ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES,

SCHOOL OF PUBLIC HEALTH

Ethiopian Field Epidemiology and Laboratory Training Program (EFELTP)

Compiled Body of Works in Field Epidemiology

By:
Alemayehu Abebe Kifle

Submitted to the School of Graduate Studies of Addis Ababa University in partial fulfillment for the degree of Master of Public Health in Field Epidemiology

June 2023

Addis Ababa, Ethiopia

Addis Ababa University, College of Health Sciences, School of Public Health

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Advisors:

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Approval by Examining Board

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List of Abbreviations and Acronyms

AAU: Addis Ababa University

ACT: Artimisinin-based Combination Therapy

AIDS: Acquired Immunodeficiency syndrome

ANC: Antenatal care

AOR: Adjusted Odd Ratio

APHI: Amhara Public Health Institute

AR: Attack Rate

ART: Anti-Retroviral Therapy

ARTI: Acute respiratory tract infection

AU: African Union

AURTI: Acute Upper Respiratory Tract Infection

BCG: Bacillus Calmette-Guerin

CBN: Community Based Nutrition

CBR: Crude Birth Rate

CDC: Centers for Disease Control and Prevention

CDR: Crude Death Rate

CFR: Case Fatality Rate

CHS: College of Health Science

CHW: Community Health Workers

CI: Confidence Interval

COR: Crude Odd Ratio

CSD: Climate Sensitive Disease

CSI: Climate Sensitive Infections

DHS: Demographic Health Survey

DPT: Diphtheria Pertussis and Tetanus

DRM: Disaster Risk Management

E.C: Ethiopian Calendar

EFELTP: Ethiopian Field Epidemiology and Laboratory Training Program

EFY: Ethiopian Fiscal Year

EPHI: Ethiopian Public Health Institute

EPI: Expanded Program on Immunization

EPRP: Emergency Preparedness and Response Plan

FDRE: Federal Democratic Republic of Ethiopia

FGD: Focus Group Discussion

FMOH: Federal Ministry of Health

GBV: Gender based Violence

HC: Health Center

HEP: Health Extension Program

HEW: Health Extension Workers

HH: Household

HIV: Human Immunodeficiency Virus

HP: Health Post

HSDP: Health Sector Development Program

ICP: International Medical Corps

IDMC: Internal Displacement Monitoring Centre

IDP: Internally Displaced Persons

IDSR: Integrated Disease Surveillance and Response

IMR: Infant Mortality Rate

IOM: International Organization for Migration

IRS: Indoor Residual Spraying

ITN: Insecticide Treated Net

ITNs: Insecticide Treated Nets

KII: Key Informant Interview

LLIN: Long Lasting Insecticidal Nets

MAM: Moderate Acute Malnutrition

MCH: Maternal and Child Health

MCV: Measles Containing Vaccine

MDG: Millennium Development Goal

NGO: Non-Governmental Organization

NGZ: North Gondar Zone

NNMR: Neonatal Mortality Rate

NS: Nasopharyngeal swab

OCHA: Office for the Coordination of Humanitarian Affair

OPD: Outpatient Department

OPV: Oral Polio Vaccine

OTP: Outpatient Therapeutic Program

PCR: Polymerase chain reaction

PHEM: Public Health Emergency Management

PHEOC: Public Health Emergency Operation Center

PITC: Provider Initiated Testing and Counseling

PMTCT: Prevention of Mother to Child Transmission

PNC: Post Natal Care

PPV: Positive Predictive Value

PTSD: Post Traumatic Syndrome Disorder

RDT: Rapid Diagnostic Test

RHB: Regional Health Bureau

RRT: Rapid Response Team

SA: Site Assessment

SAM: Sever Acute Malnutrition

SARS: Severe Acute Respiratory syndrome

SDG: Sustainable Development Goal

SM&E: Surveillance Monitoring and Evaluation

SNNPR: South Nation Nationalities People Region

SPH: School of Public Health

SPR: Slide Positivity Rate

SPSS: Statistical Package for social Science

SSA: Sub Saharan Africa

TB: Tuberculosis

TBA: Traditional Birth Attendant

TFP: Therapeutic Feeding Program

TSF: Therapeutic Supplementary Feeding

UN: United Nations

UNHCR: United Nations High Commissioner for Refugees

UNICEF: United Nations Children's Fund

VARM: Vulnerability Assessment and Risk Mapping

VCT: Voluntary Counseling and Testing

WASH: Water, Sanitation, and Hygiene

WB: World Bank

WHO/AFRO: WHO African Regional Office

WHO: World Health Organization

WoHO: Woreda Health Office

WFP: World Food Programme

Executive summary

The Ethiopia Field Epidemiology Training Program (EFETP) is a two year an in-service training program in field epidemiology adapted from the United States Centers for Disease Control and Prevention (CDC) Epidemic Intelligence Service (EIS) program. The program is designed to assist the Ministry of Health in building or strengthening health systems by recruiting promising health workers and building their competencies through on-the-job mentorship and training. The EFETP program has two main components, each of which contributes to the award of the Master‘s degree (MPH) in Field Epidemiology. A classroom-teaching component (25%) and practical attachment or field placement component (75%) consisting of disease investigations, surveillance evaluations, surveys, and applied research on national health problems.

This compiled body of works has nine main chapters which all of them were done during the residency time of the program. These chapters are include outbreak investigation, surveillance data analysis report, surveillance system evaluation, description of a health profile report, Manuscript for peer reviewed journal, abstract for submission in scientific conferences, writing protocol/proposal of epidemiologic research project, a summary of disaster situation report and other additional outputs.

Chapter One: - Three outbreak investigations were conducted. Two of them were case control and the third descriptive study. The first outbreak was conducted in Beyeda Woreda, North Gondar Zone of Amhara Region. In this case control study, 60 pertussis cases and two deaths with case fatality rate of (CFR) 3.3% were identified. It was laboratory confirmed outbreak. Vaccination status, awareness on mode of transmission of pertussis and housing condition were found statistically significant factors. We recommended strengthening routine immunization service and raising the Community awareness on mode of transmission and prevention of pertussis. The second outbreak investigation was also a case control study done in Lare Woreda, Nuer Zone, Gambella Region. In this investigation, 1,522 malaria cases and six deaths were found. Availability of mosquito breeding site near residential area was found a significant factor for contracting malaria and use of ITN and indoor residual spray as protective factors. We recommended mobilizing and participation of the community towards prevention and control activities. The third investigation was descriptive study conducted on cholera outbreak investigation in Moyale Woreda, Oromia Region. In this descriptive study, 740 cholera cases and three deaths (CFR 0.4%) occurred. The case fatality rate was high in males (0.6%). Poor hygiene and sanitation, overcrowding, high population movement, lack of clean water and poor waste disposal system were found possible factors of the outbreak. We recommend on provision of safe water supply, Community hygiene and sanitation awareness creation.

Chapter Two: - Conducting Surveillance data analysis is the other core competency for field epidemiology training program. We retrospectively analyzed a five year SNNPR malaria surveillance data collected from 2016 to 2020 to describe epidemiology of malaria in the Region.

Chapter Three: - Malaria disease surveillance system evaluation was conducted in Bahirdar Zuriya Woreda, West Gojjam Zone, Amhara Regiona from October 26 to December 4, 2021. Descriptive cross sectional study design was used. The chapter clearly presents the purpose and objectives of malaria disease surveillance and its progress towards its objectives. The surveillance attributes: simplicity, flexibility, acceptability, representativeness, timeliness, data quality, sensitivity, cost, predictive value positive and usefulness of the surveillance system were also assessed and presented in the chapter.

Chapter Four: - A community health profile is a comprehensive compilation of information about a community. The data in a profile reflects the health of a given community from many different angles. It is a process of collecting, analyzing and interpreting information from multiple and diverse sources in order to develop a deep understanding of the health of a community. Health and health related data were collected in Wera Dijo Woreda of Alaba Zone in June, 2021. Acute Upper Respiratory Infection, functional intestinal disorder and pneumonia were found the top leading causes of under-five children morbidity.

Chapter Five: - In this chapter submission of manuscripts for peer reviewed journal were included. The manuscripts were conducted on Malaria outbreak investigation in Lare Woreda, Nuer Zone, Gambella Region and malaria surveillance data analysis in SNNPR.

Chapter Six: - This chapter contains abstracts on "Pertussis Outbreak Investigation in Beyeda Woreda of Amahara Region, Ethiopia March 2022 and "descriptive epidemiology of a cholera outbreak in Moyale Woreda, Oromia Region, 2023.

Chapter Seven: - In this chapter Summary of disaster situation is presented. The situational report was carried out on war and recovery of displaced population in North Gonder Zones, Amhara Region, 2022. It was found that more than 110 health facilities were looted and destroyed.

Chapter Eight: - Contain an epidemiological protocol/proposal entitled “Insecticide Treated Bed Net Utilization and Associated Factors among Households of Lare Woreda, Nuer Zone, Gambella Region, 2023

Chapter Nine: - Contains other additional outputs. In this chapter weekly epidemiologic bulletin, Climate Sensitive Disease Surveillance System supportive supervision report, data entry report and trainings are presented.

CHAPTER- I

Outbreak Investigations

1.1 Pertussis Outbreak in Beyeda Woreda, Amhara Region, March, 2022

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Abstract

Introduction: Pertussis, more commonly known as whooping cough, is a contagious, respiratory disease caused by the bacterium *Bordetella pertussis* or *Bordetella parapertussis*. The illness is typically characterized by prolonged paroxysmal cough that is often accompanied by inspiratory whoop. Pertussis or whooping cough is highly contagious respiratory illness and about 160,000 deaths occur per year. Disease presentation can vary with age and history of previous exposure or vaccination. Pertussis rarely causes severe complications among healthy, vaccinated persons. Infants, however, are at greatest risk for pertussis-related complications and mortality.

Objective: To describe burden of pertussis outbreak, identify risk factors associated with the outbreak and to take appropriate public health control measures in Beyeda woreda, North Gondar Zone of Amhara Region, Ethiopia.

Methodology: Unmatched case-control study was conducted from March 6-25, 2022 in Beyeda Woreda. The outbreak was confirmed using real-time polymerase chain reaction (PCR). On case-control study, a total of 174 data were collected using structured questionnaire. We used the WHO adopted national standard case definition to identify cases. All 60 cases were line listed. Bivariate and multivariate analyses were conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS.

Results: We identified 60 pertussis cases and two deaths with case fatality rate of (CFR) 3.3%. The mean age of cases was 11.4 years (range from 6 month to 60 years). 83% (50/60) cases did not receive pertussis containing vaccine. 46 (79%) cases had history of contact. The attack rate (AR) was higher in males 75/100000. Vaccination status (AOR: 0.91; 95% CI: 0.23-0.355; P: 0.001), awareness on mode of transmission of pertussis (AOR: 0.44; 95% CI: 0.009-0.212; P: 0.000) and housing condition (AOR: 0.21; 95% CI: 0.005-0.88; P: 0.000) were statistically significant factors.

Conclusion and recommendations: Laboratory-confirmed pertussis outbreak occurred in the Beyeda District of Amhara Region, Ethiopia, in March 2022. Low immunization coverage, lack of awareness on mode of transmission of pertussis and housing condition contributed for the occurrence of the outbreak. In addition to these, the destruction of health facilities by northern Ethiopian conflict created delays in the response activities. We recommended strengthening routine immunization service and raising the Community awareness on mode of transmission and prevention of pertussis. Health professionals informed for early detection and treatment of pertussis cases

Keyword: B. Pertussis, Outbreak, Case Control, Beyeda Woreda,

Introduction

Whooping cough (pertussis) is a highly contagious bacterial infection caused by a Gram-negative bacterium, *Bordetella pertussis* that is transmitted by aerosol droplets (1). *Bordetella pertussis* infection has a wide-spectrum of clinical expressionS. Paroxysmal cough, facial discoloration during coughing episodes, and posttussive vomiting are primary symptoms (2). It is an acute infectious and highly contagious disease that affects people of all ages (3).

Pertussis typically has three stages of symptoms. The first stage of the disease is the catarrhal stage; which is associated with sneezing, conjunctival suffusion, rhinorrhea or nasal congestion, low-grade fever (minimal), and mild, occasional cough, the second stage is the paroxysmal stage; characterized by bursts of rapid coughs followed by a long inspiratory whoop and patients often become cyanotic during those episodes; Whoop, a forceful inspiration of air through a narrow glottis, usually develops after a paroxysmal cough, and is a characteristic of pertussis disease (2,4).

B pertussis is small, aerobic, gram-negative *coccobacillus* that is transmitted via aerosolized respiratory droplets (5). No animal or environmental reservoirs have been identified, and transmission requires close contact or prolonged exposure to an infected human host.

Clinical case definition of pertussis is a cough lasting for 2 weeks with one classic symptom, such as paroxysmal cough, posttussive emesis, or inspiratory whoop, without any other apparent causes (6). Classic symptoms are seen more often in unimmunized children, whereas previously immunized adults and adolescents commonly have atypical presentations.

Bordetella pertussis causes whooping cough, which kills 300,000 persons annually, and is reemerging despite vaccination (7). This human-restricted species is closely related to the respiratory pathogens, *B. Para pertussis*, which is also human restricted and *B. bronchiseptica*, which infects a broad range of mammals.

Pertussis (whooping cough) is an important cause of death in infants worldwide, and continues to be a public- health concern even in countries with high vaccination coverage (8). This very contagious disease is spread from person to person, most commonly by inhalation of droplets from cough or sneeze (9).

Although pertussis is a mandatory notifiable disease in most countries, there is significant under-reporting, especially in adolescents and adults (10). Studies actively seeking cases found that passive surveillance statistics underestimate the true incidence by 10- to 1000-fold, depending on the quality of the surveillance system.

Despite the availability of pertussis vaccines for routine immunization for >6 decades, pertussis remains endemic worldwide. Globally, there were 24.1 million pertussis cases and 160,700 deaths from pertussis in children younger than 5 years in 2014, with the African Region contributing the largest proportions (7.8 million [33%] cases and 92,500 [58%] deaths). 5.1 million (21%) estimated pertussis cases and 85,900 (53%) estimated deaths were in infants younger than 1 year (11).

In developing countries, immunization coverage with primary series of three doses of DPT vaccine in infants exceeds 80%, but there are considerable differences in coverage rates between regions and between and within countries. Failures to reach and maintain high immunization coverage in developing countries are caused by multiple factors, including weak management of immunization services, missing opportunities to immunize eligible children and ineffective information and motivation of mothers to return to complete the immunization series (12).

Few publications were identified from Africa and most did not contain data from surveillance systems. Obstacles to measuring pertussis in Africa, include lack of adequate diagnostic laboratories and surveillance systems along with the political and societal situations present in many countries (13).

Despite the increasing awareness of *B. pertussis*, it continues to affect millions of people worldwide. While classical pertussis was once regarded as a “child’s disease”, today, pertussis poses a serious threat to infants, and greatly affects adolescents adults, now functioning as reservoirs of infection (14). While advances in molecular biology have undoubtedly increased the capacity to diagnose pertussis, work is still needed to standardize laboratory techniques. Pertussis outbreaks can be difficult to identify and manage. Other respiratory pathogens often cause clinical symptoms similar to pertussis, and co-circulation with other pathogens does occur (15). To respond appropriately (e.g., provide appropriate chemoprophylaxis), it is important to confirm that *B. pertussis* is circulating in the outbreak setting and to determine whether other pathogens are contributing to the outbreak.

Susceptibility to pertussis in adolescents and adults results not only in direct morbidity in these age groups, but also poses a transmission risk to susceptible non-immune infants who are often too young to be vaccinated (16).

Infants too young to be fully protected by vaccination (those less than 4 months of age) are at greatest risk of a fatal outcome. Thus, early recognition and treatment of pertussis in adults and adolescents may be helpful in limiting transmission to very young children(17).

Deferent studies show that, pertussis vaccine provides protection against clinical whooping cough after exposure in the majority of immunized people (18). However, the efficacy estimates of different wP products vary substantially. The standard dose of pertussis vaccine is 0.5 ml; this is administered intramuscularly in the anterolateral thigh of children aged <12 months and in the deltoid muscle in older age groups (19).

The SARS-CoV-2 pandemic has scarcely left any corner of the world untouched, with millions of lives lost as a direct result of the virus. Equally important are the indirect effects of the pandemic. Disruptions of routine health services are likely to increase morbidity and mortality, leaving women and children particularly vulnerable (20). A decline in the number of administered doses of diphtheria–pertussis–tetanus-containing vaccine (DPT3) and first dose of measles-containing vaccine (MCV1) in the first half of 2020 was noted. The lowest number of vaccine doses administered was observed in April, 2020, when 33% fewer DPT3 doses were administered globally, ranging from 9% in the WHO African region to 57% in the South-East Asia Region.

Outbreaks are common in settings of population displacement, but documentation and evidence for action are rare, likely due to difficulties with laboratory confirmation of suspected pertussis cases (21). Risk factors for transmission in those settings include crowding, malnutrition, and co-infection with other illnesses (HIV, malaria, tuberculosis, etc.).

Following the Northern Ethiopian crisis, the local health system was compromised and many of health facilities were destroyed and became out of service. Hence, the routine health service including the immunization service was interrupted thereby posing risk for communicable disease and epidemics.

Objectives

General objective

To describe burden of pertussis outbreak, identify risk factors associated with the outbreak and to take appropriate public health control measures in Beyeda woreda, North Gondar Zone of Amhara Region, Ethiopia, March 2022.

Specific Objectives

- To verify the existence of pertussis outbreak
- To describe the burden of pertussis outbreak
- To identify risk factors associated with pertussis outbreak
- To take appropriate public health control measures

Materials and methods

Study area

The investigation was conducted in Beyeda Woreda of Amhara Regional State. Beyeda is 863 km far from Addis Ababa and 295 Km from Bahirdar Capital Town of the Region. The Woreda has 22 rural kebeles. The major town in Beyeda is Dil Yibza. According to the 2007 population census, the projected estimated population of the Woreda in 2022 was 97,559 which constitute 48,246 (49.5%) males and 49,313 (50.5%) females. Beyeda is bordered in the East by Tekeze River which separates it from Tigray, Tselemt at North, Wag Hemra Zone at South and Janamora Woreda to West.

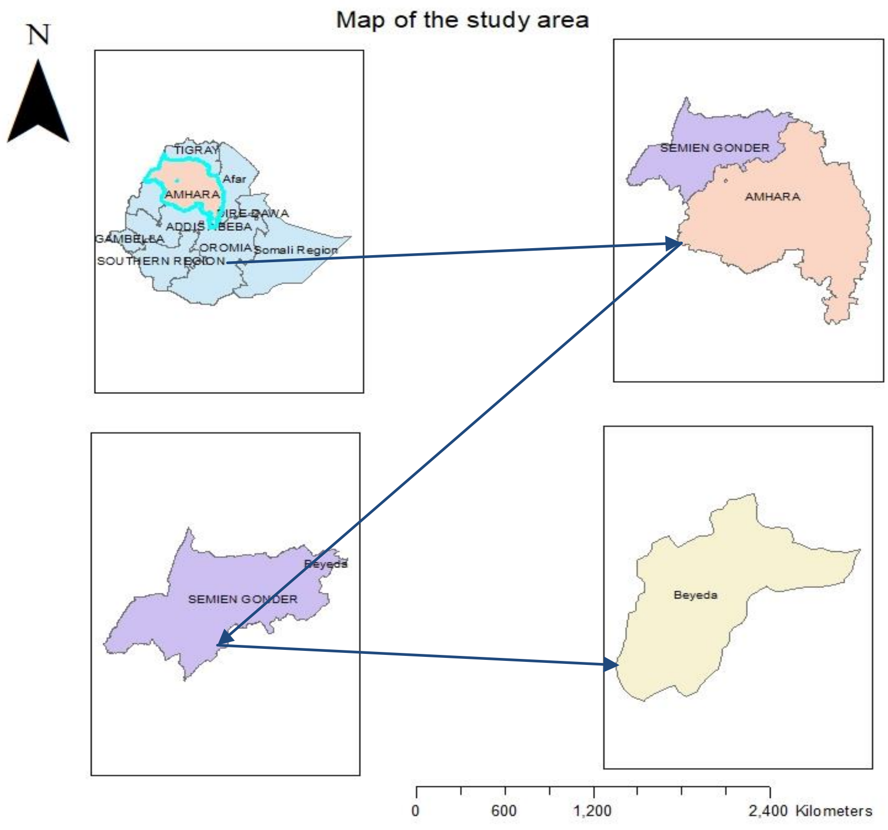

Figure 1 Map of Beyeda Woreda, North Gondar, Amhara Region, 2022

Study period

This study was conducted from March 6-25, 2022.

Study design

We conducted descriptive analysis of the collected line list of cases followed by an unmatched community based case-control study with 1:2 ratio.

Source /Target population

Population living in Segenet kebele, Beyeda Woreda was the source population.

Study population

Population that was sampled from source population was the study population.

Sample size and Sampling Method

Using Epi-info version 7.2.4.0 Statcalc for unmatched case control study;

Sampling Method

We included 58 reported cases from the line list and 116 controls randomly selected from neighboring village.

Data Collection Tools and Procedures

We reviewed the outpatient medical logbooks and medical record of cases at Liware Health Center. We discussed with key informants, Woreda Health Officials and families or care givers of cases. We also Interviewed Cases and Controls using a semi structured questionnaire (annexed), cases and controls, were interviewed by two data collectors.

Data analysis

The collected data were entered in to Epi-info version 7.2.4.0 and exported to SPSS version 20 for further analysis.

Case Definition

Suspected case of pertussis: - Non-improving cough of 14 days or more or cough of any duration with paroxysms or cough of any duration with whoop.

Confirmed:- A case of acute cough illness of any duration with a positive culture for *B. pertussis*, or a case that meets the clinical case definition and confirmed by PCR, or a case that meets the clinical case definition and is epidemiologically linked directly to a lab-confirmed case. Epidemic of pertussis is a situation when two or more cases clustered in time.

Cases: - Are individuals, who fulfill the above criteria for case definition and all reported cases, were recorded in the line list.

Controls: - Are individuals, who did not fulfill the above criteria and selected from neighboring village where cases were identified.

Ethical clearance

Ethical clearance to conduct the investigation was obtained from the Ethiopian Public Health Institute (EPHI). A letter of request was written from NGZ Health Department to Beyeda Woreda Health Office and provided for the selected health departments and health offices for their participation in the study.

Data dissemination

The findings of the study were communicated to all concerned bodies, such as EPHI, Woreda Health Offices, mentors, supervisors, coordinators and to the Addis Ababa University, School of Public Health.

Results

Descriptive Analysis

By person

During the month of March 2022, a total of 60 Pertussis cases and two deaths (CFR 3.3%) were found from Liware villages (Beretu, 26 and Wegersge 34) Beyeda District. Ten nasopharyngeal swab (NS) samples were collected in order to determine the etiologic agent and confirm the outbreak. Following PCR testing at the National Reference Laboratory at the Ethiopian Public Health Institute (EPHI), six of the ten samples tested positive for *Bordetella* pertussis. The mean age of cases was 11.4 years (range from 6 months to 60 years) Table 1**.** Thirty six (60%) of cases were males. There were 27 (45%) cases in the age group 1-4 years (AR=28.8/10000), followed by ≥15 years of age 12 (20%) (AR=2.1/10000). The outbreak's overall attack rate (AR) was 0.06% (60 cases per 100,000 people). Males had a higher attack rate (7.5/10000). The highest case fatality rate was found in the age group of 1-4 (7.4%).

Table 1: Distribution, Attack Rate and Case Fatality Rate of Pertussis Cases by Sex and Age Group, Beyeda Woreda North Gondar Zone, Amhara Region, Ethiopia, 2022

Variables	Total population	Number of Cases (N=60)	(AR/10000)	Number of death	CFR (%)
Sex					
Male	48,246 (49.5%)	36 (60%)	7.5	2	5.5
Female	49,313 (50.5%)	24 (40%)	4.9	0	0.0
Age group					
<1	3,034 (3.1%)	1 (1.7%)	3.3	0	
1-4	9,366 (9.6%)	27 (45%)	28.8	2	7.4
5-9	14,171 (14.5%)	9 (15%)	6.4	0	0
10-14	13,207 (13.5%)	11 (18.3%)	8.3	0	0
≥15	57,781 (59.2%)	12 (20%)	2.1	0	0

Clinical presentations

Paroxysmal cough was the most frequent clinical presentation in our analysis, by being a complaint in 59 (98.3%) cases, **Figure 2** followed by inspiratory whoop which was reported in 43 (71.7%) cases. Post-tussive vomiting was reported in 32 (53.3%) while 21 (35%) cases had Apnea. 1 (1.7%) of the cases had cyanosis.

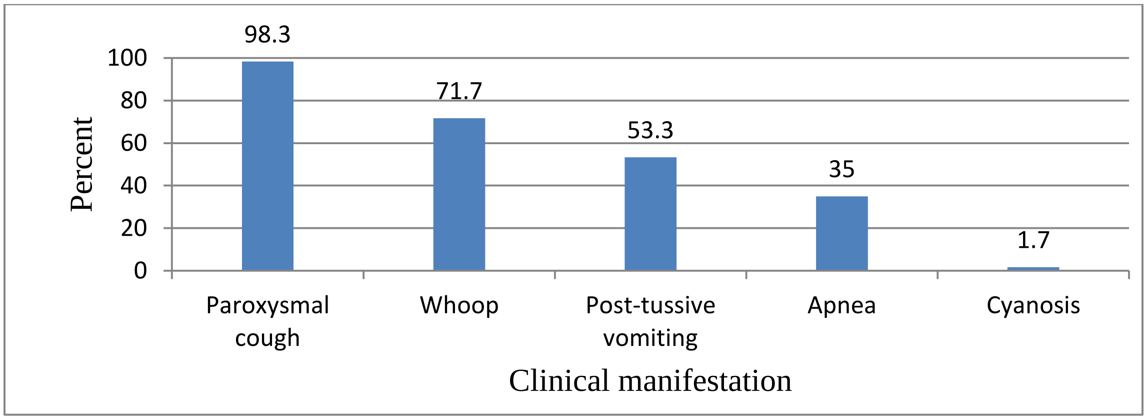

Figure 2: Common Clinical manifestations of pertussis cases, Beyeda Woreda, North Gondar Zone, Amhara Region, Ethiopia, 2022

The most frequently reported complications were pneumonia and weight-loss in twenty-three (38.3%) and twelve (20%) of cases. see**.** Nearly 9 (15%) of the overall patients exhibited conjunctival hemorrhage Table 2.

Table 2: Complication of Pertussis cases in Beyeda Woreda , North Gondar Zone Amhara Region, Ethiopia, 2022**.**

Complication	Frequency of Case	Percentage
Pneumonia	23	38.3%
Weight loss	12	20%
Subconjuctival haemorrhage	9	15%
Oedema	5	8.3%
Hernia	1	1.7%
Seizure	1	1.7%

Regarding case management, Fifty-eight (96.7%) of the cases had received treatment (**Figure 3**). The antibiotics prescribed for the cases were Erythromycin and Azithromycin. The treatment was given as door to door approach by assigning health professionals to implement mass treatment. The majority of cases have improved after treatment. Due to the epidemic complication, just one person was hospitalized.

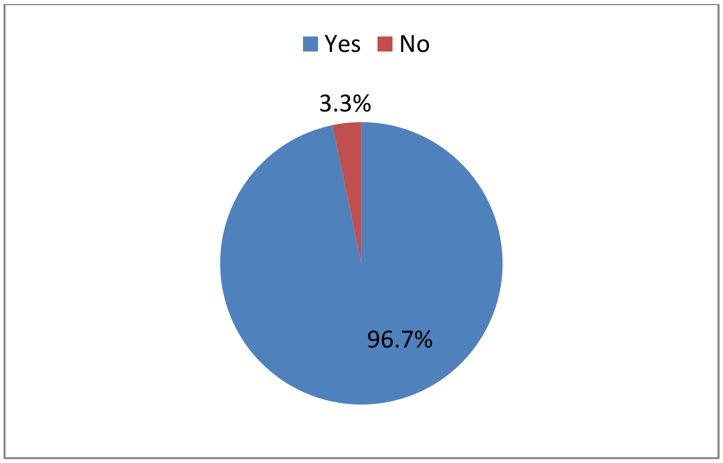

Figure 3: Proportion of pertussis cases who received treatment, Beyeda Woreda North Gondar Zone, Amhara Region, Ethiopia, 2022

By place

Sixty cases of pertussis reported from Liware Kebele of Beyeda Woreda in North Gondar Zone, Amhara Region. These cases were reported from two villages (Beretu and Wegeresge). Majority of cases were registered in Wegeresge village 34 (56.7%) with case fatality rate of (CFR) 2.7%. Of those cases, 19 (56%) of them were females. Beretu village constitutes 26 (43.3%) of total cases with one death (CFR 3.8%) (**Figure 4)**. It was possible to estimate the attack rate of the case by sex, age, and village if the population sizes for the two affected villages had been recorded. However, we were able to determine that Beretu village was more affected by the outbreak than Wegeresge during the outbreak investigation and response.

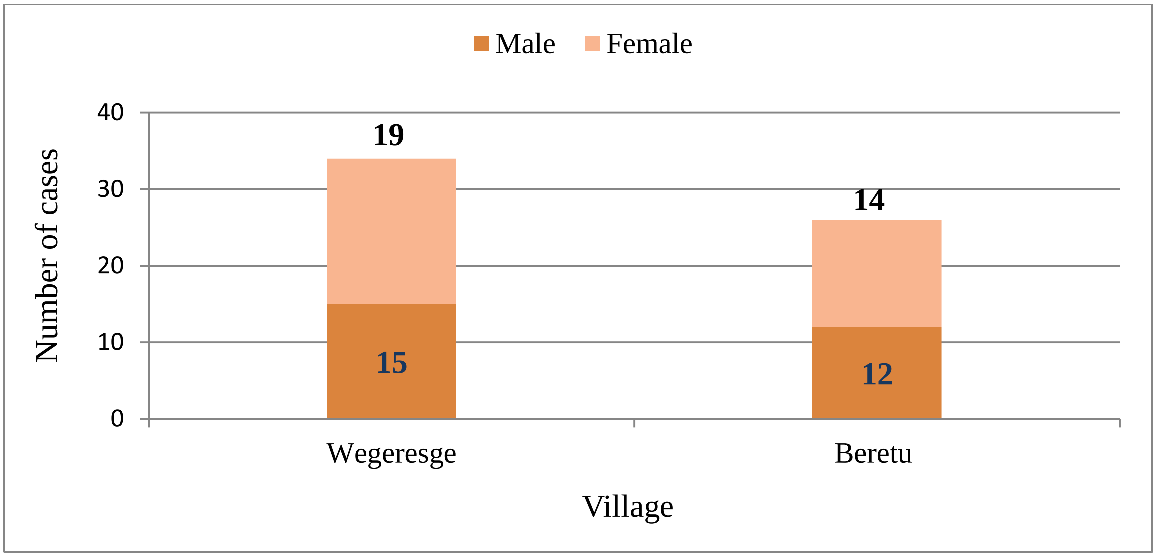

Figure 4 Distribution of pertussis cases by sex and village, Beyeda Woreda North Gondar Zone, Amhara Region, Ethiopia, 2022

By Time

Onset of symptoms occurred between January 30, and March 7, 2022. It begun with a single case and raised up gradually by the number of cases and 36 days duration of pertussis outbreak occurred in the Liware cluster of Beyeda Woreda. The first case was seen on 30th January/2022 and the last case on 7th March/2022 (**Figure 5**). Between March 11 and March 28, 2022, the majority of cases were reported. The Woreda Health Office notified occurrence of pertussis outbreak to the Zone Health Department two weeks after the occurrence of the outbreak. On March 17, 2022, the Zone Health Department informed the APHI PHEM directorate of the pertussis outbreak via a weekly report. Due to late notification, the investigation and response was started lately on March 25, 2022 by the Woreda Health Office and Zonal PHEM. The investigation and response were launched on March 25, 2022 by the Woreda Health Office and Zonal PHEM due to the late notification. There may have been delays in reporting, intervention, and response to the outbreak due to poor communication, limited road access, and the Northern Ethiopian humanitarian crisis that was occurring in the area at the time of the outbreak.
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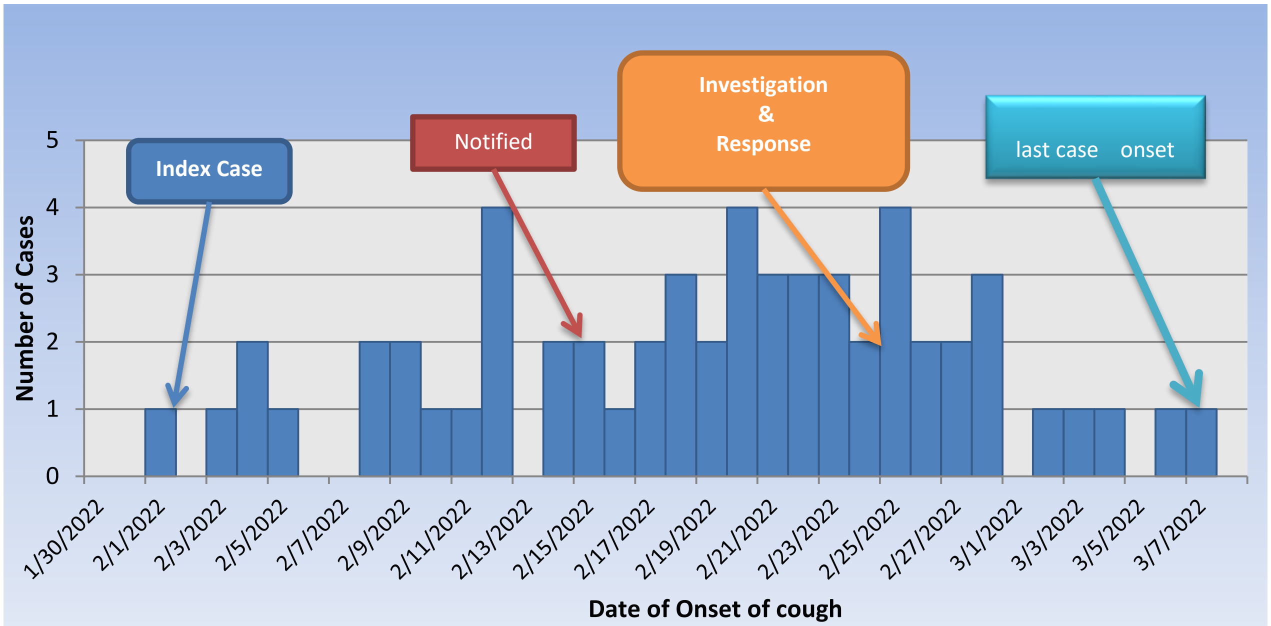

Figure 5 Epidemiologic curve of pertussis outbreak, Beyeda Woreda North Gondar Zone, Amhara Region, Ethiopia, 2022

Vaccination coverage

The health posts in the villages of Beretu and Wegersge lacked a refrigerator for the preservation of vaccines. These villages were located in a difficult-to-reach part of the district. The health extension worker walks for roughly eight hours to carry the vaccine from the cluster health center (Liware Health Center) to the Beretu health post. The vaccination was kept outside of a refrigerator for roughly a day after delivery at the health post; as a result, the vaccine loses its effectiveness. On our discussion with the local community, we found that the immunization service was not regular and interrupted, and that there was a gap on health service delivery at the health post. The health post report did not show the vaccination coverage of villages, while the District Health Office's vaccination coverage was reported as greater than 100% **(Figure 6)**.

Out of 60 cases, 10 (16.7%) had received the pertussis vaccine, and out of 116 controls, 60 (51.7%). According to the respondent's speech, it was too far to travel to the health center to vaccinate their kids. One of the possible causes of the community's low vaccination rate is the lack of cold chain management at the level of the health post. Even though there were three health professionals assigned to the health post, they weren't consistently there. Many of the health facilities, including hospitals, health centers, and health posts found in the Zone, were looted and destroyed as a result of the northern Ethiopian crisis, which also poses challenges for the response effort.

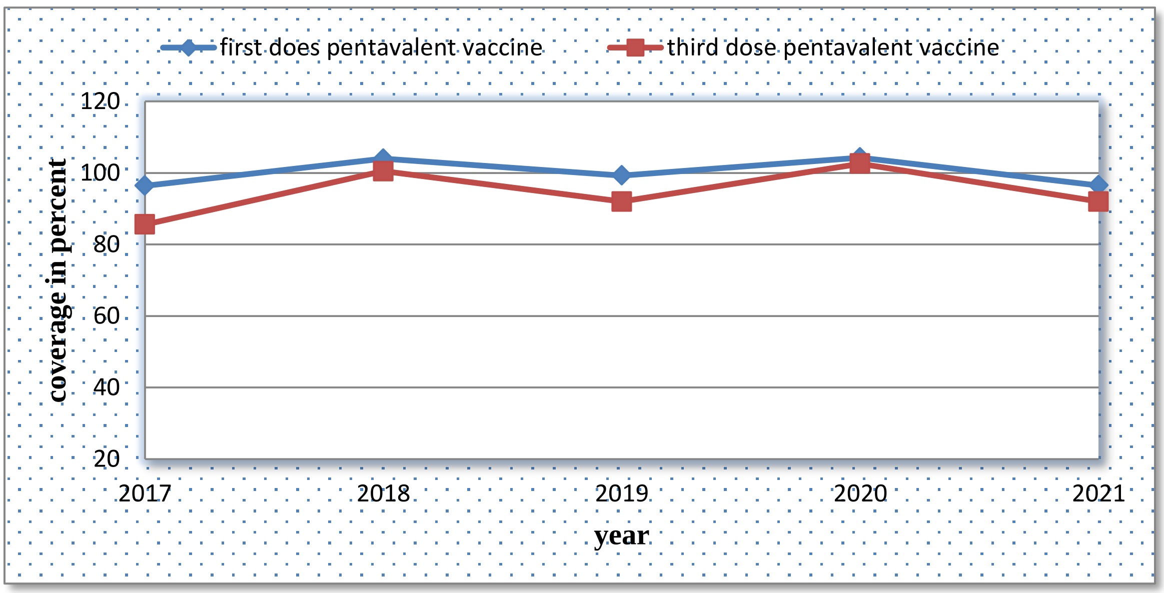

Figure 6 pentavalent vaccine coverage 2017-2021, Beyeda Woreda North Gondar Zone, Amhara Region, Ethiopia, 2022

Cold chain management

Beyeda Woreda has four health centers and 22 health posts. Out of 22 health posts 17 of them had functional cold chain and the remaining five health posts had no functional refrigerator due to different reasons like shortage of fuel cost, shortage of spare part for the fridge and lack of technical skill. All health centers had functional refrigerator.

Risk factor analysis

A total of 58 cases and 116 controls were selected for the case control study in this investigation, with a ratio of one case to two controls. Of the 58 interviewed patients, 35 (60%) were men, and of the 116 controls overall, 62 (53.4%) were men. In terms of education, 69% of mothers or caregivers of cases were litrate, compared to 77.6% of those of controls. Regarding housing condition, 42 (72.4%) of cases lacked a window in their residence Table 3. The controls' age ranged from 1 to 42 years, with a mean age of 9.8 years, while the cases' age ranged from 6 months to 60 years, with a mean age of 11.3 years. In terms of education, 69% of mothers or caregivers of cases were illiterate, compared to 77.6% of those of controls. The average formal education of mothers or caregivers of patients was 18 (32%) and that of controls was 26 (22.4%). Regarding a housing condition, 42 (72.4) of cases lacked a window in their residence.

Table 3 Socio-demographic characteristics of cases and controls, Beyeda Woreda, North Gondar Zone Amhara Region, Ethiopia, 2022.

Variable		Case	Control
		N (%)	N (%)
Sex	Male	35 (60.3%)	62(53.4%)
	Female	23(39.7%)	54(46.6%)
Age group	<1	1(1.7%)	5(4.3%)
	1-4	27(46.6%)	39(33.6%)
	5-9	9(15.5%)	30(25.9%)
	10-14	11(19%)	22(19%)
	≥15	10(17.2%)	20(17.2%)
Educational level of mother/care givers	Unable to read and write	40 (68.9%)	90(77.6%)
	Primary	4(7%)	7(6%)
	Secondary	13(22.4%)	14(12.1%)
	Tertiary	1(1.7%)	5(4.3%)
Housing condition	Ventilated	16(27.6%)	107(92.2%)
	Not ventilated	42(72.4%)	9(7.8%)
Family size	Less than or equal to four	10(17.2%)	86(74.1%)
	Greater than five	48(82.8)	30(25.9%)
Vaccination status	Yes	10(17.2%)	60(51.7%)

	No	46(79.3%)	46(39.7%)
	Unknown	2(3.44%	10(8.6%)
Know method of transmission of pertussis	Yes	6(10.3%)	68(58.6%)
	No	54(89.7%)	48(41.4%)
History of contact with person with cough	Yes	46(79.3%)	39(33.6%)
	No	12(20.7%)	77(66.4%)
Any person in the family with similar symptoms	Yes	40(69%)	33(28.4%)
	No	18(31%)	83(71.6%)

To test the association between potential risk factors, bivariate logistic regression model was employed. Housing condition (COR: 0.032; 95% CI: 0.013-0.078; P: 0.000), vaccination status (COR: 1.37; 95% CI: 0.63-0.298; P: 0.000), contact history contact history with coughing people (COR: 2.86; 95% CI: 1.46-5.62; P: 0.002), awareness on mode of transmission of pertussis (COR: 0.67; 95% CI: 0.25-0.179; P: 0.000) and the presence of a sick person with pertussis in the family (COR: 5.589; 95% CI: 2.811-11.11; P: 0.002) were statistically significant variables **Table 4**.

Table 4 Bivariate analysis for different factors to pertussis, Beyeda Woreda, North Gondar Zone Amhara Region, Ethiopia, 2022

Variable		Case	Control	COR (95% CI)	P-value
		N (%)	N (%)		
Sex	Male	35 (60.3%)	62(53.4%)	1.2(0.56-2.3)	0.518
	Female	23(39.7%)	54(46.6%)		
Age group	<1	1(1.7%)	5(4.3%)	3.20(0.35-29.07)	0.301
	1-4	27(46.6%)	39(33.6%)	1.5(0.15-14.55)	0.727
	5-9	9(15.5%)	30(25.9%)	2.5(0.259-24.09)	0.428
	10-14	11(19%)	22(19%)	3(0.312-28.84)	0.341
	≥15	10(17.2%)	20(17.2%)	--------------------	
Educational level of mother/care givers	Unable to read and write	40(68.9%)	90(77.6%)	0.94(2.32-3.823)	0.932
	Primary	4(7%)	7(6%)	2.0(0.88-4.723)	0.097
	Secondary	13(22.4%)	14(12.1%)	0.43(0.05-3.388)	0.459

	Tertiary	1(1.7%)	5(4.3%)	----------------------	
Housing condition	Ventilated	16(72.4%)	107(92.2%)	0.032(0.013-0.078)	**0.000**
	Not ventilated	42(27.6%)	9(7.8%)		
Family size	Less than or equal to four	10(17.2%)	86(74.1%)	1.2(0.626-2.30)	0.583
	Greater than five	48(82.8)	30(25.9%)		
Vaccination status	Yes	10(17.2%)	60(51.7%)	1.37(0.63-0.298)	**0.000**
	No	46(79.3%)	46(39.7%)		
	Unknown	2(3.44%	10(8.6%)		
Know method of transmission of pertussis	Yes	6(10.3%)	68(58.6%)	0.67(0.25-0.179)	**0.000**
	No	52(89.7%)	48(41.4%)		
History of contact with person with cough	Yes	46(79.3%)	39(33.6%)	2.86(1.46-5.62)	**0.002**
	No	12(20.7%)	77(66.4%)		
Any person in the family with similar symptoms	Yes	40(69%)	33(28.4%)	5.589(2.811-11.11)	**0.000**
	No	18(31%)	83(71.6%)		

We used multivariate analysis for factors that were significant on a bivariate analysis to determine whether the association was true or not. Vaccination status (AOR: 0.91; 95% CI: 0.23-0.355; P: 0.001), knowledge of pertussis prevention methods (AOR: 0.44; 95% CI: 0.009-0.212; P: 0.000), and housing situation (AOR: 0.21; 95% CI: 0.005-0.88; P: 0.000) were the variables that were significance in the multivariate analysis (

Table 5).

Table 5 Multivariate analysis for significant exposures on bivariate analysis to pertussis, Beyeda Woreda, North Gondar Zone Amhara Region, Ethiopia, 2022

Variable		Case	Control	COR (CI)	AOR (95% CI)	P-value
		N (%)	N (%)			
Vaccination status	Yes	10(17.2%)	60(51.7%)	1.37(0.63-0.298)	0.91(0.23-0.355)	**0.001**
	No	46(79.3%)	46(39.7%)			
	Unknown	2(3.44%	10(8.6%)			
Know method of transmission of pertussis	Yes	6(10.3%)	68(58.6%)	0.67(0.25-0.179)	0.44(0.009-0.212)	**0.000**
	No	52(89.7%)	48(41.4%)			
Housing condition	Ventilated	16(72.4%)	107(92.2%)	0.032(0.013-0.078)	0.21(0.005-0.88)	**0.000**
	Not ventilated	42(27.6%)	9(7.8%)			

Response intervention

On March 15, 2022 line lists of suspected pertussis outbreak was reported from Beyeda District Health Office PHEM Department to NGZ PHEM department. There were delays in notification and lack of timely proper management of suspected pertussis cases in the community. Health professionals did not suspect pertussis until a 2-year-old child died from the outbreak because they were treating cases as ARTI. The North Gondar Zonal Health Office made the decision to confirm the existence of an outbreak of pertussis. After that, an integrated team was created with three field epidemiologists, One PHEM officer from Beyeda district, One Laboratory technologist from Loware Health center and One Health officer from Loware Health center. The investigation team arrived in the Woreda on March 25, 2022 and meet with Woreda health officials.

The team traveled for eight hours on foot to reach the kebele where the outbreak occurred and they verified its existence and confirmed it by sending samples to EPHI. Since the kebele was one of the hard to reach areas in the Woreda, the response activities were very difficult. For managing the cases and surveillance efforts, assistance was given to health professionals. Health education was given for the local community to prevent transmission of the outbreak and support the active case search. Home to home treatment was given for cases to manage the outbreak and to prevent death and complications.

A solar refrigerator was also given to the health post so it could keep medications and vaccines for the local community. In order to stop the outbreak from spreading and to increase active surveillance, other villages were alerted of the outbteak. It was clear that the topography of the area and a lack of medical resources, such as medications and vaccines, made it difficult to provide health services. In the villages where the outbreak took place, a widespread immunization program was carried out.

Discussion

In March 2022, 60 Pertussis cases and two deaths were found from Beyeda Woreda. Out of those 60 cases, 6 (10%) of them were found positive using PCR test. The mean age of cases was 11.4 years. The overall attack rate was 0.06% which was lower than an outbreak investigation in Janamora District 0.13% (4). The highest attack rate (28.8/10000) was among children aged 1-4 years. Individuals in the age group of ≥15 years of age were the list affected with an attack rate of (2.1/10000) and this was lower than the finding in Mekdela District (22).

Pertussis is a serious disease for children in all countries, but it is more severe in the developing world. Disease incidence, complication rates and case fatality rates are highest in infants (23). In this investigation there were two deaths, with CFR of 3.3%. The overall pertussis case fatality rate was greater than the 3% in Papua New Guinea (24) and this mortality might be due to the delay in outbreak investigation and response. In this investigation males were more affected than females with attack rate of 7.5 per 10000 and case fatality rate of 5.5%.

Before childhood vaccination was introduced in the 1950s, pertussis was a major cause of infant death throughout the world. Widespread vaccination of children has been successful in significantly reducing morbidity and mortality (25). According to a metha-analysis and review conducted in Ethiopia, the full immunization coverage in Ethiopia was 58.92% (95% CI: 51.26–66.58%) (26). In this finding the immunization registration of the health post showed that 92% 87% and 85% coverage for penata-1, penta-2 and penta-3 respectively for the year 2021. In this investigation, out of 60 cases 6 (10%), 2 (3.3%) and 2 (3.3%) of them were vaccinated for penata-1, penta-2 and penta-3 respectively. This finding was contrary from the North Gondar Zone 2021 annual report of penta-1 and penta-3 vaccination coverage of the Woreda 96.5% and 92% respectively.

The clinical manifestations of pertussis in unimmunized children and infants are described as occurring in 3 phases: catarrhal, paroxysmal, and convalescent and it varies by host age, immune status, and coexistent conditions. Fever is generally absent throughout the course of the disease, except for a possible low grade fever during the catarrhal phase. Children and those not previously immunized are more likely to present with classic symptoms than are adults and children with previous immunity (6). In this outbreak investigation, the most prevalent clinical presentation was paroxysmal cough which was a complaint in 59 (98.3%) and this was slightly lower than the finding in southern Ethiopia 100% (27).

Pertussis-related complications fall into 3 distinct categories: pulmonary, central nervous system (CNS), and non-CNS complications. Pneumonia is the most common cause of death in children with pertussis, and it may be caused by *B. pertussis*, secondary bacterial pathogens or both (28). In this investigation, the most frequently reported complication was pneumonia in twenty-three (38.3%) cases.

Public health awareness creation on signs and symptoms of infectious diseases and how to prevent and control them plays vital role in preventing communicable diseases. In this investigation respondents who knew the mode of transmission and prevention of pertussis were 74 (43%) and this finding was lower than the finding in North West Ethiopia with 70.3% (29). This might be due to the lack health education and literacy of the community. 46 (79.3%) of cases had history of contact with suspected pertussis cases.

The benefit of antibiotic to treat pertussis when given late in the course of the disease is controversial; this is because the role of therapy is to lessen pertussis severity and duration. Macrolide antibiotic (e.g. erythromycin, clarithromycin and azithromycin) have been effective and constitute the main stay of treatment for patient with pertussis as well as for PEP (30). In this outbreak investigation, 58 (96.7%) of cases received treatment for pertussis. Erythromycin and azithromycin was given as mass treatment for cases and for those who had contact with possible cases.

An outbreak investigation conducted in 2018 indicated that previously sick with the disease (OR=7.56, 95% CI, 1.14- 49.96), being exposed to a possible case of pertussis (OR=12.61,95% CI,1.41-112.95), knowing method of prevention (0R=0.25,95% CI,0.07-0.82) and living with person affected in the family (OR=4.21,95% CI,1.84-9.65) were significantly associated with pertussis; While in this finding vaccination status (AOR: 0.91; 95% CI: 0.23-0.355; P: 0.001), awareness on mode of prevention of pertussis (AOR: 0.44; 95% CI: 0.009-0.212; P: 0.000) and housing condition (AOR: 0.21; 95% CI: 0.005-0.88; P: 0.000) were significantly associated with pertussis.

Limitation

Absence of vaccination cards made difficult to determine the vaccination status, the exact date of vaccination and other relevant information. Recall bias on the date of onset by the cases and their mothers occurred.

Conclusion

The outbreak occurred in hard to reach villages in Beyeda Woreda. Majority 46 (79.3%) of cases were unvaccinated. There was late identification and notification and this created delay in the outbreak investigation and response activities. To improve vaccination coverage of those villages and keep the cold chain system, refrigerator should be provided by prioritizing those areas which are remote and with poor infrastructures. Community awareness creation on mode of transmission and prevention of pertussis including other infectious disease should strengthen. It is important to strengthen the routine immunization service to lessen the severity of morbidity and mortality of vaccine preventable disease. The surveillance system should strengthen to improve early detection and management of cases. Poor cold chain management during transportation and storage of the vaccines affected vaccine potency,

According to this outbreak investigation finding, low immunization coverage, presence of symptomatic individual in the family, unventilated housing condition and low community awareness on pertussis transmissions and prevention methods were likely contributed for the occurrence of this pertussis outbreak. In this outbreak all treated cases, were recovered from their illness. Active case search was also conducted to detect missing cases.

Recommendations

Segenet Health Post

- should actively search affected cases at household level and treat them
- should identify those who had contact with a possible case of pertussis
- Should give health education on prevention mechanisms of pertussis (like isolation of cases, vaccination etc.) to the community and schools.
- Should prioritize high risk and remote gots (places where previous outbreak of pertussis occurred) and strengthen surveillance regularly to detect the disease early

Beyeda District health office PHEM Department

- Should monitor and evaluate overall surveillance system .
- Should strengthen Primary health care units, Heath extension workers and health development army on surveillance.
- Should strengthen RRT team, give feedback to health centers and report to zonal PHEM officers timely.
- Accredit those Health centers and health posts actively searching for cases.

North Gondar Zonal Health Office

- Should monitor surveillance system
- Strengthen Surveillance system through delivering training
- Conduct supportive supervision

- Should facilitate for sustainable cold chain management/Supply solar refrigerator in collaboration with APHI and EPHI.
- PHEM should work more on the emergency forecasting and prevention than response
- Integrated surveillance data should be analyzed regularly to be used for public health emergency early warning and response
- Prepare training and sensitization for District and Primary health care units on surveillance and outbreak investigation.

References

1. Tessier E, Campbell H, Ribeiro S, Andrews N, Stowe J, Nicholls M, et al. Investigation of a pertussis outbreak and comparison of two acellular booster pertussis vaccines in a junior school in South East England , 2019. Eurosurveillance [Internet]. 2021;26(12):1–8. Available from: http://dx.doi.org/10.2807/1560-7917.ES.2021.26.12.2000244
2. Saffar M, Hashemi A, Ghorbani G, Rezai M, Shahmohammadi S, Shojaei J. Clinical and laboratory features of pertussis in hospitalized infants with confirmed versus probable pertussis cases. Ann Med Health Sci Res. 2014;4(6):910.
3. Jenkins VA, Savic M, Kandeil W. Pertussis in high-risk groups: an overview of the past quarter-century. Hum Vaccines Immunother [Internet]. 2020;16(11):2609–17. Available from: https://doi.org/10.1080/21645515.2020.1738168
4. Almaw L, Bizuneh H. Pertussis outbreak investigation in janamora district, amhara regional state, ethiopia: A case-control study. Pan Afr Med J. 2019;34:1–7.
5. Warfel JM, Beren J, Merkel TJ. Airborne transmission of bordetella pertussis. J Infect Dis. 2012;206(6):902–6.
6. Spector TB, Maziarz EK. Pertussis. Med Clin North Am. 2013;97(4):537–52.
7. Diavatopoulos DA, Cummings CA, Schouls LM, Brinig MM, Relman DA, Mooi FR. Bordetella pertussis , the Causative Agent of Whooping Cough , Evolved from a Distinct , Human-Associated Lineage of B . bronchiseptica. 2005;1(4).
8. Kandeil W, Atanasov P, Avramioti D, Fu J, Demarteau N, Li X. The burden of pertussis

in older adults: what is the role of vaccination? A systematic literature review. Expert Rev Vaccines [Internet]. 2019;18(5):439–55. Available from: https://doi.org/10.1080/14760584.2019.1588727

9. Armstrong H, Suchecki L, Lipperman S, Roberson T, Roecker AM, Armstrong H, et al. Pharmacy and Wellness Review Whooping Cough : A Pharmacist ' s Role in an Emerging Endemic Whooping Cough : A Pharmacist ' s Role in an Emerging Endemic. 2014;5(1).
10. Tan T, Dalby T, Forsyth K, Halperin SA, Heininger U, Hozbor D, et al. Pertussis Across the Globe: Recent Epidemiologic Trends From 2000 to 2013. Pediatr Infect Dis J. 2015;34(9):e222–32.
11. Yeung KHT, Duclos P, Nelson EAS, Hutubessy RCW. An update of the global burden of pertussis in children younger than 5 years: a modelling study. Lancet Infect Dis [Internet]. 2017;17(9):974–80. Available from: https://www.sciencedirect.com/science/article/pii/S1473309917303900
12. Galazka A. Control of pertussis in the world. World Health Stat Q [Internet]. 1992;45(2–3):238—247. Available from: http://europepmc.org/abstract/MED/1462658
13. Omer SB, Kazi AM, Bednarczyk RA, Allen KE, Quinn CP, Aziz F, et al. Epidemiology of Pertussis Among Young Pakistani Infants : A Community-Based Prospective Surveillance Study. 2021;63(Suppl 4):148–53.
14. Bamberger ES, Srugo I. What is new in pertussis? Eur J Pediatr. 2008;167(2):133–9.
15. Description ID. Chapter 10: Pertussis. 2017;
16. Zepp F, Heininger U, Mertsola J, Bernatowska E, Guiso N, Roord J, et al. Rationale for pertussis booster vaccination throughout life in Europe. Lancet Infect Dis. 2011 Jul;11(7):557–70.
17. Barret AS, Ryan A, Breslin A, Cullen L, Murray A, Grogan J, et al. Pertussis outbreak in northwest Ireland , January – June 2010. Eurosurveillance [Internet]. 2010;15(35):1–5. Available from: http://dx.doi.org/10.2807/ese.15.35.19654-en
18. Poolman JT. Pertussis vaccines. Expert Rev Vaccines. 2014;13(9):1067–9.
19. States M, Advi WHOS. Pertussis vaccines : WHO position paper Note de synthèse : position de l ' OMS concernant les vaccins anticoquelucheux. 2010;

20. Shet A, Carr K, Danovaro-holliday MC, Sodha S V, Prosperi C, Wunderlich J, et al. Articles Impact of the SARS-CoV-2 pandemic on routine immunisation services : evidence of disruption and recovery from 170 countries and territories. Lancet Glob Heal [Internet]. 2022;10(2):e186–94. Available from: http://dx.doi.org/10.1016/S2214-109X(21)00512-X
21. Managing pertussis outbreaks during humanitarian emergencies WHO Technical Note. 2008;(February).

22. Alamaw SD, Kassa AW, Gelaw YA. Pertussis outbreak investigation of Mekdela district, South Wollo zone, Amhara region, North-West Ethiopia. BMC Res Notes. 2017;10(1):1–7.
23. Ivanoff B, Robertson SE. Pertussis: a worldwide problem. Dev Biol Stand [Internet]. 1997;89:3—13. Available from: http://europepmc.org/abstract/MED/9272330
24. Report OI. Pertussis outbreak in Papua New Guinea: the challenges of response in a remote geo-topographical setting. 2012;3(4):10–3.
25. Berbers GAM, de Greeff SC, Mooi FR. Improving pertusis vaccination. Hum Vaccin. 2009;5(7):497–503.
26. Eshete A, Shewasinad S, Hailemeskel S. Immunization coverage and its determinant factors among children aged 12 – 23 months in Ethiopia : a systematic review , and Meta-analysis of cross- sectional studies. 2020;1–13.
27. Mitiku AD, Argaw MD, Desta BF, Tsegaye ZT, Atsa AA, Tefera BB, et al. Pertussis outbreak in southern Ethiopia: Challenges of detection, management, and response. BMC Public Health. 2020;20(1):1–12.
28. Greenberg DP, Von König CHW, Heininger U. Health burden of pertussis in infants and children. Pediatr Infect Dis J. 2005;24(5 SUPPL.):39–43.
29. Yeshanew AG, Lankir D, Wondimu J, Solomon S. Pertussis outbreak investigation in Northwest Ethiopia: A community based study. PLoS One [Internet]. 2022;17(2 February):1–14. Available from: http://dx.doi.org/10.1371/journal.pone.0263708

30. Kilgore PE, Salim AM, Zervos MJ, Schmitt H. Pertussis : Microbiology , Disease , Treatment , and Prevention.

1.2 Malaria Outbreak Investigation in Lare Woreda, Gambella Region, July, 2022

Abstract

Introduction: Globally malaria remains one of the high burden diseases, particularly in developing countries. Globally, there were an estimated 241 million malaria cases and 627,000 deaths worldwide in 2020. Ethiopia is one of the sub-Saharan countries highly endemic for malaria. Although, recently the burden of malaria was reduced remarkably through public health interventions, it is still a major public health problem in Ethiopia. Hence, measuring the burden of the disease and assessing the trend is very important for monitoring the extent and changes over a period of time.

Objective: To describe burden of malaria outbreak, identify determinants of the outbreak and to take appropriate public health control measures in Lare Woreda, Nuer Zone Gambella Region, Ethiopia.

Methodology: We employed descriptive and unmatched case-control study with 1:2 ratio from July 6 – August 10, 2022 in Lare Woreda. On case-control study, 75 cases and 150 controls were included. All 75 cases were line listed. Bivariate and multivariate analyses were conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS version 25. Controls were selected randomly from neighboring village from participants who did not fulfill the criteria for case. We interviewed Cases and Controls using a semi structured questionnaire.

Results: During the Epi Weeks of 22-34, there were a total of 1,522 malaria cases and six deaths (CFR=0.25%). The median age of cases was 17 years. The overall attack rate of the outbreak was 272/10000 population and it was higher in age group 5-14 (17/10000 population) followed by >15 age group 13/10000 population. Forty-four (58.7%) of the cases were female. Statistically significant variables on multivariate analysis were availability of mosquito breeding site near residential area (AOR: 5.3; 95% CI: 2.7-10.7; P: 0.000), use of ITN (AOR: 0.24; 95% CI: 0.1-0.55; P: 0.001) and indoor residual spray (AOR: 0.46; 95% CI: 0.24-0.88; P: 0.020).

Conclusion and recommendations: presence of mosquito breeding site increases the chance of getting malaria infection. Hence, prevention and control activities aimed at malaria should be intensified. Spraying of house and using mosquito bed net were protective factors for malaria outbreak. Mobilizing and participation of the community towards prevention and control activity should be intensified.

Keyword: Malaria, Outbreak, Case Control, Larea Woreda,

Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes (1). Malaria is caused by infection with protozoan parasites belonging to the genus *Plasmodium* and transmitted by female *Anopheles* species mosquitoes (2).

Malaria is caused by five species of *Plasmodium*, i.e., *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and the recently included *Plasmodium knowlesi* (3). Although most deaths are caused by *Plasmodium falciparum*, the relative contribution of the non-falciparum *Plasmodium* species to the global malaria burden is increasing as incidence of *P. falciparum* falls (4).

Globally, there were an estimated 241 million malaria cases and 627,000 deaths worldwide in 2020 (5). This indicates about 14 million more malaria cases and 47 000 more deaths in 2020 compared to 2019. Most of those increases were from countries in the WHO African Region, and associated with disruption to services during the COVID-19 pandemic.

The clinical symptoms of malaria are primarily due to schizont rupture and destruction of erythrocytes (6). The most common symptoms are fever, chills, headache, and diaphoresis. Other common symptoms include dizziness, malaise, myalgia, abdominal pain, nausea, vomiting, mild diarrhea, and dry cough.

Although *Plasmodium falciparum* has declined globally both in terms of spatial extent and burden intensity, malaria remains pervasive in sub-Saharan Africa despite a halving in incidence and mortality since 2005 (7). Declines in malaria were likely to be driven by multiple factors, including widely increased access to insecticide treated bed nets and artemisinin combination therapy antimalarial drugs.

In Ethiopia, more than 3/4 of the landmass is malarious and about 68% of people of the total population are residing in areas at risk of malaria infection (8). Despite significant improvements in prevention and control in the past decades, malaria remains a significant public health concern in Ethiopia. Effective malaria control interventions are being scaled up in Ethiopia to improve access and equity to preventive as well as curative health services. These initiatives include prompt and effective treatment of malaria, selective vector control, including insecticide-treated nets (ITNs) and indoor residual spraying (IRS), and prevention and control of the epidemic

Ethiopia is one of the countries that have implemented the revised strategies to control malaria. Among those, indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) are the most important in malaria prevention and control strategy (9). Additionally, introduction of rapid diagnostic tests at community level and adaptation of artemisinin-based combination therapies (ACTs) are also practiced in Ethiopia.

Global warming induced by human activities has increased the risk of vector-borne diseases, such as malaria (10). Recent decades have witnessed changes in the ecosystem and climate without precedent in human history although the emphasis on the role of temperature on the epidemiology of malaria has given way to predisposing conditions such as ecosystem changes, political instability and health policies that have reduced the funds for vector control, combined with the presence of migratory flows from endemic countries.

A robust surveillance system should be developed and implemented to ensure timely surveillance and to capture additional data on pertussis cases that would be important to formulate hypotheses, monitor/describe the outbreak, identify risk groups, and inform targeted interventions.

Objectives

General objective

To describe burden of malaria outbreak, identify determinants of the outbreak and to take appropriate public health control measures in Lare Woreda, Nuer Zone, Gambella Region, Ethiopia August 2022.

Specific Objectives

- To verify the existence of malaria outbreak
- To describe the burden of malaria outbreak
- To identify determinants of malaria outbreak
- To conduct appropriate public health control measures

Materials and methods

Study area

The outbreak investigation was conducted in Lare woreda which is found in Nuer Zone Gambella Region. Lare is located about 776 km from Addis Ababa (the capital city of Ethiopia) in the western part of Ethiopia and about 85 km from Regional capital city Gambella. Lare woreda is bordered on the south and east by Anuak Zone, on the west by the Baro River which separates the Woreda from Jikawo, and on the north by the Jikawo River which separates it from South Sudan. The Woreda has 28 kebeles. The major town in Lare is Kuergang. According to the 2007 population census, the projected estimated population of the Woreda in 2022 was 55,769 of whom 28,442 Males and 27,327 Females. The consisted of two health centers and 14 HPs. The terrain in Lare consists of marshes and grasslands; elevations range from 410 to 430 meters above sea level. A notable landmark is Gambela National Park, which occupies part of the area south of the Baro.

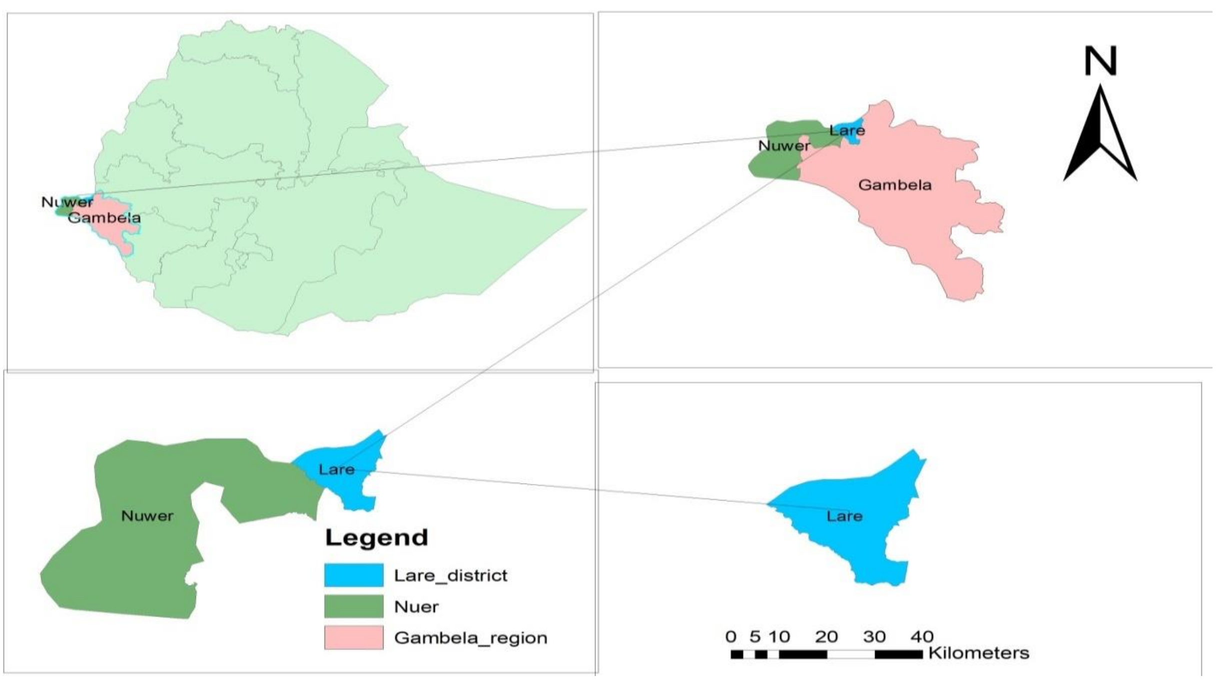

Figure 7 map of Lare Woreda, North Nuer Zone, Gambella Region, 2022

Study period

This study was conducted from July 6-25, 2022.

Study design

We conducted descriptive analysis of the collected line list of cases, followed by an unmatched community based case-control study with, 1:2 ratio.

Source /Target population

Population living in Lare Woreda was the source population.

Study population

Population that was sampled from source population was the study population.

Sample size and Sampling Method

Using Epi-info version 7.2.4.0 Statcalc for unmatched case control study;

Sampling Method

We included 75 reported cases from the line list and 150 controls randomly selected from neighboring village.

Data Collection Tools and Procedures

We reviewed the outpatient medical logbooks and medical records of cases at Health Center. We discussed with Woreda Health Officials and malaria PHEM officers. We also interviewed Cases and Controls, using a semi structured questionnaire (annexed). Cases and controls were interviewed by two data collectors.

Data analysis

The collected data were entered in to Epi-info version 7.2.4.0 and exported to SPSS version 25 for further analysis.

Inclusion criteria

All febrile patients who fulfilled the case definition of the disease during the investigation period

Exclusion criteria

We excluded suspected patients with negative Rapid Diagnostic Tests for Malaria

Variables

Dependent variables

Multispecies Malaria Rapid Diagnostic Test positive

Independent variables

Age

Sex

Residence

Occupation

Educational status

Use of Insecticide treated Bed nets (ITNs)

Indoor Residual Sprayed home (IRS)

Working outdoors in the evening or at night

Environmental Breeding site: Intermittent River, stagnant water, irrigation

Case Definition

A case of Malaria was defined as an acute febrile illness with a rapid diagnostic test (RDT) positive for malaria or a positive rapid antigen test.

Controls: - Non febrile apparently healthy individuals who were neighbors or family of cases at the time of data collection

Ethical clearance

Ethical clearance to conduct the investigation was obtained from the Ethiopian Public Health Institute (EPHI). A letter of request was written from Gambella Regional Health Bureau to Lare Woreda Health Office. Oral informed consent was obtained from participants.

Data dissemination

The findings of the study were communicated to all concerned bodies, such as EPHI, Woreda Health Offices, mentors, supervisors, coordinators and to the Addis Ababa University, School of Public Health.

Results

Descriptive Analysis

Description of the overall outbreak situation

In Lare Woreda, the malaria epidemic began in May 2022. The existence of the outbreak was confirmed by taking the second largest data of the past five years data of the Woreda. The outbreak increased gradually from week to week and reached its peak in week 32 of the epidemiologic week. During the Epi Weeks of 22-34, there were a total of 1,522 malaria cases and six deaths. All 28 kebeles of the Woreda were affected by the outbreak. For case control study, 75 cases were selected from patients who visited Kuwergeng and kwuernyaguich health centers and 150 controls were selected randomly from nearby Kebeles (**Table 6**). Among cases 41 (54.7%) of them were >15 years of age and 44 (58.7%) of them were females. Regarding marital status, 43 (57%) of the cases were married and 35 (46.6%) of them were unable to read and write.

Table 6 Demographic characteristics of cases and controls, Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

S/N	Variables		Case	Control	%	Total
1	Age	<5	8	8	7	16
		5-14	26	40	29	66
		>15	41	102	64	143
2	Sex	Male	31	64	42	95
		Female	44	86	58	130
3	Occupation	Employed	0	1	0.4	1
		Merchant	0	1	0.4	1
		Student	25	30	24.4	55
		Farmer	18	51	31.6	69
		House wife	32	67	44.0	99
4	Marital status	Single	20	47	29.8	67
		Married	43	95	61.3	138
		Widowed	1	1	0.9	2
		Divorced	0	1	0.4	1
		N/A	11	6	7.6	17

5	Education	Unable to read and write	35	43	34.8	78
		Primary	34	78	49.7	112
		Secondary	3	6	4	9
		N/A	3	23	11.5	26
6	Family Size	2-5	47	96	63.6	143
		>5	28	54	36.4	82
7	Address	Kurnuguch	15	30	20	45
		Kurnuguch 01	5	17	9.7	22
		Kutuch	11	32	19	43
		Kuwergeng	3	0	1.3	3
		kuwerlang	8	23	14	31
		kwuernyaguich	33	48	36	81

Description of cases by place

Lare wereda has two clusters (Kuwergeng and kwuernyaguich health centers) and each cluster had 14 kebeles. Majority of cases 33 (44%) were from kwuernyaguich kebeleTable 6**.** Regarding control, we selected 150 samples from apparently healthy individuals from nearby villages.

Description of cases by person

A total of 1,522 malaria cases were reported with 6 deaths (CFR=0.25%). Out of those 1522 cases, 75 cases were selected from two clusters for case control study. Of 75 cases, 33 (44%), 15 (20%) and 11 (14.7%) of them were from kwuernyaguich, Kurnuguch and Kutuch kebele respsctively. The overall attack rate of the outbreak was 272/10000 population and it was higher in age group 5-14 (17/10000 population) followed by >15 age group 13/10000 population

Table 7. The case fatality rate of the outbreak was higher (12.5%) in age group <5.

Table 7 Distribution, Attack Rate and Case Fatality Rate of Malaria Cases by Sex and Age Group, Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

Variables	Total population	Number of Cases (N=75)	(AR/10000)	Number of death	CFR (%)
Sex					
Male	28,442 (51%)	31 (41.3%)	10.8	4	13
Female	27,327 (49%)	44 (58.7%)	16	2	4.5
Age group					
<5	7,947 (14%)	8 (10.7%)	10	1	12.5
5-14	15,393 (28%)	26 (34.7%)	17	3	11.5
>15	32,429 (58%)	41 (54.6%)	13	2	4.8

Description of cases by time

Before the occurrence of the outbreak, malaria cases were reported to the Woreda Health Office on a weekly basis. Clusters were reporting increased number of malaria cases to WoHO malaria focal person. The alert threshold had been crossed in 22th WHO epidemiologic week. The health facilities notified the WoHO the sharp increase of malaria cases on the week 28 of 2022. The surveillance and response team composed of different professionals was deployed from the EPHI and Regional Health Bureau to outbreak affected areas to investigate and respond to the outbreak. The investigation team monitored malaria trends and evaluated malaria threshold graphs. During the outbreak most health facilities did not experience stock outs of supplies and anti-malarial medications. Most cases of malaria were reported between week 28-32 **Figure 8**.

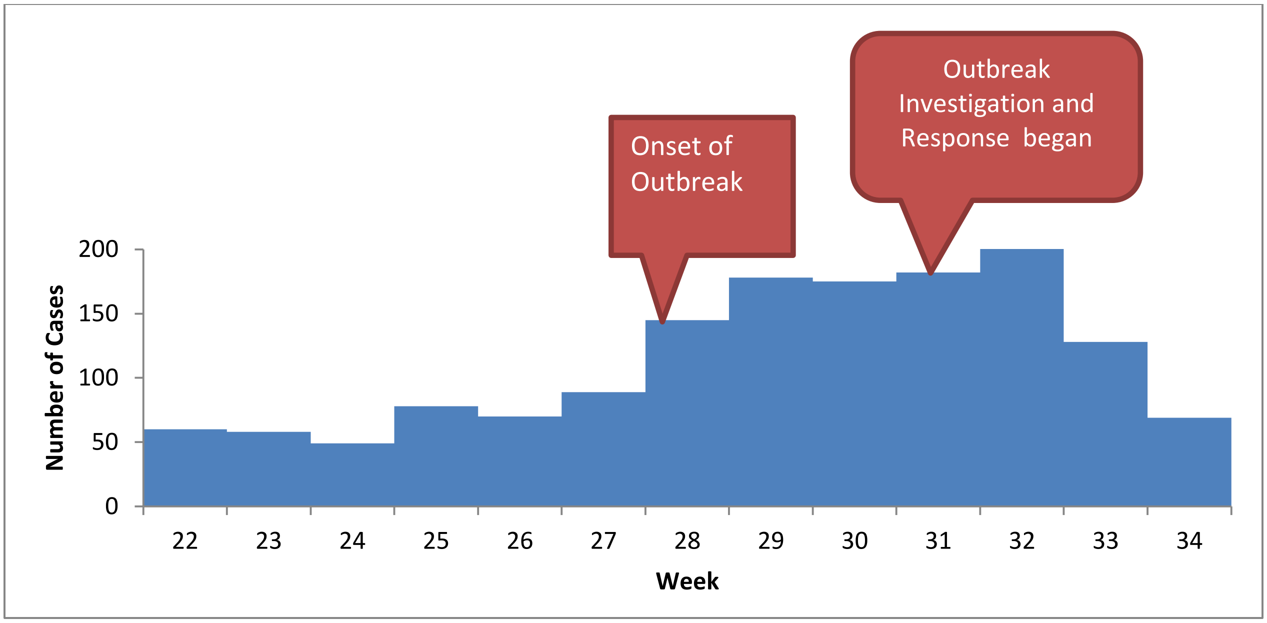

Figure 8 an epidemiological curve for Malaria Outbreak in Lare Woreda, week 22 to week 34, 2022

Clinical features of cases

The most frequently manifested clinical features were fever, headache, loss of appetite and chills (100%), 74 (98.7%), 60 (90.7%) and 60 (80%) respectively. Nausea and vomiting 45 (60), malaise 38 (50.7), body ache 34 (45.3%) and shivering 34 (45.3%) were also some of reported clinical manifestations. Convulsion/coma 2 (2.7%), impairment of consciousness 1 (1.3%), hypoglycemia 1 (1.3%) and seizure 1 (1.3%) were some of the complications **Table 8**.

Table 8 Common Clinical manifestations and complications of malaria Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

S/N	Clinical manifestations	Frequency	Percentage
1	Fever,	75	100
2	Headache	74	98.7
3	Loss of Appetite	68	90.7
4	Chills	60	80

5	Nausea &vomiting	45	60
6	Malaise	38	50.7
7	Body ache	34	45.3
8	Shivering	34	45.3
S/N	**Complications**	**Frequency**	**Percentage**
1	Convulsion/coma	2	2.7
2	Impairment of Consciousness	1	1.3
3	Hypoglycemia	1	1.3
4	Seizure	1	1.3

Laboratory

From week 22 to week 34, a total of 2,233 malaria cases were tested by Microscopy and RDT. The tests were done as a routine task and also as a campaign in outbreak affected areas. Out of the total tested cases, 1850 (89%) of them were positive for malaria specious (positivity rate: 82.7%) **Table 9**. Of the total positive cases, 1530 (82.7%) of them were *p. falciparum* and the rest 320 (17.3%) *P. vivax.*

Table 9 total malaria tests microscopic and RDT week 22-34 Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

S.N	Total malaria tests Microscopic and RDT		Total
	PF	PV	
1	1,530	320	1850

Vector control activities

Environmental modification

In line with the investigation, environmental assessment was conducted. In most areas where the outbreak occurred, breeding sites for mosquitoes were identified and environmental management was done. The identified potential breeding sites were ponds, stagnant water, intermittent rivers, and bushes. Larvae of anopheles mosquitoes were collected for entomological survey by EPHI team. During rainy season flooding will happen and this creates favorable condition for mosquito to breed and this makes the prevention and control activity difficult.

IRS

Indoor residual spray was conducted as a mechanism of vector control intervention. There were IRS activities 3 month before the occurrence of the outbreak. There was refusal for IRS in some parts of the Woreda due to its uncomfortable odor. The coverage of the IRS was not satisfactory. There were also missing houses during IRS campaign. Larvicidal activities were also done to strengthen vector control activities.

LLIN

Following the outbreak, emergency LLINs distribution was conducted by the Ministry of Health. Based on the data obtained from Regional malaria focal, 2,620 LLINs were distributed to the outbreak affected kebeles in the Woreda. Based on number of case load, two kebeles were selected for new case search and LLINs utilization assessment. Fifty households (HH) from each kebeles, were randomly selected and assessed. Out of those, 100 HHs, 96 (96%) of them had LLINs, but only 65% of them hanged properly. There were HHs who used the LLIN for other purposes, do not hang properly and do not use properly.

Case management

During the investigation, health facilities were assessed for proper use of malaria treatment guidelines for case management. During the assessment, most HPs were not functional. From the total of 12 HPs in the Woreda, only 5 (%41.7) of them were functional. All health centers had and used case management guideline and out of five assessed HPs, 3 (60%) of them used the guideline. Health centers were using microscopic examination and sometimes RDT during the outbreak period. Because of unavailability of microscopy at HP level, HEW conducted rapid diagnostic test (RDT) to confirm malaria diagnosis. HPs were supplied with RDT, artimisinin-based combination therapy (ACT) and chloroquine to diagnose and treat uncomplicated malaria cases at HP level**.**

Interventions done

- Targeted Focal spray was performed for outbreak affected kebelles.
- Environmental modification activities through community mobilization
- Awareness creation on prevention and control measures of malaria and ITN utilization
- Capacity building for health professionals on case management
- Distribution of LLINs for 2,620 HHs
- Mass test and fever treatment
- Active case search

Analytical epidemiology

A total of 75 active malaria cases and 150 apparently healthy controls were included into this analysis. The median age of cases and controls were 17 and 22 years respectively. We assessed possible risk factors that contribute to contract malaria (Table 10). In bivariate analysis Presence of Intermittent river (COR: 5; 95% CI: 1.9-13.; P: 0.001), availability of mosquito breeding site near residential area COR: 6.9; 95% CI: 3-13.; P: 0.000), using of ITN COR: .23; 95% CI: 0.11-0.48.; P: 0.000) and IRS COR: 0.46; 95% CI: 0.26-.82.; P: 0.008) were statistically significant factors.

Table 10 Bivariate analysis for different factors to malaria, Lare Woreda, Nuer Zone Gambella Region, Ethiopia, 2022

Variable		Case	Control	COR (95% CI)	P-value
		N (%)	N (%)		
Sex	Male	31(41.3)	64(42.7)	1.0(0.602-1.85)	0.849
	Female	44(58.7)	86(57.3)		
Age group	<5	8(10.6)	8(5.3)		1.111
	5-14	26(34.7	40(26.7)	2.44(.875-7.)	.087
	>15	41(54.7)	102(68)	1.6(.876-0.29	.124
Educational level of mother/care givers	Unable to read and write	35(46.7)	43(28.7)	1.62(.38-6.98)	0512
	Primary	34(45.3)	78((52)	.26(.042-1.63)	.151
	Secondary	3(4)	6(4)	.87(0.206-3.69)	.852
	N/A	3(4)	23(15.3)		
Is there intermittent river	Yes	15(20)	7(4.7)	5(1.9-13)	**.001**
	No	60(80)	143(95.3)		
Presence of mosquito breeding site near residential area	Yes	59(78.7)	52(34.7)	6.9(3-13)	**.000**
	No	16(21.3)	98(65.3)		
ITN use	Yes	24(32)	135(90)	.23(0.11-0.48)	**.000**
	No	51(68)	15(10)		
IRS sprayed	Yes	32(42.7)	92(61.3)	.046(.26-.82)	**.008**
	No	43(57.3)	58(38.7)		
Staying (working) outdoor in the evening	Yes	21(28)	26(17.3)	1.8(.961-3.5)	.066
	No	54(72)	124(82.7)		

For variables that were significant on bivariate analysis, multivariate analysis was conducted to verify whether the association is real or not, controlling for confounding factors. Statistically significant variables on multivariate analysis were availability of mosquito breeding site near residential area (AOR: 5.3; 95% CI: 2.7-10.7; P: 0.000), use of ITN (AOR: 0.24; 95% CI: 0.1-0.55; P: 0.001) and indoor residual spray (AOR: 0.46; 95% CI: 0.24-0.88; P: 0.020) Table 11.

Table 11 Multivariate analysis for significant factors on bivariate analysis to malaria, Lare Woreda, Nuer Zone, Gambella Region, Ethiopia, 2022

Variable	COR (CI)	AOR (95% CI)	P-value
Presence of mosquito breeding site near residential area	6.9 (3-13)	5.3 (2.7-10.7)	**0.000**
use of ITN	0.67 (0.25-0.179)	0.44(0.009-0.212)	**0.000**
Indoor residual spray	0.032 (0.013-0.078)	0.21(0.005-0.88)	**0.000**

Discussion

Malaria outbreak was confirmed in Lare Woreda in May 2022. The numbers of malaria cases reported from the Woreda were greater than double compared to the prior year WHO epidemic Week 28/2021. Malaria epidemic period in the Woreda was not the same as the national peak time (September to December) for malaria, in fact malaria outbreak occurred at different times depending on the region (11).

The malaria outbreak affected all age groups. However, significantly affected age groups were >15 followed by 15–14 years old, and this finding is contrary with an outbreak investigation of Simada District (12) where majority of the affected age groups were 5–14 years.

This investigation revealed that attack rate was higher among females. This is contrary to the outbreak investigation finding in Boloso Sore Woreda in which the disease was more prevalent in male (13), and it was similar to the finding of Tanquae Abergelle district Tigray Region (14).

The case fatality rate of the outbreak was (CFR=0.25%) and it was higher (12.5%) in age group <5 and this might be due to children having low immunity. This finding was lower compared to the finding of study conducted in 2012 in Ameya, Oromia Region 0.2% (15).

The predominant Plasmodium species detected was *P. falciparum* with 82.7%, followed by *P. vivax*. This was in agreement with a study done in BenaTsemay District, Southern Ethiopia (16).

Based on this finding, households found near mosquito breeding sites had odds of 5.3 of contracting malaria as compared to those living far away. This might be due to increase of mosquito density because of the breeding site and /or risk for mosquitoes bite. This finding is similar with a study conducted in Tigray (17). Hence, there should be sustainable integrated and coordinated malaria prevention and control measures and proper water management to eliminate mosquito breeding sites.

WHO recommends deployment of one of two broadly applicable vector control interventions, namely, ITNs or indoor residual spraying (IRS) (18). The finding of this study revealed that using bed net consistently and spraying of houses with chemicals were protective factors for malaria infection. This is in line with the study done in Argoba District (19). This might be due to spraying of houses with chemicals reducing the concentration of mosquitoes.

Conclusion

Findings of this study revealed that presence of mosquito breeding site increases the chance of getting malaria infection. Hence, the prevention and control activity aimed at malaria should be intensified. Spraying of house and using mosquito bed net were protective factors for malaria outbreak. Therefore, the provision of ITN for the community and health education on utilization of ITN should strengthen. Vector controlling activity and environmental modification contributes a lot in prevention of malaria outbreak, hence community mobilization towards malaria prevention and control activity should strengthen. Strengthening health facilities towards surveillance and malaria case management supports the preparedness and outbreak response activity. In this regard functionalizing non-functional health posts and monitoring of health facilities should be done on regular and planned way.

Recommendations

- Regional Health Bureau should work on strengthen the malaria surveillance system with especially emphasis at heath post level
- The Woreda Health Office has to mobilize the community to participate in prevention and control activities
- Environmental management should be conducted consistently
- Community awareness should be enhanced on ITN utilization
- Supportive supervision should be conducted in sustainable manner

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References

1. Neeta Rai et al. Different Clinical Features of Malaria. Asian Journel Biomed Pharm Sci. 2012;2(12):28–3.
2. Bratitsis T, Demetriadis S. Research approaches in computer-supported collaborative learning. Int J e-Collaboration. 2013;9(1):1–8.
3. Chew CH, Lim YAL, Lee PC, Mahmud R, Chua KH. Hexaplex PCR detection system for identification of five human Plasmodium species with an internal control. J Clin Microbiol. 2012;50(12):4012–9.
4. Nosten F, Van Vugt M, Price R, Luxemburger C, Thway KL, Brockman A, et al. Effects of artesunate-mefloquine combination on incidence of Plasmodium falciparum malaria and mefloquine resistance in western Thailand: A prospective study. Lancet. 2000;356(9226):297–302.
5. WHO. Word Malaria Report 2021. Word Malaria report Geneva: World Health Organization. (2021). Licence: CC. 2021. 2013–2015 p.
6. Trampuz A, Jereb M, Muzlovic I, Prabhu RM. Clinical review: Severe malaria. Crit Care. 2003;7(4):315–23.
7. Weiss DJ, Lucas TCD, Nguyen M, Nandi AK, Bisanzio D, Battle KE, et al. Mapping the global prevalence, incidence, and mortality of Plasmodium falciparum, 2000–17: a spatial and temporal modelling study. Lancet [Internet]. 2019;394(10195):322–31. Available from: http://dx.doi.org/10.1016/S0140-6736(19)31097-9
8. Menjetta T. Assessment of Knowledge, Attitude, and Practice towards Prevention and Control of Malaria in Halaba Town, Southern Ethiopia, 2017. J Trop Med. 2021;2021.
9. Kendie FA, Hailegebriel W/kiros T, Nibret Semegn E, Ferede MW. Prevalence of Malaria among Adults in Ethiopia: A Systematic Review and Meta-Analysis. J Trop Med. 2021;2021.
10. Rossati A, Bargiacchi O, Kroumova V, Zaramella M, Caputo A, Garavelli PL. Climate, environment and transmission of malaria. Le Infez Med. 2016 Jun;24(2):93–104.
11. Daba C, Atamo A, Debela SA, Kebede E, Woretaw L, Gebretsadik D, et al. A

Retrospective Study on the Burden of Malaria in Northeastern Ethiopia from 2015 to 2020: Implications for Pandemic Preparedness. Infect Drug Resist. 2023;16(February):821–8.

12. Workineh B, Mekonnen FA, Sisay M, Gonete KA. Malaria outbreak investigation and contracting factors in Simada District, Northwest Ethiopia: A case-control study. BMC Res Notes [Internet]. 2019;12(1):1–6. Available from: https://doi.org/10.1186/s13104-019-4315-z
13. Dawud AM. Malaria Outbreak Investigation and Response in. 2019;1–18. Available from: https://doi.org/10.21203/rs.3.rs-705729/v1
14. Tesfay K, Assefa B, Addisu A. Malaria outbreak investigation in Tanquae Abergelle district, Tigray region of Ethiopia: A case-control study. BMC Res Notes [Internet]. 2019;12(1):1–5. Available from: https://doi.org/10.1186/s13104-019-4680-7
15. Beffa Defi G. A Malaria Outbreak in Ameya Woreda, South-West Shoa, Oromia, Ethiopia, 2012: Weaknesses in Disease Control, Important Risk Factors. Am J Heal Res. 2015;3(3):125.
16. Shite Wondimu M. Malaria Outbreak Investigation in Pastoral Communities of BenaTsemay District, Southern Ethiopia: A Case Control Study. Am J Heal Res. 2019;7(3):31.
17. Study AC, Gebremichael MG. Malaria Outbreak – in Hitsats Refugee Camp , Tigray. 2017;1–15.
18. WHO. Global technical strategy for malaria 2016-2030, 2021 update [Internet]. World Health Organization. 2021. 1–40 p. Available from: https://apps.who.int/iris/rest/bitstreams/1357541/retrieve
19. Tesema GA, Akalu TY. Malaria Outbreak Investigation in Argoba District , South Wello Zone , Northeast Ethiopia , 2016 : A case control study. Res Sq. 2019;1–16.

1.3 Descriptive Epidemiology of a Cholera Outbreak in Moyale Woreda, Oromia, Ethiopia, 2023

Abstract

Introduction: Cholera is an extremely virulent disease that can cause severe acute watery diarrhoea. It takes between 12 hours and 5 days for a person to show symptoms after ingesting contaminated food or water. Globally, there were an estimated 3 – 5 million cholera cases and 28,000 –150,000 deaths annually.

Objective: To assess possible source of the outbreak, identify potential risk factors and give response in Moyale Woreda, Borena Zone, Oromia Region, Ethiopia, 2023.

Methodology: We conducted descriptive study of cases from April 25 to June 20, 2023. We collected line lists and reviewed medical records of patients. We interviewed Woreda PHEM focal and surveillance officer. We assessed cholera treatment centers and ORPs during the investigation period. We also assessed environmental hygiene and sanitation of patients during contact tracing.

Results: A total of 740 cholera cases and three deaths (CFR 0.4%) occurred. The case fatality rate was high in males (0.6%) and among age group >10 years (0.38%). The median age of cases was 20 years and the overall attack rate was 40.8 per 10000 population. All kebeles of the Woreda were affected. The highest attack rate was reported from Moyale 02 and Arbale Kebele (109 per 10000 population). Majority of cholera cases were daily laborers 193 (26%). Of the total cases, 55% of them were severely dehydrated. The outbreak started from WHO epi week 10th of 2023.

Conclusion and recommendations: The outbreak persisted in the Woreda for more than ten weeks. The use of contaminated water points were the most likely causes of the outbreak. The outbreak was confirmed using culture test at Regional Laboratory. Poor hygiene and sanitation, overcrowding, high population movement, lack of clean water and poor waste disposal system might be possible contributing factors of the outbreak. Government and humanitarian agencies should work on provision of safe water supply. Community hygiene and sanitation awareness should be enhanced.

Keyword: Cholera, Outbreak, Moyale Woreda,

Introduction

Cholera is an extremely virulent disease that can cause severe acute watery diarrhoea. It takes between 12 hours and 5 days for a person to show symptoms after ingesting contaminated food or water (1). Overcrowding, poverty, insufficient water and sanitation facilities increase the risk for cholera outbreaks (2).

The global burden of cholera is largely unknown, since the majority of cases are not reported, however, previous studies estimate 2.9 million cases, and 95 000 deaths occur annually (3). Countries report cholera outbreaks, mainly in the WHO Regions of Africa and the Eastern Mediterranean.

The cholera outbreak in the WHO African Region continues to evolve. The cholera outbreaks in the African Region are happening in the context of natural disasters, flooding, drought, conflict and multiple disease outbreaks (4).

The Case Fatality Rate (CFR) from untreated cholera can be as high as 30–50%, but prompt administration of rehydration therapy can reduce it to as low as 1% (5). Globally, an estimated 3 – 5 million cholera cases and 28,000 –150,000 deaths occur yearly disproportionately affecting sub-Saharan African countries.

It is well known that cholera affects primarily large populations with little or no access to safe water and proper sanitation. Weather and climate play a critical role because of their effect on water quality (6), and can also affect water quantity, i.e. water availability. It has now been well established that environmental conditions combined with climate are important factors in the dynamics of cholera, influencing the abundance and ecology of the pathogen naturally present in the environment and increasing exposure and risk of human infection.

In Ethiopia, despite major improvements seen in the increased access to healthcare, clean water, and improvement in maternal and child health, the country continues to be significantly affected by cholera outbreaks (7). From 2015 – 2022 several outbreaks of cholera have occurred in multiple parts of the country resulting in over 105,000 cases and thousands of deaths.

In line with the Global Roadmap for the Control and Elimination of Cholera, Ethiopia has prepared its National Cholera Elimination Plan - NCP (2021 – 2028) with aims to achieve interruption of cholera cases (zero cases) in cholera hotspot areas by 2028.

As of 30 January 2023, 1,055 cholera cases and 28 associated deaths reported from 66 kebeles of 8 woredas across Bale, Guji and West Arsi zones of Oromia and 2 woredas of Liban zone of Somali Region (8). Close to 1 million people are at high-risk in the 10 affected woredas.

The Oromia Moyale Woreda Health Office reported a suspected case of cholera in February 03, 2023. A team from Ethiopian Public Health Institute (EPHI) and Oromia Regional Health Bureau (ORHB) was deployed to the Woreda to investigate the outbreak. This study aimed to assess possible risk factors and source of the outbreak and to give response in the outbreak affected Moyale Woreda, Borena Zone, Oromia Region, Ethiopia.

Objectives

General objective

To assess possible source of the outbreak, identify potential risk factors and give response in Moyale Woreda, Borena Zone, Oromia Region, Ethiopia, 2023.

Specific Objectives

- To describe the outbreak in terms of person, place and time
- To identify the etiologic agent
- To assess source of the outbreak

Methods

Study area

The outbreak investigation was conducted in Moyale Woreda, Borena Zone, Oromia Region, Moyale is mainly Borena Market town on the border between Ethiopia and Kenya, and is the administrative center for two Ethiopian Woredas, Moyale Oromia Region and Moyale Somali Region. It is bordered on the south by Kenya, on the west by Dire, on the northwest by Arero, on the north by the Dawa River which separates it from Liben, and on the east by Dawa Zone Somali Region. Moyale is the main border post on the Nairobi-Addis Ababa road, lying north of the Dide Galgalu Desert. The population of Moyale Woreda was projected to be 181,215 of whom 88,795 (49%) were males and 92,420 (51%) females, based on the 2007 population census. The total number of households estimated to be 37,753. The Woreda consisted of one hospital, five health centers and 29 health posts. The altitude of the Woreda ranges from 1150 to 1350 meters above sea level.

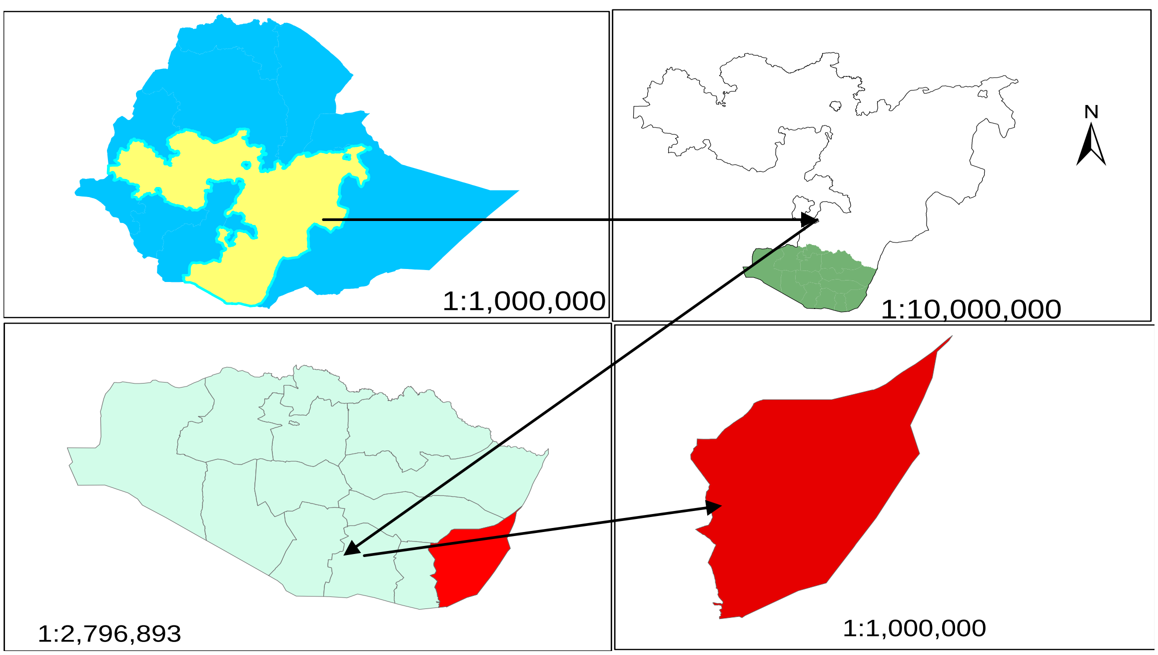

Figure 9 Map of Moyale Woreda, Borena Zone, Oromia Region, 2023

Study period

This study was conducted from April 25-June 20, 2023.

Study design

We conducted descriptive study of cases. We collected line lists and reviewed medical records of patients. We interviewed Woreda PHEM focal and surveillance officer. We assessed cholera treatment centers and ORPs during the investigation. We also assessed environmental hygiene and sanitation of patients during contact tracing.

Sample collection and Transportation

Nine stool samples were collected and transported to Regional Laboratories for conformation. Ten water samples collected from sources of drinking water for the community. We used standard transport medium for stool samples and the cold chain was maintained during transportation.

Data analysis

The collected data were analyzed using Epi-info version 7.2.4.0 and Microsoft Excel.

Case definition:

Suspected case: A case of cholera should be suspected when in an area where there is a cholera epidemic, a patient aged 2 years or more develops acute watery diarrhea, with or without vomiting.

Confirmed case: A suspected case in which Vibrio cholera O1 or O139 has been isolated from their stool.

Ethical clearance

Ethical clearance to conduct the investigation was obtained from the Ethiopian Public Health Institute (EPHI). A letter of support was written from EPHI to Moyale Woreda Health Office. Oral informed consent was obtained from participants.

Dissemination of Findings

The findings of the study were communicated to all concerned bodies, such as EPHI, Moyale Woreda Health Offices, mentors, supervisors, coordinators and to the Addis Ababa University, School of Public Health.

Results

Description of Cholera cases

The cholera outbreak began in February 03, 2023. The first suspected case was a merchant who came from Kenya. The outbreak spread and affected all 30 kebeles in the Woreda and the adjacent Somali Woreda. From February 03 - May 25, 2023, there were 740 cholera cases and three deaths (CFR 0.4%). The case fatality rate was higher in males (0.6%) and among age group >10 years (0.38%). The median age of cases was 20 years and the overall attack was 40.8 per 10000 population. The attack rate was higher among age group >10 year **Table 12.**

Table 12 Cholera outbreak attack rate and CFR by sex and age group in Moyale Woreda, Oromia Region, 2023

		Total Population	Number of cases	%	Death (CFR)	AR/10000
Sex	Male	88,795	446	60.3	03 (0.6%)	50
	Female	92,420	294	39.7	0	31.8
Age group	<5	29,775	136	18.4	1 (0.7%)	45.7
	5-10	56,492	74	10	0	13
	>10	94,948	530	71.6	2 (0.38%)	56

Majority of cholera cases were daily laborers 193 (26%). House wives 133 (18%) and Students 116 (15.7%) were also shared the high burden of the outbreak **Table 13**.

Table 13 Distribution of cholera cases by occupation Moyale Woreda, Oromia Region, 2023

Occupation	Number cases	%
Daily lobar	193	26
Student	116	15.7
Merchant	32	4.3
House Wife	133	18
Not applicable	162	22
Teacher	4	0.5
Waiter	8	1
Jobless	23	3.1
Driver	11	1.5
Farmer	11	1.5
Other	47	6.4

Distribution of Cases by Time

The index case was reported in February 26, 2015 E.C. Since then, the number of cases increased gradually. The highest number cases were reported in April 8, 2015 **Figure 10**. The outbreak was transmitted to the neighboring Woreda of Moyale Somali.

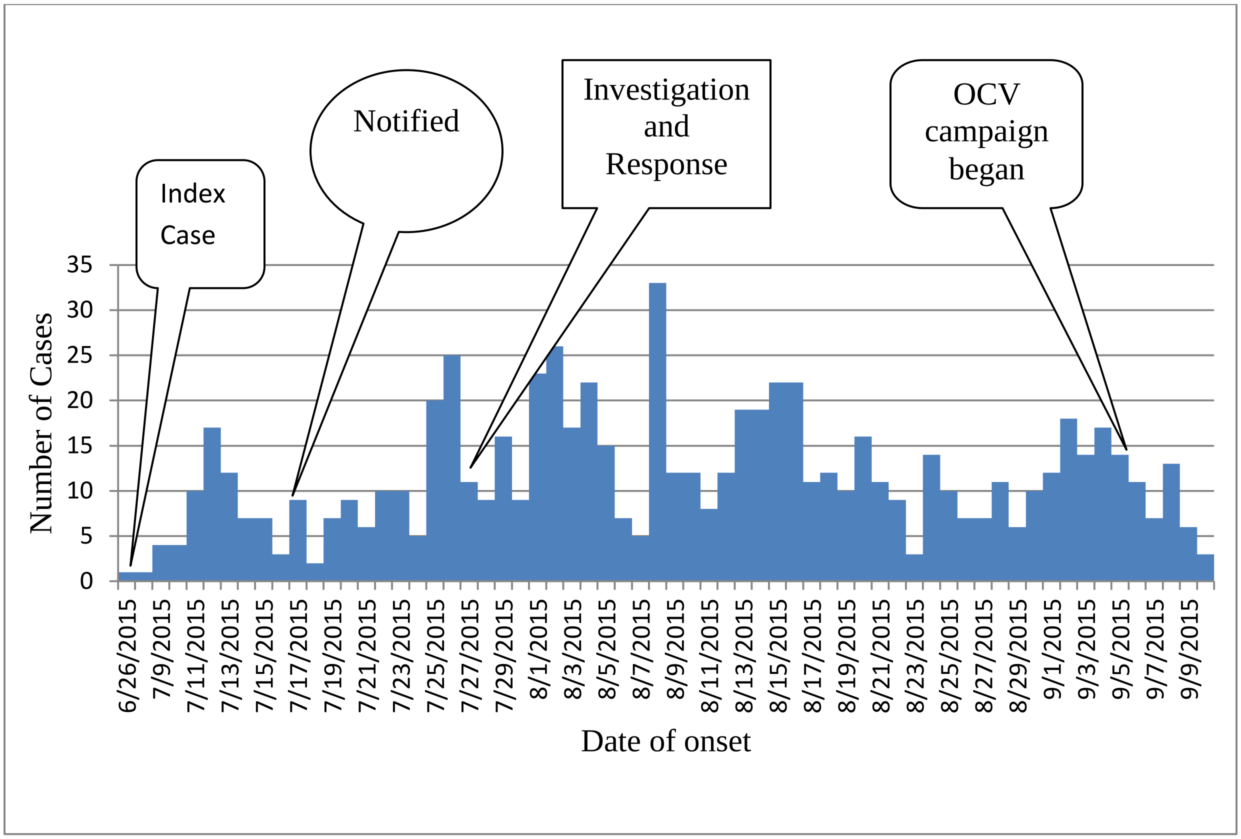

Figure 10 Epi cure of Cholera outbreak by date of onset in Moyale Woreda, Borena Zone, Oromia Region, 2023

The cholera outbreak started in WHO epidemiologic week 10 of 2023. The outbreak gradually increased and reached high in week 16 of 2023. After week 16, there was gradual decreaset of cholera cases **Figure 11**. The outbreak lasted for more than 10 weeks and it was contained after week 20.

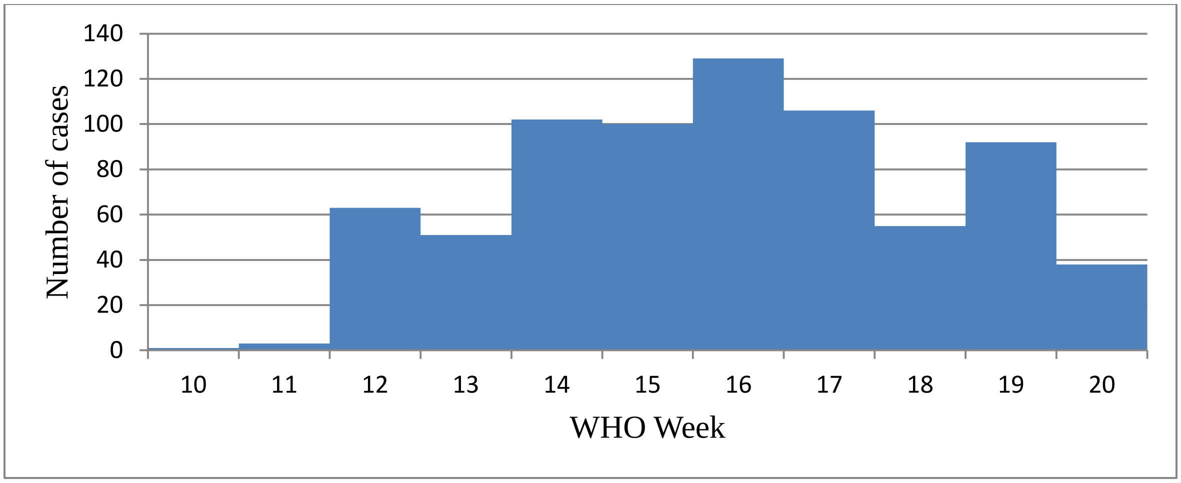

Figure 11 Distribution of cholera cases by WHO week Moyale Woreda, Borena Zone, Oromia Region, 2023

Distribution of Cases by place

The highest proportion of cholera cases were recorded in Moyale 02 Kebele (27.4%) followed by Moyale 01 Kebele (15.5%). The attack rate was high (109 per 10000 population) in Moyale 02 and Arbale Kebele. All 30 Kebeles of the Woreda were affected by the outbreak **Table 14**.

Table 14 Cholera cases distribution and attack rate by Kebele, Moyale Woreda, Oromia Region, 2023

S.N	Name of Kebele	Population	No. of cases	%	AR/10000
1	Moyale 01	18,130	115	15.5	63.4
2	Moyale 02	18,686	203	27.4	109
3	Arbale	7,998	87	11.8	109
4	Fugugi	6,610	19	2.6	29
5	Fulesa	6,267	37	5	59
6	Shewaber	7,003	48	6.5	68
7	Madomigo	6,768	32	4.3	47
8	Goro soda	3,368	6	0.8	18
9	Kebenawa	7,306	44	6	60
10	Goro bute	3,929	8	1.1	20
11	Chamuk	6,038	15	2	25
12	Ararsam	3,904	2	0.2	5

13	Galgalo dimtu	3,995	1	0.1	3
14	Tilemado	6,374	13	1.8	20.3
15	Lalabaje	3,849	1	0.1	3
16	Lagasure	7,046	5	0.7	7
17	Malab	4,669	26	3.5	56
18	Dambi Hara	4,031	2	0.2	5
19	Dambi Sapante	4,609	3	0.4	4
20	Dambi Chame	3,936	11	1.5	28
21	Bede	4,205	1	0.1	2.3
22	Iligigelu	3,805	2	0.2	5
23	Buledi	6,650	17	2.3	26
24	Bokola	5,452	4	0.5	7.3
25	Tuka	6,668	1	0.1	1.5
26	Mudi Ambo	4,503	2	0.2	4.4
27	Mado	5,921	32	4.3	54
28	Bika	2,536	1	0.1	4
29	Mormora	2,219	1	0.1	5
30	Argane	4,696	1	0.1	2

Sources of drinking water

Out of the total 740 cases, 633 (85.5%) of them used tap water and 58 (7.8%) ground water for drinking purpose

Table 15.

Table 15 sources of drinking water for cholera cases Moyale Woreda, Oromia Region, 2023

Sources of water	# of cases	%
River	6	0.8
Tap water	633	85.5
spring	3	0.4
well	8	1.1
Ground water	58	7.8
Rainfall	27	3.6
Other	5	0.7
Total	740	99.9

Availability of latrine

Regarding availability of latrine, 710 (96%) of the cases had latrine. But, based on the house hold level assessment, majority of the HHs had no hand washing facilities. Out of fifty households assessed during response period, 40 (80%) of them had no hand washing facilities **Figure 12**.

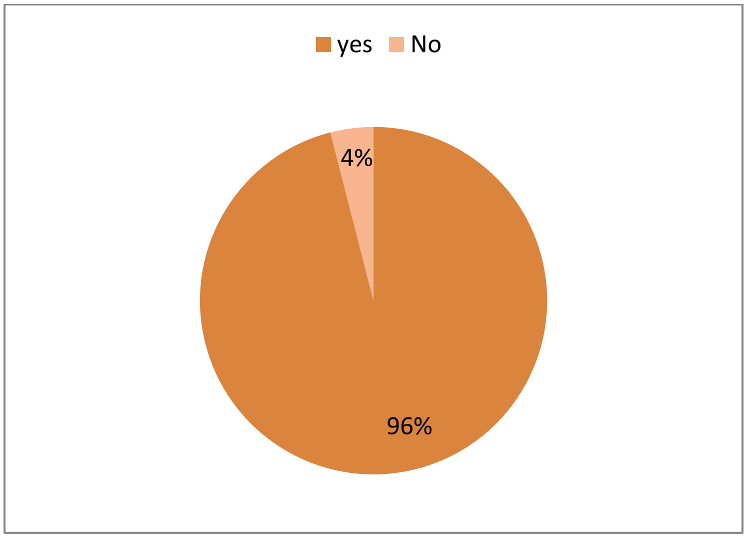

Figure 12 Proportion of cholera cases having latrine Moyale Woreda, Borena Zone, Oromia Region, 2023

Laboratory investigation

Nine stool samples were collected and sent to Regional laboratory; of nine samples seven of them were positive for *vibrio-Cholera* O1 serotype Ogawa. Seven samples tested by RDT and all were tested positive for vibrio cholera. Water Samples were taken from ten different ground water sources from which the community was using as source of drinking water. Of ten samples, nine (90%) of them were positive for fecal coliform bacteria. Chlorine Residual Test was conducted during household level assessment after the response and the result was 0.2 mg/l which indicated that the water was safe to drink.

Intervention taken to halt the outbreak

Coordination

The regional Health Bureau and Woreda Health Office were coordinating the overall preparedness and response activities. Coordination meetings were held weekly and the chair person was the Woreda Administration Head. There was multisectoral task force meeting composed of different professionals from health, water and communication offices. Surveillance, Case management, WASH, RCCE, and Regulatory teams were formed to run the response activities. Partners supported the response activities by providing technical and financial assistances.

Surveillance

Active case search and community surveillance were done in all outbreak affected kebelles. Contact tracing was done following index cases. Daily case follow up, registration, analysis and interpretation were conducted and reported for concerned bodies for decision making.

Case management

Cholera treatment center was established in Moyale Hospital and it functioned 24 hours. The CTC was established based on standard and provided with multi-disciplinary professionals to manage cases as per the national standard treatment guideline. Oral rehydration points have been established at health post level in all kebeles. Antibiotics, intravenous fluids, ORS and other necessary medical logistics were made available at CTC. Cholera cases were managed based on the degree of dehydration level. As of May 25, 740 cholera cases were treated in the CTC. Among those 55% of them were severely dehydrated **Figure 13**.

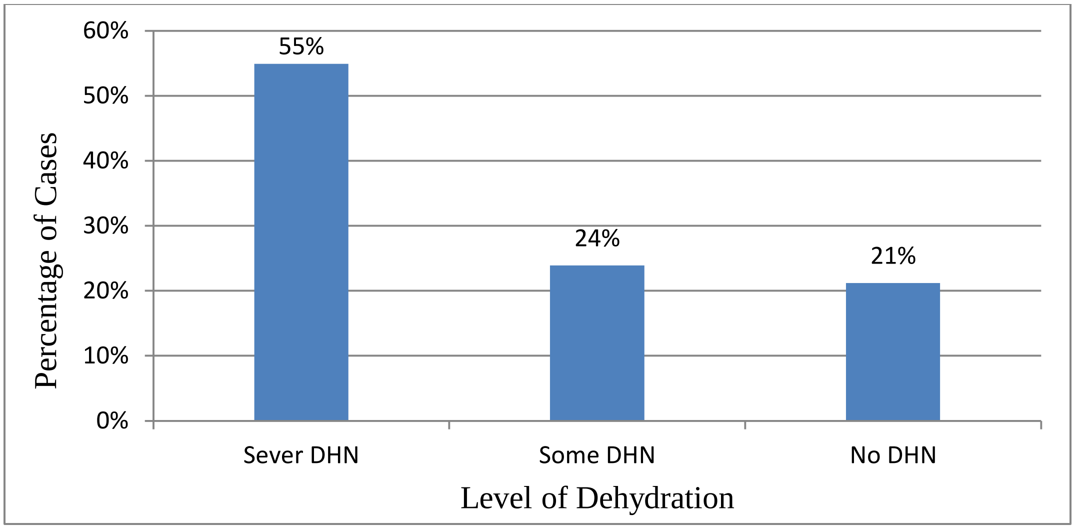

Figure 13 Dehydration Status of cases of cholera outbreak in Moyale Woreda, Boena Zone, Oromia Region, 2023

WASH

Government and partners have been working to improve water quality. Water treatment chemicals were distributed to all outbreak affected kebeles. Government and partners have distributed around 70,000 water treating tabs. Water trucks were providing water for CTC and in areas where there was shortage. Sources of water were treated to prevent further spread of the outbreak. Disinfection of cases houses and transportations were also done. Chlorine residual testing was conducted to check quality of drinking water.

Risk Communication and Community Engagement (RCCE)

Coordination meeting was conducted every Thursday b/n Partners and stakeholders, and daily meeting at Woreda Health Office level. Discussion was held between Moyale Somali, Moyale Oromia and border Kenya Health Office strengthen information sharing and community surveillance findings with each other. Kebele leaders, religious leaders and elderly people were part of the RCCE. Awareness creation activities were conducted using different means of communication with key cholera prevention messages. Discussion was held with food venders and oriented on water chlorination. Schools were visited and oriented on cholera prevention and control mechanisms.

Oral Cholera vaccine

The oral cholera vaccine (OCV) has been employed as one of the key interventions for the prevention and control of cholera outbreaks in Ethiopia since 2019. WHO recommends that the use of OCVs should be systematically considered as an additional measure to limit the spread of disease during cholera outbreak. The OCV campaign was conducted from May 17 – May 23, 2023 throughout the Woreda. All eligible individuals received the vaccine. The achievement of the campaign was 100%.

Capacity building

Capacity building training was given for health professionals by government and partners. The topics covered by sessions include, Coordination and leadership, cholera surveillance, cholera Outbreak management, Lab, IPC, CTC, RCCE, M&E and OCV. Totally 90 health professionals from Borena Zone Health Department and Moyale Woreda Health Office participated.

Discussion

Cholera outbreak began in February 3, 2023 in Moyale Woreda of Oromia. The outbreak was laboratory confirmed using culture at Oromia Regional Laboratory. Males were more affected by the outbreak. The attack rate was higher in Moyale 02 and Arbale kebeles and that might be since those kebeles were overcrowded and practiced poor waste disposal system. The outbreak expanded and affected adjacent Woredas of Somali Region and Teltele Woreda of Oromia.

A major risk factor for water-borne disease outbreaks, such as cholera, is the contamination of drinking water facilities (6). Following heavy rainfall in the Woreda, there was flooding resulted in contamination of ground water sources, thereby exacerbating preexisting water shortage.

Lack of basic hygiene and sanitation were predictor of diarrhea. High prevalence of cholera among daily laborers could be related to poor sanitation and hygiene practices. This was the same with the study done in Mille (9).

The overall attack rate (AR) of the outbreak was 40.8/10000 population; which is higher than the cholera outbreak attack rate 1.2/1000 population in Amibara Woreda AfarRegion (10). That might be related to poor environmental sanitation of the Moyale Woreda.

The WHO recommends antibiotics for cholera cases with severe dehydration. If left untreated, cholera has a 25-50% mortality rate (10). Treatment reduces this to less than 1%. The case fatality rate of Moyale Woreda was 0.4% which is inline with WHO recommendation.

Cholera cases management is based on degree of dehydration. People with severe cholera can develop severe dehydration, which can lead to kidney failure. In this outbreak, 55% of the cases developed severe dehydration. This finding is lower than the study conducted in Yemen (11).

Response to cholera outbreak requires the engagement of multiple sectors, line ministries, partners and other stakeholders. Unless there is a well-coordinated system to manage the flow of information and resources, the response activity will be difficult and its effectiveness compromised (12). The response activities in Moyale Woreda were well coordinated.

Conclusion

The cholera outbreak persisted in Moyale Woreda for more than ten weeks. Males were more affected by the outbreak. The use of contaminated water points were the most likely causes of this outbreak. The outbreak was confirmed using PCR culture test at Regional Laboratory. Poor hygiene and sanitation, overcrowding, high population movement, lack of clean water and poor waste disposal system might be possible contributing factors of the outbreak.

Recommendation

Government and humanitarian agencies should work on provision of safe water supply. Community hygiene and sanitation awareness should be enhanced. Proper waste disposal system should be practiced. We recommend robust surveillance and active participation of the community on prevention and control of cholera outbreak.

References

1. Azman AS, Rudolph KE, Cummings DAT, Lessler J. The incubation period of cholera: a systematic review. J Infect. 2013 May;66(5):432–8.
2. Deen J, Mengel MA, Clemens JD. Epidemiology of cholera. Vaccine. 2020 Feb;38 Suppl 1:A31–40.
3. Situation C. Cholera – Global situation. 2023;(February):1–10.
4. Regional W, Bulletin C. Cholera in the WHO African Region Cholera in the WHO African Region. 2023;(March):0–24.
5. Neamin Tesfay, Mengistu Biru. Three Consecutive Waves of Cholera Outbreak in Ethiopia (2015- 2017): Explanatory Analysis. Ethiop J Health Sci. 2020;30(4):469–78.
6. Constantin de Magny G, Thiaw W, Kumar V, Manga NM, Diop BM, Gueye L, et al. Cholera Outbreak in Senegal in 2005: Was Climate a Factor? PLoS One. 2012;7(8):1–9.
7. Ethiopian Public Health Institute. Multi-Sectorial Cholera Elimination Plan: Ethiopia 2021-2028. 2021;1–75.
8. Outbreak C, Update F. Cholera Outbreak - Flash Update #3. 2022;(November):28–30.
9. Bisrat S. Cholera outbreak investigation report in Mille woreda , Afar region , Ethiopia , 2019. 2022;
10. Marin MA, Thompson CC, Freitas FS, Fonseca EL, Aboderin AO, Zailani SB, et al. Cholera Outbreaks in Nigeria Are Associated with Multidrug Resistant Atypical El Tor and Non-O1/Non-O139 Vibrio cholerae. PLoS Negl Trop Dis. 2013;7(2).
11. Alassar MM, Adegboye OA, Emeto TI, Rahman KM, Olumuyiwa L. Original article Severe dehydration among cholera patients in Yemen : A cohort profile. 2020;10(December):338–45.
12. National Guideline for Cholera Surveillance and Outbreak Response. 2022;

CHAPTER- II

Surveillance Data Analysis Report

2.1 Malaria Surveillance Data Analysis Report in Southern Nations, Nationalities and Peoples Region, of Ethiopia, 2016-2020

Abstract

Background:

Malaria is a life-threatening disease caused by parasites belonging to the genus *Plasmodium* transmitted from infected individuals to other people via the bites of infected female Anopheles mosquitoes. Malaria remains a worldwide public health problem causing a significant number of morbidity, mortality, and huge economic loss despite an intensive implementation of interventions. It is preventable and curable disease. Globally 229 million new malaria infections and 409, 000 deaths occurred in 2019. The World Health Organization (WHO) African Region, with an estimated 215 million cases in 2019, accounted for about 94% of cases (1). In Ethiopia, malaria is highly seasonal, unstable with epidemic-prone transmission pattern in many parts of the country. *Plasmodium falciparum* (70 percent) and *P. vivax* (30 percent) are the major malaria parasites (2). The Southern Nation, Nationalities and Peoples Region is also one of malaria endemic Region in Ethiopia. According to Abebe 2014 there were 171,701 malaria inpatients and 3,580 deaths with CFR of 2.1% in the region (3). Routine malaria surveillance data is useful for assessing incidence and trends over time and in stratification for targeting of malaria. The reporting completeness and potential bias of such data needs assessment.

Methodology:

Five year retrospective data (2016-2020) of malaria which were reported to the Ethiopian Public Health Institute (EPHI) was analyzed to describe the epidemiology of malaria in the Southern Nations, Nationalities and Peoples Region of Ethiopia**.** Data analysis was conducted using Microsoft excel and epi info version 7.

Results:

The Southern Nation, Nationalities and Peoples Region reported a total of 1,278,467 (98.46%) laboratory confirmed and 19,934 (1.54%) clinical Malaria cases during the last five years (2016-2020) with case fatality (CFR) rate of 0.6%. Out of 1,288,603 (99.25%) outpatient and 9,798

(0.75%) admission cases a total of 59 deaths were reported. From a total of 1,278,467 laboratory confirmed outpatient cases, 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax*. The highest confirmed malaria cases due to *P. falciparum* were reported in 2019 and 2020 with 206,956 (66.10%) and 177,144 (66.40%) caseloads respectively.

Conclusion:

The incidence of confirmed and clinical malaria cases decreased in the Southern Nation, Nationalities and Peoples Region. Malaria morbidity also significantly declined in 2020. Gamo Gofa, South Omo and Wolayita Zones were the three Zones with the highest confirmed and clinical malaria cases. They contributed 673,915 (52%) of the total Regional cases. But regarding mortality Wolayita Zone was the first with 18 (30%) of total regional mortality related malaria. To reduce the burden of malaria related morbidity and mortality, malaria vector control, malaria diagnosis and treatment, and malaria surveillance acclivities should be strengthen.

Keywords: Descriptive study, Malaria, Surveillance.

Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. It is preventable and curable. Malaria is caused by *Plasmodium* parasites. The parasites are spread to people through the bites of infected female Anopheles mosquitoes. There are 5 parasite species that cause malaria in humans, and 2 of those species – *P. falciparum and P. vivax* – pose the greatest threat (4).

Malaria is an acute febrile illness. In a non-immune individual, symptoms usually appear 10–15 days after the infective mosquito bites (4). The first symptoms – fever, headache, and chills – may be mild and difficult to recognize as malaria. Fever is the cardinal symptom of malaria. It can be intermittent with or without periodicity or continuous. Many cases have chills and rigors. The fever is often accompanied by headache, myalgia, arthralgia, anorexia, and nausea and vomiting. The symptoms of malaria can be non-specific and mimic other diseases, like viral infections, enteric fever etc.

The latest WHO report indicates that, there were 229 million cases of malaria in 2019 compared to 228 million cases in 2018 (5). The estimated number of malaria deaths stood at 409 000 in 2019, compared to 411 000 deaths in 2018. The WHO African Region continues to carry a disproportionately high share of the global malaria burden (6). In 2019, the Region was home to 94% of all malaria cases and deaths. According the report, Children under 5 years of age are the most vulnerable group affected by malaria; in 2019 they accounted for 67% (274 000) of all malaria deaths worldwide (5).

There have been over 9 million cases of malaria in the East Africa since January 2016, according to the report by the United Nation Humanitarian Office (6). Even though Malaria prevention and control interventions have recently undergone major scale-up in Africa, Malaria disease burden is reported in several countries, including Ethiopia and other East African countries. There is complexity within countries, including large geographical variation in incidence and differing upward or downward trends between indicators (7).

Ethiopia is one of the malaria endemic countries in the world, with 60% of the population being at risk of infection (8). In Ethiopia, malaria is a serious public health concern and has great impact on socio-economy. It has long been a serious public health threat causing a significant number of sickness and deaths each year, and one of the top ten causes of morbidity in 2018 (9). The disease occurs throughout the year with considerable seasonal and geographical variations across the Country. The peak times of transmission range from September to December, following the main rainy seasons (June to September). *Plasmodium falciparum and Plasmodium vivax* are the two dominant parasites, contributing to 60% and 40% of morbidity, respectively (8).

In 2020, COVID-19 emerged as an additional challenge to the provision of essential health services worldwide (10). According to the WHO malaria report, most malaria prevention campaigns were able to move forward this year without major delays. Ensuring access to malaria prevention, such as insecticide-treated nets and preventive medicines for children – has re supported the COVID-19 response strategy by reducing the number of malaria infections and, in turn, easing the strain on health systems (5). Interventions aimed at curbing transmission of COVID-19, such as restrictions of movement, absenteeism, behavioral changes, closure of institutions and interruption of supply chains, are also expected to result in malaria prevention activities being scaled back (11).

In the Southern Nation, Nationalities and Peoples Region, about 26% of the population is at-risk of malaria and the disease is a primary cause of outpatient and inpatient consultations and hospital deaths (12).

Statement of the problem

Malaria is a life-threatening disease caused by parasites belonging to the genus *Plasmodium* and transmitted from infected individuals to other people via the bites of infected female Anopheles mosquitoes. Malaria remains a worldwide public health problem causing a significant number of morbidity, mortality, and huge economic loss despite intensive implementation of interventions. It is a preventable and curable disease.

Globally, 229 million new malaria infections and 409, 000 deaths occurred in 2019. The World Health Organization (WHO) African Region, with an estimated 215 million cases in 2019, accounted for about 94% of cases (5). Routine malaria surveillance data is useful for assessing incidence and trends over time and in stratification for targeting of malaria. The reporting completeness and potential bias of such data needs assessment.

Approximately 60% of the Ethiopian population live in malaria at risk areas. In 2018 alone, there were 904,495cases and 213 deaths of malaria in Ethiopia (13). The highest morbidity, 724,996 (80.1 %), was due to *P. falciparum*, while remaining 166,340 (18.4 %) and 13,159 (1.5 %) were due to *P. vivax* and mixed infection *(P. falciparum + P. vivax),* respectively (14).

In the Southern Nations, Nationalities and Peoples Region, about 26% of the population is at-risk of malaria and the disease is a primary cause of outpatient and inpatient consultations and hospital deaths (15). .

Outbreaks of malaria commonly occurred in Southern Nations, Nationalities and Peoples Region of Ethiopia and they have been reported to the EPHI during 2016-2020.

Significance of the study

In Ethiopia, malaria is a serious public health concern and has great impact on socio-economy. The trend analysis of malaria data from health facilities is useful for understanding its transmission dynamics and implementing evidence-based malaria control strategies. It is a serious public health concern in Ethiopia tracked by Public health emergency Management (PHEM) surveillance system. Reliable data can improve health promotion programs, and help policy makers and investors allocate resources effectively. Hence, this surveillance data analysis was conducted to review the epidemiology of the disease in the Southern Nations, Nationalities and Peoples Region of Ethiopia 2016-2020 in order to observe the trend and seasonality, to assess the burden and distribution, and to make possible recommendations in an attempt to improve future interventions against the disease.

Literature Review

Global malaria trend

Malaria is a life-threatening infectious disease caused by the protozoan parasite. Despite the availability of interventions, malaria remains to be a major public health problem. Globally, an estimated 3.3 billion people are at risk of malaria and it is a major health problem in tropical and subtropical regions (16). The World Health Organization estimates about 229 million new cases of malaria in 2019 in the world (17). Most of these malaria cases were in the WHO African Region (94%). Similarly, there were 409,000 malaria deaths estimated in the globe. Most of those deaths occurred in the WHO Africa Region (94%). Malaria is one of the major diseases of poor people in developing countries. The bulk of the global malaria burden is in sub-Saharan Africa, with the highest global cases and deaths. It is adversely affecting the health of the peoples as well as the economic development of many developing countries, particularly in sub-Saharan Africa (17).

Malaria in Ethiopia

Ethiopia is one of the few countries with unstable malaria transmission. Consequently, malaria Epidemics are serious public health emergencies. Approximately 58 mil people (68%) live in malaria endemic areas, mainly at altitudes below 2,000 meters (18). The main malaria parasites are *Plasmodium falciparum* and *Plasmodium Vivax*, accounting for 60% and 40% of all cases, respectively (19).

The peak periods of malaria incidence occur between September and December, following the main rainy seasons (June-September) and from March to May during and after the small rainy seasons (February-March). Since 2005, Ethiopia has scaled-up one of the largest and most ambitious malaria control programs in Africa (20).

In 2018 alone, there were 904,495 cases and 213 deaths from malaria in Ethiopia. The highest morbidity, 724,996 (80.1 %), was due to *P. falciparum*, while remaining 166,340 (18.4 %) and 13,159 (1.5 %) were due to *P. vivax* and mixed infection *(P. falciparum + P. vivax), respectively* (21).

Malaria situation in SNNPR

In the Southern Nations, Nationalities and Peoples Region, about 26% of the population is at-risk of malaria and the disease is a primary cause of outpatient and inpatient consultations and hospital deaths (22). According to the Regional Health Bureau Report, an epidemic occurred in September 2004 and August 2005 in 110 kebeles of 47 malarious Districts in the Region (15).

As a study conducted in six health centers of Wolaita Zone indicated, a total of 317,867 blood films were seen in all the six health centers within five years' period from 2008/9 to 2012/3 (23), among those, a total of 105,755 laboratory confirmed malaria cases were reported from all the six health centers, with total slide positivity rate (SPR) of 33.27% and mean annual prevalence of 21,151 cases. Based on the findings of the study, the predominantly reported species was *P. falciparum*, accounting for 75,929 (71.80%) of the total occurrence, followed by *P. vivax* and mix of both species infection with *P. falciparum and P. vivax*, each constituting 25,329 (23.95%) and 4,497 (4.25%), respectively.

A retrospective study of eight-year malaria data conducted in Gedeo Zone, southern Ethiopia signifies that the case burden due to *P. falciparum* (49.74%) was comparable to *P. vivax* (47.59%). the study indicates, *P. vivax* overtook *P. falciparum* in cases burden during 2013, 2014 and 2017 (24).

A study conducted in Boricha District, Southern Ethiopia indicates that among 135,607 malaria suspected cases examined during 2010 to 2017, 29,554 (21.8%) were positive (25), among those positive cases, 85,632 (63.1 %) were diagnosed by microscope and the remaining 49,975 (36.9 %) by RDT. Of all confirmed cases, 15,250 (51.6%) were adults of 15 years and above, and the remaining 7,230 (24.5%) and 7,074 (23.9%) were children of age 5–14 and < 5 years, respectively. Children < 15 years accounted for 48.4%. Regarding the gender distribution, 51.4% of overall confirmed cases were males and 48.6% were female.

In the study conducted from 2013-2017 in Halaba Special District, In Southern Ethiopia highest malaria case was reported (41.2 %) in 2013 (26). According to the study the prevalence of *P.*

vivax was seen increased, the lowest prevalence was (56.5 %) in 2013 and the highest prevalence was (67.2 %) in 2017, while the *P. falciparum* was observed to be decreasing from 43.5% in 2013 to 5.1% in 2017. The study revealed that, the prevalence of P. falciparum was 38.7%, whereas that of P. vivax was 61.3%.

A trend analysis of malaria conducted in Hana and Keyafer Health Centers, South Omo Zone, Southern Ethiopia showed that a total of 22,494 laboratory confirmed malaria cases were reported in the year 2008-2014, and the mean annual prevalence of malaria was 3,213, with total slide positivity rate (SPR) of 41.53% (27). The seven years' trend of malaria occurrence showed a fluctuating trend. The study indicated that prevalence had shown slight fall from 2008 to 2009. Then, from 2010 to 2012, it had shown a sharp rise, and peak malaria cases were reported in 2012 after which the prevalence had shown a sharp fall till 2014.

A cross-sectional survey conducted on Prevalence of malaria infection in Butajira area, indicated that the overall prevalence of malaria was found to be 0.93% (28). The survey also indicated that prevalence varied among villages, with the highest prevalence of 2.8% in Dadesso and Horosso, and the lowest prevalence (0.0%) at Sunke Wenz and Akababi village. The highest prevalence was found at low altitude between October and November 2009.

Objectives

General objective

The overall objective of this study was to describe malaria distribution by person, place, time; to assess yearly trend of malaria in SNNPR 2016 to 2020.

Specific Objectives

- To describe malaria distribution by time in SNNPR
- To describe distribution of malaria by place in SNNPR
- To describe malaria distribution by person in SNNPR
- To assess yearly trend of malaria disease in SNNPR

Method and materials

Study Area

SNNPR is the third largest region in Ethiopia in terms of population, and is located in the south west of the country. 2019 projection based on the 2007 Census, Central Statistical Agency (CSA), its estimated population is approximately 20 million people, which makes up 20 per cent of the Ethiopian population .The region is one of the most populous parts of Ethiopia, with a density of approximately 151 people per square kilometre. The SNNPR is divided into 15 administrative zones, 133 Woredas/Districts. The Districts included 3,602 rural kebeles (lowest administration units) and 324 towns. The SNNPR is an extremely ethnically diverse region of Ethiopia, inhabited by more than 80 ethnic groups, of which over 45 are indigenous to the Region. Hawassa is the Administrative Center of the Region.

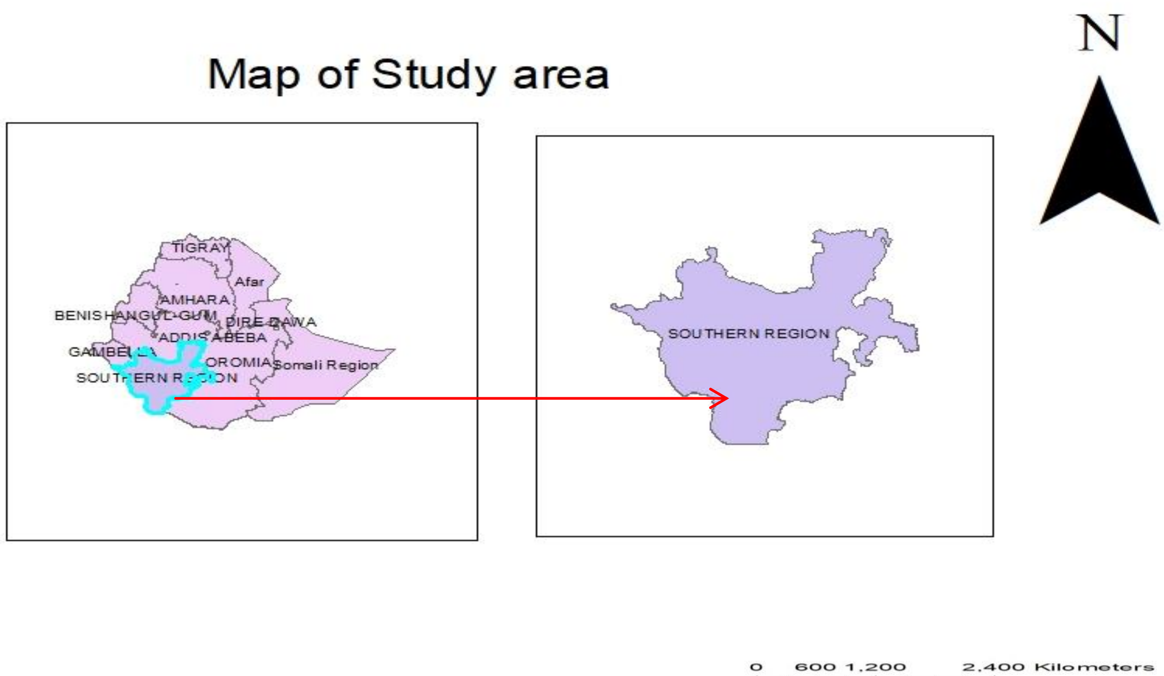

Figure 14 Map of SNNPR, Ethiopia 2020

Study Design

This study applied a retrospective analysis of the data collected from 2016 to 2020.

Data Source

Malaria surveillance data reported from SNNPR to the Ethiopian Public Health Institute (EPHI) Public Health Emergency Management (PHEM) Department between 2016 and 2020 through line list and case based format was requested and used.

Study Units

All malaria cases regardless of age and sex reported from SNNPR to the Ethiopian Public Health Institute (EPHI) during the study period (2016–2020) were included in this analysis.

Sample size and Sampling Method

The study included all Malaria cases reported from the study area during 2016-2020.

Data Collection Procedure

Line list and case based data of Malaria cases from 2016 to 2020 were collected from EPHI Public Health Emergency Management Department. Data cleaning, encoding and analysis were done using Microsoft Office Excel 2016 and epi info version 7. Demographic characteristics of reported cases and trends in cases reported over time were assessed.

Malaria Case Definition

Suspected Case:

Any person with fever or fever with headache, rigor, back pain, chills, sweats, myalgia, nausea, and vomiting diagnosed clinically as malaria.

Confirmed Malaria case:

A suspected case confirmed by microscopy or RDT for plasmodium parasites.

Data analysis procedure

Data were entered and analyzed using Microsoft excel and epi info version 7. After data organization and cleaning, descriptive analysis was done. Results were presented using graphs, tables and charts.

Ethical issues

An official letter was written to the Ethiopian Public Health Institute /EPHI / from the Addis Ababa University School of Public Health. Permission was obtained from Public Health Emergency Management /PHEM/ Department then, five years SNNPR Malaria data were accessed to carry out this analysis. Confidentiality was assured and maintained.

Data dissemination

The findings of the Malaria surveillance data analysis were shared with the SNNPR Health Bureau, AAU/SPH, mentors, supervisors, and program coordinators of AAU/SPH/EFETP.

Results

Malaria Morbidity and Mortality Trend

The Southern Nation, Nationalities and Peoples Region reported a total of 1,278,467 (98.46%) laboratory confirmed and 19,934 (1.54%) clinical Malaria cases during the last five years (2016-2020) with case fatality (CFR) rate of 0.6%. As it is depicted in **Table 16** the highest and lowest case fatality rate was recorded in 2018 and 2020 respectively. Out of 1,288,603 (99.25%) outpatient and 9,798 (0.75%) admission cases a total of 59 deaths were reported. On average, the region reported 259,680 malaria cases each year during the past five years. The highest number of cases 317,591 (24.46%) were reported in 2019.

Table 16 Annual reported malaria cases and deaths SNNPR, Ethiopia, 2016-2020

Year	Annual malaria case	Percentage	Annual malaria In Patient Deaths	Average monthly reported case	Average weekly reported case	Annual In patient case	CFR
2016	289,044	22.26%	13	24,087	5,558	2,662	0.48%
2017	240,047	18.48%	13	20,003	4,616	1,998	0.65%
2018	181,707	14%	15	15,142	3,494	1,041	1.44%
2019	317,591	24.46%	10	26,465	6,107	1,901	0.5%
2020	270,012	20.79%	8	22,501	5,192	2,196	0.36%
Grand Total	**1,298,401**	**100.00%**	**59**	**108,198**	**24,967**	**9,798**	**0.6%**

The following (**Figure 15**) presented the total malaria cases which were seen by SNNPR in the year 2016 to 2020. Malaria caseload decreased from 2016 to 2018 but in the year 2019 the case number sharply increased by 74% from the year 2018 and reached 317,591. Based on National PHEM office document that was tried to assess, the highest malaria cases were seen by the year 2019, which was equal to 317,591 (24.46%) of the total cases, and the least cases were recorded in the year 2018 with 181,707 (26%) of the total case numbers. As it is displayed in **Figure 15**, numbers of malaria cases were decreased in the year 2020 compared to 2019.

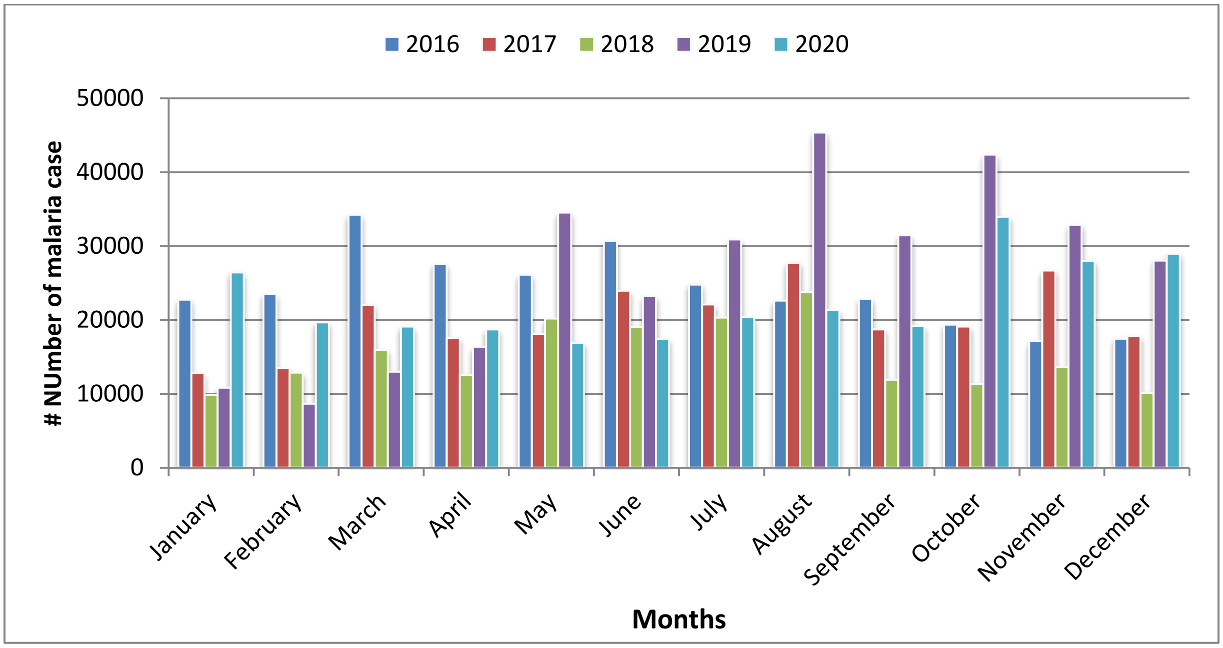

Figure 15 Total suspected and confirmed malaria cases by Month SNNPR, Ethiopia, 2016-2020.

As displayed on the figure 2 the highest monthly malaria case load was recorded in August of year 2019 to 45,355 followed by October of same year with caseload of 42,360. The lowest monthly case was also recorded in the same year in February 8,658 cases/month. Compared to August, the February caseload had a decrement of 36,697 (81%).

Distribution of Malaria Case by Place

From Southern Nation, Nationalities and Peoples Region, 15 zones and 10 towns reported suspected and confirmed malaria case during the last five years. From a total of reported malaria cases, the highest cases were reported from, Gamo Gofa, South Omo and Wolayita Zones with case number of 281,844, 221,566 and 170,505 respectively **Table 17**. The three zones accounted for 673,915 cases which is 52% of the total regional cases. The least cases were reported from Gofa, West Omo and Yem Towns with 197, 308 and 695 cases. They accounted for 0.09% of the total regional case.

In 2016, the highest malaria cases reported from Gamo Gofa, Wolayita and South Omo Zones 62525 (21.6%), 48983 (16.9%) and 36892 (12.7%) respectively. Yem Town 149 (0.05%) and Kefa Zone 1552 (0.53%) reported the least malaria cases. In 2017, Gamo Gofa Zone reported the highest cases of malaria 57851 (24%) and in 2018, South Omo Zone was the leading by reporting 49964 (27%) cases.

Table 17 Reported Malaria cases by zone and Towns by year SNNPR, Ethiopia, 2016-2020.

	Years					
Zones/Towns	**2016**	**2017**	**2018**	**2019**	**2020**	**Total**
Basketo Town	3190	6379	6430	6907	4124	27030 (2.08%)
Bench Maji	11418	16837	18020	23384	17421	87080 (6.7%)
Dawuro	11278	11770	7888	10560	11289	52785 (4.1%)
Gamo					3726	3726 (0.3%)
Gamo Gofa	62525	57851	31917	72286	57265	281844 (21.7%)
Gedeo	10307	4674	3896	7394	5382	31653 (2.4%)
Gofa					197	197 (0.02%)
Gurage	21204	8279	4032	8164	5036	46715(3.6%)
Hadiya	21620	9099	3796	11486	15221	61222 (4.7%)
Halaba	3071	2210	742	2352	5321	13696 (1.05%)
Hawassa Town	5806	8645	8996	17468	6911	47826 (3.68%)
Hawella Tulla					1933	1933 (0.15%)
Kefa	1552	2453	4195	6213	5733	20146 (1.55%)
Kembata Tembaro	15809	7370	3140	4119	6818	37256 (2.87%)
Konso					2821	2821 (0.22%)
Konta Town	2701	4339	3157	3592	2987	16776 (1.3%)
Segen	14392	14239	11343	23910	14455	78339 (6.03%)
Sheka	3640	4709	2782	5200	3328	19659 (0.015%)
Sidama	11237	9395	5421	12454	7365	45872 (3.5%)
Sidama ZHD					10431	10431 (0.8%)
Siliti	3270	1491	209	883	12467	18320 (1.4%)
South Omo	36892	48367	49964	42675	43668	221566 (17.1%)
west omo					308	308 (0.02%)
Wolayita	48983	21759	15691	58390	25682	170505 (13.1%)
Yem Town	149	181	88	154	123	695 (0.05%)
Grand Total	**289,044**	**240,047**	**181,707**	**317,591**	**270,012**	**1,298,401 (100%)**

As it is displayed in **Figure 16** Gamo Gofa, South Omo and Wolayita Zones reported the highest cases during the past five years while Sidama, Gurage and Hawasa Town reported the least cases compared to other Zones in the region.

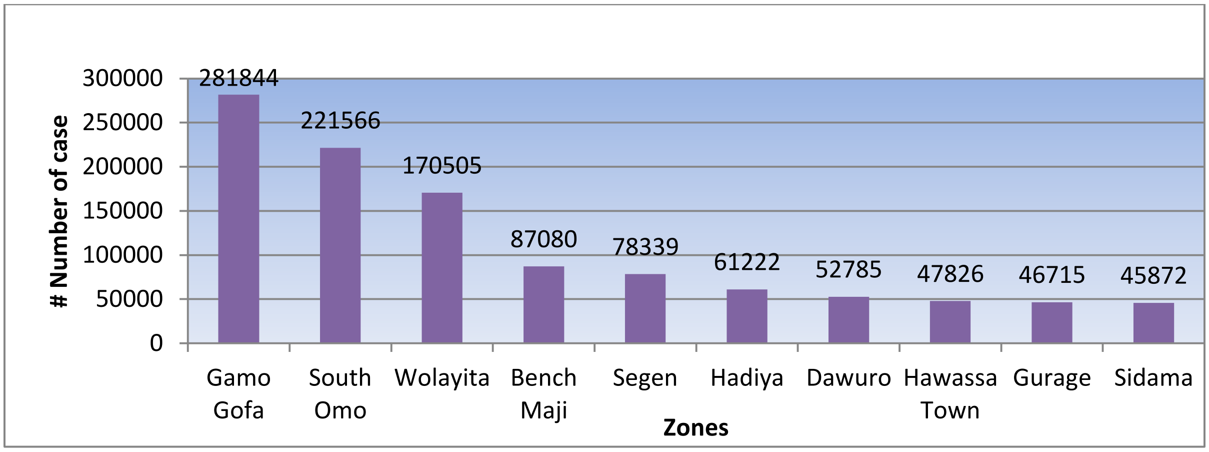

Figure 16 Top 10 Zones with reported Malaria cases SNNPR, Ethiopia, 2016-2020.

All top ten Woredas with reported malaria cases had almost similar distribution except Selamago Woreda which reported the highest 75,745 malaria caseload during the past five years. Uba Debretsehay and Deramalo woreda reported 31776 and 31398 cases respectively during the past five years. As it is illustrated in Figure 17Arba Minch Town reported the least cases among the Woredas.

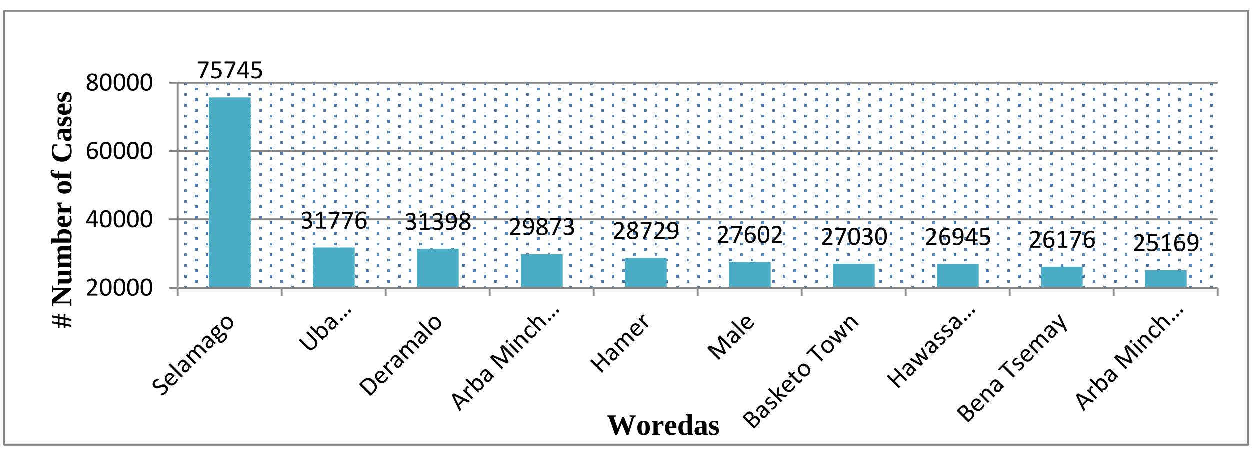

Figure 17 Top 10 Woredas with reported Malaria cases SNNPR, Ethiopia, 2016-2020.

Malaria Morbidity Trend by Time and Place

In 2016, the highest cases were recorded in week 13, (8191) and the lowest cases in week 52 (3235) cases. In week 31 of 2017, 5954 cases were reported which was the highest, and the lowest cases in the 1st week, 2930 cases. During the past five years the highest weekly cases were recorded in week 31 of 2019 9429 cases and the lowest cases in the second week of 2019 which was 2054 cases. As it is displayed in **Figure 18**, both the highest and the lowest weekly cases were recorded in the year 2019.

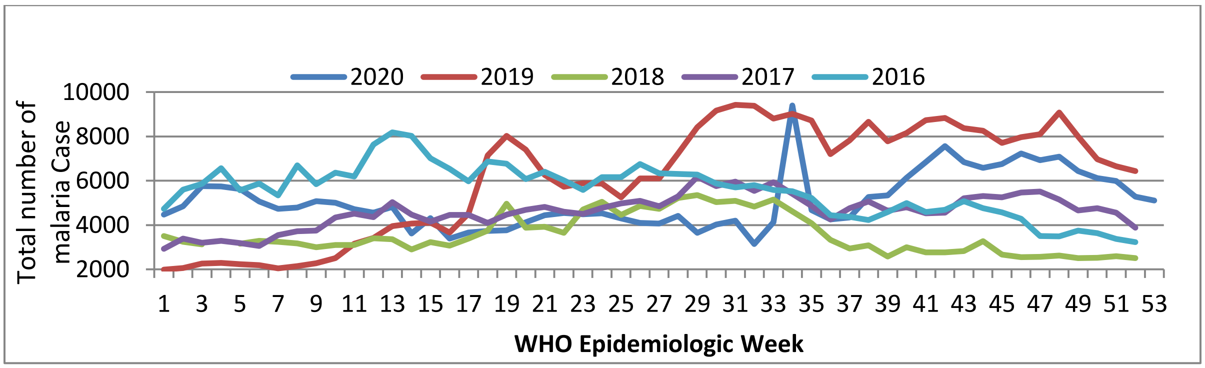

Figure 18 Total suspected and confirmed malaria cases by week SNNPR, Ethiopia, 2016-2020.

SNNPR Malaria Mortality Trend by Place and Time

As it is depicted on **Figure 19** the highest mortality rate was occurred in 2018 with case fatality rate CFR of 1.44% followed by 2016 and 2017 with CFR of 0.48% and 0.65% respectively. The overall mortality trend showed slight increment in 2018, and then the mortality trend decreased in 2019 and 2020 despite the sharp escalation in total malaria caseload in 2019. In the year 2016 and 2017 mortality was the same which was 13 deaths.

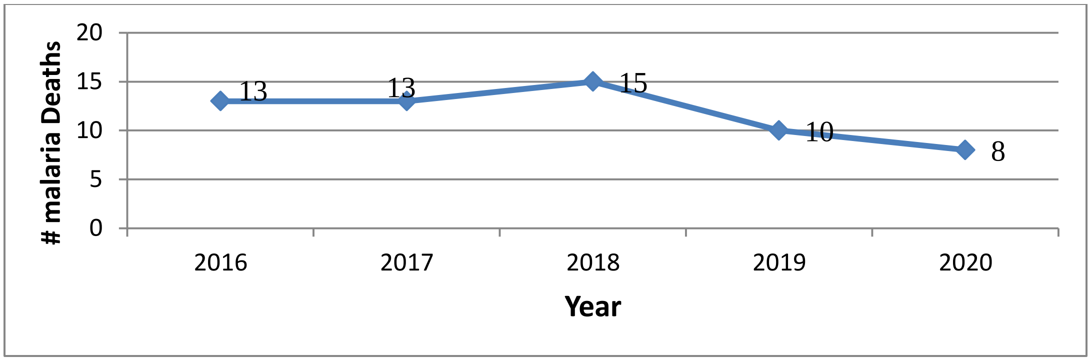

Figure 19 Annual Malaria in patient death SNNPR, Ethiopia, 2016-2020

Malaria Outpatient Cases **Trend by Time and Place**

In SNNPR Malaria outpatient cases vary from year to year. The outpatient malaria case trend was highest in 2019 and it was lowest in 2018. The 2019 outpatient case number exceeds from its previous year by 135,024 cases (around 75%). The highest outpatient caseload 280,276 was reported from Gamo Gofa zone and the least from Gofa which is 197. The peak weekly outpatient caseload was recorded on week 31 of 2019. The overall outpatient trend of the disease is displayed in the following **Figure 20**.

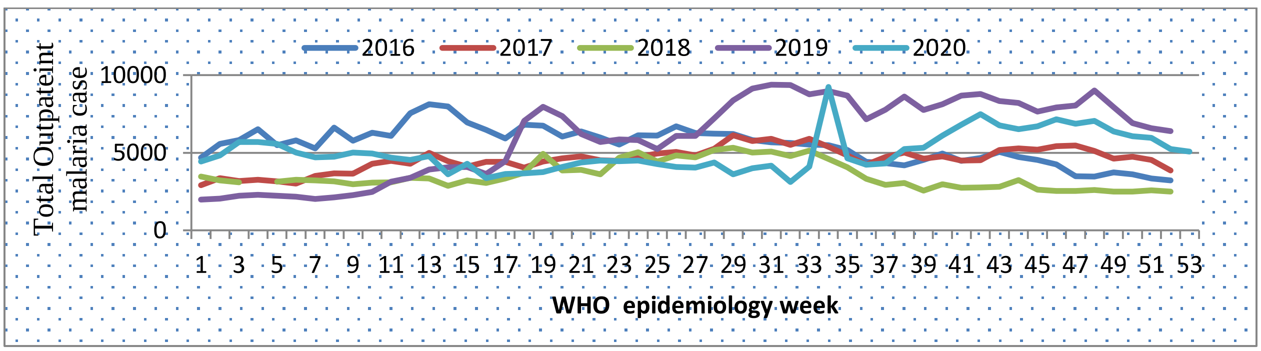

Figure 20 Total malaria Outpatient cases by week SNNPR, Ethiopia, 2016-2020.

Malaria Inpatient Cases **Trend by Time and Place**

The SNNPR reported a total 9,798 admitted malaria cases during the past five years. The highest inpatient report was documented in 2016 with a total of 2,662 admitted cases and the least in 2018 1,041. In the 2019, Wolayita zone reported the highest 1,231 admitted cases. The highest weekly cases were observed on week 32 of 2016 with 167 cases. The other high inpatient cases were reported on week 34 of 2020 to 142 admissions per week **Figure 21**.

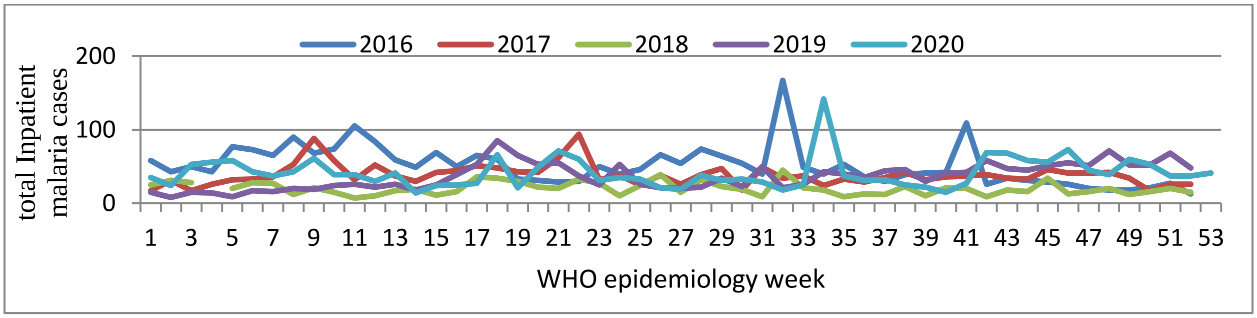

Figure 21 Total malaria Inpatient cases by week SNNPR, Ethiopia, 2016-2020

Trend of Malaria Species

From a total of 1,278,467 laboratory confirmed outpatient cases in SNNPR; 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax.* Within the Past five years period in SNNPR, *Plasmodium falciparum* accounted for majority of outpatient cases in the region. The highest confirmed malaria cases due to *P. falciparum* were reported in 2019 and 2020 with 206,956 (66.10%) and 177,144 (66.40%) caseloads respectively. The percentage of malaria species in the past five years displayed below in **Figure 22**.

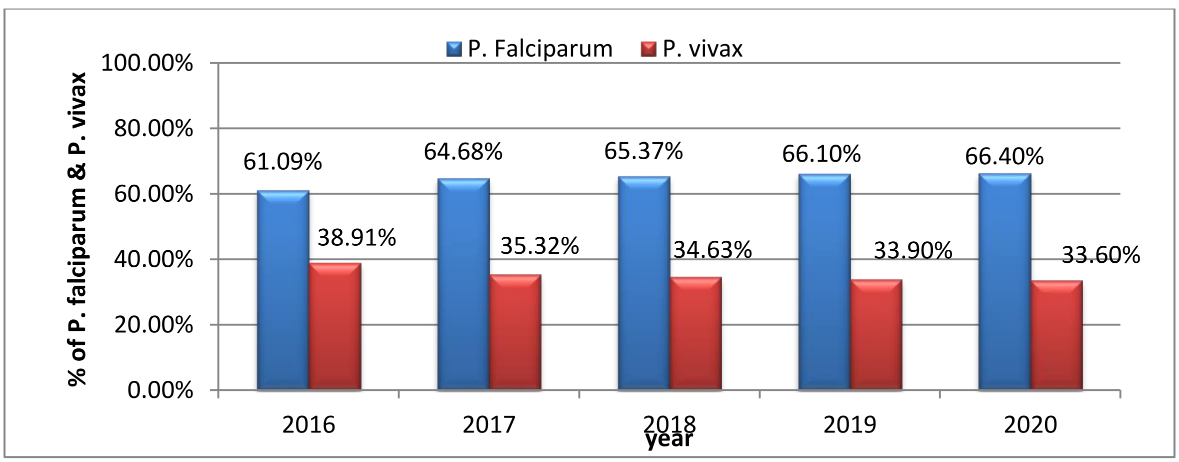

Figure 22 Trend of *P. falciparum and P. vivax* malaria cases SNNPR, Ethiopia, 2016-2020

As it is displayed on **Figure 23** in 2016 March (21,699) April (18,074) and June (18,287), had the highest cases of *P. falciparum*. November (9,317) was the lowest. In August 2019 and October 2020 the highest *P. falciparum* case numbers 30,396 and 21,935 were, respectively, registered. The highest and lowest annual *P. falciparum* cases were recorded in 2019 (206,956) and 2018 (117,751) respectively.

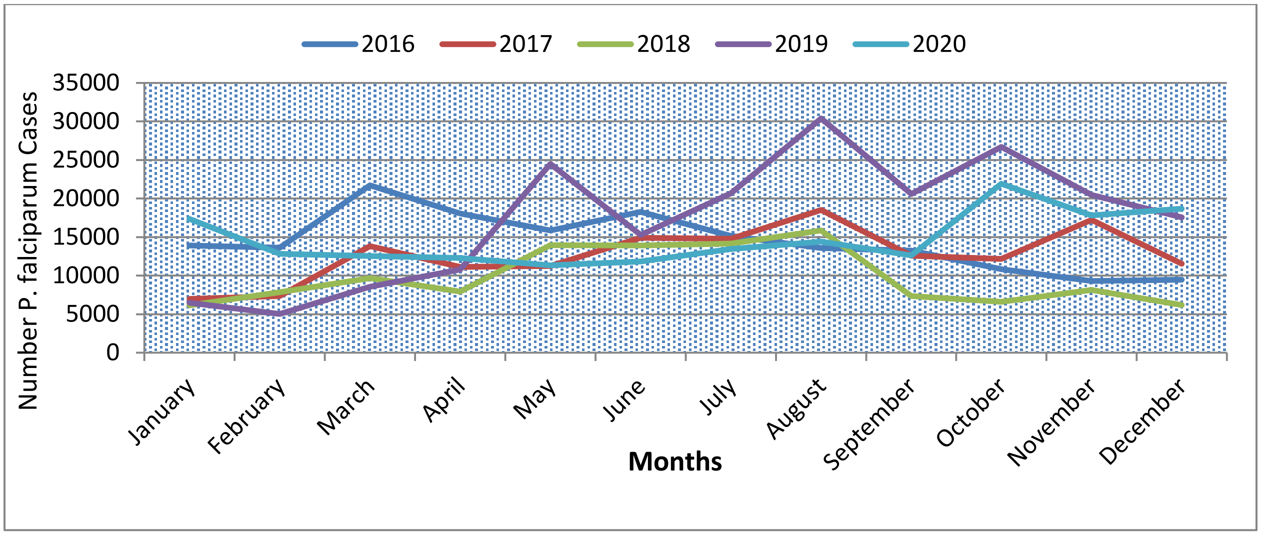

Figure 23 PF cases by Month in SNNPR from 2016–2020.

As it is displayed in **Figure 24**, the highest *P.vivax* cases were recorded in October 2019 (15,118) and August 2019 (12,110). The lowest monthly *P.vivax* cases were recorded in December 2018 to 3838 cases. The trend of *p. vivax* species had no significant difference from year to year with in the past five years in SNNPR.

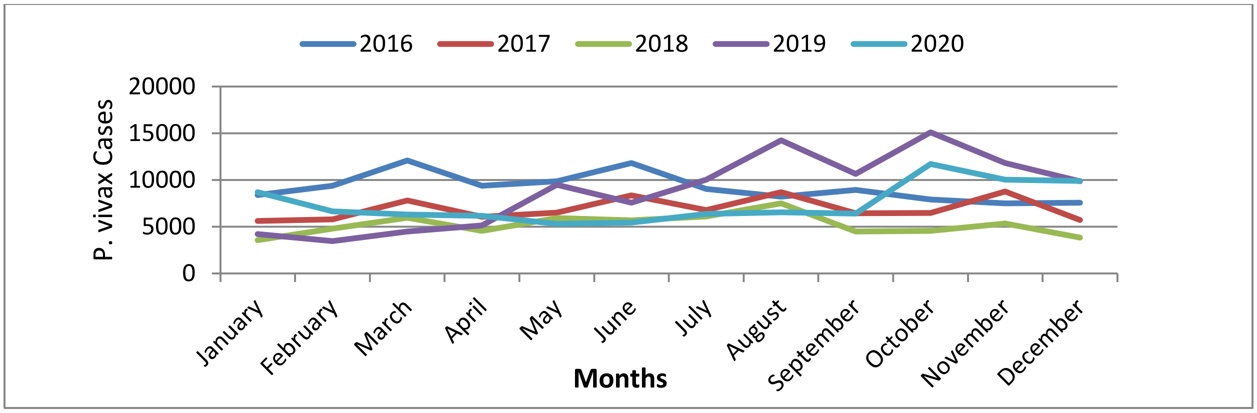

Figure 24 PV cases by Month in SNNPR from 2016–2020.

In SNNPR majority of malaria cases *were due to Plasmodium falciparum* specious which accounted (64.7%) 827,059. The rest (35.3%) 451,408 laboratory confirmed malaria cases were due to *P. vixax* **Figure 25**.

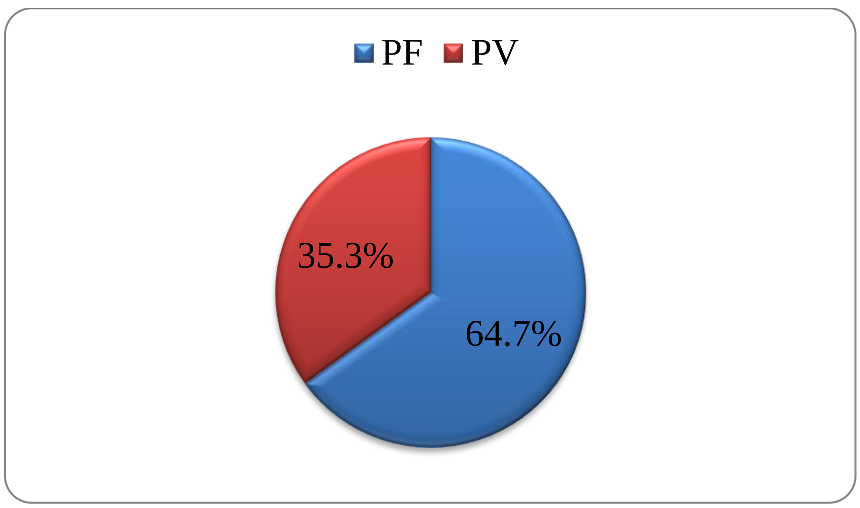

Figure 25 PF and PV malaria cases cumulative percentage SNNPR from 2016–2020.

Based on the data obtained from PHEM Department, Gamo Gofa zone reported the highest laboratory confirmed malaria cases in the past five years **Figure 26**. The Zone reported 175,131 PF and 104,945 PV cases and accounted (21.17%) and (23.24%) of the total regional reported cases respectively. South Omo and Wolayita zones reported ((172,647) PF (49,914) PV) and (121,735) PF (37,998) PV cases respectively.

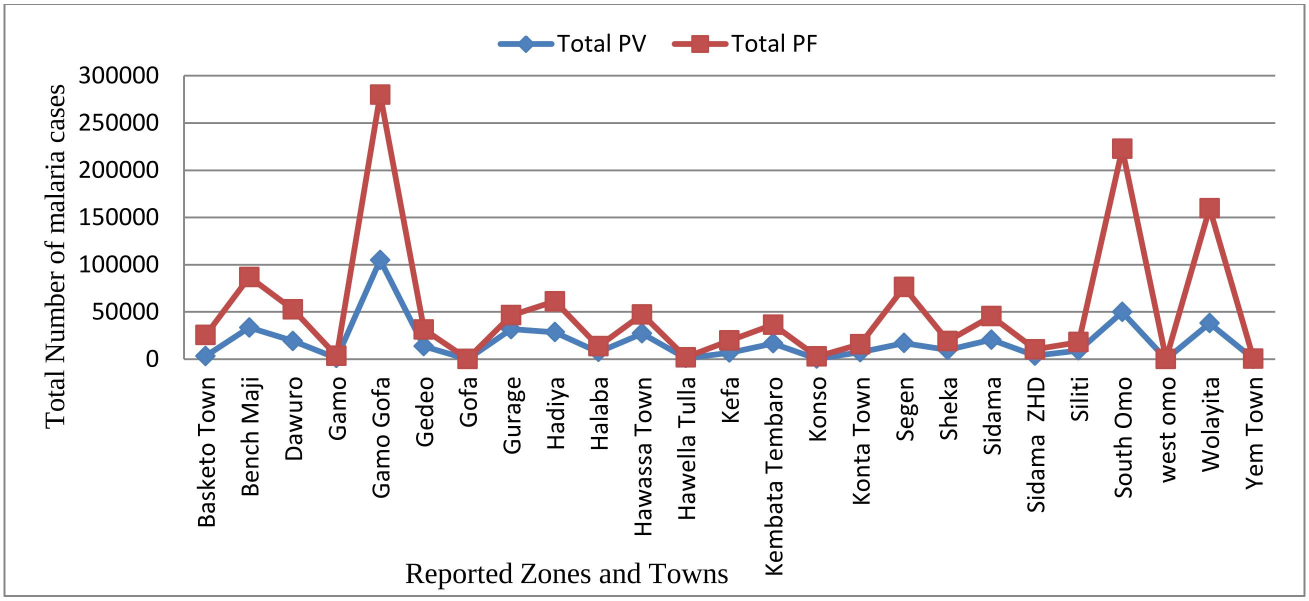

Figure 26 prevalence of PF and PV by Zones and Towns SNNPR, Ethiopia, 2016–2020.

Malaria Positivity Rate

A total of 8,025,613 malaria suspected cases were clinically examined during 2016 to 2020, of these 1,278,467 of them were diagnosed by microscope and RDT and tested positive for malaria. The overall positivity rate was (15.9%). As it is depicted in table 18, the highest case fatality rate was found in age group of 1-4 The highest case fatality rate was found in the age group of 1-4 (7.4%).

Table 1, in 2016 and 2017 laboratory confirmed malaria cases were 283,312 (16.6%) and 235,200 (14.6%) respectively. Laboratory confirmed malaria cases in 2018, 2019 and 2020 were 180,127 (11.9%), 313,071 (17.8%) and 266,757 (18.4%) respectively.

Table 18 positivity rates and species composition of malaria parasite in SNNPR, 2016-2020

Year	Total fever examined cases	Positivity rate			Malaria species (%)	
		Total	PF	PV	PF	PV
2016	1,705,995	283,312 (16.6%)	173071 (61.1%)	110,241 (38.9%)	61.1%	38.9%
2017	1,608,082	235,200 (14.6%)	152,137 (64.7%)	83,063 (35.3%)	64.7%	35.3%
2018	1,507,290	180,127 (11.9%)	117,751 (65.4%)	62,376 (34.6%)	65.4%	34.6%
2019	1,756,799	313,071 (17.8%)	206,956 (66.1%)	106,115 (33.9%)	66.1%	33.9%
2020	1,447,447	266,757 (18.4%)	177,144 (66.4%)	89,613 (33.6%)	66.4%	33.6%
Grand Total	**8,025,613**	**1,278,467 (15.9%)**	**827,059 (64.7%)**	**451,408 (35.3%)**	**64.7%**	**35.3%**

Malarious Zones' and Woredas' morbidity and Mortality Trend

In the past five years the highest 281,844 malaria cases and 8 deaths with CFR of 0.002% was reported from Gamo Gofa zone. 72,286 cases and 1 death with CFR of 0.001% were reported from the Zone in 2019 **Table 27**. The highest CFR 0.02% with 31,917 cases and 7 deaths were recorded in 2018. Gamo Gofa zone totally accounted 21.7% of the regional case. The second malarious Zone which was reported 221,566 cases and 13 deaths with CFR of 0.0058% was the South Omo Zone. South Omo zone reported 49,964 cases with no death and 42,675 cases and 6 deaths with CFR of 0.01% in 2018 and 2019 respectively. Wolayita Zone reported 170,505 cases and 18 deaths with CFR of 0.01% during the last five years. Wolayita reported the highest death 18 (30%) of total regional deaths. 58,390 cases and 2 deaths were reported from Wolayita in 2019.

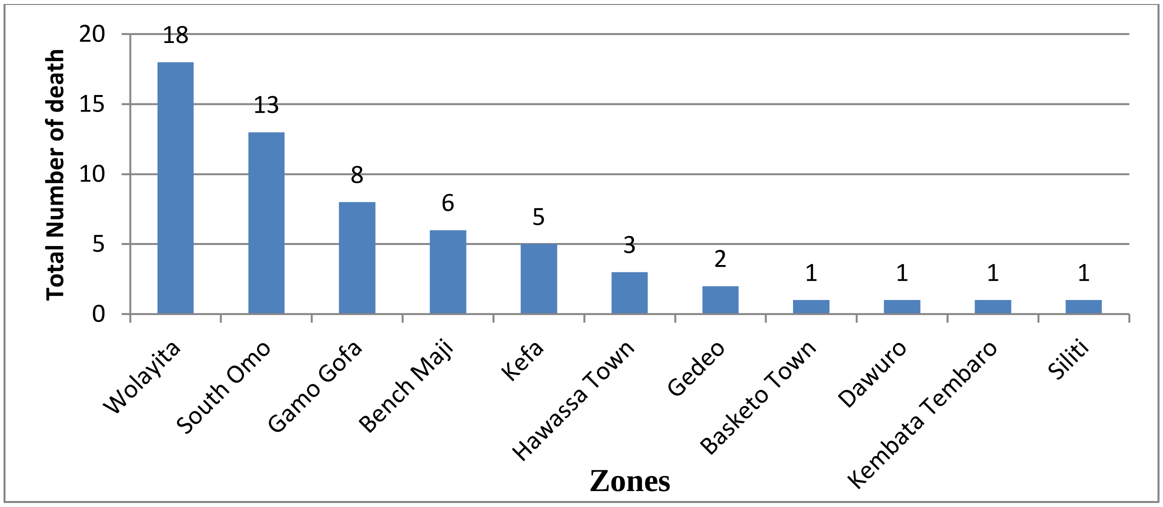

Figure 27 Mortality **of Malaria by Zones SNNPR, Ethiopia, 2016-2020.**

A total of 75,745 cases and 2 deaths with case CFR of 0.0026% were reported from selamago Woreda in the past five years. Uba debretsehay Woreda reported 31,776 cases and 0 deaths whereas deramalo Woreda reported 31,398 and 1 death. The highest mortality was reported from Sodo hospital with 7,811 cases and 11 deaths with CFR of 0.14% among Woredas **Table 28**.

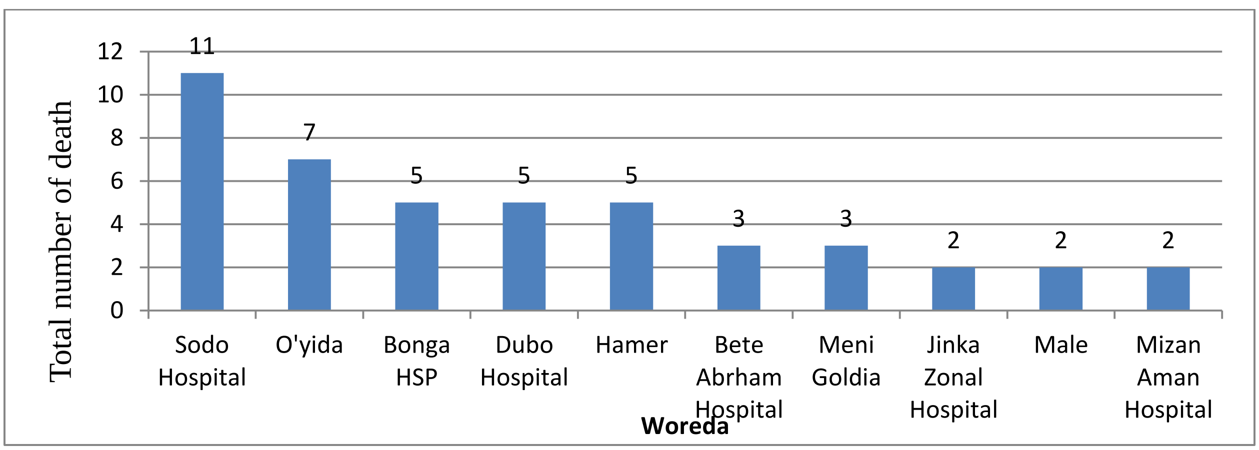

Figure 28 Mortality of Malaria by Woreda SNNPR, Ethiopia, 2016-2020.

Discussion

Malaria continued to be a major health problem in the SNNPR; the five years Malaria surveillance data analysis of the Region indicated that the incidence of confirmed and clinical malaria cases decreased from 289,044 (22.26%) in 2016 to 181,707 (14%) in 2018 and increased 317,591 (24.46%) in 2019. But in 2020, the incidence decreased to 270,012 (20.79%). The annual inpatient malaria cases decreased from 2,662 (27.2%) in 2016 to 1,041 (10.6%) in 2018. In 2020 the inpatient malaria cases were increased from 1,901 (19.4%) in 2019 to 2,196 (22.4%).

The highest malaria cases reported from, Gamo Gofa, South Omo and Wolayita Zones with magnitude of 281,844, 221,566 and 170,505 respectively and this contributed 52% of the total regional cases. The overall case fatality rate of the region was 0.6%. This finding was higher than the findings indicated in in Hana and Keyafer Health Centers, South Omo Zone, Southern Ethiopia, which indicated 22,494 number of laboratory confirmed malaria case (27). These results showed that there was decrement of cases compared to a study conducted in the region in 2019 by (melaku seyoum) which indicated 2,202,587 cases with CFR of 0.006% (25). This difference could be due to strong commitment and effort of malaria controlling strategies of the region and accessibility of controlling materials (14).

On average, the region reported 259,680 malaria cases and approximately 12 deaths each year during the past five years. There were 9,798 inpatient cases in the region during the past five years. This result was smaller compared to investigation carried out by Abebe 2014 (24) whose finding showed 171,701 inpatient cases and 3,580 deaths with CFR of 2.1% in the year 2003-2012.

The findings of this study revealed that the highest mortality rate was reported in the year 2018 with case fatality rate CFR of 1.44% followed by 2016 and 2017 with CFR of 0.48% and 0.65% respectively. The mortality trend showed slight increment in 2018, and then decreased in 2019 and 2020 despite the sharp escalation in total malaria caseload in 2019.

From a total of 1,278,467 laboratory confirmed outpatient cases in SNNPR; 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax*. During the Past five years *Plasmodium falciparum* contributes for majority of outpatient cases in the region. In all considered years *P. falciparum* was the predominant species with no trend shift. This finding showed there were increments in the number malaria species compared to 175,052 (55.1%) *P. falciparum* and 136,113(42.8%) *P. vivax* investigated by Abebe 2014 in the same region in 2014 (24).

This study demonstrated that 75,745 cases and 2 deaths with case CFR of 0.0026% were reported from Selamago Woreda in the past five years. Uba Debretsehay Woreda was the second which reported 31,776 cases whereas Deramalo Woreda reported 31,398 cases and 1 death.

Overall positivity rate was declined from 16.6% in 2016 to 11.9% in 2018. However, significant variations of confirmed cases were observed during 2019 and the positivity rate increased to 17.8% in the year. In 2020, the positivity rate was reached 18.4%.

From Southern Nation, Nationalities and peoples region Wolayita Zone reported 170,505 cases and 18 deaths with CFR of 0.01% during the last five years. Wolayita Zone reported the highest death 18 (30%) of total regional deaths.

In SNNPR majority of malaria cases *were due to Plasmodium falciparum* species which accounted (64.7%) 827,059. The rest (35.3%) 451,408 laboratory confirmed malaria cases were due to *P. vixax.* This finding was slightly lower than study conducted in Simada District, Northwest Ethiopia (67.5 %) *PV* and (32.5 %) PF (30).

Limitation/Gaps

- The surveillance data of malaria lacks variables like age and sex.
- It has only the two *P. falciparum and P. vivax* species; also lacks mixed infection so this makes difficult to analyze the surveillance data by all species and in person.
- There were also incomplete and miscoded data.

Conclusion

During 2016-2020, 8,025,613 suspected and clinical malaria cases were reported from SNNPR. Out of those 1,278,467 of them were diagnosed by microscope and RDT and tested positive for malaria parasites. The southern Nation, Nationalities and Peoples Region reported 259,680 malaria cases each year on average. There were 9,798 inpatient cases in the Region during the past five years. The highest mortality report was from Sodo Hospital with 7,811 cases and 11 deaths with CFR of 0.14% compared to other Woredas in the region.

Gamo Gofa, South Omo and Wolayita zones were the three zones with the highest confirmed and clinical malaria cases. They contributed to 673,915 (52%) of the total Regional cases. Regarding mortality Wolayita Zone was the first, with 18 (30%) of total regional mortality related to malaria.

The incidence of confirmed and clinical malaria cases decreased in the Southern Nation, Nationalities and peoples Region during the study period. Malaria morbidity was also significantly declined in 2020. From 2016 to 2020 there were variations in incidence of confirmed and clinical malaria cases. There were decrements in total malaria cases from 2016 to 2018. In 2019 there were considerable increments in total confirmed and clinical cases and in annual inpatient cases. The highest case fatality rate was reported in 2018.

Recommendations

- Lack of variables like age and sex in malaria surveillance data and unavailability of mixed infection report in the reporting format was recommended as a gap on previously conducted analysis. Despite these recommendations there is still the same gap. So, the National PHEM and SNNPR PHEM Department should work cooperatively over this issue to solve the stated gap.

- Malaria surveillance data has only *P. falciparum and P. vivax* species other species were not included in the reporting format. If the rest of species included it may yield additional output in the surveillance. So, it's good for PHEM Department to include all species list in the reporting form.

- The Regional Health Bureau should narrow the gap that is indicated on quality of data issue in surveillance system by strengthening the skill of data personnel.
- The SNNPR Health Bureau should continue its successful prevention and control activities with great emphasis to Gamo Gofa, South Omo and Wolayita Zones including Selamago Woreda.

REFERENCES

1. World health organization WHO Malaria fact sheets.1 Apr 2021.
2. U.S. President's Malaria Initiative Ethiopia Malaria Operational Plan FY 2020.

3. Abebe TN Compiled body of works in field epidemiology. MPH Thesis. School of public health and Ethiopia field epidemiology training program, Addis Ababa University, Addis Ababa, Ethiopia 2014.
4. Neeta Rai et al. Asian Journal of Biomedical and Pharmaceutical Sciences 2(12) 2012, 28-31
5. WHO World malaria report, 30 November 2020
6. The Potential Impact of Health Service Disruptions on the Burden of Malaria: A Modelling Analysis for Countries in Sub-Saharan Africa 1–44 (WHO, 2020); https://www.who.int/publications-detail/the-potential-impact-of-health-service-disruptions-on-the-burden-of-malaria
7. Ministry of Health. An epidemiological profile of malaria in Ethiopia. Addis Ababa, 2014.
8. Ministry of Health. Health & health-related indicators. Addis Ababa, 2018.
9. Global Malaria Programme: Tailoring Malaria Interventions in the COVID-19 Response (WHO, 2020); https://www.who.int/publications/m/item/tailoring-malaria-interventions-in-the-covid-19-response
10. Hogan, A. B. et al. Potential impact of the COVID-19 pandemic on HIV, tuberculosis, and malaria in low-income and middle-income countries: a modelling study. Lancet Global Health https://doi.org/10.1016/S2214-109X(20)30288-6 (2020).
11. Zarocostas J: Malaria treatment should begin with parasitological diagnosis where possible, says WHO. BMJ 2010, 340:c1402.
12. Ministry of Health. Annual Health Sector Performance Report, 2018. Addis Ababa, 2018.
13. Institute of Ethiopian Public Health. Ethiopia National Malaria Indicator Survey 2015. Addis Ababa, 2016.
14. Hassen Mamo. Malaria status in Ethiopia with the emphasis on Southern Nation Nationalities and Peoples Region (SNNPR) 2020.
15. K. Raghavendra, T. K. Barik, B. P. N. Reddy, P. Sharma, and A. P. Dash, "Malaria vector control: from past to future," Parasitology Research, vol. 108

16. WHO, World Malaria Report, World Health Organization, Geneva, Switzerland, 2020, https://www.who.int/news-room/fact-sheets/detail/malaria.
17. MOH National Malaria guideline Final, Effect of Antimalarial Interventions, Addis Ababa, Ethiopia 2012.
18. Ministry of Health. Annual Health Sector Performance Report, 2018. Addis Ababa, 2018.
19. Institute of Ethiopian Public Health. Ethiopia National Malaria Indicator Survey 2015. Addis Ababa, 2016.
20. FMoH national malaria guideline 2017.
21. SNNPR 2015. Southern Nations, Nationalities and People's Region Health Bureau Malaria Annual Report EFY 2007, Hawassa, Ethiopia.
22. Deresse Legesse et al. Trend Analysis of Malaria Occurrence in Wolaita Zone, Southern Ethiopia: Retrospective Cross-Sectional Study 2015 https://doi.org/10.1155/2015/123682
23. Molla, E., Behaksra, S.W., Tadesse, F.G. et al. Past eight-year malaria data in Gedeo zone, southern Ethiopia: trend, reporting-quality, spatiotemporal distribution, and association with socio-demographic and meteorological variables. BMC Infect Dis 21, 91 (2021). https://doi.org/10.1186/s12879-021-05783-8
24. Dabaro, D., Birhanu, Z. & Yewhalaw, D. Analysis of trends of malaria from 2010 to 2017 in Boricha District, Southern Ethiopia. Malar J 19, 88 (2020). https://doi.org/10.1186/s12936-020-03169-w
25. Shamebo, T., Petros, B. Trend analysis of malaria prevalence in Halaba special district, Southern Ethiopia. BMC Res Notes 12, 190 (2019). https://doi.org/10.1186/s13104-019-4215-2
26. Solomon Ergete, et al. Trend of Malaria Cases in Hana and Keyafer Health Centers, South Omo Zone, Southern Ethiopia 2018
27. Woyessa et al. Prevalence of malaria infection in Butajira area, south-central Ethiopia. Malaria Journal 2012 11:84.

28. Ethiopia demographic and health survey 2016. Key indicators report. https://dhsprogram.com/pubs/pdf/PR81/PR81.pdf. Accessed May 21, 2021.
29. Melaku Seyoum Compiled body of works in field epidemiology. MPH Thesis. School of public health and Ethiopia field epidemiology training program, Addis Ababa University, Addis Ababa, Ethiopia 2019.
30. Workineh, B., Mekonnen, F.A., Sisay, M. et al. Malaria outbreak investigation and contracting factors in Simada District, Northwest Ethiopia: a case–control study. BMC Res Notes 12, 280 (2019).

CHAPTER-III

Evaluation of Surveillance System

3.1 Malaria Surveillance System Evaluation, Bahir Dar Zuriya Woreda, Amhara Region, October, 2021

Abstract

Introduction: Malaria is a life-threatening disease caused by parasites belonging to the genus *Plasmodium* transmitted from infected individuals to other people via bites of infected female Anopheles mosquitoes. Malaria remains a worldwide public health problem, causing a significant number of morbidity, mortality, and huge economic loss, despite intensive implementation of interventions. Ethiopia is one of the malaria endemic countries in the world, with 60% of the population being at risk of infection and it is a serious public health concern and has great impact on socio-economy.

Objective: The objective of this study was to assess key attributes of the malaria surveillance system and to evaluate whether the surveillance system meets its objective to generate evidence-based information for the improvement of surveillance system.

Methodology: The evaluation was conducted in 13 selected health institutions. We reviewed surveillance data from October 26 to December 4, 2021. Secondary data sources such as surveillance report completeness and timeliness as well as surveillance data, supervision report, written feedbacks, preparedness plans were also reviewed. Information on system attributes were collected using the CDC surveillance system evaluation guideline.

Results: All necessary surveillance guidelines, registers and reporting formats were distributed adequately to health facilities. Reporting completeness and timeliness were 100 and 99.07% respectively. The positive predictive value of the surveillance system was 25.5%. Written feedbacks were obtained in all health facilities.

Conclusion and recommendations: The system was useful, simple, acceptable, flexible, and representative. The malaria surveillance system was able to detect change in malaria cases and outbreak. To create a well performing surveillance system, regular supervision and epidemiologically analyzed and interpreted feedback system is mandatory.

Keyword: Surveillance system, Evaluation, Bahir Dar Zuriya Woreda December 2021.

Introduction

Malaria is a preventable and curable disease. Globally, 229 million new malaria infections and 409, 000 deaths occurred in 2019 (1). The World Health Organization (WHO) African Region, with an estimated 215 million cases in 2019, accounted for about 94% of cases.

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. It is caused by *Plasmodium* parasites. The parasites are spread to people through bites of infected female Anopheles mosquitoes. There are 5 parasite species that cause malaria in humans, and 2 of those species – *P. falciparum and P. vivax* – pose the greatest threat (2).

Malaria is an acute febrile illness. In non-immune individuals, symptoms usually appear 10–15 days after infective mosquito bites (2). The first symptoms – fever, headache, and chills – may be mild and difficult to recognize as malaria. Fever is the cardinal symptom of malaria. It can be intermittent with or without periodicity or could be continuous. Many cases have chills and rigors. The fever is often accompanied by headache, myalgia, arthralgia, anorexia, nausea and vomiting. The symptoms of malaria can be non-specific and mimic other diseases, like viral infections, enteric fever etc.

The latest WHO Report indicates that, there were 229 million cases of malaria in 2019 compared to 228 million cases in 2018 (3). According to the report, Children under five years of age are the most vulnerable group affected by malaria; in 2019, they accounted for 67% (274 000) of all malaria deaths worldwide. The estimated number of malaria deaths stood at 409 000 in 2019, compared to 411 000 deaths in 2018.

Ethiopia is among the few countries with unstable malaria transmission. Malaria is mainly seasonal. Approximately 60% of the population live in malaria-endemic areas in Ethiopia, chiefly at altitudes below 2,000 meters. The main malaria parasites are P. falciparum and P. vivax, accounting for 60% and 40% of all cases, respectively. Anopheles arabiensis is the main vector(4).

Public health surveillance is defined as the "ongoing systematic collection, analysis, and interpretation of data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of those data to those who need to know (5).

Reasons for conducting public health surveillance can include the need to assess the health status of a population, establish public health priorities, and reduce the burden of disease in a population by appropriately targeting effective disease prevention and control activities (5). A public health surveillance system is useful if it contributes to the prevention and control of adverse health-related events, including, improved understanding of the public health implications of such events. A public health surveillance system can also be useful if it helps to determine that an adverse health-related event previously thought to be unimportant is actually important. In addition, data from a surveillance system can be useful to contribute to performance measures.

If data are to be used to implement immediate disease control and prevention activities for infectious diseases that are acute, severe, and highly transmissible, timeliness is critical(6). Timeliness requirements for a surveillance system might vary at different levels of public health system (e.g., local, state or international), on the basis of intended uses of the surveillance data at that level.

The evaluation of public health surveillance systems should involve an assessment of system attributes, including, simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability. With the continuing advancement of technology and the importance of information architecture and related concerns, inherent in those attributes are certain public health informatics concerns for public health surveillance systems (7). Those concerns include comparable hardware and software, standard user interface, standard data format and coding, appropriate quality checks, and adherence to confidentiality and security standards.

Rationale

In Ethiopia, malaria is a serious public health concern and has great impact on socio-economy. The trend analysis of malaria data from health facilities is useful to understand its transmission dynamics and implement evidence-based malaria control strategies. It is a serious public health concern in Ethiopia tracked by Public health emergency Management (PHEM) surveillance system (8). Reliable data can improve health promotion programs and help policy makers and investors allocate resources effectively. Hence, evaluation of surveillance system of malaria was conducted to evaluate the functionality of the surveillance system and to identify the gap for the better improvement of the surveillance system.

Objectives

General objective

The objective of this study was to assess key attributes of the malaria surveillance system and to evaluate whether the surveillance system is meeting its objective to generate evidence-based information for improvement of the surveillance system.

Specific Objectives

- To describe the malaria surveillance system in Bahir Dar Zuria Woreda
- To evaluate the attributes of malaria surveillance system in the selected Woreda
- To assess the performance of the surveillance system in line with set objective

Materials and methods

Study area

The study was conducted in Bahir Dar Zuria Woreda of West Gojjam Adminstration Zone in the Amhara Regional State (Figure-1). The population of Bahir Dar Zuria Woreda was projected to be 228,821 (115,555 (50.5%) males and 113,266 (49.5%) female), based on the 2007 population census (9). The Woreda is situated at an altitude ranging from 1750 to 2300 m.a.s.l. The Woreda constitutes 36 rural kebeles and has a total area of 1,282.9 square kilometers. There were 9 Health Centers and 36 Health posts in the Woreda. Based on the Woreda Office of Agriculture and Rural Development, the Woreda consisted of two major geographical zones, semi-highlands or "Woyna Dega" (1500 to 2300 m above sea level) and lowlands "Kolla" or hot climatic zones (below 1500 m above sea level) accounting for 25% and 75% respectively. The study was conducted from October 26 to December 4 2021.

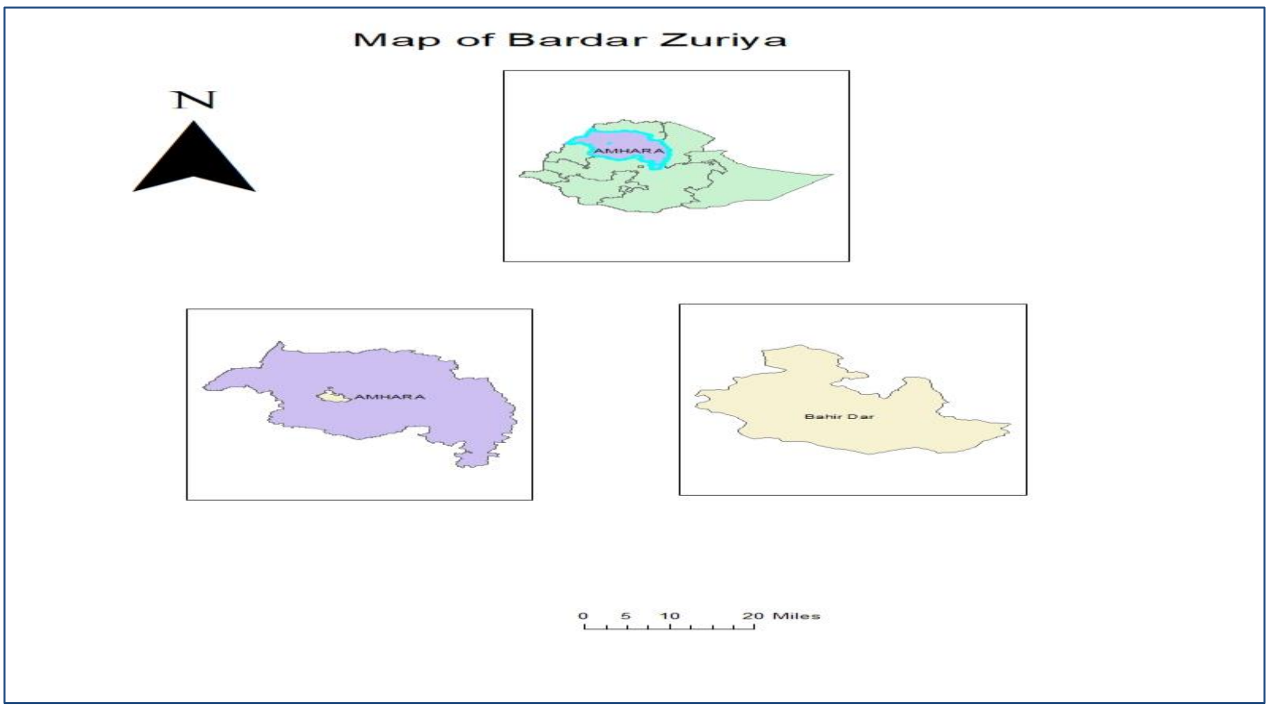

Figure 29 Map of Bahir Dar Zuriya Woreda, Amhara Region, 2021

Study design

A facility-based cross sectional study was conducted in Bahir Dar Zuria Woreda, one of the highly malarious Districts in West Gojjam Zone, Amhara Region.

Sample size and Sampling Method

First, purposive sampling was used to select the Woreda on the basis of its burden of malaria cases compared with the other Woredas of West Gojam Zone. The District Health Office, one primary Hospital and four health centers were purposively included in the study to represent the District. Then, eight (22%) health posts, at least two from each health center were selected and included in the study using lottery methods.

Study units

The Woreda Health Offices and 13 health facilities were included in this study. Those included Primary hospital (1) governmental health centers (4) and health posts (8).

Data Collection methods

Data were collected using a semi-structured questionnaire and observation check-list. Surveillance officers and health institution staff were interviewed. Secondary data sources, such as surveillance report completeness and timeliness as well as surveillance data, supervision report, written feedbacks, preparedness plans were also reviewed. Information on system attributes were collected using the CDC surveillance system evaluation guideline (5).

Data analysis

The collected data were entered and analyzed using Microsoft Office Excel 2007.

Ethical clearance

Ethical clearance to conduct the study was obtained from the Ethiopian Public Health Institute (EPHI). A letter of request was provided for the selected health departments and health offices for their participation in the study.

Data dissemination

The findings of the study were communicated to all concerned bodies, such as EPHI, Woreda Health Offices, mentors, supervisors, coordinators and to the Addis Ababa University, School of Public Health.

Operational definitions

Simplicity: The simplicity of a public health surveillance system refers to both its structure and ease of operation as a surveillance system.

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

Data quality: Is the completeness and validity of data recorded in the public health surveillance system.

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

Sensitivity: Sensitivity is the capacity of the system to detect the highest proportion of true cases

Stability: Refers to the reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability (the ability to be operational when it is needed) of the public health surveillance system.

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

Usefulness: Refers to the relevance of the system in terms of feeding information for action.
Positive predictive value: Is the proportion of reported cases that actually have the health related event under surveillance.

Flexibility: Is the ability of the system to adapt to changing needs, such as the addition of a new disease, the collection of additional data, and change in case definition.

Completeness: Proportion of all expected data reports that were submitted to public health surveillance.

Case detection: Is the process of identifying cases and outbreaks.

Kebele: The lowest administrative unit next to a district

Case registration: is the process of recording identified cases.

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

Case definition: is a set of criteria used to decide if a person has a particular disease, or if the case can be considered for reporting and investigation

Case definition for Malaria:

Suspected: Any person with fever or fever with headache, rigor, back pain, chills, sweats, myalgia, nausea, and vomiting diagnosed clinically as malaria.

Confirmed: A suspected case confirmed by microscopy or RDT for plasmodium parasites.

Findings

Overview of malaria surveillance system

Malaria is among the major public health problems of the 23 priority diseases under surveillance in Ethiopia . The FMOH's National malaria strategic plan (2017-2020) highlights the need for strong SM&E systems and emphasizes the constant need for detection and response to focal and widespread malaria epidemics in control districts and a robust surveillance system for real-time data reporting in elimination districts to measure progress towards achieving desired goals (10). An effective malaria SM&E system will enable the program to: identify areas or population groups most affected by malaria (high risk); identify trends in cases and deaths that require additional intervention; and assess the success of control and elimination measures.

A malaria surveillance system comprises of the people, procedures, tools and structures necessary to generate information on malaria cases and deaths. The information is used for planning, implementing, monitoring and evaluating malaria programmes (6).

In every evaluated health center and health posts, there was a surveillance focal person that collects and sends reports to the next reporting level. Data collected from health facilities were reported through telephone, email or mobile phone. Health posts send their weekly surveillance report to health centers every Monday through phone call or report format. The health post level uses community representatives and disease registries as sources of data for weekly reports. Reports received from heath posts were aggregated and reported to Woreda Health Office by cluster health centers in the same day afternoon. Reports received through e-mail or phone by the Woreda Health Office were reported to the West Gojjam Zone Health Department on Tuesday **Figure 30**.

All assessed health facilities and the District Health Office were using a standardized reporting format for data collection and reporting purposes. Majority of health posts reported through mobile phone, followed by paper based format.

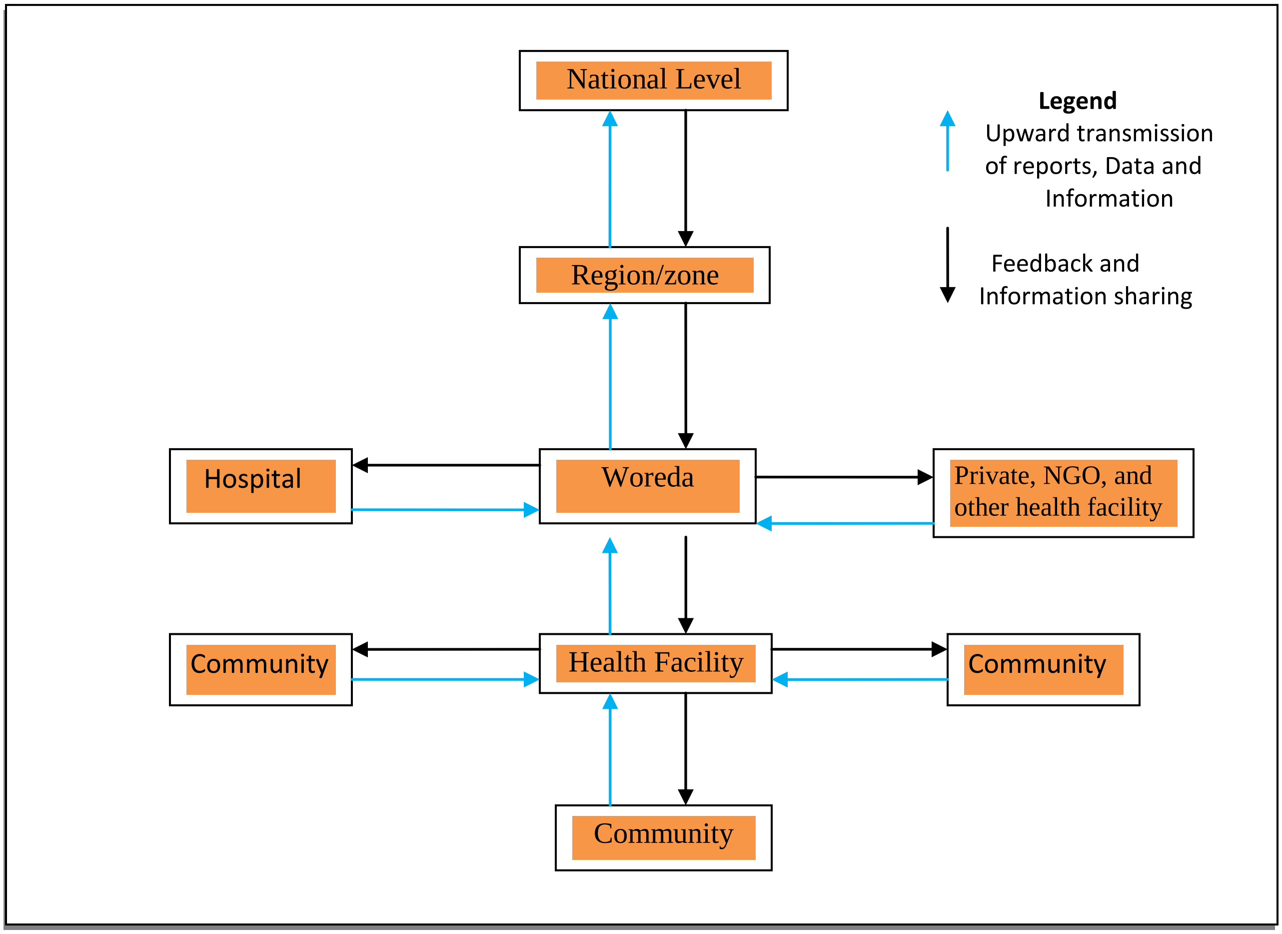

Figure 30 Diagram Illustrating Formal and Informal flow of Surveillance data throughout a health system. (Source: National PHEM Guideline, Ethiopia, 2012)

Distribution of Health Facilities

Bahir Dar Zuriya Woreda has nine health centers and 36 health posts as well as ten private clinics. There was no hospital under the Woreda, but, health facilities under the Woreda used Addis Alem and Felege Hiwot Primary hospitals for referral cases. In this study, Addis Alem Primary Hospital was randomly selected and evaluated. The health service coverage of the Woreda was 100% in 2013 EFY. The following **Table 19** depicts distribution of health facilities in BZW.

Table 19 Distribution of Health Facilities in BZW Amhara Region, 2014 EFY

Types of Health Institutions		Number	
		Public	Private
Hospital		0	0
Health centers		9	0
Clinics	Small/primary	0	0
	Medium	0	10
Health posts		36	0
Grand Total		45	10

Availability of surveillance guidelines, documents, registers and formats

All assessed health facilities and the Woreda Health Office had national guideline for malaria and reporting formats, like weekly reporting form and line list, but did not have separate clinical registration book for malaria. Malaria cases were incorporated in OPD registration book with other diseases. All evaluated health posts had Guide for Public Health Emergency Management" guideline which is a comprehensive guideline primarily prepared for health extension workers in Amharic Language. Based on the assessment finding all, assessed health facilities had weekly surveillance reporting format. There was no shortage of reporting format at all health facilities assessed in the Woreda.

The finding of the assessment indicated that out of 12 visited health facilities 10 (83.3%) of them had case definition of malaria and was posted in appropriate places. Robit and Wenjeta health centers had poor reporting system compared to other assessed health centers. Out of 16 Health professionals and health extension workers who were interviewed during the assessment, 15 (93.7%) of them understood the case definition of malaria clearly and applied the case definition accordingly.

Population under surveillance

The national PHEM targets all the population in the country to be under surveillance for all the twenty-three priority diseases. The population in the catchment area of the BZW and all health centers and posts were included. The Woreda constitutes nine clusters and 36 health posts **Table 20**. The total population of Bahir Dar Zuria Woreda was 228,821 (115,555 (50.5%) males and 113,266 (49.5%) females) was under surveillance (9).

Table 20 Population of BZW under surveillance by Cluster in the Amhara Region, 2014 EFY

S.N	Name of Cluster	Population	Male	Female
1	Robit	28,570	14428 (50.5%)	14142 (49.5%)
2	Andasa	36,276	18319 (50.5%)	17957 (49.5%)
3	Kinbaba	32,861	16595 (50.5%)	16266 (49.5%)
4	Feres Wega	20,998	10604 (50.5%)	10394 (49.5%)
5	Yinesa	43,153	21792 (50.5%)	21361 (49.5%)
6	Wenjeta	17,406	8790 (50.5%)	8616 (49.5%)
7	Lata Kerekeri	26,980	13625 (50.5%)	13355 (49.5%)
8	Sekelet	16,547	8356 (50.5%)	8191 (49.5%)
9	Dek	6,030	3045 (50.5%)	2985 (49.5%)
	Total	228,821	115,554 (50.5%)	113,267 (49.5%)

Targeted Diseases under Surveillance

Public health surveillance is part of the public health emergency management that helps to provide advance information of an incoming threat in order to facilitate the adoption of measures to reduce its potential health impact. Currently, there are twenty three priority diseases included under IDSR by categorizing it under three major groups which are, Epidemic-Prone Diseases, Diseases Targeted for Eradication and Elimination, and Other Diseases of Public Health Importance (11). **Table 21** displays diseases under surveillance in Ethiopia.

Malaria is one of the weekly reportable disease under IDSR and data from malaria surveillance systems are important for tracking geographical and temporal trends in disease incidence, detecting epidemics, assessing progress towards programme targets and evaluating the impact of interventions and the quality of the surveillance system (11). Routine use of surveillance data is expected to improve both programme decision-making and the surveillance system as gaps in data completeness and quality are identified and addressed.

Table 21 Lists of Reportable Diseases/Conditions in BZW Amhara Region, 2014 EFY

Immediately Reportable Disease	Weekly Reportable Disease
1. Acute Flaccid Paralysis (AFP) / Polio	16. Dysentery
2. Anthrax	17. Malaria
3. Avian Human Influenza	18. Meningococcal Meningitis
4. Cholera	19. Relapsing fever
5. Dracunculiasis / Guinea worm	20. Severe Malnutrition
6. Measles	21. Typhoid fever
7. NNT	22. Typhus
8. Pandemic Influenza A	23. Scabies
9. Rabies	
10. Smallpox	
11. SARS	
12. VHF	
13. Yellow fever	
14. Maternal and prenatal death	
15. Prenatal Death	

Malaria is among the major public health problems in Ethiopia. Bahir Dar Zuria Woreda, is one of highly malarious Woreda in West Gojjam Zone. In 2013 EFY, malaria accounted for 49,545 (29.1%) of all outpatient cases of the Woreda. Out of 49,545 clinical malaria cases, 11,045 (22.3 %) of them were confirmed cases for malaria diagnosed with microscopy and RDT. From 11,045 confirmed malaria cases 8,170 (74%) cases were positive for *Plasmodium falciparum*, while 2,875 (26%) cases were positive for *Plasmodium vivax*.

Health Facilities under Surveillance

Bahir Dar Zuria Woreda has nine health centers, 36 health posts and 10 non-governmental health facilities. There was no public hospital under the Woreda. All 36 health posts found in the Woreda were clustered under nine health centers **Table 22**.

Table 22 Distribution of Health centers and Posts in BZW Amhara Region, 2014 EFY

S.N	Name of Health Center	Number of Health Posts under Cluster HC	Percentage
1	Robit	4	11.1%
2	Andasa	6	16.7%
3	Kinbaba	5	13.9%
4	Feres Wega	3	8.3%
5	Yinesa	6	16.7%
6	Wenjeta	3	8.3%
7	Lata Kerekeri	4	11.1%
8	Sekelet	4	11.1%
9	Dek	1	2.8%
	Total	36	100.00%

Weekly surveillance data report completeness rate

Despite increased efforts for strengthening health systems, many developing countries especially in sub Saharan Africa (SSA) still fall short of the needed capacity (12). Disease surveillance information is reported in hierarchical order from the community to National health system. At each sub-national level, the public health system contributes to the problems of completeness, timeliness and data quality. Reporting completeness of malaria surveillance system of health facilities under BZW was evaluated. Nine health centers were expected to send 108 reports to the Woreda Health Office in the past 12 weeks (week 4-15/2021) prior to the assessment. In our assessment, it was found that 107 reports were received. Hence, the reporting completeness rate at health centers level was 107/108 (99.07%) **Table 23**. Similarly, out of 432 expected reports from 36 health posts, 426 (98.6%) of them were received by each cluster of health centers. This finding was consistent with a study conducted in Dangila district (13).

Table 23 Malaria Surveillance reporting completeness of BZW Health Office, Amhara Region, (week 4-15/2014) 2014 EFY

S.N	Name of Health Centers	Expected reports within three months	Received reports within three months	Completeness Rate %
1	Robit HC	12	12	100
2	Andasa HC	12	12	100
3	KinbabaHC	12	12	100
4	Feres Wega HC	12	12	100
5	Yinesa HC	12	12	100
6	Wenjeta HC	12	11	91.7
7	Lata Kerekeri HC	12	12	100
8	Sekelet HC	12	12	100
9	Dek HC	12	12	100
	Total	108	107	99.07%

Malaria cases detected by surveillance systems

Bahir Dar Zuria Woreda surveillance system assessment confirmed that, from 2012 to 2013 EFY; a total of 101,230 suspected cases of malaria were identified. Of those 25,857 (25.5%) were confirmed cases of malaria with 0 deaths. The highest number of confirmed cases 14,812 (57.3%) were reported in 2012, followed by 11,045 (42.7%) in 2013 EFY. In 2013 EFY the highest cases 2,725 (25%) of malaria were reported from Andasa Health Center, followed by Robit Health Center 2,200 (20%). Feres Wega health center reported the lowest malaria cases 37 (0.33%) in the same year. During the past two years 2012 – 2013 EFY the Woeda reported

12,929 cases per year on average. As displayed in **Figure 31**, malaria cases were increasing from year to year in the Woreda. This finding was contrary compared to a study conducted in Amhara Region (14).

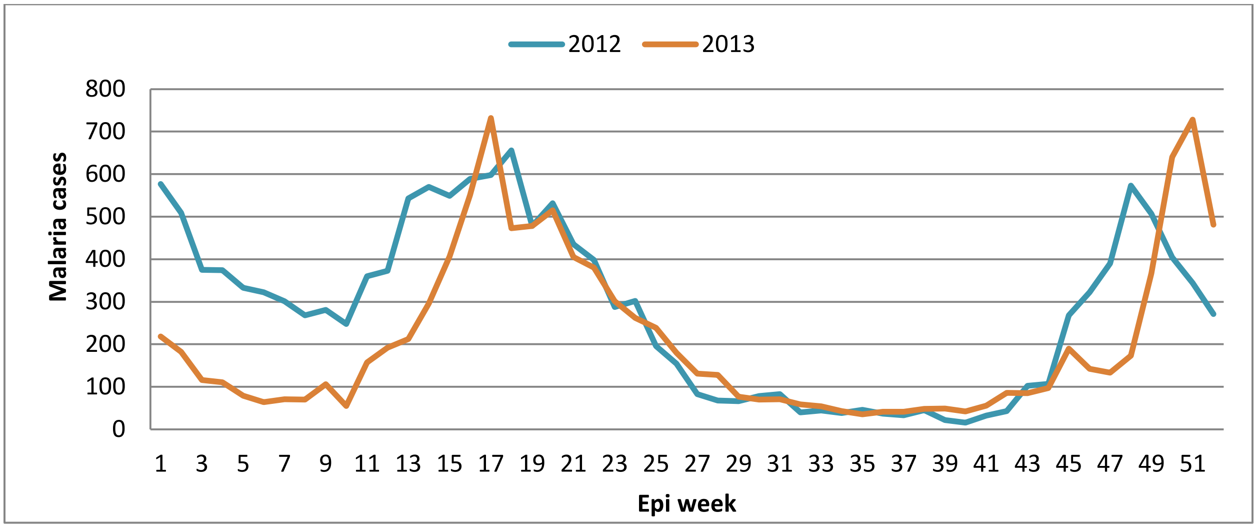

Figure 31 Trend of malaria cases, in BZW Amhara Region, 2012-2013 EFY

Malaria prevention and control

The main vector control activities implemented in Ethiopia include, indoor residual spraying (IRS), long lasting insecticidal nets (LLINs) and larval source reduction (LSM) (4). BZW distributed nearly 233,109 LLINs to 54,678 households between 2007 and 2013 EFY and sprayed 96% unit structures targeted for IRS. Almost all households of the Woreda received at least one ITN. Larval controlling activities through environmental management (draining, filling, compacting and clearing) were practiced in the Woreda.

Diagnoses of Malaria

In Ethiopia, malaria is highly seasonal, unstable with epidemic-prone transmission pattern in many parts of the country. *Plasmodium falciparum* (70 percent) and *P. vivax* (30 percent) are the major malaria parasites (10). There were 101,230 suspected malaria cases in Bahir Dar Zuria Woreda from 2012 to 2013 EFY. Out of these suspected malaria cases 53,175 (52.5%) of them were diagnosed by laboratory and the rest 48,055 (47.5%) by RDT. Of 101,230 suspected cases, 25,857 (25.3%) of them tested positive for malaria.

P. falciparum was the dominant parasite 18,546 (72%) followed by 7,311 (28%) *P.vivax.* Rapid diagnostic tests (RDTs) had been widely used at health post level and microscopy at the health center level. **Figure 32** shows distribution of malaria species.

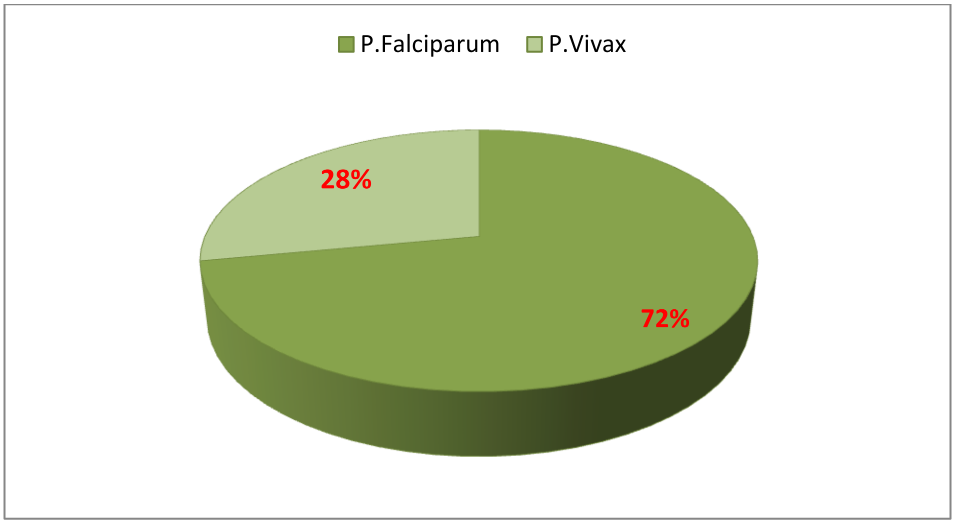

Figure 32 Trend in percentage of malaria species, BZW, Amhara, 2012-2013 EFY

Of the total confirmed malaria cases, 3,784 (14.6%) were under five children, 7,756 (30%), aged from 5-14, 14,045 (54.3%), ≥15 years old and the remaining 272 (1.1%) pregnant women **Figure 33**.

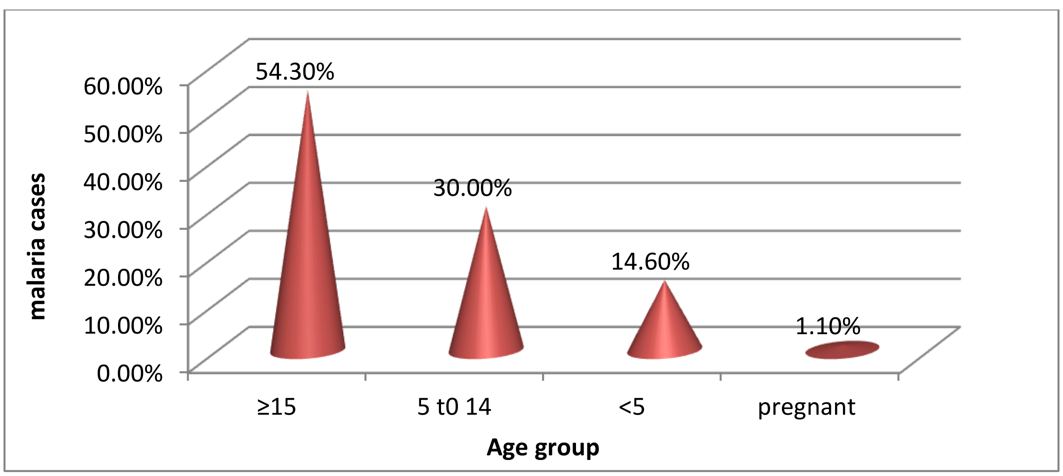

Figure 33: Age distribution of malaria in Bahir Dar Zuriya Woreda Amhara, 2013 EFY

Data analysis and interpretation

The malaria focal person is trained on basic surveillance data analysis, but the health extension workers had no any training about surveillance data analysis. At the Woreda level, the data analysis was conducted by cluster level. Epidemic management committee and rapid response team (RRT) are established both at health center and Woreda Health Office level from different disciplines, but no evidence was found that can show the functionality of the committees. All focal persons in assessed health facilities had no any training in the recent year. They had data analysis training before four years. All assessed health facilities lack trained persons in epidemic investigation and management and active rapid response committee. Out of four health facilities three and out of eight health posts six of them had and used a weekly malaria monitoring chart. The threshold for action was done for malaria at Woreda health office and health centers. None of the visited health facilities encountered shortage of drugs and in the past 1 year.

Outbreak Investigation

The respondents in all assessed health facilities declared that there was outbreak of malaria in the past 6 months and the reported data from the health facility to the Woreda Health Office also confirmed the occurrence of outbreak in the visited health facilities. Based on the Woreda Health Office, Yinesa Health Center had majority of malaria cases during the past 6 months. The following **Figure 34** displays trend of malaria cases in visited health facilities.

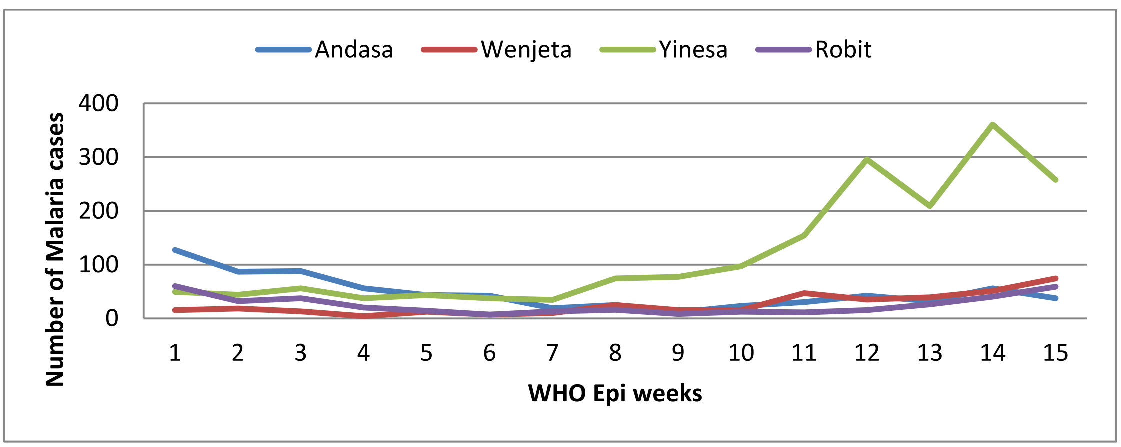

Figure 34: Malaria case trend (week 1-15, 2014 EFY) in Bahir Dar Zuriya Woreda Amhara, 2014 EFY

Feedback

Feedback is an important function of all surveillance systems. Appropriate feedback can be maintained through supervisory visits, newsletter and bulletin (15). It is possible to monitor the provision of feedback by the different levels of surveillance and to evaluate the quality of feedback provided, and the implementation of follow-up actions. In visited health facilities and Woreda Health Office had experience of providing feedback. But there was no regular pattern in addressing their feedbacks. According to the observation, it was assessed that out of four visited health centers, three of them were provided feedback both in oral and written form on quarterly bases. All visited health posts has also received feedbac from respective health centers. But there was no any documented evidence that can show feedback provision from Woreda health office to health facilities or from the health centers to health posts on malaria surveillance system.

Training

All malaria focal personnel in visited health centers have a basic training on surveillance system of the country priority diseases despite the fact there is difference in time period that they got the training. Based on the observation, they had surveillance training before 4 years.

Supervision

Supervision helps to strengthen the capacity of staff and ensure that the right skills are used appropriately, the necessary logistics are in place, and that planned activities are implemented according to schedule. As it was mentioned by surveillance personnel, supervision was conducted regularly. According to the evaluation, supervision was conducted every three months at health center level and in every two months at health post level. There were also supervision activities during special moments, like when there is occurrence of outbreaks.

Laboratory function

All visited health centers and the health posts conducted malaria diagnosis. The malaria diagnosis at the health center level was conducted using a microscope and at health posts level using RDT.

Attributes of malaria surveillance system

The attributes of a surveillance system affect the ability of the system to meet its objectives and the usefulness of the resulting information. The following surveillance system attributes were evaluated.

Usefulness

Data from malaria surveillance system was analyzed and interpreted by cluster. At the health center & health post level, the malaria surveillance data analysis and interpretation were narrow but respondents agreed that the system was able to make decisions and take actions. This indicates that the malaria surveillance system was useful in the Woreda.

Simplicity

The simplicity of a public health surveillance system refers to both its structure and ease of operation. Surveillance systems should be as simple as possible, while still meeting their objectives (5). All respondents agreed that case definitions of malaria are easy and applicable by all level of health professionals. They also believe that community case definitions are easy to understand at community level. PHEM focal person at Woreda and health center level respond that additional data collection on cases are not time consuming and it don't takes greater than 10 - 15 minutes to fill weekly reporting format on morbidity and mortality of priority disease.

Flexibility

Flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds. Based on the evaluation at

Woreda Health Office and health center level, the reporting format is flexible to accommodate changes when there is a need for additional information or modes of operation. Generally, the participant of the evaluation agreed that the malaria surveillance system is flexible and able to adapt and accommodate changes when there is a need for additional information or reporting on malaria forms.

Sensitivity

Sensitivity in surveillance refers to the proportion of actual cases in a population that are detected and notified through the system. Sensitivity is particularly important in an early warning system designed to detect outbreaks (15). It is usually not practical to obtain highly accurate estimates of sensitivity as this requires the true number of cases in the population be known, something that is almost impossible, and that the diagnosis of reported cases be confirmed to eliminate "false positives" there were no local survey conducted to establish the exact burden of malaria in Bhir Dar Zuriya Woreda.

Data quality

Data quality reflects the completeness and validity of data recorded in the public health surveillance system. Except for Robit Health Center, which had poor data quality, in all assessed health facilities all fields in the reporting formats were correctly filled and were clear to read and understand. All health centers, health posts and the Woreda Health Office send their weekly reports to higher level, as per the guideline.

Acceptability

Acceptability of a system is a reflection of the willingness of the surveillance staff to implement the system, and of the end users to accept and use the data generated through the system. It is the acceptability of the surveillance system mainly assessed by the well engagement of the reporting agents and their active participation in case detection and reporting. The average reporting rates of health facilities were 99.07% as evaluated over the reporting weeks. Thus, it is possible to conclude that the reporting system was acceptable by PHEM focal persons and health post workers. All reporting health facilities were using the standard case definition for case detection and reporting through the appropriate reporting formats.

Representativeness

Representativeness refers to the degree to which the reported cases reflect the occurrence and distribution of all cases in the population under surveillance. Geographical representativeness is particularly important for early warning system to ensure detection of outbreaks of infectious diseases. As stated by PHEM personnel, the surveillance system can pick all malaria cases in the whole community whether it is the rural or urban. Therefore, the weekly public health emergency report comes from the lowest community to the health posts and from health posts to the health centers and then to the Woreda Health Office.

Timeliness

The single most important measure of timeliness is whether data are submitted in time to begin investigations and implement control measures. Timeliness of reporting should be measured against standards developed by each country.

It reflects the speed between steps in a public health surveillance system. Timeliness of health center malaria reports at Woreda Health Office level was above 99% which is in line with the National PHEM expected level of report timeliness, of 80% and above. Timeliness of health post reports at health center level was lower than the health center. Out of eight health posts visited during the evaluation period, 7 (87.5%) of them reported on time. There were reporting gaps at the health post level in relation to documenting the date of report sent to the next level.

Completeness

Completeness of reporting sites refers to the proportion of reporting sites that submitted the surveillance report irrespective of the time when the report was submitted. This is measurable in situations where the surveillance system is such that the number of reporting sites or expected surveillance reports is known. Completeness is measured or indicated by dividing the number of facilities that sent report divided by number of total facilities expected to report. In visited health facilities, the reporting completeness was above 80%, the minimum WHO required standard.

Positive predictive value

The positive predictive value (PPV) is the proportion of people the surveillance system indicates as having the disease who actually have it. It was possible to calculate the positive predictive value of the system by dividing the number of positive malaria cases confirmed by microscope or RDT by the total suspected malaria cases. RDT/slide tests performed for malaria diagnosis and number of RDT or slide confirmed malaria cases were 101,230 and 25,857 respectively from 2012 to 2013 EFY. Hence, the PPV of the malaria surveillance system was 25.5 percent.

$$\boldsymbol{PPV} = \frac{\textbf{Number of RDT or slide confirmed malaria cases}}{\boldsymbol{Number\ of\ RDT\ or\ slide\ tests\ performed\ for\ malaria\ diagnosis}} \times 100 = \frac{25{,}857}{101{,}230} \times 100 = 25.5\%$$

Stability

Stability refers to the reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability (the ability to be operational when it is needed) of the public health surveillance system. Concerning that attribute, the surveillance system in BZW level was used to collect, manage and provide data without trouble and it was fully operational throughout the time.

Discussion

The data from a public health surveillance system should accurately reflect the characteristics of health-related event under surveillance. These characteristics generally relate to time, place, and person (5). All public health surveillance systems should be evaluated periodically in order to monitor how well the systems are being operated and determine whether their stated objectives and goals have been met accordingly.

A suspected case of malaria is one in which an individual has an illness suspected by a health worker of being due to malaria, generally on the basis of the presence of fever with or without other symptoms. This suspicion triggers the process of parasitological confirmation by microscopy or RDT (6). The Bahir Dar Zuria Woreda Surveillance System assessment confirmed that, from 2012 to 2013 EFY; a total of 101,230 suspected cases of malaria were identified. Of those 25,857 (25.5%) were confirmed cases of malaria with 0 deaths. This finding is high compared to a study finding in Benna tsemay District, Southern Ethiopia (16).

Based on the findings, the weekly surveillance report completeness in Bahir Dar Zuriya Woreda was (99.07%), which was higher than the 95% national target set by the country (17), as well as the 80% WHO target (18); indicating that all visited health facilities were reporting to their respective levels as per the standard in the national guideline.

The finding of the evaluation indicated that *Plasmodium falciparum* 72% (18,546) was the dominant species followed by *Plasmodium vivax* 28 % (7,311), this finding is different compared to the finding of *plasmodium vivax* 74%, *Plasmodium flciparum* 19.8% and mixed infection 6.2%. in Arsi Negelle, Southern Ethiopia (19).

The highest proportion, 54.3% (14,045) of the malaria cases were in age groups 15 and above, followed by 30% (7,756) in those 5-14 years of age. Under five children accounted for 3,784 (14.6%) of total cases and the rest 272 (1.1%) were pregnant women. This was high as compared to a study finding in Tselemti Wereda, North Ethiopia (20).

LLINs should be provided to households in malaria endemic areas, i.e. areas that are stratified as low, moderate and high malaria transmission will be targeted for universal (100%) LLIN coverage with one LLIN per sleeping space on average (4). Since Bahir Dar Zuriya Woreda is one of malaria endemic Woredas in West Gojjam Zone, nearly 233,109 LLINs were distributed to 54,678 households between 2007 and 2013 EFY. Almost all households of the Woreda received at least one ITN. This finding is in line with the finding of a study done in Jabi Tehnan District, north-western Ethiopia (21).

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 (5). The analysis and interpretation of the data from malaria surveillance system and using information for action was good in BDZ Woreda. The system was able to detect malaria outbreaks that took place in the Woreda. From that is possible to conclude that the malaria surveillance system in the Woreda was useful.

It is possible to monitor the provision of feedbacks by different levels of surveillance and to evaluate the quality of feedback provided, and the implementation of follow-up actions (15). The Woreda Health Offices has an experience of addressing feedbacks in oral message and bulletins and did its supportive supervision every three months.

The positive predictive value for detecting cases (PPV) is the proportion of diseased persons that are detected (clinically or through laboratory confirmation) by the surveillance system. The positive predictive value of the surveillance system was 25.5% which was nearly in agreement with the national slide positivity rate according to World Malaria Report of 2017, 27% (22).

Strengths and Limitations

Strengths

Surveillance/ PHEM system was fully operational in the Woredas. All participants from the PHEM Department and health facilities were very cooperative for this system evaluation.

Limitation of the study

Since the study design we used was non-probabilistic and most of data were secondary, the representativeness of the study might be affected.

Conclusion

Reporting timeliness and completeness are above the national and international targets. This evaluation identified problems with lack of budget, training and office materials like computer. Public health emergency management guideline and case definitions of malaria were available in all visited health facilities. Generally, the surveillance system was found to be simple, useful, flexible, acceptable, and representative. The surveillance system evaluation detects malaria cases easily.

Recommendations

The Woreda and health center PHEM and surveillance focal persons should be trained in malaria surveillance system. Surveillance information should be analyzed and used locally to address and solve problems related to malaria surveillance system. Monitoring and evaluation should be conducted regularly to establish and maintain effective and efficient surveillance systems. Regular and appropriate feedback should be maintained through supervisory visits and bulletins. To strengthen and to create a well-functioning surveillance system, regular supportive supervision and feedback system should be implemented.

REFERENCES

1. Organization WH. Tailoring malaria interventions in the COVID-19 response. Geneva: World Health Organization. 2020.
2. Rai N, Abraham J. Different Clinical Features of Malaria. Asian Journal of Biomedical and Pharmaceutical Sciences. 2012;2(12):28.
3. Dyer O. African malaria deaths set to dwarf covid-19 fatalities as pandemic hits control efforts, WHO warns. British Medical Journal Publishing Group; 2020.
4. <eth_national_malaria_guidline_4th_edition.pdf>.
5. German RR, Horan JM, Lee LM, Milstein B, Pertowski CA. Updated guidelines for evaluating public health surveillance systems; recommendations from the Guidelines Working Group. 2001.
6. Group W. Malaria surveillance, monitoring & evaluation: a reference manual. Geneva: World Health Organization. 2018:206.
7. Yasnoff WA, O Carroll PW, Koo D, Linkins RW, Kilbourne EM. Public health informatics: improving and transforming public health in the information age. J Public Health Manag Pract. 2000;6(6):67-75.
8. Jima D, Wondabeku M, Alemu A, Teferra A, Awel N, Deressa W, et al. Analysis of malaria surveillance data in Ethiopia: what can be learned from the Integrated Disease Surveillance and Response System? Malar J. 2012;11(1):1-14.
9. Csa I. Central statistical agency (CSA)[Ethiopia] and ICF. Ethiopia demographic and health survey, Addis Ababa, Ethiopia and Calverton, Maryland, USA. 2016.
10. Intiative PM. President's malaria initiative Ethiopia: Malari a operational plan FY 2016 USAID. 2016.
11. Organization WH. Achieving the malaria MDG target: reversing the incidence of malaria 2000-2015: World Health Organization; 2015.
12. Nsubuga P, Nwanyanwu O, Nkengasong JN, Mukanga D, Trostle M. Strengthening public health surveillance and response using the health systems strengthening agenda in developing countries. BMC Public Health. 2010;10(1):1-5.
13. Alemu T, Gutema H, Legesse S, Nigussie T, Yenew Y, Gashe K. Evaluation of public health surveillance system performance in Dangila district, Northwest Ethiopia: a concurrent embedded mixed quantitative/qualitative facility-based cross-sectional study. BMC Public Health. 2019;19(1):1-9.
14. Toyama Y, Ota M, Molla G, Beyene BB. Sharp decline of malaria cases in the Burie Zuria, Dembia, and Mecha districts, Amhara Region, Ethiopia, 2012–2014: descriptive analysis of surveillance data. Malar J. 2016;15(1):1-8.
15. Organization WH. Communicable disease surveillance and response systems: guide to monitoring and evaluating. Lyon [France]: World Health Organization, 2006.
16. Debo GW, Kassa DH. Prevalence of malaria and associated factors in Benna Tsemay district of pastoralist community, Southern Ethiopia. Tropical diseases, travel medicine and vaccines. 2016;2(1):1-9.
17. Singh K. Health sector performance in Ethiopia: a study in regional disparities. JADS. 2019;6(2):36.

18. Wolfe CM, Hamblion EL, Dzotsi EK, Mboussou F, Eckerle I, Flahault A, et al. Systematic review of Integrated Disease Surveillance and Response (IDSR) implementation in the African region. PLoS One. 2021;16(2):e0245457.
19. Hailemariam M, Gebre S. Trend analysis of malaria prevalence in Arsi Negelle health center, Southern Ethiopia. Journal of Infectious Diseases and Immunity. 2015;7(1):1-6.
20. Shiferaw M, Alemu M, Tedla K, Tadesse D, Bayissa S, Bugssa G. The Prevalence of Malaria in Tselemti Wereda, North Ethiopia: A Retrospective Study. Ethiopian journal of health sciences. 2018;28(5).
21. Animut A, Negash Y, Kebede N. Distribution and utilization of vector control strategies in a malarious village of Jabi Tehnan District, north-western Ethiopia. Malar J. 2014;13(1):1-6.
22. Outbreak WC. Assessing the outbreak response and improving preparedness. Geneva, Switzerland: World Health Organisation. 2004.

CHAPTER- IV

Health Profile Description Report

4.1 Wera Dijo Woreda Health Profile Report-SNNPR, 2020

Abstract

Background: A community health profile is a comprehensive compilation of information about a community. The data in a profile reflects the health of a given community from many different angles. It is a process of collecting, analyzing and interpreting information from multiple and diverse sources in order to develop a deep understanding of the health of a community. The information may include primary or secondary sources of data.

Objective: The objective of this assessment was to describe health and health related information of Wera Dijo Woreda and to identify problems for priority setting.

Methodology: A cross-sectional descriptive study design was employed to collect data from different sector offices using structured questionnaire. Collected data were entered and analyzed using Microsoft Excel 2016. Results were displayed through narration, graphs and tables.

Results: Wera Dijo Woreda has total of estimated population of 107,786 with 52,597 (48.8%) male & 55,189 (51.2%) females. Male to female sex ratio is 95:105. From the total population, under one year old children constituted (3.09%), under five (15.15%), less than 15 years old (46.5%), women of child bearing (22.62%) and pregnant women were (3.35%). The woreda had a total of 34 schools (30 primary, 2 secondary and 2 preparatory schools). Acute Upper Respiratory Infection, Functional intestinal disorder and pneumonia were the top leading causes of under-five children morbidity.

Conclusion: Access to safe water supply was the major problem of the Wera Dijo Woreda. As water is important for prevention of communicable disease, the Woreda should give emphasis to improve the water supply coverage of the community. Acute upper respiratory tract infection was the leading cause of morbidity in the district outpatient departments. This may due to lack of clean drinking water, poor sanitation and low environmental health and personal hygiene practices. Prevention and control measures should be strengthened to reduce the burden due to acute upper respiratory tract infection and other priority diseases.

Recommendation: Woreda Education Office should work towards reducing school dropout rate in collaboration with other sectors and parents. Construction of new water schemes and repairing non-functional water schemes is recommended as the Woreda has very low safe water supply coverage. Health facilities should also be supplied with safe water and electric power.

Keywords: Health profile, Woreda, 2020.

Introduction

Community Health Profile Assessment is both a process and a product. It is a process of collecting, analyzing and interpreting information from multiple and diverse sources in order to develop a deep understanding of the health of a community (1). It is also a process that uses those results to develop strategies to improve the health status of the community. The findings of the community health assessment are presented in the form of a community health profile and inform community decision making, the prioritization of health problems and the development and implementation of community health improvement plans.

The data in a profile reflects the health of a given community from many different angles. It identifies problems, suggests areas for improvement and stimulates action. Health profile provides a lively, scientifically-based account of health in the district/Woreda; it can stimulate public interest and political commitment; and it can identify targets for the future and monitor progress towards them (1).

A community health assessment often produces a long list of public health needs, issues, and problems. This list can then be used to set priorities. The purpose of prioritization is to develop consensus on a shorter list of goals that a community can realistically tackle. Prioritization is a critical and sometimes challenging process that can lead to measurable improvement in the health of a population. A prioritized list of community health issues can serve as the basis of a community health improvement plan and can inform the use of limited resources. This is the key link between a health profile and a health plan (2).

A comprehensive health profile may include many indicators; those related to selected priorities can be chosen as key indicators that a community monitors as part of keeping a pulse on community-wide changes (3). The monitoring of those indicators is a key element in the health plan, while a continuously updated profile will have many more indicators that are updated, maintaining a broader scope for use by the larger community.

In HSDP the primary focus areas are maternal and newborn care, and child health, and aims to stop and reverse the spread of major communicable diseases, such as HIV/AIDS, TB, and malaria. For this action The Health Extension Programme (HEP) works as the primary tool for the prevention, health promotion and behavioral change (2). The primary uses of a comprehensive community health profile are to: compile community data and interpretation of that data in one place, so that local health data can be reviewed and used by many sectors of the community and clearly present a community's health needs and issues so that they can be prioritized for action.

The purpose of this Community Health Profile is to describe the health status of the population, key health behaviors, describe de-terminates of health outcomes and behaviors, and examine root causes of ill health and health inequalities. A community health assessment and improvement plan is a collaborative, systemic process of collecting and analyzing data and information, mobilizing communities, developing priorities, gathering resources, and planning actions to improve the population's health (4).

The district health profile offers information through a reliable and transparent platform. It allows district health officials to monitor priority disease trends and adequately target relevant interventions. It helps the stakeholders determine what policies are needed to support work in the district, and in turn how to allocate resources to district efforts. It educates and empowers district health workers and in turn the community they serve (5).

Significance of the study

The health profile assessment helps to create a multipurpose data base of health information of a country and making it available to all stakeholders in the healthcare sectors. This data base of health information should be comprehensive, up-to-date and easy to access. The overall importance of health profile assessment is to provide relevant information for planning and decision making on an informed basis to the planners, policy makers, health administrators, research workers and others engaged in raising the health and socio-economic status of the community. However, in low income countries like Ethiopia it is difficult to obtain complete and comprehensive health information, especially at Woreda level. Hence, an assessment of current health profile of a Woreda is significant to provide comprehensive and up-to-date health information. Therefore, this study was conducted to generate health and health related information which can help Wera Dijo Woreda and other stakeholders to improve the general public health of the community.

Objectives

General objective

The general objective of this assessment was to describe health and health related information of Wera Dijo Woreda and to identify problems for priority setting.

Specific Objectives

- To describe the demographic characteristics of the population
- To assess basic health services and the health status of the Woreda
- To describe existing community health problems
- To document baseline health information about the Woreda

Method and materials

Study Area

The health profile description was conducted in Wera Dijo Woreda which is one of the three Woredas found in Alaba Zone, in the Southern Nation, Nationalities and People's Region. The woreda is 119 km far from Hawasa (Regional capital) and some 399 km from Addis Ababa, the Country's capital. The Woreda was established following the establishment of Alaba Special District as a zone in 2018. Wera Dijo Woreda has got its name from the nearest Bilate River. "Wera" means river in the local language. Its geographical coordinates are 7° 28' 0" North, 38° 12' 0" East and its original name was Besheno. The Altitude of the woreda is-2050 mt, and the average rain fall of the woreda is 2,200 mm and the annual temperature is 17-23 degree centigrade.

The Woreda has 27 Kebeles with total Population of 107,786 from this 52,597 (48.8%) are males & 55,189 (51.2%) are females. The Woreda has 1 Primary Governmental Hospital, 3 Health Centers, 26 health posts, 2 private clinics and 1 private pharmacy. All of them were functional.

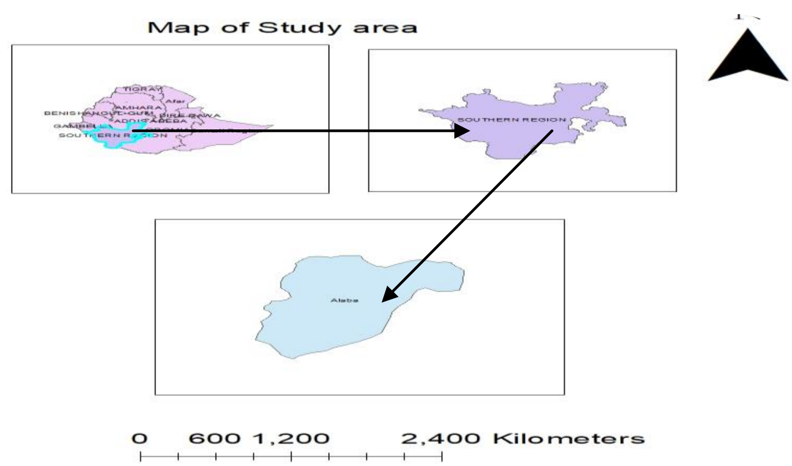

Figure 35 Map of Wera Dijo Woreda, Alaba Zone, SNNPR, 2020

Study Design

Descriptive cross-sectional study was employed using standard questionnaire. Hard and Soft copies of documented data (secondary data) were assessed to generate different data. Apart from that, interviewing and discussion with concerned bodies were also made.

Data Source

All available secondary data that contain important information for health profile were used.

Methods of Data Collection

The secondary data were collected through document review. Other important information was also collected through interviewing the responsible authority and key informants using semi structured questionnaires. Relevant information was collected from different Woreda Administrative Offices (Health, water, Culture and Tourism, Finance, Transport, Education and Agriculture) for the year 2019/2020.

Methods of Data Analysis

The collected data were edited, cleaned and entered to a computer. Data were analyzed using Microsoft excel and results were displayed using frequency distribution table and graphs.

Ethical Consideration:

An official letter, written from EPHI, was submitted to SNNPR Health Offices in order to get permission to do the health profile description of a Woreda. The Regional Health Office also sent a written letter to Alaba Zone to conduct the health profile description of Wera Dijo Woreda.

Dissemination of findings:

The results of Health profile data analysis were communicated to Wera Dija Woreda Administration, PHEM office of EPHI and Addis Ababa University School of Public Health Field Epidemiology Training Program.

Variables

Demography: The study of population and its characteristics, with reference to such factors: size, age structure, density, fertility, mortality, growth and social and economic variables.

Child Mortality Rate: The number of births occurring in 2004 per 1000 women in the reproductive ages (i.e. women aged 15-49).

Crude Birth Rate: The number of births in a population during 2004 is divided by the number of person-years-lived by the population during the same period. It is frequently expressed as births per 1,000 populations.

Crude Death Rate: The number of deaths in a population during 2004is divided by the number of person-years-lived by the population during the same period. It is expressed as births per 1,000 populations.

Infant Mortality Rate (IMR): The ratio of the number of deaths under one year of age occurring in 2004 to the number of births in the same year

Contraceptive Prevalence Rate: Proportion of women of reproductive age (15-49 years) who are using (or whose partner is using) a contraceptive method, on the year 2004

ANC rate (how many of the total expected pregnancies attended 1st ANC): Proportion of pregnant women attended, at least once during the current pregnancy, by a health professional, for reasons related to pregnancy

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, child birth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns.

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.

TB treatment Success Rate: Percentage of a cohort of new smear positive TB cases registered in a specified period that successfully completed treatment. Successful completion entails clinical success with or without bacteriological evidence of cure.

TB Cure Rate: Percentage of a cohort of new smear-positive TB cases registered in a specified period that was cured as demonstrated by bacteriologic evidence (a negative sputum smear result recorded during the last month of treatment and on at least on one previous occasion during treatment).

TB Defaulter Rate: Percentage of a cohort of new smear-positive TB cases registered in 2004 that interrupted treatment for more than 2 consecutive months.

TB Death Rate: Percentage of a cohort of new smear-positive TB cases registered in a specified period that died during treatment, irrespective of the cause.

Skilled Birth Attendant: An accredited health professional such as midwife, doctor or nurse who has been trained in the skills needed to manage normal (uncomplicated) pregnancies, child birth and the immediate postnatal period and in the identification, management and referral of complications in women and newborn. (Exclude TTBA and HEWs)

Leading Causes of Morbidity: The frequently occurring causes of morbidity (10) among patients of which the greatest number of cases have been reported during the year.

Fully Immunized: Surviving infants who receive all doses of infant antigen; The Infant Antigens are: BCG, Pentavalent (DPT-HepB, Hib), doses 1 -3; OPV, doses 1—3; and Measles.

Antenatal Coverage: Proportion of pregnant women attended, at least once during the current pregnancy, by a health professional, for reasons related to pregnancy.

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

Leading Causes of Mortality: The most frequently occurring causes of mortality (10) under which the greatest number of deaths have been reported during a given year.

Maternal Mortality Rate: The number of maternal deaths while pregnant or within 42 days after termination of pregnancy from any cause related to pregnancy or its management per 100,000 populations

Results

History

Wera Dijo Woreda was established in 2010 EFY and named after the nearest Bilate River. "Wera" means River, in the local language. Previously it was under Alaba Special District as Besheno kebele. In 2010 EFY Alaba Special District was separated to form an independent zone. Following that in 2010 EFY Wear Dijo was established as Woreda.

Geography

Wera Dijo Woreda is one of the three Woredas of the Alaba Zone of Southern Nation, Nationalities and People's Region, which is 119 km far from Hawasa and 390 km from Addis Ababa. Wera Dijo is bordered on the south east by Atoto Ulo wereda, on the south west by Shala woreda of Arsi Negele Zone, on the east by Lanfuro Woreda, and on the north by Adamitulu Jido Kombolcha Woreda. It has a total area of 49,325 km2 from which 10,287 (19.4%) hectare is used for farming. The Woreda climate contains 72% low land, 27.8% midland and 0.2% highland.

Administrative issues

Wera Dijo Woreda has a total of 23 rural and 4 urban kebeles in which the central administrative office for all sectors were found in Besheno Town. Before 2018 the Woreda was administered as Besheno kebele. The current Wera Dijo Woreda Administrative unit established as Woreda Administrative unit following the establishment of Alaba Special District as Zone in 2018.

Demography

Based on the woreda's Cultural Office data, the Wera Dijo Woreda has total estimated population of 107,786 with 52,597 (48.8%) males & 55,189 (51.2%) females. Male to female sex ratio was 95:105.The population size of the Wored varies from kebele to kebele. As a result, Alage Tech. College kebele (10.8%), Besheno kebele (8.4%) and Bendo Choloksa kebele (6.1%) have the largest share of population of the Woreda respectively. On the other hand, Doda Bereho kebele (1.6%), Alekegero kebele (1.8%) and Teta Libitora kebele (1.81%) have the smallest share of the Woreda population **Table 24**.

Table 24 Population of Wera Dijo Woreda by Kebele SNNPR, 2020

No	Kebele	Male	Female	Total
1	Buko tibame	1189 (49%)	1237 (51%)	2426 (100%)
2	Meto Dubela	1355 (49%)	1410 (51%)	2765 (100%)
3	Yato Bereho	1289 (49%)	1342 (51%)	2631 (100%)
4	Doda bereho	885 (48.97%)	922 (51.03%)	1807 (100%)
5	Aleke gero	949 (49%)	988 (51%)	1937 (100%)
6	Wejego Yato	1212 (49.5%)	1262 (50.5%)	2474 (100%)
7	Negele Wedesh	1484 (48.9%)	1545 (51.1%)	3029 (100%)
8	Teta Libitora	962 (49%)	1002 (51%)	1964 (100%)
9	Ajo Huluko	1611 (49%)	1676 (51%)	3287 (100%)
10	Sinbita	1676 (49%)	1744 (51%)	3420 (100%)
11	Anshekora Boti	2090 (49%)	2175 (51%)	4265 (100%)
12	Bendo Choloksa	3200 (49%)	3331 (51%)	6531 (100%)
13	Udana Cholokisa	1728 (49%)	1798 (51%)	3526 (100%)
14	Udana Meno	1405 (49%)	1463 (51%)	2868 (100%)
15	Qulibi	2540 (49%)	2643 (51%)	5183 (100%)
16	Weteta	1802 (49.5%)	1875 (50.5%)	3677 (100%)
17	Besheno	4446 (49%)	4627 (51%)	9073 (100%)
18	Chobare Meno	2266 (49%)	2359 (51%)	4625 (100%)
19	Kobo Chobare	2139 (49%)	2226 (51%)	4365 (100%)
20	Kobo Geto	1419 (49%)	1476 (51%)	2895 (100%)
21	Andegna Koncha	1222 (41.5%)	1721 (58.5%)	2943 (100%)
22	Huletegna Koncha	1154 (49%)	1201 (51%)	2355 (100%)
23	Bubisa	2032 (49%)	2115 (51%)	4147 (100%)
24	Kulfo	1664 (49%)	1731 (51%)	3395 (100%)
25	Laygnawo Tuka	2596 (49%)	2700 (51%)	5296 (100%)
26	Hantezo	2545 (49%)	2649 (51%)	5194 (100%)
27	Alage Tech. College	5737 (49%)	5971 (51%)	11708 (100%)
	TOTAL	52,597 (48.8%)	55,189 (51.2%)	107,786 (100%)

As it is indicated in figure 2 from the total population under one years old children constitutes (3.09%), under five (15.15%), less than 15 years old (46.5%), women of child bearing (22.62%) and pregnant women were (3.35%) **Figure 36**. The age groups above 65 years old were 3.9%. The Woreda had a total of 19,566 household with average household size of 5.5 people.

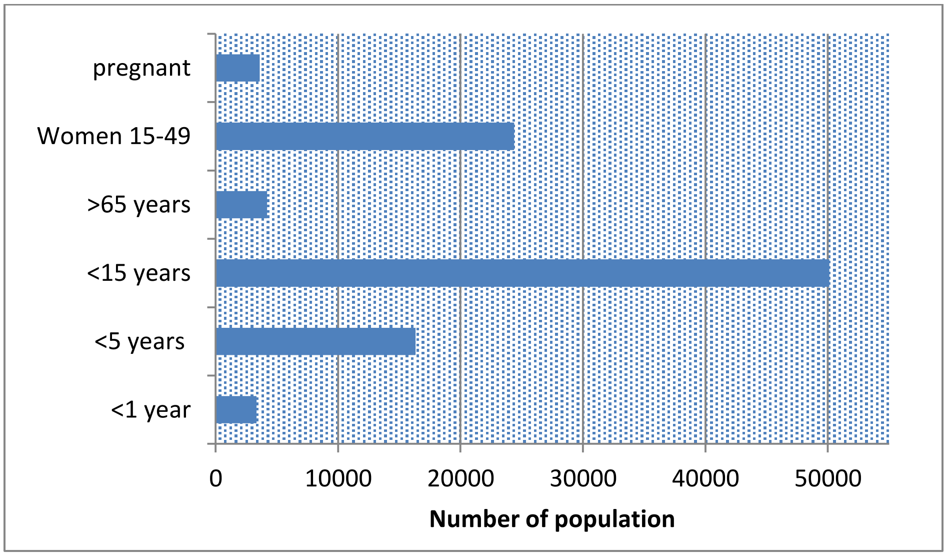

Figure 36 Distribution of population by age in Wera Dijo Woreda, SNNPR, 2020

Concerning Ethnic composition, all population living in Wera Dijo Woreda were Alaba people and Alabigna was the working language where most of the people speak it and Amharic is spoken by few people live in the urban area. In terms of religion composition almost all populations of the woreda are Muslims.

The population size of the Woreda varies from kebele to kebele. As a result, Alage Tech. College kebele (10.8%), Besheno kebele (8.4%) and Bendo Choloksa kebele (6.1%) have the largest share of population of the Woreda respectively. On the other hand, Doda Bereho kebele (1.6%), Alekegero kebele (1.8%) and Teta Libitora kebele (1.81%) have the smallest share of the Woreda population.

Economic Situation

The main economic activity of the Woreda was agriculture and livestock production. Its total area is 49,325 km^2 of which 21,418 km^2 (43.4%) is cultivated. Two rainy seasons give the chance to the Woreda to produce crops. Maize, Teff, and paper were the main crops produced in the Woreda.

There were no documented evidences that show the average income per house hold and livestock resource. In Wera Dijo Woreda farmers were using DAP and urea fertilizers to improve their productivity.

Education

Wera Dijo woreda has a total of 34 schools (30 primary, 2 secondary and 2 preparatory schools). No private school was found in the woreda. Totally 26,830 students were attending in those schools. Among students, 15,559 (58%) were males and 11,271 (42%) were females **Table 25**.

The woreda has a school dropout rate of 11.2%. From totally enrolled 26,830 students 3,000 were dropped out due to drought, flooding and shortage of food and water.

Among those 34 schools, only 3 (8.8%) of them have access to water supply. All schools have toilet but only 3 (8.8%) of them have access to water supply. All latrines were functional. All schools have health related clubs such as HIV/AIDS club. The Woreda had 278 male and 43 female teachers. No data was found to calculate the dropout rate by age and sex.

Table 25 Number of students by sex in Wera Dijo Woreda SNNPR, 2020

School Type	Male	Female	Total
Primary	5173 (33.3%)	4186 (37%)	9359 (100%)
Secondary	9015 (58%)	6172 (54.7%)	15187 (100%)
Preparatory	1352 (8.7%)	932 (8.3%)	2284 (100%)
Grand Total	**15540**	**11290**	**26830**

Infrastructure of the Woreda

Water

Access to and use of safe drinking water can contribute enormously to health, productivity and social development. The main water sources of the Wera Dijo Woreda is Hand dug well, borehole and river. The documented evidences showed that the coverage of clean water supply is around 10%. The information collected from the woreda indicates that there is high shortage of clean water supply.

Electric Power Supply, Telephone Communication and Transportation

Electricity is an essential part of modern life and important for the economy. People use electricity for lighting, heating, cooling and refrigeration and for operating appliances. There was no well-organized data that indicates household with access to electric power supply. Only 4 kebeles have access to electric power supply. But those kebeles which had infrastructure access to electric power did not get the power continuously. The Woreda has no access to fixed telephone communication, but there were few peoples who had mobile telephone access.

Road is the major infrastructure in day to day activities. All Kebeles have a road that communicates them to the Woreda. But during the rainy season it is difficult to use. Overall the Wera Dija Woreda infrastructure development was poor.

Disaster situation

Flooding was the frequently occurring disaster in Wera Dijo Woreda. The risk of further flooding is high during the kiremt season. Flood experience significant devastation. People's homes are damaged or destroyed entirely. Based on the information collected from the Woreda Tourism and Culture Office, flooding was the major cause for food insecurity for the woreda. .

Health

The woreda health budget

Based on the information from the Wera Dijo Woreda Finance & Economic Office, the annual budget in 2010 EFY was 116,812,428 ETH Birr. Out of the total district budget 10,664,832 ETH Birr (9.1%) was allocated for the health sector.

Facility Distribution

The large part of the Woreda is served by government run health facilities. There were very few private health facilities in the Woreda. It had 37 health institutions among those 92% (34) of them are owned by government and the rest 8% (3) of them were private health institutions. There was no documented evidence that indicates the health coverage of the Woreda. The following **Table 26** shows the distribution of these facilities:

Table 26 Distribution of Health Institutions in Wera Dijo Woreda, SNNPR, 2020

<table>
<tr><th rowspan="2">S/N</th><th rowspan="2" colspan="2">Type of Health institution</th><th colspan="2">Number</th></tr>
<tr><th>Government</th><th>Private</th></tr>
<tr><td>1</td><td colspan="2">Hospital</td><td>1</td><td>0</td></tr>
<tr><td>2</td><td colspan="2">Health centre</td><td>3</td><td>0</td></tr>
<tr><td>3</td><td colspan="2">Health Post</td><td>26</td><td>0</td></tr>
<tr><td>4</td><td colspan="2">Pharmacy</td><td>2</td><td>1</td></tr>
<tr><td>5</td><td colspan="2">Drug Store</td><td>1</td><td>0</td></tr>
<tr><td>6</td><td colspan="2">Laboratory</td><td>1</td><td>0</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Clinics</td><td>Small/primary</td><td>0</td><td>1</td></tr>
<tr><td>Medium</td><td>0</td><td>1</td></tr>
<tr><td>Total</td><td colspan="2"></td><td>34</td><td>3</td></tr>
</table>

Human resource in health institutions

A total of 137 health workers found in the Woreda, among those, majority 47 (34.3%) of them were health extension workers. There was one specialist and 9 Medical Doctors in the Woreda. Additionally there were 14 Health officers and 28 Clinical nurses. The following **Table 27** depicted the distribution of health professionals in the Woreda.

Table 27 Distribution of Health professionals in Wera Dijo Woreda, SNNPR, 2020

S/N	Profession	Male	Female	Total
1	Specialist	1	0	1
2	Medical Doctors	9	0	9
3	Health officers	11	3	14
5	Pharmacy technician	8	0	8
6	Lab technician	10	0	10
7	Environmental health professional	1	0	1
8	Midwifery	4	10	6
9	Clinical nurse	26	2	28
10	X-ray Technician	1	0	1
11	Nurse degree	5	0	5
12	Health extension workers	0	47	47
	Total	**75**	**62**	**137**

Vital statistics and health indicator

Neonatal mortality measures the probability of dying in the first month of life, while Infant mortality is the probability of dying before the first birthday and Under-five mortality provide probability of dying before the fifth birthday. These indicators reflect a country's level of socioeconomic development and quality of life. Health indicators like NMR, IMR, CBR and CDR could not be analyzed due to unavailability of those data. In the same manner data on measures of fertility like crude death rate, child and infant mortality rate were not available in the Woreda.

Antenatal care (ANC) is a maternal healthcare service provided by skilled healthcare professionals to pregnant women and adolescent girls. It is provided throughout pregnancy to ensure the best health outcomes for both the mother and the newborn. The care service includes the following components: risk identification, prevention and management of pregnancy-related or concurrent diseases, and health education and health promotion (6). Family planning coverage of the Woreda is 70% and the most commonly used family planning methods were Pills and Depo-Provera. The proportion of pregnant women in the Woreda that had at least one ANC and 4th ANC visit reaches 100%. The post natal service coverage of the Woreda is around 80%. In the year 2020, 76% of births attended by skilled health personnel and only 0.03% of births attended by HEWs of the Woreda. There was 1 maternal death in the year 2020 and this was due to the delay of attending to the hospital from health center.

Immunization

Expanded Program on Immunization (EPI) is one of the key programs in World Health Organization (WHO) Ethiopia under the Maternal, Child Health and Nutrition (MCHN). According to EPI Annual Report 2018, Regional coverage variation has been observed with of lowest 77% in Afar and Gambella to 100% of the highest Penta 3 coverage in Addis and Harari regions. The national Penta one to three dropout was 8% the country has reported MCV1 coverage ranging from 63% in Gambella up to 100% in Addis Ababa and Harari (7). The immunization coverage of the Wera Dijo Woreda in the year 2020 was summarized in **Table 28** below.

Table 28 EPI Coverage in Wera Dijo Woreda, SNNPR, 2020

S/No	Type of vaccine	Plan	Achievement	%
1	BCG	3094	2763	89.3
2	Polio 0	2989	2710	90.7
3	Polio 1	2989	2649	88.6
4	Polio 3	2989	2638	88.2
5	Penta 1	2989	2649	88.6
6	Penta 3	2989	2638	88.2
7	PCV 1	2989	2611	87.3
8	PCV 3	3094	2680	86.6
9	Measles	3094	2671	86.3
10	Fully Immunized	2989	2671	89.4
11	TT2	3094	2691	87.0

Environmental health, Sanitation and Hygiene

Sanitation and hygiene are critical to health, survival, and development. Many countries are challenged in providing adequate sanitation for their entire populations, leaving people at risk for water, sanitation, and hygiene (WASH)-related diseases. Throughout the world, an estimated 2.4 billion people lack basic sanitation (more than 32% of the world's population) (8). Basic sanitation is described as having access to facilities for the safe disposal of human waste (feces and urine), as well as having the ability to maintain hygienic conditions, through services such as garbage collection, industrial/hazardous waste management, and wastewater treatment and disposal (9). Data regarding the coverage of water supply indicates that population with access to safe water supply is only 10% and households' access to latrine is 92%. Solid waste management coverage of the Woreda is 38% while the liquid waste management coverage of the woreda is only 10%. This indicates the sewerage system of the woreda was poor.

Community health service

Health extension workers (HEWs) are the key resources for the implementation of the health extension program in Ethiopia. The role of HEWs aims to improve the quality of health extension services at community and household levels (10). There were 502 CHWs in the district and their responsibility was teaching each house hold on a package of HEWs and to be model for others. The health extension workers implement over all HEWs program packages.

Top Causes of Outpatients Visit (Morbidity)

According to the information obtained from the Wera Dijo Woreda Health Office, the leading causes of morbidity in 2020 are displayed in **Figure 37** . Acute Upper Respiratory Infection, functional intestinal disorder and pneumonia were the top leading causes of under-five children morbidity.

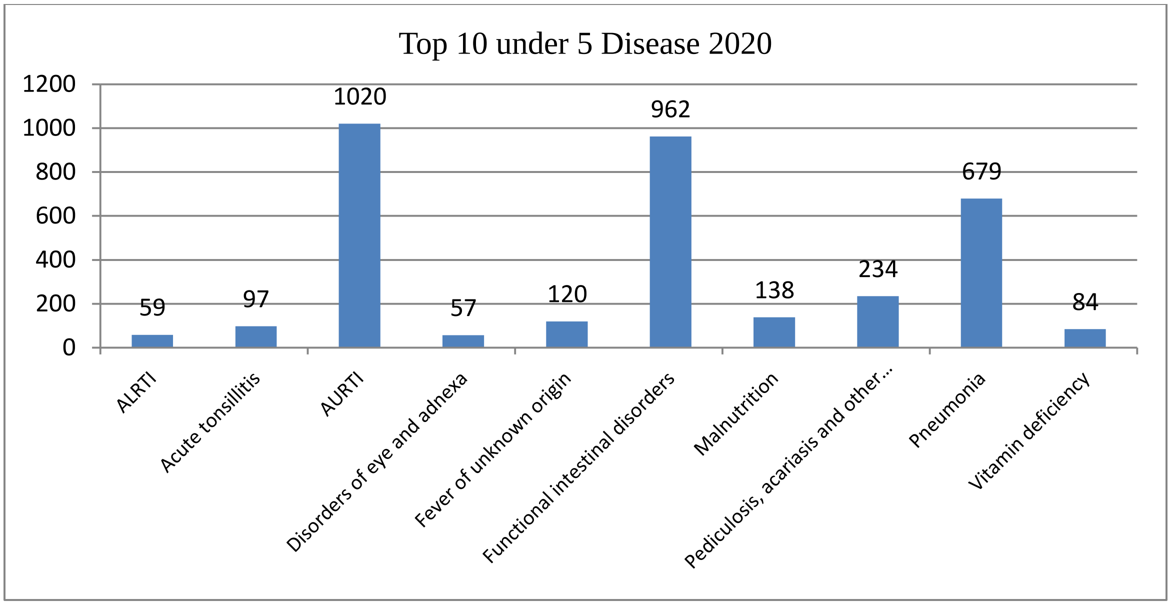

Figure 37 Top ten under -5 causes of OPD visits of Wera Dijo Woreda, SNNPR, 2020

As it is displayed in **Figure 38** Fever Unknown Origin, Acute Upper Respiratory Infection and Typhoid and paratyphoid illnesses were the top leading causes of morbidity in adult.

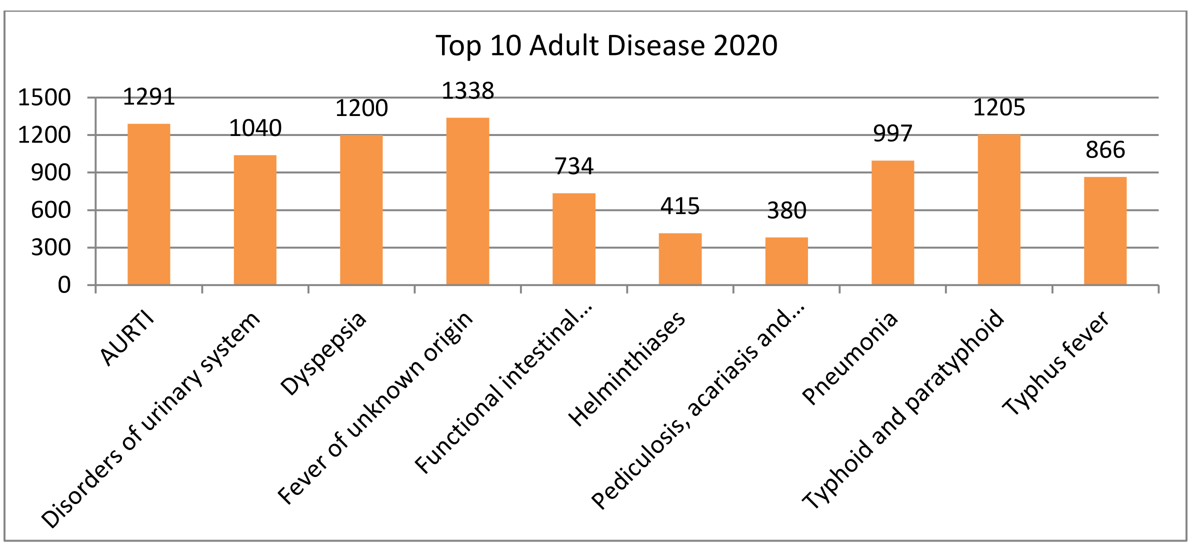

Figure 38 Top ten adult causes of OPD visits of Wera Dijo Woreda, SNNPR, 2020

Endemic Diseases

Malaria

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. Malaria is a priority disease for the Woreda. All kebeles in the Woreda are malarious and a total of 107,786 populations were at risk of being infected by malaria. A total malaria case in the year 2020 was 812 and no death was occured. Based on the Woreda Health Office data ITN distribution and the ITNs coverage was 100%. There were no shortages of anti-malaria drugs in the Woreda. Even though the Regional malaria surveillance data analysis reveals malaria as the leading cause of morbidity in adult, the Woreda report did not indicate the reality of the case. As it is displayed in **Figure 39** malaria cases were high in October followed by August with case number of 369 and 199 respectively. Malaria cases were low in September and December. From this it is possible to observe that malaria cases were high during rainy season.

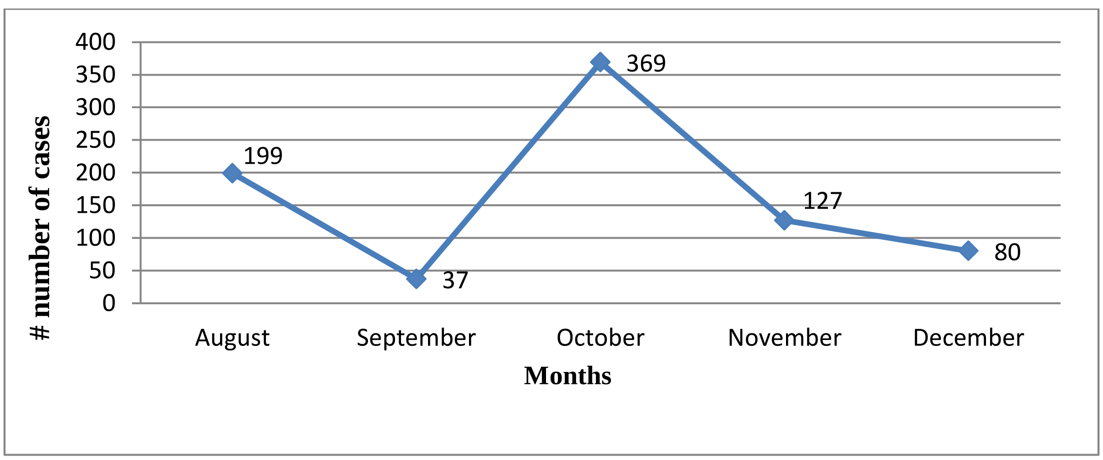

Figure 39 Malaria cases by month Wera Dijo Woreda SNNPR, 2020

Tuberculosis and Leprosy

In the year 2020 a total of 67 tuberculosis cases were registered. From the total 67 TB cases, 13 (19.4%) were pulmonary tuberculosis (PTB) negative and 36 (53.7%) of them were PTB positive. From the total TB cases 18 (26.9%) of them were extra PTB **Figure 40**. The TB detection rate of the Woreda was 43.5 % and treatment completion rate was 95%. TB treatment cure rate and TB treatment success rate were 91.3% and 95% respectively. TB default rate of the Woreda was 3.2% and no death was recorded. All TB Patients were screened for HIV and there was no leprosy case in the district in 2020.

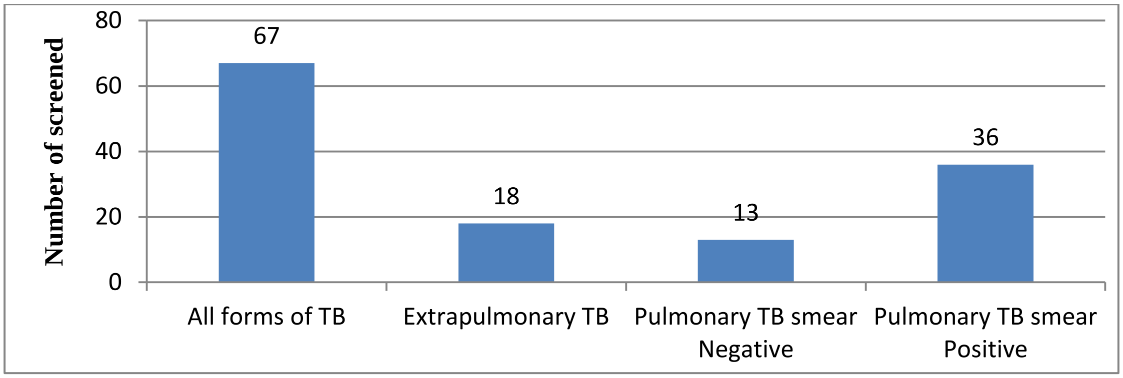

Figure 40 Distribution of TB Smear Positive, Smear negative and extra pulmonary in Wera Dijo Woreda, SNNPR, 2020

Human Immune-Deficiency Virus (HIV)/ Acquired Immune Deficiency Syndrome (AIDS)

Wera Dijo Woreda was planned to conduct 5,155 HIV screening tests and achieved (72.8%). Out of 3,755 clients screened for HIV 35 of them were screened in VCT. 3,654 clients were screened in PITC and the rest 66 in PITC (Table-6). Total PLWHIV were 4, there were two patients on ART and no new case was found in 2020 **Table 29**.

Table 29 Number of people screened for HIV in Wera Dijo Woreda, SNNPR, 2020

Total Number of People screened for HIV	3755
Number of People screened for HIV/AIDS at PICT	66
Number of People screened for HIV/AIDS at VCT	35
Number of People screened for HIV/AIDS at PMTCT	3654
TPLWHIV	04
On ART	02

Nutritional Status of the District

There were a total 26 outpatient treatment program (OTP) sites and 4 stabilization centers (SC) in Wera Dijo woreda in 2020 and the total admission to these sites was 108 and 122 per yaer respectively. There was community based nutrition (CBN) program in all kebeles of the woreda and the children in the program were 1474.

Discussion

Normal hand washing with soap and water is the best component of a hand hygiene program to reduce the risk of contracting infection through contact with hands; however, there is difficulty of maintaining compliance to basic hand washing practices and this are difficulties to conquer, especially being in a school environment (9). In Wera Dijo Woreda the coverage of water supply was only 10% which was very low compared to Emdibir town, capital city of Cheha Woreda Guraghe zone 63.3% (16)

Wera Dijo Woreda has total school dropout rate of 11.2% and this was high compared to a study conducted in the Woreda 06 of Nifas Silk Lafto sub city, Addis Ababa city Administration (17). The main factor associated with school dropout was natural disaster.

The progress in health status of the Ethiopia's population indicates that about 80% of diseases are attributable to preventable conditions related to infectious diseases, Malnutrition and personal and environmental hygiene (11). The same to this, in Wera Dijo Woreda Acute Upper Respiratory Infection, Functional intestinal disorder and pneumonia were the top leading cause of under-five children morbidity and Fever Unknown Origin, Acute Upper Respiratory Infection and Typhoid and paratyphoid illness are top leading causes of morbidity in adult.

The World Health Organization (WHO) recommends Midwife-led continuity of care models throughout pregnancy, delivery and postnatal period. Antenatal home visits are also recommended to improve antenatal care utilization and perinatal health outcomes (12). The proportion of pregnant women in the Woreda that had at least one ANC and 4th ANC visit reached 100% higher than national (82.2%) and the post natal service coverage of the Woreda was around 80% which also higher than national (42.1%) (15).

The world did not achieve the United Nations' Millennium Development Goal (MDG) sanitation target (i.e., to halve the proportion of people without sustainable access to basic sanitation by 2015). Now, the United Nations' Sustainable Development goal (SDG) is for everyone to have "adequate and equitable" sanitation by 2030 (13). In this regard the Solid waste management coverage of the Woreda is 38% while the liquid waste management coverage of the Woreda was only 10%. Despite good coverage with accessibility of latrine, the shortage of clean and safe water supply in Wera Dijo Woreda was challenging.

A well-organized and coordinated health reporting system is critical for improved health system and health care service delivery. Even though the regional malaria surveillance data analysis of 2016-2010 reveals malaria as the leading cause of morbidity in adult, the woreda report did not indicate the reality of the case.

The immunization coverage of the Woreda for measles and full immunization was 86.3% and 89.4%. This was higher compared to national vaccination coverage of measles (81.5%) and full immunization (74.5%) (15).

Limitation

Even though, most of the data for describing the health profile of Wera Dijo Woreda was accessed, there were data which were not available during the study period such as Telecom Information and Transport, Electric power, CBR, IMR and TFR. The reason for this was shortage of skilled man power and establishment the Woreda recently.

It is impossible to know the annual individual income level; the GDP and GTP for the Woreda since the agriculture and finance office have not yet developed the data. Sectors lacking appropriate data/health and health related indicators, for example, mortality records. Average income per capital, Language, Religion and Occupational characteristics were not clearly documented.

Conclusion

Access to safe water supply was the major problem of the Wera Dijo Woreda. As water is important for prevention of communicable disease, the Woreda should give emphasis to improve the water supply coverage of the community.

Acute upper respiratory tract infection was the leading cause of morbidity in the district outpatient departments. This may due to lack of clean drinking water, poor sanitation and low environmental health and personal hygiene practices. Prevention and control measures should be strengthened to reduce the burden due to acute upper respiratory tract infection and other priority diseases.

The Solid waste management coverage of the Woreda was 38% while the liquid waste management coverage of the Woreda was only 10% this indicates the Woreda expected to do much in this regard. Therefore, the Woreda Health Office should give emphasis for community awareness about environmental health and personal hygiene practices.

Concerning facilities and infrastructure, there was no all season roads in the Woreda that connect different kebeles of the Woredat as well as to other Woredas of the Zone and Woreda to Zone capital Alaba. Most health facilities were without electric power and water and this might affect the quality of service given to the community.

In Wera Dijo Woreda health service utilization like ANC, vaccination, contraceptive acceptance rate and postnatal services were in good progress.

Recommendation

- Woreda education office should work towards reducing school dropout rate in collaboration with other sectors and partners.
- Construction of new water schemes and repairing non-functional water schemes is recommended as the Woreda has very low safe water supply coverage. Health facilities should also be supplied with safe water and electric power.
- Strengthening routine health education and disease prevention should be considered to overcome communicable disease in the Woreda.
- Proper documentation of health data is necessary for future planning; in this regard the Woreda health office should give emphasis to PHEM Department to improve reporting errors.

REFERENCES

1. Clinton, Eaton, Ingham, community health profile & health needs assessment- Healthy! Capital Counties, 2012.
2. Central Statistical Agency. "Ethiopia Demographic and Health survey," 2016.
3. County of Riverside, Department of Public Health. Community Health Profile, 2013
4. Ching PK, Zapanta MJ, Reyes VCDL, Tayag E, Magpantay R. Investigation of a measles outbreak in Cordillera, northern Philippines, 2013. 2016;7(2):6–10.
5. BC Community Health Profile, Provincial Health Services Authority, Kelowna, 2014.
6. Tegegne, T.K., Chojenta, C., Getachew, T. et al. Antenatal care use in Ethiopia: a spatial and multilevel analysis. BMC Pregnancy Childbirth 19, 399 (2019). https://doi.org/10.1186/s12884-019-2550-x
7. Expanded Program on Immunization (EPI), EPI Annual Report WHO 2018.
8. WHO, UNICEF. Progress on drinking water and sanitation: update and MDG assessment 2015.
9. Sustainable Development Goal 6: Ensure availability and sustainable management of water and sanitation for all.External 2017.
10. Hassen Mamo. Malaria status in Ethiopia with the emphasis on Southern Nation Nationalities and Peoples Region (SNNPR) 2020.
11. Central Statistical Agency. "Ethiopia Demographic and Health survey," 2016.
12. World Health Organization. WHO recommendations on antenatal care for a positive pregnancy experience. Geneva: WHO; 2016.
13. Pittet D, Allegranzi B, Boyce J (2009) The WHO guidelines on hand hygiene in health care and their consensus recommendations. Infect Control HospEpidemiol 30: 611-622.
14. WHO, Country Cooperation strategy agenda (2016–2020). WHO/CCU/16.
15. FMoH Policy Planning Directorate, Health and Health Related Indicators, 2003 E.C (2010/11 G.C).
16. Antonyos, Wodajo, Assessment of Emdibir Town Water Supply System in Cheha Woreda, Gurage Zone, SNNPR, Ethiopia (2019).
17. Mukemil Hussen Compiled Body of Works in Field Epidemiology (2019)

CHAPTER-V

Scientific Manuscript for Peer Reviewed Journals

5.1 Malaria Outbreak Investigation in Lare Woreda, Nuer Zone, Gambella Region, July, 2022

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Abstract

Introduction: Globally malaria remains one of the high burden diseases, particularly in developing countries. Globally, there were an estimated 241 million malaria cases and 627,000 deaths worldwide in 2020. Ethiopia is one of the sub-Saharan countries highly endemic for malaria. Although, recently the burden of malaria was reduced remarkably through public health interventions, it is still a major public health problem in Ethiopia. Hence, measuring the burden of the disease and assessing the trend is very important for monitoring the extent and changes over a period of time.

.

Methodology: We employed descriptive and unmatched case-control study with 1:2 ratio from July 6 – August 10, 2022 in Lare Woreda. On case-control study, 75 cases and 150 controls data were included. All 75 cases were line listed. Bivariate and multivariate analyses were conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS version 25. Controls were selected randomly from neighbouring village from participants who did not fulfill the criteria for cases. We interviewed Cases and Controls using a semi structured questionnaire.

Results: During the Epi Weeks of 22-34, there were a total of 1,522 malaria cases and six deaths (CFR=0.25%). The median age of cases was 17 years. The overall attack rate of the outbreak was 272/10000 population and it was higher in age group 5-14 (17/10000 population) followed by >15 age group 13/10000 population. Forty-four (58.7%) of the cases were females. Statistically significant variables on multivariate analysis were availability of mosquito breeding site near residential area (AOR: 5.3; 95% CI: 2.7-10.7; P: 0.000), use of ITN (AOR: 0.24; 95% CI: 0.1-0.55; P: 0.001) and indoor residual spray (AOR: 0.46; 95% CI: 0.24-0.88; P: 0.020).

Conclusion: presence of mosquito breeding site increases the chance of getting malaria infection. Hence, prevention and control activities aimed at malaria should be intensified. Spraying of house and using mosquito bed net were protective factors for malaria outbreak. Supportive supervision should be conducted in regular and planned way. Mobilizing and the participation of the community towards prevention and control activity should be intensified.

Keyword: Malaria, Outbreak, Case Control, Larea Woreda,

Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes (1). Malaria is caused by infection with protozoan parasites belonging to the genus *Plasmodium* and transmitted by female *Anopheles* species mosquitoes (2).

Malaria is caused by five species of *Plasmodium*. Those are Plasmodium *falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and the recently included *Plasmodium knowlesi* (3). Although most deaths are caused by Plasmodium falciparum, the relative contribution of the non-falciparum Plasmodium species to the global malaria burden is increasing as incidence of P. falciparum falls (4).

Globally, there were an estimated 241 million malaria cases and 627,000 deaths worldwide in 2020 (5). This indicates about 14 million more malaria cases and 47 000 more deaths in 2020 compared to 2019. Most of those increases were from countries in the WHO African Region, and associated with disruption to services during the COVID-19 pandemic.

The clinical symptoms of malaria are primarily due to schizont rupture and destruction of erythrocytes (6). The most common symptoms are fever, chills, headache, and diaphoresis. Other common symptoms include dizziness, malaise, myalgia, abdominal pain, nausea, vomiting, mild diarrhea, and dry cough.

Although *Plasmodium falciparum* has declined globally both in terms of spatial extent and burden intensity, malaria remains pervasive in sub-Saharan Africa despite a halving in incidence and mortality since 2005 (7). Declines in malaria were likely to be driven by multiple factors, including widely increased access to insecticide treated bed nets and artemisinin combination therapy antimalarial drugs.

In Ethiopia, more than 3/4 of the landmass is malarious and about 68% of people of the total population are residing in areas at risk of malaria infection (8). Despite significant improvements in prevention and control in the past decades, malaria remains a significant public health concern in Ethiopia. Effective malaria control interventions are being scaled up in Ethiopia to improve access and equity to preventive as well as curative health services. These initiatives include prompt and effective treatment of malaria, selective vector control, including insecticide-treated nets (ITNs) and indoor residual spraying (IRS), and prevention and control of the epidemic

Ethiopia is one of the countries that have implemented the revised strategies to control malaria. Among those, indoor residual spraying (IRS) and long-lasting insecticidal nets (LLINs) are the most important in malaria prevention and control strategy (9). Additionally, introduction of rapid diagnostic tests at community level and adaptation of artemisinin-based combination therapies (ACTs) are also practiced in Ethiopia.

Global warming induced by human activities has increased the risk of vector-borne diseases, such as malaria (10). Recent decades have witnessed changes in the ecosystem and climate without precedent in human history although the emphasis on the role of temperature on the epidemiology of malaria has given way to predisposing conditions, such as ecosystem changes, political instability and health policies that have reduced the funds for vector control, combined with presence of migratory flows from endemic countries.

Objective

General objective

To describe burden of malaria outbreak, identify determinants of the outbreak and to take appropriate public health control measures in Lare Woreda, Nuer Zone, Gambella Region, Ethiopia August 2022.

Specific Objectives

- To verify the existence of malaria outbreak
- To describe the burden of malaria outbreak
- To identify determinants of malaria outbreak
- To conduct appropriate public health control measures

Material and Method

Study Area

The outbreak investigation was conducted in Lare woreda which is found in Nuer Zone Gambella Region. Lare is located about 776 km from Addis Ababa (the capital city of Ethiopia) in the western part of Ethiopia and about 85 km from Regional capital city Gambella. Lare woreda is bordered on the south and east by Anuak Zone, on the west by the Baro River which separates the Woreda from Jikawo, and on the north by the Jikawo River which separates it from South Sudan. The Woreda has 28 kebeles. The major town in Lare is Kuergang. According to the 2007 population census, the projected estimated population of the Woreda in 2022 was 55,769 of whom 28,442 males and 27,327 females.

The Woreda consisted of two health centers and 28 HPs. The terrain in Lare consists of marshes and grasslands; elevations range from 410 to 430 meters above sea level. A notable landmark is Gambela National Park, which occupies part of the area south of the Baro.

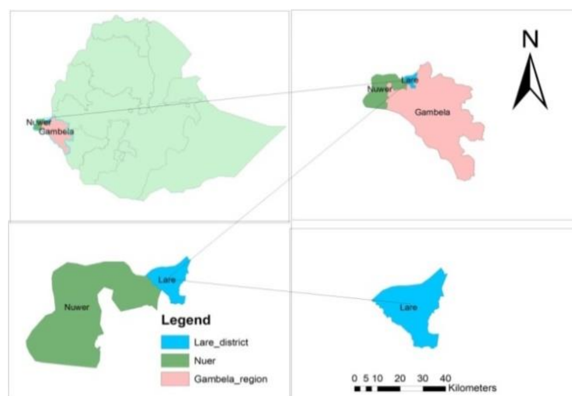

Figure 41 Map of Lare Woreda, North Nuer Zone, Gambella Region, 2022

This study was conducted from July 6-25, 2022.

Study Design

We conducted descriptive analysis of the line lists of cases and controls, followed by an unmatched case control study, with 1:2 ratio.

Source/Target Population

Population living in Lare Woreda was the source population.

Study population

Population that was sampled from source population was the study population.

Sample size and Sampling Method

Using Epi-info version 7.2.4.0 Statcalc for unmatched case control study;

Sampling Method

We included 75 reported cases from the line list and 150 controls randomly selected from neighboring village.

Data Collection Tools and Procedures

We reviewed the outpatient medical logbooks and medical records of cases at Health Center. We discussed with Woreda Health Officials and malaria focal person. We also Interviewed Cases and Controls, using a semi structured questionnaire (annexed). Cases and controls were interviewed by two data collectors.

Data analysis

The collected data were entered in to Epi-info version 7.2.4.0 and exported to SPSS version 25 for further analysis.

Study period

We excluded suspected patients with negative Rapid Diagnostic Tests for Malaria

Variables

Dependent variables

Multispecies Malaria Rapid Diagnostic Test positive

Independent variables

Age, Sex, Residence, Occupation,
Educational status
Use of Insecticide treated Bed nets (ITNs)
Indoor Residual Sprayed home (IRS)
Working outdoors in the evening or at night
Environmental Breeding site: Intermittent river stagnant water, irrigation

Case Definition

A case of Malaria was defined as an acute febrile illness with a rapid diagnostic test (RDT) positive for malaria or a positive rapid antigen test.

Controls: - Non febrile apparently healthy individuals who were neighbors or family of cases at the time of data collection

Inclusion criteria

All febrile patients who fulfilled the case definition of the disease during the investigation period

Exclusion criteria

Ethical clearance

Ethical clearance to conduct the investigation was obtained from the Ethiopian Public Health Institute (EPHI). A letter of request was written from Gambella Regional Health Bureau to Lare Woreda Health Office. Oral informed consent was obtained from participants.

Data dissemination

The findings of the study were communicated to all concerned bodies, such as EPHI, Woreda Health Offices, mentors, supervisors, coordinators and to the Addis Ababa University, School of Public Health.

Results

Descriptive Analysis

Description of the overall outbreak situation

The Malaria outbreak started in Lare Woreda in May 2022. The existence of the outbreak was confirmed by taking the second largest data of the past five years data of the Woreda. The outbreak increased gradually from week to week and reached its peak in week 32 of the epidemiologic week. During the Epi Weeks of 22-34, there were a total of 1,522 malaria cases and six deaths. All 28 kebeles of the Woreda were affected by the outbreak. For case control study, 75 cases were selected from patients who visited Kuwergeng and kwuernyaguich health centers and 150 controls were selected randomly from nearby Kebeles females Table 30.

Table 30 Demographic characteristics of cases and controls, Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

S/N	Variables		Case	Control	%	Total
1	Age	<5	8	8	7	16
		5-14	26	40	29	66
		>15	41	102	64	143
2	Sex	Male	31	64	42	95
		Female	44	86	58	130
3	Occupation	Employed	0	1	0.4	1
		Merchant	0	1	0.4	1
		Student	25	30	24.4	55
		Farmer	18	51	31.6	69
		House wife	32	67	44.0	99
4	Marital status	Single	20	47	29.8	67
		Married	43	95	61.3	138
		Widowed	1	1	0.9	2
		Divorced	0	1	0.4	1
		N/A	11	6	7.6	17
5	Education	Unable to read and write	35	43	34.8	78
		Primary	34	78	49.7	112
		Secondary	3	6	4	9
		N/A	3	23	11.5	26
6	Family Size	2-5	47	96	63.6	143
		>5	28	54	36.4	82
7	Address	Kurnuguch	15	30	20	45
		Kurnuguch 01	5	17	9.7	22
		Kutuch	11	32	19	43
		Kuwergeng	3	0	1.3	3
		kuwerlang	8	23	14	31
		kwuernyaguich	33	48	36	81

Description of cases by place

Lare wereda has 2 clusters (Kuwergeng and kwuernyaguich health centers) and each cluster had 14 kebeles. Majority of cases 33 (44%) were from kwuernyaguich kebele **Error! Reference source not found..** Regarding control, we selected 150 samples from apparently healthy individuals from nearby villages.

Description of cases by person

A total of 1,522 malaria cases were reported with 6 deaths (CFR=0.25%). Out of those 1522 cases, 75 cases were selected from two clusters for case control study. The overall attack rate of the outbreak was 272/10000 population and it was higher in age group 5-14 (17/10000 population) followed by >15 age group 13/10000 population

Table 31. Regarding educational status, 37 (49.3%) of the cases had formal education. The case fatality rate of the outbreak was higher (12.5%) in age group <5.

Table 31 Distribution, Attack Rate and Case Fatality Rate of Malaria Cases by Sex and Age Group, Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

Variables	Total population	Number of Cases (N=75)	(AR/10000)	Number of death	CFR (%)
Sex					
Male	28,442 (51%)	31 (41.3%)	10.8	4	13
Female	27,327 (49%)	44 (58.7%)	16	2	4.5
Age group					
<5	7,947 (14%)	8 (10.7%)	10	1	12.5
5-14	15,393 (28%)	26 (34.7%)	17	3	11.5
>15	32,429 (58%)	41 (54.6%)	13	2	4.8

Description of cases by time

Before the occurrence of the outbreak, malaria cases were being reported to the Woreda Health Office on a weekly basis. Clusters were reporting increased number of malaria cases to WoHO malaria focal. The alert threshold had been crossed in 22th WHO epidemiologic week. The health facilities notified the WoHO the sharp increase of malaria cases on the week 28 of 2022.

The surveillance and response team composed of different professionals was deployed from the EPHI and Regional Health Bureau to outbreak affected areas to investigate and respond to the outbreak. The investigation team monitored malaria trends and evaluated malaria threshold graphs. During the outbreak most health facilities did not experience stock outs of supplies and anti-malarial medications. Most cases of malaria were reported between week 28-34.

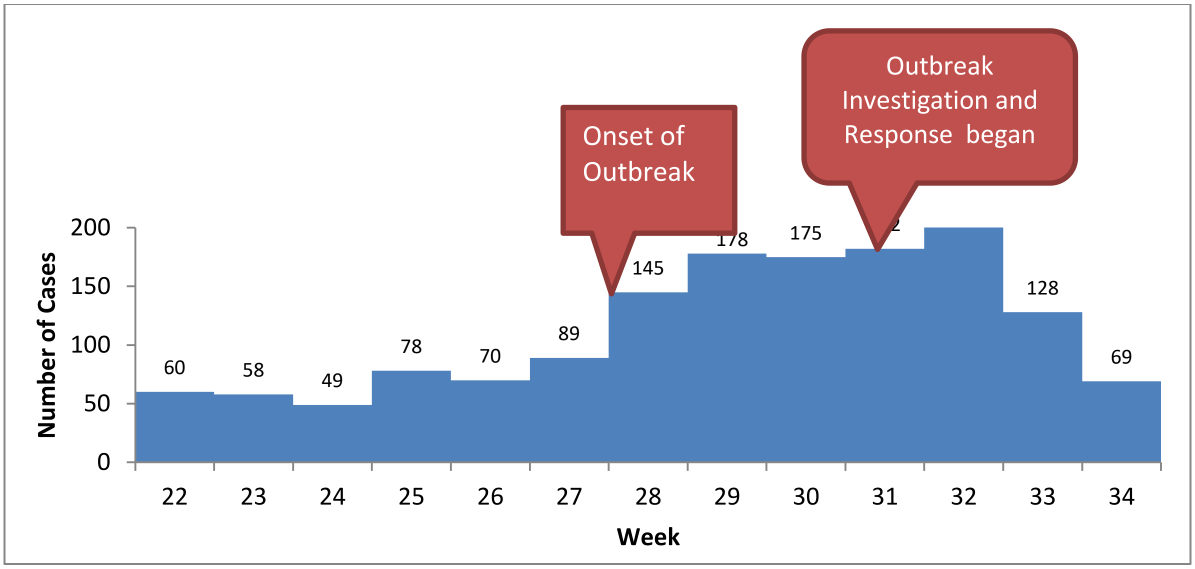

Figure 42 an epidemiological curve for Malaria Outbreak in Lare Woreda, week 22 to week 34, 2022

Clinical features of casesThe most Convulsion/coma 2 (2.7%), impairment of consciousness 1 (1.3%), hypoglycemia 1 (1.3%) and seizure 1 (1.3%) were some of the complications **Table 32**. frequently manifested clinical features were fever, headache, loss of appetite and chills (100%), 74 (98.7%), 60 (90.7%) and 60 (80%) respectively.

Table 32 Common Clinical manifestations and complications of malaria Lare Woreda Neuer Zone, Gambella Region, Ethiopia, 2022

S/N	Clinical manifestations	Frequency	Percentage
1	Fever,	75	100
2	Headache	74	98.7
3	Loss of Appetite	68	90.7
4	Chills	60	80
5	Nausea &vomiting	45	60
6	Malaise	38	50.7
7	Body ache	34	45.3
8	Shivering	34	45.3

S/N	Complications	Frequency	Percentage
1	Convulsion/coma	2	2.7
2	Impairment of Consciousness	1	1.3
3	Hypoglycemia	1	1.3
4	Seizure	1	1.3

From week 22 to week 34, a total of 2233 malaria cases were tested by Microscopy and RDT. The tests were done as a routine task and also as a campaign in outbreak affected areas. Out of the total tested cases, 1850 (89%) of them were positive for malaria specious (positivity rate: 82.7%). Of the total positive cases, 1530 (82.7%) of them were *p. falciparum* and the rest 320 (17.3%) *P. vivax.*

Vector Control Activities

Environmental Modification

In line with the investigation, environmental assessment was conducted. In most areas where the outbreak occurred, breeding sites for mosquitoes were identified and environmental management was done. The identified potential breeding sites were ponds, stagnant water, intermittent rivers, and bushes. Larvae of anopheles mosquitoes were collected for entomological survey by EPHI team. During rainy season flooding will happen and this creates favorable condition for mosquito to breed and this makes the prevention and control activity difficult.

IRS

Indoor residual spray was conducted as a mechanism of vector control intervention. There were IRS activities 3 month before the occurrence of the outbreak. There was refusal for IRS in some parts of the Woreda due to its uncomfortable odor.

The coverage of the IRS was not satisfactory. There were also missing houses during IRS campaign. Larvicidal activities were also done to strengthen vector control activities.

LLIN

Following the outbreak, emergency LLINs distribution was conducted by Ministry of Health. Based on the data obtained from Regional malaria focal, 2,620 LLINs were distributed to the outbreak affected kebeles in the Woreda. Based on number of case load, two kebeles were selected for new case search and LLINs utilization assessment. Fifty households (HH) from each kebeles were randomly selected and assessed. Out of those 100 HHs, 96 (96%) of them had LLINs, but only 65% of them hanged properly. There were HHs who used the LLIN for other purposes, do not hang properly and do not use consistently.

Case management

During the investigation, health facilities were assessed for proper use of malaria treatment guidelines for case management. During the assessment, most HPs were not functional. From the total of 12 HPs in the Woreda, only 5 (%41.7) of them were functional. All health centers had and used case management guideline and out of five assessed HPs, 3 (60%) of them used the guideline. Health centers were using microscopic examination and sometimes RDT during the outbreak period. Because of unavailability of microscopy at HP level, HEW conducted rapid diagnostic test (RDT) to confirm malaria diagnosis. HPs were supplied with RDT, artimisinin-based combination therapy (ACT) and chloroquine to diagnose and treat uncomplicated malaria cases at HP level.

Interventions done

- Targeted Focal spray was performed for outbreak affected kebelles.
- Environmental modification activities through community mobilization
- Awareness creation on prevention and control measures of malaria and ITN utilization
- Capacity building for health professionals on case management and surveillance
- Distribution of LLINs for 2,620 HHs
- Mass test and fever treatment
- Active case search

Analytical epidemiology

A total of 75 active malaria cases and 150 apparently healthy controls were included into this analysis. The median age of cases and controls were 17 and 22 years respectively. We assessed possible risk factors that contribute to contracting malaria **Table 33**. In bivariate analysis Presence of Intermittent river (COR: 5; 95% CI: 1.9-13.; P: 0.001), availability of mosquito breeding site near residential area COR: 6.9; 95% CI: 3-13.; P: 0.000), using of ITN COR: .23; 95% CI: 0.11-0.48.; P: 0.000) and IRS COR: 0.46; 95% CI: 0.26-.82.; P: 0.008) were statistically significant factors.

For variables that were significant on bivariate analysis, multivariate analysis was conducted to verify whether the association is real or not while controlling for confounding factors. Statistically significant variables on multivariate analysis were availability of mosquito breeding site near residential area (AOR: 5.3; 95% CI: 2.7-10.7; P: 0.000), use of ITN (AOR: 0.24; 95% CI: 0.1-0.55; P: 0.001) and indoor residual spray (AOR: 0.46; 95% CI: 0.24-0.88; P: 0. -0.88; P: 0.020) **Table 34**.

Table 33 Bivariate analysis for different factors to malaria, Lare Woreda, Nuer Zone Gambella Region, Ethiopia, 2022

Variable		Case	Control	COR (95% CI)	P-value
		N (%)	N (%)		
Sex	Male	31(41.3)	64(42.7)	1.0(0.602-1.85)	0.849
	Female	44(58.7)	86(57.3)		
Age group	<5	8(10.6)	8(5.3)		1.111
	5-14	26(34.7	40(26.7)	2.44(.875-7.)	.087
	>15	41(54.7)	102(68)	1.6(.876-0.29	.124
Educational level of mother/care givers	Unable to read and write	35(46.7)	43(28.7)	1.62(.38-6.98)	0512
	Primary	34(45.3)	78((52)	.26(.042-1.63)	.151
	Secondary	3(4)	6(4)	.87(0.206-3.69)	.852
	N/A	3(4)	23(15.3)		
Is there intermittent river	Yes	15(20)	7(4.7)	5(1.9-13)	**.001**
	No	60(80)	143(95.3)		
Presence of mosquito breeding site near residential area	Yes	59(78.7)	52(34.7)	6.9(3-13)	**.000**
	No	16(21.3)	98(65.3)		
ITN use	Yes	24(32)	135(90)	.23(0.11-0.48)	**.000**
	No	51(68)	15(10)		
IRS sprayed	Yes	32(42.7)	92(61.3)	.046(.26-.82)	**.008**
	No	43(57.3)	58(38.7)		
Staying (working) outdoor in the evening	Yes	21(28)	26(17.3)	1.8(.961-3.5)	.066
	No	54(72)	124(82.7)		

Table 34 Multivariate analysis for significant factors on bivariate analysis to malaria, Lare Woreda, Nuer Zone, Gambella Region, Ethiopia, 2022

Variable	COR (CI)	AOR (95% CI)	P-value
Presence of mosquito breeding site near residential area	6.9 (3-13)	5.3 (2.7-10.7)	**0.000**
use of ITN	0.67 (0.25-0.179)	0.44(0.009-0.212)	**0.000**
Indoor residual spray	0.032 (0.013-0.078)	0.21(0.005-0.88)	**0.000**

Discussion

Malaria outbreak was confirmed in Lare Woreda in May 2022. The numbers of malaria cases reported from the Woreda were greater than double compared to the prior year WHO epidemic Week 28/2021. Malaria epidemic started date in the Woreda was not the same to the national peak time (September to December) for malaria, in fact malaria outbreak occurred at different times depending on the region (11).

Based on this finding malaria outbreak affected all age groups. However, significantly affected age groups were >15 followed by 15–14 years old, and this finding was contrary with an outbreak investigation finding of Simada district (12) where majority of the affected age groups were 5–14 years.

This investigation revealed that attack rate was higher among females. This was contrary to the outbreak investigation finding in Boloso Sore Woreda in which the disease was more prevalent in male (13), and it was similar to the finding of Tanquae Abergelle district Tigray Region (14).

The case fatality rate of the outbreak was (CFR=0.25%) and it was higher (12.5%) in age group <5 and this might be due to children have low immunity. This finding was lower compared to the finding of study conducted in 2012 in Ameya, Oromia region 0.2% (15).

The predominant Plasmodium species detected was *P. falciparum* with 82.7%, followed by *P. vivax*. This was in agreement with a study done in BenaTsemay District, Southern Ethiopia (16).

Based on this finding, Households found near mosquito breeding sites had odds of 5.3 of contracting malaria as compared to those far away. This might be due to increase of mosquito density because of the breeding site and /or risk for mosquitoes bite. This finding was similar with a study conducted in Tigray (17). Hence, there should be sustainable integrated and coordinated malaria prevention and control measures and proper water management to eliminate mosquito breeding sites.

WHO recommends deployment of one of two broadly applicable vector control interventions, namely, ITNs or indoor residual spraying (IRS) (18). The finding of this study revealed that using bed net consistently and spraying of houses with chemicals were protective factors for malaria infection. This was is in line with the study done in Argoba District (19). This might be due to spraying of houses with chemical reduces the concentration of mosquitoes.

Conclusion

Findings of this study revealed that presence of mosquito breeding site increases the chance of getting malaria infection. Hence, the prevention and control activity aimed at malaria should be intensified. Spraying of house and using mosquito bed net were protective factors for malaria outbreak. Therefore, the provision of ITN for the community and health education on utilization of ITN should strengthen. Vector controlling activity and environmental modification contributes a lot in prevention of malaria outbreak, hence community mobilization towards malaria prevention and control activity should strengthen Strengthening health facilities towards surveillance and malaria case management supports the preparedness and outbreak response activity. In this regard functionalizing non-functional health posts and monitoring of health facilities should be done on regular and planned way.

Recommendations

- Regional Health Bureau should work on strengthen the malaria surveillance system especially emphasis at heath post level
- The Woreda Health Office has to mobilize the participate the community towards prevention and control activities
- Environmental management should be conducted consistently
- Community awareness should be enhanced on ITN utilization
- In those non-functional health posts, Periodic supervision and taking corrective measures might contribute to manage work absenteeism.

References

1. Neeta Rai et al. Different Clinical Features of Malaria. Asian Journel Biomed Pharm Sci. 2012;2(12):28–3.

2. Bratitsis T, Demetriadis S. Research approaches in computer-supported collaborative learning. Int J e-Collaboration. 2013;9(1):1–8.

3. Chew CH, Lim YAL, Lee PC, Mahmud R, Chua KH. Hexaplex PCR detection system for identification of five human Plasmodium species with an internal control. J Clin Microbiol. 2012;50(12):4012–9.

3. Nosten F, Van Vugt M, Price R, Luxemburger C, Thway KL, Brockman A, et al. Effects of artesunate-mefloquine combination on incidence of Plasmodium falciparum malaria and mefloquine resistance in western Thailand: A prospective study. Lancet. 2000;356(9226):297–302.

4. WHO. Word Malaria Report 2021. Word Malaria report Geneva: World Health Organization. (2021). Licence: CC. 2021. 2013–2015 p.

6. Trampuz A, Jereb M, Muzlovic I, Prabhu RM. Clinical review: Severe malaria. Crit Care. 2003;7(4):315–23.

7. Weiss DJ, Lucas TCD, Nguyen M, Nandi AK, Bisanzio D, Battle KE, et al. Mapping the global prevalence, incidence, and mortality of Plasmodium falciparum, 2000–17: a spatial and temporal modelling study. Lancet [Internet]. 2019;394(10195):322–31. Available from: http://dx.doi.org/10.1016/S0140-6736(19)31097-9

8. Menjetta T. Assessment of Knowledge, Attitude, and Practice towards Prevention and Control of Malaria in Halaba Town, Southern Ethiopia, 2017. J Trop Med. 2021;2021.

9. Kendie FA, Hailegebriel W/kiros T, Nibret Semegn E, Ferede MW. Prevalence of Malaria among Adults in Ethiopia: A Systematic Review and Meta-Analysis. J Trop Med. 2021;2021.

10. Rossati A, Bargiacchi O, Kroumova V, Zaramella M, Caputo A, Garavelli PL. Climate, environment and transmission of malaria. Le Infez Med. 2016 Jun;24(2):93–104.
11. Daba C, Atamo A, Debela SA, Kebede E, Woretaw L, Gebretsadik D, et al. A Retrospective Study on the Burden of Malaria in Northeastern Ethiopia from 2015 to 2020: Implications for Pandemic Preparedness. Infect Drug Resist. 2023;16(February):821–8.
12. Workineh B, Mekonnen FA, Sisay M, Gonete KA. Malaria outbreak investigation and contracting factors in Simada District, Northwest Ethiopia: A case-control study. BMC Res Notes [Internet]. 2019;12(1):1–6. Available from: https://doi.org/10.1186/s13104-019-4315-z
13. Dawud AM. Malaria Outbreak Investigation and Response in. 2019;1–18. Available from: https://doi.org/10.21203/rs.3.rs-705729/v1
14. Tesfay K, Assefa B, Addisu A. Malaria outbreak investigation in Tanquae Abergelle district, Tigray region of Ethiopia: A case-control study. BMC Res Notes [Internet]. 2019;12(1):1–5. Available from: https://doi.org/10.1186/s13104-019-4680-7
15. Beffa Defi G. A Malaria Outbreak in Ameya Woreda, South-West Shoa, Oromia, Ethiopia, 2012: Weaknesses in Disease Control, Important Risk Factors. Am J Heal Res. 2015;3(3):125.
16. Shite Wondimu M. Malaria Outbreak Investigation in Pastoral Communities of BenaTsemay District, Southern Ethiopia: A Case Control Study. Am J Heal Res. 2019;7(3):31.
17. Study AC, Gebremichael MG. Malaria Outbreak – in Hitsats Refugee Camp , Tigray. 2017;1–15.
18. WHO. Global technical strategy for malaria 2016-2030, 2021 update [Internet]. World Health Organization. 2021. 1–40 p. Available from: https://apps.who.int/iris/rest/bitstreams/1357541/retrieve
19. Tesema GA, Akalu TY. Malaria Outbreak Investigation in Argoba District , South Wello Zone , Northeast Ethiopia , 2016 : A case control study. Res Sq. 2019;1–16.

5.2 The Epidemiology of Malaria in Southern Nations, Nationalities and Peoples Region of Ethiopia, 2016-2020

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Abstract

Background: Malaria is a life-threatening disease caused by parasites belonging to the genus *Plasmodium* transmitted from infected individuals to other people via the bites of infected female Anopheles mosquitoes. Malaria remains a worldwide public health problem causing a significant number of morbidity, mortality, and huge economic loss despite an intensive implementation of interventions. Routine malaria surveillance data is useful for assessing incidence and trends over time and in stratification for targeting of malaria.

Methodology: Five year data (2016-2020) of malaria which were reported to the Ethiopian Public Health Institute (EPHI) was analyzed from 12th - 19th April 2021 to describe the epidemiology of malaria in the Southern Nations, Nationalities and Peoples Region of Ethiopia**.** Data analysis was conducted using Microsoft excel.

Results: The Southern Nation, Nationalities and Peoples Region reported a total of 1,278,467 (98.46%) laboratory confirmed and 19,934 (1.54%) clinical Malaria cases during the last five years (2016-2020) with case fatality (CFR) rate of 0.6%. From a total of 1,278,467 laboratory confirmed outpatient cases, 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax*.

Conclusion: The incidence of confirmed and clinical malaria cases decreased in the Southern Nation, Nationalities and Peoples Region. Malaria morbidity also significantly declined in 2020. To reduce the burden of malaria related morbidity and mortality, malaria vector control, malaria diagnosis and treatment, and malaria surveillance acclivities should be strengthen.

Keywords: Descriptive study, Malaria, Surveillance.

Introduction

Malaria is a life-threatening disease caused by parasites that are transmitted to people through the bites of infected female Anopheles mosquitoes. It is preventable and curable. Malaria is caused by *Plasmodium* parasites. The parasites are spread to people through the bites of infected female Anopheles mosquitoes. There are 5 parasite species that cause malaria in humans, and 2 of those species – *P. falciparum and P. vivax* – pose the greatest threat (1).

Malaria is an acute febrile illness. In a non-immune individual, symptoms usually appear 10–15 days after the infective mosquito bites (1). The first symptoms – fever, headache, and chills – may be mild and difficult to recognize as malaria. Fever is the cardinal symptom of malaria. It can be intermittent with or without periodicity or continuous. Many cases have chills and rigors. The fever is often accompanied by headache, myalgia, arthralgia, anorexia, and nausea and vomiting. The symptoms of malaria can be non-specific and mimic other diseases, like viral infections, enteric fever etc.

The latest WHO report indicates that, there were 229 million cases of malaria in 2019 compared to 228 million cases in 2018 (2). According the report, Children under 5 years of age are the most vulnerable group affected by malaria; in 2019 they accounted for 67% (274 000) of all malaria deaths worldwide (3). The estimated number of malaria deaths stood at 409 000 in 2019, compared to 411 000 deaths in 2018. The WHO African Region continues to carry a disproportionately high share of the global malaria burden. In 2019, the Region was home to 94% of all malaria cases and deaths (4).

Ethiopia is one of the malaria endemic countries in the world, with 60% of the population being at risk of infection and it is a serious public health concern and has great impact on socio-economy (5). The disease occurs throughout the year with considerable seasonal and geographical variations across the Country. The peak times of transmission range from September to December, following the main rainy seasons (June to September). *Plasmodium falciparum and Plasmodium vivax* are the two dominant parasites, contributing to 60% and 40% of morbidity, respectively (6).

The Southern Nations, Nationalities and Peoples' Regional State (SNNPR) has 80 malarious districts accounting for 65%, or 9 million people, at risk of malaria. Like the rest of Ethiopia, malaria is the first cause of outpatient visits, inpatient admissions and hospital deaths (7).

Method and materials

Study Area

This study was conducted from 12th - 19th April 2021 in SNNPR. SNNPR is the third largest region in Ethiopia in terms of population, and is located in the south west of the country. The projected population of the Region was about 20 million in 2019, which makes up 20 per cent of the Ethiopian population (8). The region is one of the most populous parts of Ethiopia, with a density of approximately 151 people per square kilometre. The SNNPR is divided into 15 administrative zones, 133 Woredas/Districts. The Districts included 3,602 rural kebeles (lowest administration units) and 324 towns. Hawassa is the Administrative Center of the Region.

Study Design

This study applied a retrospective analysis of the data collected from 2016 to 2020.

Data Source

Malaria surveillance data reported from SNNPR to the Ethiopian Public Health Institute (EPHI) between 2016 and 2020 through line list and case based format was requested and used.

Study Units

All malaria cases regardless of age and sex reported from SNNPR to the Ethiopian Public Health Institute (EPHI) during the study period (2016–2020) were included in this analysis.

Sample size and Sampling Method

The study included all Malaria cases reported from the study area during 2016-2020.

Data Collection Procedure

Line list and case based data of Malaria cases from 2016 to 2020 were collected from EPHI Public Health Emergency Management Department.

Malaria Case Definition

Suspected Case:

Any person with fever or fever with headache, rigor, back pain, chills, sweats, myalgia, nausea, and vomiting diagnosed clinically as malaria.

Confirmed Malaria case:

A suspected case confirmed by microscopy or RDT for plasmodium parasites.

Data analysis procedure

Data were entered and analyzed using Microsoft excel 2016. After data organization and cleaning, descriptive analysis was done. Results were presented using graphs, tables and charts.

Ethical issues

An official letter was written to the Ethiopian Public Health Institute /EPHI / from the Addis Ababa University School of Public Health. Permission was obtained from Public Health Emergency Management /PHEM/ Department then; data were accessed to carry out this analysis. Confidentiality was assured and maintained.

Data dissemination

The findings of the Malaria surveillance data analysis were shared with the SNNPR Health Bureau, AAU/SPH, mentors, supervisors, and program coordinators of AAU/SPH/EFETP.

Results

Malaria Morbidity and Mortality Trend

The Southern Nation, Nationalities and Peoples Region reported a total of 1,278,467 (98.46%) laboratory confirmed and 19,934 (1.54%) clinical Malaria cases during the last five years (2016-2020) with case fatality (CFR) rate of 0.6%. The highest and lowest case fatality rate was recorded in 2018 and 2020 respectively.

Out of 1,288,603 (99.25%) outpatient and 9,798 (0.75%) admission cases a total of 59 deaths were reported. On average, the Region reported 259,680 malaria cases each year during the past five years. The highest number of cases 317,591 (24.46%) reported in 2019.

Malaria caseload decreased from 2016 to 2018 but in the year 2019 the case number sharply increased by 74% from the year 2018 and reached 317,591. Based on National PHEM office document that was tried to assess, the highest malaria cases reported by the year 2019, which was

317,591 (24.46%) of the total cases, and the least cases were recorded in the year 2018 with 181,707 (26%) of the total case numbers. Numbers of malaria cases were decreased in the year 2020 compared to 2019.

Malaria Morbidity Trend by Time and Place

In 2016, the highest cases were recorded in week 13, (8191) and the lowest cases in week 52 (3235) cases. In week 31 of 2017, 5954 cases were reported which was the highest and the lowest cases in the 1st week, 2930 cases. During the past five years the highest weekly cases were recorded in week 31 of 2019 9429 cases and the lowest cases in the second week of 2019 which was 2054 cases. As it is displayed in **Figure 43**, both the highest and the lowest weekly cases were recorded in the year 2019.

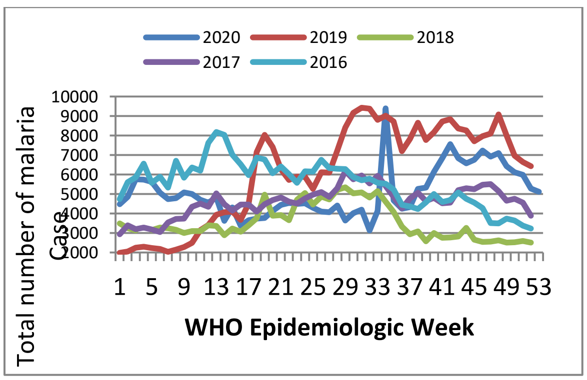

Figure 43 Total suspected and confirmed malaria cases by week SNNPR, Ethiopia, 2016-2020

SNNPR Malaria Mortality Trend by Place and Time

The highest mortality rate was occurred in 2018 with case fatality rate CFR of 1.44% followed by 2016 and 2017 with CFR of 0.48% and 0.65% respectively. The overall mortality trend showed slight increment in 2018, and then the mortality trend decreased in 2019 and 2020 despite the sharp escalation in total malaria caseload in 2019. In the year 2016 and 2017 mortality rate was 0.48% and 0.65%.

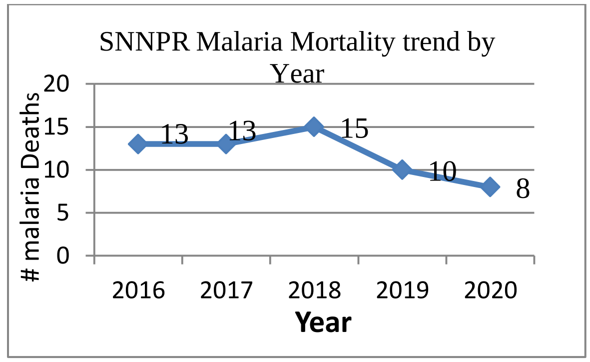

Figure 44 Annual Malaria in patient death SNNPR, Ethiopia, 2016-2020

Malaria Outpatient Cases Trend by Time and Place

The outpatient malaria case trend was highest in 2019 and it was lowest in 2018. The 2019 outpatient case number exceeds from its previous year by 135,024 cases (around 75%). The highest outpatient caseload 280,276 was reported from Gamo Gofa zone and the least from Gofa which is 197. The peak weekly outpatient caseload was recorded on week 31 of 2019.

Malaria Inpatient Cases Trend by Time and Place

The SNNPR reported a total 9,798 admitted malaria cases during the past five years. The highest inpatient report was documented in 2016 with a total of 2,662 admitted cases and the least in 2018 1,041. In the 2019,

Wolayita zone reported the highest 1,231 admitted cases.
The highest weekly cases were observed on week 32 of 2016 with 167 cases.

Trend of Malaria Species

From a total of 1,278,467 laboratory confirmed outpatient cases in SNNPR; 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax.* Within the Past five years period in SNNPR, *Plasmodium falciparum* accounted for majority of outpatient cases in the region. The highest confirmed malaria cases due to *P. falciparum* were reported in 2019 and 2020 with 206,956 (66.10%) and 177,144 (66.40%) caseloads respectively.

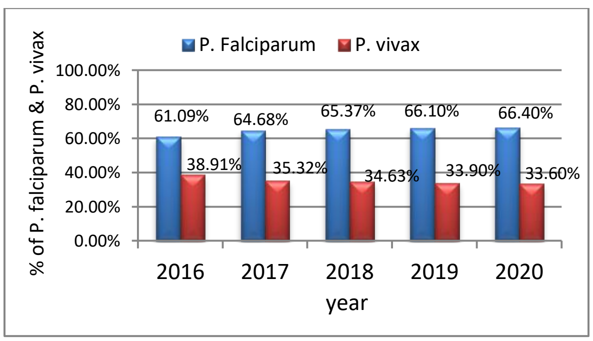

Figure 45 Trend of *P. falciparum and P. vivax* malaria cases SNNPR, Ethiopia, 2016-2020

In SNNPR majority of malaria cases *were due to Plasmodium falciparum* specious which accounted (64.7%) 827,059. The rest (35.3%) 451,408 laboratory confirmed accounted (64.7%) 827,059. The rest (35.3%) 451,408 laboratory confirmed malaria cases were due to *P. vixax.*

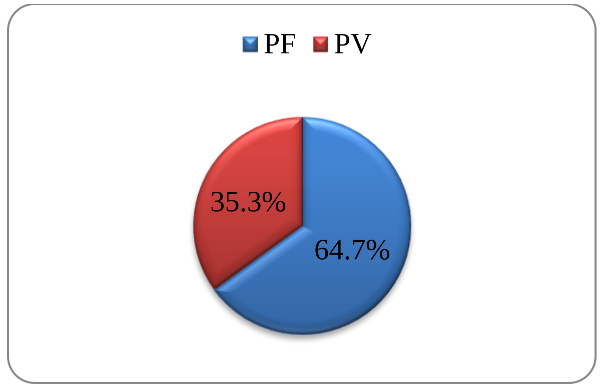

Figure 46 PF and PV malaria cases cumulative percentage SNNPR from 2016–2020

Malaria Positivity Rate

A total of 8,025,613 malaria suspected cases were clinically examined during 2016 to 2020, of these 1,278,467 of them were diagnosed by microscope and RDT and tested positive for malaria. The overall positivity rate was (15.9%). In 2016 and 2017 laboratory confirmed malaria cases were 283,312 (16.6%) and 235,200 (14.6%). Laboratory confirmed malaria cases in 2018, 2019 and 2020 were 180,127 (11.9%), 313,071 (17.8%) and 266,757 (18.4%) respectively.

Discussion

Malaria continued to be a major health problem in the SNNPR; the five years Malaria surveillance data analysis of the Region indicated that the incidence of confirmed and clinical malaria cases decreased from 289,044 (22.26%) in 2016 to 181,707 (14%) in 2018 and increased to 317,591 (24.46%) in 2019. But in 2020, the incidence decreased to 270,012 (20.79%). The annual inpatient malaria cases decreased from 2,662 (27.2%) in 2016 to 1,041 (10.6%) in 2018. In 2020 the inpatient malaria cases increased from 1,901 (19.4%) in 2019 to 2,196 (22.4%).

On average, the region reported 259,680 malaria cases each year during the past five years. The highest number of cases 317,591 (24.46%) reported in 2019. This result showed that there were an increment of cases compared to Amahara region 200,589 in 2018 (9).

The highest malaria cases reported from, Gamo Gofa, South Omo and Wolayita Zones with magnitude of 281,844, 221,566 and 170,505 respectively and this contributed 52% of the total regional cases. The overall case fatality rate of the region was 0.6%. This finding was higher than the findings indicated in in Hana and Keyafer Health Centers, South Omo Zone, Southern Ethiopia, which indicated 22,494 number of laboratory confirmed malaria cases (10).

According to Plasmodium species distribution in Ethiopia, *P. falciparum and P. vivax* are the two predominant malaria parasites occurring in the country accounting for 60% and 40% of malaria cases, respectively (11).

In this analysis from a total of 1,278,467 laboratory confirmed outpatient cases in SNNPR; 827,059 (64.7%) of them were *Plasmodium falciparum* species and the rest 451,408 (35.3%) were *Plasmodium vivax*. During the Past five years *Plasmodium falciparum* contributes for majority of outpatient cases in the region. In all considered years *P. falciparum* was the predominant species with no trend shift. This finding showed there were variation compared to Central, North and West Gondar zones finding *Plasmodium falciparum* species (73.4%) and plasmodium vivax (26.6 %) (9) and it showed slight decrement compared to Simada District, Northwest Ethiopia (67.5 %) *PV and (32.5 %) PF* (12).

Overall positivity rate was declined from 16.6% in 2016 to 11.9% in 2018. However, significant variations of confirmed cases were observed during 2019 and the positivity rate increased to 17.8% in the year. In 2020, the positivity rate was reached 18.4%. This finding was lower compared to Wolayita Zone total slide positivity rate (SPR) of 33.27% (11).

From Southern Nation, Nationalities and peoples region Wolayita Zone reported170,505 cases and 18 deaths with CFR of 0.01% during the last five years. Wolayita Zone reported the highest death 18 (30%) of total regional deaths.

Conclusion

The southern Nation, Nationalities and Peoples Region reported 259,680 malaria cases each year on average. There were 9,798 inpatient cases in the Region during the past five years. The highest mortality report was from Sodo Hospital with 7,811 cases and 11 deaths with CFR of 0.14% compared to other Woredas in the region.

Recommendations

Lack of variables like age and sex in malaria surveillance data and unavailability of mixed infection report in the reporting format was recommended as a gap on previously conducted analysis. Despite these recommendations there is still the same gap. So, the National PHEM and SNNPR PHEM Department should work cooperatively over this issue to solve the identified gap.

REFERENCES

1. Rai N, Abraham J. Different Clinical Features of Malaria. Asian Journal of Biomedical and Pharmaceutical Sciences. 2012;2(12):28.
2. Intiative PM. President's malaria initiative Ethiopia: Malari a operational plan FY 2016 USAID. 2016.
3. sBerhe B, Mardu F, Legese H, Negash H. Seasonal distribution and seven year trend of malaria in North West Tigrai: 2012–2018, Ethiopia; 2019. Tropical diseases, travel medicine and vaccines. 2019;5(1):1-7.
4. Organization WH. World malaria report 2018. Geneva: World health organization; 2018. Fecha de consulta. 2019;23:238.
5. Taffese HS, Hemming-Schroeder E, Koepfli C, Tesfaye G, Lee M-c, Kazura J, et al. Malaria epidemiology and interventions in Ethiopia from 2001 to 2016. Infectious diseases of poverty. 2018;7(1):1-9.
6. Mohammed MA, Hong T. Role of vector control in fighting against malaria: Evidence from Ethiopian health-related indicators. Journal of Infection and Public Health. 2021;14(4):527-32.
7. Dedgeba S, Mamo H. Malaria trends in Silt'i district from 2009–2015 and current childhood malaria in K'ibbet hospital, south-central Ethiopia. Malaria World Journal. 2017;8(22):1-5.

8. Agency FDRoECS. Population Projection of Ethiopia for All Regions At Wereda Level 2014-2017.
9. Lankir D, Solomon S, Gize A. A five-year trend analysis of malaria surveillance data in selected zones of Amhara region, Northwest Ethiopia. BMC Public Health. 2020;20(1):1-9.
10. Ergete S, Sorsa S, Loha E, Asnake S. Trend of malaria cases in Hana and Keyafer health centers, south Omo zone, southern Ethiopia. Ethiopian journal of health sciences. 2018;28(3):277-86.
11. Legesse D, Haji Y, Abreha S. Trend analysis of malaria occurrence in Wolaita Zone, Southern Ethiopia: retrospective cross-sectional study. Malaria research and treatment. 2015;2015.

12. Workineh B, Mekonnen FA, Sisay M, Gonete KA. Malaria outbreak investigation and contracting factors in Simada District, Northwest Ethiopia: a case–control study. BMC Res Notes. 2019;12(1):1-6.

CHAPTER-VI Abstracts for Scientific Presentations

6.1 Pertussis Outbreak investigation in Beyeda Woreda, North Gondar Zone, Amhara Region, Ethiopia: Case-Control Study March, 2022

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Abstract

Background: Pertussis or whooping cough is highly contagious respiratory illness and about 160,000 deaths occur per year. In March 2022, a cluster of suspected pertussis cases reported from Beyeda Woreda Health Office. We investigated the epidemiology of the outbreak to identify and characterize risk factors and implement control measures.

Methods: We conducted descriptive and unmatched case-control study with 1:2 ratio. Active case search and review of medical record of patients' was conducted. We defined cases as non-improving cough of 14 days or more or cough of any duration with paroxysms or cough of any duration with whoop. For case control study, 58 Cases were selected using computer-generated simple random sampling. 116 controls selected from the nearest neighbors of cases. Nasopharyngeal swab (NS) samples were taken to identify the etiologic agent. We interviewed participants using a semi structured questionnaire.

Results: We identified 60 pertussis cases and two deaths with case fatality rate of (CFR) 3.3%. The mean age of cases was 11.4 years (range from 6 month to 60 years). 83% (50/60) cases did not receive pertussis containing vaccine. 46 (79%) cases had history of contact. The attack rate (AR) was higher in males 75/100000. Vaccination status (AOR: 0.91; 95% CI: 0.23-0.355; P: 0.001), awareness on mode of transmission of pertussis (AOR: 0.44; 95% CI: 0.009-0.212; P: 0.000) and housing condition (AOR: 0.21; 95% CI: 0.005-0.88; P: 0.000) were statistically significant factors.

Conclusion: Laboratory-confirmed pertussis outbreak occurred in the Beyeda District of Amhara Region, Ethiopia, in March 2022. Low immunization coverage, lack of awareness on mode of transmission of pertussis and housing condition contributed for the occurrence of the outbreak. We recommended strengthening routine immunization service and raising the Community awareness on mode of transmission and prevention of pertussis. Health professionals informed for early detection and treatment of pertussis cases.

Key words: Pertussis, Outbreak, Beyeda, Woreda

6.2 Descriptive Epidemiology of a Cholera Outbreak in Moyale Woreda, Oromia, Ethiopia, 2023

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Abstract
Introduction: Cholera is an extremely virulent disease that can cause severe acute watery diarrhoea. It takes between 12 hours and 5 days for a person to show symptoms after ingesting contaminated food or water. Globally, an estimated 3 – 5 million cholera cases and 28,000 – 150,000 deaths occur annually.

Objective: To assess possible source of the outbreak, identify potential risk factors and give response in Moyale Woreda, Borena Zone, Oromia Region, Ethiopia, 2023.

Methodology: We conducted descriptive analysis of cases from April 25 to June 20, 2023. We collected line lists and reviewed medical records of patients. We interviewed Woreda PHEM focal and surveillance officer. We assessed cholera treatment centers and ORPs during the investigation period. We also assessed environmental hygiene and sanitation of patients during contact tracing.

Results: A total of 740 cholera cases and three deaths (CFR 0.4%) occurred. The case fatality rate was high in males (0.6%) and among age group >10 years (0.38%). The median age of cases was 20 years and the overall attack was 40.8 per 10000 population. All kebeles of the Woreda were affected. The highest attack rate was reported from Moyale 02 and Arbale Kebele (109 per 10000 population). Majority of cholera cases were daily laborers 193 (26%). Of the total cases, 55% of them were severely dehydrated. The outbreak started from WHO epi week 10th of 2023.

Conclusion and recommendations: The outbreak persisted in the Woreda for more than ten weeks. The use of contaminated water points were the most likely causes of the outbreak. The outbreak was confirmed using PCR culture test at Regional Laboratory. Poor hygiene and sanitation, overcrowding, high population movement, lack of clean water and poor waste disposal system might be possible contributing factors of the outbreak. Government and humanitarian agencies should work on provision of safe water supply. Community hygiene and sanitation awareness should be enhanced.

Keyword: Cholera, Outbreak, Moyale Woreda,

CHAPTER-VII

Narrative Summary of Disaster Situation

7.1 Summary Report on Internally Displaced Populations at North Gondar Zone, Amhara Region, February, 2022

Abstract

Introduction: War and conflict have intense effect on health. War causes damage to families, communities, and societies. Both fighters and civilians who become casualties of war manifest physical, psychological, and psychosocial harms from war, which have massive economic and social impact. Due to war, massive indirect health effects like epidemic of infectious disease, malnutrition, and population displacements will happen. Destruction of health infrastructure, loss of health workers, and contamination of the environment also affect the health of populations.

Objective: To assess the impact of war and recovery in displaced population to identify the basic needs that require immediate response in the war disaster victims, North Gonder Zones, Amhara Region, 2022.

Methodology: Discussion with key informants from DRM, Health Centers and IDP sites, observation of IDP sites and damaged infrastructures, FGD with men and women IDPs, interview with IDPs committee was used as methodology to conduct the assessment.

Result: Due to the war that started in November 2020 between the TPLF group and Ethiopian government, many people were displaced, lost their family and property, children were separated from their family, a number of women and children became victims of SGBV and enormous damage was happened to the health system and other infrastructures. Due to the conflict, a total of 136,124 individuals were displaced from different Woredas of the North Gondar zone, Amhara Region. Because of the war conflict, more than 110 governmental health facilities (02 hospitals, 21 health centers and 89 health posts), and hundreds of ambulances were looted and destroyed or turned into military camps.

Conclusion and recommendation: Damaged health facilities have not been rehabilitated and started to serve the population in war affected areas. Health workers which were displaced from

their routine works have not been returned to their normal duty. In most Woredas, there was no Emergency preparedness plan at districts PHEM department. Lack of liquid waste disposal system in all IDP sites may expose the IDP population to infectious diseases. Due to the conflict many children were malnourished and there were many MAM and SAM cases this condition resulted

Keyword: Disaster, Internal displaced populations, North Gondar, Amhara, Ethiopia

Introduction

Background

The African Union (AU) Convention for the Protection and Assistance of Internally Displaced Persons in Africa (the Kampala Convention) defines internal displacement as 'the involuntary or forced movement, evacuation or relocation of persons or groups of persons within internationally recognized state borders[(1)].

According the United Nations (UN) Guiding Principles on internal displacement, internally displaced persons (IDPs) are persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and who have not crossed an internationally recognized State border[(2)].

Based on the Ethiopian national displacement report June-July 2021, there were 4,171,550 individuals and 828,407 households across 10 regions except Addis Ababa and Tigray regions[(3)]. The main causes of displacement were conflict, drought and seasonal floods.

According to OCHA's situational overview report, IDPs in Afar, Amhara and Tigray Regions dire and requires further scaling-up of multi- sector assistance[(4)]. New displacements also continued to be reported including from Afar, Amhara and the Western Zone of Tigray. In Tigray Region, new IDPs have continued to flow from Western Zone of the region as well as from Afar and Amhara.

The Guiding Principles on Internal Displacement stipulate that " every internally displaced person has the right to liberty of movement and freedom to choose his or her residence" (Principle 14)[(2)] and that "internally displaced persons, whether or not they are living in camps, shall not be discriminated against as a result of their displacement" (Principle 22).

Primary responsibility for protecting IDPs and all persons within their own country rests with the national authorities of the country[(5)]. National responsibility is a core concept of any response to internal displacement. It is a fundamental operating principle of the international community and is routinely emphasized by governments themselves, as a function of their sovereignty.

Residents of IDP camps live in a deplorable and unhygienic environment which exposes them to a constant outbreak of infectious disease[(6)]. Factors such as educational status, water supply, hand washing, overcrowded living condition and dirty environment significantly contributed to the poor IDPs' health status.

IDPs in host families and communities usually find greater opportunities for work, business, food production, education and socialization, among other advantages, than those confined to camps[(7)]. Idleness, dependency or an inability to adequately maintain one's family undermines self-esteem. Income-generation or work opportunities in host communities can contribute to self-sufficiency and raise self-esteem.

Among health related problems IDPs encountered, PTSD is one of the psychological disorders which can be experienced following exposure to a traumatic or stressful event. According to a study conducted in Nigeria, destruction of personal property, being evacuated from town, witnessing violence, reported death of a family member, and suffering ill health were the most frequent psycho- trauma experienced by the IDPs[(8)].

Sexual violence and exploitation, which primarily targets women and children, has become one of the most disturbing and common features of contemporary armed conflict and displacement crises. Displaced women and girls are often forced to assume different and/or additional responsibilities as a result of being separated from their families [(9)]. During displacement, there is usually a dramatic increase in the number of women and children who head households and who, as a result, are at particular risk of rights violations.

Rationale of the study

Humanitarian emergencies due to different natural (flood, drought, locust warms, etc.) and man-made (armed conflicts and others) incidents are common in the country and affecting different population groups at different times. These incidents has placed multiple threats on the health, safety, security and / or wellbeing of the affected community and resulted significant morbidity and mortality in human life besides their substantial socio-economic deprivation in the community. This assessment was conducted to assess the impact of the current conflict in North Gondar Zone.

Objectives

General objective

To assess existing humanitarian situation and infrastructures damage in order to locally assess the situation and identify the basic needs that require immediate response in IDPs, North Gonder Zones, Amhara Region, 2022.

Specific objectives

- To estimate the number of affected people damaged resources and local infrastructures
- To anticipate health risks that comes as a result of the conflict and overcrowding
- To assess provision of health and healthcare services, water supply, food and sanitation
- To assess the adequacy of existing response capacity and the immediate additional needs
- To assess how well the affected population is coping the situation, the degree to which “normal life” and social structure have been disrupted

Materials and methods

Study area and period

The assessment was conducted in North Gondar Zone, Amhara Region. It was conducted from January 4 to February 20 2022. North Gondar Zone is one of 12 zones in the Amhara Region. Administratively the Zone consists of 7 Woredas and one city administrations. Based on the 2007 Census, its estimated population was approximately1,078,027 which makes up 4% of the Amhara Region population. North Gondar Zone is located in the Northern part of the region and 830 km far from Addis Ababa, the capital city of Ethiopia. It is bordered by Tigray in the North, by Central Gondar Zone in the West and South and by Wag Hemra Zone in the east. Based on the data from Zonal DRM office, there were 137,668 IDPs in the Zone.

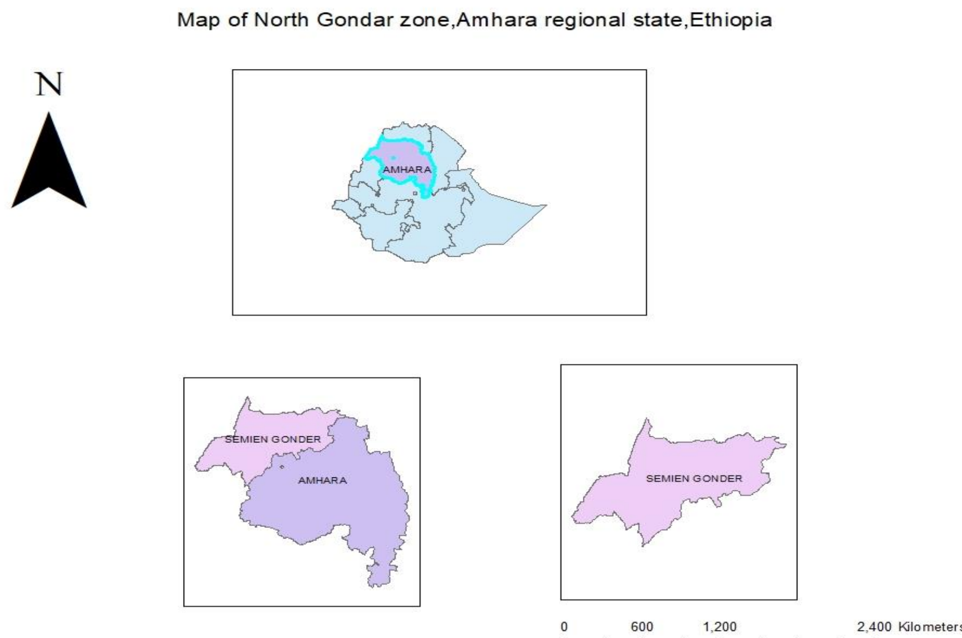

Figure 47 Map of North Gondar Zone

Study Design

A community based descriptive cross-sectional study design was conducted to assess the situation of Internally Displaced Populations (IDPs) at North Gondar Zone of Amhara Region, Ethiopia 2022.

Data Collection Methods

Data were collected by using data collection tools for IDPs from key informants from each IDPs collective sites and concerned Government officials including Zonal DRM office, Zonal Health Department and Woreda Health Office. Attending the ICP meeting and IDP site observation were also method of data collection used to determine the environmental condition of the collective sites and to assess provision health service and humanitarian assistance in collective sites.

Data Analysis

The data collected from IDPs key informants and deferent sectors were entered and analyzed using micro soft excel 2013 and presented by narrations, tables, graphs and maps.

Ethical Clearance

Ethical clearance to conduct the assessment was obtained from Ethiopian Public Health Institute (EPHI). A letter of request was provided for the North Gondar Zone Health department.

Data Dissemination

The final report of the assessment was communicated to AAU, CHS, SPH, EFETP, EPHI/PHEM, FMoH, Amhara RHB PHEM, North Gondar Zone health department, and to affected Woreda through email.

Operational definitions

Complex Emergency – A crisis in a country, region or society where there is a total (or near total) breakdown of authority, resulting from internal or external conflict, and which may require a large-scale international response beyond the mandate or capacity of any one single agency

Direct Health Effect – An adverse health effect caused by the actual physical forces of a disaster, such as a drowning or injury from flying debris.

Disaster – The serious disruption of societal functioning causing widespread human, material, or environmental losses that exceed the local response resources, triggering calls for external assistance.

Disaster Surveillance – A public health practice used to assess health effects, monitor the effectiveness of relief efforts, respond to public concerns and media inquiries, and facilitate planning for future disasters

Displacement – The forced movement of populations of people or animals from the area where they live, usually due to sudden impact from natural disasters, threat or conflict

Hazard – Any source of potential harm that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage

Infrastructure Damage – Damage to houses, business centers, hospitals, and transportation services because of a disaster.

Rapid Needs Assessment (RNA) – A collection of techniques (e.g., epidemiological, statistical, anthropological) designed to identify quickly the basic and health needs of a community.

Coping- person's cognitive ability to deal with stressful situation when the transaction between person and environment exceeding the person's resources.

Findings

Overview of the Situation

Due to the war that started in November 2020 between the TPLF group and Ethiopian government, many people were displaced, lost their family and property, children were separated from their family, a number of women and children became victims of GBV and enormous damage was happened to the health system and other infrastructures.

The public health impact of this war ranges from both direct (injury or death from the crisis itself) and indirect (changes in living conditions, forced displacement, lack of legal protection or decreased access to health care). Based on the situational reports from the health sector, this humanitarian crisis resulted a significant impact on the health and well-being of affected populations. Besides, many of the districts in the war-affected Zones had history of experiences of outbreaks such as malaria, measles, Cholera, anthrax, pertussis and so on. Due to overcrowding, inadequate safe water supply, poor hygiene and environmental health, food insecurity, and population mobility, the risk of infectious and epidemic prone disease was high. The social support and interactions have also been interpreted in these areas which can create panics and anxiety on the affected community. Based on the PHEOC report of the Regional Health Bureau, more than 2,356,587 individuals were forced to displaced from their residential area to different parts of the region by direct and indirect influence of this crisis. 154,502 IDPs were sheltered in different IDP camps in the Region. Of these displaced individuals, 11,082 (7%) of them found in North Gondar Zone in three collective sites.

The conflict resulted in destruction of health system infrastructures partially or completely, pillaging medical supplies and equipment, and interruptions of health services, leaving the community reliant on emergency medical assistance. Attacks on health facilities and health workers were common. Sexual and gender-based violence (SGBV) case were also reported in different part of the war affected Zone.

Demographic profile of displaced population

Doe to the conflict, a total of 136,124 individuals were displaced from different Woredas of the North Gondar zone, Amhara Region. These internally displaced persons were sheltered in three different collective sites and within the host community. Out of totally displaced 136,124 individuals, 9,887 (7.3%) of them were settled in three collective sites. Of the IDPs settled in collective sites, majority of them 4,505 (45.6%) were found in Adiarkay Woreda - Zarima IDP site, 3,300 (33.4%) in Dabata Woreda- Dabat IDP camp and the rest 2,082 (21%) in Debark Woreda – Kulich Meda IDP camp **Table 35**. Out of 136,124 IDPs 73,075 (53.7%) of them were males and the rest 63,049 (46.3%) female.

Table 35 Distribution of IDPs by IDP sites North Gondar Zone, Amhara Region, March 2022

S.N	Name of IDP site	# HH			#IDPs		Total IDPs
		Male	**Female**	**Total**	**Male**	**Female**	
1	Debark	108 (7.3%)	1377 (92.7)	1,485 (100%)	870 (26.4%)	2430 (73.6%)	3,300 (100%)
2	Dabat	281 (40%)	420 (60%)	701 (100%)	931 (44.7%)	1151 (55.3%)	2,082 (100%)
3	Zarima	1,035 (56.2%)	807 (43.8%)	1842 (100%)	2508 (55.7%)	1997 (44.3%	4,505 (100%)
	Total	**1,424**	**2,604**	**4,028**	**4,309**	**5,578**	**9,887**

Damages on public services and infrastructure

Health infrastructure damage

Due to the conflict majority of health facilities have been damaged including drugs and logistics. In North Gondar Zone the health service provision was interrupted. Because of the destruction of health facilities and insecurity, basic health service has been interrupted and many peoples were exposed to epidemic prone diseases. Complications of non-communicable disease were also prevalent among the IDPs. Due to the interruption of primary health service, outbreaks of vaccine preventable disease (Measles and Pertussis), SGBV, psychological disorder and mental problems were prevalent. Because of the war conflict more than 110 governmental health facilities (02 hospitals, 21 health centers and 89 health posts), and hundreds of ambulances were looted and destroyed or turned into military camps **Table 36**.

Table 36 Number damaged health facilities North Gondar Zone, Amhara Region 2022

S.No	Region	Zone	Type of Health facilities	# of Health Facilities	Type of damage	Estimated damage & loss by ETB
1	Amhara	NGZ	Hospital	02	Damaged and looted	12,250,124.00
			Health center	21	Damaged and looted	40,190,661.67
			Health Post	89	Damaged and looted	6,845,370.05
	Total			112		59,286,155.72

Source: North Gondar Zonal health department post conflict facility assessment report.

Damages on schools

Due to the northern Ethiopian conflict most of schools and teaching materials have been damaged. In assessed sites teaching process was interrupted and school compounds were changed into military or IDP camps. A total of 255 schools have been completely or partially damaged **Table 37**.

Table 37 Number of damaged schools NGZ, Amhara, 2022

S.No	Region	Zone	Type of schools	# of schools	Type of damage	Estimated damage & loss by ETB
1	Amhara	NGZ	Secondary schools	17	Damaged and looted (11 partially)	59,000,000.00
			Primary schools	238	Damaged and looted (30 partially)	691,000,000.00
			Total	255		750,000,000.00

Source: North Gondar Zonal health department post conflict facility assessment report.

Health care provision

There were 3 hospitals, 26 health centers and 141 health posts which were functional during the assessment period. There were also 3 IDP clinics established in three IDP sites namely Zarima, Debark and Dabat IDP sites and six Health and Nutrition Mobile Team (HNMT) that provide essential health service for IDPs. Kulch Meda, Dabat and Zarima IDP sites have nearby health facilities that give essential health services with well-organized referral system with a distance of 1.5km to the IDP sites. All IDPs got essential health services free of charge irrespective of their income status.

In all IDP sites and host community there were assigned health professionals that give essential health services. A total of 59 (Adi'Arkay 31, Dabat 16, and Debark 11) health professionals were working on IDP sites and host community to give minimum essential health services for community **Table 38**. Besides these health workers, other professionals from the National, Regional, Zonal and partners were supporting woredas/ IDP sites.

Table 38 Distribution of health professionals by profession category and IDP site in NGZ, Amhara, 2022

S.No	Profession	Adi'Arkay	Dabat	Debark	Total
1	Doctor	5	2	1	8
2	Health officer	5	3	1	9
3	Nurse	6	3	3	12
4	Midwife	6	6	3	15
5	Pharmacy	4	1	1	5
6	Environmental Health	2	0	0	2
7	Psychiatrist	1	1	2	4
8	Psychologist	2	0	0	2
9	HEWs	0	0	1	1
Total		31	16	12	59

Source: North Gondar Zone Health department

Maternal and Child Health Service

First Antenatal care (ANC-1) and ANC-4 was given for 747 and 560 pregnant women respectively and there were 41 deliveries and 32 post natal care (PNC) service **Figure 48**.

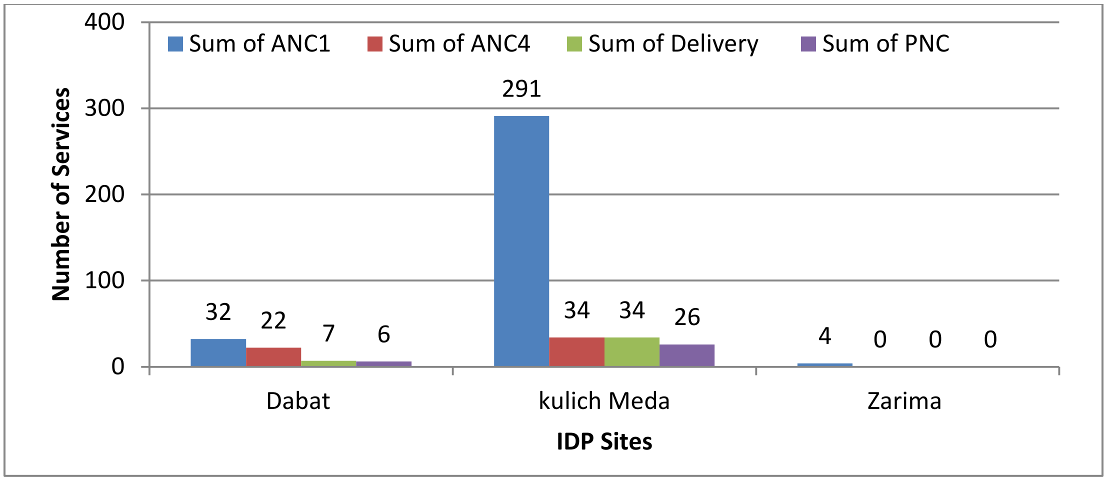

Figure 48: Maternal essential health services by IDP site and service type in North Gondar Zone Amhara Region, Ethiopia, 2022

Family planning service

Family planning service was provided for the IDPs and the host community. Out of 327 family planning services, 296 (90.5%) were short acting family planning service and the rest 24 (7.3%) long acting and 7 (2.1%) emergency contraceptive **Figure 49**.

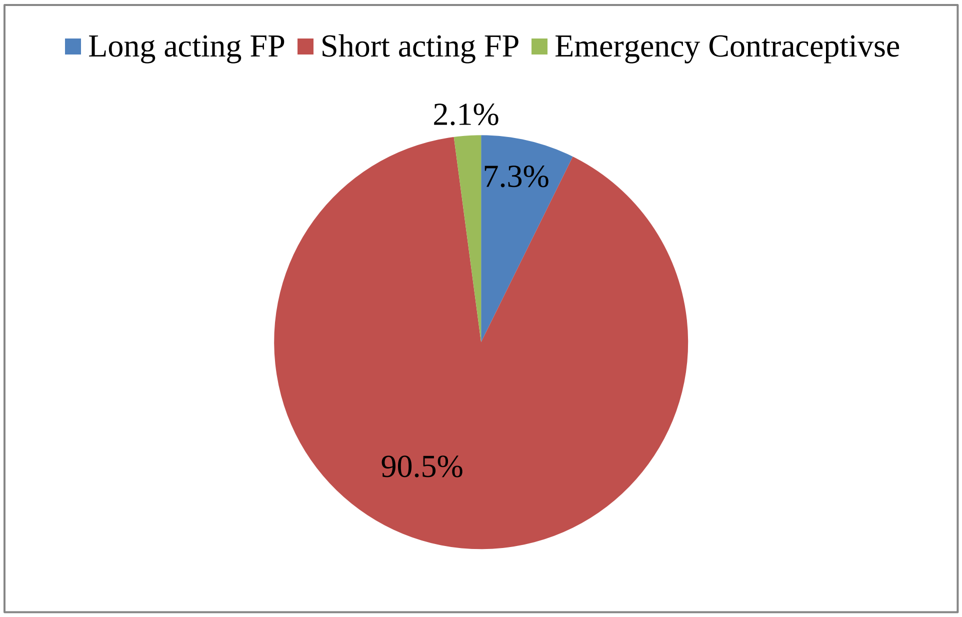

Figure 49: Family planning service by contraceptive type in North Gondar zone Amhara region, Ethiopia, 2022

Immunization

Immunization service was among services that have been provided for IDPs and host community as part of disease prevention activities. In all IDP sites immunization was given for under one year children. The following

Table 39 depicts immunization activities of the IDPs. Owing to the destruction of health facilities the immunization service was interrupted in the Zone and children were exposed to vaccine preventable diseases. There was also occurrence of vaccine preventable diseases in some Woredas.

Table 39 Immunization service by antigen type and IDP site in North Gondar zone,Amhara Region, Ethiopia,2022

S/No	Type of immunization	IDP site	Number of children vaccinated
1	Kulich-Meda	Penta 1	166
		Penta 3	13
		MCV1	36
		MCV2	85
2	Dabat	Penta 1	6
		Penta 3	0
		MCV1	2
		MCV2	1
3	Zarima	Penta 1	2
		Penta 3	1
		MCV1	2
		MCV2	0

Mental Health and Psycho-Social support (MHSSP) services

In the Kulich-Meda and Dabat collective sites A total of 1,082 MHSSP screening services were done in kulchi meda and Dabat IDP sites of those 728 mental health problems were identified and psycho-therapy given **Table 40**.

Table 40 Mental health and Psycho-Social support services by IDP site and service category in North Gondar Zone,Amhara region,Ethiopia,2022

MHSSP Center	Screening	Identified Health problem	Psycho-education	Psycho-Therapy	
				Individual	Group
Kulch Meda IDP site	660	426	407	255	205
Dabat IDP site	422	302	298	320	129
Total	1,082	728	705	575	334

Public Health Emergency Management (PHEM)

In Dabat woreda and Debark town Administration Health Office as well as at Zonal level emergency preparedness and response plan (EPRP) were available and Rapid Response Team (RRT) was established. The RRT was well organized and functional at Zonal and two Woredas (Dabat Woreda and Debark town Administration Health Office). In Adi'Arkay Woreda Health Office emergency preparedness and response plan (EPRP) was established lately and was not well organized.

Public health surveillance was conducted every week. Following the conflict there were unusual increase of scabies case in Debark IDP sites with a total of 535 under five and 721 adult cases.

No epidemics of priority diseases or cluster of cases were encountered in the IDP sites but the presence of risk factors like shortage of drinking water, overcrowding and malnutrition poses a great risk in epidemic prone diseases (cholera, scabies, malaria, measles, and severe acute malnutrition).

During the assessment a total of 8,630 cases of IDPs were treated. Of those, 5,404 (62.6%) were under five children

Table 41. Non-communicable diseases (hypertensive) were also identified and started treatment. There were two deaths in the IDP site (one maternal and one child). The maternal death was related to pregnancy and that of the child chronic disease. In those war affected woredas vaccine

preventable diseases were reported in excess of than expected and two deaths registered. Pertussis outbreak in Beyeda Woreda with 62 cases and two deaths and suspected measles outbreak in Adi-Arkay 12 cases and Beyeda Woreda 8 cases were reported and outbreak investigation and response was conducted to control the outbreak.

Table 41 Public health priority disease surveillance in IDPs by disease type and case category in North Gondar zone, Amhara region, Ethiopia, 2022

S. No	Types of Disease	Case Category and Number of cases			
		Number of <5 cases	Number of adult cases	Number of <5 deaths	Number of adult deaths
1	Scabies	542	725	0	0
2	ARI	313	665	0	0
3	Dysentery (bloody diarrhea)	188	226	0	0
4	Diarrhea (non-bloody)	158	102	0	0
5	Typhoid fever	25	71	0	0
6	Other diseases	1076	2500	0	0
7	Measles	0	0	0	0
8	Cholera	0	0	0	0
9	SAM	137	0	0	0
10	MAM	707	872	0	0
11	Typhus	1	17	0	0
12	Malaria	2	35	0	0
13	Pneumonia	77	172	0	0
14	TB	0	1	0	0
15	Peptic ulcer disease	0	16	0	0
16	Animal bite	0	1	0	0
17	Hypertension	0	1	0	0
Total cases		3,226	5,404	0	0

Other diseases, MAM, scabies, ARI (Acute Respiratory Infection) and dysentery were the leading cause of morbidity among IDPs of under-five children **Figure 50**.

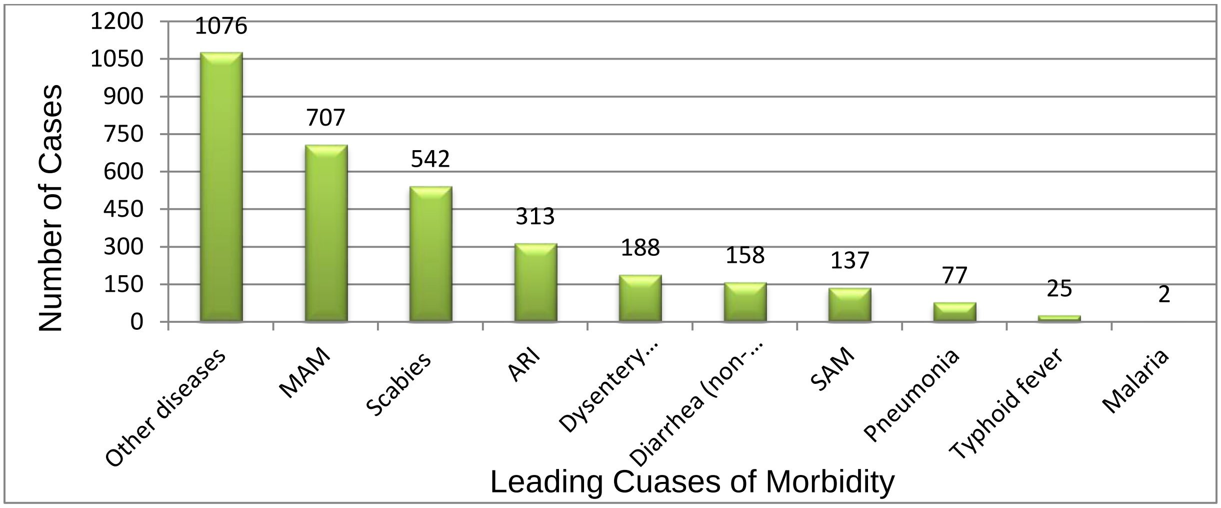

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Figure 50 Top ten leading causes of morbidity of under-five children of IDPs in NGZ, Amhar region, Ethiopia, 2022

Other diseases, MAM, scabies, ARI, dysentery and pneumonia were the leading cause of morbidity among IDPs of adult population **Figure 51**.

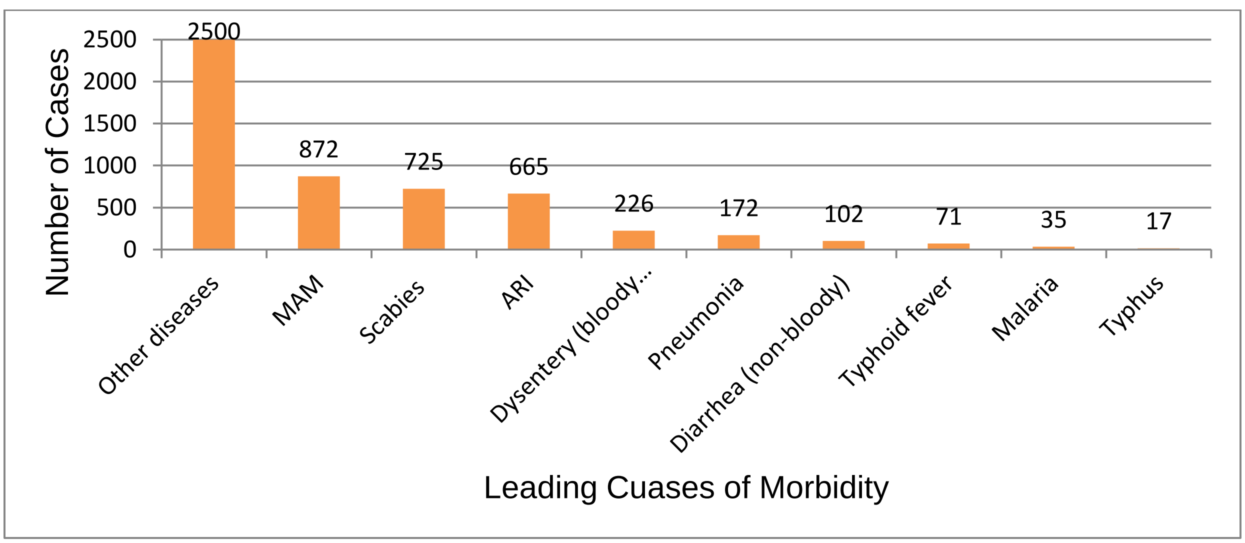

Figure 51 Top ten leading causes of morbidity of IDPs in NGZ, Amhar region, Ethiopia, 2022

Nutrition

The nutritional screening of under-five year's old children and pregnant and lactating mothers has been conducted every month in all IDP sites as well as in host communities of the three Woredas. The three IDP sites gave SAM and MAM management treatment and vitamin A for 6-59 months children and deworming for 24-59 months children as supplementation. In addition to these trained staff on emergency nutrition management were assigned in these IDP sites.

In these three IDP sites 2,904 children (6- 59 months) screened in Kulchi meda, Dabat and Adi'Arkay IDP sites of which 137 SAM cases were identified and managed in OTP and SC **Figure 52**.

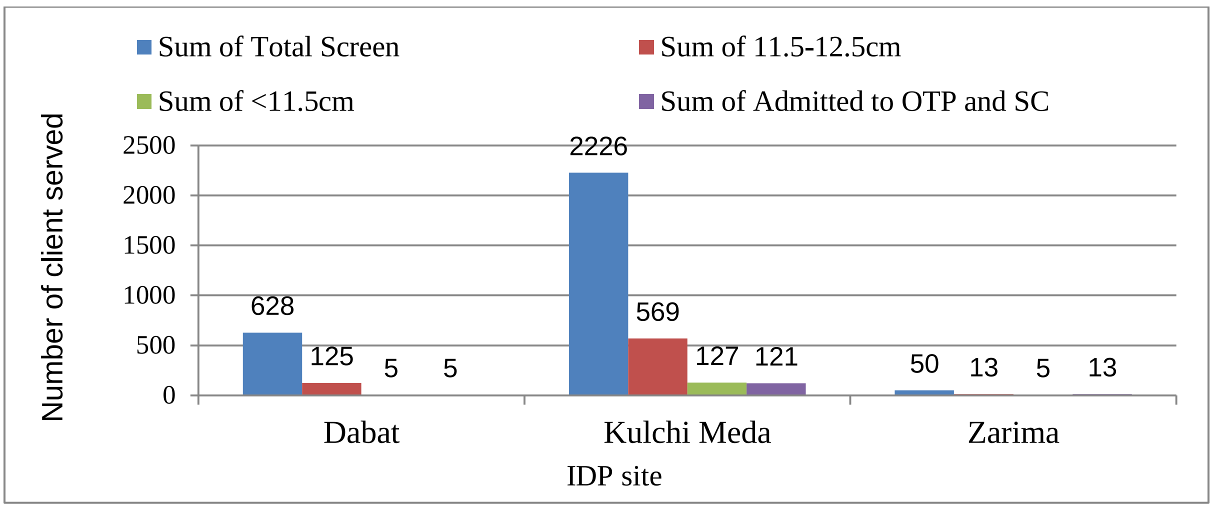

Figure 52 Nutritional screening result for children under-five years of age by IDP site North Gondar Zone of Amhara region, 2022

A total of 1208 Pregnant and lactating mothers were Screened for nutritional problems; accordingly 872 (72.2%) women were malnourished /MUAC <23cm.Of these only 436 (50%) linked to TSFP **Figure 53**.

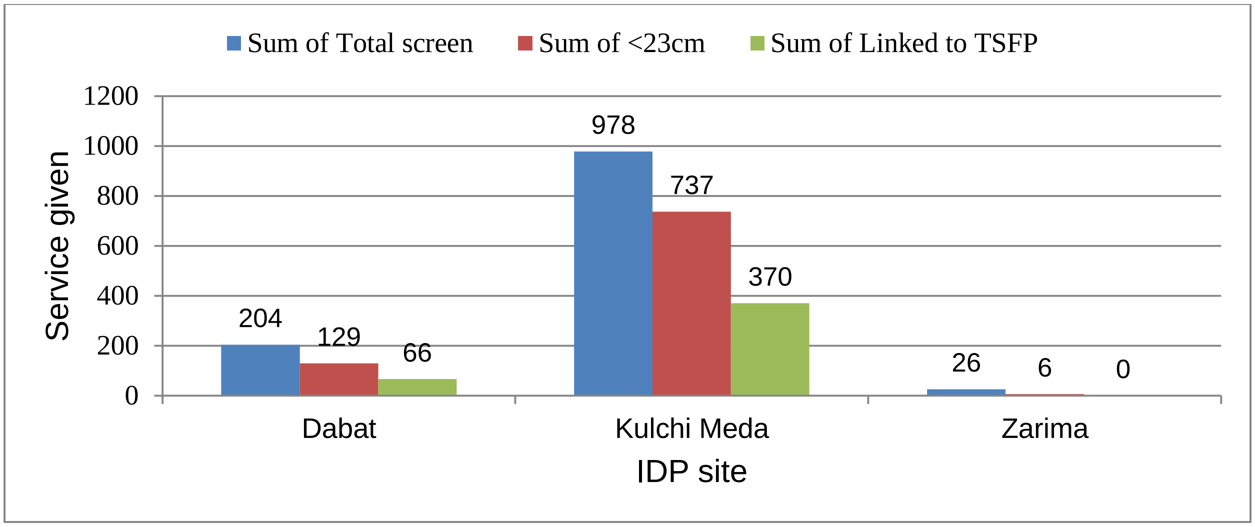

Figure 53 Nutritional screening result for PLW by IDP site among NZG Amhara Region, 2022

A total of 1175 vitamin A supplementation and 1272 deworming were given for IDPs in Dabat and Kulchi Meda IDP sites where as there were no vitamin A and deworming supplementation in Zarima IDP site **Table 42**.

Table 42 Vitamin A supplementation and Deworming for IDPs North Godar Zone Amhara Region, Ethiopia, 2022

S.No	IDP site	Vitamin A Supplementation	Deworming
1	Dabat	57	219
2	Kulich Meda	1118	1053
Total		1,175	1,272

Water, Hygiene and Sanitation

Pipe system and open well were the common sources of water for the IDPs as well host community. The average taken time to fetch water was 10 minutes for Dabat and Kulch Meda IDPs and 40 minutes for Zarima IDP including the time it takes to travel, waiting and filling the containers and the average distance of main water source to collective site was 50 meters in

Dabat and Kulch Meda IDP sites whereas in Zarima IDP site 200 meters. Average daily water consumption of individuals for all uses (drinking, cooking and hygiene) was 10 liters/house hold/day in Dabat and Kulch Meda and 15 liters/person/day in Zarima IDP site. In all IDP sites water treatment chemicals were in place but there were no water testing system in all IDP sites. IDPs were complaining shortage of water in Dabat and Kulch Meda IDP site because of overcrowdings of IDP sites. Water tracking for IDPs collective centers was supplied by IHS and IOM once per week to support shortage of water.

Health education activities were conducted in all IDP sites. Latrine was available for all IDP sites. A total of 112 seats of latrines were available in Kulch Meda IDP with separate for female and male, whereas Dabat IDP site has 28 seats with separate for male and female. Because of absence of construction of IDP camp in Zarima, the IDPs were sheltered in school compounds. In this collective site there were only 28 seats without separate room for male and female. In Dabat and Zarima IDP sites there were no proper latrine utilization, but the reverse was true for Kulch Meda IDP site. Liquid waste disposal systems were not available in all IDP sites whereas solid waste disposal site were available in Kulch Meda and Dabat IDP sites. In Kulch Meda and Dabat IDP sites private showering/bathing facility were in place for males and females with a total of 72 rooms and 20 rooms respectively. Dabat and Kulch Meda IDP sites had communal kitchen but not adequate. Dignity kits were distributed in all IDP sites; especially for GBV cases.

Food and Non-food Items (NFI)

In all IDP sites and host community regular but not adequate food distribution was in place with average 15kg/person/month in addition to these non-food items were distributed in different time for different population groups by different supporters and government **Table 43**. The population of the collective sites were overcrowded because the new influx of IDPs from war affected Woredas especially Adi-Arkay and Tselemt Woredas, this contributed for the inadequate access for the IDPs.

Table 43 NFIs distributed for IDPs in Kulch Meda, Dabat and Zarima, NGZ, Amhara Region, Ethiopia, 2022

S.No.	List of NFIs distributed	Quantity
1	Mats/mattresses	2212 pieces
2	Blankets	33,735 pieces
3	Soap (bathing and laundry)	77,341 pieces
4	Cooking pot	18,147 pieces
5	Lighting (flashlights)	2,000 pieces
6	Liquid soap(1 liter)	260 liters
7	Washing basin	18,147 pieces
8	Jerican (20 liter)	18,147 pieces
9	Plastic water bucket(20 liter)	6,126 pieces
10	Cooking ladle	12,000 pieces
11	Dignity Kit	2,500 kits

Shelter

In Kulchi Meda IDP site a total of 225 tents were available with different holding capacity. Of those 25 tents 48 meter square each with a maximum holding capacity of 400 individuals and 200 tents 16 meter square each with a maximum holding capacity of 1000 individuals, but in Kulch Meda IDP site, 3300 individuals were available in these tents which means 1.3 m^2/person. In Dabat IDP site 16 tents with 48 m^2 each with carrying capacity of 768 individuals were available but 2,082 individuals reside in this IDP site means 0.4 m^2/person. On the other hand; in Zarima IDP site no standardized site was constructed, the IDPs were sheltered in Zarima primary and secondary schools.

Sexual and Gender Based Violence (SGBV)

Due to conflict 52 children and women were raped. Of those survivors 18 adolescent girls were under 18 years old. The servitors were physically, mentally and socially affected. Mental health and psycho-social support was provided by different Governmental Organizations and humanitarian organizations. Among the supports that were provided for the SGBV cases psycho-education, psycho-therapy, medical therapy, dignity kit and cash support (10,000 birr individually) were some of the supports.

The most common significant safety and security concerns that was facing children, adolescent girls and women in the affected community were sexual violence, no safe place in the community, risk of attack when travelling outside the community, local markets and unable to access services and resources.

Among types of SGBV cases reported in the affected community sexual violence, domestic violence and having sex in exchange for money were some of them. When children, adolescent girls and women experienced SGBV they were mostly go for help to police, NGOs working in women, health professionals, friend and UN agencies. The most common barriers that prevent SGBV survivors from accessing support or medical care were fear of being identified as survivors, unavailability of confidential treatment, and lack of trained staff were some of them.

Drugs and Medical Supplies

All types of Vaccines were available in all IDP sites in the nearby health center but in Zarima IDP camp vaccines were available in the nearby health post and emergency drugs were available. All essential drugs were in place in all IDP sites. Basic laboratory services were available in Dabat, kulch Meda and Zarima IDP sites by referral to the nearby health center whereas in site basic laboratory service were not available in the nearby health center on other hand antibiotics were available to treat infectious disease. Nutritional supplies (plumpy nut, plumpy sup, F-75 and F-100) for SAM and MAM cases management were available in all IDP sites and for the host community.

Coping Mechanisms of IDPs

Coping is defined as a person's cognitive ability to deal with stressful situation when the transaction between person and environment exceeding the person's resources (10). Displaced communities respond to the challenges and losses of their changed circumstances by drawing on their remaining resources. The challenge for those working in such contexts is how to effectively combine these community initiatives with their own organizational resources. Regarding coping few IDPs of Kulich Meda were engaged in small business activities to cope up with shortage of income with help of DRM office and partners.

Response and coordination activity

In North Gondar Zone Government and partners supported IDPs and host community with food, health service, shelter and non-food items. The response activity was good at Kulich-Meda and Dabat IDP sites compared to Zarima IDP site. More than 5000 IDPs in Zarima were sheltered in school without adequate access to shelter, food and non-food items. Overcrowding make the IDPs vulnerable to communicable diseases.

All humanitarian response activities provided by clusters were monitored and coordinated through established ICP. In North Gondar Zone multi-sectorial ICP was established and perform its activity accordingly. ICP meeting held twice a week on Monday and Thursday. All relevant government, NGOs and UN agencies were well represented at Zonal level. Daily and weekly cluster update was maintained at ICP meeting by DRMC and Inter Cluster Coordination (ICC) meeting conducted at Zonal level. Partners were presenting their performance report at ICC and ICP by their cluster coordinator. Rehabilitation and recovery joint plan for IDP's was developed by the ICP members.

Discussion

Because of the Northern Ethiopian conflict, many people were displaced, lost their family and property, children were separated from their family, a number of women and children became victims of GBV and enormous damage was happened to the health system and other infrastructures. Due to the conflict, 136,124 individuals were displaced from different Woredas of the North Gondar Zone, Amhara Region.

The IDPs were sheltered in three collective sites found in (Debark, Dabat and Zarima). The collective sites of Debark- Kulich-Meda and Dabat-Dabat were well established. Zarima has no constructed shelter but the IDPs were sheltered in school compound. Zarima IDP site has no adequate shelters, materials to sleep on and NFI.

Food was being distributed by DRMO and WFP on month basis and the total amount of food consumption was increasing due to the influx of new IDPs from the conflict area. Due to the conflict 112 governmental health facilities and hundreds of ambulances and 255 schools have been completely or partially damaged.

Regarding health service provision, in all IDP sites there were mobile clinics which provide basic health services for the IDP population. There was also good referral system between these clinics and the nearby health centers and hospitals. The IDP community got the health services free of charge. For complicated cases the Gondar Referral Hospital provides the health service. MCH, ANC, immunization, nutritional screening and MHSSP services were among the services that were provided in the IDP clinics. For SGBV survivor's mental and psychosocial support was available in IDP clinics with well-trained professionals. Some partners also supported the SGBV survivors by providing cash. Comprehensive health education has been given for the IDPs to enhance the awareness of the community towards disease prevention and health promotion.

Environmental hygiene and sanitation of the IDP sites was good except for Zarima IDP site which had poor environmental hygiene and overcrowding. The provision of water supply of the sites was good. When there was water shortage, it was provided using trucks.

Except temporary shortage of some drugs, supply of drug and medical equipment was at good stand in Kulich-Meda and Dabat IDP clinics. There was high problem of health service in Zarima IDP clinic until the IDP clinic was supplied and started services.

The Zonal Incidence Command post which was headed by Zonal DRMO controls and coordinates the overall situation of the IDPs by conducting regular meeting twice a week with stakeholders and partners. In collaboration with government, partners play great role in providing food, water, shelter, non-food items (NFI), health service and cash for the affected community.

Conclusion

Damaged health facilities have not been rehabilitated and started to serve the population in war affected areas. Health workers which were displaced from their routine works have not been returned to their normal duty. In most Woredas, there was no Emergency preparedness plan at districts PHEM department. Temporary shortages of essential drugs were also reported from all IDP clinics. Routine immunization service was not reestablished in war affected Woredas and this resulted in outbreak of vaccine preventable diseases. Lack of liquid waste disposal system in all IDP sites may expose the IDP population to infectious diseases. Due to the conflict many children were malnourished and there were many MAM and SAM cases.

Recommendation

Based on assessment finding and identified gaps, we recommend

- The Amahara Region in the collaboration with the Federal Government and partners should supply adequate food in regular basis and should revitalize the affected health facilities in order to make them functional
- The regional health bureau and Zonal health department should take measure to minimize the burden of communicable disease in areas in which the health service has interrupted.
- The number of water truckers should be increased based on the number of population
- Partners should work on site construction for Zarima IDPs should
- The surveillance system be strengthen to prevent and control occurrence of outbreak

References

1. Union A, Nations U, Payne C, Voon T, Asplet BM, Bradley M. Strengthened Protection for Internally Displaced Persons in Africa : The Kampala Convention Comes Into Force. 2012;16(36).
2. Guiding Principles on Internal Displacement. Vol. 24, Refugee Survey Quarterly. 2005. p. 197–205.
3. Round SA, Assessment V, Round S. ETHIOPIA NATIONAL DISPLACEMENT REPORT 9. 2021;(September).
4. Report S. Ethiopia - Northern Ethiopia Humanitarian Updat. 2021;1–18.
5. Peate I. Gender-based violence. Br J Nurs. 2019;28(10):607.
6. Faronbi JO, Akinyoola OD, Faronbi GO, Adegbola GA, Bello CB. Health needs and health seeking behaviour of Internally Displaced Persons in Dalori camp, Maiduguri, Borno State, Nigeria. Res J Heal Sci. 2019;7(3):246.
7. Davies A. IDPs in Host Families and Host Communities: Assistance for hosting arrangements. 2012;(April):1–53.
8. Sheikh TL, Mohammed A, Agunbiade S, Ike J, Ebiti WN, Adekeye O. Psycho-trauma, psychosocial adjustment, and symptomatic post-traumatic stress disorder among internally displaced persons in Kaduna, Northwestern Nigeria. Front Psychiatry. 2014;5(SEP):1–6.
9. Sommer M, Ferron S, Cavill S, House S. Violence, gender and WASH: spurring action on a complex, under-documented and sensitive topic. Environ Urban. 2015;27(1):105–16.
10. Folkman S, Lazarus RS, Dunkel-Schetter C, DeLongis A, Gruen RJ. Dynamics of a Stressful Encounter. Cognitive Appraisal, Coping, and Encounter Outcomes. J Pers Soc Psychol. 1986;50(5):992–1003.

CHAPTER-VIII

Protocol/Proposal for Epidemiologic Research Project

8.1 Assessment of Utilization of Long-Lasting Insecticide Net and Associated Factors among Pregnant Women in Lare Woreda, Nuer Zone, Gambella Region, Ethiopia, 2023

Summary

Introduction: long lasting Insecticide nets are often used as a physical barrier to prevent infection of malaria. In sub-Saharan Africa, one of the most important ways of decreasing malaria burden is the utilization of insecticide-treated nets (LLIN). However, there are limited information on LLIN utilization and its associated factors in Ethiopia. Therefore, this study aims to assess the utilization of insecticide-treated bed nets and its associated factors among pregnant women in Lare Woreda, Gambella Region, Ethiopia.

Objective: To assess the level of long lasting insecticide treated nets use and associated factors among pregnant women

Methods: A community-based cross-sectional study will be conducted in Lare Woreda. Systematic sampling technique will be used to select 421 households. Interviewer-administered questionnaire and observational checklists will be used to collect data. The collected data will be entered into excel and exported to SPSS version 25 for analysis. Bivariate and multivariate analyses will be conducted using odd ratio with 95% confidence interval and P-value < 0.05 using SPSS. The results will be presented by texts, tables, and graphs. Both binary and multivariate logistic regressions will be used to assess factors associated with ITN utilization.

Time schedule: The study will be conducted from May to July 2023.

Cost required: The total cost required to implement this project is ETB 48, 850.00

Key Word: Lare Woreda, LLIN, Nuer Zone

1. Introduction

1.1 Background

Globally, there were an estimated 241 million malaria cases and 627,000 deaths worldwide in 2020 (1). That indicates about 14 million more malaria cases and 47 000 more deaths in 2020 compared to 2019. Most of those increases were from countries in the WHO African Region, and associated with disruption to services during the COVID-19 pandemic.

Malaria is seasonal in most parts of Ethiopia with the highest transmission season between September and October, following the main rainy season from June to August (2).

World Health Organization (WHO) recommends that all at risk persons, particularly pregnant women, should sleep under Long lasting insecticide treated nets (LLINs) during the night since it reduces miscarriages/stillbirths by one third compared with newborn babies of mothers with no protection (3). Use of LLINs during first or second pregnancies was estimated to provide a protective efficacy of 18% against neonatal mortality and of 21% against low birth weight.

Insecticide-treated bed net (ITN) utilization is one of the effective malaria preventive strategies. It can prevent malaria infection by reducing contact and bite of mosquitoes if it is employed properly and consistently (4). Evidence shows that ITN utilization can reduce malaria related deaths by about 20% from all causes of mortality in malaria-endemic areas. In areas of stable malaria transmission, ITNs also have the potential to reduce severe malaria by up to 45% and malaria-related mortality in children less than five years of age by up to 55%.

Currently, insecticide treated mosquito nets (ITNs) have received serious attention and have raised renewed interest to serve as tools in malaria control. In Africa, the use of this control strategy has been proved to be cost- effective means for the control of malaria, especially among children under 5 years of age and pregnant women (5).

There are four main intervention strategies that are being applied in Ethiopia to combat malaria. Those are early diagnosis and prompt treatment, selective vector control, the use of insecticide-treated mosquito nets (ITNs), and environmental management (6).

The control of vector-borne diseases represents one of the greatest global public health challenges of the 21st century. Malaria and other vector-borne diseases contribute substantially to the global burden of diseases and disproportionately affect poor and under-served populations living in tropical and sub-tropical regions (7). In the absence of effective control, these diseases have a major impact on public health and socio-economic development. The standard chemical, biological and physical control measures used to kill mosquitoes and other insects vectors, as well as active and passive case-detection and treatment of human infection, have a long and proven track-record of saving lives.

1.2 Statement of the problem

Malaria in pregnancy has serious health consequences for the mother, fetus, and newborn which can be preventable with inexpensive and cost-effective interventions that are available for over a decade.2,3 Malaria is associated with poor outcomes; maternal anemia, intrauterine growth restriction, low birth weight, and premature delivery (8). Worldwide an estimate of 200,000 infant deaths and 100,000 neonatal deaths occur annually, and 18% of global neonatal mortality is attributable to malaria.

Insecticide Treated bed Net (ITN) is considered to be the most efficacious of all currently feasible interventions for malaria control in Africa. However, lack of data on its use in under five children has made it difficult to keep tract of its efficacy in this population. ITN possession does not always translate to usage and consistent use is required for effective malaria control. ITN reduces mortality and morbidity in children less than five years of age in sub-Saharan Africa (9). They have been shown to reduce the number of malaria episodes by as much as 50% and childhood mortality by 20%.

A study conducted in Mozambique indicates that of the 302 households surveyed, 209 (69.2%) owned at least one ITN and 176 (58.3%) had one ITN for every two household members. The multivariate analysis indicated that the odds of ITN use was significantly lower among individuals in households with 3 or more members (5). However, the odds of ITNs use were significantly higher among older age groups, poorer households, and as the number of ITNs in a household increased.

ITN access, i.e. availability within the household, determined by the number of ITNs and number of household members, is a perquisite for ITN use. ITN access is defined as the proportion of the population that could sleep under an ITN if each ITN in the household were used by up to two people (10). Once ITNs are in a given household, individuals may choose to use or not use them on a given night, with structural, cultural, opportunistic, thinking, and social barriers impeding optimal use.

The physical barrier of the ITN prevents mosquito entry, while the pyrethroid treatment induces mosquito excito-repellency and causes paralysis leading to mosquito death. At high levels of coverage, ITNs reduce the overall density and life-span of mosquito populations, resulting in community-wide malaria protection both for those sleeping under ITNs and for neighbouring non-users of ITNs (11).

Malaria morbidity and mortality have been significantly decreased in Ethiopia and worldwide in the past decades. Ethiopia’s fight against malaria started many years ago and transmission of this infectious disease significantly decreased since 1959. However, malaria still remains a major public health problem in Ethiopia (12). The Ethiopian Demographic Health Survey showed that only 16.6% of households slept under ITN (3). Gambella is one of the highest malaria endemic regions with consistent transmission throughout the year. Hence this study aimed to assess ITN utilization among households in Gambella Region, Lare Woreda. This project targets to assess factors that might be contributing to low utilization of LLINs by pregnant women.

1.3 Significance of the study

Insecticide treated mosquito nets (ITNs) have received serious attention and have raised renewed interest to serve as tools in malaria control (13). LLINs have become one of the major components of vector-targeted interventions in Africa. The first initiative to adopt this strategy in Ethiopia was made in 1997/8 with the support of WHO, and efforts have been made to scale-up this experience in some other malarious areas of the country (14). Ethiopia has adopted the use of ITNs as one of its vector control strategies primarily in selected malarious areas with the view to a gradual scaling-up of the intervention (15). The use of mosquito nets is, however, limited and there are a number of possible explanations for this. These may be due to lack of cultural exposure to the use of mosquito nets, lack of awareness, absence of a sustainable mechanism for the distribution of ITNS, low acceptance by the community, and concerns regarding its high cost (16).

Lare Woreda is one of malaria hot spot areas in Nuer Zone of Gambella Region and malaria is a major public health problem in the District and malaria occurred as an outbreak. ITN distribution is 100%, but utilization status of the community is not known in the District. The information generated from this study will help planners to explore ways of increasing utilization of ITNs among pregnant women. Hence, this study will identify factors affecting use of ITNs/LLINs by pregnant women.

2. Literature review

A study conducted in Sub-Saharan Africa indicates that the availability and utilization of the ITN in the households ranged from a minimum of 40.0% to 82.8%. This demonstrates the countrywide and geographical discrepancies in the ownership and utilization of the ITN within Sub-Saharan Africa (17).

The finding from Ghana revealed that 67% of women had some general knowledge about malaria prevention, only 19% knew the specific risks in pregnancy (16). Determinants of ITN use included ITN ownership, good maternal knowledge of the risks of malaria in pregnancy and more antenatal care. ITNs resulted from inappropriate hanging infrastructure, a preference for other malaria prevention alternatives, allergy and heat were factors related with nonuse. .

A study conducted in Ethiopia indicates ITN utilization varies from place to place in Ethiopia which was 21.5% in Eastern Ethiopia, 66.6% to 68.8% in southern Ethiopia, 73% in Arbaminch, (18). According to this study, 73% and 60% of households in the Amhara and Oromia regions respectively utilized ITN the night before data collection day.

Study conducted in Kola Diba Town revealed that of the 260 households, 239 (91.9%) (95% CI = 88.5–95%) utilized insecticide-treated bed net on the night preceding the interview (6). 242 (93.1%) households didn't treat the bed net, whereas 18 (6.9%) treat the bed net by chemical regularly. Household structure and knowledge about malaria transmission were found to be associated with insecticide-treated bed net utilization.

3. Based on the finding from Miesso Woreda, from the total respondents, 39.9% (95% CI: 34.9–44.2%) utilize insecticide-treated nets. Pregnant women from rural (AOR = 2.05, 95% CI: 1.14, 3.38), employed women (AOR = 1.80, 95% CI: 1.13, 2.86), monthly income >1050 Ethiopian total birr (AOR = 2.02, 95% CI: 1.06, 3.84), third trimester pregnancy (AOR = 2.19, 95% CI: 1.09, 4.40), and having antenatal care for current pregnancy (AOR = 3.86, 95% CI: 1.63, 9.10) were factors significantly associated with insecticide-treated nets (8).

3. Research Questions and Objective

3.1 Research

1. What is the awareness level towards malaria, mosquitoes and insecticide treated nets?

2. How to advance the utilization of LLINs in the prevention and control of malaria?

3. What factors are influencing LLIN ownership and use among under pregnant women?

3.2 Objective

General objective

The aim of this study is to assess coverage and utilization of insecticide treated mosquito net and associated factors among pregnant women Lare Woreda, Nuer Zone, Gambella Region, Ethiopia.

Specific objective

- To assess Insecticide treated mosquito net use
- To assess awareness level towards malaria, mosquitoes and insecticide treated nets
- To identify associated factors that influence Insecticide treated mosquito net use

Research Methodology

4.1 Study area

The outbreak investigation will be conducted in Lare Woreda which is found in Nuer Zone, Gambella Region. Lare is located about 776 km from Addis Ababa (the capital city of Ethiopia) in the western part of Ethiopia and about 85 km from the Regional Capital City Gambella. Lare woreda is bordered in the south and east by Anuak Zone, on the west by the Baro River which separates the Woreda from Jikawo, and on the north by the Jikawo River which separates it from South Sudan. The Woreda has two clusters and 28 kebelles. There were two health centers and 28 health posts. The major town in Lare is Kuergang.

According to the 2007 population census, the projected estimated population of the Woreda in 2022 was 55,769 of whom 28,442 males and 27,327 females and 7,947 under-five children and 1,673 pregnant mothers.

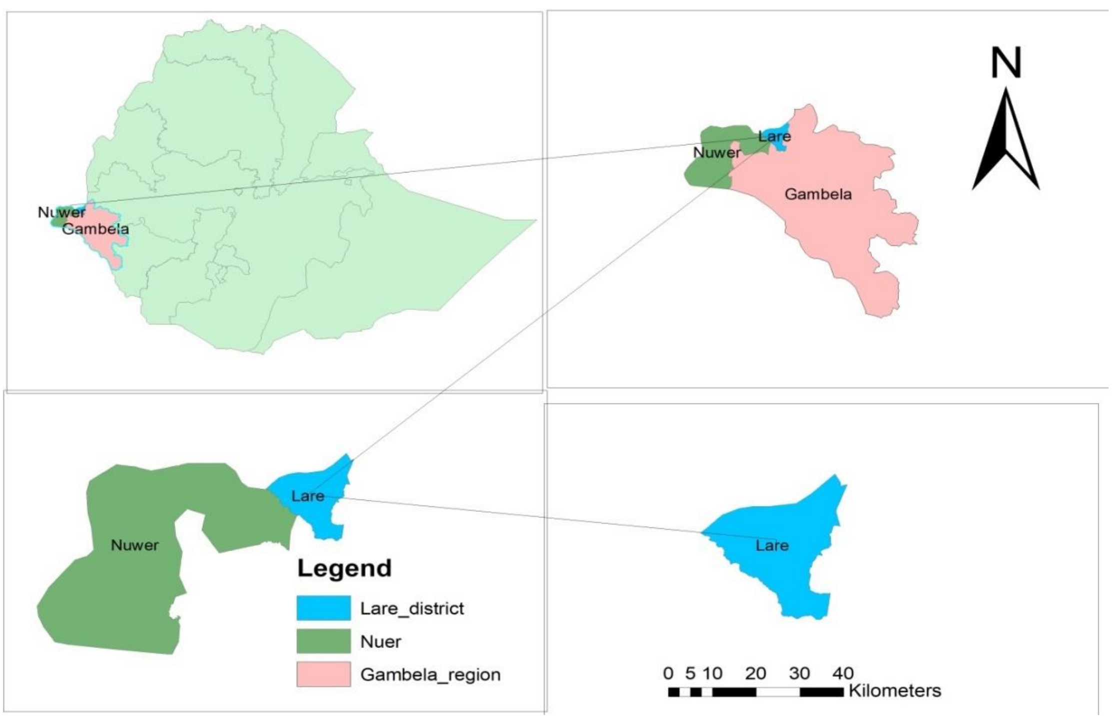

Figure 54 Map of Lare Woreda, North Nuer Zone, Gambella Region, 2022

4.2 Study design, period

A community-based cross-sectional study will be used on pregnant women from May to July 2023.

4.3 Source population

All households with pregnant women in Lare Woreda will be the source population

4.4 Study population

Pregnant women whom are going to be selected and included in the study during the sampling procedure

4.5 Sample size determination

The sample size is calculated by using the standard sample size calculation formula using one sample proportion. Taking the recent findings of 52.5% utilization of LLIN by pregnant mothers in Limu Seka District of South West Ethiopia (19), the confidence interval will be 95% (α=0.05), the marginal error of the study will be 5 % (e=.05) and10% non-response rate will be added. Based on the above assumptions the minimum sample size required for the study will be

$$\mathbf{n= Z_{\alpha/2}^{2} *p*(1-p) / e^{2}}$$

$$\mathbf{n} = \frac{1.96 \times 1.96 \times 0.525 \times 0.475}{(0.05)^2} = 383$$

When we add 10% non-respondent rate, the total sample size will be 383 + (383×0.1) = **421**.

4.6 Sampling technique

By using systematic sampling technique pregnant women will be selected to identify the study subjects. Assigning of the households from each kebele will be done by using proportional allocation to the size of the households of each selected kebeles. Sampling interval will be determined by dividing the total number of households in each kebele by the corresponding number of households to be interviewed in each kebele. The first household will be selected randomly then the next household will be selected systematically based on the sampling intervals.

4.7 Data collection

After reviewing different literatures on LLIN, a structured questionnaire (Annexed) will be developed based on the objectives of the study and local situation of the study area. The structured questionnaires prepared in English and will translate in to local Nuer language and then back translated to English. The structured questionnaire will include questions related to socio-demographic and economic characteristics, knowledge questions related to malaria, mosquito, and mosquito nets and also questions related to bed net use. Before the actual data collection process starts, the structured questionnaire will be pretested on similar population using 5% of the sample size by involving data collectors, supervisors and the principal investigator. After pretesting, if any ambiguity or difficulty occurs, related to data collector or questionnaire, any modification and correction measures will be taken before the actual data collection process will started.

Variables

Dependent variables: - ITN ownership, ITN utilization

Independent variables: - Socio demographic characteristics, such as

- ✓ Residence
- ✓ Age
- ✓ Religion
- ✓ Education
- ✓ Sex
- ✓ Marital Status
- ✓ Occupation
- ✓ Monthly Income
- ✓ Ownership of Radio
- ✓ Knowledge About Mosquitoes
- ✓ Knowledge About ITN And Malaria
- ✓ Housing Condition
- ✓ Attitude Towards Use Of Nets
- ✓ Family Size
- ✓ Condition of Nets
- ✓ Treatment Status and
- ✓ Sleeping Arrangement

4.8 Data collection procedures

For data collection either grade 10 or 12 completed or above will be recruited. They will be residents of the study area and who know the local language, culture and belief of the community. Data collectors will be oriented by the principal investigator. The orientation will include discussing about the objective, significance of the study, and how to administer the questionnaires. For supervisor both BSc or diploma graduate health professionals will be selected and they will oriented on the objective of the study, the relevance of the study and on how to supervise data collectors. The supervisor together with the principal investigator will supervise data collection process. Completed questionnaires will be collected every day after checking for possible inconsistencies, errors and omissions. Compete questionnaire with problems will return back to interviewers for re-interview. The principal investigator will be responsible for the overall coordination of data collection process

4.9 Data analysis

Data will be entered, cleaned and analyzed using Epi-info software version 7.2.2.6 and SPSS version 25 and presented using tables and figures.

4.10 Data quality measures

To control the quality of the data, before the actual data collection procedure starts, pretesting will be carried out in the study area and thorough discussion will be done with the data collectors and supervisors about the overall procedures that will be carried out. The principal investigator will check all of the questionnaires filled by the data collectors daily whether it is filled correctly or not. Every day at the field, data will be checked for completeness and consistency by supervisors. If there is any mistake made by data collector while filling the questionnaires. The data collector will be send back to the household to fill the questionnaire again.

4.11 Operational definitions

Bed net: Any mosquito nets used for sleeping either treated or untreated with insecticide. **Household:** A domestic unit consisting of the numbers of a family who lives together along with non-relatives such as maids.

Net ownership: Households owning at least one mosquito net of any type in their house

ITN: Either a long-lasting net that does not require re-treatment or a pre-treated net obtained within the last 12 months, inclusive, or a net that has been soaked with insecticide within the last 12 months inclusive.

ITN use: Household members (especially children under five and pregnant mothers) Sleeping, under the hanging ITN the night before the survey.

Household ITN ownership: Households having at least one ITN in their house.

4.12 Ethical Consideration

The ethical approval and clearance will be obtained from the Ethiopian Public Health Institute. Permission will be also obtained from the concerned bodies of Gambella Regional State Health Bureau, Nuer Zonal Health Department and Lare Woreda Health Office. The data collectors will be oriented to provide proper advice for the respondents regarding any malpractice they have come across. Similar information provision will be done by the principal investigator for the participants of the focus group discussions. Interview will be carried out only with full consent of the person being interviewed. Before each interview, clear explanation will be given about the aim of the study will not neither to evaluate the performance of the individual nor to blame anyone for weakness, but to gather information and opinions that may lead to eventual improvement in the utilization of ITN. Each respondent will be assured that the information provided by them would be confidential and used only for the purpose of research.

4.13 Dissemination of finding

To help in future interventions, the result will be communicated to governmental and nongovernmental bodies. These include the Lare Woreda Health Office, Nuer Zonal Health Department, Gambella Regional Health Bureau, Federal Ministry of Health (FMoH), EPHI, WHO country office and others. One day conference will arranged at district level to present the study results. In addition effort will be exerted to publish the paper and disseminate it via presentation on different national and international conferences.

Expected outcomes

Number of households owning ITNs, source of ITNs; (Free, subsidized or cash base) Proportion of households uses ITN, under 5 age children slept under ITN in the previous night, pregnant women slept under ITN in the previous night and how is the perception of the community towards ITN for malaria prevention shall be determined.

5. Implementation time and Budget

A total of 48,850.00 birr is required to conduct the study. The project will take about three months including data collection and preparation of final report. Details of budget break down and implementation time is annexed below.

5.1 Work plan and budget proposal

Work plan chart

Table 44 Gantt chart showing the work plan of a study on assessment of LLITN Utilization among pregnant women in Lare Woreda, Gambella Region, Nuer Zone, Ethiopia, 2023

No	Activities	Responsibility	May				June				July			
1	Proposal development	PI												
2	Submitting the finalized proposal	PI												
3	Review the Scientific merit of proposal	PI												
4	Proposal Approval of the project	AAU												
5	Obtaining letter of clearance	EPHI												
6	Training of the data collector and Pretesting	PI												
7	Data collection, entry, clearance and analysis	PI+DC												
8	Submission of preliminary report	PI												
9	Write-up of the research draft, amending	PI												
10	Compile final report	PI+RA												
11	Final Defense	PI												
12	Dissemination of findings	PI												

5.2 Budget Proposal

Table 45 Budget break down, human capital and cost of supply needed for on assessment of LLITN Utilization among pregnant women in Lare Woreda, in 2023

	Budget Category	Unit Cost	multiplying factors	Total cost (birr)
1	**Personal Cost**	Daily Wage (including per diem)	Number of staff days	
	Principal Investigator	300	1*30	9,000
	Supervisor	300	2*12	7,200
	Data collectors	300	5*10	15,000
	Data clerk entry	300	1*10	3,000
	secretarial work	300	1*10	3,000
	Sub total		Personal Total	**37,200**
3	**Supplies**	Cost per item	Number	
	Questionnaire duplication	6 Birr per questioner	450	2,700
	Clip board	150	7	1,050
	Pen	20	10	200
	Pencil	15	10	150
	Eraser	10	10	100
	Sharper	15	10	100
	Marker	150	3	450
	Printing Paper (pack)	500	1	500
	Sub total		Supplies total	**5,250**
4	**Training**	Cost per day	Number of days	
	Hall rents	2000	2	4,000
	Coffee/tea	150	8*2	2,400
			Training total	6,400
			GRAND TOTAL	**48,850**

References

1. WHO. Word Malaria Report 2021. Word Malaria report Geneva: World Health Organization. (2021). Licence: CC. 2021. 2013–2015 p.
2. Zerdo Z, Bastiaens H, Anthierens S, Massebo F, Masne M, Biresaw G, et al. Long-lasting insecticide-treated bed net ownership, utilization and associated factors among school-age children in Dara Mallo and Uba Debretsehay districts, Southern Ethiopia. Malar J [Internet]. 2020;19(1):1–13. Available from: https://doi.org/10.1186/s12936-020-03437-9
3. Greenwood BM, Bojang K, Whitty CJM, Targett GAT. Malaria. Lancet. 2005;365(9469):1487–98.
4. Yirsaw AN, Gebremariam RB, Getnet WA, Mi MS. Insecticide - treated net utilization and associated factors among pregnant women and under - five children in East Belessa District , Northwest Ethiopia : using the Health Belief model. 2021;1–12.
5. Scott J, Kanyangarara M, Nhama A, Macete E, Moss WJ, Saute F. Factors associated with use of insecticide - treated net for malaria prevention in Manica District , Mozambique : a community - based cross - sectional survey. Malar J [Internet]. 2021;1–9. Available from: https://doi.org/10.1186/s12936-021-03738-7
6. Alemu MB, Asnake MA, Lemma MY, Melak MF. Utilization of insecticide treated bed net and associated factors among households of Kola Diba town , North Gondar , Amhara region , Ethiopia. BMC Res Notes [Internet]. 2018;1–5. Available from: https://doi.org/10.1186/s13104-018-3697-7
7. Beier JC, Keating J, Githure JI, MacDonald MB, Impoinvil DE, Novak RJ. Integrated vector management for malaria control. Malar J. 2008;7(SUPPL. 1):1–10.
8. Tesfaye T, Alemu BM, Egata G, Bekele H. Insecticide-Treated Nets Utilization and Associated Factors Among Pregnant Women in Miesso Woreda , Eastern Ethiopia : Observational Study. 2022;(March):445–53.
9. Joy Chinwe N. A Review of the Literature on Insecticide Treated Bed Net Use, Anaemia and Malaria Parasitaemia in Under Five Children. Am J Pediatr. 2018;4(1):6.
10. Koenker H, Kumoji EK, Erskine M, Opoku R, Sternberg E, Taylor C. Reported reasons for non-use of insecticide-treated nets in large national household surveys, 2009–2021. Malar J [Internet]. 2023;22(1):1–11. Available from: https://doi.org/10.1186/s12936-023-04490-w
11. Shah MP, Steinhardt LC, Mwandama D, Mzilahowa T, Gimnig JE, Bauleni A, et al. The effectiveness of older insecticide-treated bed nets (ITNs) to prevent malaria infection in an area of moderate pyrethroid resistance: Results from a cohort study in Malawi. Malar J [Internet]. 2020;19(1):1–12. Available from: https://doi.org/10.1186/s12936-020-3106-2
12. Taffese HS, Hemming-Schroeder E, Koepfli C, Tesfaye G, Lee MC, Kazura J, et al. Malaria epidemiology and interventions in Ethiopia from 2001 to 2016. Infect Dis Poverty. 2018;7(1):1–9.
13. Konlan KD, Kossi Vivor N, Gegefe I, Hayford L. Factors associated with ownership and utilization of insecticide treated nets among children under five years in sub-Saharan

Africa. BMC Public Health [Internet]. 2022;22(1):1–11. Available from: https://doi.org/10.1186/s12889-022-13347-x

14. Dun-Dery F, Kuunibe N, Meissner P, Winkler V, Jahn A, Müller O. Determinants of the use of insecticide-treated mosquito nets in pregnant women: a mixed-methods study in Ghana. Int Health. 2022;14(6):619–31.
15. Mekuria M, Binegde DN, Derega J, Bala ET, Tesfa B, Deriba BS. Insecticide-Treated Bed Net Utilization and Associated Factors Among Households in Ilu Galan District , Oromia. 2022;
16. Hambisa MT, Debela T, Dessie Y, Gobena T. Long lasting insecticidal net use and its associated factors in Limmu Seka District, South West Ethiopia. BMC Public Health. 2018;18(1):1–7.

CHAPTER-IX

Other Additional Output

9.1 Weekly Epidemiological Bulletin of Gambella Region

Gambella RHB, PHEM Weekly Bulletin
(Week 21. 2022) 06 June, 2022

Prepared By:-
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Week 21, 2022 (15/09/2014-21/09/2014 E.C)

36,789	1,841	1,151	17	26
Tested	Confirmed	Recovered	Active	Deaths

HIGHLIGHTS

- Three hundred twenty nine (329) RDT tests were conducted in this week with 17 positive test result.
- No cases in severe condition in this week and a total of 6 ICU bed capacity (all available).
- The Regional Surveillance report completeness were 91.4%
- A total of 5,380 malaria suspects were examined either by microscopy or RDT, from these 3,091 (2,972
  P. falciparum and 119 P. vivax) were positive for malaria. Positivity rate was 57.4%.
- Trends of malaria at regional level above thresholds and ongoing outbreaks in five woredas(Dimma,Godere, Mengeshi, Abobo, and Gambella Town.
- The comparisons of week 19, 20, 21 of 2021 and 2022 shows that all woredas malaria cases wereincreased in 2022 specially Dimma, Godere, Mengeshi, Abobo, and Gambella Town.
- Two malaria deaths reported from Dimma in this week
- There were 34 malnutrition cases(29 outpatients and 5 inpatients) reported.
- There were 1 perinatal death reported from Gambella General Hospital
- There were no Epidemic Typhus and relapsing fever cases reported

1. COVID-19 EPIDEMIOLOGY, SURVEILLANCE and LABORATORY

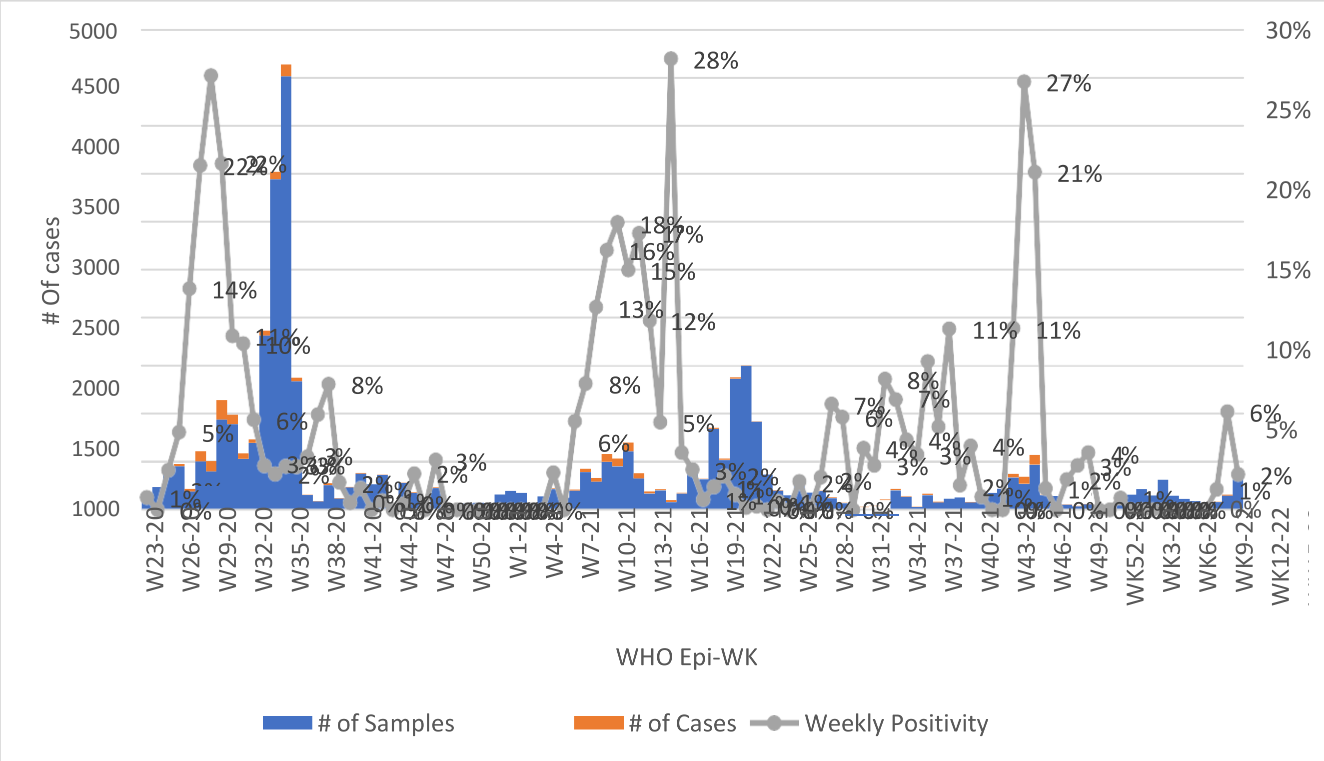
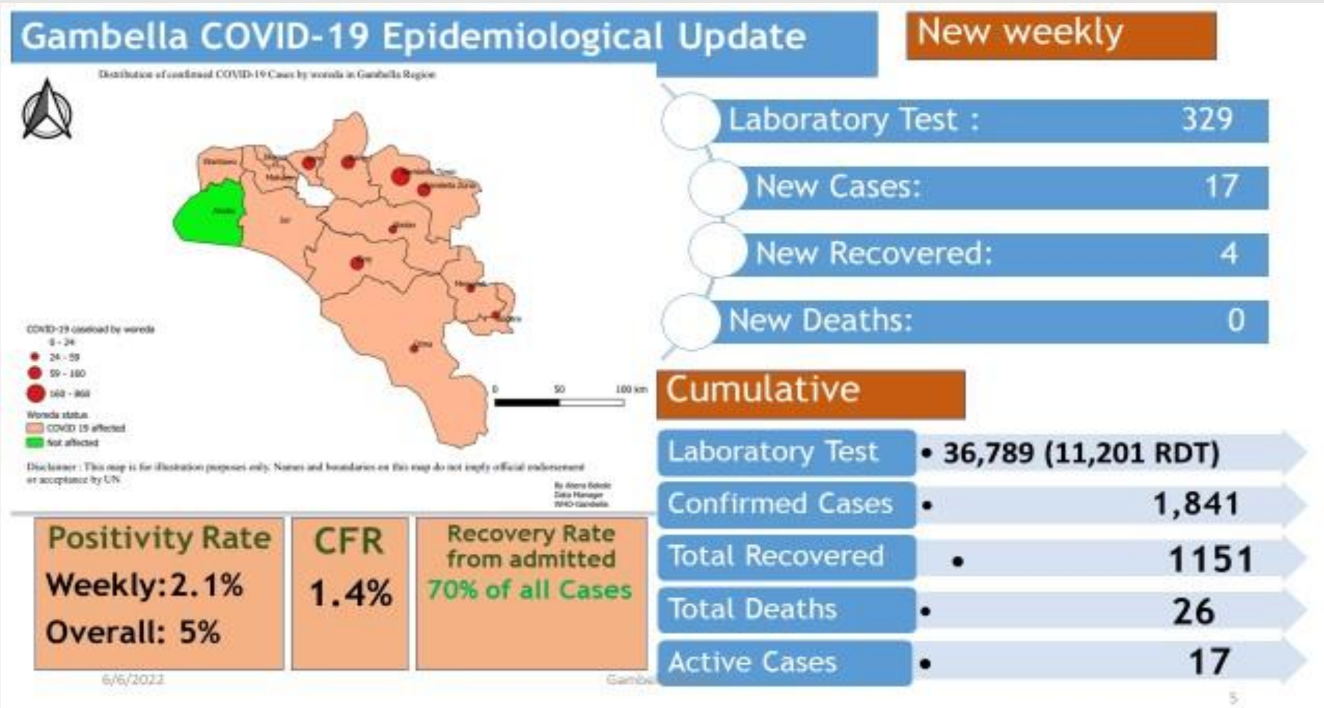


Fig_1: Number of Samples processed for COVID-19 confirmation and Positivity rate from week 22/2021 up to week 11/2022 Gambella region, Ethiopia



2. Weekly Surveillance Data

I. Weekly Disease Surveillance Report Completeness and Timeliness

A. Weekly Surveillance Data Completeness

In this epidemic week, we received weekly report from thirteen (13) woredas and one General Hospital. In the region, 174 health facilities are supposed to submit their weekly report. Out of these 159 health facilities have sent their weekly report. Accordingly, the regional completeness rate was 91.4% which is above the minimum requirement. Thirteen (13) reporting sites were fulfilled the minimum requirement, but Godere woreda was below minimum requirement which is 75% and no report from Akobo woreda.

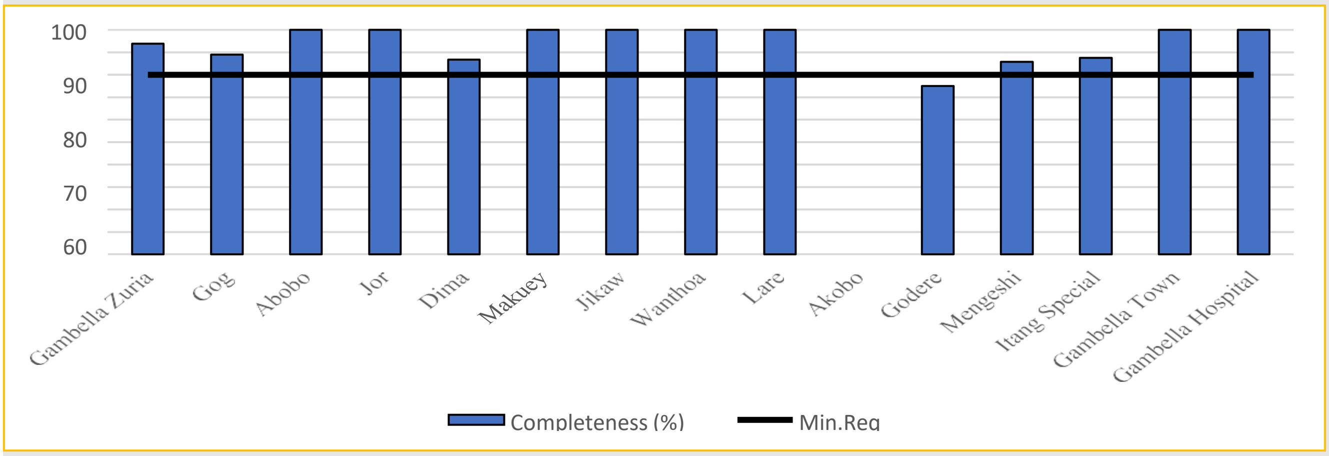


Figure 2: Weekly surveillance data completeness of reporting sites of Gambella Peoples Regional State week21, 2022

B. Weekly Surveillance Data Timeliness

This week, all expected woredas submitted their report on time except no report from Akobo woreda.

III. Priority Diseases and Conditions

1. Immediately Reportable Diseases/conditions

This week there was 1 perinatal death report from Gambella General Hospital

2. Weekly Reportable Diseases

A. Malaria

Malaria is still the leading causes of morbidity in the region. In this week, 3237 total malaria cases and 2 deaths from Dimma woreda were reported, out of this 3113 were from outpatient and the rest 124 cases were from inpatient department. Malaria suspects examined either by microscopy or RDT were 5380, from these 3091 (2972 *P. falciparum* and 119 *P. vivax*) were positive for malaria. Positivity rate was 57.4%.

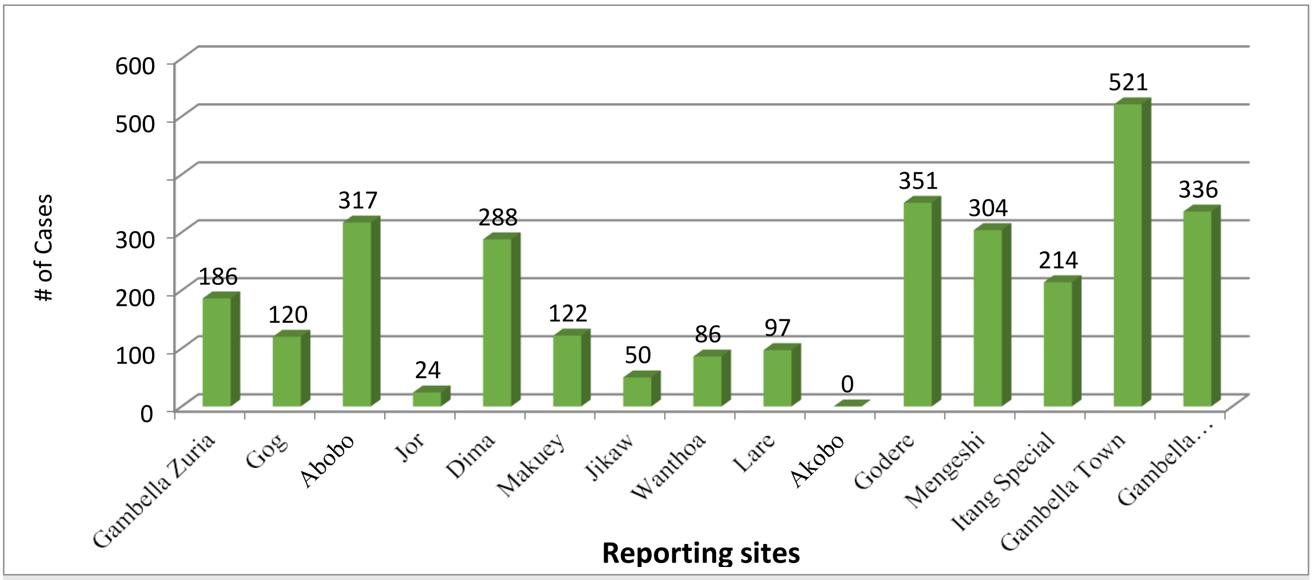


Figure 3: Malaria cases of week 21, 2022 of each reporting sites of Gambella people's national regional state.

The comparisons of week 19, 20, 21 of 2021 and 2022 shows that almost all woredas, the three weeks(19-21) malaria cases were increased in 2022 as shown table 2 below.

Table 2: Malaria disease comparison of week 19, 20, 21 of 2021 and 2022 of reporting sites in Gambella region

Woreda	Malaria cases						Change from 2021 to 2022		
	2021 Malaria cases			2022 Malaria cases					
	Week 19	Week 20	Week 21	Week 19	Week 20	Week 21	Week 19	Week 20	Week 21
Gambella Zuria	60	58	89	110	145	186	50	87	97
Gog	65	34	39	113	94	120	48	60	81
Abobo	55	47	52	208	252	317	153	205	265
Jor	0	21	18	27	21	24	27	0	6
Dima	81	119	145	283	306	288	202	187	143
Makuey	60	36	55	123	91	122	63	55	67
Jikaw	13	7	24	70	56	50	57	49	26
Wanthoa	34	45	63	161	150	86	127	105	23
Lare	71	67	79	51	70	97	-20	3	18
Akobo	0	0	0	0	0	0	0	0	0
Godere	65	60	62	264	283	351	199	223	289
Mengeshi	106	122	115	271	384	304	165	262	189
Itang Special	103	102	185	182	204	214	79	102	29
Gambella Town	135	132	271	630	945	521	495	813	250
Gambella Hospital	113	102	110	175	236	336	62	134	226

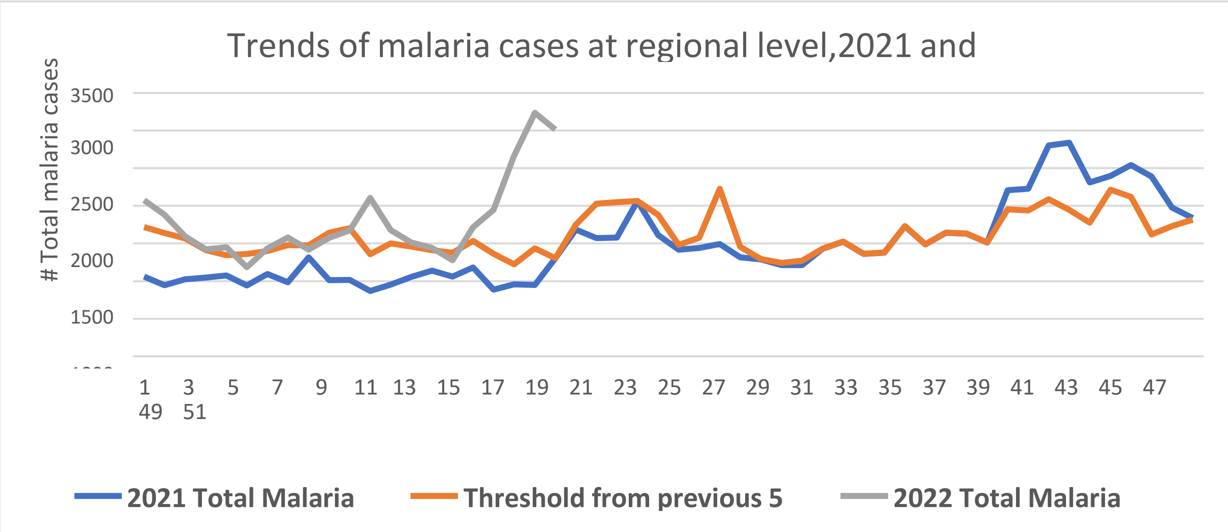


Figure 4: **Malaria Cases trend of year 2021 and 2022 in comparison with the threshold in Gambella people's nationalregional state**

B. Dysentery

This week, 48 dysentery outpatient cases and no inpatient cases were reported. Dysentery has increased by 18.8% as compared with week 20(39 cases) of the same year.

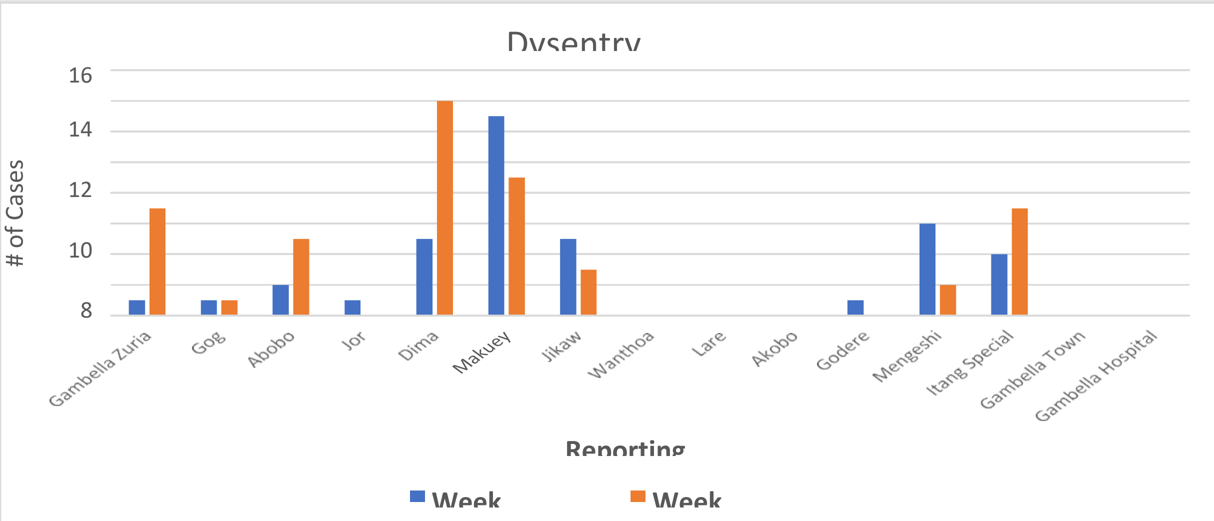


Figure 5: Dysentery Cases of week 20 and21, 2022 of each reporting sites of Gambella regional state.

C. Typhoid Fever

This week, 87 typhoid fever cases were reported and all were outpatient cases. The number of cases increasedby 47.1% as compared with week 20 (46 cases) of the same year.

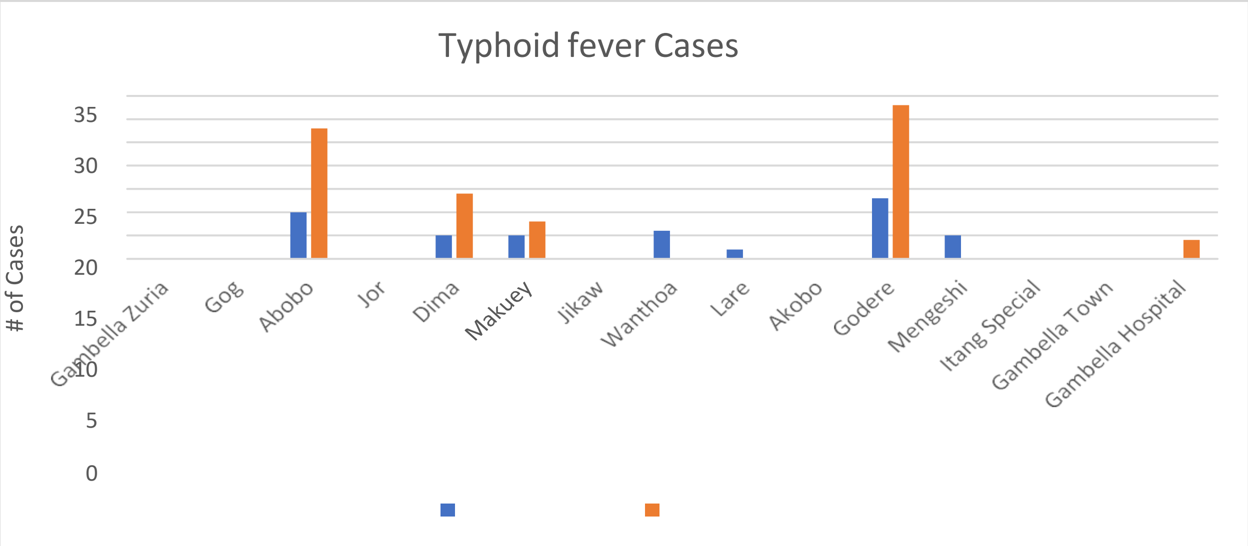


Figure 6: Typhoid fever cases of week 20 and 21 of 2022 of each reporting sites of Gambella people’s nationalregional state

D. Malnutrition

This week, 34 Sever acute malnutrition case cases (29 outpatient and 5 in patient) were reported. SAM case of week 21 was increased by 17.6% as compared with week 20(28 cases) of the same year. No death due to SAMwas reported.

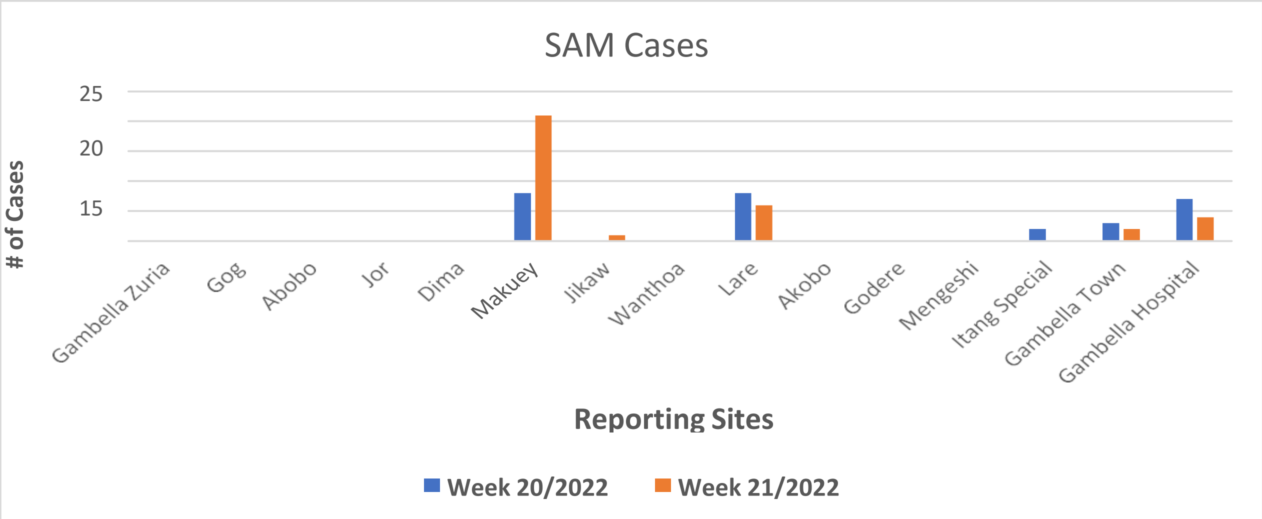


Figure 7: Sever Acute Malnutrition cases of week 20 and 21 of 2022 of each reporting sites of Gambella

E. Epidemic typhus

There were 2 epidemic typhus case reported from Godere woreda this epi-week.

F.Relapsing Fever

There was no relapsing fever case reported this epi-week.

IV. Outbreak Updates

Trends of malaria cases were above threshold at regional level this week and the last three weeks as shown fig4 above. Malaria epidemic monitoring chart shows there was ongoing malaria epidemics in the region due to malaria outbreak happening in the woredas like Dimma, Godere, Mengeshi, Abobo, Gambella Town and in other woredas, malaria cases approaches to the threshold.

V. Responses

- Alert letter on malaria outbreak investigation and response was written for all woredas.
- PHEM Basic training including malaria outbreak investigation and response was provided for woredaPHEM focals, Health facilities surveillance focals and laboratory heads.

3. Key Challenges or Gaps

- Delay in malaria outbreak investigation and response at woreda and health facility level
- Shortage of ant-malaria drugs in (Dimma woreda)
- Lack /shortage of budget for emergency response at all level
- **Not fully functional COVID-19 multisector task forces**
- Lower coverage given by the media to the pandemic and repeatedly covering public events whichviolates Directive 30 rules
- **Lower adherence by institutions to implement known prevention measures**
  - No continuation of RDT tests in some health facilities after COVID-19 revitalization response campaign
- Most woredas were silent for AFP, Measles, NNT and other immediately reportable disease
- Poor data analysis and utilization at lower level

4. Specific Actions Required

- **Continues support and supervision for woredas and Health Facilities for early outbreakinvestigation and response**
- Strengthen coordination among RHB directorates, EPHI, partners and woreda health office torespond malaria outbreak.
- **Dimma woreda malaria drug supply should be shifted from Jimma branch EPSA to Gambellabranch EPSA and early filling and requesting RRF at health facilities level.**
- Budget for emergency response should be allocated at all level

- **Activating COVID-19 multisector task forces**
- Increase coverage given by the media to the pandemic and repeatedly covering public eventswhich violates Directive 30 rules
- **Institutions should adhere to implement known COVID-19 prevention measures**
- RDT tests for COVID-19 should be strengthen at all health facilities
- Active surveillance for AFP, Measles, NNT and other immediately reportable disease at community andhealth facilities should be conducted
- Data analysis and utilization at lower level should be improved by capacity building, continuessupport and supervision by RHB, and WrHO

Acknowledgment

- I would like to thank all woreda PHEM focal persons and regional PHEM staff and Suerveillance focal (Mr. Zeynu) for collecting and sharingweekly surveillance data timely when I prepare this weekly bulletin.

9.2 Climate Sensitive Disease Surveillance System, Sentinel sites supportive supervision Report, Amhara region, Bahir Dar, Addis-Alem Primary Hospital

Introduction

The WHO estimates that one-sixth of the illness and disability suffered worldwide is owing to vector-borne diseases, with more than half of the world's population currently at risk. Every year, more than one billion people are infected, and more than one million people die from vector-borne diseases, including malaria, dengue, schistosomiasis, leishmaniasis, Chagas disease and African trypanosomiasis (1). In addition to deaths, many vector-borne diseases, such as lymphatic filariasis and onchocerciasis, also cause significant debilitation and suffering, contributing to a much larger overall burden of disease.

Vector-borne diseases also have wider socioeconomic impacts, increasing health inequities, and acting as a brake on socioeconomic development. The burden of climate-sensitive diseases is greatest for the poorest populations (1).

Human diseases are affected by climate when the pathogen spends a significant period of time outside of the human host, subject to environmental influence. The most climatesensitive diseases are, therefore, those spread by arthropod vectors, in food or water, in aerosol, in fomites, and those with free-living stages (2). Climate affects three major aspects of disease occurrence: where, when and how much. In some cases, mostly macroparasite infections caused by helminths, climate can also affect the severity of clinical disease in infected individuals.

Climate and weather are two of the most important factors in the emergence of infectious disease in humans. Climate refers to the average state over a longer time period and strongly influences weather patterns (3). Climate and weather influences the transport and dissemination of infectious agents that cause food and waterborne diseases through increased precipitation and runoff and the effects of temperature on pathogen survival and replication.

Extreme weather events such as floods, droughts, and storms directly affect human health and often serve as catalysts for outbreaks of infectious diseases (4). The health impacts of climate change and extreme weather events are likely to vary from place to place due to regional differences in the rate of climate change as well as variations in health status, public health response and adaptive capacity and preparedness of different populations.

Changing climate will give opportunities for climate-sensitive infectious diseases (CSIs) to establish or occur sporadically in new areas. Vector-borne diseases are a particular concern in this regard (5). Arthropod vectors, e.g. ticks, mosquitoes and midges, and reservoir animals, e.g. rodents, birds and wild ungulates, for infectious diseases might also extend their distribution northwards as a result of changes in ecosystems and communities associated with climate warming.

To gain more knowledge and increase the scope to adjust to a new situation where climate change drives transmission of infectious diseases, a better understanding of the current situation is needed. The first step is to identify CSIs of relevance for humans and animals living. (5)

Climate is an important influence on vector borne disease transmission, and there is evidence that ongoing climate change is affecting, and will continue to affect the distributions and burdens of these infections. The interactions are complex, however, and to move beyond these broad generalizations to inform health policy requires assessment of individual diseases with respect to specific disease control decisions.

The main purpose of climate sensitive disease surveillance sentinel sites is to reduce the burden climate sensitive disease mortality and morbidity at all levels of the health system. The objective of these supportive supervision to promotes quality service by strengthening relationships within the system, focusing on the identification and resolution of problems, and helping to optimize the allocation of resource promoting acceptable standards, teamwork, and better two-way communication.

Objectives

General objective

To strengthen and capacitate the sentinel site performance to achieve establishment objective on climate sensitive disease surveillance

Specific Objectives

- To assess the current implementation status of the sentinel site
- To assess coordination between sentinel site and other sectors and stakeholders
- To identify the general challenges in the implementation of CSDSS project

- To assess documentation of CSD surveillance reports
- To support technically relating to registration, reporting, analyzing and data management
- To assist CSD focals at the spot through awareness creation as per the gaps identified

Methods

The supportive supervision was conducted between 25 October to 6 November 2021in Amhara Region. At arrival we briefed the objective of the supportive supervision mission with the presence of regional CSD focal and PHEM Directorate director at APHI. At Addis Alem Hospital the discussion was held with the sentinel site surveillance focal/Officer in the presence of Hospital Medical director, then followed by interviews by using checklist for the assessment and overseen the sentinel site implementation status and to identify major challenges. We also observed their documentation, budget utilization and liquidation status based on the questioner developed by EPHI, discussion and awareness creation as well as technical support in Data utilization, recording, reporting and analysing CSD surveillance data by using pivot table and EWARS Dashboard as well as PHEM data was provided as per the limitations identified.

Result/Findings

Sentinel Site information

Addis Alem Primary Hospital was found in Amhara region, Bahir Dar town and have a total of 370,000 catchment population. Geographical coordination of the site is 11°59'59"N latitude and longitude 37°41'66" E.

1. Coordination and Collaboration (13/17)

The hospital established a climate sensitive disease surveillance technical workings Group with the members were Amhara Public Health Institute, Bahir Dar Town WaSH, Bahir Dar Town Metrology, Bahir Dar Town zonal Health Department PHEM but we could not see the document rather they orally talk to us. They conduct a climate sensitive disease surveillance coordination forum/meeting before July. The sectors and health departments who participated in the coordination forum were Zonal WASH, Zonal PHEM, APHI and Zonal Metrology. They have a joint action plan but there was no written document to verify so one of the weaknesses of the coordination forum was absence of the sit on the ground discussion point and not document accordingly. on the other hand, the establishment of the coordination forum was one of the strengths.

2. Health Vulnerability assessment and risk mapping (VRAM) (7/7)

The health facility conducted health vulnerability assessment and mapping (VRAM) Gudo Bahir flood, Cholera, Malaria, Meningitis and measles were the list of climate change induced health problems identified.

3. Emergency preparedness and Response Plan (EPRP) (12/13)

They have emergency preparedness plan for identified health emergencies but is not updated. From the VRAM findings only, malaria have budget from the hospital and Gudo bahir flood they found the promise from the Bahir Dar Town Administration.

4. Climate Sensitive disease Surveillance (45/50)

The sentinel site surveillance focal person has been taken climate sensitive disease training focusing on data integration and analysis four times in the previous. The sentinel site also provides the training on climate sensitive disease for local stakeholders with the sectoral mix of Health center PHEM focal, metrology, Zonal WaSH, Zonal PHEM, Regional PHEM and Hospital Department Head.

The health facility practices integrated climate sensitive disease surveillance and receive metrological data like total Rainfall, Relative Humidity, Maximum temperature, Minimum temperature, Wind speed and SSHR. The health facility also receives WASH data like Catchment ODF coverage, Catchment safe water coverage, catchment Latrine Coverage, Catchment latrine Utilization Rate, Catchment IRS coverage and Catchment ITN coverage.

The sentinel site analyzes and utilize the public health surveillance data for early warning but it was not a regular manner example for malaria they were practice simple analysis of malaria data and they sent the official letter to Bahir Dar town zonal health department for action taken. There was a technical gap to prepare the weekly bulletin from the surveillance data but now there was an improvement related to the data analysis.

The health facility used Metrological and WASH information for health early warning system but practically it needs more attention on the EWARS dashboard. They sent the weekly integrated CSD surveillance data to the next higher level. The reporting was complete but the timeliness difficult to measure because of the health facility was sent their own collected data on Monday to the zonal health department PHEM and the zone again aggregate the CSD data and resend to the hospital on Thursday then sentinel CSD Focal sent the data to the national level.

5. Early warnings and alert messages (3/3)

They used early warnings and alert messages sent from the higher levels for example Malaria alerts from national and regional PHEM for drug supply, ITN distribution and Indoor residual spraying of households with insecticide for better prevention and control activities.

6. Technical Support (3/5)

The site gets technical support and follow up from the town by phone communication but it is better to physically meet at the site.

7. Supportive Supervision (1/3)

They have not got formal supportive supervision from the higher level from both Zonal and Regional. But Amhara Public Health Institute give training to the Sentinel site focal person.

8. Financial Support (8/8)

The activities like training, Communication, Laptop computer, Stationary material, Perdiem, Review meeting were performed with the financial support of the CSDS project so the financial support help to strengthen climate sensitive disease surveillance by awareness creation of the hospital health professionals and experts and malaria disease prevention and control activities. Limitation of the financial support there was shortage of allocated budget to conduct trainings and invite other stakeholders to perform beyond they achieved because the supported budget was not enough to appropriately pay their perdiem and refreshment of the participants.

Challenges they face in utilizing allocated budget for the intended purpose first there was no separate office for the PHEM /CSD focal but now they have one room for PHEM/CSD focals to do their activity and the health facility timely liquidate the financial support by using the appropriate liquidation format. The total score of the sentinel site is **93%.**

9. General Challenges/gaps

The general challenge/gaps were seen in the implementation of the CSDS project were internet connection, coordination issue, workload for CSD focal and budget shortage.

10. Action taken by the team

- Discuss and show how they prepare the weekly bulletin, EWARS dashboard, malaria risk mapping and awareness creation activities
- Demonstrate and discuses on how to enter, filter and analyze CSD/PHEM data using computers by having the actual data in which Bahir Dar Town/Zone has sent previously
- Support technically to have their own database by availing their previous data on their computer and to build up on it in the future

10. Recommendations

We recommend the following points to improve the use of integrated disease surveillance and early warning systems: there should be strong support from zonal and regional PHEM, Budget should be funded to perform above we achieved, there should be information/Communication and support from the regional health bureau, there should be computer training for the sentinel site focal person and there should be sharing of important documents and manuals from all level (national, regional and Zonal).

11. Additional points

They raise the point related to the project was the CSD project should be expanded to other reportable diseases in addition to the three selected CSD diseases namely Malaria, Meningitis and Cholera. At the sentinel site there should be appropriate documentation system for every performed activity.

References

1. WHO. 2008 The global burden of disease: 2004 update. Geneva, Switzerland: World Health Organization
2. Alan J. Parkinson & Jay C. Butler (2005) Potential impacts of climate change on infectious diseases in the Arctic, International Journal of Circumpolar Health
3. National Research Council. Under the weather: climate ecosystems, and infectious disease. National Academy of Sciences. National Academy Press 2001. p 20-58.
4. Noji, E.K. Public health in the aftermath of disasters. BMJ 2005;330:1379-1381.
5. Hoberg E, Brooks DR. Evolution in action: climate change, biodiversity dynamics and emerging infectious disease. Phil Trans R Soc B. 2015. https ://doi.org/10.1098/rstb.2013.0553

9.3 Field Epidemiology Fellows Scope of Work for TARTARE

Retrospective Epidemiological Study

Introduction: Food borne is a serious and under-reported public health problem worldwide, leading to high morbidity and mortality. FBD can result from consumption of food contaminated with pathogens such as bacteria, viruses, parasites, chemicals or bio-toxins. The leading cause of FBD is bacteria (66%), followed by chemicals (26%), viruses (4%) and parasites (4%) (1). Recently, the World Health Organization estimated that 31 foodborne pathogens caused over 600 million illnesses and 420,000 deaths worldwide in 2010 (1). Among the main foodborne pathogens causing diseases, NTS, CAMPY and STEC remains significant (2) and have persisted since the 1990s, commanding the most research and surveillance attention from government agencies and, to a large extent, the most awareness from the food industry (3). Understanding the relative importance of different foods as exposure routes for key hazards is critical to preventing illness.

Disease burden and cost estimates are critical for risk-based decision-making yet the burden of FBD and its impact on development is not well investigated in LMICs such as Ethiopia (4). It is estimated that up to one third of the population of LMICs are affected by microbial FBD each year (4). In Ethiopia, it is estimated, with a large amount of uncertainty, that FBD causes approximately 11M illnesses (more than 9% of the population) and costs over $424M USD annually. Poor food handling and sanitation practices inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipment and lack of education for food-handlers have been identified as contributing factors.

Objective: The overarching goal of the project was to improve foodborne disease (FBD) burden estimates for non-Typhoidal Salmonella (NTS), Shiga toxin-producing E. coli (STEC), and Campylobacter (CAMPY) while strengthening pathogen surveillance in Ethiopia. The project was part of a larger project (TARTARE), which aims to reduce morbidity and mortality from FBD by developing a riskbased framework for making decisions and alloca3ng resources around food safety across the food systems of low- and middle-income countries (LMICs) using Ethiopia as a model.

Methodology: A retrospective study using secondary data from existing clinical laboratory records from three hospitals in Ethiopia was conducted to improve understanding of the epidemiology of foodborne pathogens among patients in Ethiopia. The study used 2018 – 2020 data from the microbiology and parasitology laboratories of three hospitals in Ethiopia:

1) Yekait 12 Hospital in Addis Ababa,

2) University of Gondar Hospital in Gondar, and

3) Hiwot Fana Hospital in Harar.

Data from each hospital was entered into a Microsoft Access database using a project-provided computer on the hospital premises. The computer and database was password protected to support patients' confidentiality. Computers to be used in this study were donated to each hospital by The Ohio State University. Two individuals entered data at each study site. These individuals were trained on data entry and data quality control procedures. Double entry will be used to ensure data quality. To promote data integrity, Microsoft Access fields were restricted (i.e., character or numeric only, plausible ranges, etc.) based on the data entered within each field. Data entry quality control check was performed periodically and correc3ons to data entry practices will be made as needed.

Study Population

The sample population was all patients who summited a specimen to the microbiology and parasitology laboratories at three hospitals in Ethiopia: Yeka3t 12 Hospital, University of Gondar Hospital, and Hiwot Fana Hospital in 2018 – 2020 and whose results were recorded in the logbooks.

Duties and Responsibilities of FETP Fellows

1. Training

   FETP Fellows attended a training on the study protocol, data collection tools (software), data entry and data quality.

   FETP Fellows pilot tested data collection forms before actual data entry as part of the training.

2. Data Entry

- FETP Fellows entered data recorded in the microbiology and parasitology laboratory logbooks at each hospital from 2018-2020 into a computer through Microsoft Access database. Databases was owned by the respective hospital.

  Data entry quality control checks was performed periodically and corrections to data entry practices was made by FETP Fellows as needed to ensure data quality.
- FETP Fellows entered patient name and ID into the electronic database, given that the datasets was kept for use by the hospital, but patient name will not be shared with researchers outside of the hospitals.

- Data to be extracted from the electronic database as part of this project was not contain the Patient Name field.

Data Analysis

• FETP Fellows worked with research team to plan and conduct the statistical analyses.

Data Storage Access and Sharing

• FETP Fellows stored data on secure computers with MS access.

• As the retrospective analysis of clinical laboratory data, results will not be shared directly with participants.

Communication with study team

• FETP Fellows regularly updated their immediate supervisors and PI regarding their progress.

• Study findings will not be communicated to individuals outside of the study team, unless prior approval is obtained from the PI

Findings

From Yekatit 12 Hospital microbiology and parasitology laboratory logbooks, 5,005 patients' data were entered into Microsoft Access data base. Those data were three years data taken from 2018-2020 laboratory logbooks. Out those, 2,175 (43.5) of them were males, 2,730 (54.5%) females and the rest 100 (2%) incomplete data. Of 5005 data, 4,301 (85.93%) were from microbiology logbook and 704 (14%) parasitology logbook.

Table 46 Yekatit 12 Hospital microbiology and parasitology laboratory logbooks data by sex and department 2018-2020

	Sex	Number	%
Sex	Male	2175	43.5
	Female	2730	54.5
Department	Incomplete	100	2
	Microbiology	4301	86
	Parasitology	704	14

9.4 Short Term Training

Training given on cholera outbreak response in Moyale Town from April 22-26, 2023

Training given on cholera outbreak response in Borena Zone, Yabelo Town from may 2- 5, 2023

Annex 1 Questionnaire for pertussis outbreak investigation in Beyeda Woreda, NGZ, Amhara Region, 2022

A. socio-demographic status

1. Date_____ name of investigator ---- ----------------

2. ID NO_________

3. Respondent status A. case B. control

4. Respondent: Patient Family member (Mother, Father: siblings)

5. Age _________ 6.sex________7. Residence:_________,Kebele___________, Got__________

8. Occupation: ___________income in birr--

9. Religion A. Orthodox B. Muslim C. Protestant D. Others-----

10. Level of education A.NA B. KG C. primary D. secondary and above F. Unable to read and write

11. Educational level of the mother/care giver A. Primary B. Tertiary C. Not able to read and write D. secondary E. don't know

12. Total number of family members who live in the house -----------

13. Is there any person affected by the diseases in the family 1. Yes 2. No

B. Clinical manifestations

14. Do you have any of the following clinical features? A. Paroxysmal cough? onset------B. Whoop ? Onset------C. Apnea? Onset-------- d. Cyanosis---------E. Post-tussive vomiting? Others------ Symptoms_____

15. Date of on set: ______________date/month/year

16. Date seen at health facility------/-----/------

C. complications

17. Were any of the following present? Oedema of face 1. Yes 2. No Sub Conjunctival haemorrhage

1. Yes 2. No Hernia 1. Yes 2. No Pneumonia 1. Yes 2. No Seizure 1. Yes 2. No Weight loss 1. Yes 2. No specify other you have----------------------

18. Was participant hospitalized? 1. Yes 2. No If yes, duration (in days) of hospitalization___

D. Possible source of exposure

19. Has the participant been exposed to a person(s) with a confirmed case of pertussis? 1. Yes 2. No 20. Has the participant been exposed to a person(s) with a cough lasting at least two (2) weeks with at least one of the following? Inspiratory "whooping", post-tussive vomiting (vomiting immediately after coughing and without other apparent causes, paroxysms (fits of coughing) 1. Yes 2. No

21. Has the participant been exposed to a person with a possible case of pertusis (Case as ascertained by field worker based on mother/s, or other lay person/s, declaration)? 1. Yes 2. No If above is yes:

22. Date of suspected contact: ____ / ____ / ____ Where did the patient acquired pertussis?-------

23. What is the age of the contact case? ____ (yrs) ____ (mths) ____ (wks

24. What was the date of onset in the contact case? ____ / ____ / ____

25. Relationship of contact case:——————— ———

26. Had the contact case been adequately immunized (3 or more doses of pertussis vaccine)? 1. Yes 2. No 3. Unknown

E. About Laboratory

27. Is sample taken? Yes No 28. Date of collection of sample: ________________

29. Date of specimen received by referral lab___________________

30. Did result reported? Yes No 31. If yes, is it positive? Negative Intermediate ,

F. Treatment received

32. Was Erythromycin prescribed? 1. Yes 2. No

33. Prescribed for how many days? _________________

34. Was any other antibiotic prescribed? 1. Yes 2. No 35. If yes, specify? ___________

36. Prescribed for how many days? _________________

G. Immunization History

37. Did he/she/you vaccinated against pertussis? Yes No if yes how many times-------------

38. If yes; could you tell me the date of vaccination (see immunization card ___________________

39. Number of dose received:

40. If your answer is no for question 37 what is the main reason that you/your child not vaccinated The health facility is far, I do not know the time of vaccination, The vaccine does not prevent pertussis The vaccine will hurt me /my child other specify ---------------

41. Where was he/she/you ever been sick with such diseases? Yes No 42. If yes when? -----------43. Do you know about mode transmission, prevention and control methods for pertussis? 1. YES 2. NO H. House condition

44. Number of rooms-----------

45. Does the house have windows? 1. YES 2. NO If Yes, specify direction of windows ———___

Annex 2 Outbreak Investigation Tool for Malaria outbreak investigation Nuer Zone, Lare Woreda, Gambella Region, 2022

<table>
<tr><td colspan="3">Demographic Information</td></tr>
<tr><td>1. ID</td><td colspan="2">_______________</td></tr>
<tr><td>2. Date of data collection</td><td colspan="2">D/M/Y_______________</td></tr>
<tr><td>3. Address</td><td colspan="2">Woreda, _______, Kebele________, Got_____</td></tr>
<tr><td>4. Respondent</td><td colspan="2">1-sick person 2- Parent 3- Relative</td></tr>
<tr><td>5. Respondent status</td><td colspan="2">1-Case, 2-Control</td></tr>
<tr><td>6. Age in year</td><td colspan="2">----------------------</td></tr>
<tr><td>7. Sex</td><td colspan="2">1. Male 2. Female</td></tr>
<tr><td>8. Religion</td><td colspan="2">1. Muslim 2. Orthodox 3.Protestant 4. Catholic
5. If other (specify)------</td></tr>
<tr><td>9. Ethnicity</td><td colspan="2">1. Nuer 2. Oromo 3. Amhara 4.Kembata Other specify--------</td></tr>
<tr><td>10. Occupation</td><td colspan="2">1. Farmer 2.Merchant 3.student 4. Pastoralist 5. House wife
6. Government employee 7. Unemployed 8. Other (specify) --------</td></tr>
<tr><td>11. Marital status</td><td colspan="2">1. Single 2. Married 3.Widowed 4. Divorced 5. Not applicable</td></tr>
<tr><td>12. Family size</td><td colspan="2">1. Two - five 2. Greater than five</td></tr>
<tr><td>13. Highest level of Education</td><td colspan="2">1. Unable to read and write 2. KG 3. Primary (1-8) 4. Secondary (9-12) 5. Tertiary (Dip, BSC/BA ,MSC/MA ,PHD)</td></tr>
<tr><td rowspan="2">14. Parents’ education</td><td>Mother</td><td>1- Illiterate 2- Primary 3- Secondary 4- Tertiary</td></tr>
<tr><td>Father</td><td>1- Illiterate 2- Primary 3- Secondary 4- Tertiary</td></tr>
<tr><td colspan="3">Clinical Information</td></tr>
<tr><td colspan="3">What sign and symptoms of the disease do you have? (only for cases)</td></tr>
<tr><td colspan="3">15. Fever 1-yes 2-No 16. Headache 1-Yes 2-No 17. Chills 1-Yes 2-No 18. Sweating 1-Yes 2-No</td></tr>
<tr><td colspan="3">19. Shivering 1-Yes 2– No 20. Nausea and /vomiting 1-Yes 2 –No 21. Body aches 1 -Yes 2 - No</td></tr>
<tr><td colspan="3">22. General Malaise 1-Yes 2 – No 23. Loss of appetite 1-Yes 2 – No</td></tr>
<tr><td colspan="3">24. Date of onset of symptoms (date/month/year)______________________</td></tr>
<tr><td colspan="3">Did you have one or more of the following complications?</td></tr>
<tr><td colspan="3">25. Convulsion/coma 1-Yes 2-No 26. Impairment of consciousness 1-Yes 2-No

27. Hypoglycemia 1-Yes 2-No 28. Seizures 1-Yes 2-No 29. Breathing complication 1-Yes 2-No</td></tr>
<tr><td>30. Did you visit Health facility</td><td colspan="2">1- Yes 2- No, when--------------------------------</td></tr>
<tr><td>31. was your blood sample taken and tested</td><td colspan="2">1- Yes 2- No</td></tr>
<tr><td>32. If Q”28” yes, What was the</td><td colspan="2">1- Positive 2- Negative</td></tr>
</table>

result	
33. Was treatment given	1- Yes 2- No
34. If Q”30” yes, What type of drug	
35. Paracetamol (anti pain)	1-Yes 2-No
36. Chloroquine	1-Yes 2-No
37. Quartem	1-Yes 2-No
38. Fansidar	1-Yes 2-No
39. Other	--
40. How and where did you receive the medication	1- Treated and go home 2- Admitted
41. Did you completely recovere	1- Yes 2 – No

Knowledge Assessment

42. What is malaria	---------------------------------------
43. Do you know how malaria is transmitted	1- Yes 2 – No
If Q”40”yes, How	
44. Through the air	1 Yes 2 No
45. Through insect bite	1 Yes 2 No
46. Close contact with an ill person	1 Yes 2 No
47. Other	specify ______
48. Do you think malaria can be prevented?	1 Yes 2 No

49. If Q”45” yes, what are the prevention activities /mechanisms (multiple response possible)

A. Removing pooled water /plants B. Using ITN - Using IRS C. Using insecticide repellent Other specify ----------------------

Risk factors

50. Have you ever been sick with malaria?	1 Yes 2 No
51. IfQ”47” yes, when (M/Y)	_________________________
52. Have you travelled outside of your village/Malarious area within the past 3-4Weks before the onset of illness?	1 Yes 2 No
53. If yes, Where and when did you travel to?	District_________________ Kebele_______(DD/MM/YY)----

54. Is there any other person with similar symptoms (fever ,headache) in the place /district you travelled at the time?	1 Yes 2 No
55. How long does it take you to walk to the health center from your house?	1. < an hour 2. > an hour
56. Do you work /outdoor/ in the evening or night?	1 Yes 2 No if yes, what activities
57. Sheeperd	1 yes 2 No
58. Irrigation	1 yes 2 No
59. Farming	1 yes 2 No
60. Other public /private /service	(specify)----------------------------
61. Where have you been sleeping during night? (sleeping preference)	1. Inside house 2. Outside home
62. Was your home sprayed for (IRS)	A Yes B No
63. If yes, Which type	1 Bendocard 2 Proxure 3 other_(specify)__________
64. Do you have ITN	1. Yes 2. No
64.Do you use ITN while sleeping	1. Yes 2. No
65. When did you use bed net?	1. Regularly 2. When you remember 3. When malaria seasons reach
66. How many people live in your house?	---------------------------------
67. Do all family members use ITN while sleeping	1- Yes 2- No
68. Frequency of bed net washing	1. Every Month 2. Every three month 3. Every six month 4. Not washing
Environmental investigation	
Breeding site availability	
69. River / Intermittent river	1- Yes 2- No
70. Pooled water	1- Yes 2- No
71. Irrigation	1- Yes 2- No
72. Presence of water containing Plants around home	1- Yes 2- No
73. Type of house/window	Caved door (window) 1 Yes 2- No Local screen 1 Yes 2- No

Annex 3 Questionnaires for cholera outbreak investigation in Moyale Woreda, Borena Zone, Oromia Region, 2023

Part I. Interview Information

1.1 Interviewer name…………….Interview Date --------------GPS coordinate -------------------

1.2 Zone -----------------Woreda--------------- Kebele----------------

1.3 Participant type ☐confirmed case ☐suspected case ☐control Control description:

Part II. Demographic Information

2.1 Gender ☐ Male ☐Female

2.2 Age (years) ----------

2.3 Monthly income -----------------

2.4 Marital status ☐single ☐married ☐widowed ☐Divorced ☐separated ☐ others

2.5 Education ☐none ☐pre-primary ☐ primary ☐secondary ☐college level ☐some degree level

2.6 Occupation ☐Government employee ☐Private company employee ☐Housewife ☐Daily laborer ☐other

2.7 Any chronic diseases? ☐Yes ☐No If yes, which of these? ☐AIDS/HIV ☐Diabetes ☐Hypertension ☐Cancer ☐CHD ☐Other:

2.8 Number of persons in house ------Number of persons in the compound --------------

3 Part III. Patient Knowledge about the Disease

3.1 Have you ever heard about cholera? ☐Yes ☐No If yes, from where did you hear?

☐Ra ☐TV ☐HEW ☐Brochures ☐Other:

3.2 If yes, what are its routes of transmission? ☐Eating contaminated food ☐drinking contaminated water ☐contacting with CHOLERA patient ☐Other:

4 **Part IV. Clinical Description**

4.1 Date of onset of diarrhea -----------------Date seen at health facility-------------------

#Diarrheal episodes in 24hrs-------------------------

4.2 Symptoms seen? ☐Watery diarrhea ☐Vomiting ☐Abdominal cramps ☐Dehydration ☐Other:

4.3 Illness outcome ☐ Alive ☐Died

5 **Part V: Exposure History**

5.1 Water at home, indicate which water is used for which use (tick all applicable)

	Drinking	Preparing food	Bathing	shared	unshared	remark
Type of water						
Municipal tap water indoors						
Municipal tap water outdoors						
Private well/borehole water						
Untreated surface water (river, pond,..)						
Other(tanker, bottled)						

5.2 Water at work, indicate which water is used for which use (tick all applicable)

	Drinking	Preparing food	Bathing	shared	unshared	remark
Type of water						
Municipal tap water indoors						
Municipal tap water outdoors						
Private well/borehole water						
Untreated surface water (river, pond,..)						
Other(tanker, bottled)						

5.3 Water storage container? (tick all applicable)

Plastic containers without lids □ Plastic containers with lids □Metal containers without lids □ Metal containers with lids Other-----

5.4 How do you use water from the container? □scooping □tilting □Other:

5.5 How often do you treat water before use? □Never □sometimes □always

5.6 If yes, how? □Boiling □Filtration □Aquatab □Woha Agar □Bishangari □PUR □ Other

5.7 Did you drink holy water in the last 5 days? □Yes □No □DK If yes, where? ---------------

5.8 Food and Beverages:

5.8. 1 Where did you shop for fresh fruit, vegetables and milk in the last 5 days?

Source L	Location	Description
Street shop(Gulit)		
Private farm/garden		
Vegetable stall (Atkilt tera)		
Others		

5.8. 2 Did you eat or drink in the last 5 days prior to your illness onset? Remark

		Remark
Raw vegetables (salad, etc)	□Yes □No □DK	
Street shop(Gulit)	□Yes □No □DK	
Private farm/garden	□Yes □No □DK	
Vegetable stall (Atkilt tera)	□Yes □No □DK	
Others	□Yes □No □DK	

5.8. 3 In the 5 days before your illness onset, did you eat food/beverages from these areas?

Type of establishment	Name and location	Date	Items eaten
Fast food establishments			
Work canteen (Staff lounge)			
Street vendor			
Others			

How do you store food after preparation? □Refrigerator □Room temperature □use immediately □ Other

How often do you reheat food? □Never □sometimes □always

What do you think for the cause of your illness? ---

5.9 Hygiene and Sanitation

5.9.1 Do you have latrine? □Yes □No If no, where do you defecate?

5.9. 2 Type of toilet □ shared □unshared □ Others

5.9.3 When do you wash your hands? □Before eating □after latrine use □before food preparation □before food service □after handling wastes □Other

5.9.4 With what do you wash your hands? □water only □water and soap □water and sand □water and ash □Other

5.9.5 How do you dispose solid waste materials □ Genda □Open pit □Open dumping □waste collectors □Other

5.10 Travel history 5.10.1 Did you travel anywhere in the last 5 days? □Yes □No □DK

5.10.1 Was there diarrhoea in the area during your visit? □Yes □No □DK 5.

10.2 If yes, where? Departure date Return date

5.10.3 Did you have any visitors in the last 5 days before your illness? □Yes □No □DK

5.10.4 Contacted with diarrheic man in the last 5 days before your illness? □Yes □No □DK If yes, relation Contact date

5.10.5 Did you attend any gatherings in the last 5 days before your illness? □Yes □No □DK Event Location Date Description 6 General assessment/observations:

Annex 4 Check list to evaluate the **surveillance system of Bahirdar Zuriya Woreda**

REGIONAL /ZONAL LEVEL QUESTIONNAIRE

Identifiers:

Assessment team — Respondent

Date

Surveillance System — Interviewer

General

I. ***Availability of a National Surveillance Manual***

1. Is there a national manual for surveillance?
   Yes / No / Not applicable / Unknown
2. ***If yes***, describe (last update, diseases included, case definitions, surveillance and control, integrated or different for each disease):
   ____
   ____
   ____
   ____

II. ***Case Detection and Registration***

3. Do you have standard case definitions for the Country's priority diseases like AWD, AFP (polio), malaria, and measles?
   Yes / No / Unknown / Not applicable
4. **Obs [1 to n priority diseases] Observed** the standard case definition for (each priority disease)
   Yes No Unknown Not applicable

III. ***Data reporting::***

Presence of recommended reporting forms in the country at all times over the past 6 months

5. Is the central level responsible for providing surveillance forms to the health facilities?
   Yes No Unknown Not applicable
6. ***If yes***, have you lacked appropriate surveillance forms at any time during the last 6 months?
   Yes No Unknown Not applicable
7. What are the reporting entities for the surveillance system?
   a. Public health facilities
   b. NGO health facilities
   c. Military health facilities
   d. Private health facilities
   e. Others__________________________

8. Percent of district reports(either directly or through an intermediate level) received each reporting period at the central level during the past 3 months:
   Number of reports in the last 3 months compared to expected number

Weekly: /12 times the number of districts

Immediately: /------ times the number of districts

9. **On time (use national deadlines)**
   Number of weekly reports received on time: /12 times the number of districts

10. Was there any report of the immediately reportable diseases in the past 1 month? Yes/ No
11. If yes, with in what time is the report received after detection of the case/ diseases?
    a. Less than 1 hour
    b. 2-24 hour
    c. 1- 2 days
    d. 3- 7 days
    e. After 1 week
12. **Percent of districts that have means for reporting to next level by e-mail, telephone, fax or radio**
    ____
13. **Capacity to report to next level by e-mail, telephone, fax or radio:**
    How do you report?
    a. Mail
    b. Fax
    c. Telephone
    d. Radio
    e. Electronic
    f. Other

IV. Data analysis

Does the regional level:

14. **Describe data by person** (case based, outbreaks, sentinel)?
    (Obs) Observed description of data by age and sex:
    Yes No Unknown Not applicable
15. **Describe data by place?**
    (Obs) Observed description of data by district (tables, maps)
    Yes No Unknown Not applicable

16. **Describe data by time?**
    (Obs) Observed description of data by time:
    Yes No Unknown Not applicable
17. **Perform trend analysis?**
    Obs Observed line graph of cases by time
    Yes No Unknown Not applicable
18. List disease(s) for which line graph is observed
    ____
    ____

19. **Have an action threshold defined for each priority disease?**
 Do you have an action threshold defined for AWD, Measles, AFP (polio), malaria?
 Yes No Unknown Not applicable
20. Who is responsible for the analysis of the collected data? ___________________________

21. How often do you analyze the collected data?
    a. Daily
    b. Weekly
    c. Every 2 weeks
    d. Monthly
    e. Quarterly
    f. As needed……..
22. **Have appropriate denominators?**
 Obs Observed presence of demographic data (E.g. population by district and hard to reach groups)
 Yes No Unknown Not Applicable

V. Outbreak Investigation

Percent of suspected outbreaks that were investigated in the past 6 months

23. Number of outbreaks suspected in the past year:___________________________
24. List the diseases: ____
25. Of those, number investigated: ___________________
 (Observe reports and take copies if possible)

Of the investigated outbreaks in the past 1 year, percent in which risk factors were looked for:

26. Number of outbreaks in which risk factors were looked for:______________

Of the investigated outbreaks in the past 1 year, percent in which findings were used for action

27. Number of outbreaks in which findings were used for action:_______________
 [Observe report]
28. **Of districts that investigated an outbreak, percent that looked for risk factors**
 Number of districts that looked for risk factors [observe in reports]
 ____
29. **Of districts that investigated an outbreak, percent that used the data for action (action include containing outbreak, improving surveillance, community actions)**
 Number of districts that used the data for action [observe in final report]
 ____

VI. Epidemic preparedness(relevant for epidemic prone diseases)

30. **Existence of a Regional/Zonal plan for epidemic preparedness and response**
 Obs Observed a written plan of epidemic preparedness and response
 Yes No Unknown Not applicable

31. **Existence of emergency stocks of drugs, vaccines, and supplies at all times in past 1 year:**
    Has the region had emergency stocks of drugs, vaccines, and supplies at all times in past 1 year?
    Yes No Unknown Not applicable

32. **Experience of a shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)**
    Has the country experienced shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)?
    Yes No Unknown Not applicable

33. **Existence of a standard case management protocol for AWD, Malaria, AFP (polio), measles**
    Obs Observed the existence of a written case management protocol for at least 1 priority disease
34. ***If yes***, list:____

35. **Presence of a budget line for epidemic response**
    Is there a budget line for epidemic response?
    Yes No Unknown Not applicable
36. **I. Existence of a regional epidemic management committee**
    Observed minutes (or report) of meetings of epidemic management committee
    Yes No Unknown Not applicable

37. **Existence of a regional rapid response team for epidemics**
    Does the country have a rapid response team for epidemic?
    Yes No Unknown Not applicable

VII. <u>Response to epidemics</u>

38. **Ability of the regional level to respond within 48 hours of notification of most recently reported outbreak:**
    Obs Observed that the central level responded within 48 hours of notification of most recently reported outbreak (from written reports with trend and intervention)

    Yes No Unknown Not applicable

39. **Ability of the regional epidemic management committee to evaluate its preparedness and response activities:**
    (Obs) Has epidemic management committee evaluated its preparedness and response activities during the past year (Observe written report to confirm)?

    Yes No Unknown Not applicable

VIII. <u>Feedback</u>

Existence of a report or bulletin that is regularly produced to disseminate surveillance data:

40. How many feedback bulletin or reports has the regional level produced in the last year? ___________________
41. **Obs:** Observed the presence of a report or bulletin that is regularly produced to disseminate surveillance data
    Yes No Unknown Not applicable

IX. Supervision

Percent of supervisors that made the required number of supervisory visits in the past 6 months

42. How many supervisory visits have you made in the last 6 months? ______________
    Obtained required number of visits from regional level _______________
43. The most usual reasons for not making all required supervisory visits. (Text) ____
    ____
    ____
    ____

X. Training

Percent of health personnel trained in disease surveillance

44. What percent of your subordinate personnel have been trained in surveillance? __________
45. Have you been trained in disease surveillance?
    Yes No Unknown Not applicable
46. ***If yes,*** specify when, where, how long, by whom?
    ____
    ____
    ____

Percent of health personnel that have received post-basic training in epidemic management

47. Have you received any post-basic training in epidemic management?
    Yes No Unknown Not applicable
48. ***If yes,*** specify when, where, how long, by whom?
    ____
    ____
    _____
49. **Obtain and analyze the content of the surveillance and epidemic management training**
    Strengths____
    Weaknesses ____
    Opportunities ____
    Threats ____

XI. Resources

Percent of sites that have:

50. **Data management**
    - Computer
    - Printer
    - Photocopier
    - Data manager
    - Statistical package

51. **Communications**
    - Telephone service
    - Fax
    - Radio call
    - Satellite phone
    - Computers that have modems
52. **Budget line** ____
53. **Logistics** ____

XII. Surveillance

Have a functional computerized surveillance network

54. Do you have a computerized surveillance network at this level?

    Yes No Unknown Not applicable

Budget for surveillance

55. Is there a budget line for surveillance in the Regional Health Bureau budget?

    Yes No Unknown Not applicable
56. ***If yes***, what is the proportion: %

Opportunities for strengthening surveillance

57. How could surveillance be improved?

    ____

    ____

XIII. Surveillance Co-ordination

Existence of focal unit for surveillance at RHB level

58. **Obs** Is there a focal unit for surveillance at the MOH central level? [Observe organogramme of MoH to confirm]

    Yes No Unknown Not applicable

Opportunities for integration

59. What opportunities are there for integration of surveillance activities and functions (core activities, training, supervision, guidelines, resources etc.)?

    ____

    ____

    ____

    ___

Questionnaire for Attributes and level of Usefulness:

1. Total population under surveillance______________
2. What is the incidence / Prevalence of -------in your area/region
    - AWD _________cases __________Deaths _________
    - Malaria _________cases __________Deaths _________
    - AFP(polio) _________cases __________Deaths _________
    - Measles _________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? Yes/ No
2. to estimate the magnitude of morbidity and mortality related to these disease, including identification of factors associated with these diseases? Yes/ No
3. permit assessment of the effect of prevention and control programs? Yes/ No
   Observe (confirmation):
    - interventions and diseases trends analyzed ---Available //Not available

II. Describe Each System Attributes:

i. Simplicity:

1. Is the case definition of AWD, malaria, AFP (polio), and measles easy for case detection by all level health professionals? Yes/ 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? Yes/No
4. How long it takes to fill the format? a, <5 minute b-10-15minuts c- >15 minutes
5. How long does it take to have laboratory confirmation of
    A. AWD
    B. Measles
    C. AFP (Polio)
    D. Malaria

ii. Flexibility:

1. Can the current reporting formats be used for other newly occurring health event (disease) without much difficulty? Yes/ No
2. Do you think that any change in the existing procedure of case detection, reporting, and formats will be difficult to implement? Yes /No
   Comment:____
   ____
   ____

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? Yes/ No
2. Are the reporting site / data collectors trained/ supervised regularly? Yes/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? Yes/No
2. If yes, how many are active participants (of the expected to)?______________
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 analysis data back to reporting facilities
    C. Reporting formats are difficult to understand
    D. Report formats are time consuming
    E. Other:

    ____

    ____

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? Yes / No
3. Who do you think is well represented by the surveillance data? the urban/ the rural

vi. **Timeliness:**

1. ---------------
2. ------------------

vii. **Stability:**

1. Was the new BPR restructuring affect the procedures and activities of the surveillance of these diseases? Yes/ No
2. Was there lack of resources that interrupt the surveillance system? Yes/No

Annex 5 Health Profile Assessment Questionnaire for Wera Dijo Woreda, Alaba Zone, SNNPR, 2020

1. Historical aspects of the woreda

Woreda Name____

How & why the name given_________________________________

How and when the woreda was formed_________________________

Any other historical aspect about the worda______________________ ___________________________________

2. Geography and Climate

Woreda map____

Location (distance) ___________________Direction _________________ Altitude _________________ Surface Area __________________(_______% from the zone) Town ______________rural ______________________(land) Geographical coordinate

Latitude ____________________________________

Longitude __________________________________

Annual rain fall (average)______________________

Annual temp (average)_______

Climatic zones_____________ (%) ___________ (%) ____________ (%)

Woreda boundaries

North________________ South___________________ East__________________ West__________________

3. Political and Administrative Organization

Total no. of kebeles: __________

rural________

Urban____________

4. Population and Population structures

Demographic data

1. Total Population ___________Male _________Female_______ sex ratio______

2. Urban Total __________ Male ___________Female______________

3. Rural Total _________ Male____________ Female______________

4. Population under 1yrs_____________

5. Population under five yrs__________

6. Population < 15 years_____________

7. Population >64 years_____________

8. Women 15_49 years of age______________

9. Total population by kebele (each kebele pop)____________

10. Population enumerated by H.E.Ws______________________

Population pyramid

Population data by age and sex								
Male	<1	1-5	6-14	15-24	25-34	35-49	50-64	>65
Female	<1	1-5	6-14	15-24	25-34	35-49	50-64	>65

Ethnic/language

1. Oromo________ (________ %), Amhara________ (__________ %),
2. Afar________________ (_____%), Tigre __________ (_____ %),
3. Others__________ (________ %)

Religion

1. Orthodox _______ (_____ %),
2. Muslim _____________ (________ %),
3. Protestant____________(_________%),

Other ____________ (_____ %)

5. Economy (mainstay of the economy, average income levels etc)

Main income sources

Agriculture - Cultivated area__________________ - Grazing area____________________ - Cropping seasons_________________

Land density____________________ Livestock Truism Trade Other business House hold income source 1. Agriculture______ (#)

2. Government Employer_______(#) 3. Private Employer___________(#) 4. Daily Laborer______________(#)

5. Different business_____ (#) 6. Jobless ______ (#) Average Income__________________________

6. Education and school Health

Number of educational institution

1. K.G._________________________ 2. Primarily School_______________
3. Secondary____________________4. Preparatory___________________
5. College/ University_____________ 6. TVET ________________________
7. Total School Age Children (target) ____________________
8. Total Enrolment _______________Male ___________Female___________

9. School dropout in 6 months or year 2004 ___________________________
10. If there is school dropout why ____________________________________
Educational status of the community
1. Total Educated people________ - Male _____________ - Female ___________
2. School health activities:
Number of schools with water supply_____________________________
Toilets:
Schools with functional latrines (male & female)___________
Schools with HIV/other Health clubs____________________

7. Facilities

Transport

1. Accessibility (main roads)__________________________________

2. Type of road ____

3. How many kebeles have access to transportation __________________

4. Flow of transportation per day_________________________________

Telecommunication

1. How many people have access to fixed telephone? _____________

2. How many people have access to mobile phone? (Coverage) _____________

Post Office___________________________________

Bank____

Power supply

1. How many house hold get power supply____________________?

Water

1. Total safe water coverage _______________________ (___%)

2. Safe water supply coverage by kebele _________________________

3. Main source of water supply ______________________

4. Kebeles getting safe water____ (__ %)

5. Population getting safe water_____ (__ %)

6. Daily water consumption per day per person____________

8. Disaster situation in the woreda

1. was there any disaster (natural or manmade) in the woreda in the last one year? ________
2. Any recent disease outbreak/other public health emergency_____________________

3. If yes cases________ and deaths___________

9. Vital Statics and Health Indicators

1. Infant Mortality Rate (IMR) ___________(total <1 yr deaths this 2004yr________)

2. Child Mortality Rate_______________(this year‘s total <15 yr deaths______)

3. Crude Birth Rate__________ 4. Crude Death Rate___________ (total deaths 2004yr____)

5. Maternal Mortality Rate____________(2004 total maternal deaths______)

6. Contraceptive prevalence rate_______________ 7. Contraceptive acceptance rate __________

8. ANC rate (how many of the total expected pregnancies attended 1st ANC) _________

9. ANC rate (how many of the total expected pregnancies attended 4th ANC) _________

10. Percentage of deliveries attended by skilled birth attendants__________

11. Percentage of deliveries attended by HEWs___________

12. Percentage of deliveries attended by TBA ________________________

13. Average family size____________________________

10. Immunization Coverage (for children and Women)

1. BCG _____ (__ %). 2. OPV0____ (____ %), OPV1_____ (___ %), OPV3______ (___ %)

3. Penta1_____ (___ %), penta2 _____ (___ %) penta3______ (___ %) 4. Measles_____(___ %). 5. PCV-10-1______(__%), PCV-10-3_______(___%) 6. TT2+P.W_____(__%),TT2+ N.P.W_____(___%)

11. Health Service

Type and Number of Health Institution

<table>
<tr><th rowspan="2">S/N</th><th rowspan="2" colspan="2">Type of Health institution</th><th colspan="2">Number</th></tr>
<tr><th>Government</th><th>Private</th></tr>
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</table>

Health institution to pop ratio:

Hospital: Pop----------. - HC: Pop------------ - HP: Pop----------- - Health service coverage------

Type and Number of health professionals

S/N	**Profession**	**Male**	**Female**	**Total**

Health professional to population ratio

- Doctor: pop. Ratio_____

- Nurse: pop. Ratio____

- Mid. Wife: pop. Ratio ____

- HEW: pop. ratio_____

12. Top causes of morbidity and mortality

Top ten leading causes of OPD visit (morbidity)

Adult		Pediatrics/ < 5 years
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

13. Health budget allocation Government

1. Total budget allocated for the woreda _______________

2. Total budget allocated for health ________(____%)

Funds from NGO

1. Total ___________ (purpose/programs)____________________

14. Community Health Services Status of services provided by community health workers namely:

1. No. of TBAs/TTBA__________ and their responsibility ______________________________ 2. No. of CHWs/CHPs__________ and their responsibility ____________________________

3. Responsibility of HEWs____ 4. Others____

15. Status of Primary Health Care Components – with focus on the eight PHC elements and MDG

1. MCH (Delivery, ANC, PNC)
____

2. FP (Methods)
____

EPI (outreach service, cold chain, vaccine)

____

Environmental Health & sanitation

1. Latrine coverage________ & utilization rate______________________________

2. Solid waste management____

3. Liquid waste management ____

4. others____

 Health Education (what, when, where, how and who conducted health education) ____

16. Endemic diseases

Malaria:

1. Total malarious kebeles______________& Pop at risk________________
2. ITNs coverage (including current dist)______________________________
3. Is there IRS this year(No of kebeles)______________________________
4 Total cases/yr______ deaths/yr________,<5yr cases_____ deaths______
5. Malaria supplies (Coartem, RDT, etc) shortage _____________________
6. Other issues____

TB/Leprosy:

1. Total TB cases____________________________________

2. PTB negative_____________________________________
3. PTB positive_____________________________________
4. Extra PTB _______________________________________
5. TB detection rate _________________________________
6. TB Rx completion rate ____________________________
7. TB cure rate _____________________________________
8. TB Rx success rate _______________________________
9. TB defaulter_____________________________________
10. Death on TB Rx_______________________________
11. Total TB patients screened for HIV________________
12. Total Leprosy cases______________________on Rx_______________

HIV/AIDS

1. Total people screened for HIV (last one year)_____________________
2. VCT_____________ PITC__________________PMTCT___________
3. HIV prevalence____
4. HIV Incidence (new cases/yr)__________________________________
5. Total PLWHA____
6. On ART________________on Pre-ART________________________
7. Other HIV prevention activities_________________________________

Nutrition

1. Total OTP sites______, total admissions to OTP/yr________________
2. Total SC sites,_______, Newly opened/yr______, total admissions to SC/yr____
3. Is there TSF (targeted supplementary feeding) program in the woreda_____
4. CBN program________ PSNP_______________other_________________

17. **Essential drugs (shortage)**
____
____

Annex 6 Epi project Structured and Semi-structured questionnaire

HOUSEHOLD QUESTIONNAIRE

District Name_______________Kebele Name_________________ Gote Name____________

SECTION 1. General Information

INTRODUCTION AND CONSENT

INFORMED CONSENT

Introduction

Questionnaire ID NO___________

Hello. My name is ------------------- and I am part of a team of people who are carrying out a Research on "Assessment of LLITNs Utilization among pregnant women and associated factors in Lare Woreda" (Show a letter of approval from LWHO). Thank you for taking the time to speak with us today. We wanted to speak with head of house and/or spouse. Our aim is to figure out factors affecting the utilization of bed net among pregnant women in the community. We are very interested in your experience and your point of view. We will start by asking your willingness to participate in the study and clearly explain you the objective, benefit and risks of the study to get your consent. And then we will ask you all a multiple of questions for discussion. Questions are simple and what you are clearly known in your daily activities. Please feel free to speak your mind; your name, position, and anything that could identify you personally will not be used in any official reports or presentations. (Fill consent Form). The Questions will take about 30 minutes. Your answers will remain confidential, and we will not be taking down your name or address, so your answers will be anonymous. Participation in this study is voluntary and you can choose not to answer any individual question or all of the questions. However, we hope that you will participate in this study since your views are important. At this time, do you want to ask me anything about the study? May I begin the interview now? Identification Code Name of House hold head_____________________

House number______________________________

Kebele____

INSTRUCTIONS: please circle or write the appropriate response of the respondents based on the given questions.

PART-I. Socio demographic characteristics of the respondents

101. Age of the respondent --------------------- years

102. Sex of the respondent: 1 Male 2 Female

103. Marital status of the respondent: 1 Married 4 Divorced 3 single 4 Widowed

104. Ethnicity: 1 Nuer 2 Oromo 3 Amhara 4 Sidama 5 Gurage 6 Tigre 7 Others ---------

105. Religion: 1 Orthodox 2 Protestant 3 Muslim 4 Catholic 5 0thers ----------

106. Educational status of head of the households: 1 Unable to read and write 2 Able to read and write but not attend formal education 3 highest grades completed-------------

107. Educational status of the spouse of head of the house holds 1 Unable to read and write 2 Able to read and write but not attend formal education 3 Highest grades completed----------------- 108. Occupation of the respondents 1 Farmer 2 Daily laborers 3 Merchant 4 House wife 5 Government employers 6 others--------------------------

109. Occupation of your spouse 1 Farmer 2 Merchant 3 Government employers 4 Daily laborers 5 House wife 6 others--------------

110. What is your monthly house hold income? ---------------birr

111. Type of roof of the house 1 corrugated iron sheet 2 thatched roof 3 others specify

112. Type of wall of the house 1 Mud 2 Cement 3 Only wood (no mud or cement) 4 others ------

113. Type of floor of the house 1 Cement 2 Mud 3 Wood 4 Others------------

114. The main source of drinking water for the house holds 1 pipe water 2 protected spring 3 unprotected springs 4 protected well 5 unprotected well 6 River 7 others

115. Do you have toilet/latrine? 1 Yes 2 No

116. If your answers yes what kind of latrine do you have? 1 individual Pit latrine 2 common pit latrines 3 others

117. Type of energy used for cooking 1 wood 2 cow dung 3 Charcoal 4 Electricity 5 Gas 6 others-----

118. Do you have functioning radio in your house? 1 yes 2 no

119. Total number of people living in this house -------------------------------

120. Total number of under-five children's living in this house --------------

121. Number of pregnant mothers in the house hold (if there is pregnant mothers) --------------

122. How many rooms do you have in your house? ---------------------

123. How many beds do you have in your home? ---------------------

124. How many people usually sleep in your home? -----------------------

125. How many sleeping mats do you have in your home? -----------------------

126. How many people in your home usually sleep on beds? ---------------------

127. How many people in your home usually sleep on mats? --------------------

PART II Questions Related To Malaria Knowledge

201. Is malaria the major health problem in your area? 1 Yes 2 No 3 I don't know

202. What main symptoms of malaria you aware of? (Multiple answers is Possible) 1 Fever (hotness of body) 2 Feeling cold (Chills/shivering 3 Headache 4 Vomiting 5 Body weakness 6 Loss of appetite 7 Body pain or joint pain 8 Eye become yellow 9 Profuse sweating 10 Diarrhea 11 don't know 12 other specify---------

203. What is the main cause of malaria? 1 Being in the rain 6 another person with malaria 2 Working in the sun 7 Mosquitoes bites 3 Exposure to cold weather 8 God/Allah 4 Drinking dirty water 9 don't know 5 living near collected water 10 other specify –

204. Which group of people are more affected by malaria (multiple answer are possible) 1 Adults 4 pregnant women 2 Elderly people 5 Children less than five year 3 Younger people 6 All are equally affected 7 other (please specify) ----------------

205. Do you think malaria can be transmitted from one person to another? 1 Yes 2 No 3 I don't know

206. How is malaria transmitted from one person to another? 1 Sleeping together 5 Mosquito bites 2 Eating together 6 sharing clothes 3 Living in the same house 7 I don't know 4 Nursing the sick 8 others specify-----------

207. Do you think that malaria is a preventable disease? 1 Yes No 3 I don't know

208. If yes to Q 207. Would you tell me the preventive measures of malaria you aware of? 1 Use a mosquito net 2 burning things to make smoke 3 Taking drug 4 use traditional medicine 5 Use insecticides sprays 6 use curtains 7 Close the doors and windows at night 8 Nothing 9 lighting fire in the house 10. Keep the house and surrounds clean/draining standing water? 11 others specify-------------

PART III KNOWLEDGE QUESTIONS RELATED TO MOSQUITOES

301. Do mosquitoes cause any trouble to you? 1Yes 2 No

302. If yes, in what ways do they cause you trouble? (Multiple responses possible) 1 They bite 4 I don't know 2 they carry disease 5 others, specify_________ 3 they make noise

303. During what season do you notice a lot of mosquitoes? Do not prompt 1 during the dry season 4 don't know 2 during the rainy season 5 other (specify) ---------- 3 throughout the year 304. At what time of the day do mosquitoes bite most? Do not prompt 1 in the morning

5 All day 2 in the afternoon 6 don't know 3 in the evening 7 other (please specify) ---------- 4 at night in the bed

305. What methods are you currently using to protect your household from mosquitoes? (Multiple responses possible) 1 Use a mosquito net 7 Do nothing 2 Use insecticide spray 8 others specify------- 3 Close windows and doors 4 Light fire in the house 5 Burn cow dung/traditional plants 6 Clean surroundings/drain standing water

PART IV KNOWLEDGE QUESTION RELATED TO MOSQUITO NETS

401. Have you heard/ seen any education message about mosquito nets 1 yes 2 No

402. If yes from where did you see or hear these education message (multiple response) 1 Radio 6 Parents 2 TV 7 health worker 3 newspaper /magazine 8 Government 4 Posters/notice 9 church /mosque 5 Friends 10 School 11 Others

403. What are the benefits of sleeping under the bed nets (multiple answers?) 1 Not bitten by mosquitoes 5 It gives warmth 2 to prevent malaria 6 No benefit 3 to protect other insect biting 7 don't know 4 Sleep better 8 others specify

404. Is there any problem associated with sleeping under a bed net? 1 Yes 2 No

405. If yes what are they (multiple response possible) 1 It is too hot to sleeping 2 Mosquitoes can bite through a net 3 it is difficult if you want to get up in the night 4 it takes time to tuck the net each night 5 there is no enough air 6 other specify

406. Mosquito nets can have different shapes which shape do you prefer (only one answer) 1 Rectangular 3 Triangular 2 Round /conical 4 others specify

407. Bed net has different colors which colors would you prefer (one answer only) 1 White 2 Black 3 Blue 4 Green 5 Others-----------------

408. Bed nets has different size which size would you prefer (only one answer) 1 Single size 2 Double size 3 Family size

409. For whom do you give priority in case of shortage of bed nets in the house hold? 1 under five children only 3 parents 2 pregnant mothers only 5Children greater than five years 4 both under five children and pregnant mothers 6 0thers specify--**PART V** QUESTION S RELATED TO BED NET UTILIZATION

501. Do you have a bed net in the house hold currently? 1 Yes 2 No (skip to question 523)

502. If yes to question 501, what type of bed net do you have (verify by observation) 1 ITN (LLITN or Retreat able) 2 Local made bed net 3 others specify

503. How many bed nets do you have --------------------?

504. How did you obtain your bed nets? (Multiple responses possible) 1 Were given to me free 3 I can't remember/don't know 2 I bought it/them 4 other specify____

505. Where do you obtain the bed net? 1 At the health center/post 4 from market 2 from kebele 5 from private drug vendors 3 From Shops 6 Others

506. How much would you paid for the bed net (if you bought it) --------- birr

507. How long ago did your household obtain the bed net--------------months/years?

508. If there is no free distribution of ITN in your locality are you willing to buy the bed net? 1 Yes 2 no

509. If yes how much will you pay to buy the bed net--------------------- birr? 510. Is the net (are the nets) being used currently? 1 yes 2 no 511. If yes, to question

510, how many? ---

511. If yes to question 510, what is the main reason you use bed nets in your house? 1 To prevent against mosquito bites 2 To prevent malaria 3 To prevent annoyance by other insects 4 To prevent other boring insects and vermin 5 Prevent falling roof debris /dusts 6 Others specify----

512. If NO to question 510, why? 1 it is too hot 2 Mosquito still bites through the net 3 Difficult to get up during the night 4 It takes time to tuck the net each night 5 Cause irritation 6 Others specify

513. Did any one of the family members sleep under the mosquito net(s) last night? 1 yes 2 no 514. Did you personally sleep under the bed net last night? 1 Yes 2 no 516. If yes for question 515 use the following chart about bed net use in the family members. Start by filling the youngest children age in the family.

516. If all family members is not sleep under the net why? --

517. How often do you use bed net? 1 Daily 2 occasionally 3 during malaria season 4 others

518. If not daily why? ---

519. Did you wash your bed net? 1 yes 2 no

520. If yes to Q How often do you wash the bed net? 1-- Times a week 2--- Times in month 3 ----- ---Times in three months 4 -------- Times in six months 5 ------- Times in year 6 others

521. What was the reason for washing your bed net? 1 Net is dirty 2 net is soiled 3 due to bad smelling of chemicals

522. If NO to Q 501, what are the reasons for not having (buying) bed nets for your Household? 1. I do not know what mosquito (bed) net is 2. Net is not a priority to my household 3. I do not have money to buy 4. Net is too expensive to buy 5. Net is not available in this area 6. I do not know where to buy net 7. Waiting for free distribution of bed nets by

the government 8. I do not like sleeping under net 9. I do not know its benefit 10. Other (Specify):

PART VI Fill the following by observing the bed net

1. Number of bed net in the house during observation -----

2. Things to be observed 1st bed net to be observed Put “X” mark for each option given below 2nd bed net to be observed Put “X” mark for each option given below 3rd bed net to be observed Put “X” mark for each option given below

3. Type of bed net Permanent (long lasting ITN) Treatable ITN Locally made net Others

4. Size of bed net Small (W x L X H =70x180x150) Medium (100x180x150) Large (130x180x170)

5. Shape of bed net Conical Rectangular

6. The bed net Hanged In the package Used for other purpose

7. If hanged on the bed on the sleeping floor / mat If not hanged why? Used for other purpose Hang during the night We don’t know how to hang It is not convenient to hang Others

8. Nets for holes and tears No holes and tears(intact) Small Visible holes and tears Large visible holes and tears (damaged)

9. Cleanness of the bed net clean Dirty

The interview is now finished. Thank you for taking the time to answer these questions.

Data collector	Checked by Supervisor	Checked by Principal Investigator	Data Entered
NAME ____________ DATE ___________ Signature___________	NAME ____________ DATE ___________ Signature___________	1. Yes 2. No	1. Yes 2. No Date_________

Annex 7 Epi project Consent form

Title: Assessment of long-lasting insecticidal net utilization and associated factors among pregnant women Lare Woreda, Nuer Zone, Gambella Region, Ethiopia, 2023.

Objective: To assess the coverage and use of insecticide treated mosquito nets and associated factors among pregnant women Lare Woreda, Nuer Zone in order to produce information to point public health intervention.

Procedure: This project will take about 30 minutes of your time. There are two parts. First, we will clearly explain you the purpose, benefits and risks of the study. We will give you a chance to ask questions and get answers about the study. Second, we will ask you about bed net utilization and associated factors among pregnant women in your family. All information collected during this study will be kept private and will only be known by the investigators.

Benefits: This project will help the government of Ethiopia and all level government health sectors to enhance the utilization of bed nets and maximize the benefits.

Risks: There is no risk to you from answering the questions or being participated in this study. We will give you a copy of this consent.

Privacy: We will keep information about you private. We will not collect your name. Only the investigators will have access to the data and only for study purpose. We will not use any information that might identify you when we present or publish the study's results.

Payment: There is no cost to you for being part of the project. The approximate time that this study will take is 30 minutes. There will be no involvement past today.

Participant Agreement: The project has been explained for me. I have been given a chance to ask questions. I feel that all my questions have been answered. Being in this study is my choice. I may change my mind and leave the study any time during the interview. The purpose of the study and confidentiality procedures has been explained to me and me on my own consent:

Agree _____ b) Disagree_____

Signature of Interviewer______________________

Date of interview _______________Time started__________ Time completed________
Checked by supervisor: Name_____________Signature_______ Date----------------

Declaration

I, the undersigned, declare that this is my original work and never been presented by another person in this or any other University and that all the source materials and references used for this thesis have been duly acknowledged.