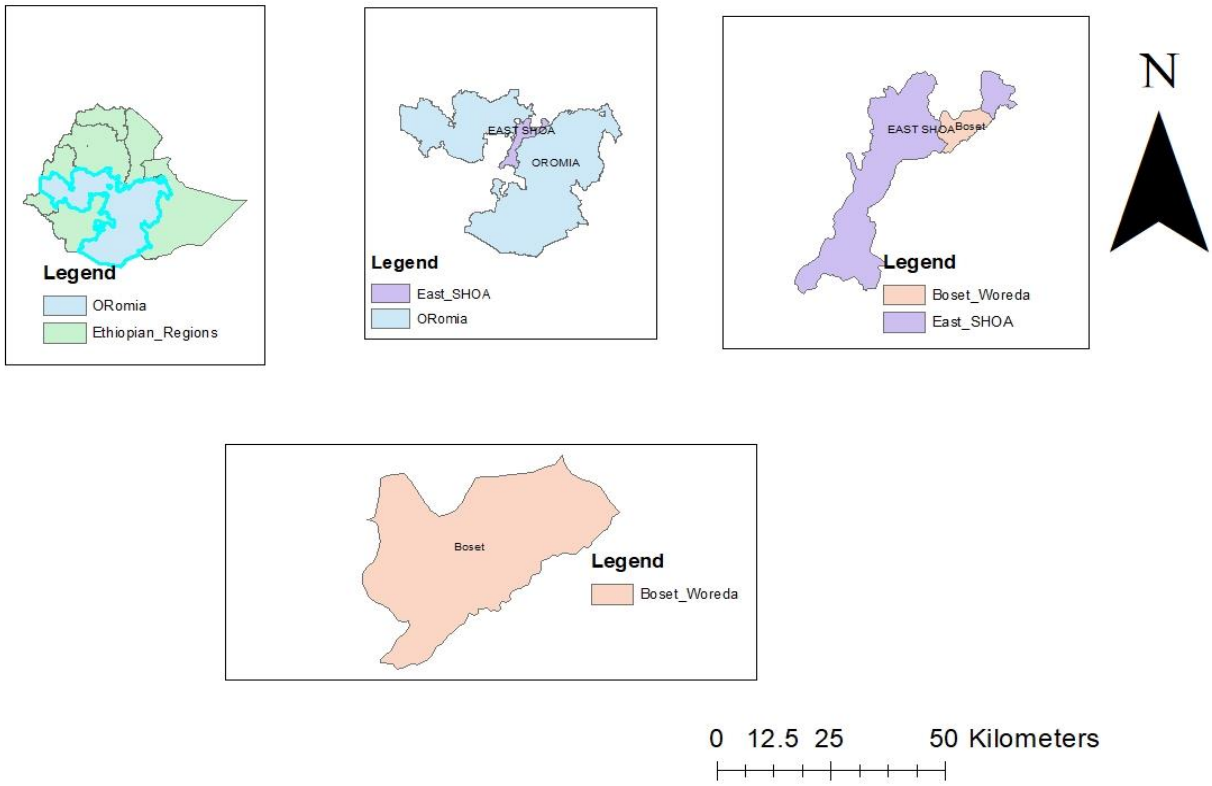


*Figure 30: Map of study area (Bosat District) 2021*

### Study period

This study was done from May 3- June 5 /2021.

### Study Design

A descriptive cross-sectional study was conducted to describe the health profile of the Bosat District East Shewa Zone Oromia regional state, Ethiopia.

## Variables

- Sex
- Age
- School coverage infrastructure accessibility
- Health Facility distribution
- Health worker availability
- Health budget allocation
- Causes of morbidity
- Immunization
- Contraceptive acceptance Rate
- Anti-natal care
- Postnatal care
- HIV prevalence
- TB prevalence
- Community

## Data Sources

All available secondary data (documents) that have relevant information for health profile was collected. The data source was the district health office, education sector, finance sector, water office, vital statistics office, and other sectors. Data was collected from the annual report and DHIS2 reports. National census 2007 and 2019/20 health indicators and research articles were reviewed as well. To develop this health profile, descriptive report data was collected and reviewed from the following district offices: -

- Health office,
- Administration office,
- Water bureau,
- Plan and Program Core Process
- Sector bureau
- Culture and tourism office
- Agriculture and rural development office,
- Education office,
- Bureau of Finance and Economic Development (BoFED)
- Health facilities, animal health office, and review of related literature conducted in the region

## Method of data collection

Data were collected by reviewing documents and interviewing key informants in different sectors' offices using an unstructured questionnaire. The unstructured questionnaire developed by the Ethiopian Field Epidemiology and Laboratory Training Program (EFELTP) was adopted to collect the district health profile. The interview was performed with the right officers from concerned offices based on the required data. Before collecting the data, the main investigator made brief discussions on the purpose and benefit of this work with Sub-city administrative, sub-city health office, and other concerned offices. Health and health-related data were collected using check list by principal investigator. The principal investigator was checked the collected data for completeness, accuracy, clarity and consistency throughout the data collection period in order to maintain the quality of the data.

## Data management

Health and Health-related data collected from the above organizations were entered, cleaned, and analyzed using Microsoft Excel 2010. The result is presented using tables, different figures, and charts.

## Dissemination and reporting of the findings

After the Health profile data description finalized, the report will be prepared and shared to AAU of Public Health, EPHI, ORHB, East Shewa zonal health department, Bosat Woreda Health office, and other relevant offices and also to Ethiopian field epidemiology training program in soft copy, and hard copy accordingly. The findings of the health profile description will be presented at different meetings and conferences.

## Ethical clearance:

The first official letter from AAU was given to EPHI. Then EPHI wrote a supportive letter to the Oromia region health bureau. Then ORHB wrote a supportive letter to the east Shewa health office. Finally, the zonal health office wrote a letter to Bosat woreda health office to accept the legality of the study. As this study uses secondary data, consent and other ethical measures are not applicable.

## Operational Definitions

**Demography:** The study of different population characteristics, including size, age structure, density, fertility, mortality, growth, and social and economic variables**.**

**ANC rate:** Proportion of Pregnant women attended, at least once during the current pregnancy, by a skilled health professional, for reasons related to pregnancy.

**Early ANC**: The proportion of women who received ANC before 16 weeks of Gestational age.

**Skilled delivery:** Proportion of deliveries attended by skilled health attendants; A skilled birth attendants an accredited health professional – such as a midwife, doctor, or nurse – who has been trained in the skills needed to manage normal (uncomplicated) pregnancies, childbirth, and the immediate postnatal period, and in the identification, management, and referral of complications in women and newborns.

**Clean and safe delivery**: Proportion of deliveries attended by HEWs.

**Postnatal care (PNC) coverage:** Proportion of women who seek care at least once during post-partum (42 days after delivery) from skilled health attendants including HEWs for reasons relating to post-partum.

**Fully immunized**: According to the guidelines developed by WHO, children are considered to have received all basic vaccinations when they have received a vaccination against tuberculosis (also known as BCG), three doses each of the DPT-HepB-Hib (also called pentavalent) vaccine, vaccines against polio, and vaccination against measles.

**Improved latrine**: a latrine having at least a hut, coverings over the opening of a pit, hand washing facility attached to it, and currently using it.

**Tuberculosis (TB) case detection rate**: Number of new smear-positive TB cases detected, among the new smear-positive TB cases estimated to occur in the woreda.

**Tuberculosis (TB) case detection rate**: Number of new smear-positive TB cases detected, among the new smear-positive TB cases estimated to occur in the woreda.

# Result

## Bosat Woreda Historical Aspects

Bosat Woreda was established in 1986 EC. The name was named after one of the most known mountains in Oromia called “Bosat,” found in the woreda and used as a tourist area. Before 1985 EC, it was under Adama Woreda as Bosat Kebele. In 1986 to make better for administrative purpose and sustainable development, the kebele Bosat was established as a woreda. The capital city of the woreda is ‘Walanciti”.

## Demography

The population of Bosat woreda is 202,666 in total. According to 2019/20 data, 104,862 (51.74%) of these were men and 96961 (47.2%) were women. The sex ratio of men to women was 1:1.1. According to the projected age breakdown of the district's population, infants under one year old make up 6525 (3.2%), children under five make up 33398 (16.47%), children under 15 make up 95251 (47%) and people over 65 make up 7295 (3.6%), while women between the ages of 15 and 49 make up 44664 (22%) and women who are pregnant make up 7033. 30933 (or 15.7%) of the total population, or 170890, reside in urban areas. The average household size was 4.8 (42,222HH), and the yearly growth rate was estimated to be 2.6%. 42 kebeles make up the woreda, with 33 being rural, 5 being urban, and 4 being governmental agricultural kebeles.

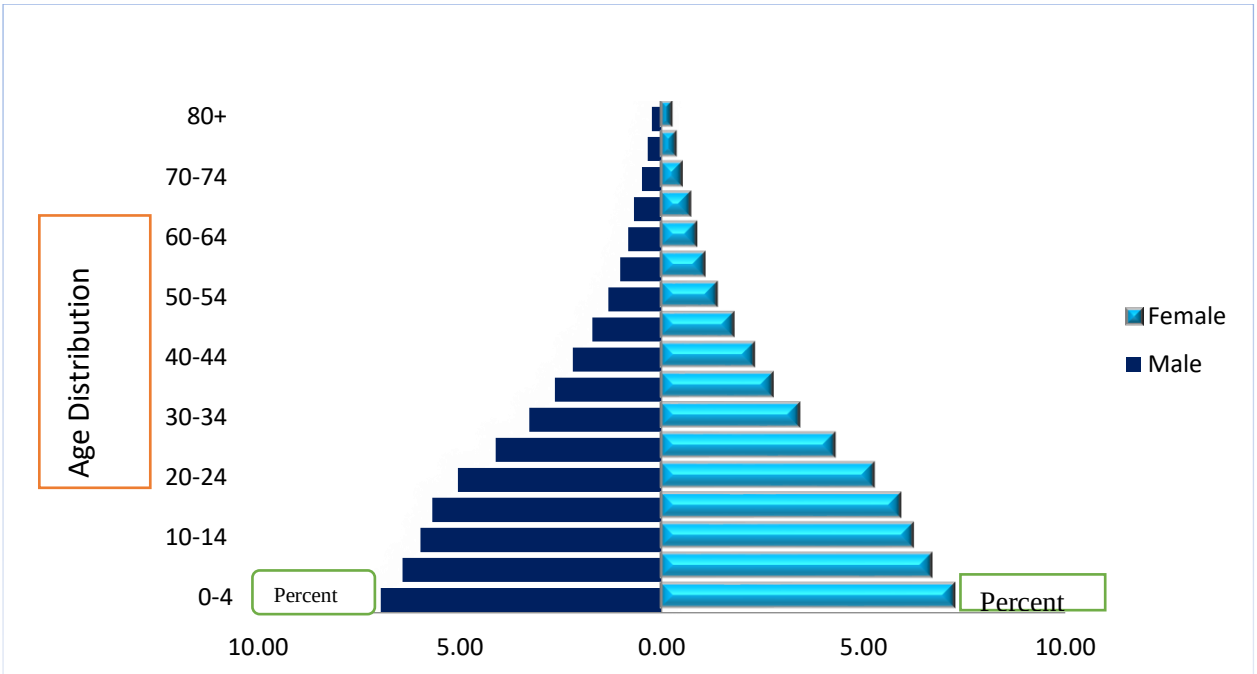


*Figure 31: Population pyramid of Bosat district 2020*

The population profile shows broader at the base and becoming narrower at the top, which indicates a high population in 0-65 years

*Table 22: population size of Bosat district Administration by Primary health care unit and sex 2019/20.*

| S. No | Name of PHCU | Male | Female | Total |
|---|---|---|---|---|
| 1 | Amecha | 5211 | 5423 | 10634 |
| 2 | Bole | 18827 | 19596 | 38423 |
| 3 | Buta Bedaso | 8662 | 9016 | 17678 |
| 4 | Dengoro Chale | 10157 | 10571 | 20728 |
| 5 | Doni | 13265 | 13805 | 27070 |
| 6 | Goda Dera | 13799 | 14361 | 28160 |
| 7 | Walanchiti | 28897 | 30076 | 58973 |

*Table 23: Population size of Bosat District Administration by PHCU, age group and House Hold 2019/20.*

| S. No | Name of PHCU | Total population | <1 year (3.2%) | <5year (16.43%) | <15 year (47%) | >65 year (3.6%) | Total HH |
|---|---|---|---|---|---|---|---|
| 1 | Amecha | 10634 | 341 | 1744 | 4998 | 383 | 2215 |
| 2 | Bole | 38423 | 1230 | 6301 | 18058 | 1383 | 8005 |
| 3 | Buta Bedaso | 17678 | 565 | 2899 | 8308 | 636 | 3683 |
| 4 | Dengoro Chale | 20728 | 663 | 3399 | 9742 | 746 | 4318 |
| 5 | Doni | 27070 | 866 | 4439 | 12723 | 975 | 5640 |
| 6 | Goda Dera | 29160 | 933 | 4782 | 13705 | 1050 | 6075 |
| 7 | Walanchiti | 58973 | 1887 | 9671 | 27717 | 2123 | 12286 |
| Total | | 202666 | 6485 | 33235 | 95251 | 7295 | 42222 |

The area's demographic characteristics are mostly composed of its ethnic and religious diversity. The majority of the population in the woreda is Oromo, and Afan Oromo is the language that is spoken there the most, followed by Amharic, though the precise number or proportion is unknown. Tigrigna and other languages are also rarely used.

## Geography and climatic condition

Bosat woreda is 25 kilometers from Adama, the East Shewa Zone's capital, and 125 kilometers from Addis Ababa. The district covers a total area of 14,050.27 km2.Bosat woreda is located at an elevation of 1050 meters and 2500 meters above sea level. The average annual rainfall in the region is 600–900 mm, and the average annual temperature ranges from 12–34 °C. The study area's agro-climate conditions are 1% Dega, 20% Weyinadega, and 79% Kola.

## Administrative and Political Organization

Bosat is one of the Districts in Ethiopia's Oromia regions. It is bordered to the south by Arsi Zone, to the north by Amara Region, to the west by Adama woreda, and to the east by Fentale woreda. Walanciti Town serves as the administrative center of the woreda. The administrative division of the woreda is into 42 kebeles, of which 33 are rural, 5 are urban, and 4 are government agricultural kebeles. The capital town of Walanciti is located 5 kilometers away, and Bole is the kebele that is closest to it.

## Education and School Health

Bosat Woreda is home to 105 educational institutions, including 17 preschools, 82 elementary schools (for students in grades 1–8), and 6 high schools (for students in grades 9–12). There are 27 privately managed schools and 78 public schools in the area. There is only one private college in the woreda. During the 2012 academic year, there were 42,827 students enrolled, of whom 20,054 (46.7%) were female and 22783 (53.2%) were male. 36851 (86%) were primary school students (grades 1 through 8). In the 2012 EFY, 1,017,069 students from elementary school and 69 students from high school abandoned the class. In total, 890 teachers were employed throughout all schools, with 61% of them men and 39% of them women. Six secondary schools and 41 primary schools have access to clean water. Despite not being required, seventy-two primary schools and five secondary schools have functional latrines. The majority of them have poor quality, uncleanliness, and underuse bathrooms. Every school has an AIDS/HIV group.

*Table 24: Education Coverage and School distribution in Bosat district 2019/20.*

| S. No | Type of school | #of schools | #of male students | # of female students |
|---|---|---|---|---|
| 1 | Nursery (KG) | 17 | 1289 | 1210 |
| 2 | primary school (1-8) | 82 | 19579 | 17272 |
| 3 | secondary school (9-12) | 6 | 3605 | 1572 |
| Total | | 105 | 24473 | 20054 |

## Infrastructures and Facilities (communication and utilities)

Only 63% of the 42 kebeles under the Bosat Woreda administration have access to road facilities or vehicle transportation. Roads are important for daily activity. With the exception of one health post, all health centers and health posts have access to road service. Since the majority of the season is dry, it might be quite challenging to use and remain inoperative throughout the wet season. Additionally, access to clean water is available to 64% of the woreda kebeles. The sole water used in the woreda is groundwater or bore hole water, which is extremely hard to purify and may include fluoride. Rivers and ponds are potential water supplies for the population that has been discovered. Overloading may be the cause of the water schemes' dysfunction. The average amount needed for each water project is 109,000 ETB.

Five Health Centers and only two Health Posts have piped water supply, whereas 31 health posts and two health centers have no piped water supply. Regarding communication although the network is not as stable in the majority of distant places, all health centers and health posts have access to telephone service. Traditional energy sources like charcoal, animal waste, farm waste, and firewood are used alongside modern energy sources like electricity, biogas, fossil fuels, and solar energy. Except for one health center where solar and a generator provide service, all health centers have reliable, 24-hour electric power supplies. No Health post has electricity around-the-clock. The district's towns were all powered by electricity. The traditional energy source continues to be the main one for cooking and other uses in both rural and urban settings. In metropolitan areas, charcoal is the most major energy source, followed by electricity, firewood, crop byproducts, and animal manure. In contrast, firewood, crop waste, animal dung, and kerosene are the main sources of energy in rural areas.

## Economy

The main economy of the woreda is based on agriculture (80%) and livestock (15%). Most of the population are farmers (dependents on seasonal agriculture and animal production). The remaining are Government and private sector employees and have their own business. Only a few groups of the population are merchants. The area gives different types of crops during rainy season or Meher/Gena and Belg/Hageya with short rainy season. Fertilizers, improved seeds, herbicides and insecticides are very essentials agricultural inputs to improve crop production and productivity, to meet rapid increase of demand for food and industrial raw material. In Bosat woreda, farmers were using DAP and urea fertilizers to improve productivity.

## Health System

### Vital statistics

*Table 25: Population statistics of Bosat district, East Shewa Oromia of 2019/2020*

| SN | Vital statistics | Number | Percentage |
|---|---|---|---|
| **1** | Total male population | 104862 | 51% |
| **2** | Total female population | 96961 | 49% |
| **3** | Urban population | 30933 | 15% |
| **4** | Rural population | 170890 | 85% |
| **5** | # of <1 years | 6525 | 3% |
| **6** | # of <5 years | 33398 | 16% |
| **7** | # of <15 years | 95251 | 47% |
| **8** | # of 15-49 years women | 44664 | 22% |
| **9** | # of >65 years population | 7295 | 4% |
| **10** | # of pregnant women | 7033 | 3.40% |
| **11** | Dependency ratio | | |
| **12** | Infant Mortality rate | Data not available | |
| **13** | Neonatal mortality | Data not available | |
| **14** | child mortality rate | Data not available | |
| **15** | Crude Birth Rate | Data not available | |
| **16** | Crude Death Rate | Data not available | |
| **17** | Maternal Mortality Rate | Data not available | |

### Health Sector Facilities and Human Power

There are 76 Heath facilities in the district, including one Hospital, 7 Health centers, 33 Health posts, 24 Private Clinics, eight drug stores, one drug vendor, and two government-owned clinics. One Health center averagely gives service for 25,000 people, see Table below:

*Table 26: Health Facility status of Bosat District*

| S. No | Types of Facilities | # of Facilities |
|---|---|---|
| 1 | Private Hospital | 0 |
| 2 | Government Hospital | 1 |
| 3 | Health Center | 7 |
| 4 | Clinics | 24 |
| 5 | Pharmacy | 8 |
| 6 | Drug Venders | 1 |
| 7 | Private Health center | 0 |
| 8 | Basic Diagnostic Laboratory | 0 |
| 9 | Health post | 33 |
| | **Total** | **76** |

The district health office has about 298 total health workers currently on work, including supportive staff at different health system levels. There were at least three health officers, 14 nurses, 5 midwife nurses, 6 lab technicians, 4 pharmacists & druggist, one environmental health professional, and other paramedics and supportive staff per the standard in all health centers. However, these criteria may not be fulfilled at some health centers. In 10 health posts there are 19 health extension workers, which mean 2 health extension workers for each kebeles. In the woreda health office a total of 6 health professionals were working at different department. Additional information regarding several health professionals and other administrative staff presented in the Table below.

*Table 27: Number of health professionals and other administrative staff employed in Bosat Woreda 2019/2020*

| S. No | Type of Profession | Total |
|---|---|---|
| 1 | MPH | 4 |
| 2 | Health Officer | 22 |
| 3 | Lab Technician | 9 |
| 4 | Lab technologist | 0 |
| 5 | Druggist | 7 |
| 6 | Nurse BSc | 14 |
| 7 | Mid wife's | 12 |
| 8 | HEWs | 85 |
| 9 | HIT | 6 |
| 10 | X-ray technician | 0 |
| 11 | Anesthesia | 0 |
| 12 | Biologist BSc | 1 |
| 13 | Pharmacy BSc | 5 |
| 14 | Environmental Health | 5 |
| 15 | HMIS | 3 |
| 16 | Clinical Nurse | 39 |
| 17 | Supportive staff | 86 |
| 18 | Total | 298 |

Bosat Woreda also has one Hospital which is found in capital of woreda Walanciti, not governed under Bosat Woreda Health Office but directly by the Oromia Regional Health office. Totally 178 staffs are working currently in Walanciti Hospital.

*Table 28: Number of health professionals and other administrative staff employed In Walanciti Hospital 2019/2020.*

| S. No | Type of Profession | Male | Female | Total |
|---|---|---|---|---|
| 1 | Surgeon | 1 | 0 | 1 |
| 2 | Internist | 1 | 0 | 1 |
| 3 | ObyGyn | 1 | 0 | 1 |
| 4 | GP | 14 | 4 | 18 |
| 5 | Dentist | 1 | 0 | 1 |
| 6 | Nurse BSc | 18 | 19 | 37 |
| 7 | Clinical Nurse | 8 | 10 | 18 |
| 8 | Midwife | 8 | 4 | 12 |
| 9 | Lab Technologist | 8 | 0 | 8 |
| 10 | Pharmacist | 6 | 5 | 11 |
| 11 | Druggist | 1 | 1 | 2 |
| 12 | Psychiatry | 3 | 0 | 3 |
| 13 | Ophthalmology | 1 | 0 | 1 |
| 14 | Anesthesia | 3 | 1 | 4 |
| 15 | Radiologist | 3 | 0 | 3 |
| 16 | Surgical Nurse | 1 | 0 | 1 |
| 17 | Pediatrician | 0 | 1 | 1 |
| 18 | pediatric nurse | 1 | 0 | 1 |
| 19 | OR nurse | 2 | 0 | 2 |
| 20 | supportive staff | 36 | 16 | 52 |
| | Total | 117 | 61 | 178 |

Top ten causes of morbidity in the outpatient department and the most frequently occurred disease for >5 years old adults were upper respiratory tract infection which accounts for 23.9% of total cases, followed by Diarrheal diseases in adults 11.83%. In under-five children, diarrhea was the leading course of morbidity, which accounts for about 33% of total cases followed by Pneumonia 19.1% and Acute upper respiratory tract infection 9.8% to a few. The detail of top 10 diseases is presented as follows in Table below.

*Table 29: List of top ten leading causes of morbidity in both Adults and under-five children Bosat District 2019/20*

| S. No | Adult OPD | #Cases | % | < 5 OPD | #cases | % |
|---|---|---|---|---|---|---|
| 1 | AURTI | 3332 | 23.9% | Diarrhea | 3011 | 33% |
| 2 | Diarrhea | 1649 | 11.83% | pneumonia | 1747 | 19.1% |
| 3 | Typhoid Fever | 1643 | 11.79% | cough | 1053 | 11.5% |
| 4 | AFI | 1551 | 11.2% | AURTI | 897 | 9.8% |
| 5 | Tonsillitis/Acute pharyngitis | 1269 | 9.1% | Nasopharyngitis | 678 | 7.4% |
| 6 | UTI | 1190 | 8.4% | AFI | 499 | 5.4% |
| 7 | Dyspepsia | 1031 | 7.3% | Neonatal sepsis | 354 | 3.9% |
| 8 | Typhus | 906 | 6.5% | Vomiting | 350 | 3.8% |
| 9 | Cough | 754 | 5.4% | prematurity | 301 | 3.3% |
| 10 | Helminthiasis/ IP | 609 | 1.5% | Other Unspecified perinatal diseases | 214 | 2.3% |
| | Total | 13,934 | 100% | | 9,104 | 100% |

**Maternal and child health services coverage (MCH)**

Many activities were implemented to decrease Maternal and childhood death in Bosat Woreda. The proportion of women receiving ANC1 was 5078 (72.2%), and the proportion of women receiving ANC4 was 3238(46%). Only 2812 (40%) gave birth at a health facility or skilled delivery from the district's estimated pregnant mother. While the proportion of mothers who received Early PNC was 4736 (67.3%). Of the total 5078 pregnant women who received ANC services, 4853(69%) had tested for HIV and known their HIV status, of which no mothers tested HIV positive. Immunization is one preventive and control of vaccine-preventable disease strategies used to protect surviving infants' lives against vaccine-preventable diseases. The immunization as child health booster is being given routinely in all government health facilities available in the district under the expanded program for immunization. From the target, 7033 live births, 6586(93.6%) got BCG vaccine, and from surviving infants, 6757(103%) had received Penta1, but only 6074 (93%) reach full vaccination. (See the details from table 9).

*Table 30: MCH Performance and achievement of Bosat district of 2019/20 or 2012 EFY*

| SN | Activities | Plan of 2012EFY | Achievement | % |
|---|---|---|---|---|
| 1 | All FP | 37757 | 23280 | 61.7 |
| 2 | LAFP | 37757 | 8313 | 22 |
| 3 | ANC 1 | 7033 | 5078 | 72.2 |
| 4 | ANC 4 | 7033 | 3238 | 46 |
| 5 | Skilled Delivery | 7033 | 2812 | 40 |
| 6 | PNC 7 days | 7033 | 4736 | 67.3 |
| 7 | Hepatitis test | 7033 | 4468 | 63.5 |
| 8 | Syphilis test | 7033 | 4627 | 65.8 |
| 9 | BCG | 7033 | 6586 | 93.6 |
| 10 | Penta1 | 6526 | 6757 | 103.5 |
| 11 | Penta 3 | 6526 | 6424 | 98.4 |
| 12 | Rota2 | 6526 | 6560 | 100.5 |
| 13 | PAB | 6526 | 6778 | 103.9 |
| 14 | Measles | 6526 | 6080 | 93.2 |
| 15 | Fully | 6526 | 6074 | 93.1 |
| 16 | IPV3 | 6526 | 6400 | 98.1 |
| 17 | MCV 2 | 6526 | 4068 | 62.3 |
| 18 | GMP <2yrs | 11572 | 9026 | 78 |
| 19 | Nut.Screening (6-59M) | 30400 | 19760 | 65 |
| 20 | Vit A | 30400 | 29521 | 97.1 |
| 21 | De-Worming(24-59M) | 21726 | 28860 | 132.8 |
| 22 | Pneumonia | 33298 | 3611 | 10.8 |
| 23 | Diarrhea | 33298 | 5438 | 16.3 |
| 24 | Sepsis | 534 | 165 | 30.9 |
| 25 | Asphyxia | 703 | 27 | 3.8 |
| 26 | Preg mother HIV test | 7033 | 4853 | 69 |
| 27 | Partner test | 7033 | 4430 | 63 |
| 28 | PLW MUAC | 7033 | 4618 | 65.7 |
| 29 | CAC | 703 | 388 | 55.2 |
| 30 | All TT2+ | 44789 | 16641 | 37.2 |

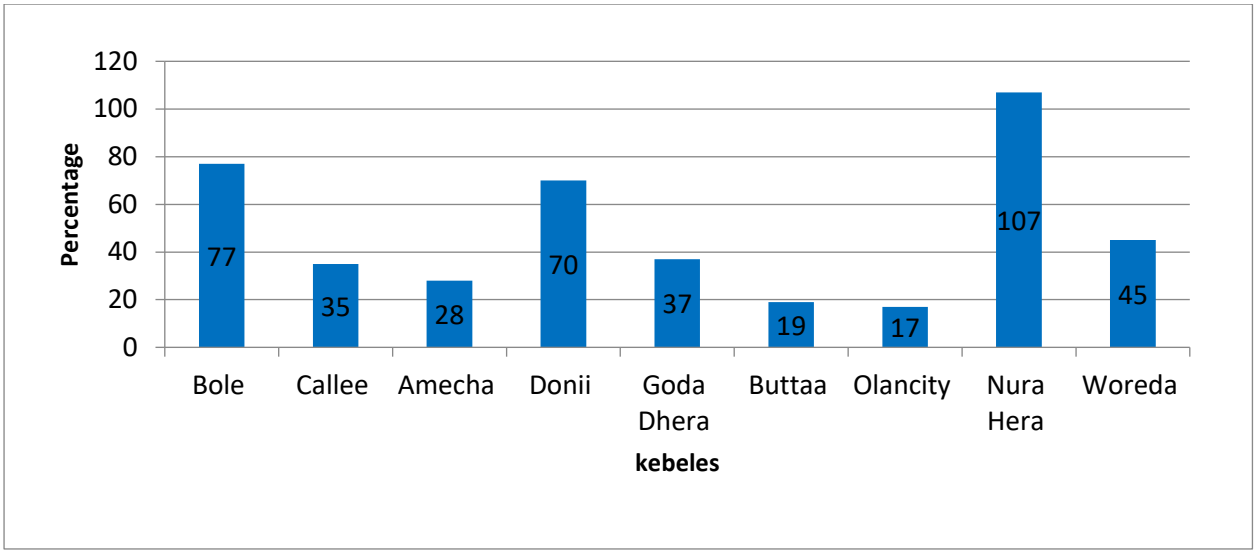


*Figure 32: ANC 4 performance in percentage 2012 EFY.*

As indicated on the above figure, out of the total planned 7033 women who expected to attend ANC 4, only 3238(46%) of them had visited a health facility in 2012EFY.

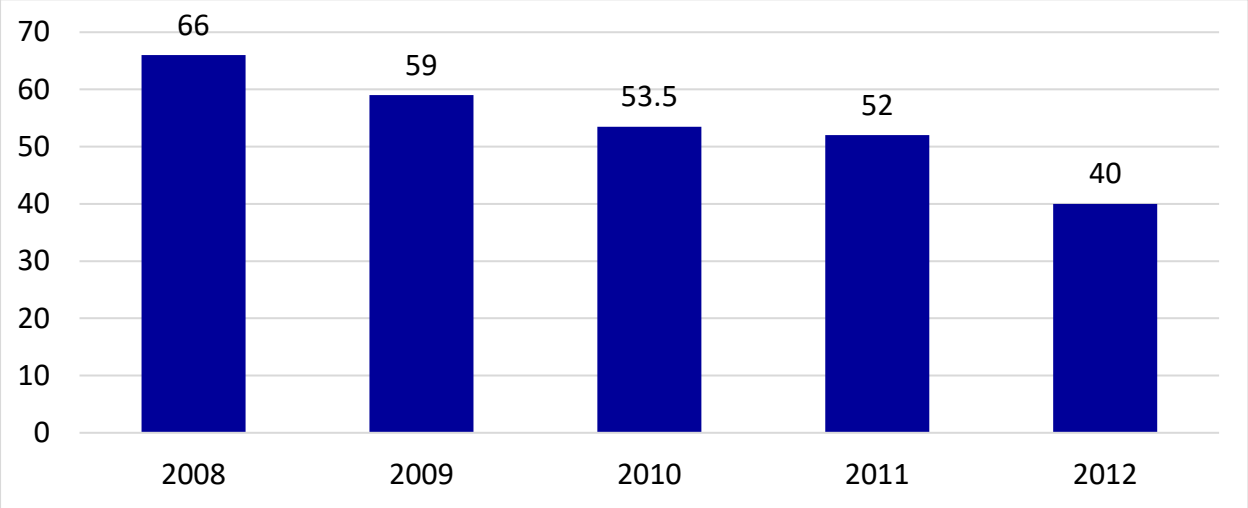


*Figure 33: Five years SBA (skilled Birth Attendants) by % in Bosat Woreda, 2012EFY*

The above figure number of pregnant women who attend skilled delivery is only 2812(40%) out of targeted 7033 who visit Health center for ANC1 follow up. This is the least when compared to the last five years. In 2008 (66%), 2009 (59%), 2010 (53.5%), 2011 (52%) and in recent 2012 EC only 40% attend skilled delivery at health facility.

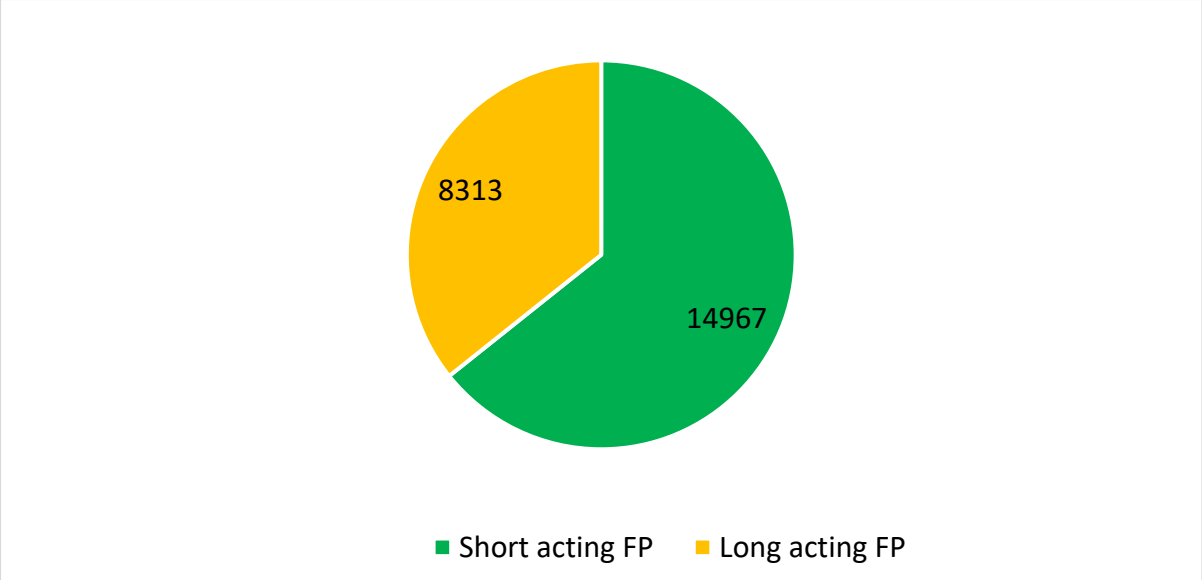


*Figure 34: Family planning mostly used by women of Childbearing age (Long term vs. short term) 2012 EFY.*

As depicted in the above figure, short-term family planning is highly used, accounting for about 64.2% of all family planning used in 2012 EFY, whereas long-term family planning used is 35.8%.

## Community Health Service

Starting from 2010, FMOH has implemented a community development army at each kebele level, replacing the community health workers all over the country.

### Endemic and Epidemic Diseases

#### A. Prevalence of TB/Leprosy: 2019/20

Totally 226 cases were registered in 2019/20 in Bosat Woreda Health centers. About 98.1% of cases were cured completely after treatment. All 226 (100%) have screened for HIV and. The death rate was 0%. No leprosy case registered

*Table 31: TB related performance of Bosat District 2012 EFY*

| S. No | Activities | Plan | Achievement | % |
|---|---|---|---|---|
| 1 | Case Detection | 203 | 115 | 56.7 |
| 2 | All Form TB | 332 | 226 | 68 |
| 3 | Cured | 159 | 156 | 98.1 |
| 4 | Rx Success of P/Pos | 159 | 156 | 98.1 |
| 5 | Treatment completes all form | 247 | 241 | 97.6 |
| 6 | TB HIV test | 226 | 226 | 100 |

## B. HIV/AIDS

HIV/AIDS Prevention and control measures like counseling, testing, health education, and distribution of condom services were given to the Bosat district community. In 2019/20, a total of 23545 clients were screened for HIV. Among the screened individuals 58 of them became positive to the virus and 40 of them are on ART currently. About 1212 cases are on ART.

ART service was available in the woreda and linked HIV-positive cases with ART service. In all health centers, VCT and PICT services were given to the community. In addition, in all health centers health education was given on HIV/AIDS for the costumers. On the other hand, in all health posts, health education was given to the community by health extension workers and at the same time they facilitate schedule for VCT service in the health post. In all schools, an anti-AIDS club was established. There is no NGO working on HIV/AIDS prevention and control program in the woreda**.**

*Table 32: HIV/AIDS-related performance of Bosat district of 2020*

| S. No | Activities | Plan | Achievement | % |
|---|---|---|---|---|
| 1 | HIV/AIDS(HCT) tested | 28654 | 23545 | 82.2 |
| 2 | New positive (HCT) | | 58 | |
| 3 | New ART | 58 | 40 | 69 |
| 4 | Currently on ART | 1354 | 1212 | 89 |
| 5 | STI cases tested for HIV | 233 | 191 | 82 |
| 6 | Viral load | 1212 | 636 | 52.5 |
| 7 | ANC clients tested for HIV | 7033 | 4853 | 69 |
| 8 | Option B+ | 60 | 22 | 36.6 |
| 9 | ICT | 164 | 16 | 11 |

**Malaria**

Malaria is one of the major global health concerns. Ethiopia is also working to end its epidemic in 2030. Currently, Bosat woreda also applies lots of prevention and control strategies, including House hold ITNs, Indoor Residual Sprat (IRS), and other prevention measures. All kebeles in the woreda have been reporting malaria cases every year. Plasmodium Falciparum is highly reportable specious every year. Overall, the trend of total malaria cases for both species is decreasing. In the recent year 2012, about 1800 malaria cases were reported, out of which 1333(74%) were P. Falciparum.

*Table 33: Malaria related performance of the last four years 2009-2012 EFY*

| Year | Exam | Positive | PF | PV | Mixed |
|---|---|---|---|---|---|
| 2009 | 24067 | 4590 | 2580 | 1681 | 529 |
| 2010 | 23063 | 3069 | 1968 | 1077 | 51 |
| 2011 | 20326 | 1839 | 1125 | 691 | 23 |
| 2012 | 20488 | 1800 | 1302 | 455 | 31 |
| Total | 87944 | 11298 | 6975 | 3904 | 634 |

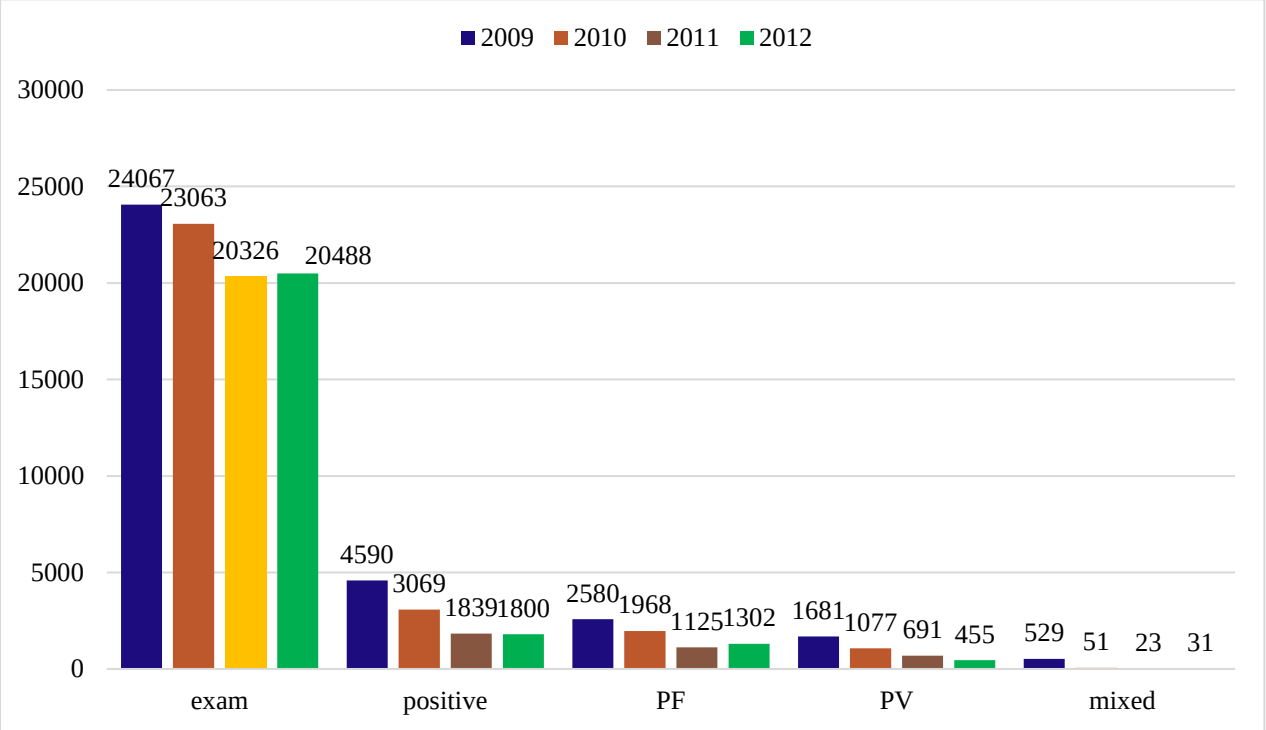


*Figure 35: Bosat Malaria 5 Years trend by Species 2009-2012 EFY*

As indicated in the above figure, the trend of malaria in the district was decreasing from year to year. Out of 87944 total examined cases, about 11,298 were either microscopic or slide-positive cases. Plasmodium falciparum holds 61.7%, while vivax accounts for around 34.5%. Only 634(5.6%) of cases were mixed of both falciparum and vivax.

## Latrine coverage

Total households in the district were 38564, with total latrine coverage of 25806(67%). Out of this, 40% have improved latrine, and 27% of latrines are unimproved. Latrine coverage of 2012 EFY is very low per their plan. Buta Bedaso Catchment area has covered 39.6% of their plan, which is the highest in the district in 2012. The Doni catchment area has covered the least, which was only 7.3% of their plan.

*Table 34: 2012 Latrine coverage by PHCU in Bosat district*

| SN | Name of PHCU | 2011(baseline) | | 2012 | | |
|---|---|---|---|---|---|---|
| | | Achievement | % | plan | achievement | % |
| 1 | Walanchiti | 8702 | 71 | 3547 | 393 | 11.1 |
| 2 | Bole | 2704 | 63 | 3144 | 191 | 6.1 |
| 3 | Doni | 2439 | 43 | 2231 | 162 | 7.3 |
| 4 | G/Dhera | 4170 | 69 | 1392 | 170 | 12.2 |
| 5 | Chale | 2010 | 61 | 1778 | 549 | 30.9 |
| 6 | B/Badaso | 2509 | 68 | 859 | 340 | 39.6 |
| 7 | Amecha | 1466 | 66 | 561 | 156 | 27.8 |
| | Woreda | 37375 | 64 | 11842 | 1961 | 16.6 |

## Discussion

The majority of the population proportion, 49.6% in the district, was 15-64 age groups. Populations that are significantly greater than 2016 EDHS find that 48% of the population are between 15-64 age group (6). The result was also significantly above the study conducted in 2015 in assessing the Demographic Profile of African Countries, which indicated Africa has a young age structure, with about 47% of its population in the 15-64 age (7).

The difference might be attributed to the study methodology. Since most of the district areas were Rural, which is similar to a study conducted to assess the demography of the population in Ethiopia by the World Bank in 2019, and 78.78% of the population live in rural areas (8). Ethiopia is one of the countries with the lowest primary school enrollment rates globally; thus, attaining universal primary education in the country requires greater efforts. Furthermore, low quality of school and a high dropout rate, and gender and rural-urban disparities remain the country's major challenges.

Household and School Factors from 1992 to 2012 G.C a twenty years trend study as well as when compared to a study done in Oromia regional state East Shewa zone titled as Prevalence of Primary School Dropout in East Shewa zone Pastoralists of Oromia Region, Southeastern Ethiopia, 2020 which is 11% dropout rate. The school dropout rate of Bosat district was 5%. According to the woreda water office report, 67% of the population uses improved water sources. This is lower compared to the national report of 2016, which is 65%.

Inadequate sanitation is mostly responsible for diseases that are transmitted through the fecal-oral route. Unimproved hygiene, inadequate sanitation, and insufficient and unsafe drinking water account for 7% of the total disease burden and 19% of child mortality worldwide. In Ethiopia, about 75% of causes of OPD visits are largely due to the lack of basic sanitation provisions (9). Similarly, in Bosat woreda, from the top 10 cause 's morbidity in adults and children, the top four are infectious diseases that can be prevented by improved hygiene and sanitation.

The expanded immunization program is one of the prevention and control measures performed by the child health department. World Health Organization and EPI coverage target for the control of vaccine-preventable diseases. In the fiscal year, Bosat woreda's overall EPI performance was less than the target.

BCG and fully immunized coverage were 93.6% and 93.1%, respectively, which is greater than National immunization coverage (58.92%), which indicates almost all children who the contraceptive acceptance rate of the women in the reproductive age group in the district was 23280(52.12%). Regarding method selection, about 64.2% (14967) of women of the reproductive age group were using Short-Acting Family Planning. About 8313(35.8%) were using LAFP. This study result was higher when compared to the Ethiopian Mini-EDHS 2019 finding, which came up with all forms of family planning method 42% of CAR, while the proportion of reproductive-age women utilizing long term family planning methods (10). Bosat district CAR result has higher family planning than Ethiopia Mini-EDHS 2019, finding both coverage and long-term family planning method selection. The difference might be attributed to the over-reporting/double reporting and poor data management. The proportion of women receiving ANC1 was 7033(72.2%), out of which only 3238(46%) had ANC4. From the estimated pregnant mother of the district, only 2812 (40%) gave birth at a health facility, while the proportion of mothers who received early PNC was 4736(67.3%). This study was comparable with a little difference with the study conducted in Jimma in which 93.3% had ANC visits, 77.4% institutional delivery, and 92% had PNC (11). The difference attributed to the study methodology and secondary data was used for this study which was more prone to errors in data quality.

Ethiopia has been experiencing a high prevalence of infectious diseases, which resulted in high morbidity, mortality, and hospital admission rates. One of the highest contributing factors for this is the lower level of latrine utilization. Of total households, 42222 in the district (40%) had improved latrine. Households with unimproved latrines were 27%, and 33% house hold has no restroom, indicating that many of them use the field for defecation. This finding shows it is low compared to the district-based study done in Ilu Abba Bora Zone in South western Ethiopia, which shows improved latrine coverage was approximately (88.2%), the study participants reported that they had sanitary facility whether it be improved or unimproved and only (11.8%) of households had no latrine (12). The observed difference might be due to differences in the study design and poor data aggregation in the study area since there is no updated and documented data in the Bosat district health office. Two hundred twenty-six TB cases were registered in 2019/20 in Bosat district health centers. The case detection rate in the Bosat district was above 56.7%. The cure rate was 98.1 % & the treatment success rate was 98.1%.

The study finding is slightly different with WHO and Ethiopia national report of 68% TB detection rate, 91% treatment success rate with a cure rate of 85.4%, which is greater than the threshold (85%) recommended by WHO (13) . The difference may be due to poor accessibility of TB diagnostic tools, the presence of high-quality TB care services, and a significant skilled workforce.

In 2011, the Ethiopians launched a Community-Based Health Insurance scheme. By December 2012, enrolment reached 45.5% (14). In Bosat District, the enrolment of community-based health insurance membership was low that only 9798(20%) Family heads were enrolled, which was very low compared with the enrolment status of the Pilot study done in 2013, which depicted the overall enrolment in the pilot schemes is 48 percent, with wide variation by woreda and 2016/17 HSTP national annual report revealed that 36% of the total population was enrolled in CBHI (15). The finding of another study shows that CBHI-affiliated facilities experience a 111% increase in annual outpatient visits and annual revenues increase by 47% (16). Increased revenues are used to facilitate drug shortages. These increases have translated into enhanced patient satisfaction.

## Conclusion

In Bosat District, infectious diseases like Pneumonia, Acute febrile illness, and diarrhea are the most frequently occurring diseases in adult and pediatric populations. In addition, in the woreda, 49% of the schools do not have a water supply, and 25% do not have a functional toilet. Therefore, the woreda has to promote hygiene and sanitation for the community. The woreda has to work with other sectors that work in hygiene and sanitation to improve water and toilet facility availability at schools. The Maternal and child health coverage was not uniform across MCH indicators in the district that. Most indicators' coverage was good, but the associated services are too low. For example, overall ANC coverage was good while early PNC and institutional delivery were low. Long-acting Family planning method usage was low, but short-term methods usage was high when compared. There was low improved latrine coverage which may be related high prevalence of CDs. The majority of the district's health Facilities were not screening NCD. The habit of utilizing community health insurance was low in the district. There was the inadequacy of health professionals like Physicians, Field epidemiologists, Lab technologists. The district's Tb detection rate is low, which may need due attention.

## Recommendations

- Bosat district health offices should focus on the maternal and child health implementation protocol, improving the quality of service and number of clients/Attendants.
- The District Administration should improve access to water and electric supply for health facilities and the communities.
- Laboratory capacity should be increased for pulmonary TB detection rate and achieve a quality diagnosis for other diseases.
- The District Administration should focus on delivering sustainable Electric energy sources to health facilities and their population and reduce an interruption of water supply as those the Basic needs of the community.
- All health facilities should increase their capacity for screening of NCD.

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# Chapter Five- Scientific Manuscript

## Malaria Outbreak Investigation in Loma District of Dawro zone, SWEP Region, Ethiopia, 2022

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## Abstract:

**Background**: Malaria is a significant public health problem that still results in disease and fatalities. The WHO estimates that there were 247 million cases of malaria worldwide in 84 countries with endemic transmission (including French Guiana) in 2021. Ethiopia is a Sub-Saharan African nation with a high annual malaria case count because the geography of the vast majority of the country favor's vector breeding. The objective of this study was to assess the scope, describe amount of morbidity and mortality and potential causes of the malaria outbreak in the Loma District of the Dawro Zone, SWEP Region, Ethiopia, between May 19 and June 11, 2022.

**Methods**: From May 19 and June 11, 2022, a descriptive and 1:1 unmatched case-control study was conducted in the Loma district. There were 340 instances used in total for the descriptive study. 199 cases and 199 controls were chosen using a computer-generated basic random approach with a line list as a sampling frame in order to find the factor linked to the outbreak. Malaria positive patients who presented to a health facility with symptoms were recognized as active cases, and controls were chosen from the patients' neighbors. We gathered information using a standardized questionnaire; cases were described in terms of the time, place, and person. logistic regression was then used to determine the factors associated to malaria.

**Results**: A total of 340 cases were found, with an attack rate of 3.6 per 1000 people and a case fatality rate (CFR) of zero. Children under the age of 59 months had the highest attack rate (4.8/1000). Being close to stagnant water increased the risk of contracting the malaria parasite compared to living farther away (AOR = 2.1, 95% CI: 0.96-4.56 and P value = 0.046). Other factors which statistically linked to the development of malaria include: lack of education (AOR = 0.4, 95% CI (0.24-0.72 P-value 0.008), sleeping outside at night (AOR = 3.96, 95 CI (1.96-8.1), not using an ITN (AOR = 0.81, 95% CI: 0.1-0.9), and not using an IRS at home (AOR =8.9, 95% CI (5.23-14.32), P=0.001).

**Conclusion**: Over all during this outbreak 3.6/1000 people were affected. Residents of Zima Waruma kebele were most affected kebele and children of <15 years were more affected by this malaria outbreak. The Plasmodium falciparum species is the most frequent reason for the outbreak.

**Key Words**: Malaria, Loma, Outbreak and Case control.

# Introduction

## Background

The World Health Organization (WHO) estimates that 3.3 billion people are at risk of malaria, with 1.2 billion of those individuals having a high risk. Globally, in 84 countries with endemic malaria (including French Guiana), there were an estimated 247 million cases in 2021, up from 245 million in 2020, with most of this increase coming from the WHO African Region. There were an estimated 230 million cases of malaria in 2015, the baseline year for the Global Technical Strategy for Malaria 2016-2030 (GTS).(1) Malaria is endemic in all tropical regions of the world, with sub-Saharan Africa, India, and Southeast Asia having the highest prevalence rates. In 2018, there were an estimated 23 million fewer cases of malaria than in 2010, due to the global community's funding and implementation of malaria control measures. During the course of these efforts, millions of malaria deaths have also been prevented. However, from 2014 to 2018, the number of cases worldwide remained consistent, and in 2020, the number of cases rose in comparison to earlier years, partially as a result of the COVID-19 pandemic's impact on health services and interventions. The World Health Organization suggested the first malaria vaccine in October 2021 to protect newborns and young children living in areas with moderate-to-high transmission who are 5 to 24 months old.(2)

Almost 68% of Ethiopia's population lives in locations with a high risk of malaria.(3) Malaria affects more individuals in Ethiopia's lowlands (below 2000 meters of elevation) than in its highlands (above 2000 meters of altitude).(4) In Ethiopia most parasite transmission occurs indoors during the night in rural homes in the lowlands and in the intermediate elevations due to typical human and mosquito behavior. Malaria transmission may also take place outside during social or professional nocturnal activities, or it can be linked to brief overnight travel to other districts in malaria-prone areas. Recent findings, both published and unpublished, suggest an increase in the prevalence of malaria among migrant daily laborers in a number of regions of the nation, most significantly in the northwest development corridors of the country bordering South Sudan and Sudan.(5)

About 2.9 million cases of malaria and 4,782,000 related deaths have been reported annually, and the rate of morbidity and mortality dramatically increases during epidemics.(6)

It is becoming more vital to develop reliable, cost- and time-effective methods to assess and monitor changes in transmission intensity as malaria transmission levels continue to drop in many malaria-endemic areas. The problem is especially important to national malaria control programs because they are primarily in charge of malaria surveillance and because more extensive methods (such as extensive population surveys and long-term entomological surveillance) are likely to be logistically and financially challenging for them.(7)

Plasmodium parasites that cause malaria are transmitted through the bite of an infective Anopheles mosquito, resulting in an intraerythrocytic illness. Malaria is an intraerythrocytic infection that can be mild or asymptomatic or severe and lethal. Human disease is brought on by four different Plasmodium species: P. falciparum, P. vivax, P. ovale species (which includes P. ovale curtisi and P. ovale wallikeri), and P. malariae. Humans can get sick from simian malarias as well, especially P. knowlesi in Southeast Asia. P. falciparum, which predominates in Africa and accounts for an estimated 95% of cases, is the most common source of infections worldwide.(8) Anopheles arabiensis is the primary malaria vector in Ethiopia, and Plasmodium falciparum (PF) and Plasmodium vivax (PV) are the two most common malaria parasites.(9)

Ethiopia declared to achieve national-level malaria elimination in 2030, by prioritizing elimination in targeted low transmission settings and preventing the reintroduction of malaria into districts reporting zero indigenous malaria cases.

As a result, the purpose of this study was to look into what caused the epidemic in the Loma District of the Dawro Zone, SWEP Region, Ethiopia. The focus was on risk factors for malaria, with the epidemic being described by the person, place, and time that it occurred. The findings were then used to implement control and preventive measures.

## Methods

**Laboratory method**

Rapid Diagnostic Test (RDT) was utilized at the community level and in health posts during the case-finding phase of outbreak

investigations. At the hospital and health center levels, a microscope (slide) is used to determine the species of malaria.

**Descriptive Epidemiology**

During this outbreak, malaria was characterized and recognized as an acute febrile sickness with either a blood RDT or slide positive for the parasite. In order to establish an epidemic threshold level and compare it to a similar week this year in 2022, we looked at malaria data from the prior year of 2021 from cluster health offices and health facilities. Malaria cases was gathered on a daily and weekly basis from health facilities. By person, location, and time, the outbreak's magnitude was described. The RDT positivity rate was computed as the proportion of people who tested positive for malaria. Attack rates were determined by person and location. An epidemic curve was developed.

**Analytical Epidemiology**

To determine the risk factors related to malaria, we conducted an unmatched 1:1 case-control study. For patients with newly confirmed malaria cases (within two weeks of the interview), a community control group was chosen. Controls were those who had been free of malaria symptoms and signs for the previous three months. Risk factors such as places to sleep and remain at night, insecticide-treated bed nets, indoor residual sprays, and the presence of standing water or any other mosquito breeding grounds were evaluated using a standard checklist.

We calculated the sample size using the statistical software calculation of Epi-info taking the power of 80%. We used literature done on Prevalence of Malaria and Associated Risk Factors among the Community of Mizan-Aman Town and Its Catchment Area in Southwest Ethiopia. percentage of exposed controls of 24.1%, and case to control the ratio of 1:1 with odd ratio of 0.46%. The total sample size yields 398. Bivariate and multivariate analysis was conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS.

Then Ethiopian public health institute (EPHI) gave directive and approval to investigate and respond to the outbreak. Verbal informed consent was obtained from participants or mothers/caregivers, any information related with personal identification was not used on the report. Cases were also referred to the nearby health facilities for medical care

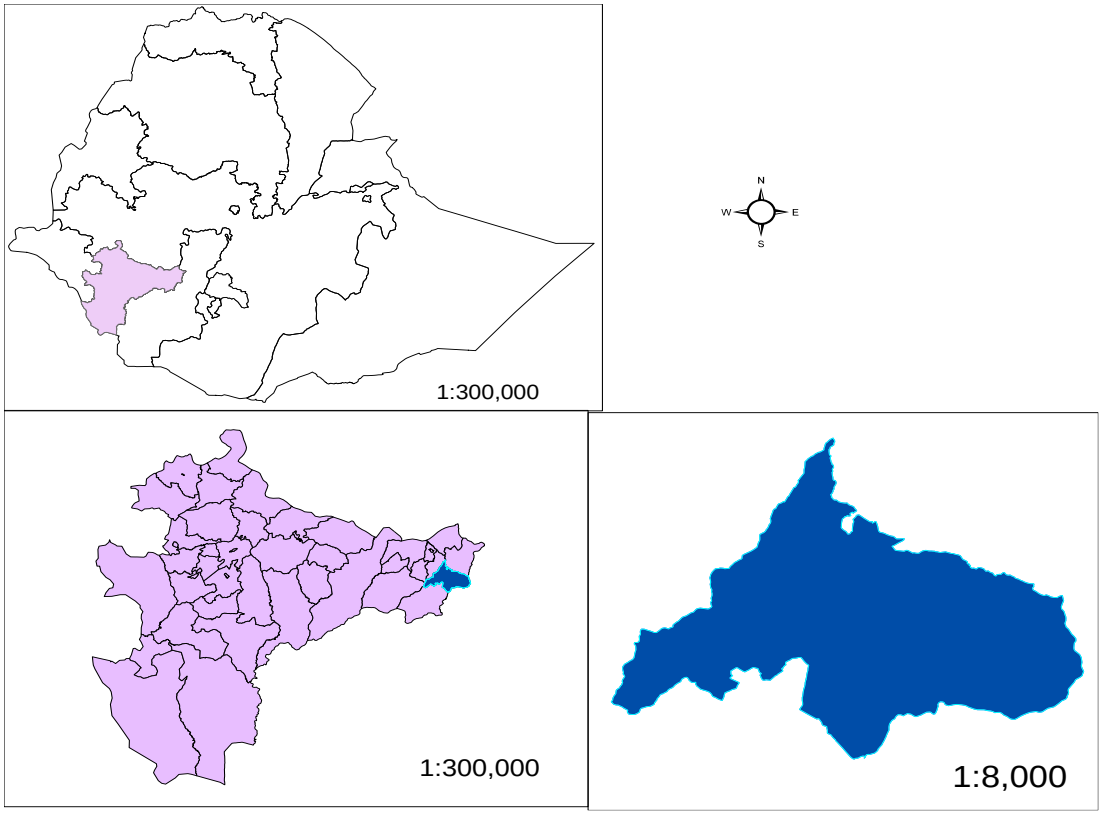


Figure 1: Showing study area Loma woreda, SWEP region, Ethiopia, 2022

## Environmental assessment

Only 50% of the 100 randomly chosen and inspected households have bed nets, and only 10% of those who do use bed nets properly. Special environmental management was advised for certain areas since the Omo Dam proximity to the inhabitants had a negative impact. Last year, IRS did not cover every kebele in every hot spot woreda due to a scarcity of chemicals. Case reports from the kebeles that had been sprayed were considerably higher, suggesting that it would be better to switch the pesticides used the year before. There are no partners for Woredas who are particularly interested on malaria. Health education for the community is difficult to deliver in some kebeles because they are too remote from woredas and are challenging to access. In the affected areas, we observed poor use of bed nets, improper hanging of bed nets, and malaria breeding grounds (stagnant water, irrigation canals, and exposed plastic containers).

## Results

### Descriptive epidemiology

Between May 19/2022 to June 10/2022 Loma District of the SWEP region reported 340 suspected malaria cases. 239 (70%) of

these cases underwent laboratory investigation and were found to be positive for malaria. According to this study, 167 men and 173 women out of 340 suspected cases of malaria were found to be affected. The most common clinical signs were a fever, headache, and chills. Less frequently occurred diarrhea and cough also seen in some of the patients. Median age of cases was 16 years (IQR: 8–25 years) and approximately half were in the age group of 15–59 years.

Table 1: Age specific malaria attack rate and case fatality rate by age group in Loma district of Dawro zone, SWEP region, Ethiopia, 2022

| **Age group** | **Total population** | **Number of cases** | **Number of deaths** | **Attack rate (Per 1000 population)** | **Case fatality rate (%)** |
|---|---|---|---|---|---|
| ≤5 years | 14999 | 73 | 0 | 4.8/1000 | 0 |
| 6-14 years | 32248 | 129 | 0 | 4/1000 | 0 |
| ≥15 years | 48902 | 138 | 0 | 2.8/1000 | 0 |
| **Total** | **96149** | **340** | **0** | **3.6/1000** | **0** |

The median age of suspected malaria cases were 24years old (range- 8months to 65 year). The most affected age group was above 15 years age group 138 (41%) followed by 6-14 age groups 129(38%) and <=5years age group (21%) of all notified suspected malaria cases. The highest and lowest positivity rate was reported in the age group above 6- 14 years (81%) and >=15 (54.3%) respectively. Of the confirmed malaria cases, the result by species shows that 83.2% of the cases were Plasmodium falciparum, 13.8% of the cases were Plasmodium vivax and 2.9% of the cases were mixed cases of both P. falciparum and Vivax.

Table 2: Distribution of malaria cases by age and plasmodium species

| **Age Group** | **Total Tested** | **Total positive** | **Positivity rate** | **Plasmodium Species** | | |
|---|---|---|---|---|---|---|
| | | | | **PF** | **PV** | **Mixed (PF + PV)** |
| ≤5 | 73 | 57 | 78.1 | 50 | 7 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 6-14 | 129 | 105 | 81.4 | 83 | 19 | 3 |
| ≥15 | 138 | 77 | 54.35 | 66 | 7 | 4 |
| **Total** | **340** | **239** | **69.71** | **199** | **33** | **7** |

Plasmodium falciparum accounts for 83.2% of the 239 positive cases overall, followed by Plasmodium vivax at 13.8%. The 340 febrile cases that were initially identified underwent lab testing, and the outcome was a 70.2 positive rate. These findings confirmed the outbreak, which met the national guideline's 50% positive threshold.

Table 3: Distribution of malaria cases by sex and plasmodium species Loma woreda, June 2022

| **Gender** | **Total tested** | **Total Positive** | **Positivity rate (%)** | **Plasmodium species** | | |
|---|---|---|---|---|---|---|
| | | | | **PF** | **PV** | **Mixed** |
| Male | 167 | 117 | 70.1 | 94 | 20 | 3 |
| Female | 173 | 122 | 70.5 | 105 | 13 | 4 |
| Total | 340 | 239 | 70.2 | 199(83.2%) | 33(13.8%) | 7(2.9%) |

Zima Waruma village accounted for 340/157 (46.2%) of the total suspected malaria cases, followed by Hailan kebele (340/72; 21%), Dodi (54; 15.8%); Bodari (39; 11.5%); and Yello Lala (18; 5.3%). Plasmodium vivax was the second most prevalent species in all of the kebeles that was responsible for this outbreak, after plasmodium falciparum

Table 4: Distribution of malaria cases by village and plasmodium species in Loma district malarious Kebeles June 2022

| **Kebele** | **Total tested** | **pf** | **PV** | **mixed** |
|---|---|---|---|---|
| Zima Waruma | 157 | 85 | 18 | 3 |

| | | | | |
|---|---|---|---|---|
| Halian | 67 | 51 | 5 | 1 |
| Dodi | 54 | 37 | 4 | 0 |
| Yello Lala | 20 | 10 | 2 | 0 |
| Bodary | 38 | 13 | 3 | 3 |
| Afuki | 4 | 3 | 1 | 0 |
| **Total** | **340** | **199** | **33** | **7** |

More people were afflicted by the malaria outbreak in Zima Waruma and Dodi kebeles than in Halian and Bodari kebeles, which had attack rates of 35.6, 16.6, and 13.8 and 11.3 per 1000 people, respectivey.

Table 5: malaria attack rate by sex, village and age group Loma district Dawro zone SWEP region, Ethiopia, June 2022

| **Kebeles** | **Total Population** | **Sex** | | **Age Group** | | | **Total Case** | **AR per 1000** |
|---|---|---|---|---|---|---|---|---|
| | | *Male* | *Female* | *<=5* | *6-14* | *>=15* | | |
| Zima Waruma | 4410 | 2161 | 2249 | 397 | 926 | 3087 | 157 | 35.6 |
| Halain | 4857 | 2380 | 2477 | 437 | 1020 | 3400 | 67 | 13.8 |
| Dodi | 3248 | 1592 | 1656 | 292 | 682 | 2274 | 54 | 16.6 |
| Bodari | 3377 | 1655 | 1722 | 304 | 709 | 2364 | 38 | 11.3 |
| Yello Lala | 3401 | 1667 | 1734 | 306 | 714 | 2381 | 20 | 5.9 |

By comparing the new cases with the doubled number of previously reported cases from previous years, the malaria outbreak was identified in our study area. As a result, as shown in figure below, the threshold line (the second-largest report of the previous five-year weekly report) was crossed at the start of WHO epidemiological week 18 and reached its peak in week 19.

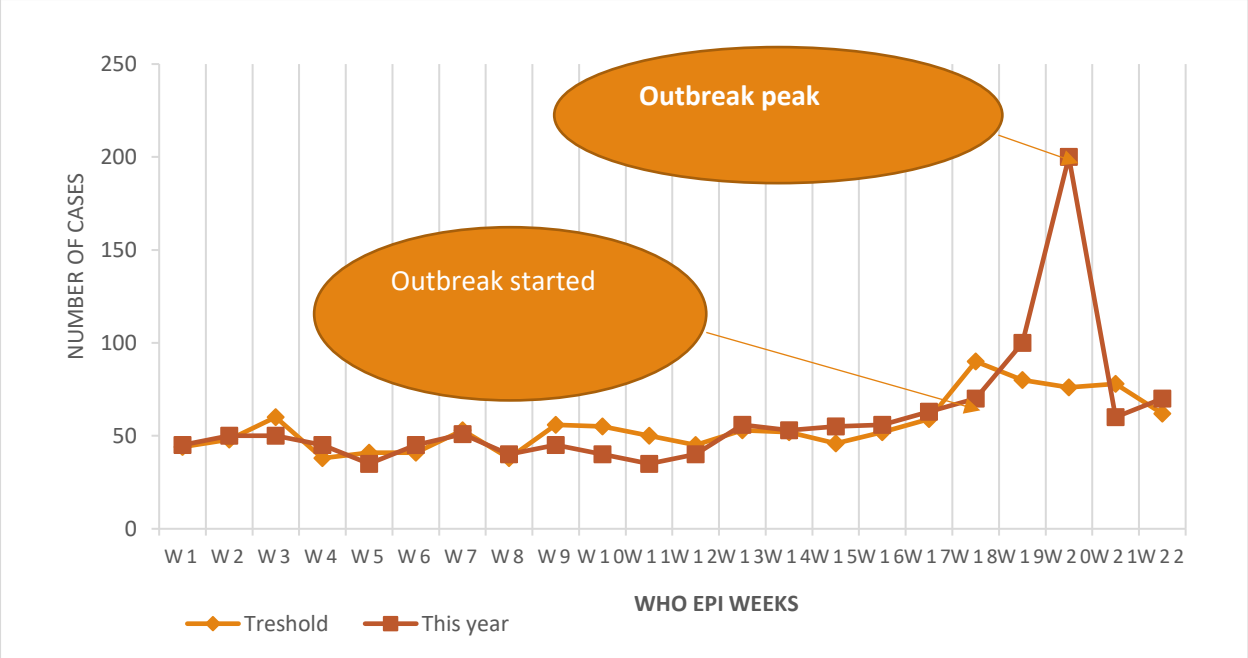


Figure 36: Trends of malaria cases crossing the number of threshold (the second largest report of the last five year weekly report the same week) Loma District, Dawro zone, SWEPR region, Ethiopia, 2022.

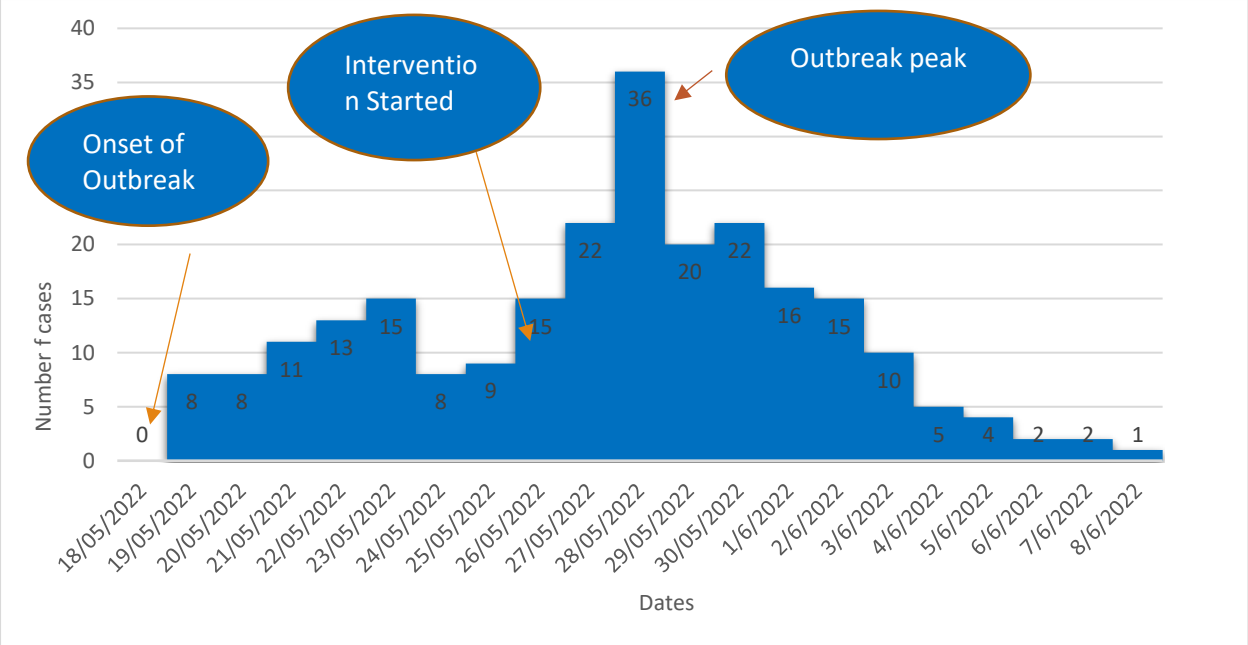


Figure 37: Epi-curve showing confirmed malaria cases by date of onset in Loma district, Dawro Zone, SWEPR, Ethiopia, from May 19/2022 to June 08/2022

The district health office departed for the site of the outbreak a week after the disease begun in accordance with an epic curve. The Epi-curve showed that the outbreak had multiple peaks and the potential for transmission from person to person. Outbreak was started on May 19, 2022. But the district health department was informed

on May 25, 2022. The peak numbers of malaria patients were on May 29, 2022. Infections with Plasmodium falciparum were more common than those with Plasmodium vivax

.

**Analytical epidemiology**

To evaluate associated factors, 199 malaria case-patients and 199 unmatched neighborhood community controls were conveniently selected and interviewed from the Loma District villages of Zima Waruma, Halian, Dodi, Bodari, and Yello Lala. There were 93 (46.2%) females among the 199 case-patients and 87 (44%) of the 199 controls. In our findings from the bivariate study, sociodemographic variables like sex and age category had no correlation with malaria. In bivariate analysis, availability of mosquito breeding sites (irrigation, stagnant water), recent travel history, IRS, and ITN use have a significant association with ((0.001) OR= 0.89 95%CI (0.25-1.25)), ((0.0001), OR= 0.475 95%CI (0.313-0.798)], (0.001) [OR (47) =, 95% CI (26.08-87.06)], and (0.001) [Odds Ratio (5.578) respectively.

*Table 6: Bivariate analysis of socio-demographic and environmental factors associated with malaria infection in Loma district, Dawro zone, SWEP region, Ethiopia, 2022.*

| **Variables** | **Classification** | **Cases** | **Controls** | **COR (95% CI)** | **P value** |
|---|---|---|---|---|---|
| Age | <=5 | 31 | 22 | | |
| | >5 | 168 | 177 | 1.48(1.21-3.78) | 0.186 |
| Sex | Male | 112 | 106 | | |
| | Female | 87 | 93 | 1.13(0.59-2.84) | 0.546 |
| Education level | Formal Education | 107 | 115 | | |
| | No formal education | 92 | 84 | 0.84(0.25-1.96) | **0.002*** |
| presence of man-made or natural water holding bodies close to the home | Yes | 66 | 40 | | |
| | No | 133 | 159 | 1.97(0.89-3.9) | **0.001*** |
| Travel History | Yes | 90 | 56 | | |
| | No | 109 | 143 | 2.11(1.52-6.81) | **0.000*** |
| Sleeping out door at night | Yes | 105 | 41 | | |

| | | | | | |
|---|---|---|---|---|---|
| | No | 94 | 158 | 4.3(1.91-12.35) | **0.001*** |
| Awareness on transmission, prevention and control of malaria | Yes | 130 | 191 | | |
| | No | 69 | 8 | 0.78(0.52-1.96) | **0.001*** |
| ITN utilization | Yes | 128 | 181 | | |
| | No | 71 | 18 | 0.18(0.12-2.12) | **0.001*** |
| Sleeping in poorly constructed house | Yes | 128 | 43 | | |
| | No | 71 | 156 | 6.54(2.35-24.12) | 0.194 |
| IRS Last year | Yes | 19 | 166 | 0.47(26.08-87.056) | |
| | No | 180 | 33 | 0.2(0.01-0.91) | **0.001*** |

## Discussions

The study's findings supported the existence of a malaria epidemic in the study area based on five years' worth of epidemiological records of malaria cases. In terms of the time period when more malaria cases were reported, the area's malaria outbreak started around the same time as other regions of Ethiopia and according to national data. In many locations of Ethiopia, malaria epidemics frequently occur from May to July.(10) Unusual temperatures and heavy rain in the middle of June in the affected village may also enhance mosquito breeding sites, due to some stagnant water bodies, which is consistent with literature.(11)

Following surprising rises in malaria cases found and reported from various health centers, the existence of the disease was confirmed. Our research revealed a three-week-long malaria outbreak in the Loma district. The epidemic curve features many peaks that are indicative of a spreading outbreak (propagative type) and indicate transmission from person to person. In comparison to the previous year during WHO epidemic week, there were more than double as many malaria cases reported. On week 19 of 2022, malaria cases peaked in severity. The threshold graph and index case of the Epi-curve indicated that the epidemic response had been delayed There were numerous mosquito breeding sites found in the area that may be the cause of the outbreak. The stable water at the dam's edge, which occasionally rises, severely impacted Zima waruma Kebele, which shares a long boundary with the Omo dam. Due to recent numerous road construction projects, which result in many portions of the kebele having standing water, Halian

kebele was the second most affected kebele of the district. Moreover, interior residual spraying of homes in infected kebeles was delayed.

**Factors independently associated with malaria infection**

Five variables were revealed to be substantially linked with malaria infection in the multivariable regression model after controlling for confounding effect. In multivariate analysis Education level (AOR = 0.4, 95% CI (0.24-0.72 P-value 0.008), the presence of mosquito breeding sites close to residence areas (AOR = 2.08, 95% CI (0.96-4.56), P= 0.046), sleeping outside at night (AOR =3.96, 95% CI (1.96-8.1), not using ITN (AOR = 0.81, 95% CI: 0.1-0.9) P value 0.001, and not using IRS at home (AOR =8.9 (5.32-14.23), P= 0.001) are statistically associated with development of the malaria.

Table 7: Multivariable logistic analysis of factors independently associated with malaria infection in Loma district, Dawro zone, SWEP region, Ethiopia, 2022.

| Variables | Classification | Cases | Controls | AOR (95% CI) | P value |
|---|---|---|---|---|---|
| Education level | Formal Education | 107 | 115 | | |
| | No formal education | 92 | 84 | 0.4(0.24-0.72 | 0.008** |
| presence of man-made or natural water holding bodies close to the home | Yes | 66 | 40 | 2.08(0.96-4.56) | 0.046** |
| | No | 133 | 159 | | |
| Sleeping out door at night | Yes | 105 | 41 | 3.96(1.96-8.1) | 0.001** |
| | No | 94 | 158 | | |
| Awareness on transmission, prevention and control of malaria | Yes | 130 | 191 | | |
| | No | 69 | 8 | 0.064(0.18-0.56) | 0.001** |
| ITN utilization | Yes | 79 | 181 | | |
| | No | 120 | 18 | 0.81(0.25-1.23) | 0.001** |
| IRS Home last year | Yes | 19 | 166 | | |
| | No | 180 | 33 | 8.9 (5.32-14.23) | 0.001** |

After the outbreak started, spraying was initiated in a small number of rural kebeles, but not all of the district's maladjusted kebeles were affected. Study done in Duke University, Durham, North Carolina revealed that one of the most promising solutions for reducing the burden of malaria worldwide is indoor residual spraying. IRS greatly reduces the prevalence of malaria parasitemia in the community.(12)

Children of <15 and females were more affected with AR of 4.3 and 2.5 per 1000 population. Research in India,(13) Ethiopia,(14) and Zimbabwe (15) found that children and women were more likely to contract malaria than adults. This may be due to Children may have low immune systems than adults, and inappropriate ITN use, not prioritizing children and women's use of ITNs at home, and spending more time outside in the evening conducting household tasks. The district's overall attack rate was 36 cases per 10,000 population. This finding was significantly lower than those from studies conducted in the Tanqua Abergelie (331 per 10,000 population) and Afar (367 per 10,000 population) regions of northern Ethiopia, but at a higher attack rate than those from the Laelay Adyabo district (12.1 per 10,000). (16)(17)(18).

Other findings of the analytical epidemiological investigation demonstrated that exposure to the malaria parasite was primarily influenced by stagnant water. Those who live close to man-made or natural water holding bodies are 2.1 times more likely to contract malaria than those who do not. A result that is in line with earlier studies in the literature from Sri Lanka and India indicate that being close to vector breeding grounds increased exposure risk to the malaria parasite compared to living farther away.(19) (20) The other triggering factor for anopheles mosquito breeding was the Omo River Dam. This might be caused by a shift in the climate; a lack of rain leading to water bodies breaking up, which would increase the population of breeding vectors. As a result, the majority of the population that were affected lived at and around irrigation sites of the dam. However, due to the district's decrease in malaria cases over the past four years, proper vector control measures, such as the use of LLINs, IRS performance, and environmental control management, were not taken. When compared to the nationally registered proportions of Plasmodium falciparum and Plasmodium Vivax, which are 60% and 40% respectively, the high proportion of Plasmodium falciparum cases demonstrates a difference.(21) 83.2% of those affected by this outbreak had Plasmodium falciparum, 13.8% had Vivax, and 3% had both species together.

Use of insecticide-treated nets (ITNs) was substantially related with malaria infection, according to our study. Cases had 65% fewer chances of utilizing ITNs than controls, which raised the likelihood of contracting malaria. This result is in line with a study carried out in Kenya that shown the use of mosquito nets (ITNs) was linked to a lower likelihood of malaria impact and transmission.(22) In most households of the cases observed, LLIN bed nets were improperly put and poorly used, yet in a study conducted in Prion, Mali, also indicates that using LLIN considerably reduced the burden of malaria. (23) Moreover, in this district's poor performance in the areas of early warning surveillance, environmental management, and absence of IRS spray in some kebeles for the last three years may have caused seasonal peaks to rise above the epidemic threshold.

According to the study, treating homes with chemicals (IRS) was linked to a lower risk of contracting malaria. Not using IRS increases the odd of contracting malaria 8.9 times more than those who used IRS in the previous year. This outcome is comparable to a study conducted in Uganda, which found that using IRS at home greatly reduced the incidence of malaria.(24) This is due to community acceptance of IRS has been impeded by Insecticide odour, mess caused by sprayers, trouble of having to remove home goods before spraying, rise in the frequency of other insects, perception of ineffectiveness, and side effects have all hindered community adoption of IRS. It is necessary to remove these obstacles in order to enhance the use of IRS for malaria preventio

## Study Limitations

- Some kebeles lack a road, making them challenging to easily reach to conduct investigations into the surrounding environment and certain situations.
- The chosen disease-free controls can be in the malaria incubation phase

## Conclusions

3.6/1000 people were affected by malaria overall during this episode, which had a high attack rate. Residents of Zima Waruma and female populations were disproportionately affected by this malaria outbreak. The Plasmodium falciparum species is the most frequent reason for the outbreak. Even if there are efforts to stop malaria from spreading in the region, the

elements that keep malaria from spreading are not adequately managed. Predictors of the infection include the availability of mosquito breeding grounds close to the house (Different Road construction projects, the Omo River dam), sleeping outside at night, not using an ITN, and not having IRS at home.

Thus, it is necessary to put malaria prevention and control measures into place, beginning with environmental safeguards and hygienic practices. Malaria outbreaks may be decreased through improved environmental management at irrigation sites, the elimination and treatment of stagnant water bodies, animal disturbance of mushy water lands and vector breeding sites, distribution of bed nets, provision of diagnostic and therapeutic materials to each risk area, community awareness of malaria mode of transmission and prevention modalities, and community empowerment on environmental cleanliness.

- Maintains community health education regarding disease transmission mechanisms and preventative measures (HEW and district Health office)
- To reduce the rate of false positives, further study is required to assess the validity and reliability of fast diagnostic tests.

## Recommendations

- Encourage people to stay away from potential mosquito breeding grounds or Avoid breeding sites. (District Health office and HEW)
- Replacement of ITNs in the malarious kebeles on time (FMOH and SWEP region Health office)
- When sleeping outside at night, use bed nets with insect protection (Community)
- Appropriate chemicals must be used in timely indoor residual spraying operations that are planned in accordance with the required standard (twice per year) and sprayed prior to the rainy season. (Loma District and Dawro zone Health bureau)

## Competing interests

No competing interests.

## Authors' contributions

Ebsa File- concept, design, acquisition of data, analysis, interpretation and writing of manuscript.

Adamu A, Nigussie D, Wedimu A, Abdulnasir A, and Abadit N – guidance and review of the manuscript.


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# Chapter SIX - Abstracts for Scientific Presentation

### 6.1. Malaria Outbreak Investigation in Loma District of Dawro zone, SWEP Region, Ethiopia, 2022

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## Abstract:

**Background**: Malaria is a significant public health problem that still results in disease and fatalities. The WHO estimates that there were 247 million cases of malaria worldwide in 84 countries with endemic transmission (including French Guiana) in 2021. Ethiopia is a Sub-Saharan African nation with a high annual malaria case count because the geography of the vast majority of the country favor's vector breeding. The objective of this study was to assess the scope, describe amount of morbidity and mortality and potential causes of the malaria outbreak in the Loma District of the Dawro Zone, SWEP Region, Ethiopia, between May 19 and June 11, 2022.

**Methods**: From May 19 and June 11, 2022, a descriptive and 1:1 unmatched case-control study was conducted in the Loma district. There were 340 instances used in total for the descriptive study. 199 cases and 199 controls were chosen using a computer-generated basic random approach with a line list as a sampling frame in order to find the factor linked to the outbreak. Malaria positive patients who presented to a health facility with symptoms were recognized as active cases, and controls were chosen from the patients' neighbors. We gathered information using a standardized questionnaire; cases were described in terms of the time, place, and person. logistic regression was then used to determine the factors associated to malaria.

**Results**: A total of 340 cases were found, with an attack rate of 3.6 per 1000 people and a case fatality rate (CFR) of zero. Children under the age of 59 months had the highest attack rate (4.8/1000). Being close to stagnant water increased the risk of contracting the malaria parasite compared to living farther away (AOR = 2.1, 95% CI: 0.96-4.56 and P value = 0.046). Other factors which statistically linked to the development of malaria include: lack of education (AOR = 0.4, 95% CI (0.24-0.72 P-value 0.008), sleeping outside at night (AOR = 3.96, 95 CI (1.96-8.1), not using an ITN (AOR = 0.81, 95% CI: 0.1-0.9), and not using an IRS at home (AOR =8.9, 95% CI (5.23-14.32), P=0.001).

**Conclusion**: Over all during this outbreak 3.6/1000 people were affected. Residents of Zima Waruma kebele were most affected kebele and children of <15 years were more affected by this malaria outbreak. The Plasmodium falciparum species is the most frequent reason for the outbreak.

**Key Words**: Malaria, Loma, Outbreak and Case control.

## 6.2. Measles Outbreak Investigation in Raso District of Afder zone, Somali Region Ethiopia, 2022

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**Abstract**

**Background**: Measles is a viral illness that is extremely contagious. Globally, over 207 000 people died from the measles in 2019, which was the greatest number of cases documented in 23 years. A measles epidemic was reported from Raso district in Somali Region, Ethiopia, on March 27, 2022 (4th WHO week). Thus, we investigated into the outbreak's existence and the contributing factors.

**Method**s: From March 27 to April 29/2022, a descriptive and 1:2 unmatched case-control study was conducted in the Raso district. There were 85 cases used in total for the descriptive study. 58 cases were chosen by computer-generated simple random approach employing line list as a sampling frame, and 116 controls were analyzed in order to find the factor linked to the outbreak. Home-to-home searches in the affected kebeles were used to find active cases, and controls were chosen from cases' neighbors. To confirm cases, an IgM test was performed on five serum samples. Cases were defined as anyone who experienced a fever, maculopapular rash, cough, coryza, or conjunctivitis, whereas controls did not have these symptoms. We gathered information using a standardized questionnaire, and cases were described in terms of the person, place, and time they occurred. Logistic regression was then used to find factors linked to measles cases. P-value 0.05 was used in the multivariable analysis to denote statistical significance.

**Results:** Totally 85 cases were found, with an attack rate of 1.7 per 1000 people overall and a case fatality rate (CFR) of 2.3%. Children under the age of 59 months had the highest attack rate (6.5/1000). Being unvaccinated (adjusted odds ratio/AOR with 95% confidence interval [CI]:1.039(1.026-1.256), contact with patients (AOR=3.22, 95% CI: 1.05-11.17), moderate malnutrition (AOR=1.156, 95% CI: 1.085-1.210), family size greater than five (AOR = 1.32, 95% CI: 0.03-3.56), and being younger than five years of age (AOR=22.8, 95% CI: CI: 1.69-309.2) were shown significant associated with measles infection.

**Conclusion:** Investigation attack and fatality rates were high. The outbreak was linked to immunization status, Age, malnutrition, family size and previous contact with measles cases. To prevent further measles outbreaks, we advise implementing vaccination campaigns, nutritional interventions, and strengthened routine immunization program.

**Keywords:** outbreak, measles, Raso, case control, Somali Region Ethiopia 2022.

# Chapter Seven - Summary of Disaster Situation Visited

## 7. Health and Nutrition Emergency Needs Assessment Report for the South West Ethiopia Region, Dawro Zone, June 2022.


### Abstract

**Background:** The impact and actions of disasters in one region can affect risks in another, and vice versa. Natural and man-made disasters have become more common as human populations have increased and societies have become more interconnected and complex. In order to produce appropriate analyses and judgments, good assessment practice necessitates the availability of sufficient relevant information. The data is then used to make decisions on four major issues: whether to intervene, the nature and scope of the intervention, resource prioritization and allocation, and program design and planning. Humanitarian need assessment or community risk assessment is a participatory approach to assessing hazards, vulnerabilities, risks, and ability to cope, developing coping strategies, and finally developing a risk reduction option implementation plan by the local community

**Methods**: All five affected woredas were visited on purpose. To collect primary and secondary data, semi-structured check lists were used. Officers from PHEM, nutrition, and emergency risk management were interviewed. Some work areas were directly observed, and a community group discussion was held. The assessment included all health and health-related events.

**Results:** Drought hit five woredas, affecting a total population of 230839 people and 70162 households. All kebeles in the affected woredas are nearly affected. The boundaries of all five woredas are the same**.** More than 300,000 of these were addressed. 68,927 animals died, including cattle, sheep, goats, horses, and donkeys**.** According to the most recent nine-month nutrition report, 2217 SAM and 15546 MAM cases were reported out of a total of 138174 under-five children. The total number of pregnant and lactating mothers was 60745. There were 14392 PLW from this MUAC 23. Only two hotspot woredas have done mass screening with UNICEF support. Two U-5 deaths reported from Loma woreda due to areas from where they come is difficult to reach and cases arrived after medical complications.

**Conclusion and Recommendation:** There is evidence of an increase in the prevalence of malnutrition among PLW and under five children in the months under consideration for this assessment. As a result, it is recommended that nutritional support for feeding enhancement and feeding practices be increased. Health education in the community (health posts, health centers, HEW, community centers).



**Key words:** Drought, Nutrition, Dawro zone

## Introduction

Disaster is defined as a severe disruption in societal functioning those results in widespread human, material, or environmental losses that exceed local response resources, necessitating calls for external assistance.(1) Disaster risk is becoming a global concern, and its impact and actions in one region can affect risks in another, and vice versa. Natural and human-caused disasters have become increasingly widespread as human populations have grown and societies have become more interconnected and complex. The interaction and compounding of socioeconomic, political, and cultural factors, as well as geographical and other factors, broadens the scope of a disaster's impact.(2)

Early warning necessitates the collection of disparate types of information in order to make a specific prediction about how many people, where, when, and for how long an event may have a significant impact. Ethiopia's early warning system dates back further than any other in Africa, to the aftermath of the 1973 Wallo famine. (3) Disaster loss and damage are increasing in Ethiopia, with serious consequences for our citizens' survival, dignity, and livelihood, particularly among the poor. Currently, the Ethiopian government is devoting significant resources to responding to Public Health Emergencies such as disease epidemics, widespread malnutrition, and internal conflict caused by drought and current political and socioeconomic situations. The country is also vulnerable to potential natural disasters such as floods and internal conflict, which result in the displacement of a large number of people, causing health and social problems with varying degrees of impact on the health sector

Humanitarian need assessment or community risk assessment is a participatory approach to assessing hazards, vulnerabilities, risks, and ability to cope, developing coping strategies, and finally developing a risk reduction option implementation plan by the local community. Humanitarian need assessments use scientific data and predictions, as well as participatory debates, to identify, analyses, and evaluate a community's risk environment, as well as reach community consensus on risk-management activities.(4) In order to produce appropriate analyses and judgments, good assessment practice necessitates the availability of sufficient relevant information. The data is then used to make decisions on four major issues: whether to intervene, the nature and scope of the intervention, resource prioritization and allocation, and program design and planning. Formal needs assessments can also be used to coerce others into making a decision, influence the nature of other people's decisions, or verify or justify previous decisions. Humanitarian need assessment is a method of obtaining a more consistent and

accurate picture of the magnitude and nature of the problems people face during humanitarian crises, as well as ensuring that response decisions are properly guided by that knowledge.(5)

A rapid assessment is carried out immediately after the onset of a disaster in order to assess the disaster-affected areas and the needs of disaster victims on a local level. When faced with catastrophic disasters such as conflict displacement, earthquakes, and floods, medical providers' first instinct is to go and provide assistance. However, one must resist the initial urge and conduct an initial rapid assessment. This is distinct from the immediate lifesaving efforts of emergency search and rescue or disaster medical assistance teams. The first step in humanitarian response, as stated in the Sphere Standards, is to assess the needs of the affected population and design a prioritized plan of action based on those needs. As a result, the quality improves, as well as response time significant gaps or overlaps in assistance may occur if a rapid assessment is not conducted. The initial rapid assessment is carried out as soon as a disaster occurs and should be completed within a week at the most. (5)

Ethiopia's government has been conducting emergency health and nutrition assessments in the past few years to address the country's critical health and nutrition needs. Because the country is vulnerable to natural disasters such as floods, which can result in population displacement and health and social problems with different degrees of impact on the health sector, the federal government has been allocating significant resources to the response to public health emergencies, which range from disease epidemics to widespread malnutrition due to drought. In the assessments, both government and non-governmental organizations participated. During the assessment, possible human health and nutrition risks were identified, and the numbers of beneficiaries were estimated. Finally, using the results of the assessment, a humanitarian document was developed and distributed to all partners to fill the gaps identified to avert and minimize public health consequences.

The goal of this assessment is not to conduct a detailed survey, but rather to conduct a broad assessment of the disaster and the population's basic needs in order to identify priority areas for assistance. When conducting the assessment, it is recommended that information be gathered from as many sources as possible and that direct observation be performed in order to verify the data further burden to the affected population.

## Statement of the problem

Every disaster has a negative impact on affected populations' health, hygiene, sanitation, and social/care situation. Because of the high disease burden and inadequate diet, acute malnutrition frequently increases in the immediate aftermath of an emergency. Emergencies can also have a negative impact on stunting, infant and young child feeding practices, and vulnerable groups' micronutrient status.(6)

Food insecurity, malnutrition, and disinvestment in health systems have all contributed to rising national crises and made countries more vulnerable to systemic shocks over the last 15 years. The impact on the underlying causes of malnutrition: food insecurity, poor health systems, and poor interpersonal caring amplify crises. Food-insecure, marginal agricultural areas hit by drought, high winds, floods, or global financial market shocks are especially vulnerable to the humanitarian disaster and poor nutrition cycle.(7)

The indicators 'environmental constraints, “restriction and obstruction to services and assistance,' and ‘restriction of movement within the country' were the most common challenges across all crises and scored highest among the considered indicators in the first half of 2022.(8) In 2018, over 821 million people worldwide suffered from hunger, food insecurity, and malnutrition.(9)

In Africa, Somalia and Ethiopia face access challenges due to the remoteness of some areas that are not accessible by road. Some roads in southern and central Somalia are closed, and many rural areas are particularly remote due to a lack of road networks, forcing humanitarian operations to rely on more expensive air transport.(8)

## Significance of the study

In Ethiopia, which has limited resources, early detection and prevention activities are critical strategies for responding to public health emergencies. Malaria outbreaks are expected in several parts of Ethiopia following the Meher rains, due to the ideal conditions created for mosquito breeding. Due to Ethiopia's location in the meningitis belt, an outbreak of meningitis is possible during the dry seasons. Furthermore, year after year, internal displacement caused by drought and flooding exposed far too many Ethiopians to diarrheal infections, measles, severe acute malnutrition, and other illnesses. A lack of drinking water during the dry season is one of the major risk factors for the occurrence of acute watery diarrhea throughout the country, and remote areas are especially vulnerable to the aforementioned health occurrences due to geographical and climatic conditions.

Due to this, early vulnerability assessment and the provision of appropriate resources to at-risk populations are critical to minimizing health budget losses, school dropout rates, and production power losses caused by natural and man-made disasters and epidemic diseases. As a result, this assessment is critical in identifying locations where emergency assistance (health and nutrition) may be required as a result of acute problems, as well as estimating the size of the population in need of emergency assistance over the next three months. The results may be useful as a reference for interested scholars.

## Objective

### General Objective

Assess existing health and nutrition-related emergency events and contribute to proper and effective humanitarian planning and response, resulting in lower morbidity and mortality in the most vulnerable areas of the assessed zone in the South West Ethiopian People Region (Dawro Zone) (May to July 2022)

### Specific Objectives

- To assess the extents, types, magnitude, severity, and likelihood of various hazards (drought and human epidemics)
- To assess the existing capacity of health services to respond to health and nutrition emergencies those are likely to occur during the first months of the drought.
- To identify areas where emergency assistance (health and nutrition) may be required due to acute problems
- To develop emergency preparedness plans for the region based on the findings

## Method and Materials

### Study Areas and Period

Dawro (or Dawro) is a zone in Ethiopia's South Western Region. It is about 500 kilometers southwest of Addis Ababa, Ethiopia's capital, and 70 kilometers from Bonga, the SWEPR's capital. Dawuro is bounded on the south by Gamo Gofa Zone, on the west by Konta special woreda, on the north by the Gojeb River, which defines its border with Oromia Region, on the northeast by Hadiya and Kembata Tembaro Zones, and on the east by Wolayita Zone; the Omo River defines its eastern and southern boundaries. Waka was the administrative center of Dawuro before it was moved to Tarcha.

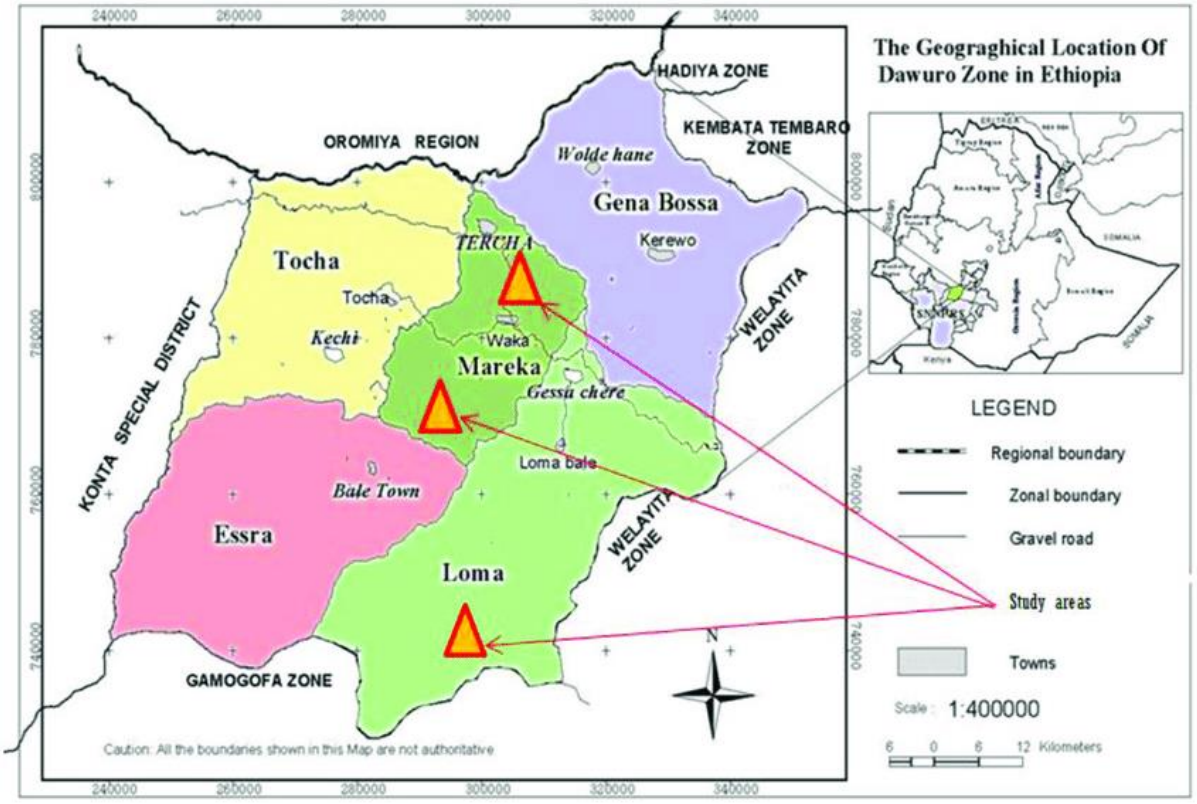


*Figure 38: SWEP region, Dawro zone assessment zone area map*

## Tools for Evaluation

Semi-structured questionnaires were used to collect data. Two separate questioners were used to collect health and nutrition-related data at the district and zonal levels. The questioners inquire about the socio-demographic profile, the health profile, the top five causes of morbidity, the status of epidemic-prone diseases in the previous three months, the existence of outbreaks in the previous three months, and the current epidemic situation, as well as the availability of emergency drugs at the zonal and district levels, the status of epidemic prevention and control plans, the existence of multi-sectoral coordination committees at all levels, and the availability of multi-sectoral coordination committees at all levels.

## Source of data

District health offices provided both primary and secondary data. The documents were examined. In a specific point, the woreda health office, health facilities, and community were all visited. Secondary data was obtained by reviewing HMIS and Surveillance records. Primary data was collected from the woreda health office head, the woreda disaster and risk management officer, the public health emergency management focal person, maternal and child health officers, and the nutrition focal person using a structured checklist. In addition, a community focus group discussion on health and health-related events was held.

## Ethical clearance

The teams from MOH and EPHI informed the region before moving to the study area, and legal permission was obtained from the region. The regional health bureau and the regional disaster risk management commission send a circular letter to all selected Woredas. Individuals took part in interviews, and members of the community took part in focus group discussions. Participants were asked for their willingness informally after being briefed on the purpose of the assessment. Through assessment, confidentiality is maintained.

## Results

### Socio-demographic Profile

The total population of the Dawro Zone was 700072, with 344435 (49.2 percent) males and 355637 (50.8 percent) females. When it came to the age group of these assessed woredas, 109281 (15.61 percent) were under five children. The rural population was 595061 (85.0%), while the urban population was 105011 (15.0%).

Drought hit five woredas, affecting a total population of 230839 people and 70162 households. All kebeles in the affected woredas are nearly affected. The boundaries of all five woredas are the same.

*Table 35: Drought-affected woredas and population estimates with health facilities, Dawro zone, SWEPR 2022*

| Woreda | Total Popⁿ | House Hold | No of Primary Hospitals | No of HC | No of functional HC | No of HP | No of HEWs |
|---|---|---|---|---|---|---|---|
| Zaba Gazo | 53950 | 11010 | 1 | 3 | 3 | 17 | 34 |
| Gena | 46686 | 9528 | 0 | 1 | 1 | 14 | 28 |
| Loma | 112954 | 23051 | 1 | 3 | 3 | 28 | 46 |
| Disa | 58337 | 11906 | 0 | 1 | 1 | 16 | 30 |
| Tercha Zuria | 71866 | 14667 | 1 | 2 | 2 | 18 | 36 |
| **Total** | 230839 | 70162 | 3 | 10 | 10 | 93 | 174 |

### Structure of zonal administration

Dawro has ten Woredas, two town administrations, and eighty-two Kebeles (161 rural and 21 urban kebeles)

### Health Facilities

Dawro zone is served by three hospitals (one general and two primary), 21 health centers, and 172 health posts. 45 different types of private health facilities, including small clinics, medium clinics, drug stores, and pharmacies, provide services in the Dawro zone. 95 percent of these health facilities provided regular reports to the RHB/PHEM weekly IDSR reporting system. All of the health facilities are operational, according to the assessed functionality. One hospital and two health centers are being built and will be completed this year. There were not enough health posts in some remote areas of woredas.

**System of coordination and management**

All assessed woredas and health facilities have public health emergency management (PHEM) officers, and there are established rapid response teams (RRT) comprised of multidisciplinary professionals in each member. The reporting system is the same in all of the Woredas we've visited. All health facilities report data to Woreda every Monday until midday. The Woreda PHEM officer compiles data from respective health centers on Tuesdays until midday and reports to the regional health bureau.

Multi-sectorial epidemic control and prevention coordination committees were formed at each assessed Woreda level with a regular meeting schedule, which led by the Zonal health office. Only Gena Woreda lacks a preparedness and response plan for public health emergencies, and none of the woredas visited have an accessible emergency response fund. No non-governmental organization (NGO) is assisting all drought-affected woredas.

**Stakeholders took part in humanitarian response activities**.

Many governmental organizations and a few non-governmental organizations (NGOs) were involved in humanitarian response activities by providing technical, financial, and logistical support. The following organizations are taking part in the response: MoH, EPSA, EPHI, RHB, UNICEF, and GOAL.

**Zonal Preparedness and Response Capacity**

Disease outbreaks and other public health emergencies necessitate a well-coordinated system at all levels. All of the woredas visited had an epidemic prevention and control committee led by the chief woreda administrator, as well as a rapid response team comprised of multidisciplinary health professionals. However, when an epidemic is not reported, the committee and teams are never called to action in any of the Woredas visited.

The availability of emergency drugs, medical supplies, logistics, and budget all have an impact on the effectiveness of outbreak control measures. According to drug and supply stock reviews, more than 70% of the assessed woredas have emergency stocks specifically kept for emergency response. However, no specific budgets for woreda-level emergency rapid response were found in any of the woredas visited. There were shortages of emergency drugs and diagnostic test supplies in many woredas for treating malaria complications and malnutrition. Water availability at stabilization centers is a major issue in some woredas

In general, woredas' preparedness and capacity to respond to public health emergencies in terms of stockpiling emergency drugs and medical supplies, securing a contingency budget, medical staff experience in managing outbreaks other than AWD, and coordination have all been found to be insufficient.

## Zone General Drought Situational Analysis

Long periods of no rain lasting more than a year, resulting in the deaths of thousands of animals and a shift in geo-climatic conditions from dega to kolla in many woredas. Rainfall has been significantly lower than normal in the early part of the long rains season (March-May), and the limited rains are not expected to replenish water sources. Kolla geo-climatic conditions characterize the majority of drought-affected areas. It was observed and affected primarily two woredas in the zone before worsening and expanding to new geographic areas, necessitating continued, increased and immediate life-saving response in the months ahead to address increasing needs in scope and scale.

The humanitarian situation in drought-affected areas and across sectors of intervention continues to deteriorate. Food prices have risen significantly, exposing vulnerable communities to food insecurity. As a result of a year-long drought, people are facing food shortages and the extinction of thousands of life stocks. Thousands of animals have died due to a lack of water, food, and disease caused by desert flies. Despite a strong health system and strong staff commitment at all levels, HFs face logistic and supply shortages due to a lack of vehicles and a poor road network that makes reaching every location quickly difficult. There are also kebeles that are difficult to reach due to poor road and topography of the area.

There are no displaced people in the zone, and there are no IDP camps. Drought has affected 230,839 individuals and 70,162 households. More than 300,000 of these were addressed. 68,927 animals died, including cattle, sheep, goats, horses, and donkeys. Field observations show that disease risks and mortality in livestock increase in the immediate first season of drought. Despite the thousands of deaths, there was no livestock feed supplementation or veterinary assistance.

*Table 36: Summary of Life stocks died due to drought*

| S.NO | Woreda | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Oxen | Cow | Bull | Heifer | calf | Total | Sheep | goat | Horse | Mule | Donkey | Hen |
| 1 | Esara | 203 | 1080 | 610 | 470 | 340 | 2703 | 620 | 107 | 43 | 13 | 27 | 0 |
| 2 | Loma | 566 | 561 | 117 | 430 | 633 | 2307 | 94 | 404 | 0 | 49 | 106 | 0 |
| 3 | Disa | 2585 | 3798 | 2695 | 2486 | 3432 | 14996 | 3693 | 2447 | 12 | 103 | 98 | 949 |
| 4 | Zaba | 279 | 321 | 206 | 205 | 308 | 1319 | 35 | 247 | 0 | 19 | 55 | 324 |
| 5 | Gena | 2242 | 1942 | 334 | 149 | 173 | 4840 | 398 | 1750 | 11 | 39 | 720 | 5204 |
| 6 | T/Zuria | 3600 | 5380 | 4230 | 4280 | 216 | 17706 | 580 | 1540 | 6 | 120 | 127 | 4486 |
| 7 | | 49 | 240 | 0 | 0 | 144 | 433 | 25 | 38 | 0 | 4 | 47 | 83 |
| | Total | 9524 | 13322 | 8192 | 8020 | 5246 | 44304 | 5445 | 6533 | 72 | 347 | 1180 | 11046 |

## A summary of the major activities carried out by response clusters

### Coordination

The establishment of an Emergency Operation Center monitored and coordinated all humanitarian response activities provided by clusters (EOC). We collaborate closely with the Water Office, the DRM Office, Hospitals and Zonal Office. Feedback was given to HFs, health, water, and DRM offices in each woreda immediately following the meeting and supervision, as well as the Zonal Task Force. SC Sites and OTP Sites have supervised at all facilities, and discussions on challenges and next steps have taken place.

## Wash

Water coverage of the zone was 36.71% with 34.73% was Rural and 47.19% was urban coverage. Different type of water scheme is nonfunctional currently due to lack of budget for maintenance. Functional water scheme coverage is around 77%. Surface water available during period of rainy season. Other population uses river that crosses along the Woredas or Kebeles. The water table decrement also aggravates the non-functionality. Out of 1947existing different types water scheme 439 are nonfunctional and 1501 are functional. Due to these Thousands of populations has not access water.

*Table 37: Dawro zone, 2014 EFY Water access coverage (%)*

| S. No | Woreda/Town Adm./Zone | Population with access to safe water | | | Water access coverage (%) | | |
|---|---|---|---|---|---|---|---|
| | | Urban | Rural | U+R | Urban | Rural | Average |
| 1 | Mari Mansa | 2420 | 15203 | 17623 | 33.92 | 19.05 | 20.27 |
| 2 | Mareka | 6606 | 20979 | 27585 | 47.07 | 41.12 | 42.4 |
| 3 | Tarcha Zuria | 1930 | 14644 | 16574 | 42.91 | 18.38 | 19.69 |
| 4 | Gena | 370 | 14160 | 14530 | 9.89 | 30.08 | 28.59 |
| 5 | Zaba Gazo | 8185 | 17799 | 25984 | 73.17 | 36.01 | 42.87 |
| 6 | Loma | 9000 | 43596 | 52596 | 43.05 | 43.35 | 43.3 |
| 7 | Dissa | 1255 | 10614 | 11869 | 31.52 | 18.3 | 19.15 |
| 8 | Tocha | 8326 | 26335 | 34661 | 61.83 | 42.48 | 45.93 |
| 9 | Kechi | 250 | 10845 | 11095 | 5.1 | 25.13 | 23.09 |
| 10 | Esera | 13866 | 53892 | 67758 | 62.94 | 61.09 | 61.46 |
| 11 | Tarcha Town Admin | 6565 | 1905 | 8470 | 35.21 | 60.28 | 38.84 |
| 12 | Dawro/Zone | 58773 | 229972 | 288745 | 47.19 | 34.73 | 36.71 |

## Latrine Status

Zonal Latrine coverage was only 54.5%, which is extremely low. This is due to a lack of coordination among hygiene actors, cultural and behavioral issues, and a limitation in Health Extension program activities due to a lack of funding and capacity building. Other reasons could be a lack of community empowerment, a push for unequal access, or a combination of the two. Failure to communicate with wash partners in order to provide different kits, as well as failure to make political commitments Prioritize issues and seek assistance as needed.

**Some Wash activities performed**

- Water sources were chlorinated, and soap and water treatment chemicals were distributed.
- Latrines in schools previously occupied by IDPs were cleaned, deluged, and decommissioned.
- Water trucking to IDPs, health centers, and nutrition facilities (SCs) Capacity-building training on water quality management and other WaSH-related activities was provided to Woreda staff (6 health workers from each woreda)
- The Water Bureau was given pumps and generators for installation.

## Nutrition

### Availability of therapeutic supplies

Nutrition supplies and routine drugs for malnutrition treatment were assessed in all affected woredas based on their availability and sufficiency for the next three months. There was some report of a shortage of nutrition supplies or standard medications for the treatment of severe acute malnutrition, according to the assessment team. All affected woredas will require medical supplies for the next three months.

### Malnutrition Reporting System

Diverse individuals from various sectors have been assigned to work collaboratively at the zone and woreda levels. Common channel of communication created with Monthly/Quarter feed-back. Monitoring the consistency of data, integration with available partners is good monitoring training gaps and training data by title. In addition to what is routinely done by HEW, nutritional screening is performed daily at HFs (in MCH and under five OPD) Last month; a nutritional mass campaign was completed. The nutritional supply shortage was alleviated by changing from other health care facilities bringing items from other zones and regions to the affected area.

### Screening Performance

Malnourished patients are identified and assisted in receiving early nutritional intervention. All health centers and hospitals have a SC site to treat cases of severe acute malnutrition. Capacity building has been updated for professionals involved in case management across all sites. All facilities have dedicated staff. Excellent communication with the woreda and the zonal office. Hospitals are available in some woredas to refer complicated cases immediately. According to the most recent nine-month nutrition report, 2217 SAM and 15546 MAM cases were reported out of a total of 138174 under-five children. The total number of pregnant and lactating mothers was 60745. There were 14392 PLW from this MUAC 23.

*Table 38: Summary of 9 months nutrition screening report.*

| Woreda | Total screened <5children | Total MAM cases | Total SAM cases | #PLW screened for acute malnutrition | #MUAC < 23 cm/MAM cases |
|---|---|---|---|---|---|
| **Gena** | 2585 | 486 | 139 | 1563 | 634 |
| **Disa** | 8013 | 1041 | 262 | 6961 | 2019 |
| **Issara** | 26386 | 298 | 371 | 8278 | 144 |
| **T/G/H** | 12 | 5 | 132 | 11 | 11 |
| **Mari mansa** | 24502 | 261 | 128 | 4032 | 146 |
| **Tocha** | 14995 | 576 | 53 | 3486 | 30 |
| **Mareka** | 8942 | 1759 | 87 | 1845 | 124 |
| **Loma** | 29512 | 10159 | 821 | 24608 | 10709 |
| **Zaba** | 7477 | 1486 | 515 | 2941 | 438 |
| **Tercha Zuria** | 15274 | 261 | 62 | 3068 | 136 |
| **Kechi** | 8392 | 33 | 29 | 3952 | 1 |
| **ZHD** | 138174 | 15546 | 2217 | 60745 | 14392 |

With the assistance of UNICEF, two woredas, Disa and Zaba, the two most affected woredas were screened as part of a mass screening after concerned professionals were trained. Other woredas screenings were conducted concurrently with other routine tasks as part of a mass screening.

*Table 39: Report on mass screening in two of the most affected woredas (Disa and Zaba)*

| | Target | | | **screened** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Woreda | **6-24 Month** | **24-59 month** | **Total** | 6-24 month | | | 24-59 month | | | Total Screened | | | |
| | | | | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** | **Male** | **Female** | **Total** | **% of Screening Coverage** |
| **Zaba** | 2274 | 5625 | 7520 | 1494 | 1575 | 3069 | 2159 | 2249 | 4408 | 3653 | 3824 | 7477 | 99.4 |
| **Disa** | 2460 | 6085 | 8130 | 1191 | 1270 | 2461 | 2701 | 2851 | 5552 | 3892 | 4121 | 8013 | 98.6 |
| **Total** | 4728 | 11710 | 15655 | 2685 | 2845 | 5530 | 4860 | 5100 | 9960 | 7545 | 7945 | 15490 | 98.9 |

*Table 40: Severe Acute Malnutrition summary report (Disa and Zaba)*

| MUAC <11.5CM | | | | | | Bilateral Oedema | | | | | | Total SAM | SAM rate |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6-24 Months | | | 24-59 Months | | | 6-24 Months | | | 24-59 Months | | | | |
| Male | Female | Total | Male | Female | Total | Male | Female | Total | Male | Female | Total | | |
| 115 | 160 | 275 | 98 | 105 | 203 | 5 | 10 | 15 | 12 | 10 | 22 | 515 | 6.89 |
| 45 | 66 | 111 | 52 | 46 | 98 | 2 | 0 | 2 | 1 | 2 | 3 | 214 | 2.67 |
| 160 | 226 | 386 | 150 | 151 | 301 | 7 | 10 | 17 | 13 | 12 | 25 | 729 | 4.71 |

In those two woredas, a total of 2527 MAM cases for children under the age of five were identified. There were 1486 men and 1041 women among them.

*Table 41: Moderate Acute Malnutrition summary report (Disa and Zaba)*

| MUAC 11.5-<12.5 CM | | | | | | MUAC 11.5-<12.5 CM | | #GAM | Proxy GAM Rate |
|---|---|---|---|---|---|---|---|---|---|
| 6-24 Months | | | 24-59 Months | | | MAM Total | MAM rate | | |
| Male | Female | Total | Male | Female | Total | | | | |
| 318 | 361 | 679 | 404 | 403 | 807 | 1486 | 19.87 | 2001 | 26.76 |
| 207 | 227 | 434 | 274 | 333 | 607 | 1041 | 12.99 | 1255 | 15.66 |
| 525 | 588 | 1113 | 678 | 736 | 1414 | 2527 | 16.31 | 3256 | 21.02 |

Out of total screened under five children 12234 have greater than 12.5 MUAC.

*Table 42: Children MUAC > 12.5 in Zaba and Disa woredas*

| MAUC >= 12.5CM | | | | | | |
|---|---|---|---|---|---|---|
| 6-24 months | | | 24-59 months | | | G. Total |
| Male | Female | Total | Male | Female | Total | |
| 1056 | 1044 | 2100 | 1645 | 1731 | 3376 | 5476 |
| 937 | 977 | 1914 | 2374 | 2470 | 4844 | 6758 |
| 1993 | 2021 | 4014 | 4019 | 4201 | 8220 | 12234 |

Despite having limited human resources, all Health Posts provide OTP services. Woreda and the Health Center continue to provide routine health extension services despite a lack of vehicles and poor road conditions. We worked closely with Woreda Officers to strengthen the referral link between the health post and the health center.

Due to a lack of SC Kits, stabilization centers (SC) are only found in a few health centers and hospitals. Zonal Logistic Officer checked stock outs on a regular basis and deliver them only once during this drought season. Zonal logistic officers and All Woreda officers communicated about requesting stock out materials from the regions and partners due to a lack of SC and OTP registrations at many facilities. There is no regular mobile health team in almost all woredas due to a lack of funds and a lack of vehicles, we would like to recommend that the region, concerned partners, and federal institutions pay attention to those areas and allocate regular funds.

Only two hotspot woredas have done mass screening with UNICEF support. Two U-5 deaths reported from Loma woreda due to areas from where they come is difficult to reach and cases arrived after medical complications. Stock out of some crucial logistics for malnutrion like F-75, F-100 and Food for malnourished pregnant due to Transportation issue from Zone to woredas. There are no Permanent Partners available in the zone.

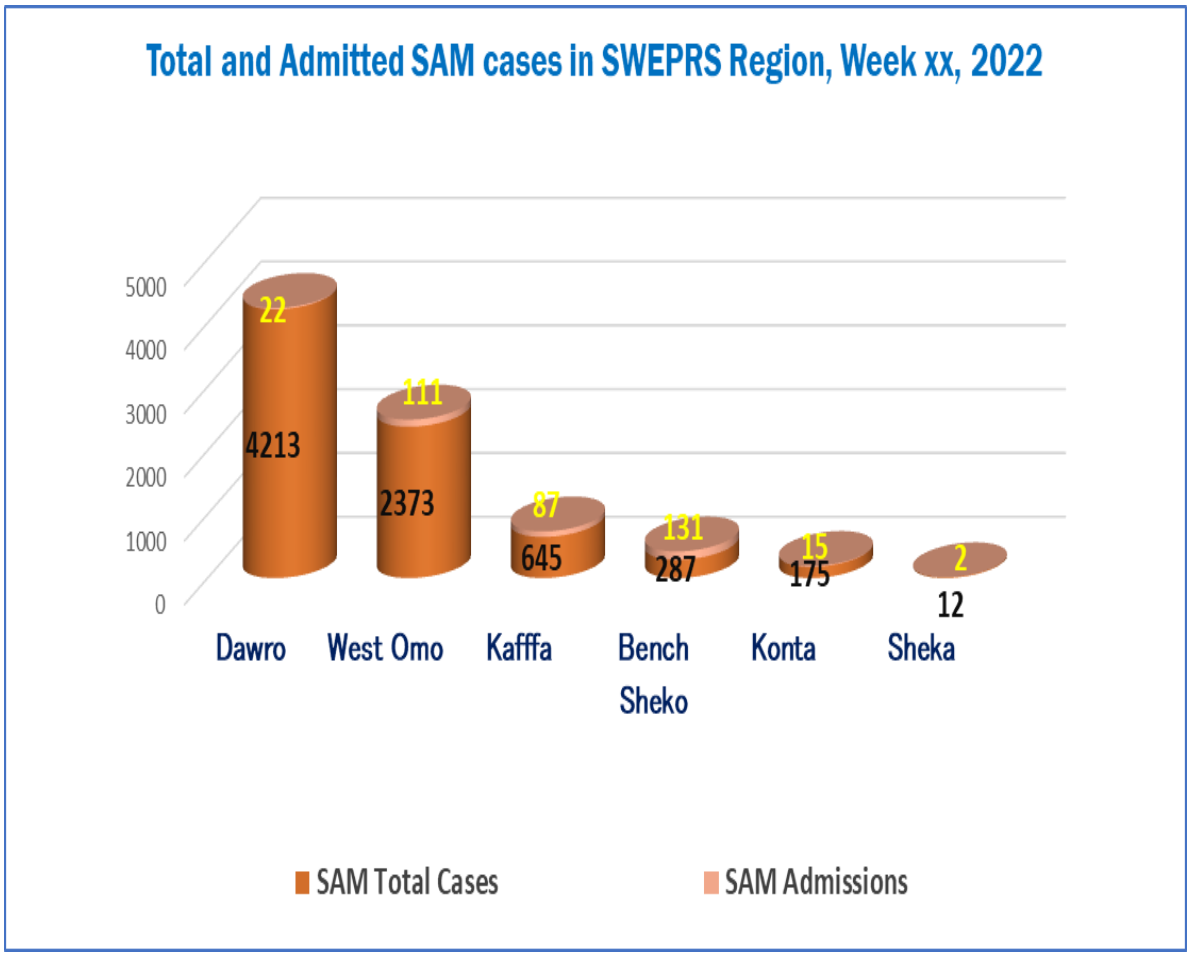


*Figure 39: Total and admitted SAM cases in SWERP in WHO epi week 20.*

According to the above figure, Dawro zone had the most SAM cases in week 20, with 4213 cases and 22 admissions, the highest number in the region when compared to all zones found in the region.

There are no separate supplies for malnourished chronically ill (TB/HIV) or elderly people. Because WFP supplies are not keeping up with the growing number of MAM beneficiaries, there is a critical shortage of TSFP supplies. The SC Room is missing a blanket, mattress sheet, and pillow. Some health centers have a scarcity of SC materials (cups, permuz, stove, baldi, etc.). Scarcity of logistics/vehicles and fuel Beneficiaries of logistic issues (vehicles and motorcycles at the woreda level).

## Emergency Activities performed

- Safety net and the Joint Emergency Operation Program distributed food in three rounds in two Woredas
- Mass screening was done by UNICEF support in two highly affected woredas (Zaba and Disa) Woredas
- Women's Dignity Kits were distributed.
- To improve SAM case management, capacity building training was conducted.
- Therapeutic Supplementary Feeding (TSF) distribution was carried out to address the need identified during the screening process.
- Cases of mam and SAM discovered during screening were handled appropriately.
- Stabilization centers (SC) were subjected to supportive supervision in order to assess their functionality and identify their needs.
- The Ministry of Health, EPHI, and EPSA have consistently supported supplementary food, particularly for MAM and SAM treatment.

## Early warning and Surveillance

The surveillance system at the Kebele level was insufficient, particularly in kebeles with only one or no HEWs and kebeles in difficult-to-reach areas with no network access. Kebele Mobilization was initially ineffective, but it is now beginning to mobilize the community. In HFs and at the Woreda health office, RRT is ineffective. Responses and follow-ups to suspected outbreaks were delayed. Suspect cases are sampled and examined.

### Woredas Report Timeliness and Completeness

All Woredas reported all report items from all HFs, so completeness is 96% in all drought months. However, there is a significant gap in report completeness, and I haven't found any reports on time during the drought months.

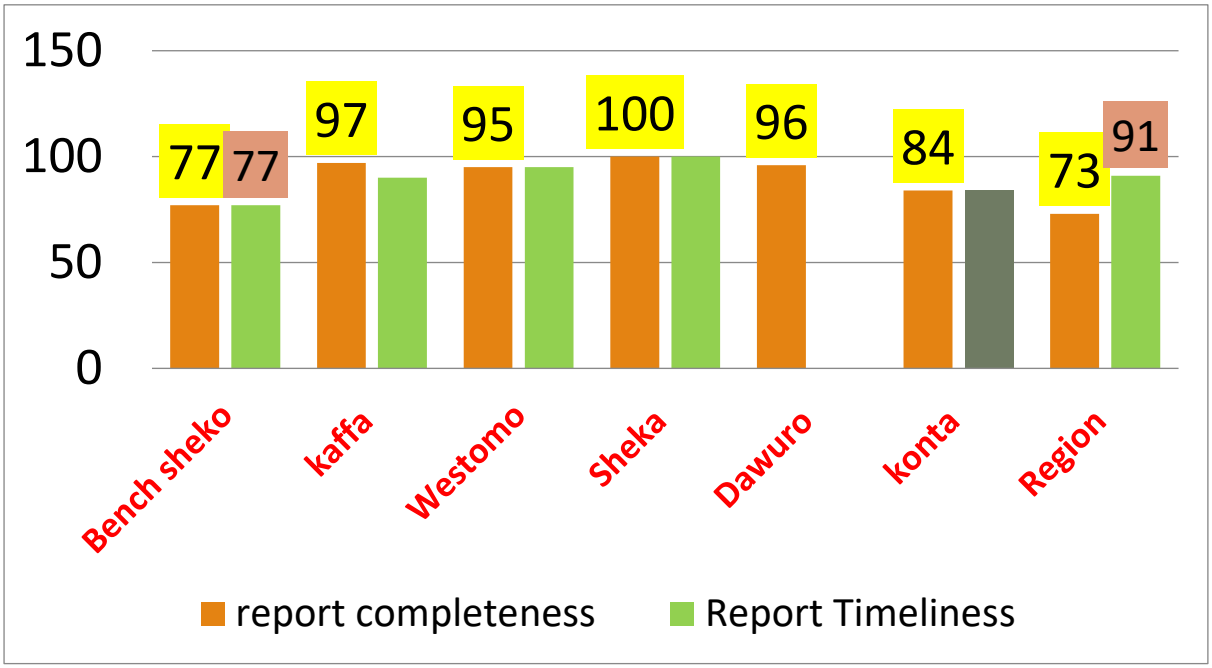


*Figure 40: Report Timeliness and completeness by Zones in SWEP region 2022*

As shown in the above **figure**, Dawro zone has poor report completeness in comparison to other Zones in the region.

## Epidemic prone Diseases report

### 1. Malaria

Malaria has been identified as an endemic disease in various areas of the Dawro zone. In Epidemiological Week 2022, total malaria confirmed plus clinical cases totally 1086, which is the second highest report though out the year, but 196 decrement from last month. Among tested febrile cases in 1957, 55% (1086) were positive for malaria, with 901 (83%) being P. Falciparum and 185 (17%) being P. Vivax. Due to a societal skill gap, bed net usage was low in Malarious woredas. Bed nets were distributed as a zone four years ago, which is out of the recommended schedule.

Because the population around the Omo Dam was severely impacted, special environmental management was recommended for those areas. Due to a lack of chemicals, IRS did not cover

all kebeles in all hot spot woredas last year. Case reports from those sprayed kebeles were even higher, indicating that it is preferable to change the type of chemicals used in the previous year

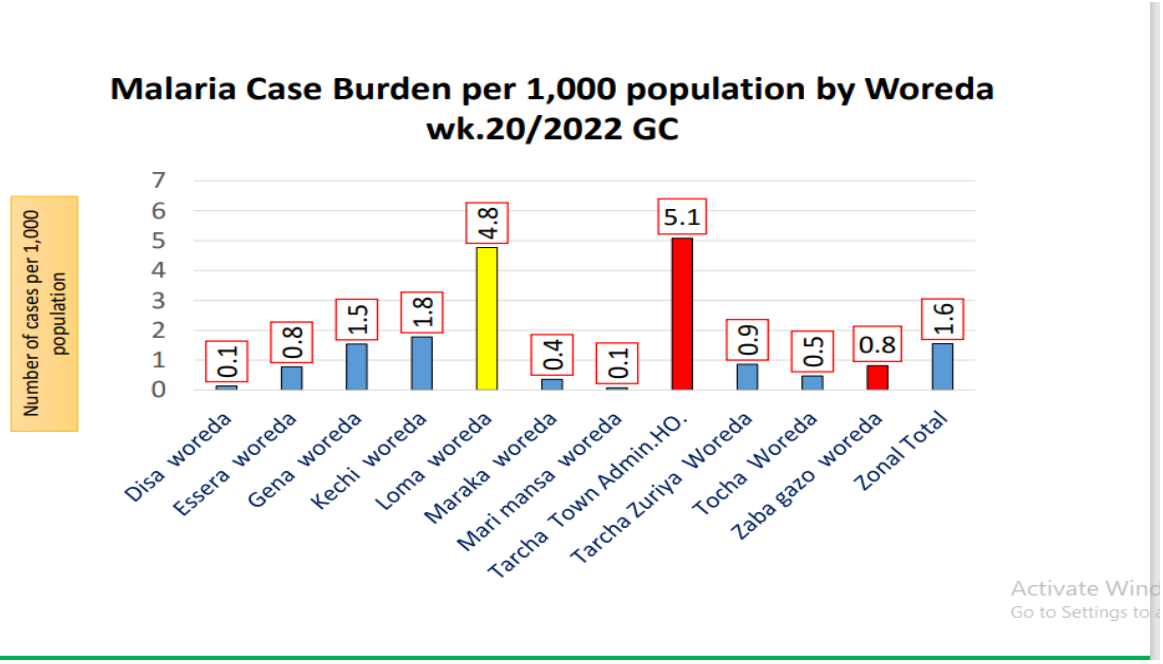


*Figure 41: Malaria Case burden per 1000 population by woreda in week 20/2022*

As indicated on the above figure malaria number of cases is high in Loma and Tercha Town Administration. Malaria Outbreak also detected in Loma woreda.

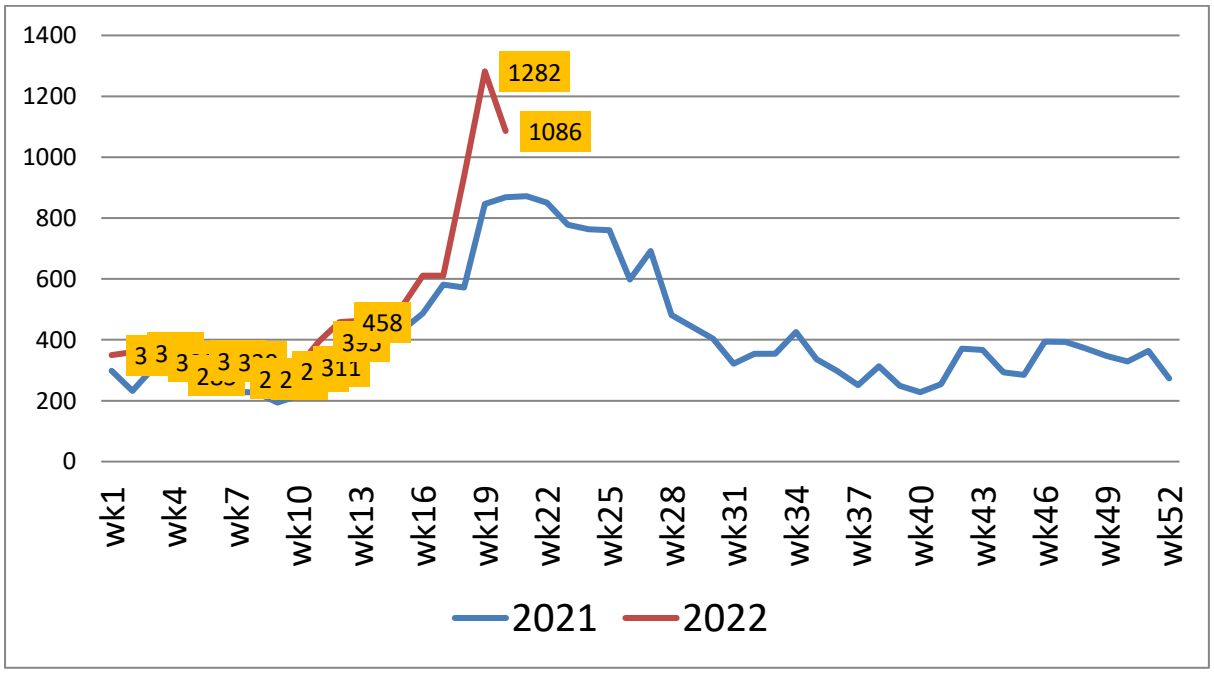


*Figure 42: Dawro Zone malaria trend in 2022*

Malaria cases increased beginning in week 16 and peaked in WHO epi week 20. The most severe case reported from Loma woreda, where outbreak was discovered. No death reported due to malaria from all woredas.

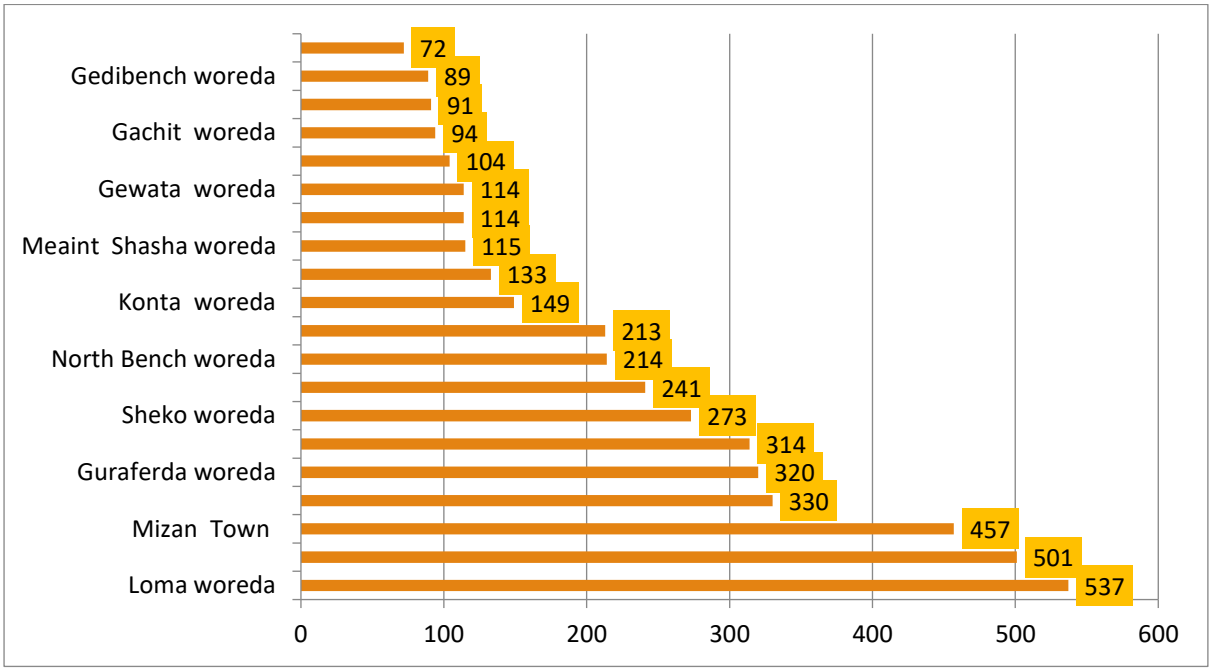


*Figure 43: SWEPRS Top 20 malaria reported Woredas week 20/2022*

Loma woreda which is found in the Dawro Zone in the region was the location where the most cases were detected in comparison to all other woredas found in the SWEPRS in WHO epi week 20. In week 20, 537 cases were reported (the outbreak week).

Due to a lack of chemicals, IRS did not cover all kebeles in all hot spot woredas last year. Case reports from those sprayed kebeles were even higher, indicating that it is preferable to change the type of chemicals used in the previous year. Woredas does not have any partners who are specifically interested in malaria. Some kebeles are too far from woredas and difficult to reach, making it difficult to provide health education to the community. Population/hardship settlement is sparse. Turnover of trained personnel has been observed in some woredas. Budget constraints make it difficult to closely monitor the quality of programs/services on the ground. Many facilities lack an EPRP (Emergency Preparedness Response Plan), and those that do have one have no budget for it.

**Supply and Chain management of Malaria**

- Logistic and supply need assessment were done
- Regional emergency drug budget allocated
- Other Emergency drug Request order were set to EPSA

- Drug and supply profession and its fairly utilization
- Integration with other sectors and stake orders some emergency drug avail for malaria and malnutrition 40 EDK kit
- Plat form were done among RHB and EPSS

**Challenges in Malaria Response**

- ❖ In cooperation of zone health Department for Command post (late report, no line list utilization, monitoring chart and data analysis)
- ❖ Scarcity of Vehicles for transportation in regional level for supportive supervision
- ❖ In some Health centers and health posts lack of trained personal in Emergency malaria
- ❖ low Coverage and utilization of ITN
- ❖ shortage and low quality of Chemicals for IRS
- ❖ Weak community engagement
- ❖ Inadequate of Zonal and Woreda mentorship and supportive supervision
- ❖ week Health seeking behavior (for those who live far away from the town)
- ❖ There was no specific partner that supported the Malaria program.
- ❖ Because of the region's topography, some affected Kebeles are difficult to reach.
- ❖ Some underground permanent breeding sites are difficult to spray with larvicidal chemicals.
- ❖ Increase in the number of temporary breeding sites for agricultural purposes

# Measles

Approximately 8 cases of measles were reported during the drought months. Three of those cases were reported during the 16th WHO Epi Week, while five were reported during the 19th Epi Week. Responses were provided on time at both woredas, and further exacerbation of cases did not occur. During the drought months, no deaths have been reported as a result of measles cases.

## Discussion

The 2022 Dawro zone health and nutritional needs assessment, which was led by multi-sectorial agencies in the SWEPR due to the emergency drought, yielded a variety of results. Our evaluation prioritizes health care, which is divided into three categories: primary health care, secondary health care, and tertiary health care. Due to a lack of hospitals in some woredas, one primary hospital serves more than 300,000 people who are from nearby woredas, which is above the recommended range. One health center serves approximately 25,000 people, which is within the recommended range, and one health post serves approximately 4,000 - 5000 people, which is also within the recommended range.

The fourth Ethiopian health sector development program (EHSDP IV) recommends that one health post serve 3000-5000 people, one health center serve 15,000-25,000 people (rural), 40,000 urban primary hospitals serve 60,000-100,000 people, and a general hospital serve 1,000,000-1,500,000 people in order to improve community health.(10)This is the first drought in South West Ethiopian history caused by natural climatic conditions. A well-organized emergency response sector is critical to addressing this issue, and my assessment revealed the presence of established multi-sectoral public health emergency managers at all levels (from woreda to health center), indicating the sectors' readiness to respond to emergency situations in accordance with national guidelines.

Malaria is the most common epidemic-prone disease in the Zone. A few cases of measles have also been reported. Malaria cases are high in all assessed woredas, indicating a high risk of malaria outbreaks in the Zone, which was more than double the previous year's report. The main risk factors for malaria and few diarrhea cases are irregular rail falls, unprotected irrigations, some road construction projects, interrupted rivers resulting in low water coverage and poor hygiene, low latrine coverage and low utilization, all of which require immediate intervention.

Malnutrition may be the most serious problem in all drought-affected areas in many regions of Ethiopia as a result of natural climatic change.(11) When the admission load of malnourished children in 2021 and 2022 is compared, the trend shows a very large increase in 2022, with a slight increase during the drought months. This clearly indicates nutritional security, and it serves as a warning sign because cases begin to rise in the first month of the dry season. After screening at-risk populations for nutritional problems and admitting them, the cure rate, defaulter rate, death rate, and non-responder rate of service recipients are used to evaluate

nutritional service performance. According to FMoH guidelines for SAM treatment, the cure rate of all assessed woredas was greater than 95%, which is within the acceptable range of CMAM performance.(12) This indicates that SAM treatment is very well adhered to in therapeutic feeding programs in health facilities, MHNT, and outreach programs.

## Conclusion

- Because of the presence of malaria breeding sites, low LLITN coverage, and IRS coverage, malaria is prone to becoming an epidemic.
- There is a lack of water and sanitation, as well as unsanitary habits.
- Inadequate preparedness and response capabilities in terms of stockpiling emergency drugs and medical supplies, establishing a contingency budget, and coordinating efforts.
- All assessed woredas' CMAM performance and service coverage exceed national guideline. This outstanding work should be supported.
- There is evidence of an increase in the prevalence of malnutrition among PLW in the months under consideration for this assessment and the same months the previous year.

## Recommendations

- Extending health services to the zone's most remote areas
- Case management training for health care workers (Woreda health office, Partners, RHB)
- Expanding access to safe drinking water at health centers and health posts
- Malaria control measures should be implemented to avoid further outbreak in the coming months (ITN and IRS distribution, case management strengthening, and removal of malaria breading sites) (Woreda Health Office, Woreda Health Facility).
- Increasing the effectiveness of the surveillance system (Health Center, Woreda Health Office, RHB, partners)
- Nutritional enhancement and feeding practices Community education (health posts, health centers, HEW, community centers)
- Increase latrine coverage in order to reduce open defecation and raise awareness about proper usage (Woreda health office, health centers, health posts, HEW, community).

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# Chapter Eight -Protocol/Proposal for Epidemiologic Research Project

## 8. Distribution of Malaria and Mosquito Species along Pagag Point of Entry in Lare Woreda, Gambella-Ethiopia: Cross Sectional Study


**Executive Summary**

**Introduction:** Malaria caused an estimated 212 million cases and 429 000 deaths worldwide in 2015, with 90% of cases and fatalities occurring in the WHO Africa region.(1) Ethiopia is one of the malaria-endemic countries, with malaria affecting 75 percent of the country's area. In Ethiopia, over 52 million people (68%) reside in malaria-risk zones. (2)

Gambella has a high malaria transmission rate due to its suitable habitat and copious rainfall. It is one of the places with the highest number of cases and deaths from malaria. According to one study, there are at least eight different species of anopheles in the area, each with its own set of habits. Malaria is endemic in Gambella's Lare Woreda, as well as throughout South Sudan. Plasmodium Falciparum, which causes 93 percent of malaria infections and can coexist with other significant parasite species such as Plasmodium Ovale, P. Vivax, and P. Malariae, was the prevalent parasite species detected in South Sudan, similar to Ethiopia. (3) Malaria transmission via population inflows from highly endemic areas with limited control efforts poses significant challenges for national malaria control programs.

**Objective:** The objective of this study is to investigate the distribution of Malaria parasites along Pagag Points of Entry travellers and Circulating Mosquito Species in the Lare Woreda, Gambella

**Method:** A descriptive cross-sectional approach will be used to conduct the research from January 2022 to September 2022. A quantitative method will be utilized to collect information on socio-demographic and risk factor. Blood samples will be collected for parasitological purposes, and larvae will be collected for entomological purposes, and the Focus Group Discussion method will be utilized to assess population movement patterns and spectrum. All travelers (migrants, refugees, and others) moving to either side of the Pagag point of entry will be the source population.

**Budget:** The overall budget for this study is projected to be $3330.



**Key words:** Malaria, cross border, travelers and Mosquito

## Introduction

### Back ground

Countries share international borders, which creates unique challenge for malaria elimination and control. National boundaries are political constructs that ignore the shared demographic, cultural, and social environments through which they cut. People and disease vectors move between the map's lines. Border malaria occurs because people, parasites, and vectors frequently mix in contiguous areas due to a shared ecology (4).

Malaria endemicity varies across Ethiopia's geo-climatic zones. Malaria transmission in the "kola," or hot zone below 1500m altitude, is seasonal or perennial, depending on local conditions, with moderate to high endemicity. The "woina dega" or temperate zone (46 percent of the territory) has malaria transmission characterized by sporadic outbreaks of unstable malaria caused by sudden climatic changes such as heavy rains or floods. Microclimates are created by the interaction of mountainous topography with fluctuating winds, seasonal rainfall, and ambient temperatures. Tropical Indian Ocean conditions and global weather patterns, such as El Nio and La Nia, have an impact on Ethiopian weather. When a microclimate develops local puddles, flooding conditions and warm ambient temperatures continue for several weeks in a dangerous area with low population immunity. (11)

In general, the country's diversified ecology allows for a wide range of transmission intensities, from low-seasonal to high-perennial transmission. The Ethiopian Federal Ministry of Health (FMoH) has stratified the country's malaria transmission burden using ‘woreda' (district)-level transmission intensity based on annual parasite incidence per 1000 people (API) and elevation for planning and intervention strategy targeting (12).

Because of its favorable environment and abundant rainfall, the region of Gambella has a high malaria transmission rate. It is one of the areas with the highest number of malaria cases and fatalities. According to one study, the region is home to at least eight anopheles species, each with its own set of behaviors (5).

Research has revealed that the malaria condition in Gambella is hyper endemic, with steady malaria transmission along the Baro River basin (6) However, the emergence of drug-resistant P. falciparum and insecticide-resistant A. gambiae, as well as a large influx of people from non-malarious regions of the country along with concomitant agricultural expansion programs, are expected to have an impact on the epidemiology of malaria transmission in the area(5).

Furthermore, Lare woreda, study area, has been classified as malarious lowland with intense transmission. A. Gambiae s. (n= 1914; 69.9 percent), A. Phronesis (n= 602; 22 percent), A. Nilli (137, 5 percent), and A. Coustani s. (n= 82; 3.1 percent) were found to contribute to transmission among a total of 2735 anopheles mosquitoes collected from Lare Woreda (3).

Malaria is endemic in the woredas bordering Lare Woreda, as well as throughout South Sudan. Similar to Ethiopia, the dominant parasite species found in South Sudan was Plasmodium Falciparum, which causes 93 percent of malaria cases in South Sudan and can coexist with other major species such as P. Ovale, P. Vivax, and P. Malariae. According to the 2017 South Sudan health survey, malaria parasites are transmitted by the vectors Anopheles gambiaess, Anopheles arabiensis, and Anopheles funestus.(6)

The movement of people and goods across borders is crucial in the transmission of malaria and the introduction of new species. Malaria parasites infected people across international borders, including airports and sea ports, resulting in cross-border malaria as well as malaria transmission that occurs along and spans international borders (7).

Pagag is one of the points of entry (PoE) between South Sudan and Ethiopia. It is found in the Gambella Region's Lare woreda. Since the start of political unrest in South Sudan (December 2013), pagag has been identified as one of the main entrance points for refugees. According to a UNHCR and Authority for Refugee and Returnee Administration (ARRA) study during 2019, out of 329,123 South Sudanese refugees in Ethiopia, 8,219 reached the Gambella region through various points of entry, including Pakag POE. Additionally, during the course of the year, some persons returned to South Sudan across similar PoE and were subjected to additional cross-border travel (5). Furthermore, Pakag PoE is the pathway for movement of travellers other than refugees between the two countries.

The study's goal is to determine the distribution of malaria parasites among cross-border travelers/refugees going between Ethiopia and South Sudan across pagag point of entry, as well as the circulating mosquito species in Lare Woreda, Gambella Region.

## Statement of the problem

Malaria at international borders poses unique challenges in terms of control and elimination. Although malaria ecologies are shared across international borders, neighboring countries are frequently at different stages of the control-to-elimination pathway (4).

In Ethiopia Although major scale-up of malaria control initiatives, such as case diagnosis and treatment, distribution of long-lasting insecticidal nets (LLINs), and indoor residual spraying of houses with insecticides (IRS) are targeted in most malarious areas, as a substantial challenge, cross-border malaria is becoming a problem. Border malaria can spread up to a certain distance from an international boundary, or through nearby administrative areas along the international border. Border malaria is frequently thought to be a transmission hotspot that crosses international borders.

WHO report of 2018 on border malaria indicate that; Owing to the remoteness and/or political complexity of border locations, border malaria may arise due to limited or no access to malaria prevention, diagnosis, and treatment initiatives, as well as an inadequate monitoring response.(7)

One of the greatest obstacles to malaria management in Ethiopia has recently been a lack of understanding of the epidemiology of malaria transmission, which is linked to cross-border movement of individuals via various pathways. The current study aims to give more information on the vectors that transmit malaria and the distribution of Malaria parasites in the Lare Woreda along pagag point of entry. It is envisaged that it will aid in the development of customized malaria intervention techniques across the borders in Gambella region.

## Significance of the study

Since the study explores the prevalent species of parasites, distribution of malaria vectors in Lare woreda and characterizes the population pattern and dynamics along pagag PoE, the study will help the ministry of health, Gambella regional health bureau and Lare woreda to implement the customized malaria control and prevention at the border areas and the intervention can be expanded to other regions if proved effective.

## Literature Review

The disease has long been a problem in Ethiopia, where all four human malaria parasites are found, with Plasmodium falciparum being the most widely distributed and dominating parasite type, followed by Plasmodium vivax, Plasmodium malariae, and Plasmodium ovale. In Ethiopia, it is estimated that 75 percent of the overall land is malarious, with 68 percent of the people at risk of infection (8). Anopheles Arabiensis, a member of the Anopheles gambiae group, is the predominant malaria vector in Ethiopia, with minor vectors An.funestus, An.pharoensis, and An.nili (6). Anopheles arabiensis is the most common vector, with Anopheles Pharoensis, Anopheles Coustani, Anopheles Funestus, and Anopheles Nili playing minor roles in disease transmission. Although An. Pharoensis is widespread in Ethiopia and has demonstrated high levels of pesticide resistance, its significance in malaria transmission is unknown. An. Nili is a potential malaria vector, especially in Gambella Regional State. Malaria transmission is primarily found at altitudes below 2000 meters in Ethiopia, while endemic areas beyond 2000 meters have been observed (9)(10). Except in the southern international border low land area, where transmission is year-round, malaria risk and transmission intensity levels showed seasonal, inter-annual, and geographic fluctuation. The main transmission season in Ethiopia is from September to December, following the main wet season of June to September. In some places of Ethiopia, there is a short transmission season from April to May following the short wet season(6). Plasmodium falciparum is endemic in many regions of the country. Plasmodium malaria and P.ovale infection are uncommon and account for < 1% of confirmed malaria cases(11)

The host-seeking behavior of An. Arabiensis varies, with the human blood index collected from different areas ranging between 7.7 percent and 100 percent. An. Funestus, a mosquito that prefers to feed exclusively on humans, can be found along the swamps of the Baro and Awash rivers and shores of lakes in Tana in the North and the Rift Valley area. An. Pharoensis is widely distributed in Ethiopia and has shown high levels of insecticide resistance, but its role in malaria transmission is unclear. An. Nili can be an important vector for malaria, particularly in Gambella Regional State. Recent published and unpublished reports indicate an increased malaria incidence among migrant daily laborers in various parts of the country, most importantly in the northwest development corridors of the country bordering Sudan and South Sudan. Many Ethiopian communities have a “low” and “unstable” malaria transmission pattern that results in low host immunity and significant clinical malaria illness risk after malaria(12).

Border malaria can spread up to a certain distance from an international boundary, or through nearby administrative areas along the international border. The final few cases of malaria in nations on the verge of eradication frequently occur along international boundaries with countries that have not achieved significant reductions in malaria transmission. Cross-border malaria difficulties are a serious difficulty for many countries reaching elimination. Malaria concerns referred to as "cross-border" can refer to two separate but connected issues: the movement of malaria-infected people over international borders, such as airports and sea ports, and malaria transmission that crosses or occurs along international land borders (7) .

South Sudanese are Ethiopia's largest refugee population, according to a UNHCR report from a year ago, with 422,240 people registered as of the end of the year. In 2018, 17,554 new arrivals sought asylum due to ongoing violence in Upper Nile, Jonglei, and Unity States, which has increasingly impacted border areas. The majority were housed in the Gambella Region through the expansion of Nguenyyiel Camp (13). As mobile populations, displaced South Sudanese communities are exposed to a variety of situations and can play a key role in the spread of parasite resistance to previously unaffected areas. They are vulnerable to novel malaria parasite strains, such as P. Vivax in Ethiopia's southwest, which can cause significant morbidity and can then be transported back to their homeland. Malaria parasites and vectors develop antimalarial drug resistance in a variety of ways. One of the main causes of resistance is poor standard medication practices, which could be the case in a displaced community(2).

Anopheles stephensi, a South Asian malaria vector, was recently discovered in Ethiopia, raising worries about its influence on malaria transmission in Ethiopia and the Horn of Africa. In South Asia and the Middle East, especially the Arabian Peninsula, Anopheles stephensi is a prominent malaria vector. An. stephensi was initially reported in the Horn of Africa in Djibouti in 2013, and it was recently confirmed to be present in the country. Anopheles stephensi was first discovered in Ethiopia in Kebridehar (Somali Region) in 2016; however it is uncertain how widespread the species is in the rest of the country (14)(15). One recent study also indicates that; An. stephensi mosquitoes have spread from Asia to the Horn of Africa. The widespread presence of An. stephensi mosquitoes in developmental stages in artificial water bodies demonstrates that these mosquitoes are well established in an urban setting in Ethiopia, located on the main transportation corridor from Djibouti to Addis Ababa. The spread of An. stephensi mosquitos also increases the risk of P. falciparum and P. vivax receptivity and local transmission in urban Africa (16).

The indicators of standardized WHO pesticide resistance testing and other relevant studies demonstrate no epidemiological effects of resistance, implying that vector control efficacy may not be directly related to epidemiological efficacy. Thus, beyond immediate vector death, it is necessary to evaluate the influence of pesticide resistance on the epidemiology of malaria (5).

## Objectives

**General Objective**

- To describe the distribution of Malaria parasites along Pagag Points of Entry in relation to people's mobility status and Circulating Mosquito Species in the Lare Woreda, Gambella Region

**Specific Objectives**

- To identify the distribution of malaria along Pagag PoE and characterize species variation based on the place of infection [Ethiopia / South Sudan].
- To identify the circulating mosquito species in Lare Woreda, Gambella.
- To describe the travel/mobility status of people in the across Pagag Point of Entry

## Methods and materials

**Study area:**

Gambella is tropical lowland in South West Ethiopia, located at 45° N, 35° E. The elevation ranges from 500 to 600 meters above sea level. The rainy season lasts from late April to mid-November, whereas the dry season lasts from late November to early April (1). The Baro, Alwero, Gillo, and Akobo rivers run through the area. At different seasons of the year, rivers flow with wildly variable volumes of water.

The research will be carried out in the Lare district of the Nuer zone in south-west Ethiopia. The Anuak Zone borders Lare on the South and East, the Baro river on the West, which separates it from Jikawo, and the Jikawo river on the North, which separates it from South Sudan and host the Pagag PoE; the main gateway for traveler to and from South Sudan. The woreda has a total population of 31,406. It has both urban and rural Villages.

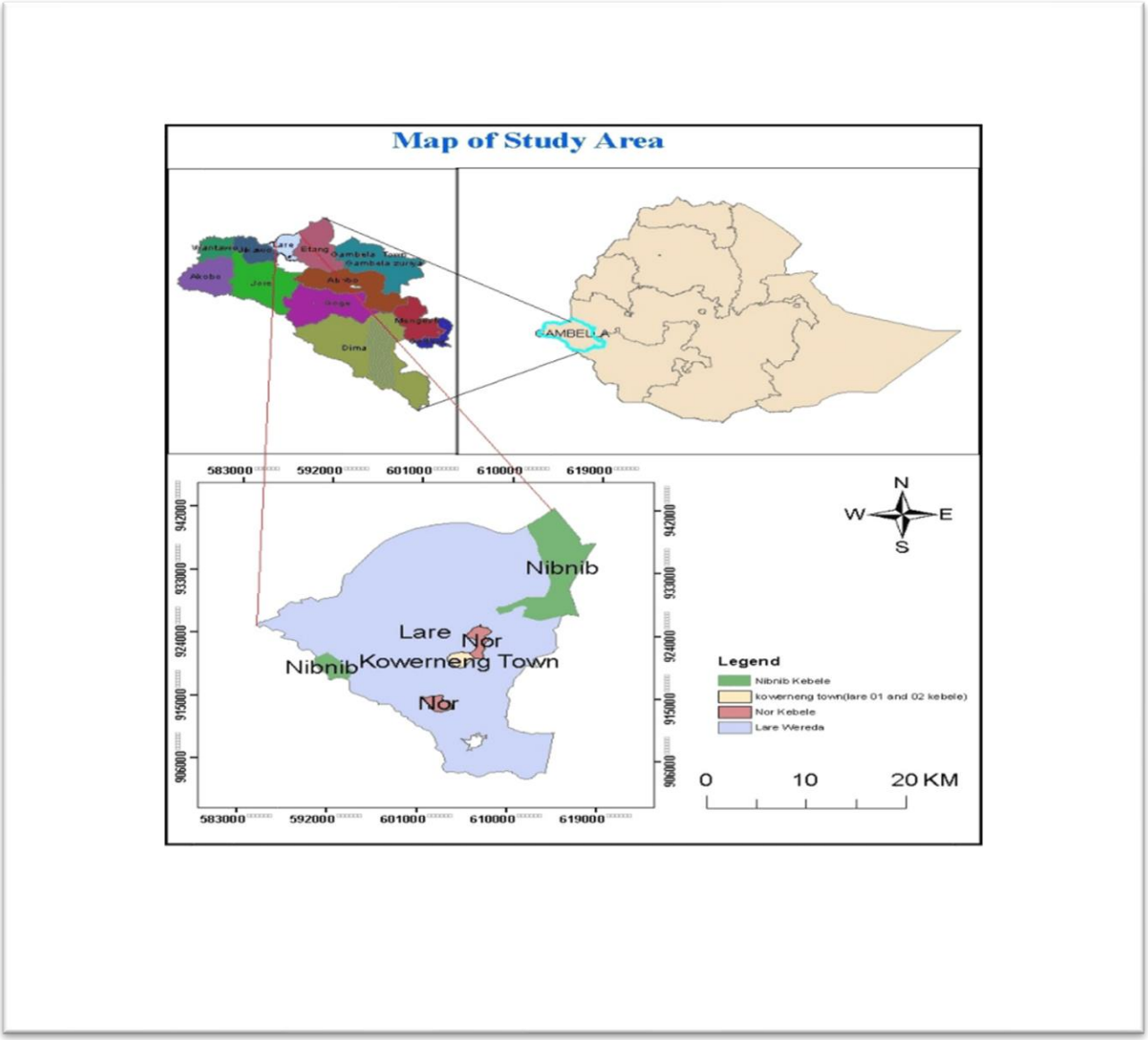



*Figure 44: Map of study area (Lare District)*

**Study period:**

The actual research will take place between January 2022 and September 2022.

**Study design:**

The study will be conducted using a descriptive cross-sectional design. The mixed method will be used (quantitative and qualitative approach). Blood samples will be collected for parasitology, larvae will be collected for entomology, and the Focus Group Discussion method will be used to assess population movement patterns and spectrum.

**Source population for parasitological aspects**

All travelers (migrants, refugees, and others) moving to either side of the Pagag point of entry will be the source population.

**Study population for parasitological aspects:**

The target audience will be those who have reported being on either side (Ethiopia vs. South Sudan) for at least one week prior to arriving at Pagag PoE. Those that are willing and cooperative will be enrolled in the study. According to statistics received from the national public health emergency operation center, a total of 2277 travelers crossed Pagag PoE from South Sudan to Ethiopia and were checked for COVID-19 between 4$^{th}$ February and 3$^{rd}$ October, 2021. If the same number of people crosses from Ethiopia to South Sudan, the daily average passenger flow will be 20 passengers.

**Sample size and sampling procedures:**

Using a single population proportion formula, the appropriate sample size will be computed.

- There hasn't been a similar study done yet, so I assume a proportion of traveler 50 % , q=0.5, P=0.5( because, I used 50%, which is conservative and provides the largest sample size, which is what we expect the results to be).

$$n = \frac{(z_{\alpha/2})^2 \cdot pq}{d^2}$$ = (1.96x1.96x0.5x0.5)/ (0.05X0.05) = **384**

The study units will be addressed using a convenience sampling procedure with a 10% chance of non-response rate=**422.**

Where; n=sample size: Z=the standard normal value at a 1-percent confidence level, which is usually 5%, i.e. at a 95-percent confidence level; D=the sample error margin tolerable. As a result, using the preceding method, D=5 percent =0.05 at a 95% confidence level, a 5% margin of error, and a p=50% percent.

## Sampling Method for parasitological study:

Every traveler arriving in/exiting Ethiopia who meets the inclusion criterion of staying one week or more on either side of Pagag PoE will be included in the study using non-probability convenience sampling. Data collection will begin in the April 2022 and will continue until the intended sample size of 422 is met.

## Sampling Method for Mosquito identification:

### Larval habitat characterization

The entomological part will involve selecting four villages in Lare Woreda and proximal to South Sudan using a simple random sampling (SRS) technique, using the accessible villages in Lare Woreda as a sampling frame by using information from woreda offices, with the ultimate goal of identifying the mosquito species in Lare Woreda. The second stage entails identifying mosquito breeding sites (habitat). The larval habitats will selected and characterized based on their distance to the nearest house, stability (temporary or permanent), presence of vegetation, water flow (stagnant water or with movement), water clarity (clear or turbid), use (for animal, domestic). First different habitats will observed to determine if larvae present, then larval collection will be carried out using the standard dipping technique. The four types of habitats will be included, paddy fields, irrigation channels, water containers and drainage ditches. The habitat which positive for larvae will be included as sampling sites. The coordinates (latitude and longitude), habitat type, and vegetation covering of the sampling sites will all recorded using GPS and Globe Observer. A tape measure will be used to determine the distance from the nearest dwelling.

### Identification and sampling of larvae

Water samples from the breeding sites will be collected using a standard dipper, with three samples collected from each site. The larvae will be categorized initially based on their position in relation to the water surface. Then Globe observer app will then be used to determine the larval type after taking photograph of larva.

### Inclusion and Exclusion Criteria

Travelers who have stayed less than one week at their point of departure will be excluded from the study due to the infection/incubation period of malaria. Those who have been at their points of departure for a week or more will be included in the study after receiving ethical approval.

## Data collection:

The interviewer administered questionnaires initially developed in English and translated to local languages will be used to assess socio-demographic, malaria exposure/risk factor and traveler movement related information.

Rapid Diagnostic test (RDT) based parasitological test will be done on spot at pagag PoE by trained specimen collectors. The result will be informed to the study participants and those positive will be referred to the catchment health facility for further investigation and treatment. As a data quality validation process, orientation of the data/specimen collection will be given. The entomological data will be collected by the trained entomologist mobilized from EPHI. Larval collection will be carried out using the standard dipping technique after specific breeding site identified. Two supervisors with an MPH will be recruited for supervisory tasks.

### Data quality control

The aim and procedures of data gathering will be taught to data collectors and supervisors, ensuring data quality. The primary investigator will provide training to five data collectors and two supervisors. On a daily basis, the supervisors and principal investigator review and assess the content of the data obtained.

### Data entry and analysis:

The information gathered will be put into Epi-info version 7 before being exported to SPSS. The use of travel history as a proxy for determining importation will be used, and it will be classified as either local or imported. To assess the relationships between categorical independent factors and outcome variables, the Chi square test will be utilized. The relationship between the two Variables will also be investigated using logistic regression and other statistics accordingly.

### Ethical Clearance

The Ethiopian Public Health Institute (EPHI) institutional review board will receive a proposal explaining the details of the approach to be used. All IRB comments/concerns will be modified in accordance with the recommendation, and data collection will begin after ethical approval has been obtained. Aside from that, a formal authorization request letter will be sent to the Gambella regional health bureau and the Lare Woreda Health office. They will be informed of the study's findings.

Furthermore, each study participant will give their informed permission; he or she will be educated about the research risk, benefit, cost, expectation, and damage, and will give their ethical agreement once they are convinced. Anyone who is no longer interested in the research has the right to leave at any moment.

**Study Variables**

**A. Socio-demographic Variable or independent variables**

- Age
- Sex
- Ethnicity/Nationality
- Marital status
- Occupation
- Race
- Location (Village of origin)
- Cross border frequency

**B. Malaria related Variables**

- Bed net utilization/ITN
- IRS
- Personal protection
- Prophylaxis

**C. Parasitological information**

- Result (positive vs. Negative)
- Species of parasite

**D. Entomological Information**

- Species of mosquito
- Habitat type
- Habitat Location

## Operational definitions

**Border malaria**: Malaria transmission or the possibility for transmission across administrative units sharing an international boundary.

**Cross border malaria:** Malaria transmission linked to the movement of people or insects across national borders

**Imported cases:** A case of malaria or an infection that was obtained outside of the place where it was diagnosed.

**Transnational malaria**: Malaria cases brought across a border or into a country via air or sea ports may not necessarily affect transmission inside the border area.

**Population movement across a border:** Movement of persons over border crossing points, which may be legal or unlawful, and sometimes not recognized by local border communities.

**Malaria Out breaks:** When compared to the previous year's reported WHO epidemic week, crossing the usual line or doubling the number of malaria cases.

**A confirmed case**: is one in which the presence of malaria parasites has been confirmed using microscopy or a rapid diagnostic test (RDT).

## The study's Strengths and Limitations

### Strengths of the study

The result will be representative because the sample size is large enough. As far as I know, there are few such studies in the country, particularly in the research area, and my study is unique in its settings. Based on my findings, I may adjust the study design in the future by incorporating this data as secondary data.

### Limitations of the study

The lack of a comparable study in Ethiopia for comparison, as well as other study limitations, will be discussed. Because this is a cross-sectional study, causality cannot be attributed to the components of the determinant.

## Dissemination of findings:

The result of the finding will be communicated to Ethiopian public health institutions and Addis Ababa University School of Public Health. It will also be disseminated to the Gambella Regional Health Office and also be previewed at different conferences for publication. Lastly, the findings will be presented at different conferences and published in reputable journals.

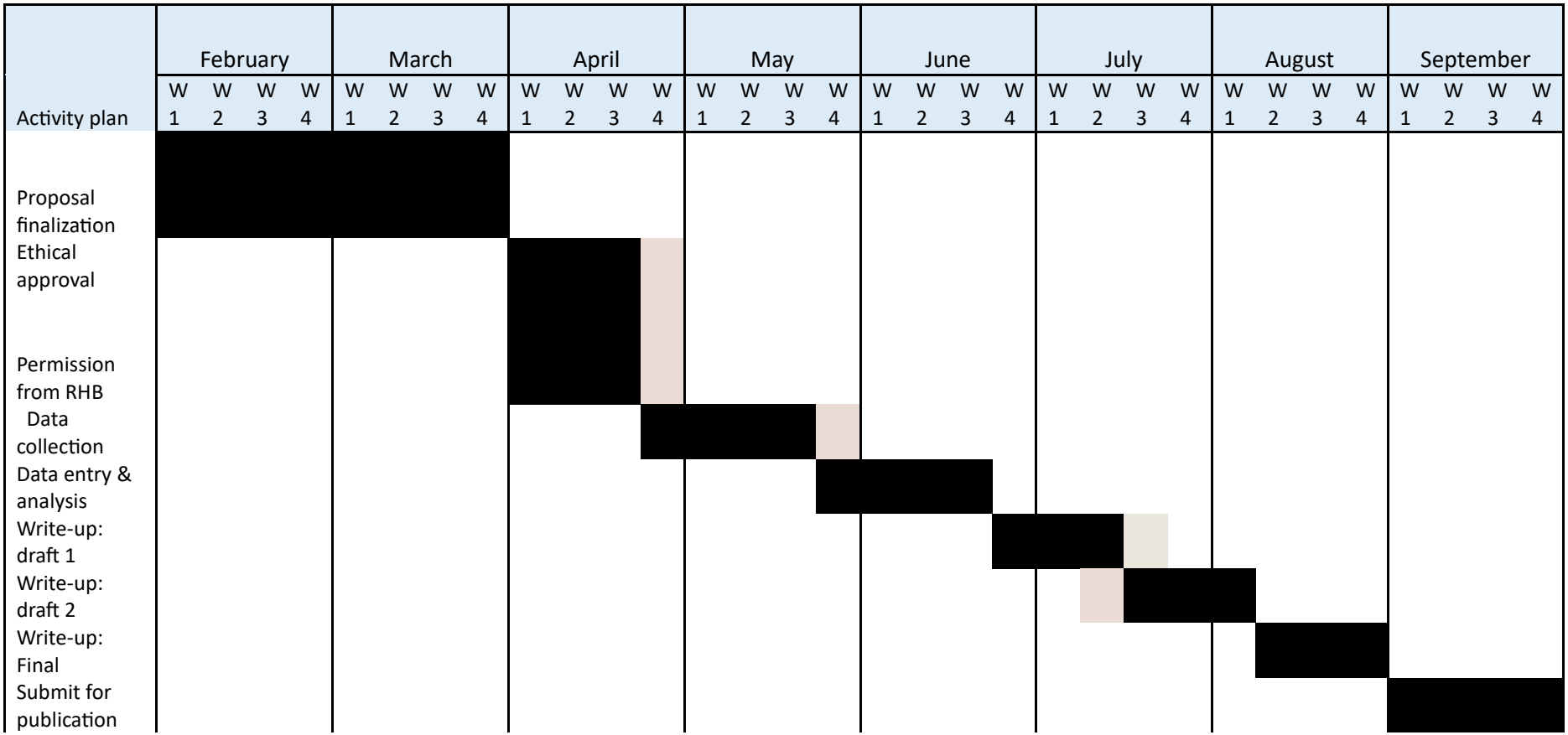
## Budget estimation

*Table 43: Overall budget going to be used.*

| S. No | Cost Elements | Unit | Unit cost (USD) | Quantity | Duration (in days) | Total Cost (USD) |
|---|---|---|---|---|---|---|
| **I. Field Work** | | | | | | |
| 1 | Tool development (per Diem) | Number | 20 | 3 | 2 | 120 |
| 2 | Orientation for data collector | Number | 20 | 5 | 1 | 100 |
| 3 | Per diem for data collector | Number | 20 | 5 | 20 | 2000 |
| 4 | Per diem for specimen Analyzer | Number | 20 | 2 | 4 | 160 |
| 5 | Per diem for supervisor | Number | 20 | 1 | 16 | 320 |
| 6 | Per diem for local translator | Number | 3 | 1 | 20 | 60 |
| **II. Supplies and Equipment** | | | | | | |
| 1 | RDT | Box of 50 Pcs | 6.75 | 10 | 1 | 67.5 |
| 2 | Face Mask | Box of 50 Pcs | 5 | 2 | 1 | 10 |
| 3 | Sanitizer | Bottle of 1L | 3 | 10 | 1 | 30 |
| **III. Travel** | | | | | | |
| 1 | Sample transport cost (air ticket) | Trip (round) | 112 | 2 | 1 | 224 |
| 2 | Transport cost for data collectors and supervisor (Lampsum cost for transportation from Woreda to Pagag and to selected villages) | | 2 | 5 | 20 | 200 |
| **IV. Other/Miscellaneous Cost** | | | | | | |
| 1 | Card cost | | 1.16 | 10 | 1 | 11.6 |
| 2 | Printing and Copying | Pages | 0.04 | 500 | 1 | 20 |
| **Total** | | | | | | **3323.1** |

## Gant Chart

Table 44: Work Plan and Schedule



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# Chapter Nine- Other Additional Output Reports

## 9. National Weekly epidemiological bulletin of Week 16: April 18 – April 24, 2022

### Ethiopian Public Health Institute

### Center for Public Health Emergency Management



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## Highlights

- The national surveillance data report completeness and timeliness are 81.5%.
- Number of reported cases of Relapsing fever, Anthrax and Chemical Poisoning cases have shown increment in this week.
- Deaths due to Malaria, suspected Meningitis, Relapsing fever and Dysentery have also shown increment as compared to the previous week.
- A total 161 COVID-19 new cases, 230 suspected Measles cases, 26,574 confirmed & clinical Malaria cases, 8,119 SAM cases, 51 suspected AFP/Polio, 148 Human exposure to rabies cases, 7,150 Dysentery, 2,485 Scabies cases, 132 suspected Meningitis cases, three (3) Neonatal tetanus cases, 92 Relapsing Fever cases, 13 Anthrax case, 10,317 Typhus cases, 27,392 Typhoid fever cases and 16 Chemical Poisoning were reported during this week nationally.
- One (1) death due to COVID-19, three (3) deaths due to Malaria, eight (8) deaths due to Severe Acute Malnutrition (SAM), 230 Perinatal deaths, 19 Maternal deaths, one (1) death due to Dysentery, four (4) suspected Meningitis deaths, one (1) Relapsing fever deaths and three (3) Neonatal deaths were reported in the week.

*Table 44: Summary of immediately Notifiable diseases by regions, as of April 24, 2022*

Cases/Deaths Summary of Immediately Notifyable Disease/Conditions by Regions

| Region | Susp. AFP/Polio | Anthrax | Susp. Cholera | Maternal_Death | Susp. Measles | Neonatal Tetanus | Perinatal_Death | Rabies_Cases |
|---|---|---|---|---|---|---|---|---|
| Addis Ababa | 0 | 0 | 0 | 2 | 78 | 0 | 51 | 0 |
| Afar | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |
| Amhara | 6 | 13 | 0 | 0 | 43 | 0 | 87 | 112 |
| B. Gumuz | 0 | 0 | 0 | 0 | 22 | 0 | 4 | 9 |
| Dire Dawa | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Gambella | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Harari | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 |
| Oromia | 28 | 0 | 0 | 4 | 46 | 1 | 40 | 11 |
| Sidama | 7 | 0 | 0 | 0 | 4 | 0 | 12 | 0 |
| SNNPR | 5 | 0 | 0 | 4 | 11 | 0 | 11 | 12 |
| Somali | 2 | 0 | 0 | 8 | 11 | 2 | 1 | 0 |
| SWEPRS | 3 | 0 | 0 | 1 | 15 | 0 | 9 | 4 |
| **Total** | **51** | **13** | **0** | **19** | **230** | **3** | **230** | **148** |

## Overview

Ethiopia is providing humanitarian assistance where there are displacements and drought, responding to COVID-19 pandemic throughout the country and ongoing outbreaks of Measles and Rota virus in different parts of the country. Severe Acute Malnutrition is also affecting the community in different parts of the country in particular where there were conflicts, internal displacement and related emergencies.

In this weekly bulletin ongoing the reportable diseases, outbreaks and other emergencies will be discussed. All the immediately and weekly reportable diseases including COVID-19 will be entertained in the bulletin.

## Completeness and timeliness of reports

The national surveillance data report completeness and timeliness are 81.5% which is higher than national standard. All regions except Afar, Benishangul Gumuz, SNNPR and Tigray regional states had achieved above the minimum requirement of 80%. In the week 16, there are no reports from Tigray regional states because of current security issues and humanitarian crisis in the region.

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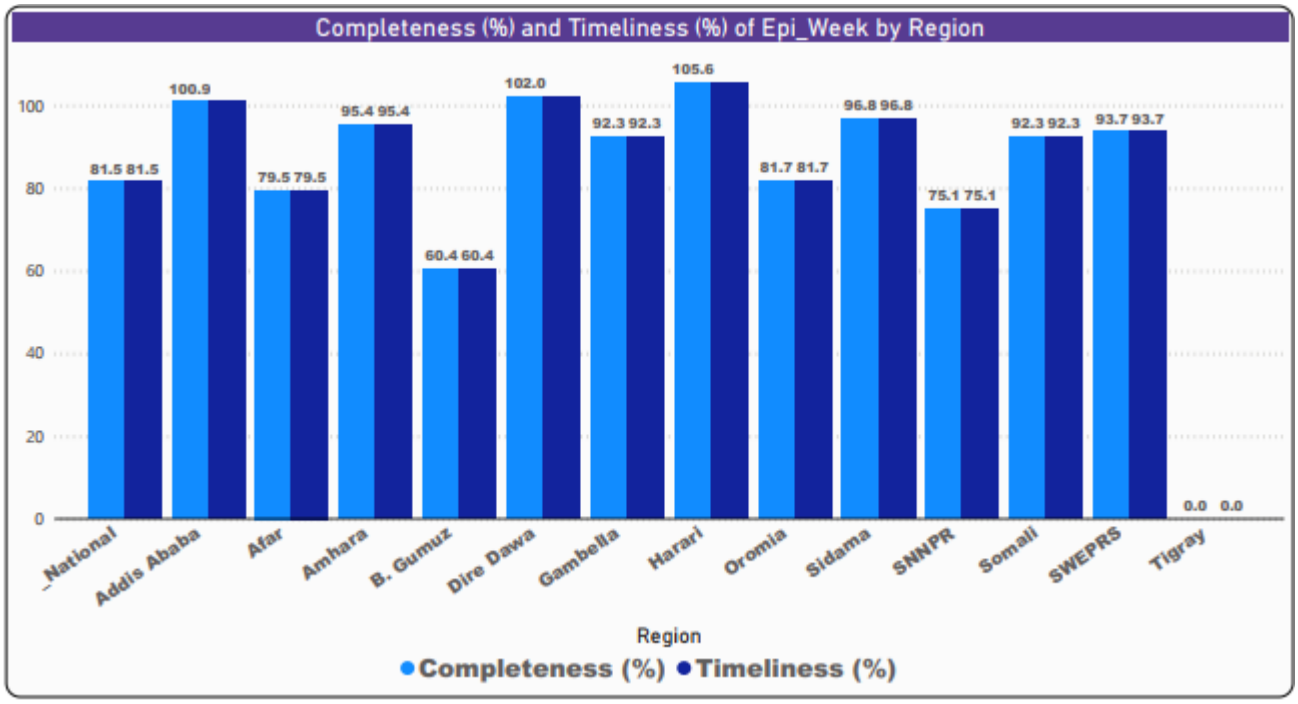



*Figure 45: National weekly report completeness and Timeliness by region, week 16, 2022*

## COVID-19

During the Epi-Week-16, 161 new confirmed COVID-19 cases and 1 COVID-19 related deaths were reported, bringing the total number of cases and deaths to 470,434 and 7,510, respectively. As a result, the overall COVID-19 Positivity Rate is 1.6% in the country. In this week, the number of COVID-19 confirmed cases decreased by 28% as compared to the previous week.

To date, a total 4,765,964 laboratories across the country samples have tested for COVID-19 of which, 28,991 laboratory tests were processed during the week. The number of laboratory tests conducted during Epi-Week-16 decreased by 11% from the previous week.

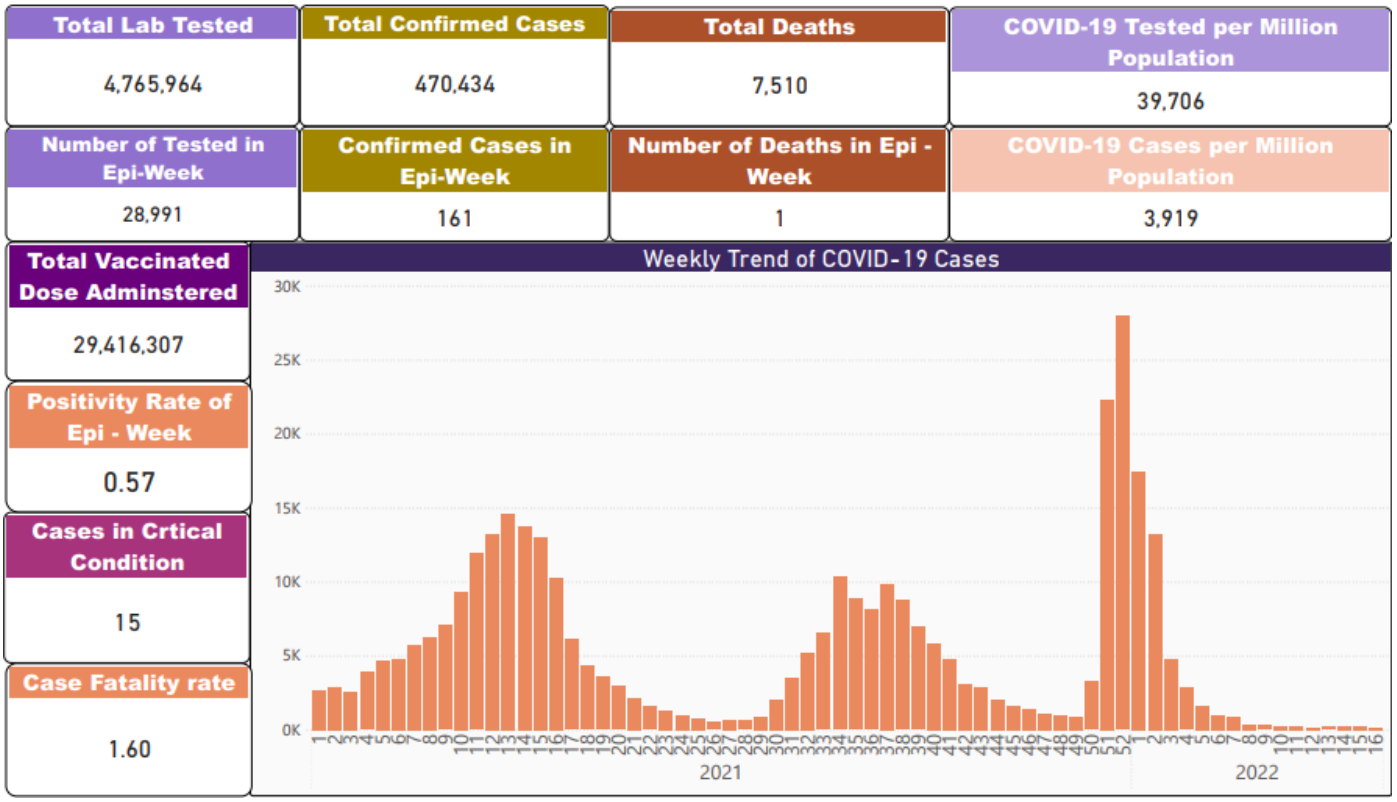



*Figure 46: Summary of COVID-19 situation in Ethiopia as of April 24, 2022*

## Measles

In 2022, as of 24 April a total of 4,407 suspected cases and 26 deaths reported (Case Fatality Rate (CFR) 0.6%). Out of the 230 suspected cases reported, 34% (78 cases) were reported from Addis Ababa city administration followed by Oromia region (20% of the national report) in the week-16 and there is a 41% decrease in the number of new suspected cases compared to previous week. No new death due to suspected measles was reported in this week.

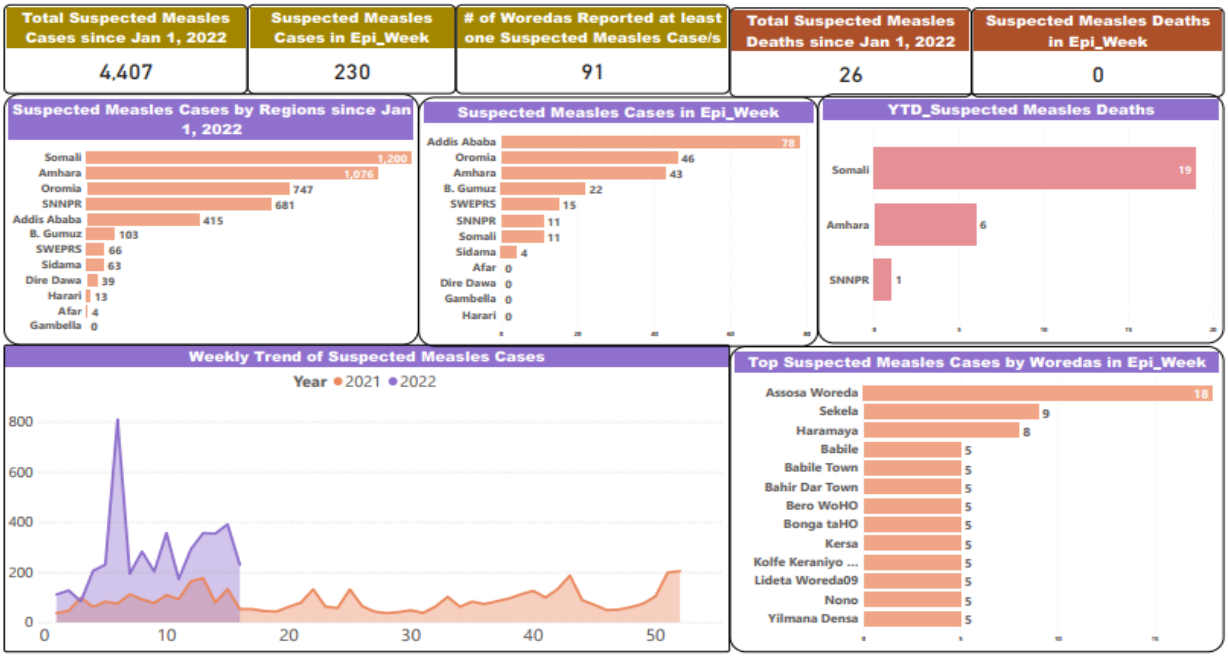



*Figure 47: Suspected Measles cases summary in Ethiopia as of October April 24, 2022*

## Malaria

A total of 26,574 Malaria cases were reported which is a 9% decrease compared to previous week of which, 18,362 (69%) were caused by plasmodium falciparum. SNNP reported the highest number (49% of the total) of malaria cases followed by Amhara (34% of national report) region in this week. There are three (3) new deaths reported due to malaria in the week.

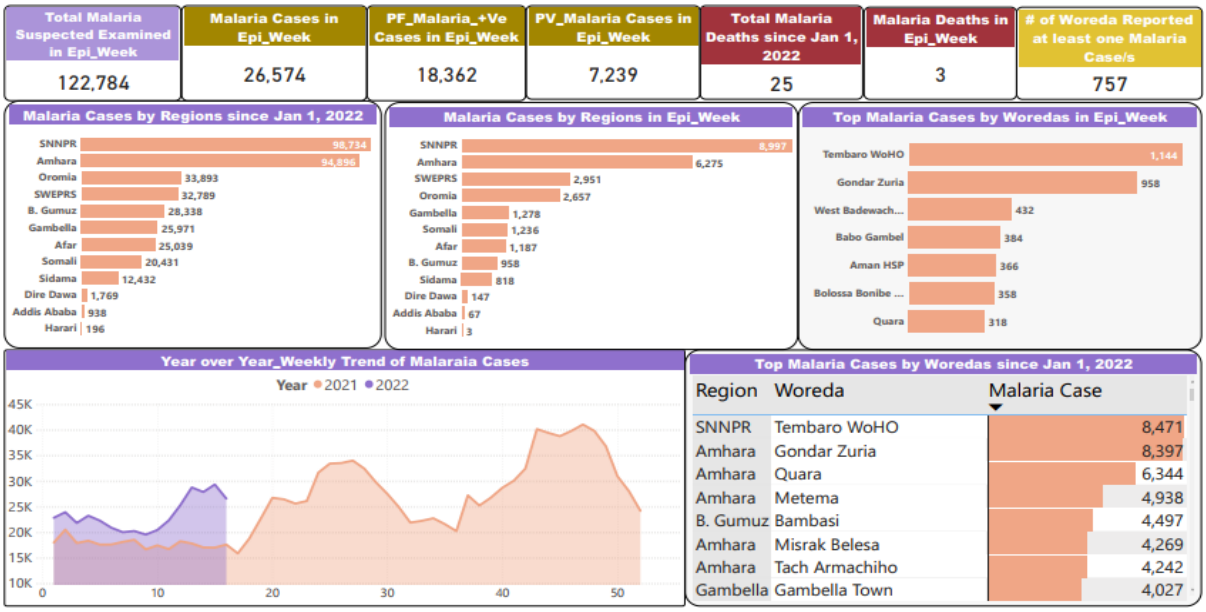



*Figure 48: Summary of malaria situation in Ethiopia as of April 24, 2022*

## Severe Acute Malnutrition (SAM)

High number of Severe Acute Malnutrition (SAM) cases is reported in 2022 as compared to the same weeks of previous two years based on the report as of April 24, 2022. A total of 128,621 SAM cases and 151 deaths (CFR=0.001%) are reported in since January 1, 2022 so far out of which 8,119 cases and eight (8) deaths are reported in week-16. There is a 19% decrease in number of SAM cases in this week as compared to the previous week. Oromia region reported the highest number (34% of the national report) of SAM cases in the week followed by Somali region (29% of national report).

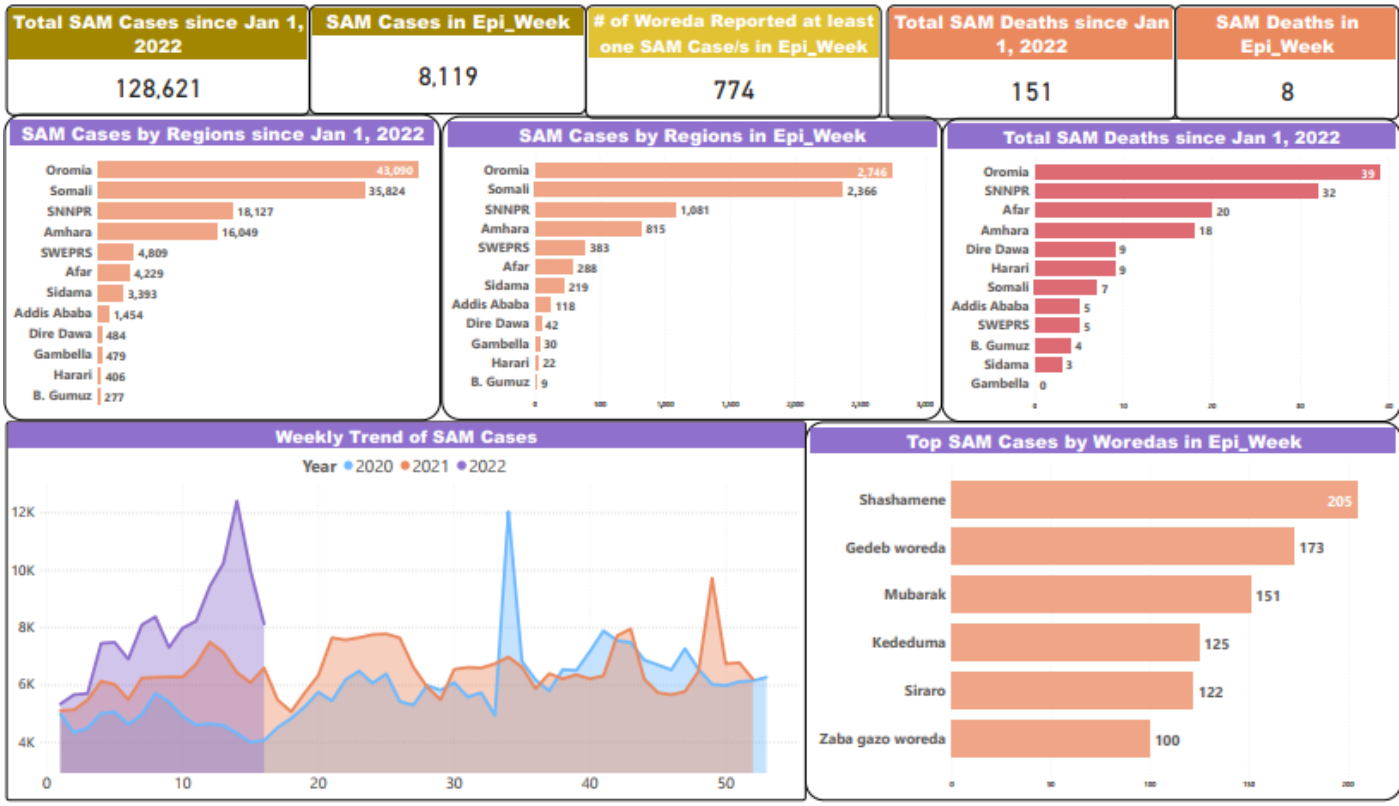



*Figure 49: Severe Acute Malnutrition in Ethiopia as of April 24, 2022*

## Cholera

A total of 14 suspected cholera cases with no deaths were reported in Ethiopia, since January 01, 2022 with overall CFR of 0%. No new case and death due to suspected Cholera were reported in the week-16 in the country.

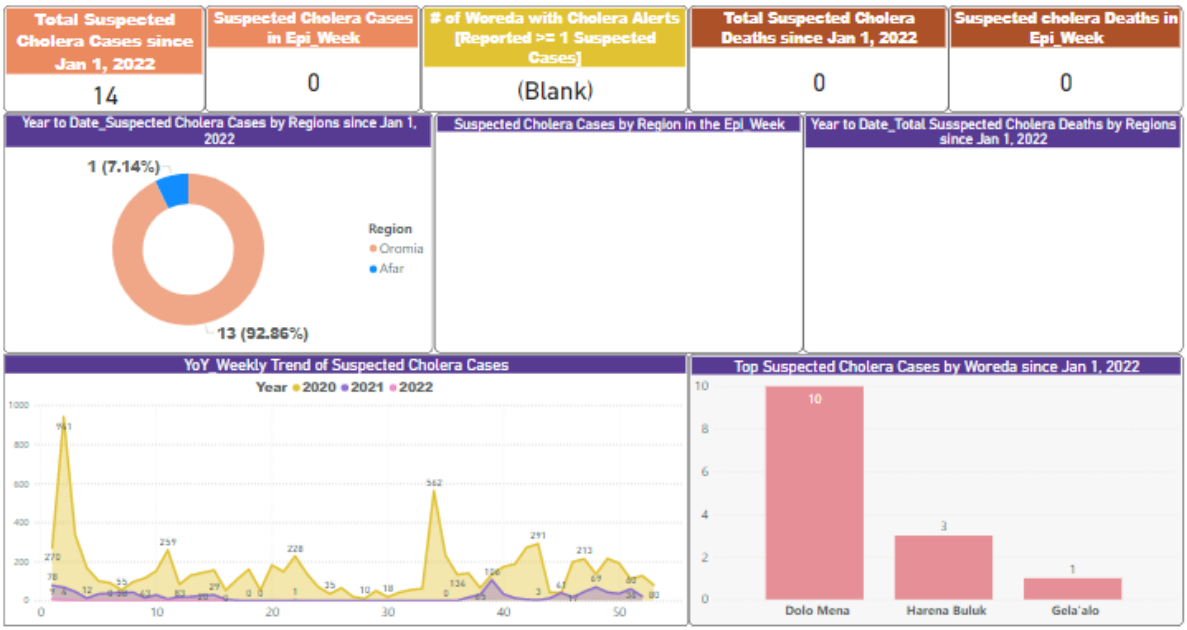



*Figure 50: Summary of cholera disease situation in Ethiopia as of April 24, 2022*

## Acute Flaccid Paralysis (AFP) /Polio

In this week, 51 suspected AFP/polio cases were reported which is a 27% decrease in number as compared to the previous week. No new death due to AFP/Polio reported in this week.

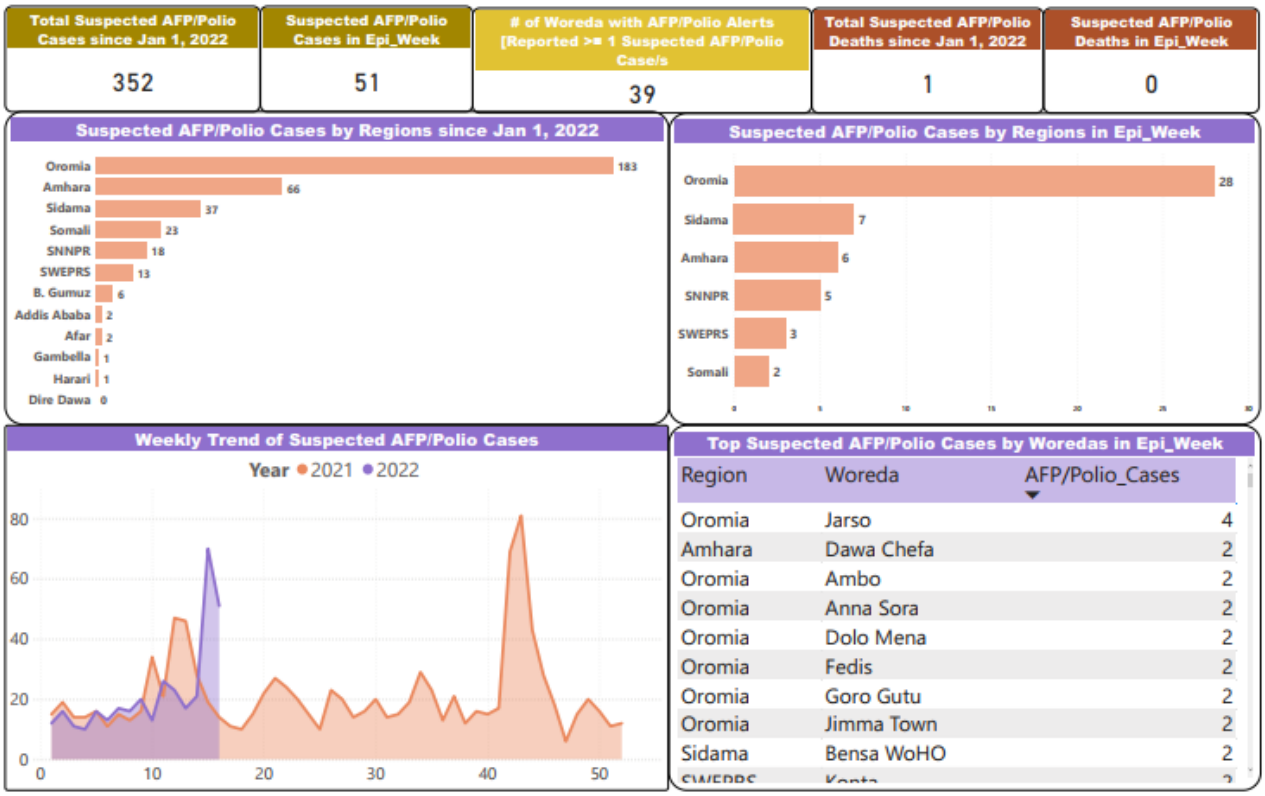



*Figure 51: Acute Flaccid Paralysis / Polio status update in Ethiopia as of April 24, 2022*

## Perinatal death

As of April 24, 2022 a total of 3,356 perinatal deaths were reported in 2022 out of which 230 perinatal deaths were reported in week-16. There is a 2% decrease compared to the previous week. Finote Selam Hospital from Amhara region reported the highest number of perinatal deaths (6%) followed by Abebech Gobena Hospital from Addis Ababa city administration (4% of national) in the week.

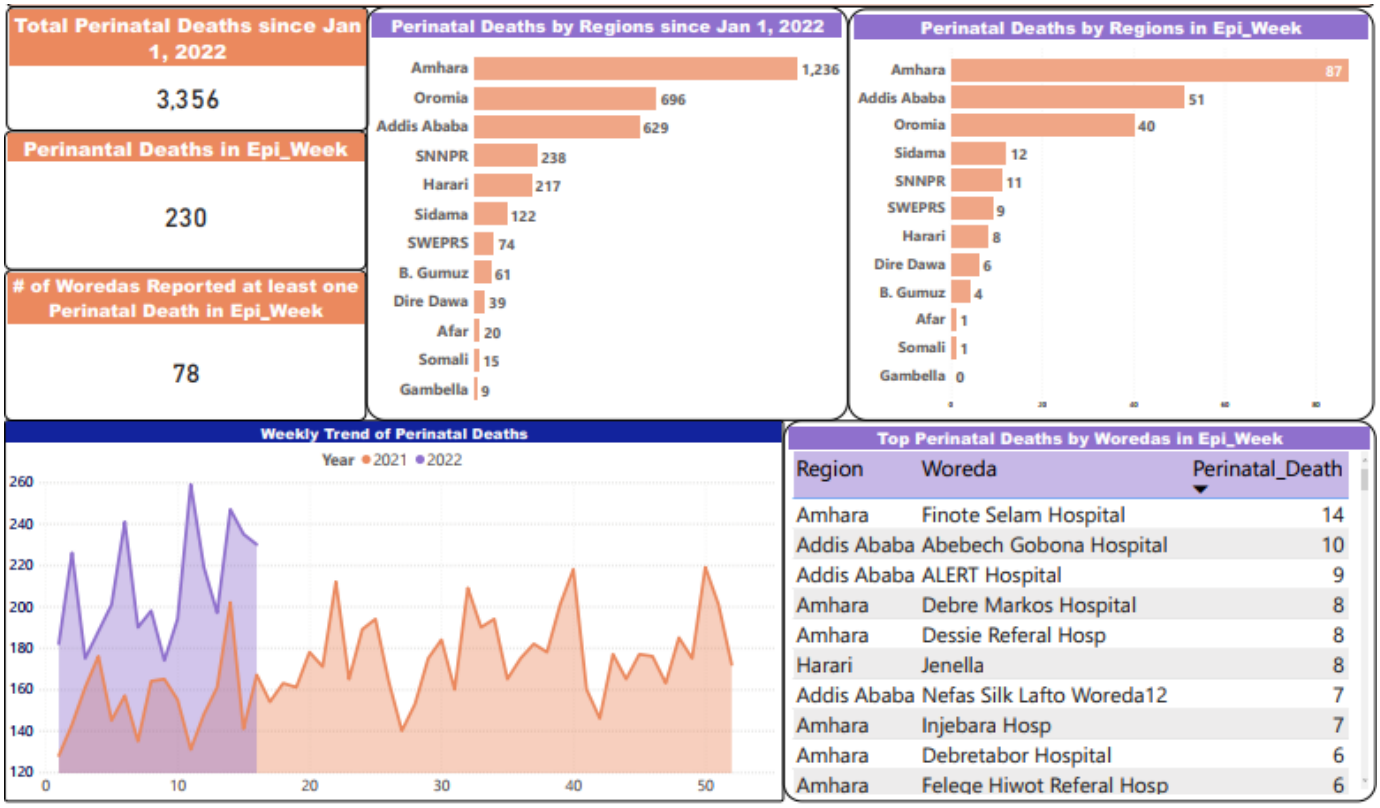



*Figure 52: Perinatal death update in Ethiopia as of April 24, 2022*

## Maternal death

Nineteen (19) maternal deaths from 13 different Woreda/Hospitals of the country were reported in the week-16 which is a 50% decrease in number of deaths as compared to previous week of which 8 (42% of the national report) of the total deaths are reported from Somali region followed by Amhara region (21% deaths).

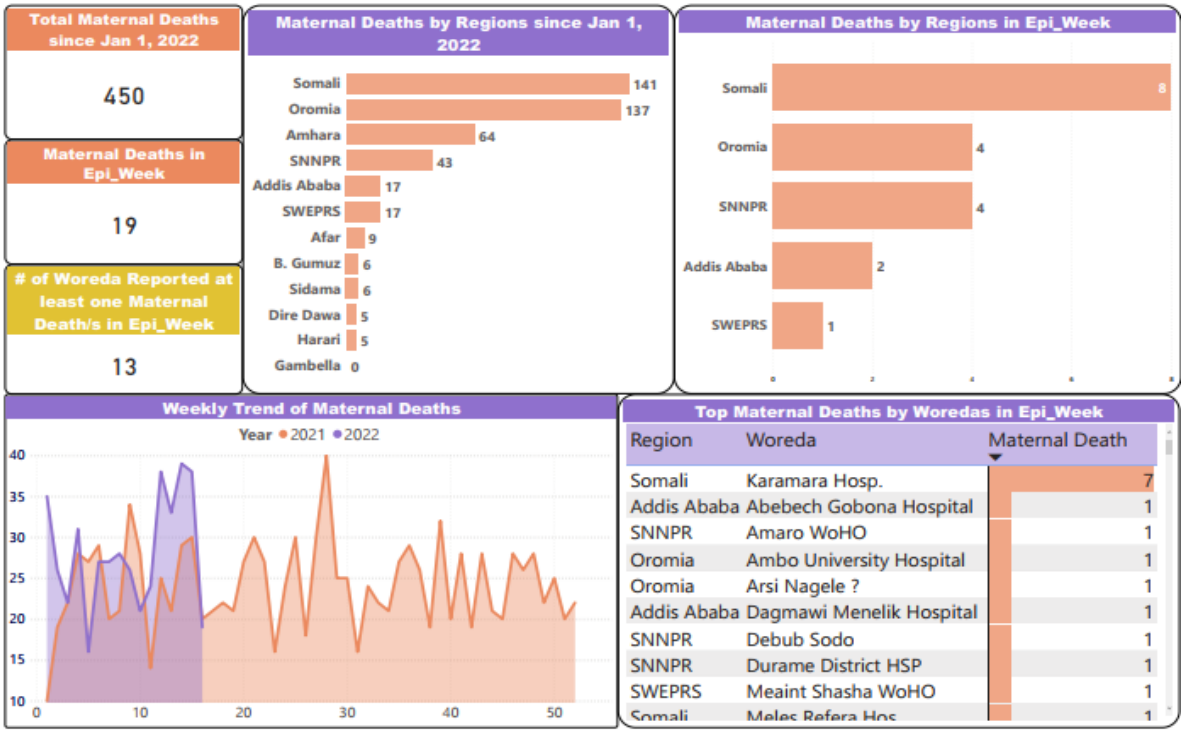



*Figure 53: Maternal death summary in Ethiopia as of April 24, 2022*

## Rabies exposure

Nationally 148 rabies exposures with no death were reported during the week which is shown a 36% decrease in number of cases as compared previous week. Highest number of rabies exposures are reported from Addis Alem Hospital (20%) followed Gondor Town by (7% of national report) from Amhara region in the week.

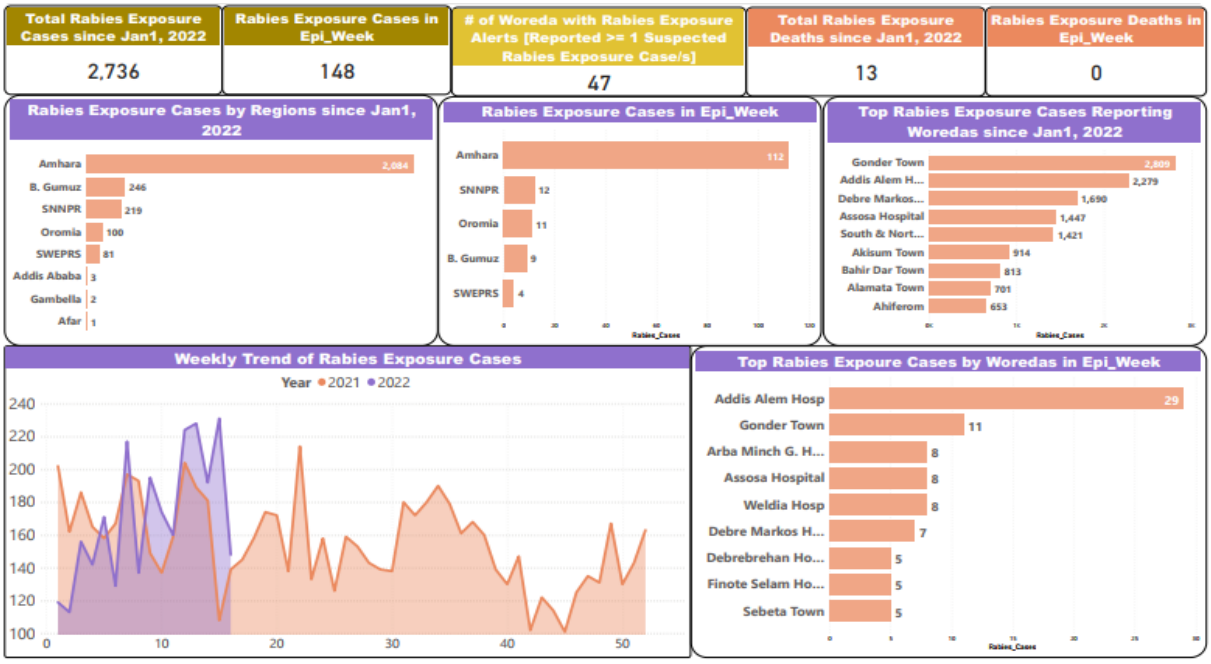



*Figure 54: Rabies exposure summary in Ethiopia as of April 24, 2022*

## Dysentery

A total of 102,483 dysentery cases and 3 deaths were recorded since January 01, 2022 of which 7,150 cases and one (1) death were reported in week 16. This is a 6% increment of cases as compared to the previous week. Oromia region is the highest number of dysentery cases reported (35%) followed by Amhara region (34%) in the week.

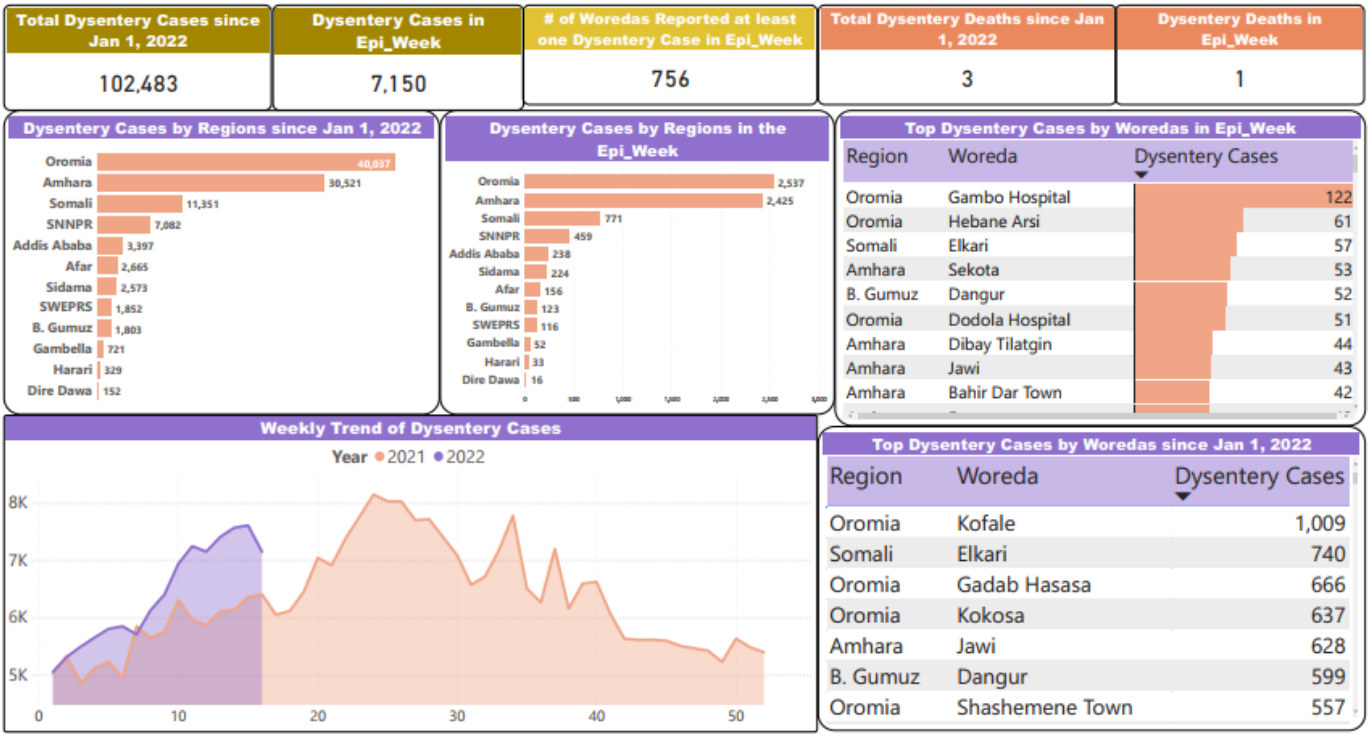



*Figure 55: Summary of Dysentery situation in Ethiopia as of April 24, 2022*

## Scabies

A total of 2,485 Scabies cases (20% cases decrease as compared to previous week) were reported during the week. Amhara region reported the highest number (54%) of Scabies cases followed by Oromia region (29%) in the week.

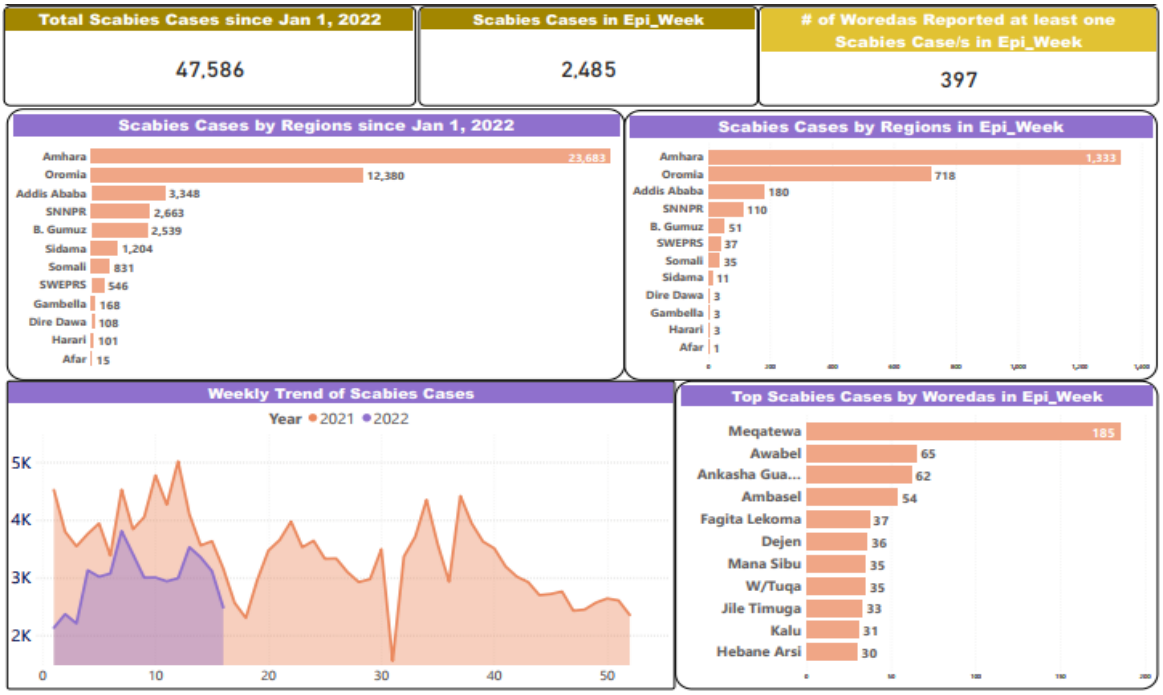



*Figure 56: Summary of Anthrax situation in Ethiopia as of April 24, 2021*

## Meningitis

A total of 132 suspected meningitis cases which is two (2 cases) decrease in number of cases compared to previous week. Four (4) new deaths were reported due to suspected meningitis in the week. Oromia region reported the highest number (44%) followed by SNNP region (18% of national report) in the week.

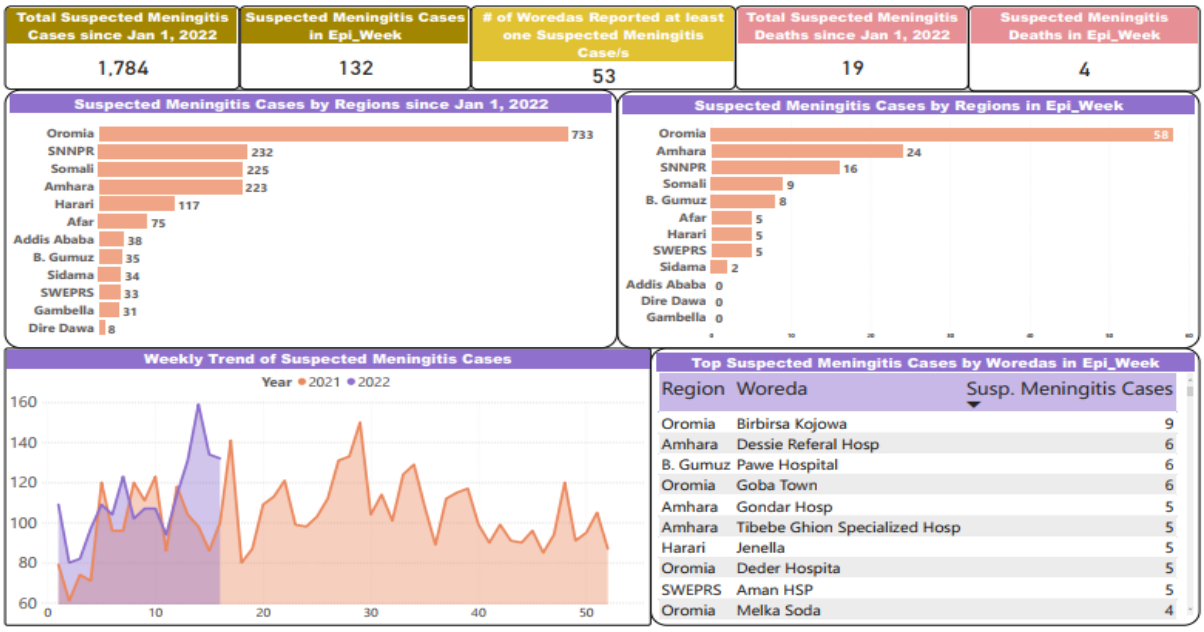



*Figure 57: Summary of suspected meningitis cases in Ethiopia as of April 24, 2022*

## Neonatal tetanus

Overall, 40 neonatal cases and 22 deaths occurred since January 1, 2022 with CFR of 55%. Three (3) new cases from Oromia and Somali regions with three (3) deaths were reported in week 16.

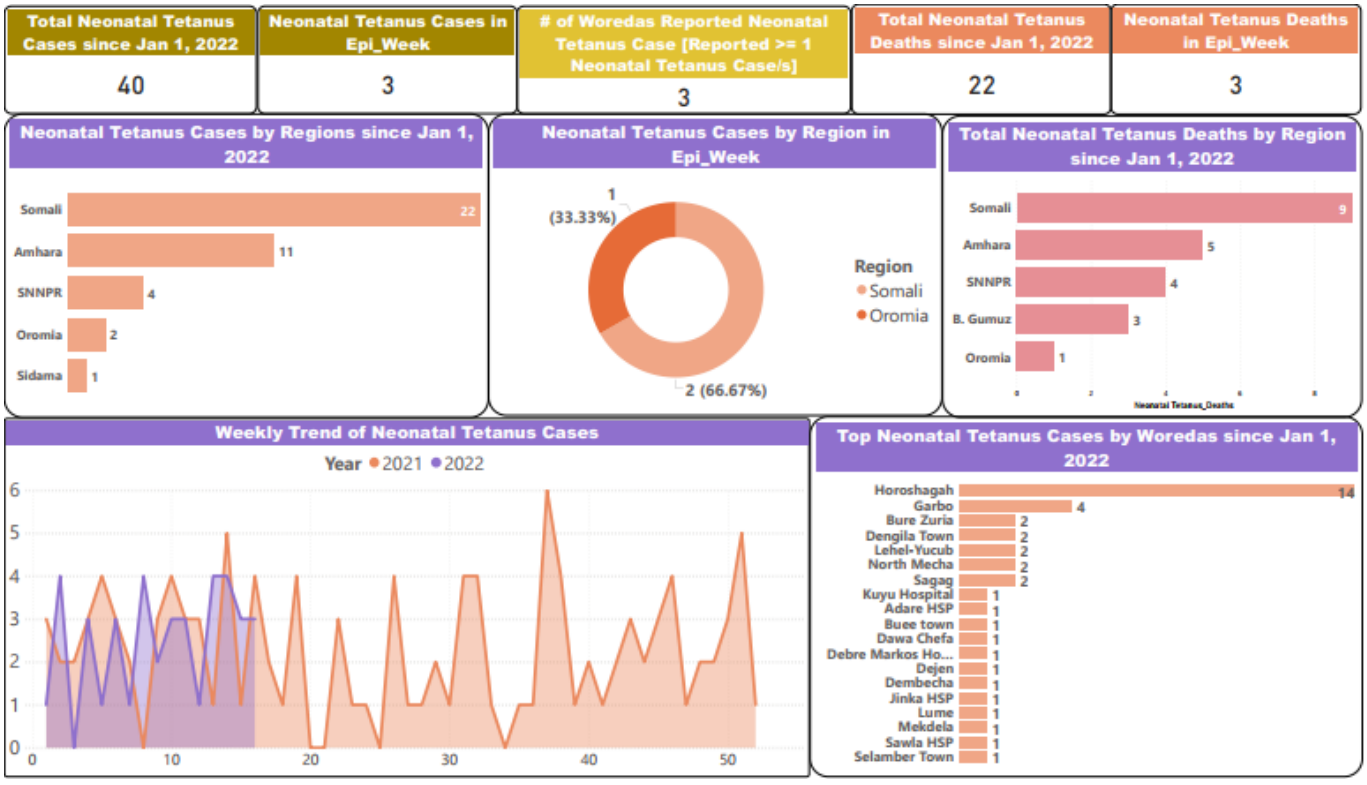



*Figure 58: Summary of neonatal tetanus in Ethiopia as of April 24, 2022*

## Relapsing fever

A total of 92 relapsing fever (RF) cases which is a two (2 cases increment as compared to previous week) with one (1) new death were reported during the week. Highest number of Relapsing Fever cases were reported from Yirgalem Hospital (22%) from Sidama region followed by Arada Woreda 06 (20%) from Addis Ababa city administration in the week.

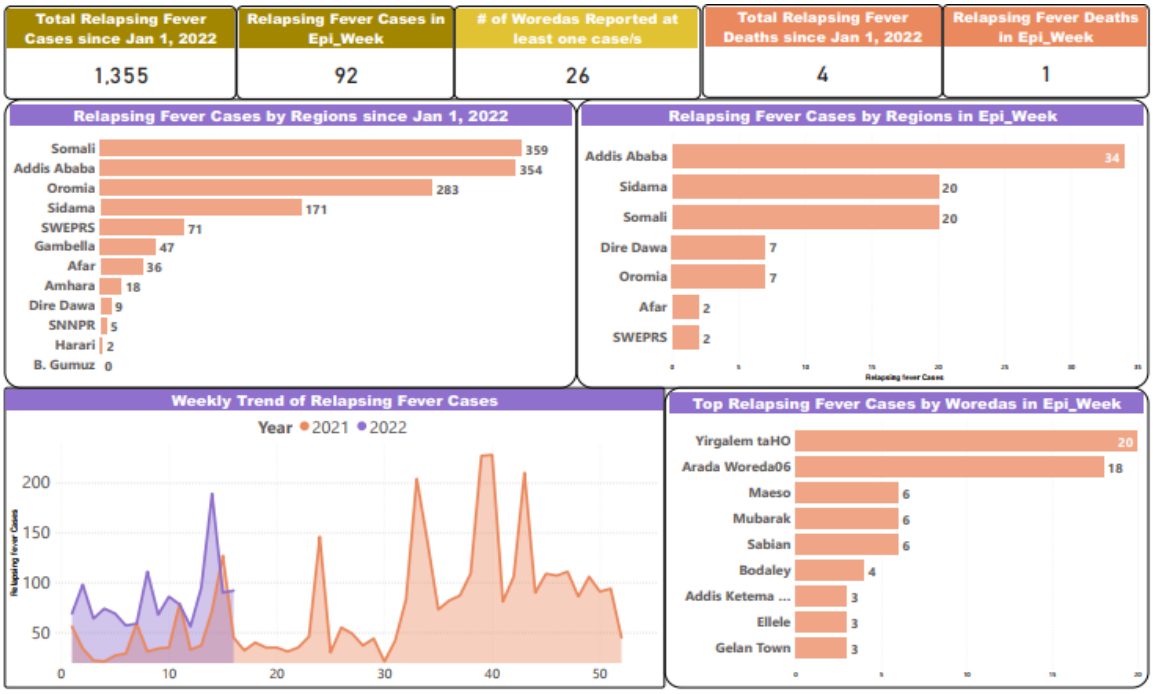



*Figure 59: Relapsing fever in Ethiopia as of April 24, 2022*

## Anthrax

A total of 321 Anthrax cases and 14 deaths were reported nationally since January 1, 2022. In the week-16, 13 new cases were reported which is a one (1 case) case increase as compared to the previous week. No new death was reported. All Anthrax cases were reported from Amhara region (100%) in the week.

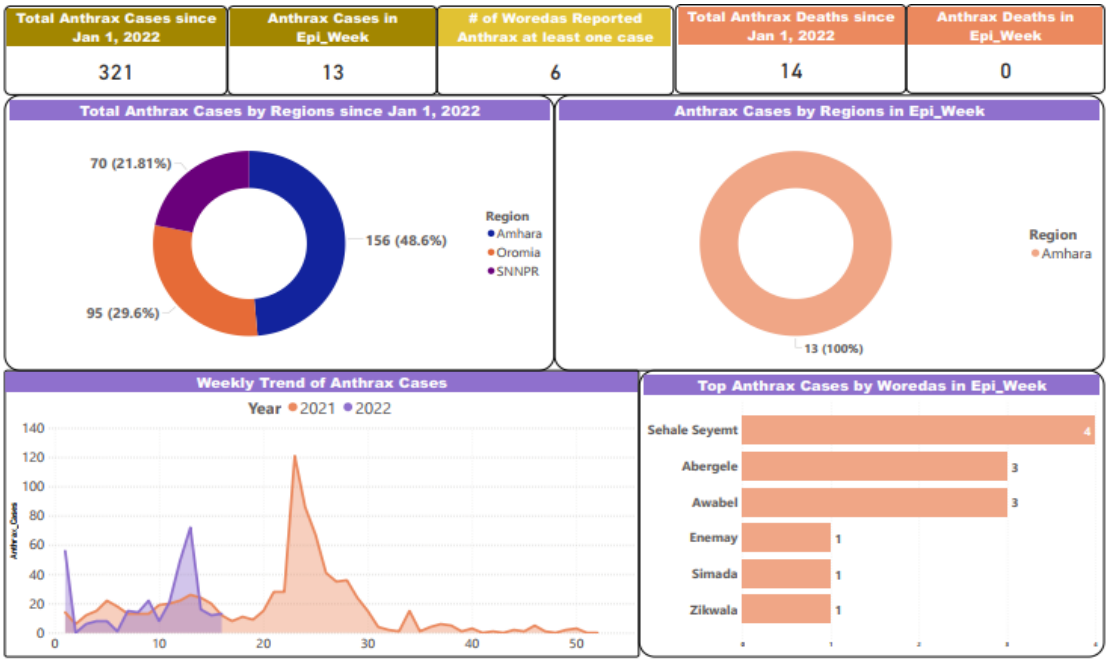



*Figure 60: Anthrax in Ethiopia as of April 24, 2022*

## Epidemic typhus

A total of 191,827 Epidemic typhus cases and 8 deaths are reported in the country since January 1, 2022. Among the total cases, 10,317 cases were reported during week 16. The number of Epidemic typhus cases reported in this week decreased by 12% as compared to the one reported in the previous week.

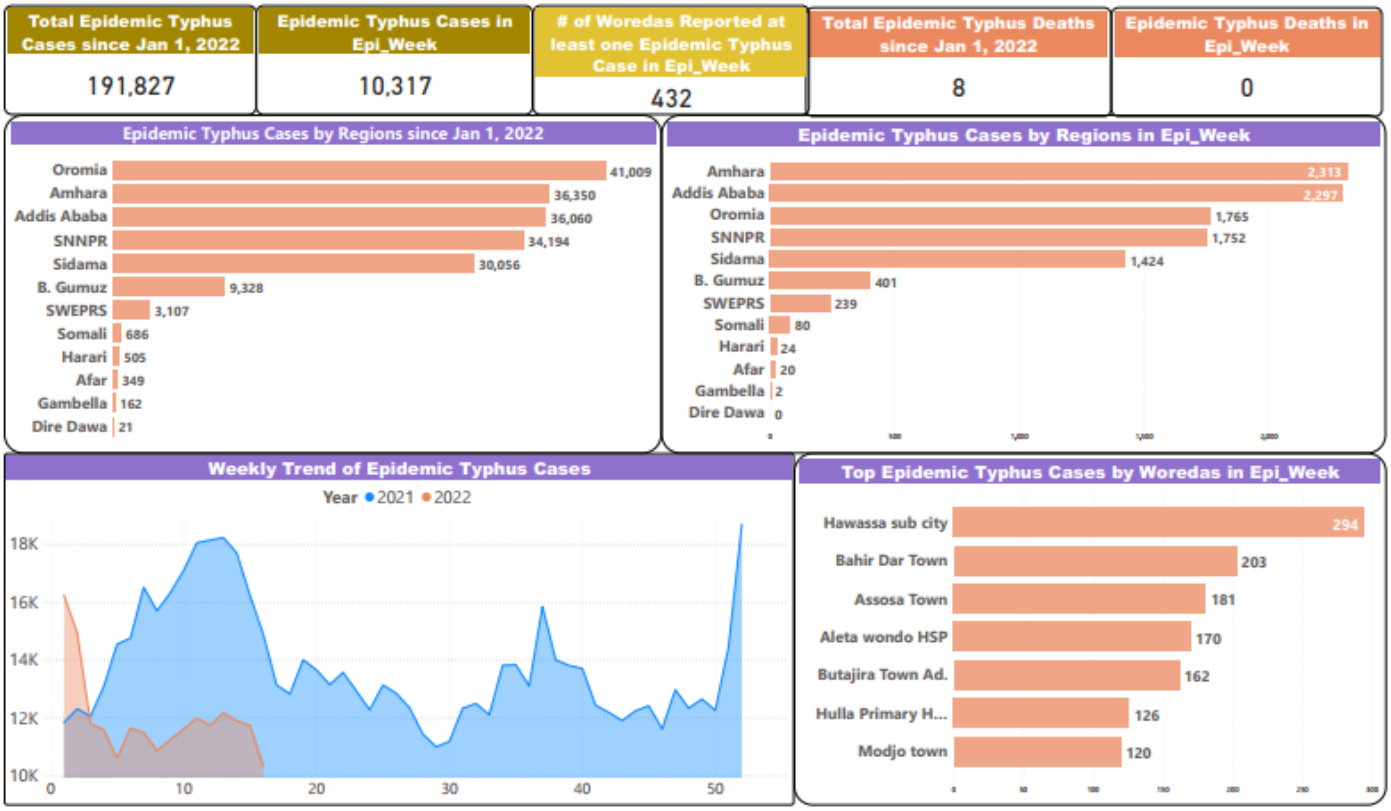



*Figure 61: Summary of typhus cases in Ethiopia as of April 24, 2022*

## Chemical Poisoning

A total of 237 Chemical poisoning cases and 14 deaths recorded from reporting regions since January 1, 2022. In the Epi-week 16, 16 cases with no death are reported, of which Amhara region reported eight (8) cases, Addis Ababa city administration five (5) cases and one (1) case from Diredawa city administration (5 cases).

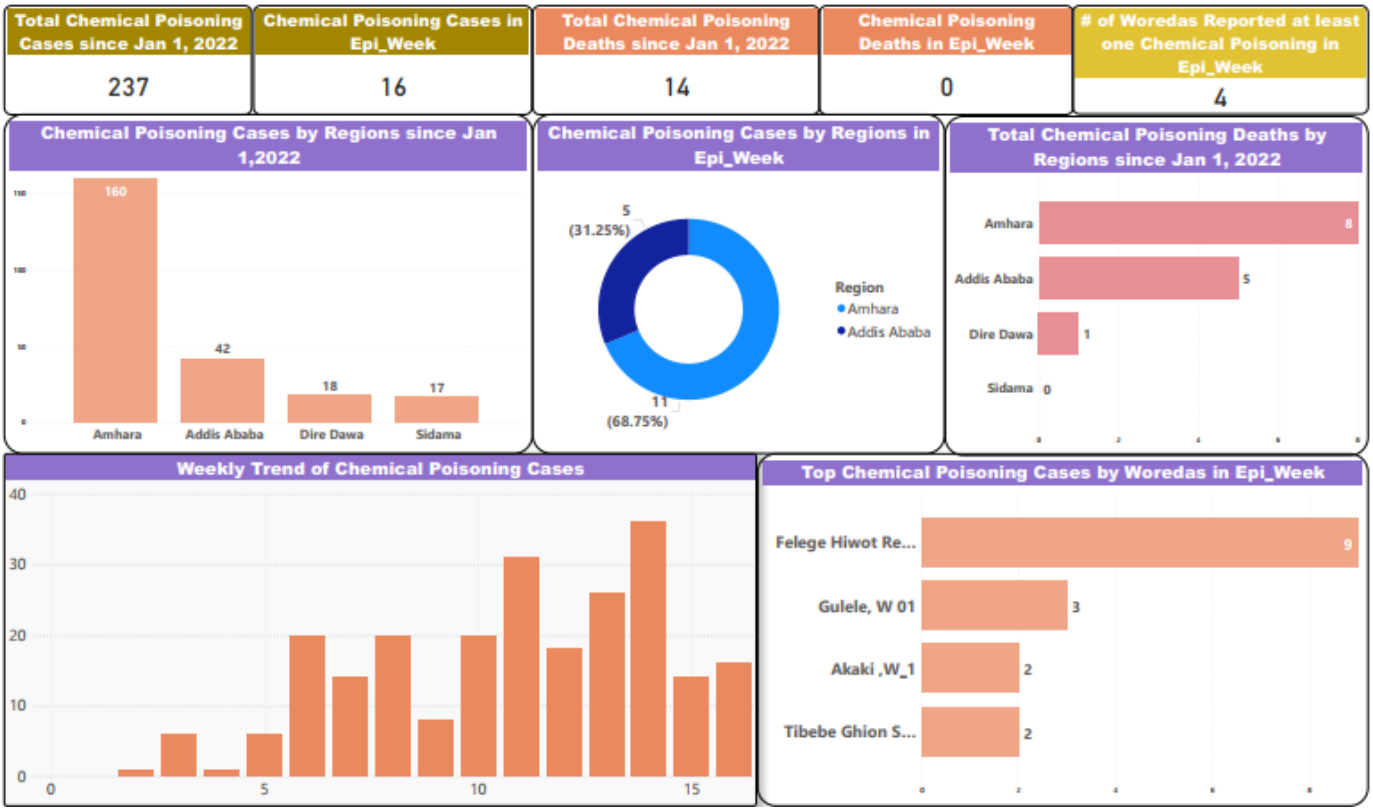
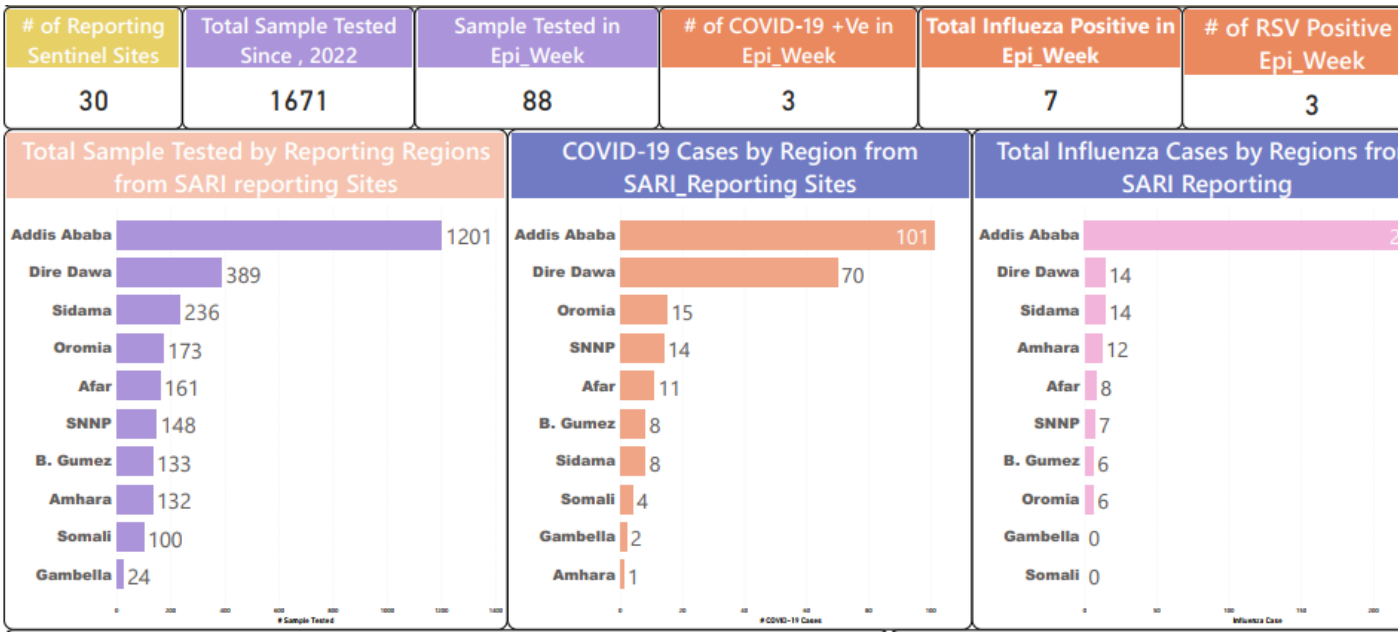



*Figure 62: Summary of Chemical Poisoning cases in Ethiopia as of April 24, 2022*

## SARI

Among 88 sample tested, three (3) COVID-19 cases, seven (7) Influenza cases and three (3) RSV cases were detected in the week-16 from reporting sentinel sites nationally.



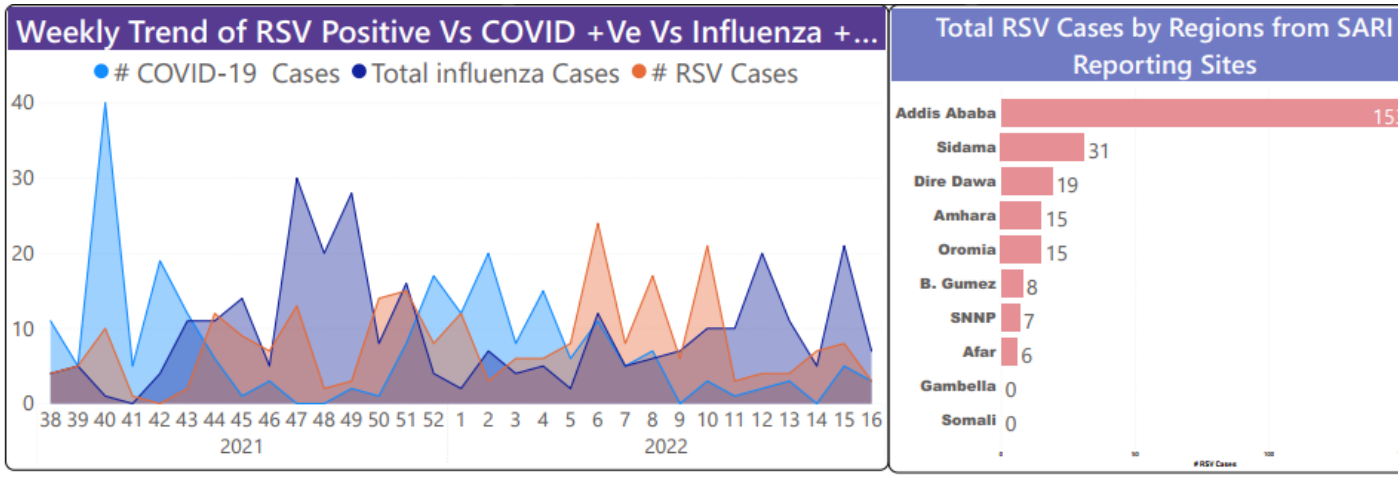



*Figure 63: Summary of SARI situation in Ethiopia as of April 24, 2022*

## Typhoid fever

A total of 27,398 typhoid fever cases with no death are reported during the week 16, which showed decrement as compared to the number of typhoid fever cases reported in the previous week.

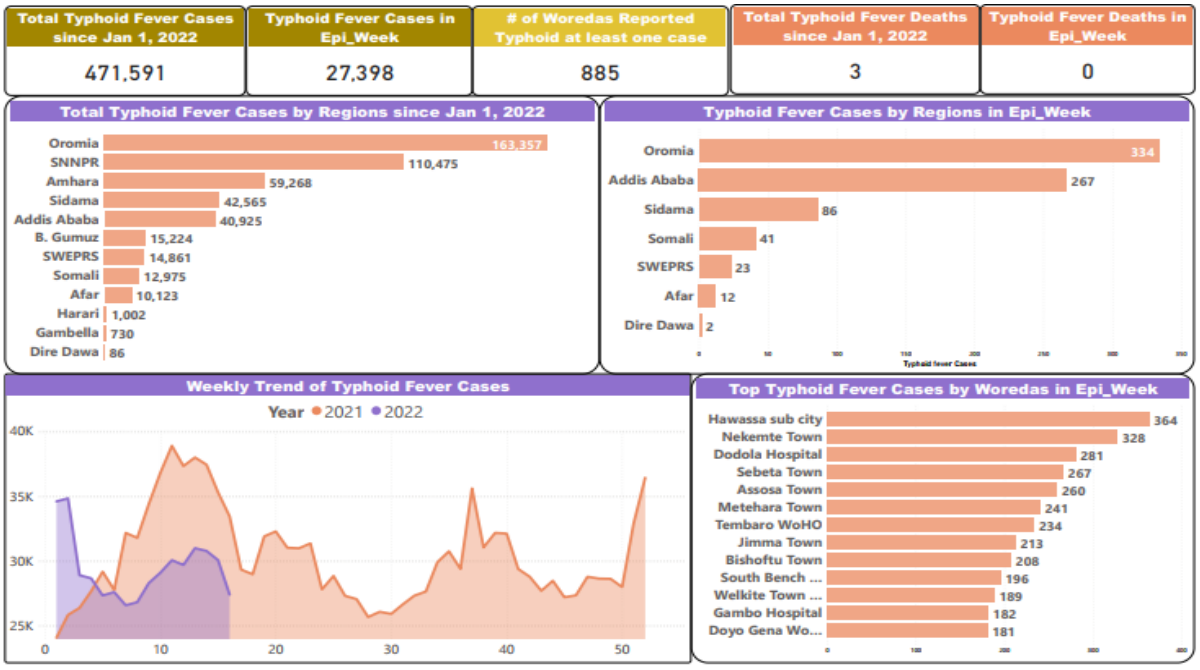



*Figure 64: Summary of typhoid fever situation in Ethiopia as of April 24, 2022*

## Other weekly reportable diseases

No cases and deaths were reported for Avian Human Influenza, dracunculiasis (guinea worm), Pandemic Influenza, smallpox, viral hemorrhagic fever and yellow fever among the immediately and weekly reportable diseases in the week. Public health intervention activities against the diseases and events are not included in this bulletin. Weekly reportable diseases with region were summarized in the following Table 2.

*Table 45: Summary of weekly reportable diseases by regions, as of April 24, 2022*

**Cases Summary of Weekly Reportable Disease/Conditions by Regions**

| Region | Malaria Case | Susp. Meningitis Case | Dysentery Cases | Typhoid Fever | RF Cases | SAM Case | Typhus Cases |
|---|---|---|---|---|---|---|---|
| Addis Ababa | 67 | 0 | 238 | 2,630 | 34 | 118 | 2,297 |
| Afar | 1,187 | 5 | 156 | 510 | 2 | 288 | 20 |
| Amhara | 6,275 | 24 | 2,425 | 3,732 | 0 | 815 | 2,313 |
| B. Gumuz | 958 | 8 | 123 | 731 | 0 | 9 | 401 |
| Dire Dawa | 147 | 0 | 16 | 5 | 7 | 42 | 0 |
| Gambella | 1,278 | 0 | 52 | 23 | 0 | 30 | 2 |
| Harari | 3 | 5 | 33 | 83 | 0 | 22 | 24 |
| Oromia | 2,657 | 58 | 2,537 | 8,882 | 7 | 2,746 | 1,765 |
| Sidama | 818 | 2 | 224 | 2,197 | 20 | 219 | 1,424 |
| SNNPR | 8,997 | 16 | 459 | 6,938 | 0 | 1,081 | 1,752 |
| Somali | 1,236 | 9 | 771 | 719 | 20 | 2,366 | 80 |
| SWEPRS | 2,951 | 5 | 116 | 948 | 2 | 383 | 239 |
| **Total** | **26,574** | **132** | **7,150** | **27,398** | **92** | **8,119** | **10,317** |

# Annexes

### Annex 1: Consent form for Malaria outbreak investigation in Loma District, Dawro Zone, SWEP Region, Ethiopia, 2022

Hello! My name is..... And I am an Addis Ababa University Field Epidemiology Resident. Also, I am gathering information on the study's risk factors for a malaria outbreak in the Lom area in the SWEP region of Ethiopia in 2022. I'd like to know your thoughts on the causes of malaria from your perspective. The district, region, country, and other stakeholders will all benefit from this knowledge as they develop malaria prevention and control measures. It simply takes 15 to 20 minutes to finish the questionnaire. Your involvement is crucial to identifying the risk factors of a malaria outbreak. The data you provide will be kept totally confidential and won't be disclosed to anyone. There are hazards involved as well as no incentives or immediate advantages**.**

You have the option to participate in this study voluntarily and choose not to answer all, some, or all of the questions. Nonetheless, since your participation is important, I hope you'll take part in our study.

Both verbal and written consent are required.

Respondent agrees to be interviewed Start interview..... 1
Respondent doesn't agree to be interviewed Terminate Interview..... 2
Name of interviewer: _____ Signature _____
Date: _____
Data collector mobile number _____

### 2. History taking checklist for Malaria outbreak investigation in Loma district, Dawro zone SWEPR

**1. Socio-demographic information:**

1.1. Respondent ID

1.2. Age in years_____

1.3. Sex: M_____F____

1.4. Address: kebele _____ village_____

1.5. Occupation: 1) gov't employed 2) daily laborer 3) student 4) farmer 5) Merchant 6) other_____

1.6. Total family members _____

1.7. Ethnicity: _____

1.8. Religion: 1) orthodox 2) protestant 3) Muslim 4) other _____

1.9. Marital status: 1) Married 2) single 3) Widowed 4) Divorced

1.10. Educational status:

1) Formal education 2) No formal education

2. **Questions related to Clinical presentations:**

2.1. When did the first symptom appear? (Symptom onset date)

DD/MM/YY_____

2.2. What were symptoms

a. Fever

b. Headache

c. Vomiting

d. Sweating

e. Anorexia

f. Shivering

g. Others (specify)

2.3. Did you get any treatment? Yes__ no ___

2.3.1. If yes, what treatment did you get?

a. Coartem b. Chloroquine
c. Quinine tablets
d. Quinine injection e. Other _____

**3. Risk Factors: (For both cases and controls)**

3.1. Sleeping areas in side home _____outside home_____

3.2. Did you stay outside overni0ght (after 6:00 pm)? Yes___ no ____

3.3. Did you travel outside your village in the past 2-3 weeks: - yes____ no___

3.4. Is there a similar sick patient in your household yes----no----

3.5. If yes Q 3.4, the number of sick individuals _____

3.6. Do you have bed net in your household yes ___no ___

3.7. If yes Q 3.6, how often do you use

A) Always b) sometime c) never

3.8. If yes Q 3.6 the number of bed nets _____

3.9. If yes Q 3.6 Do mothers and children given priority of using bed nets? Yes __no ___

3.10. Was indoor residual sprayed (IRS) this year? Yes ___no___

3.11. If yes Q3.10 when? (DD/MM/YY _____

3.12. If yes to Q3.10 how often? Once ___twice___ three times_____

3.13. History of malaria in the past two months: - yes no

3.14. If yes Q3.13, did you treat ed for the malaria? Yes no

3.15. Have you applied IRS with the past 8 months? Yes no

**4. Environmental investigation**

4.3. Presence of mosquito vectors/ mosquitoes breeding sites around the home or vicinity?

a) Yes b) no

4.4. If Q 4.3 yes, presence of larvae in breeding site: - a) yes b) no

4.5. Type of house: a) mad b) cement c) stone d) others_____

4.6. Do you use repellents: - a) yes b) no

4.7. Protective clothing at night (long close cover hands and legs): - a) yes b) no

4.8. Waste collection: a) yes b) no

4.9. Unprotected irrigation: - a) yes b) no

4.10. Presence of intermittent rivers close to the community: - a) yes b) no

**5. Awareness assessment**

5.1. What are the sign and symptom of malaria (possible to answer more than one answer).

5.2. How it transmitted?

a. By mosquito bite b. Blood transfusion

c. Mother to child d. By flies

e. Breathing f. Body contact

g. By hunger

5.3. How it can be prevented?

a. Early diagnosis &treatment b. House spray by insecticidal

c. Use of mosquito bed net d. Environmental hygiene

e. By using good nutrition

## Annex 2: Data collection tool to evaluate Malaria surveillance system in Gambella Zuria, District 2022

### I. REGIONAL /ZONAL LEVEL QUESTIONNAIRE

Identifiers: ---------- Date: ----------

Respondent name: ---------- Responsibility: ----------

**A. Surveillance system**

1. Is there national Malaria guideline?

1. Yes 2. No 3. Not applicable 4. Unknown

2. Do you have standard case definitions for the Country's priority diseases like malaria?

1. Yes 2. No 3. Not applicable 4. Unknown

3. Is the central level responsible for providing surveillance reporting forms to the health facilities?

1. Yes 2. No 3. Not applicable 4. Unknown

4. If yes, have you lacked appropriate surveillance forms (Line list, weekly reporting form, and epidemic reporting form, rumor investigation) at any time during the last 6 months?

1. Yes 2. No 3. Not applicable 4. Unknown

5. What are the reporting entities for the surveillance system?

1. Public health facilities
2. NGO health facilities
3. Military health facilities
4. Private health facilities
5. Others (Specify) _____

6. Percent of district reports (either directly or through an intermediate level) received during each reporting period at the central level during the past 3 months:

6.1. Number of reports in the last 3 months compared to expected number (completeness)

6.2. Weekly: /12 times the number of districts (timeliness)

6.3. Immediately: /------ times the number of districts

7. Was there any report of the immediately reportable diseases in the past 1 month?

1. Yes 2. No

8. If yes, with in what time is the report received after detection of the case/ diseases?

1. Less than 1 hour 2. 2-24 hours

3. 1- 2 days 4. 3- 7 days

5. after 1 week

9. How do you report? (Multiple responses are possible)

1. Mail 4. Radio
2. Fax 5. Electronic
3. Telephone 6. Other (specify)_____

**A. Data analysis**

1. Does the Zonal level describes the data by age, sex, time and places:

1. Yes 2. No 3. Unknown 4. Not applicable

2. Is there a line graph for malaria? observed

_____

_____

3. If they do not made analysis for Malaria ask the reason why they don't_____

_____

4. Do you have an action threshold defined for, malaria?

1. Yes 2. No 3. unknown 4. Not Applicable

5. Who is responsible for the analysis of the collected data? _____

6. How often do you analyze the collected data?

1. Daily 4. Monthly
2. Weekly 5. Quarterly
3. Every 2 weeks 6. As needed….

7. Do you have appropriate denominators?

1. Yes 2. No 3. Unknown 4. Not Applicable

8. Do you give feedback for woredas?

1. Yes 2. No

9. If the answer is yes for Question 8, how often?

1. Daily 3. Weekly
2. Monthly 4. Quarterly

**B. Outbreak Investigation**

1. Percent of suspected outbreaks that were investigated in the past 6 months_____ (# of suspected outbreak) _____ (# of investigated) _____ (%)

2. List the diseases: _____

**C. Epidemic Preparedness (relevant for epidemic prone diseases)**

3. Existence of a Regional/Zonal plan for epidemic preparedness and response

1. Yes 2. No 3. Unknown 4. Not applicable

4. Has the zone had emergency stocks of drugs, LLITN, and supplies at all times in past 1 year (2014)?

1. Yes 2. No 3. Unknown 4. Not applicable

5. Has the region experienced shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)?

1. Yes 2. No 3. Unknown 4. Not applicable

6. Existence of standard case management protocol for Malaria

1. Yes 2. No 3. Unknown 4. Not applicable

7. Is there budget line for epidemic response?

1. Yes 2. No 3. Unknown 4. Not applicable

8. Does the region have rapid response team for epidemic?

1. Yes 2. No 3. Unknown 4. Not applicable

**D. Response to Epidemics**

1 Ability of the regional level to respond within 48 hours of notification of most recently reported outbreak

1. Yes 2. No 3. Unknown 4. Not applicable

2. How many feedback bulletins or reports had the regional level produced in the last year?

_____

3. How many supervisory visits have you made in the last 6 months? _____

4. The most usual reasons for not making all required supervisory visits:

_____

5. Have you been trained in disease surveillance?

1. Yes 2. No 3. Unknown 4. Not applicable

6. If yes, specify when, where, how long, by whom?

_____

7. What percent of your subordinate personnel have been trained in surveillance?

_____

8. Have you received any post-basic training in epidemic management?

1. Yes 2. No 3. Unknown 4. Not applicable

9. If yes, specify when, where, how long, by whom?

_____

_____

_____

___

**Percent of sites that have:**

10. Data management
    1. Computer:
    2. Printer:
    3. Photocopier:
    4. Data manager:
    5. Statistical package:
11. Communications
    1. Telephone service:
    2. Fax:
    3. Radio call:
    4. Satellite phone:
    5. Computers that have modems:
12. Budget line _____
13. Logistics _____

**Surveillance**

14. Do you have computerized surveillance network at this level?
    1. Yes 2. No 3. Unknown 4. Not applicable

**F. Budget for surveillance**

15. Is there a budget line for surveillance in the Regional Health Bureau budget?
    1. Yes 2. No 3. Unknown 4. Not applicable
16. How could surveillance be improved?

_____

_____

_____

_____

17. What opportunities are there for integration of surveillance activities and functions (core activities, training, supervision, guidelines, resources etc.)?

_____

_____

_____

**G. Questionnaire for Attributes and level of Usefulness:**

1. Total population under surveillance_____

2. What are the incidence / Prevalence of Malaria in your area/region?

 Malaria _____cases _____Deaths _____

**I. Level of Usefulness of the Surveillance System for these selected priority diseases**

Does the surveillance system help?

1. To detect outbreaks of these selected priority diseases early?

   1. Yes 2. No

2. To estimate the magnitude of morbidity and mortality related to these diseases, including identification of factors associated with these diseases?

   1. Yes 2. No

3. To permit assessment of the effect of prevention and control programs?

   1. Yes 2. No

4. To Observe (confirm): interventions and diseases trends analyzed

   1. Available 2. Not available

**II. Describe Each System Attributes:**

**I. Simplicity:**

1. Is the case definition of malaria and case detection known by all level health professionals?

   1. Yes 2. No

2. What are the organizations which need to receive reports of the surveillance data?

3. Do you feel that additional data collected on a case are time consuming?

   1. Yes 2. No

4. How long it takes to fill the format?

   1. <5 minute 2.-10-15minuts 3.- >15 minutes

5. How long does it take to have laboratory confirmation of Malaria?

   1. <5 minute 2.-10-15minuts 3.- >15 minutes

**ii. Flexibility:**

1. Can the current reporting formats be used for other newly occurring health event (disease) without much difficulty? 1. Yes 2. No

2. Do you think that any change in the existing procedure of case detection, reporting, and formats will be difficult to implement? 1. Yes 2. No

**iii. Data Quality:** (Completeness of the reporting forms and validity of the recorded data)

1. Are the data collection formats for these priority diseases clear and easy to fill for all the data collectors/ reporting sites? 1. Yes 2. No

2. Are the reporting site / data collectors trained/ supervised regularly? 1. Yes 2. No

3. Observe: Review the last months report of these diseases

A. Average number of unknown or blank responses to variables in each of the reported forms _____

_____

B. Percent of reports which are complete (that is with no blank or unknown responses) from the total reports _____

**iv. Acceptability:**

1. Do you think all the reporting agents accept and well engaged to the surveillance activities? 1. Yes 2. No

2. If yes, how many are active participants (of the expected total)? _____

3. If No, what is the reason for their poor participation in the surveillance activity?

A. Lack of understanding of the relevance of the data to be collected

B. No feedback or recognition given by the higher bodies for their contribution; i.e. no dissemination of the analyzed data back to reporting facilities

C. Reporting formats are difficult to understand

D. Report formats are time consuming

E. Other (specify): _____

**v. Representativeness:**

1. What is the health service coverage of the district/ zone/ region? _____(#) _____%

2. Do you think, the populations under surveillance have good health seeking behavior for these diseases? 1. Yes 2. No

3. Who do you think is well represented by the surveillance data? the urban/ the rural and what is the reason?

**vi. Timeliness**:

Timeliness of reporting in the past one year (by Zone and Woreda)

1. On time_____ 2. Late _____

**vii. Stability:**

1. Was the new BPR restructuring affected the procedures and activities of the surveillance of these diseases? 1. Yes 2. No

2. Was there lack of resources that interrupt the surveillance system? 1. Yes 2. No

## II. HEALTH FACILITY QUESTIONNAIRE

**Identifiers:**

Type of health facility: _____Date: _____ District: _____

Interviewer: _____ Region/province: _____

Respondent: _____ Country: _____

Name of health facility: _____ Surveillance system:

1. Is there national manual for surveillance at this site?

1. Yes 2. No 3. Unknown 4. Not applicable

**I. Case detection and registration**

2. Percent of health facilities that have a clinical register

1. Yes 2. No 3. Unknown 4. Not applicable

3. Percent of health facilities that correctly register cases filling of the clinical register during the previous 30 days

1. Yes 2. No 3. Unknown 4. Not applicable

4. Do you have a standard case definition for: malaria?

1. Yes 2. No 3. Unknown 4. Not applicable

**II. Case confirmation**

5. At this facility are you able to collect

Blood: 1. Yes 2. No 3. Unknown 4. Not applicable

6. Observation: Observe the presence of materials required to collect

Blood: 1. Yes 2. No 3. Unknown 4. Not applicable

7. Do you have the capacity to handle sputum, stool, blood/serum and CSF until shipment at this facility?

1. Yes 2. No 3. Unknown 4. Not applicable

8. Do you have RDT to test Malaria at this facility?

1. Yes 2. No 3. Unknown 4. Not applicable

9. Do you have functional microscope to test for Malaria at this facility?

1. Yes 2. No 3. Unknown 4. Not applicable

10. Observation: Observe presence of functional cold chain at health facility

1. Yes 2. No 3. Unknown 4. Not applicable

11. Is there transport media for stool at health facility?

1. Yes 2. No 3. Unknown 4. Not applicable

12. Observation: Observe presence of packing materials for shipment of specimens at health facility

1. Yes 2. No 3. Unknown 4. Not applicable

**III. Data reporting**

13. Have you faced lack of appropriate surveillance forms at any time during the last 6 months? 1. Yes 2. No 3. Unknown 4. Not applicable

14. Is the last monthly report agreed with the register for malarial diseases; major public health importance

Observation: Malaria 1. Yes 2. No 3. Unknown 4. Not applicable

15. Percent of sites that reported each reporting period to the next higher level during the past 3 months

Number of reports in the last 3 months compared to expected number

Observe Weekly: /12 times the number of sites

Observe immediately: /-- times the number of sites

16. on time (use national deadlines)

Observe: Number of weekly reports submitted on time: -_____ /12 times the number of sites

Observe: Number of immediately reports submitted on time: ___/-- times the number of sites

17. How do you report?

1. Mail 4. Telephone
2. Fax 5. Radio

3. Electronic 6. Other (specify): _____

18. Strengthening reporting

How can reporting be improved?

_____

_____

**IV. Data analysis**

Percent of sites that:

19. Describe data by person, place and time

20. Do you have an **action threshold** for any of the Country priority diseases?

1. Yes 2. No 3. Unknown 4. Not applicable

21. If yes, what is it (Ask for malaria diseases)? _____cases ____ % increase _____rate _____

22. Who is responsible for data analysis? _____

23. How often do you analyze the collected data?

1. Daily 4. Monthly
2. Weekly 5. Quarterly
3. Every 2 weeks 6. As needed

24. Do you have appropriate denominators? Observe demographic data at site (E.g., population <5 yr., population by village, total population)

1. Yes 2. No 3. Unknown 4. Not applicable

**V. Epidemic preparedness**

25. Is there written case management protocol for malaria epidemic prone disease?

1. Yes 2. No 3. Unknown 4. Not applicable

**VI. Epidemic response**

26. Has the health facility implemented prevention and control measures based on local data for at least one epidemic prone disease?

1. Yes 2. No 3. Unknown 4. Not applicable

**VII. Feedback**

27. How many feedback bulletins or reports has the health facility received in the last year?

___

28. How many meetings has this health facility conducted with the community members in the past six months?

**VIII. Supervision:**

29. How many times have you been supervised in the last 6 months? _____

**IX. Training**

30. Have you been trained in disease surveillance and epidemic management?

1. Yes 2. No 3. Unknown 4. Not applicable

31. If yes, specify when, where, how long, by whom? _____

_____

**X. Resources**

Percent of sites that have:

32. Logistics

1. Electricity 3. Motor cycles
2. Vehicles 4. Bicycles

33. Data management

1. Stationery 3. Computer
2. Printer 4. Calculator

34. Communications

1. Telephone 3. Service Radio call
2. Fax 4. Computers that have modems

35. Information education and communication materials

1. Posters 4. Projector
2. Megaphone 5. Screen 6. Generator
3. Flipcharts or Image box 7. Other (Specify): _____

36. Hygiene and sanitation materials

1. Spray pump
2. Disinfectant

37. List Protection materials _____

_____

38. Are you satisfied with the surveillance system?

1. Yes 2. No 3. Unknown 4. Not applicable

39. If no, how can the surveillance system be improved? _____

_____

## Annex 3: Data collection tool for health profile assessment of Bosat District Health office

1. Historical Aspects of the area (if available)
 How and why the name

_____

_____

 How was the Bosat District formed_____
 Any other historical aspect_____

2. Geography and Climate

 Area of the sub-city _____
 Altitude _____
 Latitude_____
 Longitude _____
 Average Annual rain fall _____
 Average Annual temperature _____
 Land bodies_____
Water bodies_____
 Boundaries of the district East----------South---------North----------West--

3. Demographic information

 Total Population _____
 Household size----------
 Male_____
 Female_____
 Urban_____
 Rural_____
 Sex ratio (Male to Female) _____
 Age structure: - percentage of children < 1yrs_____. <5yrs____< 15 years
 Percentage of old people >65 years_____
 Women child bearing age_____
 Percentage of pregnant women_____
 Dependency ratio_____

| Sr. no | Name of PHCU | Population size | | Total House hold | Total CBAW (15-49yrs) | Total Pregnant women |
|---|---|---|---|---|---|---|
| | | Male | Female | | | |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| **Total** | | | | | | |
| | | | | | | |

**6. Population distribution**

| S. N | Description | Total | % | Remark | |
|---|---|---|---|---|---|
| 1 | Male | | | | |
| 2 | Female | | | | |
| 3 | Under 1 year population | | | | |
| 4 | Under 5-year population | | | | |
| 5 | 5-15 year | | | | |
| 6 | 15-49 year | | | | |
| 7 | 49-64 | | | | |
| 8 | 65+ | | | | |
| 9 | 6-59 months age group | | | | |
| 10 | 24-59 months age group | | | | |
| 11 | Pregnant women | | | | |
| 12 | NPW in reproductive age group | | | | |
| 13 | Sex ratio M:F | | | | |
| 14 | Dependency ratio (65+ & <15 yrs. to 15-64 years | | | | |
| | | | | | |

| 6.1 population pyramid | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | |
| Population data by age and sex | | | | | | | | | | | | | | | |
| Male | <5 | 6-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65+ | Total |
| | | | | | | | | | | | | | | | |
| Female | <5 | 6-9 | 10-14 | 15-19 | 20-24 | 25-29 | 30-34 | 35-39 | 40-44 | 45-49 | 50-54 | 55-59 | 60-64 | 65+ | Total |
| | | | | | | | | | | | | | | | |
| Total | | | | | | | | | | | | | | | |

**7. Administrative setup**

Total number of woreda:

_____

No of Ambulances_____

No of Health Development Army (HDAs)_____

Health Insurance Coverage_____

**Vital Statistics and Health Indicators**

| S. N | Vital Statistics and Health Indicators | Sex | | Total | % | Remark |
|---|---|---|---|---|---|---|
| | | M | F | | | |
| 1 | Infant Mortality Rate (IMR) | | | | | |
| 2 | Neonatal mortality | | | | | |
| 3 | Child Mortality Rate | | | | | |
| 4 | Crude Birth Rate | | | | | |
| 5 | Crude Death Rate | | | | | |
| 6 | Maternal Mortality Rate | | | | | |

**8. Health status**

**Number of health facilities 2012 EFY (2019/20)**

| Sr. no | Type of Health facility | Number |
|---|---|---|
| 1 | Hospital (Primary, General) | |
| 2 | Health center | |
| 4 | Pharmacy | |
| 6 | Diagnostic Laboratories | |
| 7 | Private Clinic/Hospitals | |

**9 Human resource of the district health office and health facility in 2012EFY**

| Sr. no | Type | Male | Female | Total |
|---|---|---|---|---|
| | Field epidemiologist | | | |
| 1 | Physicians | | | |
| 2 | Health officers | | | |
| 3 | Laboratory technologists | | | |
| | Laboratory technicians | | | |
| 4 | Pharmacists | | | |
| | Druggists | | | |
| 5 | Nurses | | | |
| 6 | Midwife | | | |
| 7 | HEWs | | | |
| 8 | HIT | | | |
| 9 | X-Ray technician | | | |
| 10 | Sanitarian (Environmental H) | | | |
| 12 | Anesthesia | | | |
| 13 | Supportive Staff | | | |
| | Total | | | |

**10. Ratio of health facility and professional to population 2012EFY.**

| Sr. no | Description | Ratio |
|---|---|---|
| 1 | Hospital: population | |
| 2 | Health center: population | |
| 3 | Health post: population | |
| 4 | Physician; population | |
| 5 | Health officer: population | |
| 6 | Nurse: population | |

| | | |
|---|---|---|
| 7 | Midwife: population | |
| 8 | HEW: population | |

**11. Coverage of PHCU**

| S. No | Name of PHCU | Catchment population | Ratio of Health Center to Population |
|---|---|---|---|
| **1** | | | |
| **2** | | | |
| **3** | | | |
| **4** | | | |
| **5** | | | |
| **6** | | | |
| **7** | | | |

**12. Major non-communicable disease in Bosat district**

| S. N | Diseases | Frequency | % | Remarks |
|---|---|---|---|---|
| 1 | | | | |
| 2 | | | | |
| 3 | | | | |
| 4 | | | | |
| 5 | | | | |
| | | | | |

**11. Infrastructure of Health institutions**

| | **Types of institution** | | **# of institution** | **Remark** |
|---|---|---|---|---|
| | Number of Health centers | with sustainable/ 24 hour /electric power | | |
| | | without sustainable/ 24 hour /electric power | | |
| | | with telephone service (cable based/mobile) | | |
| | | without telephone service (cable based/mobile) | | |
| | | with piped water supply | | |
| | | Without piped water supply | | |
| | | No of HC with transportation road access | | |
| | **Number Of health posts** | with sustainable/ 24 hour /electric power | | |
| | | without sustainable/ 24 hour /electric power | | |
| | | with telephone service (cable based/mobile) | | |
| | | without telephone service (cable based/mobile) | | |
| | | with piped water supply | | |
| | | Without piped water supply | | |
| | | No of HC with transportation road access | | |

**13. Top Ten causes of morbidity and mortality 2012EFY (2019/20)**

**A. Top ten leading causes of OPD visit (morbidity)**

| Sr. no | Adult | | | Pediatrics | | |
|---|---|---|---|---|---|---|
| | Diseases type | Number | % | Diseases type | Number | % |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

**B. Top ten causes of deaths (mortality).**

| **Sr. no** | **Adult** | | | **Pediatrics** | | |
|---|---|---|---|---|---|---|
| | Diseases type | Number | % | Diseases type | Number | % |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |
| 4 | | | | | | |
| 5 | | | | | | |
| 6 | | | | | | |
| 7 | | | | | | |
| 8 | | | | | | |
| 9 | | | | | | |
| 10 | | | | | | |

14. **MNCH and EPI coverage of the district 2012EFY (2019/20)**

| **Sr. no** | Description | **Performance** | | | **Remark** |
|---|---|---|---|---|---|
| | | **Plan** | **Achievement** | **%** | |
| 1 | ANC 1$^{ST}$ | | | | |
| 2 | ANC 4 | | | | |
| 3 | PMTCT | | | | |
| 4 | PNC | | | | |
| 5 | BCG | | | | |
| 6 | Measles | | | | |
| 7 | Penta1 | | | | |
| 8 | Penta3 | | | | |
| 59 | Rota1 | | | | |
| 10 | Rota2 | | | | |
| 11 | PCV1 | | | | |
| 12 | PCV3 | | | | |
| 13 | Fully Immunized | | | | |

| | | | | | |
|---|---|---|---|---|---|
| 14 | TT2+PW | | | | |
| 15 | TT2+NPW | | | | |
| 16 | Contraceptive short | | | | |
| 17 | Contraceptive Long | | | | |
| 18 | PNC Early | | | | |
| 19 | Number of live births | | | | |
| 20 | Number of still births | | | | |
| 21 | Total Obstetrics deaths | | | | |
| 22 | MAM | | | | |
| 23 | SAM | | | | |
| 24 | Total number of Sc in the woreda | | | | |
| 25 | OTP sites in the Woreda | | | | |
| 26 | Total admission to OTP | | | | |
| 27 | Total admission to Sc | | | | |
| 28 | GM for under 2yrs children | | | | |

**15. Hygiene and environmental health services 2012 EFY (2019/20)**

| S. N | Description | | Plan | Achievement | % |
|---|---|---|---|---|---|
| 1 | Environmental sanitation | | | | |
| 2 | Latrine coverage | | | | |
| 3 | Number of HH with latrine | | | | |
| 4 | Utilization rate | | | | |
| 5 | Improved latrine | | | | |
| 6 | Un standardized latrine | | | | |
| 7 | Availability of safe drinking Water | | | | |
| 8 | Number of woredas accessed to safe water | | | | |
| 9 | Number of health facility with water supply | | | | |
| 10 | Daily water consumption per day per person | | | | |
| | Main source of water supply | Pipe | | | |
| | | Spring | | | |
| | | Well | | | |
| | | Pond | | | |
| | | River | | | |

**16. Endemic Diseases**

**A. Prevalence of TB/Leprosy: 2011 EFY (2018/19)**

| **Sr. No** | **Description** | | **Population no. (%)** |
|---|---|---|---|
| | Prevalence of TB | | |
| 1 | Pulmonary TB | Smear positive | |
| | | Smear negative | |
| 2 | Extra PTB | | |

| | | |
|---|---|---|
| 3 | TB detection rate | |
| 4 | TB Rx completion rate | |
| 5 | TB cure rate | |
| 6 | TB Rx success rate | |
| 7 | TB defaulter rate | |
| 8 | Death on TB Rx | |
| 9 | Total TB patients screened for HIV | |
| 10 | HIV prevalence rate among TB cases | |
| 11 | Prevalence of Leprosy | |

**B. HIV/AIDS 2011 EFY (2018/19)**

| Sr. No | Activities | Male | Female | Total | Remark |
|---|---|---|---|---|---|
| 1 | Total people screened for HIV | | | | |
| 2 | VCT | | | | |
| 3 | PICT | | | | |
| 4 | PMTCT | | | | |
| 5 | HIV Prevalence | | | | |
| 6 | Total PLWHIV | | | | |
| 7 | On ART | | | | |
| 8 | Pre ART | | | | |
| 9 | No of health facilities providing ART service | | | | |
| 10 | Condom Distribution | | | | |

**17. Socio economic conditions 2012 EFY**

**A. Education and school Health**

| Sr. no | Type of School | | # Schools | # teachers | | | # Students | | | Student School Drop out | Female Student School Drop out |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Male | Female | Total | Male | Female | Total | | |
| | Nursery | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| 1 | Primary | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 1-4 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 5-8 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 1-8 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | Seconda ry | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 9-10 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 11-12 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | 9-12 | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| 3 | College | Private | | | | | | | | | |
| | | Gov't | | | | | | | | | |
| | Total | | | | | | | | | | |

**17.1. school health activities:**

- Schools with water supply_____
- Schools with functional latrines _____
- Schools with HIV/other Health clubs_____
- Literacy ratio_____

**B. Employment**

- Number of people employed_____
- Number of people un employed_____
- Ratio of Employed to un employed_____

**C. Income**

- Main source of income _____
- No. of the population committed in:
  - ✓ Urban Agriculture _____ _____
  - ✓ Government employee_____
  - ✓ merchandise_____
  - ✓ Husbandry _____ _____
  - ✓ Hotel and catering _____
  - ✓ Others (specify) _____ _____
- Yearly income per house hold_____
- Average income per capita _____

**D. Social aspects**

- Number of youth clubs_____
- Number of public libraries_____
- Others_____

**E. Communication and Utilities**

How many of the health facilities and woreda have access to:

**a. Transportation**: woreda _____ (%)

Health facility_____ (%)

**b. Telecommunication**: woreda _____ (%)

Health facility_____ (%)

c. **Electric power**: woreda _____ (%) Health facility _____ (%)

**18. Health sector expenditure and financing 2008 - 2012 EFY (2016/2020)**

| | **Source** | 2008 EFY | 2009 EFY | 2010EFY | 2011EFY | 2012EFY |
|---|---|---|---|---|---|---|
| 1 | Total district budget (Birr) | | | | | |
| 2 | Allocated to health sector (Birr) | | | | | |
| 3 | Total per capital health expenditure (Birr) | | | | | |

*Name of NGOs which Support the health Sector: _____

**19 Health Care financing /HCF/ (_____2008____to_2012_____ EFY)**

| Sr. No | Name of the Health HFs | HCF Started at (EFY) | Budget Allocated (birr) | | | | |
|---|---|---|---|---|---|---|---|
| | | | 2008 | 2009 | 2010 | 2011 | 2012 |
| 1 | | | | | | | |
| 2 | | | | | | | |
| 3 | | | | | | | |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |

**20 Fee Waiver (FW) 2012EFY**

**Budget Allocated (Birr) _____**

| **Sr. no** | **Name of woreda** | **Total Population** | **Budget Utilized (Birr)** |
|---|---|---|---|
| | | | |

**21. Disaster situation in the sub city 2012 EFY (2019/2020)**

| S. N | Disaster situation in the woreda in last one yea | | |
|---|---|---|---|
| 1 | Was there any disaster natural or manmade disaster in the sub-city last year | | |
| 2 | If yes population affected | | |
| 3 | Displaced | | |
| 4 | Died | | |
| 5 | Got recovery response | | |
| | Any recent disease outbreak/other public health emergency? | | |
| 6 | If yes number affected | | |
| 7 | Number died | | |
| 8 | Response activity | | |

21. Population screened for malnutrition

Children _____ Moderate Acute Malnutrition----------Severe acute Malnutrition--------
Pregnancy _____ Moderate---------

**22. Nutrition intervention in Bosat Health office 2012**

| **Sr. No** | **Type of food intervention program** | |
|---|---|---|
| 1 | OTP sites | |

| | | |
|---|---|---|
| 2 | TFU program | |
| 3 | TSF program | |
| 4 | CBN program | |
| 5 | Others | |

**23. What do you think the major Health problems of the sub-city?**

- 
- 

**24. What do you think solutions of the addressed problems**

- ❖
- ❖

12. Problem Identification and Priority Setting – set priority health problems based on the public health importance, magnitude, seriousness, community concern, feasibility etc.

_____
_____
_____

13. Discussion of the highlights and the main findings of the health profile assessment and description

## Annex 4: Data Collection Tool for Distribution of Malaria and Mosquito Species along Pagag Point of Entry in Lare Woreda, Gambella-Ethiopia: Cross Sectional Study (Proposal)

**Informed Consent**

**1: Informed Consent Form: the investigator/data collector will read this consent form to the participants intended to be enrolled)**

My name is (**Investigator**) _____I am the data collector/investigator for research titled "distribution of Malaria among Cross Border Travelers moving along Pagag Point of Entry and Circulating Mosquito Species in Lare Woreda, Gambella-Ethiopia"

If you consent to participate in this research, you will be asked to respond to the question related to your socio-demographic, travel and malaria related information and you will provide blood specimen for malaria RDT. Furthermore, the result of the test will be informed to you on-spot and you will be linked to the nearby health facility if you found to be positive for malaria.

Your contribution will be confidential and that there will be no personal identifiers of yours in the data/report/publication. Except minor pain at areas of pierce on the finger during specimen collection, there will not be any potential risks or burdens associated with this study nor does any payment for your involvement.

You will have full right/guarantee to ask an investigator unclear issue related to the study, refuse to be part of the study or once you are enrolled you can leave the study at any time "t".

By signing below, hereby declare that I am informed of the purpose of the research, the risk, benefit and procedures of the study and I hereby indicate my consent with my signature.

Participant Signature_____

Date_____

Name of persons obtaining consent_____

Signature of persons obtaining consent_____

| **PART I. SOCIO-DEMOGRAPHIC CHARACTERISTICS OF TRAVELLER:** | | | |
|---|---|---|---|
| S.No. | Questions and filters | Responses | Sk |
| Q100 | Sex | 1. Male 2. Female | |

| | | | |
|---|---|---|---|
| Q101 | Age | _____ Years | |
| Q102 | Marital status | 1. Married 2. Single 3. Divorced/separated 4. Widowed | |
| Q103 | Religion | 1. Orthodox 2. Muslim 3. Protestant 99. Other (specify)_____ | |
| Q104 | Ethnic group | 1.Nuer 2. Agnuak 3. Mejenge<br>99.Others(specify)_____ | |
| Q104 | Educational level | 1. Illiterate<br>2. Read and write only<br>3. Formal education (last grade completed ----------) | |
| Q106 | Occupation (at origin) | 1. Farmer 2. Student 3. Housewife 4. Government employee 4. Private gainful work 6. Merchant<br>99. Other (specify)_____ | |
| **PART II: TRAVEL RELATED INFORMATION** | | | |
| Q200 | What is the purpose of travel | 1. Business purposes<br>2. Trade<br>3. Daily laborer<br>4. Refugee/Asylum seeker<br>5. Social purposes (visiting family, etc.)<br>99. Other (Specify)-------- | |
| Q201 | Permanent residence /home land of traveler | 1. Country: _____<br>2. Region/Province: _____<br>3. Specific location (District/Town): _____ | |
| Q202 | Are you moving from your permanent residence/refugee camp to other side? | 1. Yes<br>2. No | |
| Q203 | Are you returning from other side to permanent residence area/refugee camps? | 1. Yes<br>2. No | |
| Q204 | If YES to Q202, what is the intended area of destination/arrival | 1. Country: _____<br>2. Region/Province: _____<br>3. Specific location (District/Town): _____ | |
| Q204 | If YES to Q202, have you ever been to that area before? | 1. Yes<br>2. No | |
| Q206 | If YES to Q204, how frequently have you been to the sites | _____times | |
| Q207 | For how long will stay at the destination area? | _____Days | |
| Q208 | Where are you going to stay at destination sites | 1. Home 2. at refugee camp 3. With friend/relative 4. Hotel 99. Other (specify)_____ | |
| **PART III: MALARIA RISK FACTOR STATUS AT DEPARTURE SITE** | | | |
| Q300 | Where did you stay overnight after day task at your departure site? | 1. In the farm 2. Shelter 3. Town/rental 99. Other(specify)_____ | |
| Q301 | How was the status of the House or shelter you have slept in before your departure? | Yes No<br>1. Door/Window ----------. --1 2<br>2. Wall with whole ----------1 2<br>3. Roof with whole ---------- ------1 2<br>4. Hanged ITNs ----------1 2 | |
| Q302 | What was the average number of persons that you slept with before your departure? | _____ person/shelter | |
| Q303 | Was the shelter adequate for persons sleeping there? | 1. Yes 2. No | |
| Q304 | Did you stay in the evening outside the shelter or in the farm area? | 1. Yes 2. No | |
| Q305 | If Yes, Q304 list the type of work? | _____ | |

| | | | |
|---|---|---|---|
| Q306 | If yes, Q304 how long did you stay? | _____ | |
| Q307 | Did have mosquito net at your departure site? | 1. Yes 2. No | |
| Q308 | If yes, Q307, how was your usage? | 1. Daily 2. Sometimes 96. I don't remember | |
| Q309 | What is the status of the bed net? | 1. Has no hole 2. Has hole 99. Other(specify)_____ | |
| Q310 | Did you apply mosquito repellent cream when you were at departure site? | 1. Yes 2. No | |
| Q311 | Were you wearing protective/long sleeve cloths during the night when you were at departure site? | 1. Yes 2. No | |
| Q312 | When was your bed time most when you were at departure site? | _____ | |
| Q313 | Were you using smoke to repel mosquito when you were at departure site? | 1. Yes 2. No | |
| Q314 | Was there any traditional means that you might use to avoid mosquito bite when you were at departure site? (If yes list them) | _____ | |
| Q315 | Did you hear of malaria information when you were at departure site? | 1. Yes 2. No | |
| Q316 | If yes, 315 who gave the education? | _____ | |
| **PART IV: ENVIRONMENTAL RISK FACTORS AT DEPARTURE SITE** | | | |
| Q400 | Was there mosquito breeding site around your shelter when you were at departure site? | 1. Yes 2. No | |
| Q401 | If Yes, Q400 how far it was? | _____ m | |
| Q402 | Was there vegetation near to the shelter when you were at departure site (Observe) | 1. Yes 2. No | |
| Q403 | What was the physical environment of the working area when you were at departure site? | 1. Open land 2. Forest area<br>99. Other (specify)_____ | |
| Q404 | Was there deforestation when you were at departure site? | 1.Yes 2. No | |
| Q405 | How long have you stayed at departure site? | _____ month | |
| **PART V: PARASITOLOGICAL INFORMATION** | | | |
| Q500 | The RDT result | 1. Positive<br>2. Negative<br>3. Inconclusive | |
| Q501 | If answer to Q501 is Positive, specify the species of parasite | 1. P. Falciparum<br>2. P. Vivax<br>3. P. Malaria<br>4. P. Ovale<br>5. Mixed | |

Interviewer's observation:

_____

Name of the interviewer: _____Signature_____ Date:_____

Name of the supervisor: _____Signature_____ Date: _____
Thank You

## Questions for Focus Group Discussion (Qualitative Part)

1- Why do people cross borders between two countries?

2- When more people cross the border?

3- Why are they relocating to Sudan from Ethiopia?

4- Why are they relocating to Ethiopia from Sudan?

5- Do you get a lot of new visitors or do you get a lot of the same ones?

6- Describe the patterns of visiting or traveling through this location of interest on a daily, weekly, and seasonal

7- Why did they choose this particular crossing point/ Pakag PoE?

8- With the COVID-19 pandemic, how have mobility patterns changed?

## Focus Group Discussion Participants

1- Community Leadership
2- Migrants
3- Transporter /drivers
4- Community Members
5- Border Officials

Annex 5: ***Consent form for measles outbreak investigation in Raso District, Afder zone, Somali Region, Ethiopia, 2022***

**Measles outbreak Investigation checklist.**

| SN | Variables | | Remark |
|---|---|---|---|
| | **A. Socio-Demographic Data.** | | |
| 101 | Age | _____ | |
| 102 | Sex | 1-Male | |
| | | 2-Female | |
| 103 | Marital Status of care giver | 1.Single | |
| | | 2.Maried | |
| | | 3.Divorced | |
| | | 4.Widowed | |
| 104 | Educational Status of care giver | 1-No Formal Education | |
| | | 2-Primary education | |
| | | 3-Secondary Education and above | |
| 105 | Occupation of care giver | 1- Daily Labourer | |
| | | 2-Patoralist | |
| | | 3-Marchant | |
| | | 4-Government employee | |
| | | 5-Other | |
| | **Clinical History of Diseases** | | |
| 201 | What was the symptom? | 1. Fever 2.Rash 3.cough,<br>4.coryza (runny nose),<br>5. conjunctivitis (red eyes)<br>7. Ear discharge 8. pneumonia<br>10. Vomiting 11. Other(<br>specify_____ | |
| 202 | Date of rash on set | _____/_____/_____ | |
| 203 | Duration of rash_____ | _____/_____/_____ | |
| 204 | Date of onset of fever | _____/_____/_____ | |
| 205 | Do you have complications? _____<br>ONLY if complication | 1.Pneumonia<br>2.Corneal ulcer<br>3.Blindness<br>4.Convulsion | |

| | | | |
|---|---|---|---|
| | | 5.Otitis media<br>6.Diarrhea<br>7.none | |
| 206 | Date seen at health facility | _____/_____/_____ | |
| 207 | Illness duration before visiting the health facility | _____ in days/hours | |
| 208 | Did you (he/she) take treatment? | 1.Yes 2.No | |
| 209 | Location when rash started? | District_____Kebele_____ | |
| 210 | Did you recovered after the treatment? | 1. Cure 2. partially<br>3. deteriorated/disabled 4.death | |
| | **B. Risk Factors** | | |
| 301 | Family size | 1-<5 Person/HH | |
| | | 2.>5 Person/ HH | |
| 302 | Vaccination status | 1.Yes | |
| | | 2.No | |
| | | 3.Unknown | |
| 303 | Travel history to the area with active measles | 1-Yes | |
| | | 2.No | |
| 304 | Contact With measles case patients | 1.Yes | |
| | | 2.No | |
| 305 | Measles case presence at home | 1.Yes | |
| | | 2.No | |
| 306 | Knows mode of measles case transmission | 1.yes | |
| | | 2.No | |
| 307 | Knowledge of measles is vaccine Preventable | 1.Yes | |
| | | 2.No | |
| 308 | Malnutrition status | 1.Normal | |
| | | 2.Modarate | |
| | | 3.Severe | |
| 309 | Time taken to reach health facility by foot | < 30 minutes | |
| | | 30-60minutes | |
| | | >60 minutes | |

I am Ebsa File, currently Field Epidemiology resident working in Ethiopian public health Institute. I am interesting to do study on measles disease outbreak investigation and response, which is very common disease affect mostly under five children in this country and occurs as outbreak repeatedly. Additionally, my objective of this study is to describe the magnitude of the disease and identify risk factors contracting of measles and gives response for measles disease happen as outbreak in the woreda. I am going to give you information and invite you to be part of this study. You will participate in the study voluntarily. Before you decide to participate, you can ask to anyone you feel comfortable and some words that you do not understand. Please ask me to stop as I go through the information and I will take time to explain. If you have questions later, you can ask them of me.