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:

Melaku Seyoum

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

April 2019

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

ETHIOPIAN FIELD EPIDEMIOLOGY AND LABORATORY TRAINING PROGRAM (EFETP)

Compiled Body of Work in Field Epidemiology

By:

Melaku Seyoum

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

Advisors:

ADAMU ADDISSIE (MD, MPH, MA, PHD, ASSOCIATE PROFESSOR)

YIMER SEID (BSc, MHP)

April 2019

Addis Ababa, Ethiopia

ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF PUBLIC HEALTH

ETHIOPIAN FIELD EPIDEMIOLOGY AND LABORATORY TRAINING PROGRAM (EFELTP)

Compiled Body of Work in Field Epidemiology

By:

Melaku Seyoum

Approval by Examining Board

_____ _____

Chairman, School Graduate Committee

_____ _____

Advisor

_____ _____

Examiner

_____ _____

Examiner

_____ _____

Acknowledgment

Firstly, my sincere and deepest gratitude goes to academic mentors Dr. Adamu Addissie and Mr. Yimer Sied for their assistance and relevant guidance.

Secondly, I would like to acknowledge Addis Ababa University School of public health (AAU SPH) resident advisor Mr. Abdulnasir Abagero and Ministry of health Ethiopian field epidemiology training program coordinator Mr. Mohammed Ahmed for their coordinal guidance and support during development of this body of work.

Thirdly, I would like to thank my field base mentor Mr. Abraham Lilay and Colleagues (Mikias Alayu, Neamin Tesfaye, Mukemil Hussen, Habtamu Tilahun, Diriba Sufa, and Zewdu Aseffa) for their unreserved support and guidance from the inception of this body of work.

Lastly, I would like to thank Ethiopian public health institute for giving me the chance to join field epidemiology and laboratory training program and Addis Ababa University School of public health Ethiopian field epidemiology training program academic coordinators.

Table of content

Contents

List of Tables

List of Figures

List of Maps

List of Annexes

List of Abbreviations and Acronyms

AAU……Addis Ababa University

ACT……Artemisinin-based combination therapy

AFI ……..Acute Febrile Illness

AIDS……...Acquire immunodeficiency syndrome

ANC……Antenatal Care

API…….Annual parasite incidence

AR……...Attack rate

ART ……Anti-Retroviral Therapy

AWD……...Acute watery Diarrhea

BCC…….Behavioral change Communication

BCG……Bacilli Chalmette-Guerin

BPR……..Business Process Reengineering

CDC…….Centers for disease control and prevention

CFR……..Case Fatality Rate

DHN……..Dehydration

CI……..Confidence interval

CSA……...Central Statistical Agency

CTC……...Cholera Treatment Center

DRC……...Democratic republic of Congo

E.C……Ethiopian Calendar

EDEP…….....Ethiopian Dracunculiasis Eradication program

EFETP……...Ethiopian Field Epidemiology program

EFY……Ethiopian Fiscal Year

ELISA……Enzyme linked immuno-sorbent assay

EPI……Expanded program on immunization

EPHI……..Ethiopian Public Health Institute

ETB……Ethiopian Birr

FDRE…….....Federal Democratic Republic of Ethiopia

FMOH……Federal Ministry of Health

GDP……Growth Domestic product

GIS…….....Geographic Information System

GTFCC……..Global Task Force on Cholera Control

GWD …….....Guinea worm Disease

GWEP……Guinea worm Eradication program

HEW……...Health Extension Worker

HIV…….Human Immunodeficiency Virus

HSDP……..Health Sector Development Plan

IDP…….....Internally displaced population

IDSR……...Integrated disease surveillance and response

IEC……..Information, Education and Communication

IgM……..Immunoglobulin M

IHR…….....International Health Regulation

IOM……International organization for Migration

IRC…….....International Red-cross community

IRS……...Indoor Residual Spray

ISS……Integrated Supportive Supervision

ITNs……Insecticide Treated Net

MAM……...Moderate Acute Malnutrition

MCH……Maternal and child health

MIS …….Malaria Indicator Survey

MoE…….....Ministry of Education

MoLF…….....Ministry of Livestock and fishery

MOP ……..Malaria Operational Plan

MoWCA…….....Ministry of Women and child Affairs

MSF…….Medicines sans Frontiers

MUAC…….Mid-Upper Arm Circumference

NDRMC……..National Disaster Risk Management Commission

NGO……None Governmental Organization

NNP…….....National Nutritional program

NSP …….National Strategic Plan (Same as NMSP)

NTD…….Neglected Tropical Disease

OCHA…….Office for the Coordination of Humanitarian Affairs

OCV……Oral Cholera Vaccine

OPD…….Out Patient Department

OPV…….Oral Polio Vaccine

OR……...Odds Ratio

OTP…….....Out-patient treatment program

PCR……..Polymerase Chain reaction

PCV …….Pneumococcal Conjugative Vaccine

PHEM……..Public Health Emergency Management

PICT ……Provider initiated counseling and testing

PLW…….Pregnant and lactating women

PMTCT ……...Preventing Mather to Child Transmission

PNC …….....Post Natal Care

PSNP…….....Productive Safety Net Program

RBM …….....Roll Back Malaria

RDT…….Rapid Diagnostic Test

REC…….Reaching Every Child

RHB…….Regional Health Bureau

RRT…….Rapid Response Team

RUTF……...Ready –To- Use Therapeutic Feeding

SAM……Severe Acute Malnutrition

SC……Stabilization Center

SIA……...Supplementary Immunization Activity

SITREP……...Situational Report

SNNPR……South Nation Nationalities people region

SOP……..Standard operating procedure

SPMMC……...Saint poul Millennium Medical College

SUFI…….Scaling up for impact

TOR…….Term of Reference

TSFP……Target Supplementary Feeding Program

TVET……...Technical Vocational and Education Training

UNECA……United Nations Economic Commission for Africa

UNESCO ……....United Nations Educational, Scientific and Cultural Organization

UNICEF……....United Nations International Children's Emergency Fund

VCT……..Voluntary Counseling Test

WASH …….Water Sanitation and Hygiene

WHO…….World Health organization

WHO/AFRO……....WHO Africa regional Office

Executive summary

This compiled body of works has nine main chapters which all of them were done during the residency time of the program. These nine sections are expected outputs during the residency time; such as 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:-Two outbreak investigations were carried out. The first outbreak was conducted in Hudet Woreda, Dawa zone of Somali region and the second in Addis Ababa. In the first outbreak a total of 358 measles cases with 13 deaths were identified in Hudet woreda and in the second outbreak 260 imported cholera cases with no death were identified in Addis Ababa Bole international airport. Both outbreaks were confirmed at EPHI national reference laboratory. To identify the risk factors case-control study design was conducted for the first outbreak investigations and descriptive for the second outbreak. Recommendation was given for both based on the findings.

Chapter Two:-Conducting Surveillance data analysis is the other core competency for field epidemiology training program. We retrospectively analyzed a five year national malaria surveillance data collected from 2013 to 2017 to describe epidemiology of malaria in Ethiopia.

Chapter Three:-Gambella regions' Guinea worm disease surveillance system was evaluated from March 20 to April 5, 2018. Descriptive cross sectional study design was used. The chapter clearly presents the purpose and objectives of Guinea worm disease surveillance; 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:-Health profile is a system of collecting and summarizing health and other health related events, demographic, socio-economic, political and cultural aspect of a particular district. Health and health related data was collected in Soro Barguda Woreda of west Guji Zone during February 25-March 15, 2018.

Chapter Five:-Included two manuscripts for peer reviewed journal. The manuscripts were conducted on measles outbreak investigation and cholera outbreak investigation reports.

Chapter Six:-Presents abstracts on "Investigation of Measles Outbreak in pastoralists and hard to reach Hudet woreda of Somali region, Ethiopia October 2018" and "Challenges of imported cholera cases among deportees in Ethiopia: From Saudi Arabia prisons March 2019. Both abstracts were developed during this residency period.

Chapter Seven:-Narrative summary of disaster situation. Rapid conflict impact and recovery assessment in internally displace population in west Guji and Borena zones was conducted in March 2018.

Chapter Eight:-Contain an epidemiological protocol entitled "community based measles immunization coverage survey among children aged 12–23 months in Hudet district of Somali region". Community based measles immunization coverage was not widely assessed and often there is variation between actual coverage in the community versus administration coverage. The main purpose of this study is to determine community based measles immunization coverages and validate it with administrative coverage figures in the woreda. Cross sectional study design will be used in Hudet woreda from 1st July to 30th July 2019.

Chapter Nine:-Contains other additional outputs like training and weekly epidemiologic bulletin. EFETP frontline workshop1 training was given to woreda and hospital level PHEM officers/focals in Tigray region, November 2018. Training material was comprised of importance of surveillance, Surveillance data collection, Surveillance data analysis and interpretation, surveillance data quality assessment; monitoring and evaluation.

In addition to this Weekly epidemiological bulletin was written to SNNPR. FETP frontline trainings given to Oromia and SNNPR, PHEM Integrated supportive supervision, Influenza supportive supervision and the likes were conducted but not included in this report.

Chapter I: Outbreak investigation reports

1.1. Measles outbreak investigation and response in pastoralist's community, Hudet woreda, Somali region, Ethiopia, October 2018.

Abstract

Background: Measles is a highly contagious vaccine-preventable disease. Globally, in 2015, there were 254,928 cases and ~134,200 measles deaths. The aim of the investigation was to describe the magnitude of measles, to identify risk factors and to undertake control measures.

Methods: Unmatched case-control study was conducted from October 1-20, 2018 in Hudet woreda. The outbreak was confirmed by using serological laboratory test. Sample size were determined based on similar studies. On case-control study a total of 116 data were collected using structured questionnaire. We used WHO adopted national standard case definition to identify cases. All 358 cases were line listed. Bivariate and multivariate analysis was conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS.

Results: A total of 358 cases (AR 597/100,000) and 13 deaths (CFR 4%) were identified. Infants were more affected than others (AR 1340/100,000). The median age of the cases was 15 years (2 months to 57 years). Statistically significant variables on multi- variate analysis were family size above four (AOR: 21.8; 95% CI: 2.14-222.2; P: 0.009), travel history to measles affected area (AOR: 16.3; 95% CI: 2.1-125.7; P: 0.007), being malnourished (AOR: 11.24; 95% CI: 1.21-104.5; P: 0.033), being vaccinated as protective factor (AOR: 0.11; 95% CI: 0.015-0.804; P: 0.03), knowing measles is vaccine preventable as protective factor (AOR: 0.093; 95% CI: 0.011-0.82; P: 0.032). None of the health posts had refrigerator and health centers are in average 150km far from health posts. So in these condition it is impossible to keep vaccine potency.

Conclusion and recommendation: Infants were primarily affected by the outbreak. Malnutrition, low awareness level, inadequate and poor cold chain management and low vaccination coverage were likely contributed to the outbreak. Undertaking supplementary immunization, enhancing routine vaccination coverage, increasing community awareness, strengthening cold chain management and managing malnourished cases can reduce measles outbreak.

Key words: measles outbreak, Case control study, Hudet, Somali Region Ethiopia, 2018.

1.1.1. Introduction

1.1.1.1. Background

Measles is an acute, highly contagious viral disease caused by a measles virus. The measles virus is a member of the genus Morbilli virus of the Paramyxoviridae family. It is a vaccine preventable respiratory infection, but has been, and remains, a major killer disease of children around the world. This highly contagious virus is transmitted primarily by respiratory droplets or airborne spray to mucous membranes in the upper respiratory tract or the conjunctiva (1).

Despite tremendous achievements towards global measles mortality reduction and measles elimination goals, globally, in 2010, there were 327,305 measles cases reported and an estimated 139,300 measles deaths (i.e., approximately 380 deaths/day). During 2009–2010, measles outbreaks were reported in Europe, Africa and Asia. In 2010–2011, Western Europe saw a rise in measles cases with at least 33 countries reporting more than 68,743 measles cases, resulting in importations into the Americas (1).

The WHO created the Expanded Program on Immunization (EPI) in 1974 as a means to continue the great success that had been achieved earlier with the eradication of smallpox. At that time less than 5 percent of the world's children in the developing world were receiving immunizations. The six diseases chosen to be tackled under this new initiative were tuberculosis, diphtheria, tetanus, pertussis, polio and measles (2).

Measles is still a public health problem in many developing countries, particularly in parts of Africa and Asia. According to the World Health Organization (WHO), more than 20 million people are affected by measles each year with more than 95% of measles deaths occur in countries that have low per capita incomes and weak health infrastructures(3).

According to WHO report since 2006 through 2017 Ethiopia have reported 67,603 laboratory confirmed measles cases. From September 2017 to August 2018 the incidence rate of measles was 26.4 cases per 100,000 population among under one and 25.7 cases per 100,000 population among 1-4 age group. All age group were affected.

Measles spreads by coughing and sneezing, close personal contact or direct contact with infected nasal or throat secretions. The Secondary attack rates among susceptible household contacts have been reported to be 75%–90%. Due to the high transmission efficiency of measles, outbreaks have been reported in populations where only 3% to 7% of the individuals were susceptible. The virus

remains active and contagious in the air or on infected surfaces for up to 2 hours. It can be transmitted by an infected person from 4 days prior to the onset of the rash to 4 days after the rash erupts, Infectivity is greatest three days before rash onset. Measles outbreaks can result in epidemics that cause many deaths, especially among young, malnourished children. In countries where measles has been largely eliminated, cases imported from other countries remain an important source of infection (1, 2, 3, and 6).

In developing countries with low vaccination coverage, epidemics often occur every two to three years and usually last between two and three months, although their duration varies according to population size, crowding, and the population's immune status. Outbreaks last longer where family size, and hence the number of household contacts, is large. In the absence of measles vaccination, virtually all children will have been infected with measles by the time they are 10 years old (12)
Unvaccinated young children are at highest risk of measles and its complications, including death. Unvaccinated pregnant women are also at risk. Any non-immune person (who has not been vaccinated or was vaccinated but did not develop immunity) can become infected. The overwhelming majority (more than 95%) of measles deaths occur in countries with low per capita incomes and weak health infrastructures. Humans are the only natural hosts of measles virus. Although monkeys may become infected, transmission among them in the wild does not appear to be a mechanism by which the virus persists in nature (3).

It usually does not kill children directly; however, as a result of its associated immunosuppression, measles can lead to lethal complications, such as pneumonia, croup, and diarrhea. Measles can also lead to lifelong disabilities, including blindness, brain damage, and deafness (1, 4).
The incubation period is 10–12 days from exposure to the virus to the onset of fever, and a rash usually appears at around day 14 (range 7–18 days). Patients are contagious from about 4 days before eruption of the rash until 4 days after the eruption. Measles occurs naturally only in human being. All persons who do not had the disease or who have not been successfully immunized are susceptible (5, 6, 7 and 8).
Other risk factors for measles virus infection include: infants who loose passive antibody before the age of routine immunization, children with vitamin A deficiency and immunodeficiency due to HIV or AIDS, leukemia, alkylating agents, or corticosteroid regardless of immunization status and children who travel to areas where measles is endemic or contact with travelers to endemic

areas. Malnourished and young children are at higher risk of developing complications and mortality from measles infection (6).

Since the introduction of effective measles vaccines, the epidemiology of measles has changed in both developed and developing countries. As vaccine coverage has increased, there has been a marked reduction in measles incidence, and with decreased measles virus circulation, the average age at which infection occurs has increased (7).

The severity of measles varies widely, depending on a number of host and environmental factors. The risk of developing severe or fatal measles increases for those aged less than 5 years, living in overcrowded conditions, who are malnourished and those with immunological disorders, such as advanced HIV infection (9).

In 2001, countries in the World Health Organization (WHO) African Region started implementation of the regional measles mortality reduction strategies with a goal to reduce the estimated number of measles deaths in 2005 to half of the estimate for 1999 (10). This goal was achieved, and a new goal was established to reduce measles mortality in 2009 to 90%. The measles mortality reduction strategy adopted by the African Region includes improving routine measles vaccination coverage, providing a second opportunity for measles vaccination through supplementary immunization activities (SIAs), monitoring the impact of vaccination activities through case-based measles surveillance, and improving measles case management (10).

There are four recommended techniques for collecting specimens from suspected measles cases. In Ethiopia, currently blood sample (serum specimen) and nasopharyngeal swab samples are the two sample types collected. A blood sample is for measles-specific IgM detection and a nasopharyngeal swab sample is collected for virus isolation in order to identify the genotype of the measles virus in a particular outbreak. WHO recommends the IgM indirect ELISA method for rapid confirmation of measles cases. The test can be run in one day so that results can be returned in a timely manner. The laboratory result has to be sent to the users to the maximum within 7 days.

Filter paper method dried blood sample is another method used to test for the presence of measles-specific IgM; and sample of patient urine is used to do virus isolation for genotyping. This method is not currently used in Ethiopia. A small proportion of samples may give indeterminate results on IgM testing. All measles laboratories are expected to re-test measles IgM indeterminate samples,

and to perform rubella IgM testing on all measles IgM indeterminate and IgM negative specimens (1, 10).

There is no specific antiviral treatment exists for measles virus. Severe complications from measles can be avoided through supportive care that ensures good nutrition, adequate fluid intake and treatment of dehydration with WHO-recommended oral rehydration solution. This solution replaces fluids and other essential elements that are lost through diarrhea or vomiting. Antibiotics should be prescribed to treat eye and ear infections, and pneumonia. All children in developing countries diagnosed with measles should receive two doses of vitamin A supplements, given 24 hours apart. This treatment restores low vitamin A levels during measles that occur even in well-nourished children and can help prevent eye damage and blindness. Vitamin A supplements have been shown to reduce the number of deaths from measles by 50% (1, 6).

Routine measles vaccinations for children, combined with mass immunization campaigns are key public health strategies to reduce measles deaths. The measles vaccine has been in use for over 50 years. It is safe, effective and inexpensive. In 2014, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services – up from 73% in 2000. Two doses of the vaccine are recommended to ensure immunity and prevent outbreaks, as about 15% of vaccinated children fail to develop immunity from the first dose (6).

Case-based measles surveillance was initiated in Ethiopia in 2003. The number of reported suspected measles cases has increased through the years and this might be partly due to the increased sensitivity of the surveillance system, rather than a failure of the control efforts. Although measles is one of the weekly reportable disease in Ethiopia the number of reported cases represents only a small proportion of the expected cases. Measles case usually comes late to the health facilities and often after they have developed complication. As a result, the diagnosis given by the health workers tend to be one of the complication rather than measles itself, which is one of the reasons for under reporting of measles cases. A combination of poor quality of record keeping, failure to identify epidemics and proper filing as well as failure of mothers to bring children affected by measles to health facilities for treatment are among other contributing for under reporting (7).

According to the Assessment result of the 2010 global measles mortality reduction goal: results from a model of surveillance data, estimate that, after more than 45 years of measles vaccine availability, the disease caused nearly 140, 000 deaths in 2010 (12).

Globally, in 2015, there were 254,928 measles cases reported and an estimated 134,200 measles deaths (i.e., approximately 367 deaths/day). During 2015, measles outbreaks were reported in several countries in the African, European, and Eastern Mediterranean regions.

Approximately one case of encephalitis and two to three deaths may occur for every 1,000 reported measles cases (18).

On 4th September 2018, one suspected measles case was recorded in unvaccinated child from Chekorsa kebele of Hudet woreda. Later on the Hudet woreda health office detected increasing number of cases of suspected measles which later confirmed by lab test for measles IgM and notify Somali regions' Public health emergency unit (PHEM). On 29th September 2018 the regional PHEM notified Ethiopian Public health Institute (EPHI). These cases were distributed among eleven kebele's in the Woreda. Within two days of notification on 1st October a team of EFETP residents from EPHI; Epidemiologist and laboratory personnel from reginal PHEM were deployed. On 3rd October 2018 investigation and response initiated.

1.1.1.2. Statement of the problem

Measles is one of the vaccine preventable diseases that contribute a significant share of morbidity and mortality among children. It is a highly contagious, serious disease caused by a virus (1).

The disease remains one of the leading causes of death among young children globally, despite the availability of a safe and effective vaccine. Approximately 134,200 people died from measles in 2015 mostly children under the age of 5. It is normally passed through direct contact and through the air. The virus infects the respiratory tract, and then spreads throughout the body. In populations with high levels of malnutrition and a lack of adequate health care, up to 10% of measles cases result in death [26].

1.1.1.3. Rationale of the study

Measles is a notifiable disease condition that needs immediate verbal reporting on clinical Suspicion within 30 minutes to the next higher level; within maximum of 2 hours should reach Ethiopian Public health institute (EPHI). Three confirmed or five suspected cases are considered as an outbreak. Investigation of suspected or confirmed measles outbreak and responding to this outbreak is important in order to contain the outbreak locally before spreading. Investigating and responding to any outbreak reduces morbidity and mortality that would happen from the outbreak.

Local capacity to detect (diagnose) and monitor (collect, compile, and analyze data) measles occurrence, is central to an effective surveillance system and to planning control measures. Countries affected by measles are encouraged to strengthen routine immunization, disease surveillance and national preparedness to rapidly detect and respond to outbreaks. So during outbreak investigation local disease surveillance will increase.

Furthermore, the study also helps to identify risk factors associated with outbreak, implement appropriate prevention and control measures.

1.1.2. Objective

1.1.2.1. General Objective

To describe magnitude of measles outbreak, identify risk factors associated with the outbreak and undertake appropriate public health control measures in Hudet woreda, Dawa Zone of Somali region, Ethiopia, October 2018.

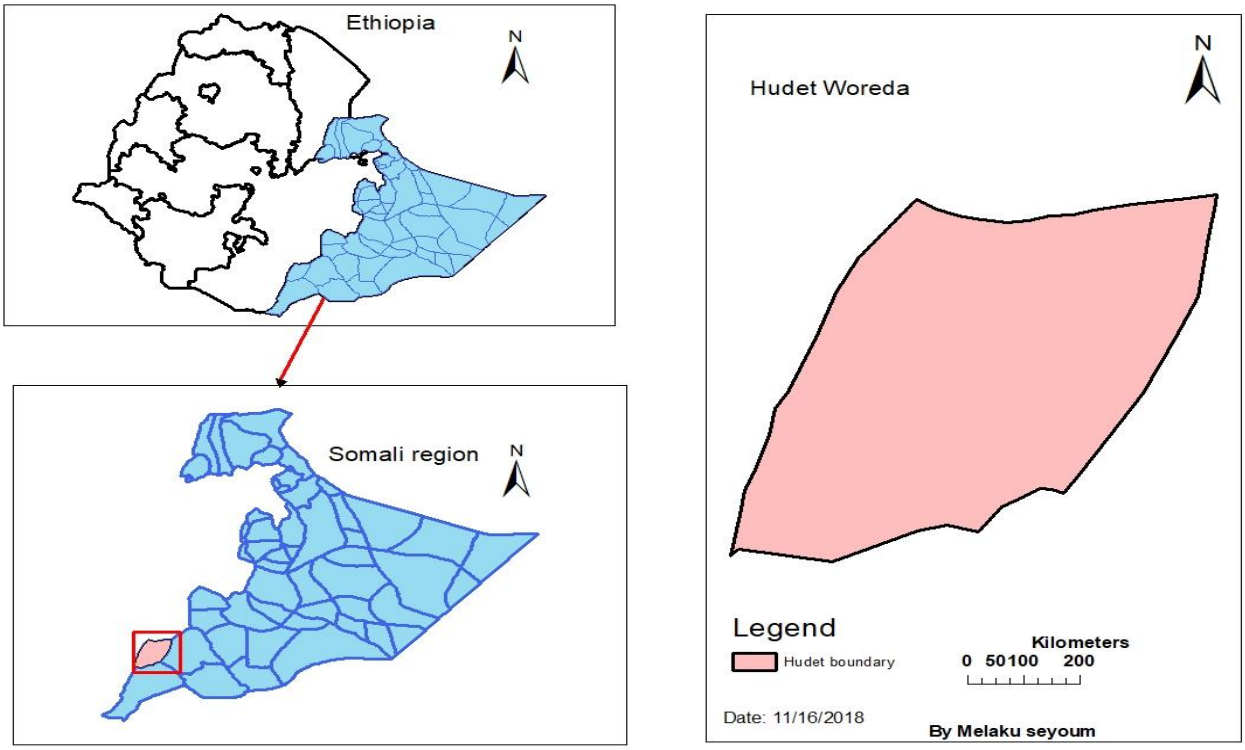
1.1.2.2. Specific Objectives

- To verify the existence of measles outbreak in Hudet woreda.
- To describe outbreak in terms of person, place and time in the woreda.
- To identify risk factors associated with measles outbreak.
- To implementing appropriate prevention and control measures.

1.1.3. Methods and materials

1.1.3.1. Study area

The investigation was conducted in pastoral community of Hudet woreda, Somali region. It is 712km far from Addis Ababa and 1440 Km from Jigjiga capital town of the region. The woreda has 21 rural and 4 urban kebeles. According to the 2007 population census, the projected estimated population of the woreda in 2018 is to be 59,920 which constitute 26,365(44%) male and 33,555(56%) female. It is bounded by Filtu woreda of Somali region to the east, Liben woreda of Oromia at North, Moyale woreda of Somali region at South and Arero woreda of Oromia region to West. 10.46% are urban inhabitants and 72.21% are pastoralists. 99.35% of the population are Muslim. The woreda has an average temperature and an average rain fall of 25^0c-40^0c & 100mm-400mm respectively. Hudet woreda is located at Latitude of 4° 45' 00" N and 39° 14' 00" E Longitude (According to Somali regions' database).



Map 1: showing study area Hudet woreda, Somali region, Ethiopia, 2018.

1.1.3.2. Study period

The study was conducted from October 1-20, 2018.

1.1.3.3. Study Design

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

1.1.3.4. Source /Target population

All population living in Hudet district were the source population.

1.1.3.5. Study population

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

1.1.3.6. Sample size determination and procedure

Using epi-info version 7.1 Statcalc for unmatched case control study;

Assumptions: - power of the study 80%, 95% CI, Control to case ratio 2, from similar study conducted in Abaya woreda of Oromia region (28); taking percent of controls exposed 46.3, odds ratio 3.5, percent of cases with exposure 53.7 gives 39 cases and 77 controls.

1.1.3.7. Sampling Method

We included 39 reported cases randomly from the line list and 77 controls randomly from the same village where cases were identified.

1.1.3.8. Case Definition and Selection of Cases and Controls (1)

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

Suspected case: Any person with fever and maculopapular (non-vesicular) generalized rash and cough, coryza or conjunctivitis (red eyes) OR any person in whom a clinician suspects measles.

Confirmed cases: A suspected case with laboratory confirmation (positive IgM antibody) or epidemiological link to confirmed cases in an epidemic.

Cases- Are individuals, who fulfils the above criteria and all reported cases were recorded in the line list.

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

1.1.3.9. Data Collection Tools and Procedures

The following procedures and tools were applied to collect data during the investigation.

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

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

C. Interviewing Cases and Controls- Using a structured and semi structured questionnaire (annexed), case and controls were interviewed by two data collectors (including the principal investigator)

1.1.3.10. Operational definition

A suspected measles case is defined as: Any person with generalized maculopapular rash and fever plus one of the following: cough or coryza (runny nose) or conjunctivitis (red eyes).

A laboratory confirmed case: - is a suspected case which has laboratory results indicating infection (IGM positive or isolated for a measles virus).

Epidemiologically linked case: - is a suspected case, which has contacts (possibly got the virus) with laboratory confirmed case or another epidemiologically confirmed case.

Measles-related death: - is a death in an individual with confirmed (clinically, laboratory, or epidemiologically) measles in which death occurs within 30 days of rash onset and is not due to other unrelated causes.

Malnourished: - children who had MUAC measurement of less than 11.5 cm as a severe malnutrition and between 11.5- 12.5 cm as moderate malnutrition. In addition, who had edema without MUAC measurement is also taken as malnourished.

1.1.3.11. Data Quality Assurance

Before the start of data collection, a half-day orientation was given for data collectors. Each completed questionnaire was daily reviewed by the principal investigator to monitor the data quality. Before analysis, data was also cleaned for any missing and logically inconsistent values.

1.1.3.12. Data Analysis

All collected data were entered and analyzed using statistical software (using epinfo-7 and SPSS), bivariate and multivariate (using logistic regression model) analysis were conducted using SPSS taking 95% confidence limit and p-value < 0.05.

1.1.3.13. Ethical Consideration

Somali region requested Ethiopian Public Health Institute (EPHI) technical and logistic support. Then EPHI gave the directive and approval to investigate and respond to this outbreak. Before field investigation a formal letter was written by EPHI to Somali region, the region also wrote a letter to Hudet Woreda health office to get permission and facilitate the investigation process. Verbal informed consent was obtained from participants or mothers/caregivers of cases to participate in the study and any information related with personal identification was not used on the report. Cases were also referred to the nearby health facilities for medical care.

1.1.3.14. Dissemination Plan

This study report was submitted to Ethiopian Public Health Institute, Addis Ababa University, School of Public Health, Ethiopian field epidemiology program, Somali region, Dawa zone and Hudet woreda. The manuscript of the report would be published in peer-reviewed journals to reach the scientific community.

1.1.4. Result

1.1.4.1. Descriptive Epidemiology

By Person

From September 4 to November 5, 2018, which is considered as epidemic period, 356 measles cases and 13 deaths were recorded on a line list throughout in Hudet woreda. Among these 5 blood samples were taken to identify the etiologic agent and confirm the outbreak. Accordingly, three samples were positive for measles IgM using the conventional polymerase chain reaction (PCR) at national reference laboratory at Ethiopian public health institute (EPHI). The median age of the cases is 15 years with a range of 2 months to 57 years. Fifty six percent of the cases were female.

Table 1: Distribution of measles cases by age group, Hudet woreda of Dawa zone, Somali region, Ethiopia, 2018.

S.No.	Kebele	Age group															
		Frequency								Percentage							
		<1	1-4	5-14	15-24	25-34	35-44	45+	Total	<1	1-4	5-14	15-24	25-34	35-44	45+	Total
1	Chokorsa	14	47	10	54	16	4	0	144	10%	32%	7%	37%	11%	3%	0%	41%
2	Dheera	1	0	0	0	2	0	0	3	33%	0%	0%	0%	67%	0%	0%	1%
3	Dibe	11	12	2	13	11	0	2	51	22%	24%	4%	25%	22%	0%	4%	14%
4	Dirir	0	10	6	10	3	1	1	31	0%	32%	19%	32%	10%	3%	3%	9%
5	El-kala	1	22	10	18	14	0	1	65	2%	33%	15%	27%	21%	0%	2%	18%
6	Haloye	4	3	0	9	5	1	0	22	18%	14%	0%	41%	23%	5%	0%	6%
7	Hudet 01	0	0	2	2	0	0	0	4	0%	0%	50%	50%	0%	0%	0%	1%
8	Hudet 02	0	2	1	2	2	0	0	7	0%	29%	14%	29%	29%	0%	0%	2%
9	Hudet 03	0	2	0	1	1	0	0	4	0%	50%	0%	25%	25%	0%	0%	1%
10	M/guba	0	2	0	1	1	0	0	4	0%	50%	0%	25%	25%	0%	0%	1%
11	Q/hargesa	1	4	6	5	5	0	0	21	5%	19%	29%	24%	24%	0%	0%	6%
	Total	**32**	**104**	**37**	**115**	**60**	**6**	**4**	**356**	**9%**	**29%**	**10%**	**32%**	**17%**	**2%**	**1%**	**100%**

The overall attack rate (AR) of the case was 597 cases per 100,000 populations. The attack rate is high in females (602 cases per 100,000 populations) than males (592 cases per 100,000 populations). Infants were more affected than others (AR <1 year 1340 cases per 100,000 population), 1-4 years of age 1000 cases per 100,000 population and >5 years 450 cases per 100,000 population. The AR for less than 15 years of age was 674.7/100,000 and for greater than 15 years was 539.7/100,000. Further classifying infants show that 13(3.7%) were 0-6 months of age and 19(5.33%) were 6-12 months of age.

All patients have fever, rash, cough and conjunctivitis/red eye. Concerning complications, 97.5% of the cases have pneumonia and 37.5% have otitis media/ear discharge (table 2).

Table 2: Common sign & symptoms and complications of cases with measles, Hudet woreda of Dawa zone, Somali region, Ethiopia, 2018. (N=39 enrolled cases)

Sign and Symptoms	**Frequency of cases**	**Percentage**
Fever	39	100%
Rash	39	100%
Cough	39	100%
Conjunctivitis	39	100%
Coryza /runny nose	36	92.5%
Diarrhea	32	82.5%
Loss of appetite	24	60%
Vomiting	9	22.5%
Complication		
Pneumonia	38	97.5%
Otitis media	14	37.5%
Convolution	2	5%
Blindness	0	0%
Corneal ulceration	0	0%

From all cases 17 (42.4%) took treatment. All treated cases took antibiotics and none of them took supplementary feeding. Among treated cases 3(18%) were cured, 10(59%) were partially cured and the remaining 4(24%) deteriorated after treatment (table 3).

Table 3: Type of treatment taken, Hudet woreda of Dawa zone, Somali region, Ethiopia, 2018.

(N=17 Cases that took treatment)

Type of treatment taken	Treatment taken	Number	percentage
ORS	Yes	3	18%
	No	14	82%
Antibiotics	Yes	17	100%
	No	0	0%
Vit.A	Yes	5	29%
	No	12	71%
Antipyretics	Yes	4	24%
	No	13	76%
TTC eye ointment	Yes	7	41%
	No	10	59%
Supplementary	Yes	0	0%
	No	17	100%

Eighty three percent of the interviewee believe that measles is from God and two percent by contact with ill person. Lack of knowledge is the main reason for not vaccinated. Fifty nine percent replied that measles can be cured by modern medicine (table 4).

Table 4: Knowledge and attitude towards measles**,** Hudet woreda of Dawa zone, Somali region, Ethiopia, 2018. (N=116 both cases and controls)

Variables	Alternatives	Number	percentage
How people get measles	Contact with ill person	2	1.70%
	From God	96	82.75%
	Bad weather	15	13%
	others	3	2.60%
Reason for not vaccinated	Lack of knowledge	25	22%
	Absent during campaign	11	10%
	NA	80	69%
How do you think measles can be cured	By modern medicine	68	58.60%
	By traditional medicine	45	38.80%
	keeping sick person in door	3	2.60%
Where do you go fist when you get sick	Health facility	64	55.20%
	Traditional healer	6	5%
	Stayed at home	41	35%
	others	5	4.20%

Place

The highest attack rate was registered in Chokorsa Kebele, 5938 cases per 100,000 populations and followed by Dibe, El-Kela and Haloye Kebeles, 2352, 1664 and 1062 cases per 100,000 populations respectively.

Thirteen deaths were reported with the overall case fatality rate (CFR) of 4%. The highest CFR was identified in Hudet 02 Kebele, which was 14%, followed by El-Kela 6% (table 5).

Table 5: Measles Attack rate (AR) and case fatality rate (CFR) by kebele in Hudet woreda of Dawa zone, Somali Region, Ethiopia, 2018.

S.No.	Kebele	Total population	# cases	# deaths	Attack rate (AR per 100,000 population	CFR
1	Chokorsa	2442	144	6	5938	4%
2	Dhedertu	3345	3	0	90	0%
3	Dibe	2168	51	2	2352	4%
4	Dirir	3499	31	0	886	0%
5	El-kala	3967	65	4	1664	6%
6	Haloye	2072	22	0	1062	0%
7	Hudet 01	5301	4	0	75	0%
8	Hudet 02	4240	7	1	165	14%
9	Hudet 03	3621	4	0	110	0%
10	Melka Guba	1600	4	0	250	0%
11	Qal-Hargesa	2005	21	0	1047	0%
	Hudet woreda	**59,920**	**356**	**13**	**597**	**4%**

By Time

Onset of rash occurred between September 4, 2018 and November 5, 2018 was presented in figure1. The detection of the outbreak (the cases) was late by 3 weeks. The outbreak continued for about 12 weeks (three months). The case builds up gradually to reach its peak on October 19, 2018 and had multiple peaks.

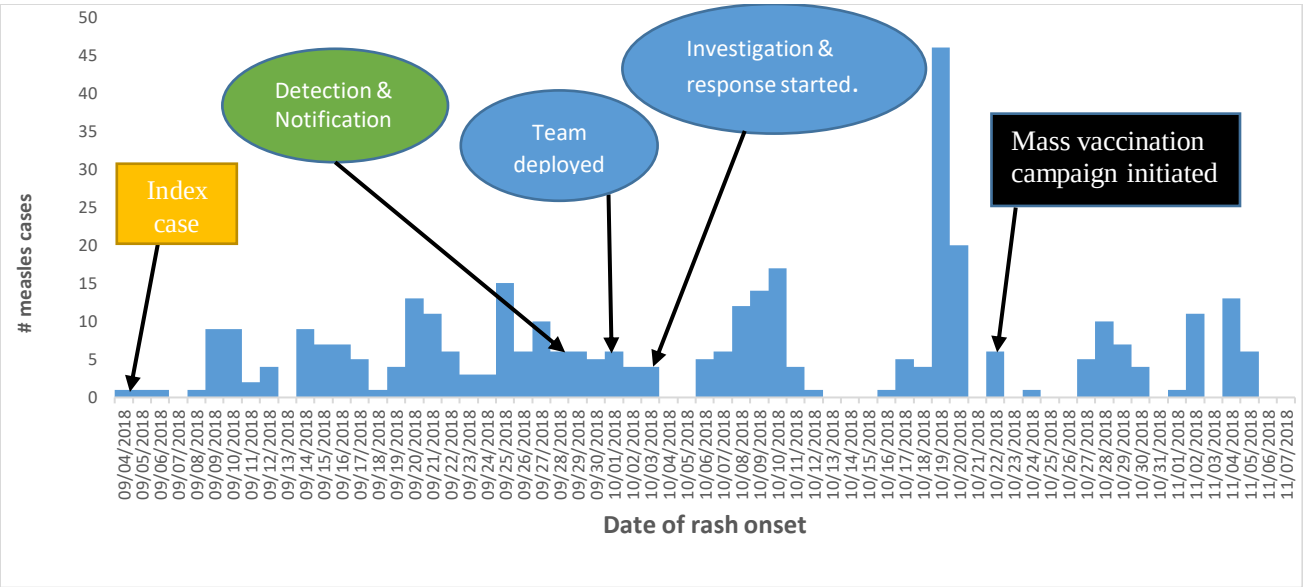


Figure 1: Epidemiologic curve of measles outbreak, Hudet woreda, Somali region, Ethiopia 2018.

1.1.4.2. Vaccination coverage

The administrative measles vaccination coverage was 68%, in 2018. 254(71%) of measles cases had not received any dose of measles containing vaccine (MCV1). Moreover, 32% of the cases aged between 1 year and 15 years, the age range in which a high level of vaccination coverage is to be expected, had not received any dose of the vaccine. Among the total cases, 25% of the patients had received one dose of measles containing vaccine (MCV1) and the rest 5% of them had received two doses of measles containing vaccine (MCV2). The highest unvaccinated cases were reported from Chokorsa Kebele which was 38% from the total unvaccinated cases and followed by El-Kela and Dibe which was 22% and 14% respectively.

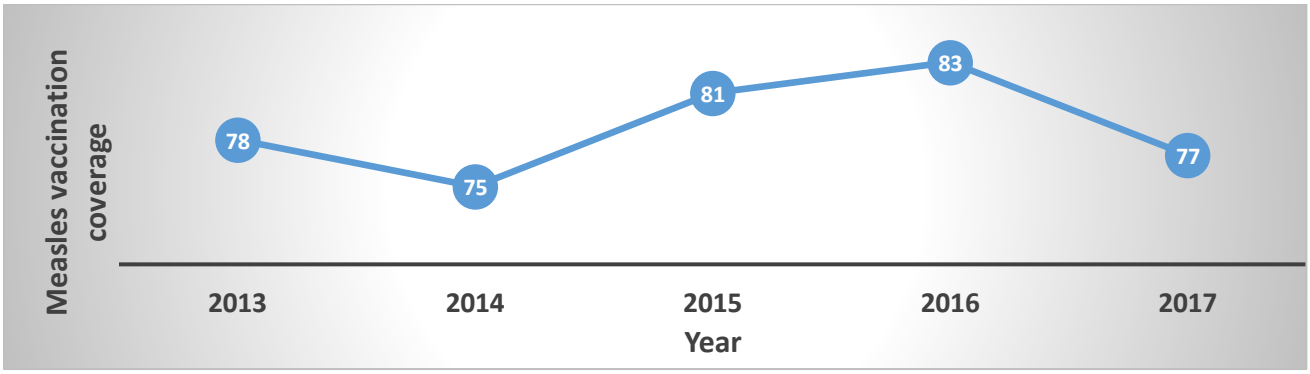


Figure 2: measles vaccination coverage, 2013-2017, Hudet woreda, Somali Ethiopia.

Table 6: Vaccination status of Measles cases by kebelel, Hudet Woreda of Dawa Zone, Somali Region, Ethiopia, 2018.

S.No.	Kebele	Vaccine dose			# cases	% of Unvaccinated cases from kebele total cases	% of Unvaccinated cases by kebele
		0	1	2			
1	Chokorsa	96	43	6	144	66%	38%
2	Dhedertu	2	1	0	3	67%	1%
3	Dibe	36	12	3	51	71%	14%
4	Dirir	20	7	4	31	65%	8%
5	El-kala	55	9	2	65	83%	22%
6	Haloye	16	5	1	22	73%	6%
7	Hudet 01	2	2	0	4	50%	1%
8	Hudet 02	5	2	0	7	71%	2%
9	Hudet 03	2	1	1	4	50%	1%
10	Melka-guba	2	2	0	4	50%	1%
11	Qal-hargesa	17	4	0	21	81%	7%
	Grand Total	**253**	**88**	**17**	**356**	71%	100%

1.1.4.3. Cold chain management

The woreda has 27 health posts and 5 health centers. These functional health posts have no functional refrigerator due to different reasons like shortage of fuel cost, shortage of spare part for the fridge and lack of technical skill. There is functional fridge at all health center.

1.1.4.4. Identified risk factors for measles outbreak

Bi-variate and Multi-variate analysis was performed to determine the strength of association of potential risk factors for measles. Statistically significant variables on bi-variate analysis were being vaccinated as protective factor (COR: 0.052; 95% CI: 0.02-0.14; P: 0.001), family size above four (COR: 8; 95% CI: 3.12-20.5; P: 0.001), living in unventilated house (COR: 4.58; 95% CI:1.6-13; P: 0.004), being malnourished (COR: 12.94; 95% CI: 4.75-35.25; P: 0.001), having travel history to measles affected area 7-18 days prior to onset of rash (COR: 7.78; 95% CI: 3.21-18.9; P: 0.001), absence of health facility within 5 km radius (COR: 5; 95% CI: 1.61-15.45; P: 0.005), knowing mode of transmission (COR: 0.23; 95% CI: 0.099-0.544; P: 0.001), Knowing measles is Vaccine preventable (COR: 0.12; 95% CI: 0.46-0.289; P: 0.001) (Table 7).

Table 7: Bivariate analysis for different exposures to measles, Hudet Woreda, Somali Region, Ethiopia, 2018.

Variable		Case (%)	Control (%)	COR (95% CI)	P-value
Sex	Male	22 (43.6%)	40 (52%)	1.2 (0.55-2.6)	0.649
	Female	17 (56.4%)	37 (48%)		
Educational status of the family	Illiterate	36 (92.3%)	61 (79.2%)	3.1 (0.858-11.55)	0.084
	Literate	3 (7.7%)	16 (20.8%)		
Family size	Less than or equal to four	7(17.9%)	49 (63.6%)	8.0 (3.12-20.5)	**0.001**
	Greater than four	32 (82.1%)	28 (36.4%)		
Any sick person in the family with similar symptom	Yes	25 (64.1%)	32 (41.6%)	2.5 (1.13-5.57)	**0.023**
	No	14 (35.9%)	45 (58.4%)		
Vaccination status	Yes	8 (20.5%)	64 (83.1%)	0.1(0.02-0.14)	**0.001**
	No	31 (79.5%)	13 (16.9%)		
Contact with a person with measles symptoms 2-3 months before on set of rash	Yes	28 (71.8%)	55 (71.4%)	1.0 (0.43-2.39)	0.96
	No	11(28.2%)	22 (28.6%)		
Travel history to o measles affected area 7-18 days prior to onset of rash	Yes	23 (59%)	12 (15.6%)	7.7 (3.21-18.9)	**0.001**
	No	16 (41%)	65 (84.4%)		
knowing mode of transmission of measles	Yes	10 (25.6%)	46 (59.7%)	0.2 (0.099-0.544)	**0.001**
	No	29 (74.4%)	31 (40.3%)		
Nutritional status	Normal	17(43.6%)	70 (90.9%)	12.9 (4.75-35.25)	**0.001**
	Malnourished	22 (56.4%)	7 (9.1%)		
House condition	Ventilated	5 (12.8%)	31 (40.3%)	4.6 (1.6-13)	**0.004**
	Not ventilated	34 (87.2%)	46 (59.7%)		
Distance from HF	less than or equal to 5km	4 (10.3%)	28 (36.4%)	5.0 (1.61-15.45)	**0.005**
	Greater than 5km	35 (89.7%)	49 (63.6%)		
Knowing measles is Vaccine preventable	Yes	17 (43.6%)	67 (87%)	0.1(0.46-0.289)	**0.001**
	No	22 (56.4%)	10 (13%)		

For exposures that were significant on bivariate analysis we verified whether the association of potential risk factors for measles were due to confounder, effect modification or real association. Statistically significant variables on multi-variate analysis were family size above four (AOR: 21.8; 95% CI: 2.14-222.2; P: 0.009), travel history to measles affected area (AOR: 16.3; 95% CI: 2.1-125.7; P: 0.007), being vaccinated as preventive factor (AOR: 0.11; 95% CI: 0.015-0.804; P: 0.03), Knowing measles is vaccine preventable (AOR: 0.093; 95% CI: 0.011-0.82; P: 0.032), being malnourished (AOR: 11.24; 95% CI: 1.21-104.5; P: 0.033) (table 8).

Table 8: Multivariate analysis for significant exposures on bivariate analysis to measles, Hudet Woreda, Somali Region, Ethiopia, 2018.

Variables		**Cases (%)**	**Controls (%)**	**AOR (95% CI)**	**P-value**
Being from un educational family	Illiterate	36 (92.3%)	61 (79.2%)	4.5 (0.11-175.5)	0.424
	Literate	3 (7.7%)	16 (20.8%)		
Family size above four	Less than or equal to four	7(17.9%)	49 (63.6%)	21.8 (2.14-222.2)	**0.009**
	Greater than four	32 (82.1%)	28 (36.4%)		
presence of sick person in the family	Yes	25 (64.1%)	32 (41.6%)	1.3 (0.2-9.0)	0.76
	No	14 (35.9%)	45 (58.4%)		
Knowing measles is vaccine preventable	Yes	17 (43.6%)	67 (87%)	0.1 (0.011-0.82)	**0.032**
	No	22 (56.4%)	10 (13%)		
Travel history to measles affected area 7-18 days prior to onset of rash	Yes	23 (59%)	12 (15.6%)	16.3 (2.1-125.7)	**0.007**
	No	16 (41%)	65 (84.4%)		
Knowing modes of transmission of measles	Yes	10 (25.6%)	46 (59.7%)	5.6 (0.95-33.13)	0.057
	No	29 (74.4%)	31 (40.3%)		
Nutritional status	Normal	17(43.6%)	70 (90.9%)	11.2 (1.21-104.5)	**0.033**
	Malnourished	22 (56.4%)	7 (9.1%)		
House condition	Ventilated	5 (12.8%)	31 (40.3%)	2.7 (0.21-35.3)	0.45
	Not ventilated	34 (87.2%)	46 (59.7%)		
Distance of house from HF greater than 5km	less than or equal to 5km	4 (10.3%)	28 (36.4%)	6.6 (0.61-70)	0.12
	Greater than 5km	35 (89.7%)	49 (63.6%)		
Vaccination status	Yes	8 (20.5%)	64 (83.1%)	0.1 (0.015-0.804)	**0.03**
	No	31 (79.5%)	13 (16.9%)		

1.1.4.5. Interventions undertaken to contain the outbreak

The investigation team identified and characterized the measles outbreak. Technical assistance was given for health workers on case management, recording and reporting situation. Cases were treated to prevent further spread; and reduce morbidity and mortality attributed to measles. Routine surveillance was enhanced and the situation was closely followed at each level on a daily bases. Health education was given for the community members to prevent the transmission of the disease, to motivate health seeking behavior and treatment if there is sign and symptoms of measles. The zone has started closely working with the affected district and the entire neighboring districts to prevent/control the outbreak from spreading to these areas, and alarming the community, health extension workers and community leaders to strength the local surveillance system.

The nomadic nature of the population and hard to reach areas challenged the routine immunization delivery system and during an outbreak investigation, it was witnessed that health posts in outbreak affected areas suffered from a lack of constant delivery of potent vaccine and regular maintenance of cold chain equipment. The outbreak occurred in remote kebeles with many hours walk on foot from the main road which makes it difficult to provide routine immunization service. Despite, the difficulties an outbreak response immunization (Mass immunization vaccination campaign) was conducted starting from October 22, 2018, targeting children from 6 months to 15 years. A total of 25,045 (98%) of under 15 age group population was vaccinated. Among this 8082(32%) were not vaccinated before (table 9).

Table 9: Supplementary mass Immunization campaign by kebele, Hudet Woreda of Dawa Zone, Somali Region, Ethiopia, 2018.

S.N	kebele	Target Population				No. vaccinated for Measles							
						6-11 months		12-59 months		60-179 months		Total vaccinated for measles	Coverage %
		6-11 months	12-59 months	60-179 months	Total	Vaccinated before	Not vaccinated before	Vaccinated before	Not vaccinated before	Vaccinated before	Not vaccinated before		
1	Dhederetu	53	462	906	1421	19	34	320	142	470	411	1396	98.2
2	Gal-Harar	51	443	869	1363	17	34	250	160	510	359	1330	97.6
3	El-kala	59	520	1020	1599	20	39	382	138	620	350	1549	96.9
4	choqorsa	39	338	662	1038	9	34	210	120	390	250	1013	97.6
5	Dibe	34	300	588	922	4	30	192	85	350	240	901	97.7
6	K/harsesa	32	277	544	853	8	24	162	100	378	170	842	98.8
7	Wolena	56	486	954	1496	15	39	385	101	621	300	1461	97.7
8	D/wata	30	259	507	795	0	30	125	134	309	187	785	98.7
9	Dirrir	55	484	949	1488	10	38	310	170	683	250	1461	98.2
10	Tawokal	31	269	527	827	11	19	191	78	347	165	811	98.1
11	Marsha	19	168	329	517	0	19	98	60	170	150	497	96.2
12	Kliwe	18	159	312	490	0	17	83	70	162	145	477	97.4
13	Lami	23	206	404	633	8	13	114	84	291	108	618	97.6
14	Luchole	33	293	575	901	11	20	190	98	376	180	875	97.1
15	Haloye	33	287	562	881	8	20	170	95	324	238	855	97.0
16	Hudet 01	84	733	1437	2254	40	35	520	211	965	440	2211	98.1
17	Hudet 02	67	586	1150	1803	37	28	398	170	780	357	1770	98.2
18	Hudet 03	57	501	982	1539	32	20	351	130	638	324	1495	97.1
19	M/cadey	26	228	446	700	0	20	135	90	310	130	685	97.8
20	Nini	22	189	371	582	10	12	170	10	350	10	562	96.5
21	M/dhera	14	122	239	375	8	6	110	12	210	20	366	97.7
22	El-nasib	50	440	863	1353	23	27	400	32	720	130	1332	98.5
23	Roba	38	337	661	1036	12	24	290	40	520	120	1006	97.1
24	Dir-dima	29	252	494	775	15	14	185	62	411	60	747	96.4
	Total	**952**	**8338**	**16351**	**25641**	**317**	**596**	**5741**	**2392**	**10905**	**5094**	**25045**	**98**

We used 2708 measles vaccine vial from total 2846 vial vaccine received. Total wastage rate was 7.9% (table 10).

Table 10 : Supplementary Immunization campaign wastage rate, Hudet Woreda of Dawa Zone, Somali Region, Ethiopia, 2018.

S.No.	kebele	Total vaccinated for measles	Vaccine wastage rate for measles				
			No. of measles vial received	No. of measles vial used	No. of measles vial unused due to VVM change	No. of vial returned unused & in good condition	Wastage rate %
1	Dhederetu	1396	158	151	0	0	**7.5**
2	Gal-harer	1330	151	144	0	0	**4.5**
3	El-kala	1549	177	167	0	5	**7.2**
4	Choqorsa	1013	115	109	0	3	**7.1**
5	Dibe	901	102	97	1	1	**8.1**
6	K/harsesa	842	95	91	0	1	**7.5**
7	Wolena	1461	166	158	2	2	**8.7**
8	D/wata	785	88	85	0	0	**7.6**
9	Dirrir	1461	165	158	1	3	**8.1**
10	Tawokal	811	92	88	0	2	**7.8**
11	Marsha	497	57	54	0	2	**8**
12	Kliwe	477	54	52	0	1	**8.3**
13	Lami	618	70	67	0	1	**7.8**
14	Luchole	875	100	95	0	2	**7.9**
15	Haloye	855	98	92	1	1	**8.1**
16	Hudet 01	2211	250	239	1	3	**7.9**
17	Hudet 02	1770	200	191	1	2	**7.8**
18	Hudet 03	1495	171	161	0	4	**7.1**
19	M/cadey	685	78	74	0	1	**7.4**
20	Nini	562	65	61	0	2	**7.9**
21	M/dhera	366	42	40	0	0	**8.5**
22	El-nasib	1332	150	144	1	1	**8.1**
23	Roba	1006	115	109	0	3	**7.7**
24	Dir-dima	747	86	81	1	3	**8.9**
	Total	**25045**	**2846**	**2708**	**9**	**48**	**7.8**

1.1.5. Discussion

A prolonged measles outbreak occurred in Hudet Woreda of Somali region starting from September 4, 2018 to 5 November 2018. The crude attack rate was higher (597cases per 100,000 population) compared with the attack rate of measles outbreak recorded nationally, 4.1 per 100,000 population, in 2008 (1). In addition, this finding was also higher compared with outbreak investigations conducted in Jarar zone of Somali region, neighboring Guji zone, Abaya woreda of Borena zone of Oromia, Uganda and France which were 282, 8, 390, 13 and 18.5 cases per 100,000 population respectively (17, 24, 26, 28 and 32). This could be due to delayed detection & notification, insufficient interventions covering all affected kebeles, security problem, inadequate logistics and supplies and absence of health facilities in recommended distance range. But lower than other studies done in Kebridehar town of Somali region and Solomon Iceland which was 790 and 1230 cases per 100,000 population respectively (27, 30).

Highly affected age group was less than one year of age (AR 1340/ 100,000) which is comparable with the outbreak investigation conducted in other areas (17, 22, 30, and 31). The AR for 1-4 years was 1000 cases per 100,000 and it was lower than the attack rate reported on other study conducted in Abaya woreda (1160/ 100,000) of Borena zone and study conducted in Solomon Iceland which was 2785 cases per 100,000 population (28 and 30).

Deaths from measles occur mainly due to complications of measles. Infants and young children, especially those who are malnourished, are at highest risk of dying.

In Ethiopia, the expected case-fatality rate is between 3% and 6%; the highest case-fatality rate occurs in infants 6 to 11 months of age, with malnourished infants at greatest risk. These rates may underestimate the true lethality of measles because of incomplete reporting of outcomes of measles illness. In certain high-risk populations, case-fatality rates as high as 30% have been reported in infants aged less than 1 year of age. Malnutrition (including vitamin A deficiency), underlying immunodeficiency and lack of access to medical care are all factors leading to the high case-fatality rates observed in many parts of the world. Unless managed early and aggressively, complications may lead to death within the first month after the onset of rash. The case fatality from measles is estimated to be 3%-6% in developing countries but may reach more than 10% in outbreaks especially when it is compounded by malnutrition (1, 8, and 11).

In this study 4% measles case fatality rate (CFR) was recorded. This is higher compared to similar studies conducted in Kebridehar town and Jarar zone of Somali region, Abaya woreda of Borena zone, Guji zone of Oromia region and Sudan findings CFR of 1.8%, 1.2%, 0.4%, 0.2% and 0.9% respectively (17, 25, 26, 27 and 28). This high CFR might be due to delayed detection & notification, insufficient interventions covering all affected kebeles, security problem, unavailability of logistics and supplies and absence of health facilities in recommended distance range. Though it's high the measles case fatality rate (CFR) in this study was within expected range CFR in Ethiopia and sub-Saharan Africa (1, 2).

In this outbreak, eleven kebeles were affected with measles outbreak. An active case search and contact tracing was conducted. This help to identify the source of infection and determine whether other areas have been exposed or not. The index case was seen in chokorsa kebele on September 4, 2018 on 25 year's old unvaccinated female case.

Seventy one percent of measles affected cases had not received measles vaccination. In other similar studies done in the Jarar zone of Somali region, Guji zone, Sudan, LAO, France, USA and Ireland also discovered that 86.2%, 75%, 50.4%, 99.6%, 69%, 65% and 91.2% of affected children by measles outbreak were unvaccinated (17, 18, 25, 26, 31,32 and 33). Vaccination is known to be the main protection against Measles. The recent (2018) measles vaccination coverage was less than 90% (national and WHO target) (1). About 52% of the kebeles vaccination coverage was less than the target (especially those measles affected kebeles). From the total measles cases the highest cases were reported from Chokorsa kebele and the low (62%) routine measles vaccination coverage for 2018 was also reported from this kebele. According to this study findings, there is a strong association between vaccination and the chance of acquiring measles virus. Theory that measles is one of the fist disease to reemerge when vaccination coverage falls. This may reflect if low immunization coverage, as a result more susceptible individuals accumulate and create favorable condition for measles outbreak.

According to WHO health service standard, to increase health seeking behavior of the community health service unit should be available within 5 km radius. If health facilities are available within acceptable range of distance community can utilize the facility and any outbreak can be detected early. In this study distance is one risk factor. Most of the affected group was far from health center by 5km and above. According to bivariate analysis result, there is a strong relationship between

the distance of health center from the household and the chance of getting measles. In other words, when people are far from health center greater than 5 km, there was 5 fold chance of acquiring measles during an outbreak.

There was a relationship between educational status of the parents and the chances of acquiring measles. This study showed that children born from non-educated family were 8.6 time at high risk than those educated one for measles infection during an outbreak. Correspondingly the parents' knowledge about measles transmission and prevention was low; only 25% in both groups knew that measles can be transmitted by inhalation and only 45% knew that the disease could be prevented by vaccination. Similar study conducted in Abaya woreda of Oromia region showed that 45% and 40% knew that measles can be transmitted by inhalation and the disease can be prevented by vaccination respectively (28).

Furthermore, the most powerful relationship was observed for “contact history" which is not surprising given that the virus has a secondary attack rate of more than 90% among susceptible individuals. Due to the high transmission efficiency of measles, outbreaks have been reported in populations where only 3% to 7% of the individuals were susceptible (8, 12 and 27).

Measles was more common in households with more than four child. This could reflect an increased risk of exposure to measles, increased severity of measles or both (28). The association between number of family members more than four in the household and measles was stronger for measles cases transmission. Moreover, the transmission of the measles virus is strongly associated with ventilation of the house. This means a person living in unventilated house has a chance of 4.6 fold acquiring measles than living in ventilated house.

Measles infection is more severe among children who are already malnourished. Moreover, measles may exacerbate malnutrition because of decreased food intake due to malaise, increased metabolic requirements in the presence of fever, or the mistaken belief of parents and health practitioners that a child’s food should be withheld during an acute illness. Under nutrition may lead to or worsen vitamin A deficiency and keratitis, resulting in a high incidence of childhood blindness following measles outbreaks (12). My result showed that, there is strong association between malnourished children and measles cases.

Immunization may not produce protection if the vaccine has been improperly handled. All health posts had no fridge and they take vaccine from the nearest health center on monthly base. However, most of health posts were found in long distance (almost greater than 50 km from the nearest health center) and the topography is challenging. Long distance coupled with hardship topography need more than a day to take vaccine from health center. Because of this reasons the vaccine potency and the cold chain system be questionable. This all factors might contribute to measles outbreak.

1.1.6. Limitation of the study

During the study time of home to home visiting for data collection vaccination card was not available in most of interviewed households. Because of that, vaccination history was taken by simply asking the family. This may introduce bias on the vaccination status.

In the case control study, we used asymptomatic controls, we did not test the controls for measles IgM antibodies and hence this might have led to misclassification bias for controls. However control persons were carefully selected based on the case definition mentioned above.

1.1.7. Conclusion

A prolonged measles outbreak occurred in pastoralists and hard to reach kebeles of Hudet woreda. Infants were primarily affected by the outbreak. The outbreak was confirmed based on laboratory diagnosis. Unvaccinated infants were the most affected segment of the population. The case fatality rate was high but in acceptable range. The crude attack rate was also high. The highest attack rate was reported from Chokorsa kebele of Hudet woreda of Somali region. Late detection and notification, security problem, in adequate logistic and supply, in adequate response covering all affected kebeles and the woredas location far from main road likely contributed to higher attack rate and case fatality rate.

The woreda routine measles vaccination coverage was lower to protect the community. Above half of the woreda kebeles, vaccination coverage was less than 90%. The lowest vaccination report was reported from Chokorsa kebele. On the other hand cold chain management was the major problem in the affected area. There was no functional fridge in all health posts except at health center level.

According to this study findings, low vaccination coverage, poor cold chain management, presence of many family members (greater than four), unventilated housing condition, low community awareness on measles transmissions and prevention, unvaccination and presence of health center at a long distance from households (>5km) were likely contributed for the occurrence of this measles outbreak. In this outbreak all treated cases, were recovered from their illness. This shows that the case management was relatively good. However, the activities performed on community mobilization and providing the key massages for the community to control and prevent the outbreak was weak.

1.1.8. Recommendations

- The woreda should strengthen measles routine immunization activities with the target of reaching more than 90% of infants of 9 to 11 months of age and the coverage should be monitored accordingly in each level.
- The woreda should consider second opportunity as a form of supplemental immunization activities in 2-3 year interval with the routine immunization system to improve population immunity.
- The woreda should consider regular analysis of routine immunization data and taking corrective action to ensure a sustained increase in the coverage of measles vaccination, focusing on unvaccinated communities/children.
- Social mobilization campaigns should be conducted to inform parents and community leaders about the importance of obtaining measles vaccination as soon as possible before one year age.
- Attention should be given for cold chain and functional fridge should be established for hard to reach health posts (specially affected kebeles).
- The woreda should give particular emphasis to hard to reach areas to enhance the current immunization service.
- The woreda should boost the immunization status of schoolchildren is essential for preventing and controlling measles outbreaks.

References

1. Ethiopian public health institute (EPHI). Guideline on measles surveillance and outbreak management 4th edition, December 2016 Addis Ababa Ethiopia.
2. Mark A. Miller and John T. Sentz. Disease and Mortality in Sub-Saharan Africa, Chapter 12 Vaccine Preventable Diseases, 2nd edition, 2006.

3. Public Health Agency of Canada, guidelines for the prevention and control of measles outbreaks in Canada, October 2013.
4. World Health Organization, Measles and Rubella Strategic Plan, 2014

5. World Health Organization, Measles epidemiological record, NOVEMBER 2018, 93th year / November 2018.

7. Akalu HB. Review on Measles Situation in Ethiopia 2015; Past and Present. J Trop Dis 4: 193.

8. World Health Organization, Global Report on Measles and Rubella, 2014

9. Tikelaye Kidane, Mikceal Teki. Factors Influencing Child Immunization Coverage in a Rural District of Ethiopia, Ethiopian Journal of Health Development, 2000

10. Mekonen Getahun, Berhane Beyene, Ayesheshem Ademe, Birke Teshome, Mesfin Tefera, Anjelo Asha, Aklog Afework, Yoseph HaileMariyam, Esete Assefa, and Kathleen Gallagher. Epidemiology of laboratory confirmed measles virus cases in Amhara Regional State of Ethiopia, 2004–2014.
11. Geneva WHO. Manual for the Laboratory Diagnosis of Measles and Rubella Virus Infection. 2007.
12. Simons E FM, Fricks J, et al. Assessment of the 2010 global measles mortality reduction goal: results from a model of surveillance data. PubMed April 24.
13. WHO. Immunization, Vaccines and Biologicals 2014.
14. RC Fernandez NA, A Rammohan. Determinants of apparent rural-urban differentials in measles vaccination uptake in Indonesia. 2011.
15. WHO/AFRO. Measles elimination in Africa. 2009.
16. World Health Organization Rofs-eA. Measles and Rubella Surveillance and outbreak investigation guideline 2009.
17. Ketema Belda, Ayesheshem Ademe Tegegne, Amare Mengistu Mersha, Mekonnen Getahun Bayenessagne, Ibrahim Hussein, Belay Bezabeh. Measles outbreak investigation in Guji zone of Oromia region, Ethiopia. The Pan African Medical Journal. 2017.
18. Preeta Kutty, Jennifer Rota, William Bellini, Susan B. Redd, Albert Barskey, Gregory Wallace, Vaccine Preventable Diseases Surveillance Manual, 6th Edition, 2013.

19. Tariq Khan, Javaria Qazi. Measles Outbreaks in Pakistan: causes of the tragedy and future Implications, Herbert Open Access Journal Epidemiology Reports 2014.

20. Central Statistical Agency (CSA) of Ethiopia. Summary and statistical report of the 2007 population and housing census. Addis Ababa, Ethiopia: CSA; 2008.

21. Amare Mengistu Mersha, Fiona Braka, Kathleen Gallagher, Aysheshim Ademe Tegegne, Aron Kassahun Argay, Mekonnen Admassu Mekonnen, Merawi Aragaw, Debritu Mengesha Abegaz, Etsehiwot Zeamlak Worku, Mekonen Getahun Baynesagn**.** Measles burden in urban settings: characteristics of measles cases in Addis Ababa city administration, Ethiopia, 2004-2014.
22. Munira Nasser Hassen, Abyot Bekele Woyessa, Mekonen Getahun, Berhane Beyene, Lucy Buluanger, Ayesheshem Ademe, Alemayehu Bekele, Adamu Addissie, Amha Kebede and Daddi Jima. Epidemiology of measles in the metropolitan setting, Addis Ababa, Ethiopia, 2005–2014: a retrospective descriptive surveillance data analysis.
23. Misganu Endriyas, Tarekegn Solomon, Bekele Belayhun and Emebet Mekonnen. Poor quality data challenges conclusion and decision making: timely analysis of measles confirmed and suspected cases line list in Southern Nations Nationalities and People's Region, Ethiopia.
24. Robert Kaos Majwala, Lydia Nakiire, Daniel Kadobera, Alex Riolexus Ario, Joy Kusiima, Joselyn Annet Atuhairwe, Joseph K. B. Matovu and Bao-Ping Zhu. Measles outbreak propagated by children congregating at water collection points in Mayuge District, eastern Uganda, July-October, 2016.
25. Fa´ tima Coronado, Nisreen Musa, El Sayed Ahmed El Tayeb, Salah Haithami, Alya Dabbagh, Frank Mahoney, Robin Nandy and Lisa Cairns. Retrospective Measles Outbreak Investigation: Sudan, 2004.
26. Yusuf Mohammed and Ayalew Niguse. Measles Outbreak Investigation and Response in Jarar Zone of Ethiopian Somali Regional State, Eastern Ethiopia, 2017.
27. Yusuf Mohammed. Measles Outbreak Investigation & Response; Kebridehar Town, Ethiopia Somali Region, November 2013.
28. Birhanu Reda. Investigation of Measles outbreak –Abaya woreda, Borena zone, South Eastern Oromia, Ethiopia 2013.
29. World Health Organization. Measles supplementary immunization activities (SIAs)* and the delivery of other child health interventions, by region and country; African, Eastern Mediterranean, European, South-East Asia, and Western Pacific Regions, 2017.
30. Jason Diau,a Christopher Jimuru,a James Asugeni,a Lyndell Asugeni,a Mike Puia,a John Maomatekwa, Humpress Harrington, David MacLaren, Rick Spearecd and Peter D Masseye. Measles outbreak investigation in a remote area of Solomon Islands, 2014.
31. Bounthanom Sengkeopraseuth, Bouaphanh Khamphaphongphane, Phengta Vongphrachanh, Anonh Xeuatvongsa, Sisouveth Norasingh, Chansay Pathammvong, Manilay Phengxay, Phanmanisone Philakongd and Siddhartha Sankar Dattad. Analysing the characteristics of a measles outbreak in Houaphanh province to guide measles elimination in the Lao People's Democratic Republic 2014.
32. Anne Bernadou1, Cyril Astrugue1, Matthieu Mechain, Valerie Le Galliard, Catherine Verdun-Esquer, France Dupuy, Julia Dina,Fatima Ait-Belghiti, Denise Antona, Stephanie Vandentorren.

Measles Outbreak linked insufficient vaccination coverage in Nouvelle Aquitine region, France, October 2017 July 2018.
33. Peter Barrett1, Suzanne Cotter, Fiona Ryan1, Jeff Connel, Anthony Cronin1, Mary Ward, Rose Fitzgerald[5], Catherine Lynch, Tony Margiotta. A national measles outbreak in Ireland linked to a single imported case April to September 2016.
34. Shahrokh Izadi, Seyed-Mohsen Zahraie2 and Majid Sartipi. An Investigation into a Measles Outbreak in Southeast Iran 2012.
35. Fred Nsubuga, Lilian Bulage, Immaculate Ampeire, Joseph K. B. Matovu, Simon Kasasa, Patricia Tanifum, Alex Ario Riolexus and Bao-Ping Zhu. Factors contributing to measles transmission during an outbreak in Kamwenge District, Western Uganda, April to August 2015.
36. Kasidet Manakongtreecheep and Robert Davis. A review of measles control in Kenya, with focus on recent innovations, The Pan African Medical Journal. 2017.
37. Yu Hu, Ying Wang, Yaping Chen, Hui Liang and Zhiping Chen. Measles vaccination coverage, determinants of delayed vaccination and reasons for non-vaccination among children aged 24–35 months in Zhejiang province, China, 2018.
38. Rita Sá Machado, Mariana Perez Duque, Soraia Almeida, Ivo Cruz, Ana Sottomayor, Isabel Almeida, Júlio R Oliveira, Delfina Antunes. Measles outbreak in tertiary level hospital in Porto, Portugal: Challenges in post-elimination era.
39. Goncalo Figueiredo Augusto, Diogo Cruz, Andreia Silva, Natalia Pereira, Barbara Aguiar, Ana Leca, Elisabete Serrada, Paula Valente, Teresa Fernandes, Fernando Guerra, Paula Palminha, Elsa Vinagre, Silvia Lopo, Rita Cordeiro, Emma Saez-Lopez, Maria Neto, Paulo Jorge Nogueira, Graca Freitas. Challenging Measles case definition, three Measles outbreaks in three Health regions of Portugal, February to April 2018.

1.2. Challenges of imported cholera cases among deportees in Ethiopia: from Saudi Arabia prisons, March 2019.

Abstract

Introduction: Cholera is an acute, diarrheal illness which leads to epidemic a high rate of mortality. The aim of this study is to investigate imported cholera epidemic and describe it by person, place and time in deportees' of prisoners from Saudi Arabia in Ethiopia.

Method: We conducted a descriptive cross sectional study in Addis Ababa, from June 12, 2018 to March 16, 2019. We used standard case definition to identify imported cholera cases. We reviewed medical record and laboratory findings. All collected data were entered and analyzed using Microsoft excel 2013. Ethiopian Public Health Institute gave the directive and approval to investigate, respond and contain the outbreak locally.

Result: From June 12, 2018 to March 16, 2019; the investigation team screened 37,380 deportees from Saudi Arabia and identified 260 suspected imported cholera cases. The overall attack rate was 7 cases per 1000 populations. There was no death. The median age of the affected deportees was 21 years with a range of 13 to 65 years. 93% of the cases were male and most cases were in the age group of 15-44. 65/170 (38.2%) of samples were positive for *vibrio cholerae* by rapid diagnostic test (RDT). For 65 RDT positive cases stool culture were sent to national reference laboratory. Accordingly, 16 out of 65 or 24.6% of samples were positive for *vibrio cholerae* O1 serogroup and Ogawa serotype. Sixteen out of total 260 cases or 6% of cases were confirmed cases and the remaining cases were epidemiologically linked.

Conclusion and recommendations: A confirmed cholera outbreak due to imported cases identified in Addis Ababa. This outbreak prompts the need for increased local public health capacity to apply prevention and control strategies.

We recommend to the public health emergency management unit to strengthen cholera screening in the entry points and cross border responses.

Key words: Cholera, outbreak, Imported, Investigation, Addis Ababa, Ethiopia, 2019.

1.2.1. Introduction

1.2.1.1. Background

Cholera is an acute, diarrheal illness caused by infection of the intestine with the toxigenic bacterium Vibrio cholerae serogroup O1 or O139. Cholera is one of the major epidemic diseases in Ethiopia and resulted, in times of the worst outbreaks, in a high rate of mortality. The disease caused by infection of the intestine with the gram-negative bacteria. Both children and adults can be infected. It is one of the key indicators of social development and remains a challenge to countries where access to safe drinking water and adequate sanitation cannot be guaranteed (1, 2 and 3).

Cholera is transmitted by the fecal-oral route. About 20% of those who are infected develop acute, watery diarrhea 10–20% of these individuals develop severe, watery diarrhea with vomiting. If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts (more than 10-20 liters/day in severe forms) can lead to severe dehydration and death within hours. The case-fatality rate in untreated cases may reach 30–50%.Treatment is straightforward (basically rehydration) and, if applied appropriately, should keep the case-fatality rate below 1% (1 and 2).

Cholera prevention and control remains a public health priority as the case fatality rate may go up to 50%. In approximately 90% of cholera cases, the disease is mild and it is difficult to differentiate from other diarrheal diseases. It is therefore important for all the stakeholders in cholera prevention and control to use correct intervention strategies useful in curbing the epidemic (2).

Cholera, largely eliminated from industrialized countries by water and sewage treatment over a century ago, still remains a significant cause of illness and death in many African countries. In the twenty-first century, sub-Saharan Africa bears the brunt of global cholera. The region is broadly affected by many cholera cases and outbreaks that can spread across countries. The percentage of people who die from reported cholera cases remains higher in Africa than elsewhere. This reflects the lack of access to basic health care because of cholera's simple treatment of rehydration therapy (3).

Cholera has been prevalent worldwide since the early 19th century and the world is currently in the so-called 7th pandemic. The number of cholera cases has steadily risen worldwide due to cholera

outbreaks. The world health organization (WHO) estimates that globally 3-5 million cases and 100 000-120 000 deaths occur annually. This disease is endemic in sub-Saharan African countries (2). An estimated 2.9 million cases and 95,000 deaths occur each year around the world (3).

Over the past two decades, the incidence in sub-Saharan Africa has remained the same. In 2009, 98% of 221 226 cholera cases and 99% of 4946 cholera deaths reported to the World Health Organization (WHO) occurred in sub-Saharan Africa. CFR for all parts of the world outside of Africa has been below 0.4% since 2002, the overall CFR for Africa in 2009 was 2.3% (4).

Ethiopian Public Health Institute reported about 2,145 (nationally) and 25 (in Addis Ababa) suspected AWD cases as of 12 June 2016. In week 15 (week ending 16 April 2017), a total of 2,388 suspected cases of AWD/cholera were reported in Afar, Amhara and Somali regions of the country. While some decline has been observed in the trend in the last weeks [4,200 cases in week 14; 4,104 cases in week 13; 4,358 cases in week 12], Somali region remains the most affected, accounting for 99% of the new cases reported in the reporting week. On 20 April 2017, WHO elevated the outbreak of AWD/cholera and the humanitarian crisis in Ethiopia to grade 3 emergency. Since the beginning of 2017, a total of 37,459 cases including 784 deaths (case fatality rate 2.1%) have been reported from six regions of Somali, Oromia, Amhara, Afar, SNNP and Tigray. Eighty-nine percent of the reported cases and 96% of the deaths were reported in Somali Region alone (8).

In January 2018, nine regions in Ethiopia have been affected, and 73.6% of the total cases are from Somali region. Between January and December 2017, a cumulative total of 48,814 cases and 880 deaths (CFR 1.8%), have been reported from 9 regions. In 2018 only, a total of 98 cases have been reported from two regions, Somali and Dire Dawa regions. From week 1 to 23, 2018, a total of 728 cases with 18 deaths (CFR-2.5%) has been reported from the following regions: Somali (136 cases), Afar (537 cases with 18 deaths), Tigray (38 cases), and Dire Dawa City Administration (17 cases). A total of 3,090 cases have been reported in 2018 (8).

On 12th June 2018, Saudi airlines notified FMHACA about massive deportees from Saudi Arabia. FMHACA in turn notified the situation to Ethiopian Public health Institute (EPHI). Then EPHI deployed team of residents to screen deportees' for any communicable disease at Bole international airport. We detected a number of suspected cholera cases which later confirmed by lab test for cholera and we initiated investigation and response.

1.2.1.2. Statement of the problem

Cholera is an extremely virulent disease that can cause severe acute watery diarrhea. Cholera affects both children and adults and can kill within hours if untreated. It can cause devastating epidemic or even pandemic in short time. The case fatality rate may exceed 50% if left untreated. During the 19th century, cholera spread across the world from its original reservoir in the Ganges delta in India. Six subsequent pandemics killed millions of people across all continents. The current (seventh) pandemic started in South Asia in 1961, and reached Africa in 1971 and the Americas in 1991. Cholera is now endemic in many countries. Cholera can be life-threatening but it is easily prevented and treated (1, 2).

The world health organization (WHO) estimates that globally 3-5 million cases and 100,000-120,000 deaths occur annually in ninetieth century (2).
In 2018 an estimated 2.9 million cases and 95,000 deaths occur each year around the world. The infection is often mild or without symptoms, but can sometimes be severe (3).

Cholera, largely eliminated from industrialized countries by water and sewage treatment over a century ago, still remains a significant cause of illness and death in many African countries. In the twenty-first century, sub-Saharan Africa bears the brunt of global cholera. The region is broadly affected by many cholera cases and outbreaks that can spread across countries. The percentage of people who die from reported cholera cases remains higher in Africa than elsewhere. This reflects the lack of access to basic health care because of cholera's simple treatment of rehydration therapy. Many African countries face the dual challenges of improving both cholera treatment access to basic health care, and prevention improved water and sanitation systems (3).

In 2009, 98% or 221, 226 cholera cases and 99% or 4946 cholera deaths reported to the World Health Organization (WHO) occurred in sub-Saharan Africa. A recent article, based on the analysis of 632 reports of cholera outbreaks worldwide, has shown that 87.7% of cholera cases occurred in sub-Saharan Africa (4).

According to EPHI's database since 2015 every year there were reports of cholera outbreaks from all regions including the metropolitan Addis Ababa except Gambella region of the nation. The path of the outbreak was it starts from Moyale Town/woreda which borders Kenya then to Arbamich Town and Arbamich zuria woreda to Addis Ababa. After Addis Ababa, the metropolis, have infected the outbreak spread to all the remaining regions. This time, on 20 April 2017, WHO elevated the outbreak of AWD/cholera and the humanitarian crisis in Ethiopia to grade 3 emergency. Since the beginning of 2017, a total of 37,459 cases including 784 deaths (case fatality rate 2.1%) have been reported from six regions of Somali, Oromia, Amhara, Afar, SNNP and Tigray. Eighty-nine percent of the reported cases and 96% of the deaths were reported in Somali Region alone (8).

In January 2018, nine regions in Ethiopia have been affected, and 73.6% of the total cases are from Somali region. Between January and December 2017, a cumulative total of 48, 814 cases and 880 deaths (CFR 1.8%), have been reported from 9 regions.

1.2.1.3. Significance of the study

Imported cholera outbreak was uncommon in Ethiopia in previous years. Cholera is a notifiable disease condition that needs immediate verbal reporting on clinical Suspicion within 30 minutes to the next higher level; within maximum of 2 hours should reach EPHI. Even a single cholera case is considered as an outbreak. Investigation of suspected and confirmed imported cholera outbreaks and responding to this outbreak is important in order to contain the outbreak locally before spreading to other regions. Deportees were from all regions of the nation so investigating and responding to such outbreak is mandatory to contain the outbreak. If it was not investigated and responded, it would became source of local infection and source of outbreak.

According to WHO update as of April 8, 2019, Yemen was experiencing the worst cholera epidemic since 2016; reporting more than 10,000 cases per week or a total 1.3 million cholera cases recorded. In 2019, 195,000 suspected cases of cholera have been registered in Yemen since January 1 of this year, while more than 3,000 people have died of the disease since 2016. Amanat Al Asimah, Ibb, Sanaa, Dhamar and Taizz, Al Hudaydah and Arman governorates were affected.

This deportees went through Afar region of Ethiopia to Djibouti, then Yemen to Saudi Arabia as illegal migration to find job and better life. They all have history of travel to Yemen and stay sometimes on the way to Saudi Arabia. Commonly they caught at Yemen and Saudi Arabia border area on the way to Saudi Arabia and sent to Gyzan prisons. Named as Gyzan 1, Gyzan 2, Gyzan 3 and Gyzan 4. These illegal migrants were deported to Ethiopian. So screening deportees at point of entry (Bole international airport), identifying imported cholera cases, investigating and responding to this outbreak is mandatory.

Local capacity to detect (diagnose) and monitor (collect, compile, and analyze data) cholera occurrence, is central to an effective surveillance system and to planning control measures. Countries affected by cholera are encouraged to strengthen disease surveillance and national preparedness to rapidly detect and respond to outbreaks.

1.1.2. Literature Review

AWD outbreak is still ongoing in 10 woredas in six zones of Oromia and Somali regions. By week 20, a total of 1,884 AWD cases and 19 deaths had been reported. During the same week, a new area, Dolo Bay woreda in Somali region was affected. (WHO, 27 May 2016)

Since the Federal Ministry of Health confirmed the first two AWD cases on 9 June, the number of confirmed cases are increasing. The Ethiopian Public Health Institute reported about 2,145 (nationally) and 25 (in Addis Ababa) suspected AWD cases as of 12 June 2016. The Addis Ababa Health Bureau and partners launched an AWD response plan to curb the spread of the outbreak. OCHA, 20 Jun 2016

In week 15 (week ending 16 April 2017), a total of 2,388 suspected cases of AWD/cholera were reported in Afar, Amhara and Somali regions of the country. While some decline has been observed in the trend in the last weeks [4,200 cases in week 14; 4,104 cases in week 13; 4,358 cases in week 12], it is still premature to deduce overall improvement in the situation on the ground, especially with the weak surveillance system. Somali region remains the most affected, accounting for 99% of the new cases reported in the reporting week. On 20 April 2017, WHO elevated the outbreak of AWD/cholera and the humanitarian crisis in Ethiopia to grade 3 emergency. This new grading enables the organization to leverage its global capacity and scale up the response to the outbreak and the humanitarian crisis. (WHO, 21 Apr 2017)

There was a decrease in the number of AWD cases reported in week 24 (week ending 18 June 2017): a total of 661 cases were reported from the three regions compared to 1,080 cases reported in week 23 (week ending 11 June 2017). Since the beginning of 2017, a total of 37,459 cases including 784 deaths (case fatality rate 2.1%) have been reported from six regions of Somali, Oromia, Amhara, Afar, SNNP and Tigray. Eighty-nine percent of the reported cases and 96% of the deaths were reported in Somali Region alone. (WHO, 23 Jun 2017)

The AWD outbreak situation continues to improve. During week 27 (week ending 9 July 2017), 275 new AWD cases were reported from the three regions of Somali (149), Oromia (68) and Amhara (58). Since the beginning of 2017, 38,715 cases including 797 deaths (case fatality rate 2.1%) have been reported from the seven regions of Somali, Oromia, Amhara, Afar, SNNP, Tigray, and Benishangul Gumuz. Eighty-eight percent of the cases and 94% of the deaths were reported in Somali Region alone (WHO, 17 Jul 2017).

A 27 per cent increase in the number of [AWD] cases was reported nationwide last week, mainly due to spikes in new cases reported in Amhara and Tigray regions and a resurgence of the outbreak in Afar region where community transmission of the disease is widespread. Currently, the major risk factors for the spread of the outbreak are holy water sites where large numbers of Christian pilgrims congregate from around the country, especially in Amhara and Tigray, and seasonal mobility of daily laborers to commercial farms. The high risk for further spread of the AWD outbreak continues due to the degradation of health determinants on the back drop of overburdened local health systems, including inadequate access to safe drinking water and internal and cross-border movements (OCHA, 03 Sep 2017).

AWD cases continue to be reported from Afar, Amhara, Tigray and Oromia regions mainly from religious sites and commercial farms that have poor sanitation facilities and limited access to clean water. Somali region also continues to report AWD cases although at a reduced rate. With the ongoing rains, increased numbers of AWD cases are expected in the coming weeks; particularly in Amhara, Benishangul-Gumuz, Oromia and SNNP regions. (UNICEF, 20 Sep 2017)

The outbreak is showing a downward trend. Only 61 new cases have been reported this week from 4 regions, and the majority of new cases are from Amhara and Somali regions. As of now, 9 regions in Ethiopia have been affected, and 73.6% of the total cases are from Somali region (WHO, 09 Dec 2017).

Only 11 new cases have been reported this week from 4 regions: Amhara, Somali, Dire Dawa and Benishangul-Gumuz regions. Nine regions in Ethiopia have been affected, and 73.6% of the total cases are from Somali region (WHO, 05 Jan 2018).

Between January and December 2017, a cumulative total of 48 814 cases and 880 deaths (CFR 1.8%), have been reported from 9 regions. In 2018 only, a total of 98 cases have been reported from two regions, Somali and Dire Dawa regions (WHO, 02 Mar 2018).

In most parts of the country, the situation has stabilized, however, Afar region is experiencing an increase in cases which began since week 18. In week 23, 233 cases were reported, all of which are from Afar region. From week 1 to 23 2018, a total of 728 cases with 18 deaths (CFR-2.5%) has been reported from the following regions: Somali (136 cases), Afar (537 cases with 18 deaths), Tigray (38 cases), and Dire Dawa City Administration (17 cases) (WHO, 29 Jun 2018).

A total of 1407 cases of [AWD] have been reported since June 2018 in Tigray region, affecting some 34 woredas. Currently the number woredas reporting AWD cases is reduced to 16 and 80 per cent of the cases are from four woredas. Central zone and Mekelle have the majority of cases but now it is shifting to Western zone. This week there were 64 patients of which 43 per cent are from Western zone, 35 per cent in Mekelle. Risk factors are mainly due to untreated water consumption which accounts to 70 per cent of the total factors. Government and partners are distributing water treatment chemicals and health supplies, but needs surpass resources being availed. High operational cost for response, low involvement of sectors and low level of response by most partners are among the critical challenges to AWD response in the region. Meanwhile trend of AWD cases is decreasing in all Woredas of Afar region. However, the regional AWD command post identified that provision of safe drinking water remains a major gap in all affected woredas (OCHA, 19 Sep 2018).

In 2018, cases have been reported from five regions, namely; Oromia, Dire Dawa, Somalia, Tigray and Afar. There has been a general decline since the peak in week 33 when more than 500 cases were reported. In week 41(ending 14 October 2018), 48 cases of AWD were reported from two regions: Oromia (7) and Tigray (41) (WHO, 19 Oct 2018).

No new cases of AWD were reported in the existing hotspots on weeks 46 and 47. In total, 3 090 cases have been reported in 2018 (WHO, 30 Nov 2018).

1.2.3. Objective

1.2.3.1. General objective

To describe epidemiology of cholera by person, place, time**,** identify cases at point of entry and link them to cholera treatment center in deportees' of prisoners from Saudi Arabia in Ethiopia 2019.

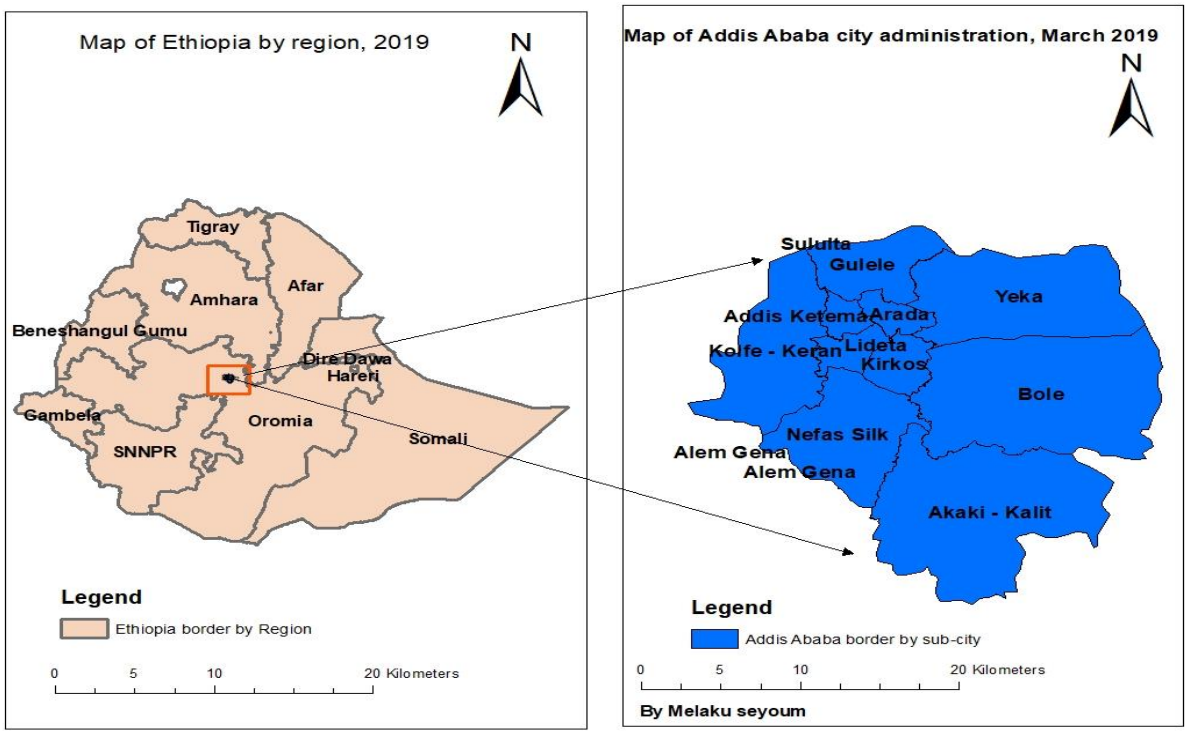
1.2.3.2. Specific objectives

- To describe epidemiology of imported cholera cases in deportees by Time.
- To describe epidemiology of imported cholera cases in deportees by person.
- To describe epidemiology of imported cholera cases in deportees by place.
- To identify imported cholera cases at point of entry and link them to CTCs.

1.2.4. Method

1.2.4.1. Study Area

The study was conducted in Addis Ababa Bole international airport. Addis Ababa is the capital city of Ethiopia which is governed by the City Council. The population of the city is 3,433,999 according to Central Statistical Agency report. The city serves as the seat for many national and international organizations and diplomats, including the African union. The City Government Health Bureau is responsible for leading the health sector in the city. Under the Regional Health Bureau, the Public Health Emergency Management (PHEM) Sub-Process within the Public Health Research and Emergency Management (PHREM) core process is responsible for managing health emergencies. PHEM has a multi hazard approach comprised of four case teams, which are public health emergency preparedness, early warning, response, and recovery that focuses on anticipating, preventing, preparing for detecting responding to, controlling and recovering from the consequences of public health threats in order that health and economic impacts are minimized.



Map 2: showing study area, Addis Ababa city Administration, Ethiopia, 2019

1.2.4.2. Study period

The study was conducted from June 12, 2018 to March 16, 2019.

1.2.4.3. Study Design

We applied a descriptive cross sectional study design.

1.2.4.4. Case Definition

Suspected case: In a patient age 5 years or more, with severe dehydration or death from acute watery diarrhea.
If there is a cholera epidemic, a suspected case is any person age 5 years or more with acute watery diarrhea, with or without vomiting.
Confirmed cases: A suspected case in which Vibrio cholerae O1 or O139 has been isolated in the stool.

1.2.4.5. Data Collection Tools and Procedures

We used standard case definition to identify cases from returnees/ deportees. All suspected cases were referred to cholera treatment center (CTC) after filling a line list. At CTC samples were collected for confirmation.

We reviewed medical record of cases at CTCs and laboratory finding from the reference laboratory. We discussed with health professionals which attended medical care of cases and Addis Ababa health bureau officials, EPHI officials, partners.

1.2.4.6. Operational definition

The following terms are used in the study:
A laboratory confirmed case: - is a suspected case in which Vibrio cholerae O1 or O139 has been isolated in the stool.
Epidemiologically linked case: - is a suspected case, which has contacts (possibly got the bacteria) with laboratory confirmed case or another epidemiologically linked case.

Imported case: - a case of cholera that was acquired in a place other than where the cases was detected and reported.

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

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

Case/outbreak confirmation: refers to the epidemiological or laboratory capacity for confirmation.

Rumor of cholera: information about an alleged case of cholera obtained from any source (informants).

1.2.4.7. Data Quality Assurance

Before analysis, line listed data was cleaned, checked for any missing and miscoded or wrongly entered data.

1.2.4.8. Data Analysis

All collected data were entered and analyzed using Microsoft excel 2013.

1.2.4.9. Ethical Consideration

Ethiopian Public Health Institute gave the directive and approval to investigate, respond and contain the outbreak locally. Verbal informed consent was obtained from participants. In addition, any information related with personal identification was not used on the report. Cases were also referred to CTC for medical care.

1.2.4.10. Dissemination Plan

This study report was submitted to Ethiopian Public Health Institute, Addis Ababa University School of Public Health Department of field epidemiology, Addis Ababa health bureau public health emergency management unit.

1.2.5. Result

1.2.5.1. Descriptive Epidemiology

By Person

From June 12, 2018 to March 16, 2019 (10 months), which is considered as epidemic period, we have screened 37,380 deportees from Saudi Arabia prisons and identified 260 imported cholera cases. Among these suspected cases 170 stool samples were taken and 65(38%) were positive for vibrio cholera by rapid diagnostic test (RDT). For RDT positive cases stool culture identified and transported to national reference laboratory to identify the etiologic agent and confirm the outbreak. Accordingly, 16 out of 65(24.6%) of samples were positive for vibrio cholerae O1 serogroup and Ogawa serotype. Sixteen out of total 260 cases or 6% of cases were confirmed cases and the remaining cases were epidemiologically linked.

The median age of the affected deportees was 21 years with a range of 13 to 65 years. Ninety three percent of the cases were male and 96.2% of cases were in the age group of 15-44 years. Figure 2 & 3.

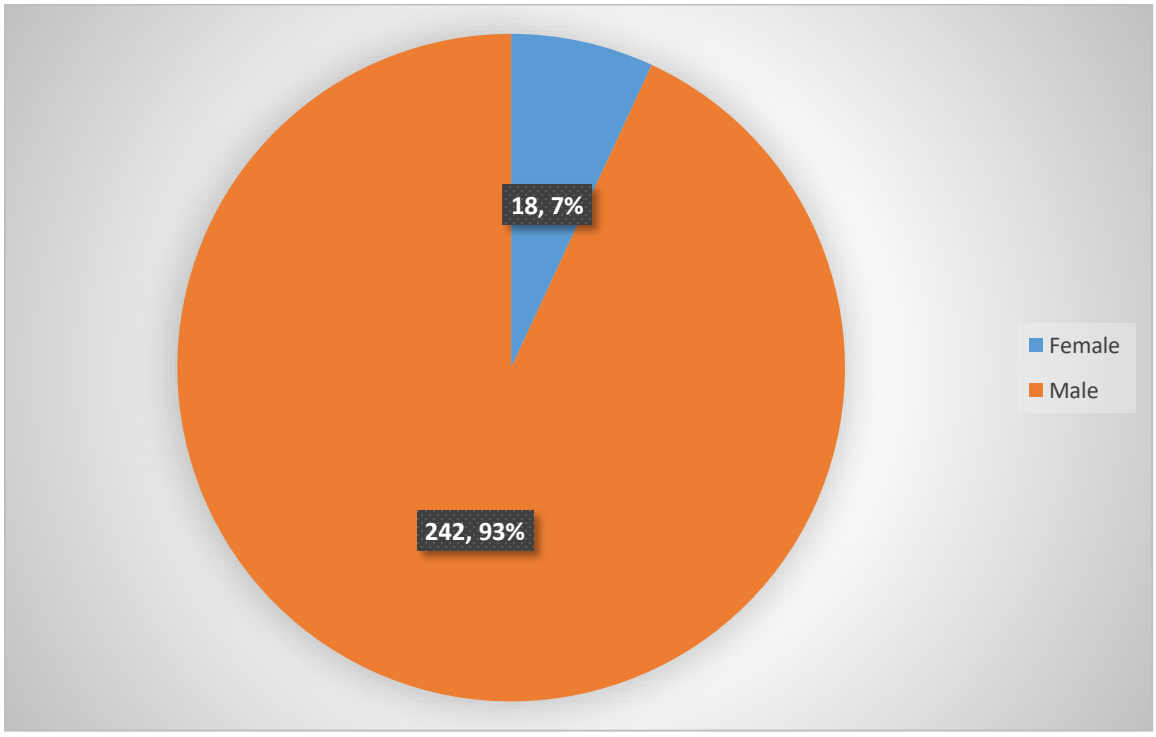


Figure 2: Distribution of cholera cases by sex, Addis Ababa, Ethiopia, from June 2018- March 2019.

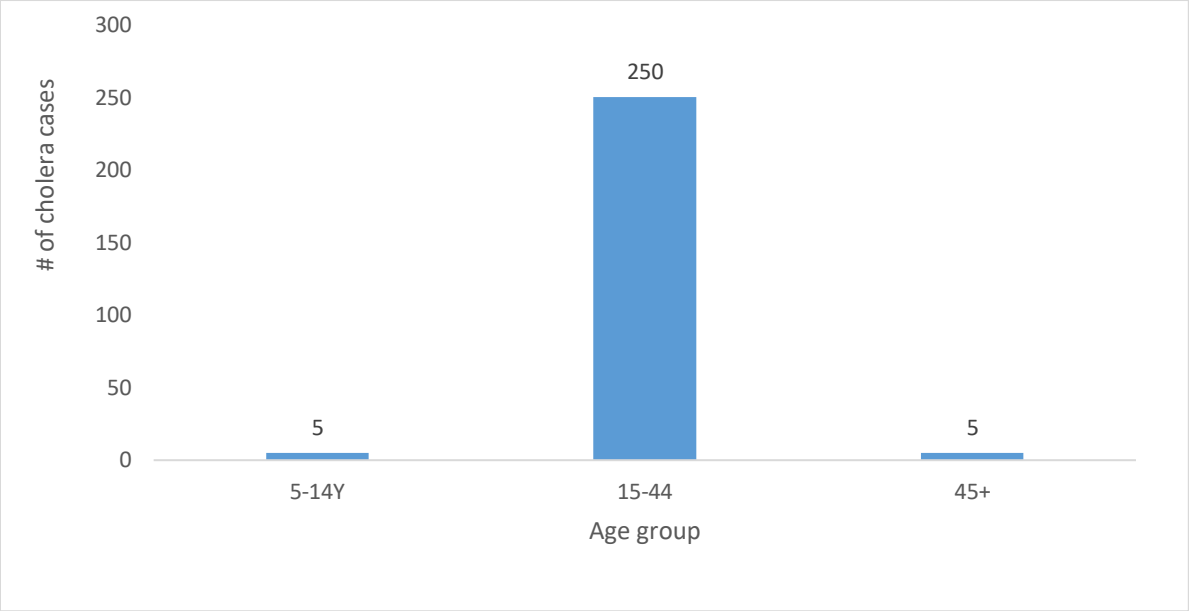


Figure 3: Distribution of cholera cases by age group, Addis Ababa, Ethiopia, from June 2018-March 2019.

The overall attack rate (AR) of the case was 70 cases per 10,000 populations (considering total deportees as denominator or as total population). There was no death and all cases were treated inpatient.

215(83%) of cases have presented with watery diarrhea and 50 (19%) presented with vomiting. 203(78%) of cases were classified as some dehydration and 97% of cases have travel history to cholera affected area (Table 11).

Table 11: Sign and symptom, type of case, laboratory result, DHN status and travel history of cases, Addis Ababa, Ethiopia from June 2018- march 2019.

S.No.	Variables	Number of cases	Percentage
1	**Watery diarrhea**		
	No	45	17%
	Yes	215	83%
	Total	260	100%
2	**Vomiting**		
	No	210	81%
	Yes	50	19%
	Total	260	100%
3	**Sample taken**		
	No	90	35%
	Yes	170	65%
	Total	260	100%
4	**RDT result**		
	Negative	105	62%
	Positive	65	38%
	Total samples taken for RDT	170	100%
5	**Culture result**		
	Negative	49	75.4%
	Positive	16	24.6%
	Total samples taken for culture	65	100%
6	**Type of case**		
	Confirmed	16	6%
	Suspected	244	94%
	Total	260	100%
7	**Dehydration status**		
	No DHN	54	21%
	Some DHN	203	78%
	Severe DHN	3	1%
	Total	260	100%
8	**Travel history to cholera outbreak affected area**		
	No	9	3%
	Yes	251	97%
	Total	260	100%

By Time

Date of onset occurred between June 02, 2018 and March 13, 2019 was presented in figure 4. The outbreak continued for about 10 months and still ongoing as deportees came to Ethiopia. The peak of the outbreak was reached on 9th June 2018 with 14 suspected cases. As depicted on epidemiologic curve there were multiple peaks as it was ongoing outbreak.

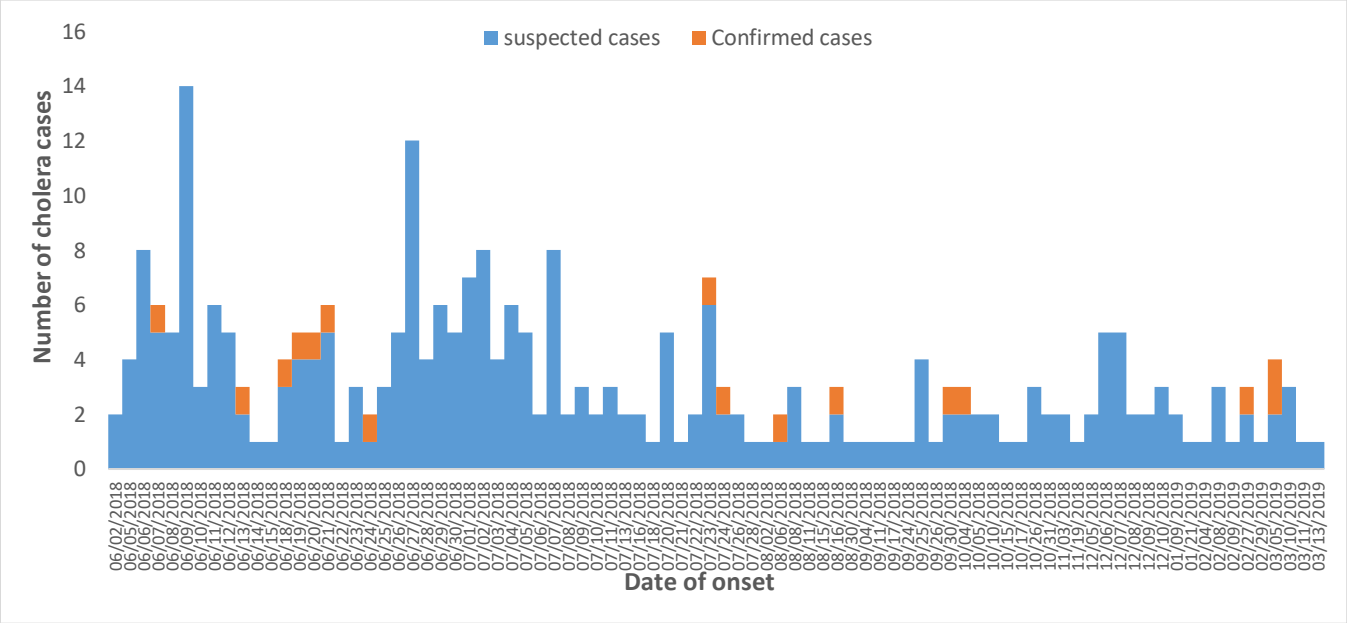


Figure 4: Epidemiologic curve showing suspected and confirmed imported cholera cases by date of onset, Addis Ababa, Ethiopia from June 2018- March 2019.

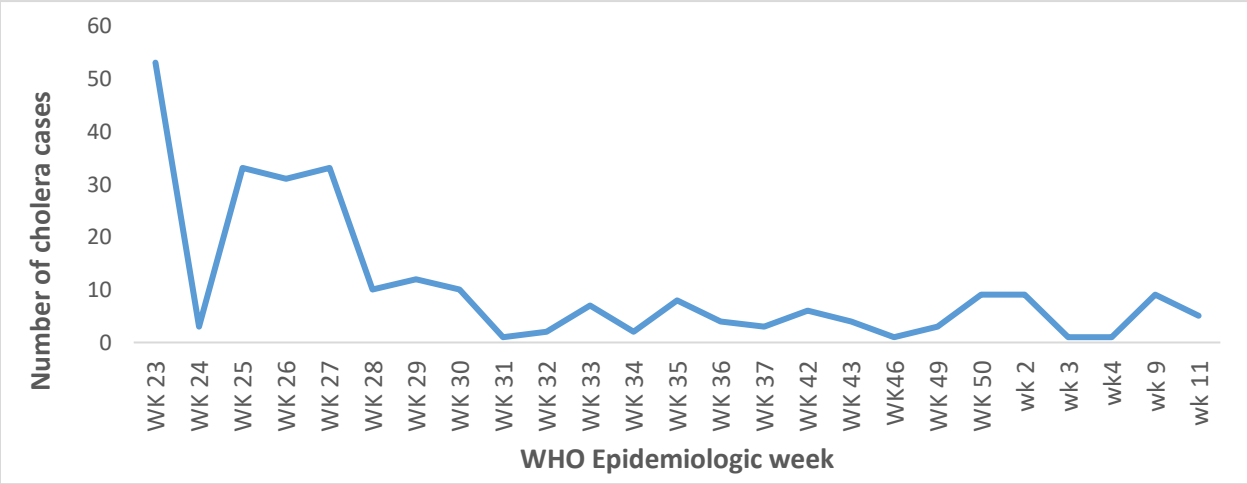


Figure 5: Distribution of cholera cases by WHO epidemiologic week, Addis Ababa, Ethiopia from June 2018- March 2019.

Table 12: Distribution of cholera cases by month, Addis Ababa, Ethiopia from June 2018- March 2019.

Months	Number of cases	Percentage
January	10	3.8%
February	1	0.4%
March	14	5.4%
June	120	46.2%
July	66	25.4%
August	9	3.5%
September	16	6.2%
October	11	4.2%
November	1	0.4%
December	12	4.6%
Total	260	100.0%

In 2018, we identified 235(90%) of cases and the remaining 25(10%) in the first three months of 2019. One hundred twenty (46.2%) of the cases were reported in June 2018 (table 12).

By Place

All cases/ deportees were from Saudi Arabia prison/Gyzan 1-4/ and has history of travel through Djibouti and Yemen as illegal migration; both were cholera affected countries at that time.

1.2.5.2. Intervention undertaken to contain the outbreak locally

Rapid response team activated, cholera treatment centers (CTCs) established, training provided to health workers, resources availed and a screening team was deployed to bole international airport to deportees from Saudi Arabia prison. All suspected cases were treated by the cases management team members and daily follow up of cases was also done by the same team members. All cases were classified and admitted to different wings of CTCs based on their dehydration status.

EFETP residents from AAU and SPMMC were assigned to take history and use the case definition to identify cases at Bole international airport and link cases to CTCs. In addition Addis Ababa health bureau also assigned health professionals like nurses and medical doctors to assist screening.

Environmental Investigation

The infection prevention team assessed the overall cleanliness and suitability of the CTCs. The team also observed the availability of infection prevention supplies and communicated the gaps with other team members.

Technical Working Groups establishment

- The following Technical Working Groups were established and functional as per national cholera outbreak management TOR:

  A. Case management team

  B. Surveillance team (Disinfection, Contact tracing and Active case search)

  C. Social mobilization team

  D. WASH team

  E. Logistics and human resource management team

  F. Monitoring and evaluation team

  All listed teams have conducted different activities mentioned as follows.

A. Case Management Team

- Assesses the patients' level of dehydration soon after admission.
- Rehydrate patients according to their level of DHN.
- Monitor the patient frequently and reassessed their hydration status at recommended intervals as per the national cholera guideline.
- Collect stool samples from admitted patients.
- Establish case management protocols and train health personnel for implementation.
- Availed treatment guidelines both in hard and soft copies to health workers.
- Ensure regular supplies.
- Plan and request for more supplies before they runout of stock.
- Manage CTC.
- Proper case management as per the protocol.
- Implementing infection prevention and control precautions activities at CTC.

- Arranging staff schedule of CTC workers 24hrs/7days.
- Proper history taking, format filling and documentation.
- Provide health education for the patients.

B. Surveillance Team

- Screen passengers at Bole International Airport using the national PHEM guideline case definition for cholera.
- A total of 260 suspected cases were linked to CTCs as well.
- Line listing of cases.
- Preparation of SITREP.
- Analyzing the surveillance data.
- Updating report daily.
- Communicating the findings to decision makers and stakeholders.
- Make sure to receive zero report from all sub-cities.
- Ensuring the case definition has been met.
- Notification of the laboratory result to responsible bodies.

C. Social mobilization team

- Communities awareness creation on cholera risk factors, mode of transmission, sign and Symptom, prevention and control using different IEC/BCC materials (posters & leaflets)
- Case definition, guideline and IEC/BCC materials distribution.
- Providing health education at different public gathering areas (meeting, school, church, mosque, market, bus stations, etc.) and using community media.
- Orienting influential individuals (community leaders, elders, religious leaders) to convey key message for the public.
- Providing brief orientation for workers and owners of food and drink establishment, private clinics and different transportations drivers.

D. WASH team

- Latrines and water sources inventory.
- Treating of water schemes by using chlorine solution.
- Maintenance and protection of water sources.
- Cleaning pipe water reservoirs and treating with chlorine solution.

- Availing and distributing of household water purification chemicals.
- Encouraging traditional water treatment methods.
- Enforcing maintenance of physically destroyed and filled latrines.
- Facilitating new latrine construction and utilization at the HHs and institutional level.
- Insisting construction of communal latrines at market places, bus stations.
- Mobilizing sanitary campaigns in the city, school and the like.
- Ensuring presence of/ establishing hand washing facilities at schools, FDEs, bus station, offices and etc.
- Strengthening waste segregation and disposal system (preparation of waste disposal pits).
- Water quality monitoring (including residual chlorine tests).

E. Logistics and human resource management team

- Established CTCs in 5 sub-cities in 8 health centers as part of preparedness activity, three of them were receiving admission of imported cases at the beginning of the outbreak, then we standardized Dil Fire HC CTC to admit all imported cases (Table 13 and Figure 6).
- Distribution of the following materials to CTC sites.
  - ✓ Water treatment chemicals and hand washing soaps
- Ensuring availability of separate latrines for health workers and patients.
- Availing ambulance service at Bole international airport to take patients from the airport to CTCs.
- Make sure the suitability of the construction of latrines at the CTCs.

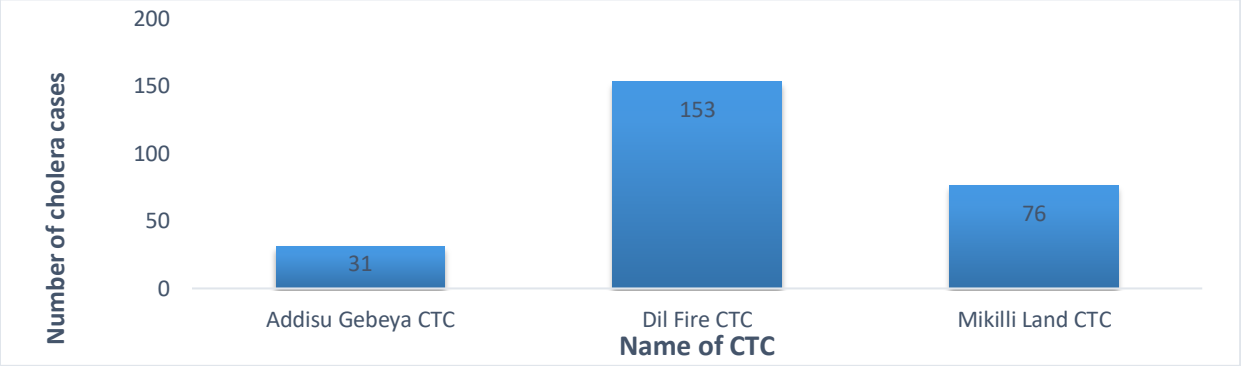


Figure 6: Distribution of imported cholera cases by CTC, Addis Ababa, Ethiopia from June 2018-March 2019.

As depicted on the figure 5 most cases were treated at Dil Fire CTC as it is the only CTC functional ever since till now after closure of other CTCs.

Table 13: CTC that were established at the beginning of the outbreak of imported cholera cases, Addis Ababa, from June to September, 2018.

S.No.	Sub-city	Health Center
1	Bole	Dil Fire
		Goro
2	Gulele	Addisu Gebeya
		Maychew
3	Kolfe	Mikilli Land
		Woreda 6
4	Akaki	Serti
5	Nifas silk	Woreda 1
	Total	8

F. Monitoring and evaluation team

- Monitor and evaluate all aspects of the intervention activities using checklists.
- Regular supervision of each thematic areas activities (either supportive and evaluative)
- Identify gaps and challenges, solve and put ways forward.

Other humanitarian aids

Apart from the clinical management of cases other humanitarian aids like provision of food, Water, clothes and transport fees were fully covered by EPHI.

1.2.6. Discussion

A prolonged cholera outbreak was identified among deportees due to imported cases from Saudi Arabia prisons; starting from June 12, 2018 to March 16, 2019. The crude attack rate was lower compared to national reference which is about 200 per 1000 population or 20% of those who are infected develop acute watery diarrhea, 10-20% of these individuals develop severe, watery diarrhea with vomiting. It was also lower compared to similar study conducted in Guinea Bissau which was 20.4 cases per 1000 population. But higher compared to a study conducted in three zones of Oromia regional state (Bale, Guji and East Shewa) of Ethiopia which was 0.5% or 5 cases per 1000 population (1, 2, 11 and 14).

If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts (more than 10-20 liters/day in severe forms) can lead to severe dehydration and death within hours. Case fatality rate in this study was 0% as there was no death in the CTCs throughout. This was lower compared to other similar studies conducted in different African countries like Kenya, Guinea Bissau, Cameroon, Somali, Zimbabwe, Ethiopia itself (0.4%-1.9%, 3.7%, 12%, 0.67%, 5.7% and 1.11%) respectively. It was good achievement and this zero CFR suggests good case management, early detection and referral to CTCs. For this zero CFR not only the above mentioned reasons but also proximity of CTC to the airport, availability of ambulance service to get suspected cases to CTC, availability of rehydration unit at screening site for dehydrate cases, forced referral of cases in case they refused to seek medical care and other factors also contributed. The overall response to this cholera outbreak was most impressive at all levels. Once the cholera outbreak had been identified in deportees, health care providers, EPHI, Addis Ababa health bureau, partners like MSF Spain, Ethiopian Red Cross society and international organization for migration responded to the outbreak in coordinated manner. This action resulted in a timelier and better coordinated response. Multiple nongovernmental organizations responded to the outbreak by supplying tents, providing medical supplies. The CTCs varied greatly with regard to their facilities and supplies. A combination of community and health-facility surveillance aided the response. Despite this low CFR, additional deaths may have been possible to prevent through better training of health center personnel. Patients died due to delays in rehydration or over-hydration; lack of experience in establishing intravenous infusions may have contributed to the outcome.

Delays in rehydration may be reduced, in part, by additional emphasis on use of oral rehydration solution. Oral rehydration solution may be used to hydrate most dehydrated patients rapidly and safely.

Adequate patient monitoring during rehydration prevents over-hydration. To assist in monitoring of oral or intravenous rehydration, individual cholera treatment records (which were not used during this epidemic) might also help ensure quality care. Prevention of death in epidemic cholera is a formidable challenge, even for countries with longstanding experience with cholera," and rests upon two interrelated mechanisms: appropriate health education and proper treatment. Treatment facilities can help only those who seek care. The case-fatality rate in untreated cases may reach 30–50%.Treatment is straightforward (basically rehydration) and, if applied appropriately, should keep the case-fatality rate below 1% (1, 2, 3, 4, 11, 14, 16, 17 and 20).

At the time of this outbreak, cholera was not endemic to Ethiopia. Therefore, one would have anticipated that adults and children would be equally affected. Although the demographics seem to illustrate the contrary, the age group categories vary in length, making age distribution difficult to interpret. The data were collected by individual CTCs using these specific age categories, and the available demographics did not permit calculation of age-specific and sex- specific attack rates. In this study 78% of the cases presented with some dehydration, 21% no dehydration and the remaining one percent severe dehydration. For severe dehydration it was lower than national one; which is 10–20% of these individuals develop severe, watery diarrhea with vomiting. If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts (more than 10-20 liters/day in severe forms) can lead to severe dehydration and death within hours. Severely ill cholera patients can lose up to 10% of their body weight in diarrhea and vomitus. In extreme cases, fluid losses can reach up to 1 liter per hour during the first 24 hours of illness. Patients who are severely dehydrated may develop hypovolemic shock. Such patients have a low blood pressure and a weak or absent radial pulse. They may appear drowsy or be unconscious. These patients must be rehydrated rapidly using intravenous fluids in order to prevent kidney failure or death (1, 2, 3, 6 and 7).

It is therefore important to improve the detection capacity of the surveillance system by involving all stakeholders (health facilities, private clinics, traditional healers, etc.) that deliver health services within the country's health system in the notification process. In Ethiopia, cholera is a

mandatory, notifiable disease. All suspected cases of cholera must be reported immediately to the appropriate authority. Therefore, continuous surveillance of the disease should be carried out year round, at all levels. Based on the case definition, a health worker should suspect cholera upon encountering a single case of profuse, acute, watery diarrhea. This must be reported to the surveillance focal point or person in charge immediately for further investigation (1 and 2).

The median age of cases in this study was 21 years with a range of 13-65 years. This is almost similar with the study conducted in Sierra Leone which was 23 years with a range of 5-50. This slight difference was due to the difference in the population characteristics i.e. in our study deportees were mainly of young adults who went abroad illegally for job rather than residents of certain settled population (15).

Ninety three percent of the cases were male and Ninety six percent of the cases were in the age group of 15-44. This higher gender and age group variability was also due to the difference in the population characteristics i.e. in our study deportees were mainly of young adult males who went abroad illegally for job rather than residents of certain settled population.

1.2.7. Limitation of the study

Limitations of this study were; calculated attack rate was likely underestimate the true rates as we have used total deportees as denominator. In addition, the limited demographic information available for imported cases did not permit calculation of age- and sex-specific attack rates.

1.2.8. Conclusion

In conclusion a confirmed cholera outbreak due to imported cases were identified in Addis Ababa from June 2018 to March 2019. Cases were identified with screening conducted at Bole international airport. Working in collaboration with stakeholders and partners have contributed to control the outbreak effectively before spreading further to other regions.

This outbreak prompts the need for increased local public health capacity to apply prevention strategies; establish active surveillance, receiving zero report from all sub-cities, activation of rapid response team, preparation of epidemic preparedness plan. Signatories to the World Health Organization International Health Regulations must report outbreaks of non-endemic diseases. Low overall CFR in imported cases, compared to CFRs reported during other epidemics in the country and sub-Saharan Africa, suggests that medical care provided at treatment centers prevented numerous deaths, most of the cases were not severely dehydrated at the time of admission (only 1%), the rest were either Some dehydrated or not dehydrated at all. Additional deaths may be prevented by strengthening the case treatment, rehydration, monitoring rehydration process and enhanced public education regarding the need for persons with cholera to promptly seek medical care.

For the future lessons should be learnt from this epidemic that the necessity of strengthening border and cross border health in order to prevent and contain locally any public health treat before it spread further. In addition this approach is mandatory to minimize morbidity and mortality. This in turn minimizes economic and social crisis that would have happened. Undoubtedly there would have other epidemics in other parts of the country; if we were not screen deportees at point of entry.

1.2.9. Recommendations

We recommend that:

Ethiopian public health institute in collaboration with Ministry of health and regional health bureau should:

- Strengthen border and cross border health issue; to manage such kind of public health emergencies.
- Engage stakeholders like national disaster risk management commission (NDRMC), Agency for refuge and returnees Affairs (ARRA), ministry of foreign Affairs (MoFA) and others non –governmental organizations and partners.
- Collaborate partners in advance before the occurrence of public health emergencies.
- The Ministry of Health/EPHI supports each regional health bureau in developing a functional epidemic preparedness and response committee and a clearly defined epidemic preparedness and control plan as soon as possible.
- we recommend to the public health emergency management unit to ensure surveillance system detect outbreaks and notify in a timely manner with special attention to point of entry and cross border health.
- We recommend enhancing screening at point of entry to minimize morbidity and mortality. This in turn minimizes economic and social crisis that would have happened.
- Undoubtedly there would have other epidemics in other parts of the country; if we were not screened deportees at point of entry.
- We recommend onsite screening before deported to Ethiopia in order to minimize spread of infection.

References

1. EPHI. National cholera guideline. May 2011 Addis Ababa Ethiopia.

2. Health department of South Africa. National guideline for cholera control, South Africa, 2014.

3. CDC. Cholera infection in Africa. Online. https://www.cdc.gov/cholera/africa/index.html. Accessed on March 18, 2019.

4. E. J. CARTWRIGHT, M. K. PATEL, F.X. MBOPI-KEOU, T. AYERS, B. HAENKE, B.H. WAGENAAR, E. MINTZ AND R. QUICK. Recurrent epidemic cholera with high mortality in Cameroon: persistent challenges 40 years into the seventh pandemic. Epidemiol. Infect. (2013), 141, 2083–2093. Cambridge University Press 2013 doi: 10.1017/S0950268812002932.

5. RICHARD PANKHURST. The history of cholera in Ethiopia. https://www.cambridge.org/core/services/aop-cambridge core/content/view/S0025727300013302, online Accessed March 19/2019.

6. WHO. Cholera 2011. External Weekly Epidemiological Record. 2011; 87:289–304. https://www.cdc.gov/cholera/asia/index.html. Online Accessed on March 21, 2019.

7. WHO. Cholera fact sheet. https://www.who.int/news-room/fact-sheets/detail/cholera, 17 January 2019.

8. Relief web. Acute Watery Diarrhoea (AWD) Outbreak, Ethiopia, May 2016. https://reliefweb.int/disaster/ep-2016-000143-eth.

9. CDC Emerging infectious diseases. Lakes as Source of Cholera Outbreaks, Democratic Republic of Congo. EID journal, Volume 14 November 5 May 2008.

10. WHO. Ending Cholera, a Global Roadmap to 2030. https://www.who.int/cholera/publications/global-roadmap/en/. Online Accessed on March 22, 2019.

11. Susan A. Bartels, MD, MPH; P. Gregg Greenough, MD, MPH; M. Tamar, MD, MPH; Michael J. Van Rooyen, MD, MPH. Investigation of a Cholera Outbreak in Ethiopia's Oromia

Region. Disaster Medicine and Public Health Preparedness. December 2010 https://www.researchgate.net/publication/49675071.

12. Penguele A, Djeintote M., Balekouzou A., Tembeti J, Feilema P, Kazambu D, Delissaint D. Cholera Outbreak Investigation in the Central African Republic, October – November 2011.

13. Didier Bompangue Nkoko, Patrick Giraudoux, Pierre-Denis Plisnier, Annie Mutombo Tinda, Martine Piarroux, Bertrand Sudre, Stephanie Horion, Jean-Jacques Muyembe Tamfum, Benoît Kebela Ilunga, and Renaud Piarroux. Dynamics of Cholera Outbreaks in Great Lakes Region of Africa, 1978–2008.

14. Geir Gunnlaugsson, PhD; Frederick J. Angulo, PhD; J6nina Einarsdbttir, BA; Alberto Passa, RN and Robert V: Tauxe, MPH. Epidemic Cholera in Guinea-Bissau: The Challenge of Preventing Deaths in Rural West Africa. Int J Infect Dis 1999; 4:8-13.

15. Center for Disease prevention and Control. Epi-Aid # 2010-074 Trip Report: Sierra Leone Cholera Outbreak Investigation, 2012.

16. Center for Disease prevention and Control. Epi-Aid # 2010-029 Trip Report: Nationwide Outbreak of Cholera in Kenya, 2009-2010

17. Qabale G; Sharmila Sh; Orkhan N; Abubakar H; Eliud W; Mark O; Daniel M; Raymond N. Musyoka; Hussein A; Maurice O; Rachael J; Willy K; John K; Munawwar S; Waqo B; Tura G; Sara A. Lowther; Bonventure J; Robert M; Newton W; Clayton O; Zeinab G; Marc-Alain Widdowson; Kevin M. DeCock; John W. Burton. Cholera Outbreak in Dadaab Refugee Camp, Kenya, November 2015–June 2016.

18. World Health Organization. Cholera outbreak. Assessing the outbreak response and improving preparedness. Geneva 2004.

19. Ezra J. Barzilay, M.D., Nicolas Schaad, M.P.H., Roc Magloire, M.D., Kam S. Mung, M.D., Jacques Boncy, M.D., Georges A. Dahourou, Pharm.D., Eric D. Mintz, M.D., Maria W. Steenland, M.P.H., John F. Vertefeuille, Ph.D., and Jordan W. Tappero, M.D. . Cholera Surveillance during the Haiti Epidemic, the First 2 Years. The New England journal *of* medicine February 14, 2013 vol. 368 no. 7.

20. World Health Organization. Cholera situation in Somali. February 2019.

Chapter II: Surveillance data analysis report

2. Epidemiology of malaria in Ethiopia: A Five years retrospective surveillance data analysis February 2018.

Abstract

Introduction: Malaria is a mosquito-borne parasitic disease. Malaria kills 881,000 people every year, 90% of whom are in Africa and 85% of whom are children under five. Approximately 52 million people (68%) live in malaria risk areas in Ethiopia. The aim of this study was to describe distribution of malaria by person, place and time; to assess clinical malaria and slide positivity rate in Ethiopia.

Methods: Retrospective document review was conducted. A five years malaria surveillance data from 2013 to 2017 was collected from national Public health emergency management (PHEM) database. Data analysis was carried out by using Microsoft excel and Arc GIS.

Result: Nationally during the last 5 years about 10 million malaria cases 9,002,345(89.48%) laboratory confirmed and 1,057,918(10.5%) clinical malaria cases were reported. Among this about 3.3 million cases (33%) were reported only in 2013. During the past five years on average 2 million cases were reported each year. Most cases 9,985,106(99.25%) were treated as outpatient. 788 deaths with overall case fatality rate (CFR) of 1.05% were reported. Somali, Gambella, Oromia and Benishangul Gumuz (BG) regions reported high clinical malaria cases. 67% P. Falciparum and 33% P. vivax were observed.

Conclusion and recommendations: National malaria trend decreased year to year. Regional malaria trend was almost similar to national. Majority of malaria cases were treated at an outpatient department. At least rapid diagnostic test (RDT) should be done for any suspected malaria cases at health post level and microscopy at health center/hospital level to achieve the national malaria strategic plan (NMSP).

Keywords: Trend**,** Surveillance, Analysis, Malaria, descriptive study, Ethiopia.

2.1. Introduction

2.1.1 Background

Malaria is a mosquito-borne parasitic disease that is common in the world's poorest countries. Malaria is a life-threatening infectious disease caused by the protozoan parasite called Plasmodium. The World Health Organization (WHO) estimated 660,000 deaths in 2011 directly attributed to malaria, approximately half of the world's population being at risk of infection [1].

Four main species of malaria infect humans: Plasmodium falciparum (P.f), Plasmodium vivax, Plasmodium malariae and Plasmodium ovale. Plasmodium falciparum is the most highly virulent species and is responsible for almost all of the 1.7–2.5 million deaths worldwide caused by malaria [2, 3].

It is a leading public health problem in Ethiopia where an estimated 52 million people (68%) of the population lives in malarious areas primarily at altitudes below 2,000 meters and three quarters of the total land mass is regarded as malarious. It is preventable and treatable, yet it still kills some 881,000 people every year, 90% of whom are in Africa and 85% of whom are children under five. Malaria was eliminated in most western countries more than 50 years ago; today, more than half of all estimated malaria cases occur in just five African countries: Nigeria, Democratic Republic of Congo, Ethiopia, United Republic of Tanzania and Kenya. Malaria predominantly affects rural and poor populations that have little or no access to current prevention and treatment tools. It is estimated that malaria costs Africa more than US $12 billion every year in lost GDP, due to the heavy toll it inflicts on families in rural areas. [1]

It is a serious disease and remains an important public health problem in many developing countries including Ethiopia. Ethiopia is among the few countries with unstable malaria transmission. Consequently, malaria epidemics are serious public health emergencies. In most situations, malaria epidemics develop over several weeks, allowing some lead-time to act proactively to avoid larger numbers of illnesses and to prevent transmission (2).

Malaria is mainly seasonal with unstable transmission in the highland fringe areas and of relatively longer transmission duration in lowland areas, river basins and valleys. Historically, there have been an estimated 10 million clinical malaria cases annually. Since 2006, however, cases have reduced substantially. (2)

Ethiopia has implemented Integrated Disease Surveillance (IDSR) reporting from all hospitals and health centers using a one page form since 1990s. Most diseases were reported on the monthly form, but certain high priority indicators were to be reported immediately. Health stations and health posts were not formally included in the initial phase. While IDSR data exist on paper at the district level, they were available in electronic form at zone and Regional Health Bureau level in an Epi Info database entered in Addis Ababa, formerly under the Disease Prevention and Control Department, but now at the Public Health Emergency Management (PHEM) center at Ethiopian Health Institute (2).

After this time period (in 2009), the reporting format changed, health posts were included in reporting, and the time interval for reporting changed to weekly during major Ministry of Health reorganization. This time was the transformation of IDSR to Public Health Emergency Management (PHEM) which brought many changes to the country's' health system. During all this times malaria surveillance was one of the most important component of the country's surveillance system (2).

2.1.2. Statement of the problem

Globally, in 2011, an estimated 3.3 billion people (about half of the world population) lived in areas where malaria is a health risk for the population. Malaria caused an estimated 219 million cases and up to 660,000 deaths in 2010. Malaria is preventable and treatable, yet it still kills some 881,000 people every year, 90% of whom are in Africa and 85% of whom are children under five. Approximately 80% of the cases and 90% of the deaths occur in Africa while the remaining cases and deaths occur mainly in the South-East Asia and Eastern Mediterranean Regions. Nationally, about 52 million people (68%) live in malaria risk areas in Ethiopia. (1)

2.1.3. Significant of the study

Ongoing analysis of surveillance data is important for detecting outbreaks and unexpected increases or decreases in disease occurrence, monitoring disease trends and evaluating the effectiveness of disease control programs and policies. This information is also needed to determine the most appropriate and efficient allocation of public health resources and personnel.

Analyses should be performed at regular intervals and in timely manner to identify changes in disease reporting. These analyses can be performed using standard approaches (e.g., running a standard computer program to generate a summary report). Findings of analyses should be reviewed regularly and provided as feedback to medical providers and others in the community who are asked to report cases. Therefore, this surveillance data analysis will help to identify national incidence and trends of malaria disease throughout 5 years. It also helps to identify and try to solve major data quality issues that encountered during analysis.

2.2. Literature review

Malaria situation in Ethiopia

Malaria transmission: vector, parasite and human host interactions

Anopheles arabiensis, a member of the An. gambiae complex, is the primary malaria vector in Ethiopia, with An. funestus, An. pharoensis and An. nili as secondary vectors. The sporozoite rate for An. arabiensis has been recorded to be as much as 5.4 percent. The host-seeking behavior of An. arabiensis varies, with the human blood index collected from different areas ranging between 7.7 percent and 100 percent. An. funestus, a mosquito that prefers to feed exclusively on humans, can be found along the swamps of the Baro and Awash rivers and shores of lakes in Tana in the North and the Rift Valley area. An. pharoensis is widely distributed in Ethiopia and has shown high levels of insecticide resistance, but its role in malaria transmission is unclear. An. nili can be an important vector for malaria, particularly in Gambella Regional State. Detailed information on the basic ecology and distribution of these vectors in Ethiopia is provided in the FY 2008 MOP. However, insecticide resistance among these vectors has become an important issue, with implications for vector control strategies. Plasmodium falciparum and P. vivax are the major malaria parasites in Ethiopia, with several recent therapeutic efficacy trials documenting that ACTs and chloroquine continue to have adequate effectiveness for treating these pathogens, respectively. To date, there have been no major problems detected yet with emerging drug resistance, or with counterfeit or substandard antimalarial drugs in Ethiopia; however, constant vigilance is needed regarding these important issues that have adversely affected the malaria control programs of many other countries. Typical human and mosquito behavior results in most malaria parasite transmission occurring indoors during nighttime hours within rural households within the lowlands, and in the middle elevations, and only occasionally in the highland fringe areas of Ethiopia greater than 2,000 meters above sea level. Malaria transmission may also sometimes occur outdoors during nighttime work or social activities, or may be associated with temporary overnight travel to other districts in malarious areas. Recent published and unpublished reports indicate an increased malaria incidence among migrant daily laborers in various parts of the country, most importantly in the northwest development corridors of the country bordering Sudan and South Sudan. Many Ethiopian communities have a “low” and “unstable” malaria transmission pattern that results in low host immunity and significant clinical malaria illness risk after malaria

infections, increased tendency for rapid progression to severe malaria, and propensity for malaria epidemics affecting all age groups.

The epidemiology of malaria in Ethiopia, therefore, contrasts with that of many other countries in Africa with high malaria transmission where malaria morbidity and mortality mainly affects young children. (1)

Malaria transmission: seasonality, weather, geography and climate

In Ethiopia, the interaction of mountainous terrain with variable winds, seasonal rains, and ambient temperatures creates diverse micro-climates. Ethiopian weather is also influenced by tropical Indian Ocean conditions and global weather patterns, including El Niño and La Niña. When a micro-climate creates local puddles, flooding conditions, and warm ambient temperatures that persist for several weeks within a malarious area with low population immunity, the resulting Anopheles mosquito proliferation may cause focal malaria transmission to accelerate, sometimes explosively. In Ethiopia, malaria is highly seasonal in many communities, but may have nearly constant transmission in other some areas; at the district level, malaria outpatient caseloads may vary several-fold from year to year in an "unstable" epidemic-prone transmission pattern. Peak malaria transmission occurs between September and December in most parts of Ethiopia, after the main rainy season from June to August. Certain areas experience a second "minor" malaria transmission period from April to June, following a short rainy season from February to March. January and July typically represent low malaria transmission seasons in most communities. Since peak malaria transmission often coincides with the planting and harvesting season, and the majority of malaria burden is among older children and working adults in rural agricultural areas, there is a heavy economic burden in Ethiopia. Although historically Ethiopia has been prone to periodic focal and widespread malaria epidemics, malaria epidemics have been largely absent since 2004, after the scale up of malaria control interventions. (1)

Parasite prevalence, altitude strata and annual parasite incidence (API):

The 2007 Malaria Indicator Survey (MIS) indicated that parasite prevalence (as measured by microscopy) in Ethiopia was 0.7% and 0.3%, respectively, for P. falciparum and P. vivax below 2,000 meters altitude. The 2011 MIS indicated that 1.3% were positive for malaria using microscopy and 4.5% were positive for malaria using RDTs below 2,000 meters, with only 0.1% prevalence above 2,000 meters elevation. Plasmodium falciparum constituted 77% of infections

detected below 2,000 meters elevation. The 2011 MIS demonstrated a remarkable demarcation of malaria risk at an altitude of 2,000 meters, with a 13-fold higher malaria prevalence at lower altitudes compared to higher elevations. There was essentially no P. falciparum detected by microscopy among persons surveyed within households having measured elevations above 2,000 meters in the 2011 MIS. In 2014, the FMOH updated the country's malaria risk strata based upon malaria API, calculated from recent routine surveillance data from more than 800 districts. Malaria transmission risk by API classified as High (>100 cases/1,000 population), Medium (5-99.9), Low (0.1-4.9), and Malaria-Free (~0). Areas with the highest malaria transmission risk as stratified by district API appear to be largely in the lowlands and midlands of the western border with South Sudan and Sudan, with additional high transmission areas in or near the Rift Valley, which extends from the southwest of the country to the northeast. Many densely populated highland areas were newly classified as malaria-free (API=0), including the capital city of Addis Ababa.

Ethiopia is also one of the most malaria epidemic-prone countries in Africa. Rates of morbidity and mortality increase dramatically (i.e. 3-5 fold) during epidemics. Since 2005, Ethiopia has scaled-up one of the largest and most ambitious malaria control programs in Africa, designed to support the country's Health Sector Development Plan (HSDP), the NSP and the national child survival strategy, in order to reduce under-five mortality rates by two thirds by 2015. (1, 2)

2.3. Objective

2.3.1. General objective

To describe distribution of malaria by person, place, time; to assess clinical malaria and slide positivity rate in Ethiopia from 2013 to 2017.

2.3.2. Specific objectives

- To describe malaria distribution by place in Ethiopia from 2013 to 2017.
- To describe malaria distribution by person in Ethiopia from 2013 to 2017.
- To describe malaria distribution by time in Ethiopia from 2013 to 2017.
- To assess clinical malaria and malaria positivity rate in Ethiopia from 2013 to 2017.

2.4. Methods and Materials

2.4.1. Procedures for reporting the disease

Health posts and Health facilities submit their weekly surveillance data report to woreda health office on Monday till midday. Woreda health offices report weekly surveillance data to zonal health office on Tuesday till midday. Zonal health offices should submit its' weekly surveillance data report on Wednesday till midday to regional health office. Regions in turn should report their weekly surveillance data to EPHI PHEM center on Thursday till midday.

2.4.2. Population under surveillance

Since malaria can affect all age groups and both sexes, all population of the country are under surveillance.

2.4.3. Databases used

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

2.4.4. Clinical and laboratory sources of information

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

2.4.5. Case definitions

2.4.5.1. Suspected case

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

2.4.5.2. Confirmed case

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

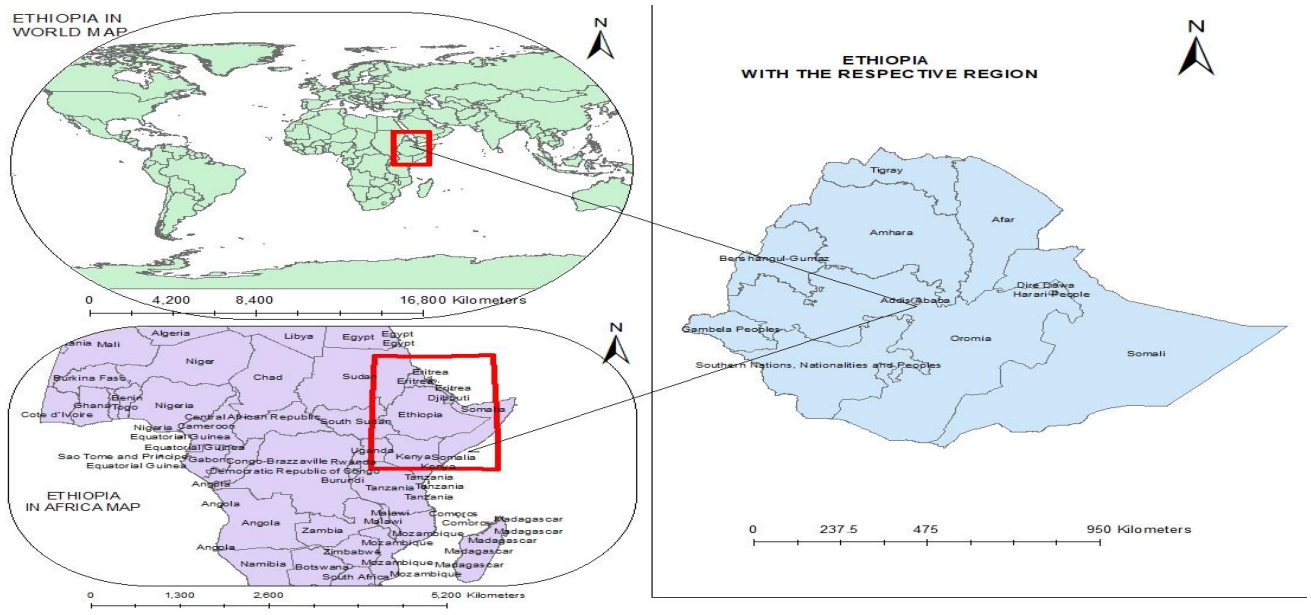
2.4.6. Basic formulas for calculating different indicators in malaria surveillance

Slide Positivity Rate (MPR) =	Total positive Cases/Total Examined*100
PF Positivity Rate (PF-PR) =	Total positives (Pf)/Total Examined*100
Clinical malaria Cases =	Total cases - Total confirmed cases
Clinical malaria Percentage =	Clinical cases/Total cases*100
In-Patient Rate =	Inpatient cases/Total cases*100
Case Fatality Rate =	Deaths/Inpatient cases*100

2.4.7. Study Area

Ethiopia is the tenth largest country in Africa, covering 1,104,300 square kilometers (with 1 million square km land area and 104,300 square km water. It has great geographical diversity; its topographic features range from the highest peak at Ras Dashen, 4,550 meters above sea level, down to the Afar Depression, 110 meters below sea level (17). The climate varies with the topography, from as high as 47 ^{0}c in the Afar Depression to as low as 10^{0}C in the highlands. Its geographical coordinates are between 8 00 N and 38 00 E.

According to EPHIs database there are 113 Zones/ Special woredas including Towns, 914 woredas including current Addis Ababa woredas, 223 Hospitals, 3,593 Health centers, 16,190 Health posts, 153 NGOHFs, 252 other health facilities.



Map 3: showing study area, 2018, Ethiopia.

2.4.8. Study period

Five years malaria surveillance data collected from Ethiopian public health Institute PHEM center database, analyzed and interpreted from 30 January to 15 February 2018.

2.4.9. Study design

Retrospective document review was conducted to analyze malaria surveillance data in terms of person, time and place.

2.4.10. Data Analysis Procedures

A five years (2013-2017) weekly surveillance data from Ethiopian public health Institute Public health emergency management center was collected. Before analysis data was cleaned and checked for consistency, missing value and miscoded value. Data analysis was carried out by using Microsoft office excel 2013 to show malaria trend, clinical to describe malaria by place, person and time. Using Arc GIS version 10.4.1 to show study area and special distribution.

2.4.11. Dissemination of Results

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

2.4.12. Ethical Consideration

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

2.5. Result

2.5.1. Surveillance report Completeness Rate

The report completeness rate is calculated as number of reported health facilities during that specific week divided by number of expected health facilities multiplied by 100 and expressed as percentage. In the past five years the average completeness rate was 89%. As shown on the figure below in some weeks it was far below minimum requirement in week 20 (54.7%) & week 37(74.7%) of 2013 and week 3(70.6%), week 9(67.8%) & week 11(70.5%) of 2015 and week 36(75.6%) of 2017.

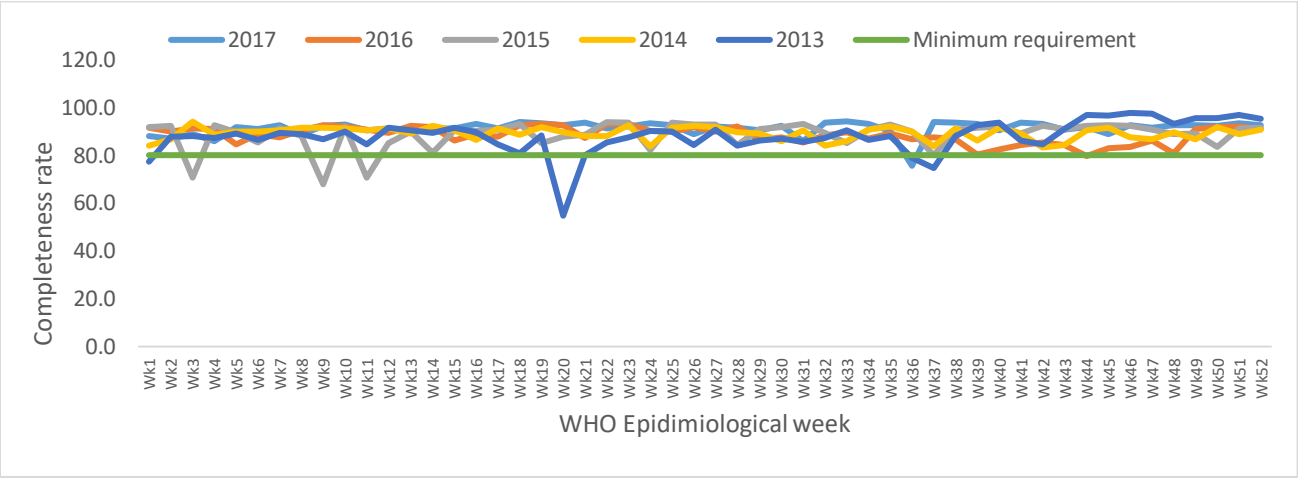


Figure 7: Surveillance report completeness rate trend by week, 2013-2017, Ethiopia.

2.5.2. National malaria morbidity and mortality trend by Place and Time

Nationally during the last 5 years about 10 million malaria cases (9,002,345 or 89.48% laboratory confirmed and 1,057,918 or 10.5% clinical malaria cases) with average annual incidence of 23.3 cases per 1000 population. Among these 75,157(0.75%) admissions & 9,985,106(99.25%) outpatient cases with 788 deaths were reported. In average 2 million cases were reported each year during the past five years. Annually about 3.3 million cases (33%) were reported only in 2013, but this decreased by 20% in 2017. Malaria CFR is calculated as dividing inpatient malaria deaths by inpatient malaria cases. The highest case fatality rate was observed during 2015 and the lowest in 2017. The overall CFR was 1.05%.

Table 14: Annual reported malaria cases and deaths, mean of annual monthly and weekly reported cases, annual CFR, from 2013-2017, Ethiopia.

Year	Annual malaria case frequency	percentage	Annual malaria inpatient deaths	Average monthly reported malaria case	Average weekly reported case	Annual in patient malaria cases	Annual CFR
2013	3,310,273	33%	297	275856	63659	26,873	1.1%
2014	2,101,451	21%	134	175121	40413	16,049	0.83%
2015	1,653,444	16%	170	137787	31797	10,902	1.56%
2016	1,733,316	17%	138	144443	33333	12,935	1.06%
2017	1,261,779	13%	49	105148	24265	8,398	0.58%
Total	10,060,263	100%	788	838,355	193,467	75,157	1.05%

2.5.2.1. National malaria morbidity trend by Place and Time

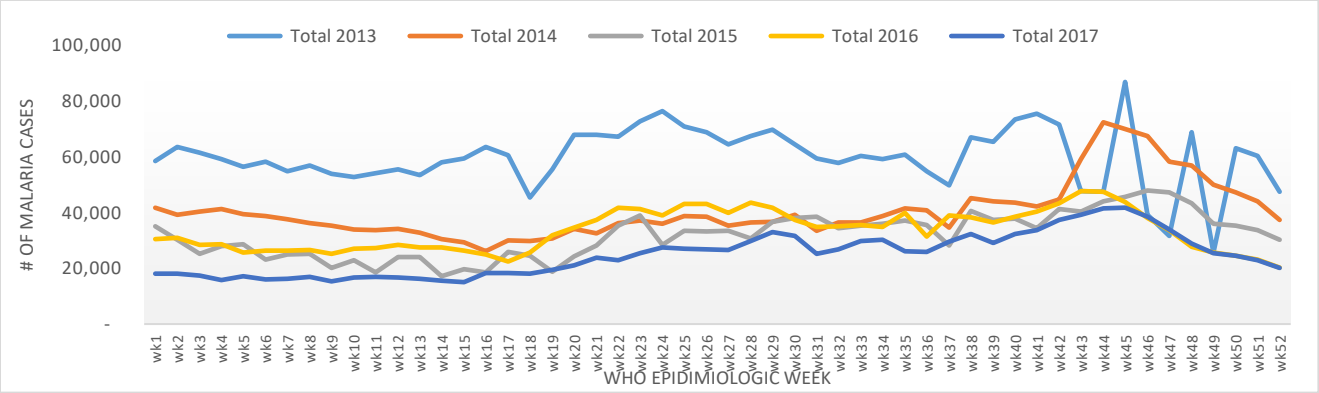


Figure 8: Total suspected and confirmed malaria cases trend by week, 2013-2017, Ethiopia.

As depicted on the figure 8 number of malaria caseload decreased year to year; 2013s' cases trend were highest of all the five years trend and that of 2017s' were lowest of all. In 2013, national weekly case load ranges from 25,599-86,651 with weekly incidence rate (3.2-10.7 cases per 10,000 population). In 2017 national weekly caseload ranges from 15,005-41,674 with Weekly incidence rate (1.55-4.32 cases per 10,000 population). So 2013s' national weekly caseload decreased by more than half comparing it with 2017s' weekly caseload. The peak weekly incidence rate in the past five years was observed on week 45 of 2013 with 10.7 cases per 10,000 population and the lowest weekly incidence rate was reached on week 15 of 2017 with 1.55 cases per 10,000 population.

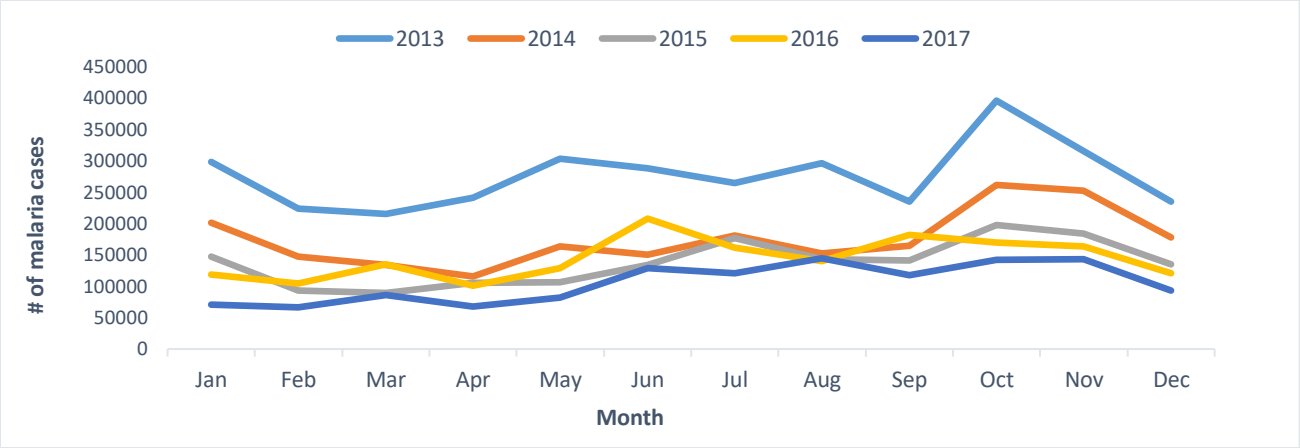
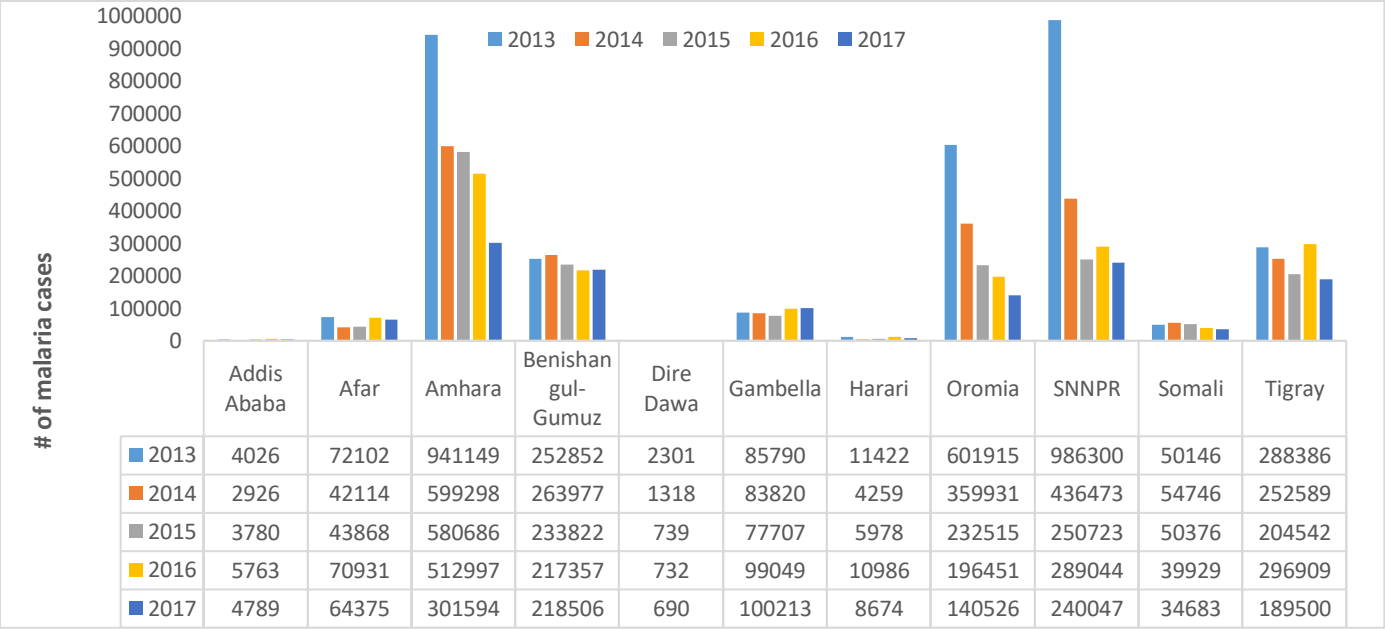


Figure 9: Total suspected and confirmed malaria cases trend by month, 2013-2017, Ethiopia

As shown on the figure 9 monthly malaria case load decreased in similar manner to the weekly case load. 395,841cases/month, was the highest monthly malaria case load in the last five years, which was recorded in October 2013 to 142,246 cases/month (253,595 cases or 64%) decrement compared with similar month of 2017. The lowest monthly malaria case load in the last five years was recorded in February 2017, 66,406 cases/month. The above figure shows that malaria trend increased slightly from April to June, then decreased from June to September and raised sharply from September to November, then felled onwards up to April to complete the cycle.



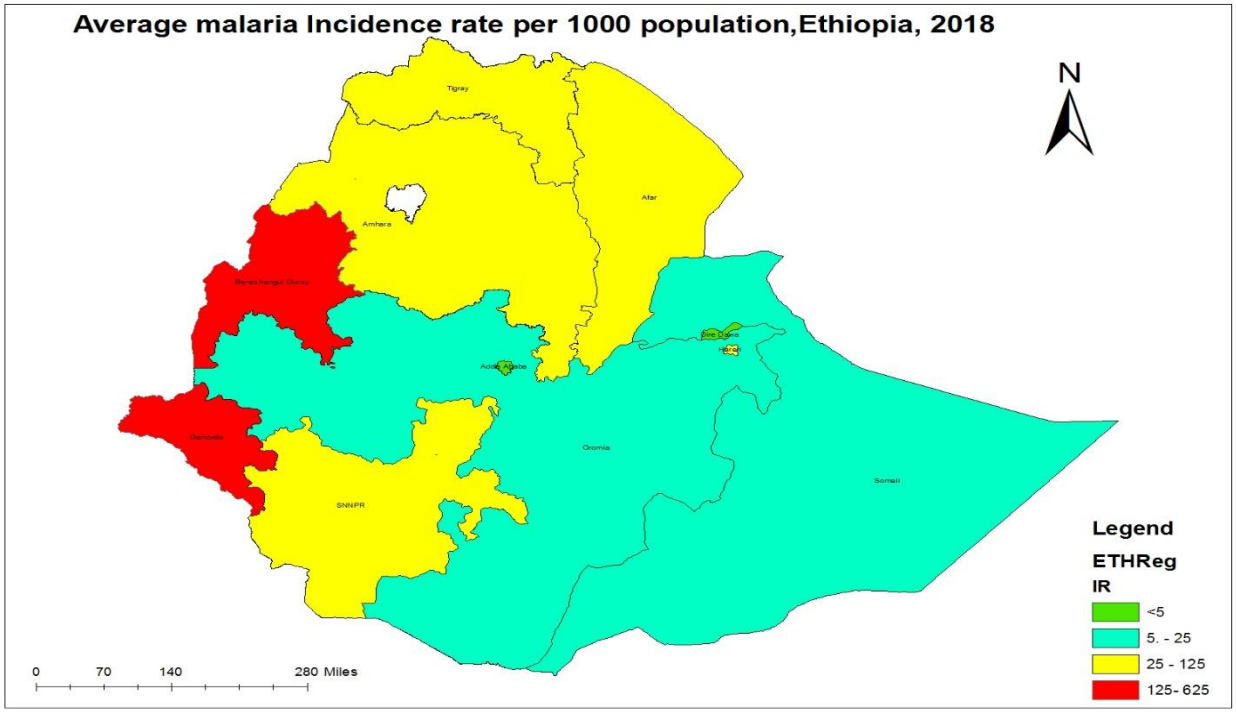
	Addis Ababa	Afar	Amhara	Benishangul-Gumuz	Dire Dawa	Gambella	Harari	Oromia	SNNPR	Somali	Tigray
2013	4026	72102	941149	252852	2301	85790	11422	601915	986300	50146	288386
2014	2926	42114	599298	263977	1318	83820	4259	359931	436473	54746	252589
2015	3780	43868	580686	233822	739	77707	5978	232515	250723	50376	204542
2016	5763	70931	512997	217357	732	99049	10986	196451	289044	39929	296909
2017	4789	64375	301594	218506	690	100213	8674	140526	240047	34683	189500

Figure 10: Total suspected and confirmed malaria cases trend by region, 2013-2017, Ethiopia

As it is clearly observed from figure 10 similar to national malaria case trend the regional trend shows that malaria cases decreased year to year from 2013-2017 except SNNPR and Tigray regions in 2016. 2013s' cases were highest and that of 2017s' were lowest in most of the regions (Afar, Amhara, D.D, Harari, Oromia and SNNPR). In Addis Ababa, Afar and Gambella malaria case trend shows decrement in the first three years (2013-2015) and then increased during the last two years(2016 & 2017).

During the last five years the peak annual regional caseload were reported from SNNPR (986,300 cases), followed by Amhara (941,149 cases), Oromia (601,915 cases) and Tigray (288,386 cases) regions respectively in 2013.

The peak annual incidence rate also reached in 2013; except Benishangul-Gumuz and Somali regions all including national annual incidence rate were high during the calendar year. The highest annual incidence rate was reported from Benishangul-Gumuz (276.4), followed by Gambella (234.5), Tigray (59.3), SNNPR (56.7), Harari (51.9), Amhara (48), Afar (44.1), Oromia (18.8), Somali (10.3), Dire Dawa (5.5) and Addis Ababa (1.3) cases per 1000 population respectively. At the same time annual national incidence rate was 38.4 cases per 1000 population.



Map 4: Average annual malaria IR per 1000 population, Ethiopia, 2013-2017.

As depicted on the map Benishangul-Gumuz and Gambella regions were highly malarious with average incidence rate of 125-625 cases per 1000 population. Tigray, Amhara, Afar, SNNPR and Harari were the five regions with average incidence rate of 25-125 cases per 1000 population. Somali and Oromia were the two regions with average incidence rate of 5-25 cases per 1000 population. On the other hand Addis Ababa and Dire Dawa were regions with low malaria incidence i.e. less than five cases per 1000 population.

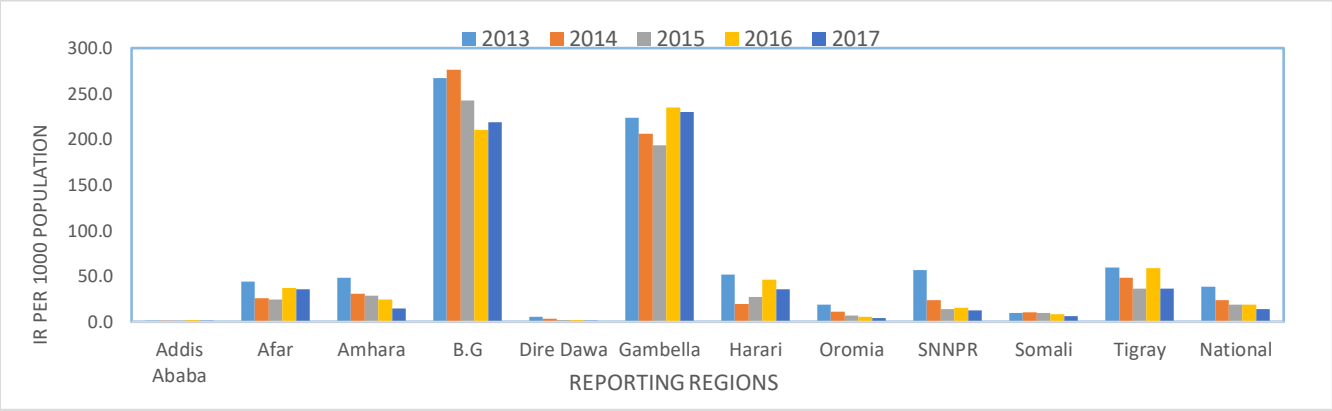


Figure 11: National malaria incidence rate per 1000 population by region, 2013-2017, Ethiopia

As clearly observed from the above figure by far the highest annual incidence rate were observed in Benishangul-Gumuz and Gambella regions throughout the past five years. More than 200 cases per 1000 population were reported in most of the calendar years. But the national annual incidence rate trend shows decrement from time to time from 38.4 cases per 1000 population in 2013 to 14 cases per 1000 population in 2017.

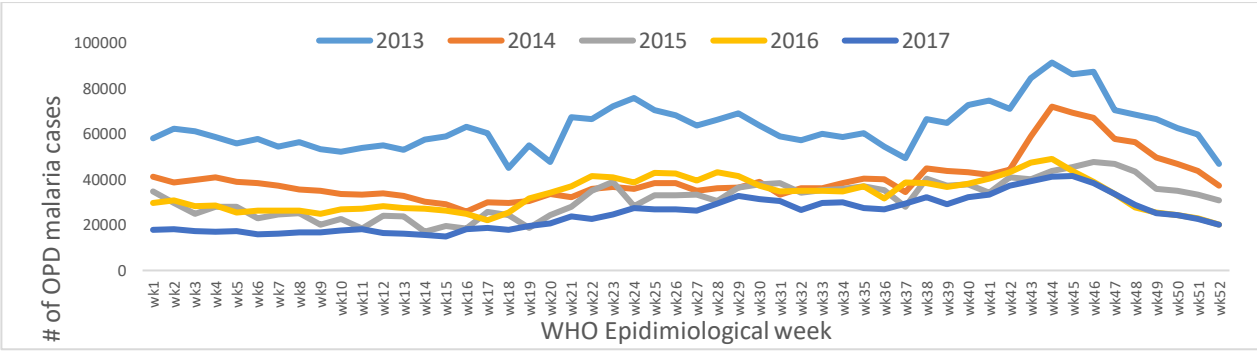


Figure 12: Total malaria OPD cases trend by week, 2013-2017, Ethiopia.

Malaria outpatient caseloads vary several-fold from year to year, Similar to total national malaria case trend the outpatient malaria case trend was also highest in 2013 and decreases year to year thereafter. The peak reached on week 44 in all four years except 2015, though there were many local peaks in different weeks.

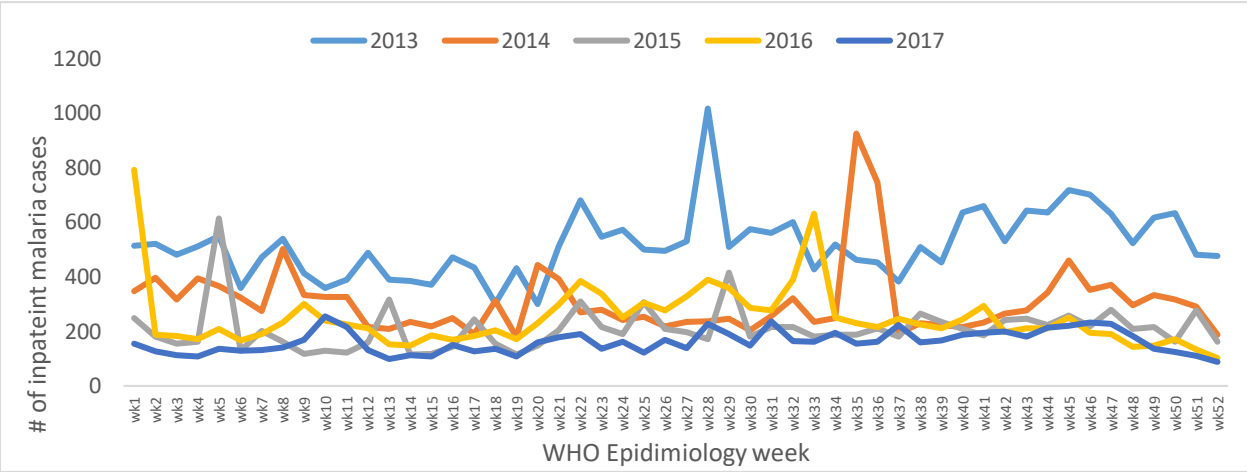


Figure 13: Total malaria in patient cases trend by week, 2013-2017, Ethiopia.

Similar to total national malaria case trend and outpatient malaria case trend inpatient case trend was also highest in 2013 and decreases year to year thereafter. The highest cases were admitted on week 28 of 2013 (more than 1000 cases). The other high inpatient cases were observed on week 35 of 2014, week 2 of 2016, 925 & 792 admissions per week respectively.

2.5.2.2. National malaria mortality trend by place and time

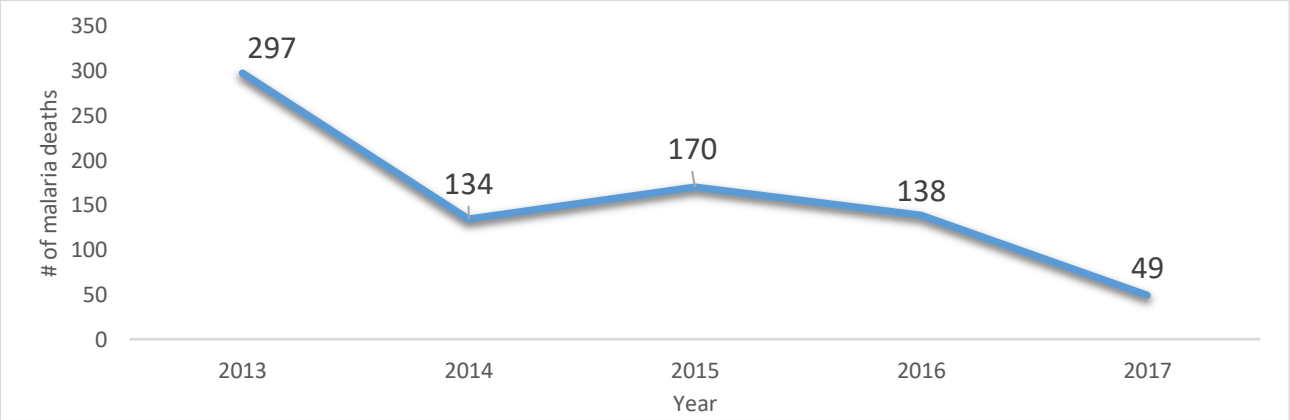


Figure 14: Annual malaria in patient death trend, 2013-2017, Ethiopia.

As depicted on the figure 14 malaria death trend is similar to that of malaria case trend, it has been decreasing year to year from 2013 to 2017. The highest malaria mortality was observed in 2013, but highest CFR was observed in 2015 as described above.

2.5.3. P. falciparum vs P. vivax trend

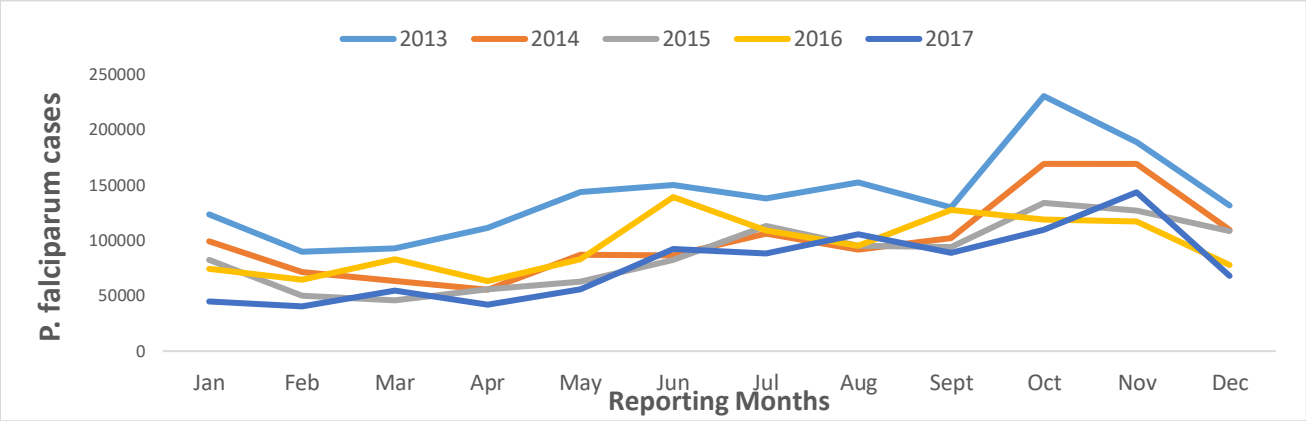


Figure 15: P. falciparum malaria cases trend by month, 2013-2017, Ethiopia

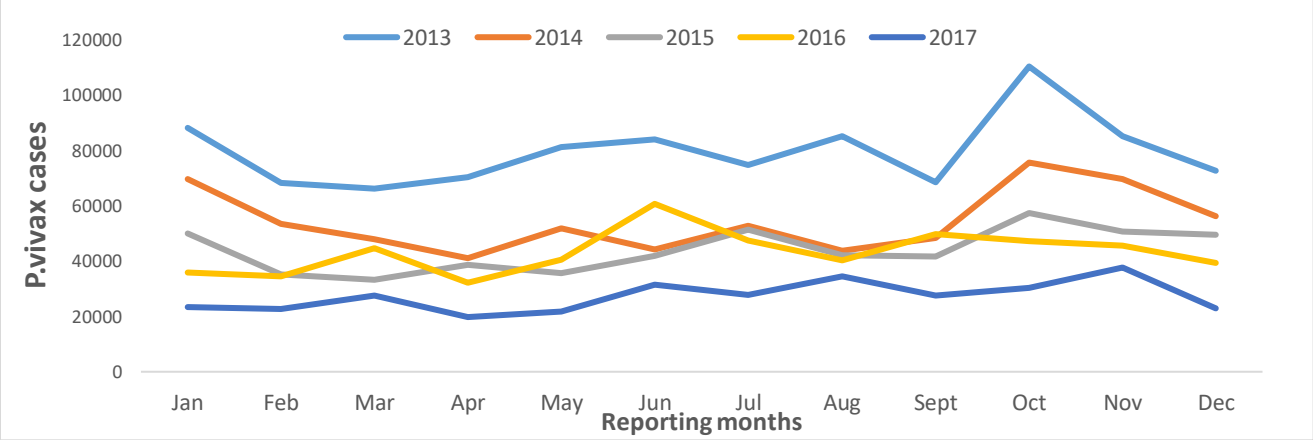


Figure 16: P. vivax malaria cases trend by month, 2013-2017, Ethiopia

Both *P. falciparum* and *P. vivax* malaria case trends clearly depicts that the seasonality of malaria in Ethiopia with main transmission season after summer rainy season from September to December and peak was reached on October. The second transmission season after minor rain April to June with peak in June.

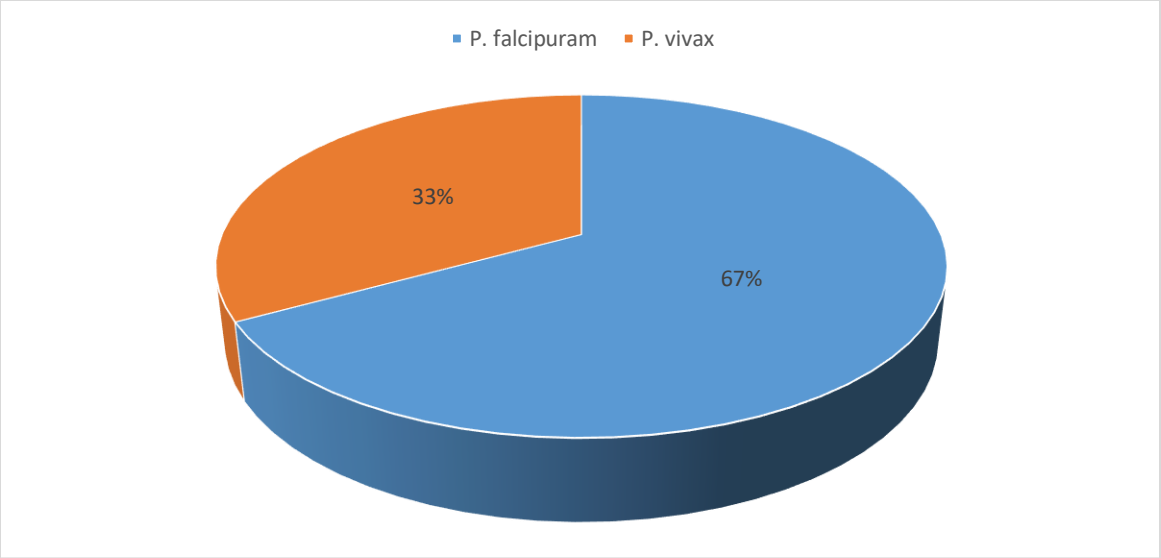


Figure 17: P. falciparum and P. vivax malaria cases cumulative percentage, 2013-2017, Ethiopia.

The above figure shows Plasmodium falciparum specious dominancy (67%) than P. vivax (33%) specious during the past five years.

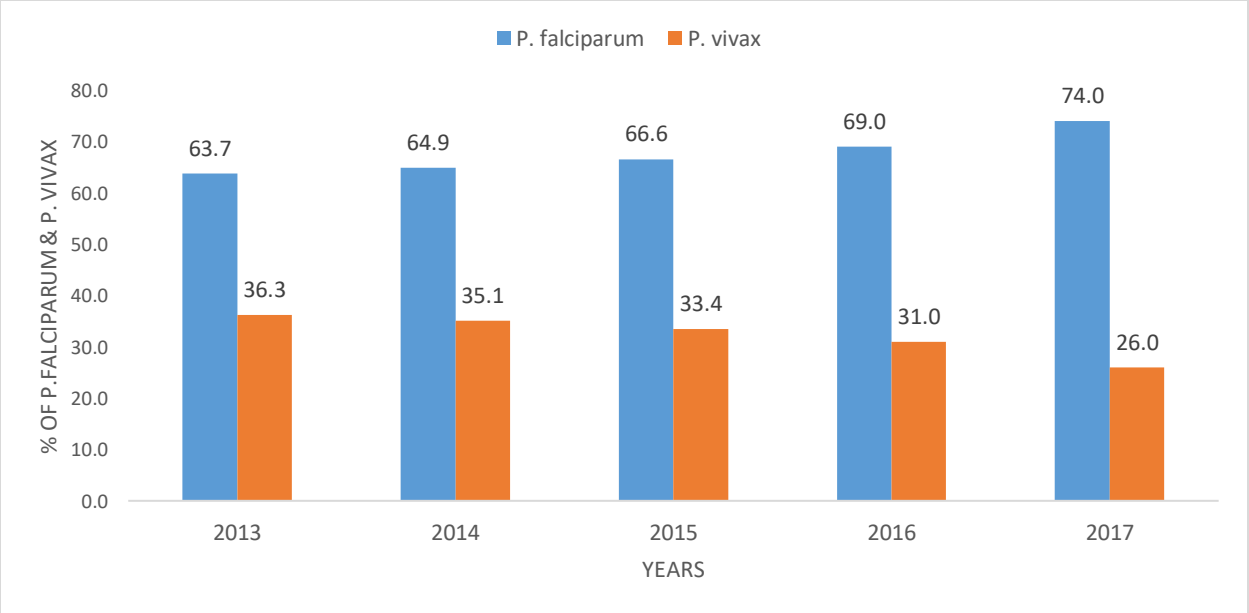


Figure 18: P. falciparum and P. vivax malaria cases trend, 2013-2017, Ethiopia

As depicted on the figure 18 P. falciparum specious is increasing progressively from 2013 to 2017 and in contrast P. vivax trend is decreasing in the last five years.

2.5.4. National clinical malaria case trend by place and Time

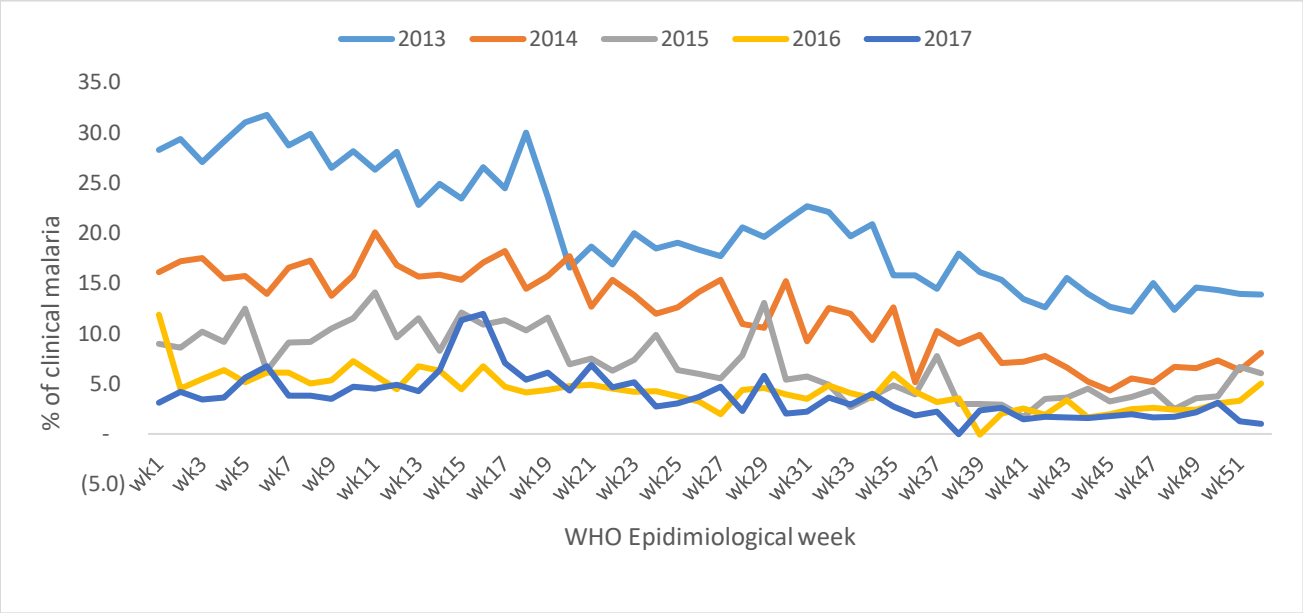
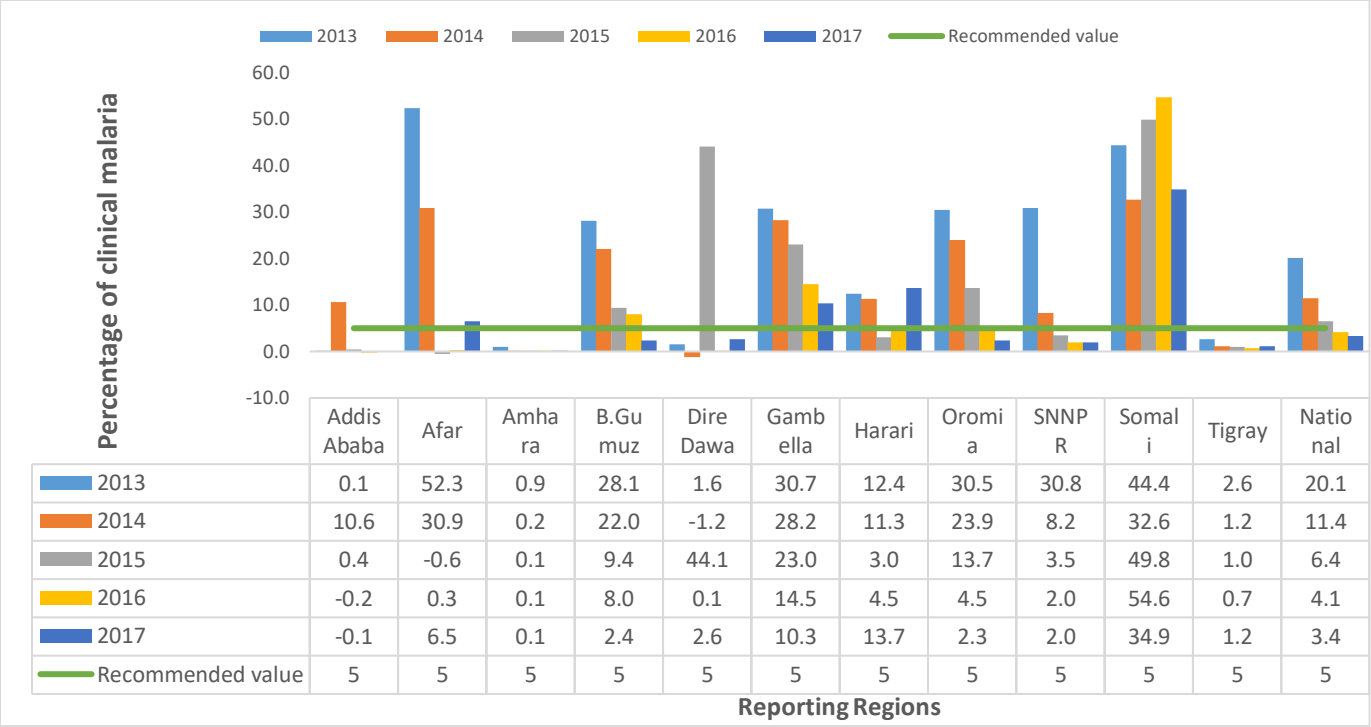


Figure 19: Clinical malaria cases trend by week, 2013-2017, Ethiopia

As shown on the above figure during the past five years clinical malaria ranges from 1%-31.8%. The highest clinical malaria was recorded in 2013, median 19.6% which ranges from 12.2%-31.8% and then decreased year to year thereafter. The lowest clinical malaria was recorded during 2017, 3.5 % (1%-11.9%).



	Addis Ababa	Afar	Amhara	B.Gumuz	Dire Dawa	Gambella	Harari	Oromia	SNNPR	Somali	Tigray	National
2013	0.1	52.3	0.9	28.1	1.6	30.7	12.4	30.5	30.8	44.4	2.6	20.1
2014	10.6	30.9	0.2	22.0	-1.2	28.2	11.3	23.9	8.2	32.6	1.2	11.4
2015	0.4	-0.6	0.1	9.4	44.1	23.0	3.0	13.7	3.5	49.8	1.0	6.4
2016	-0.2	0.3	0.1	8.0	0.1	14.5	4.5	4.5	2.0	54.6	0.7	4.1
2017	-0.1	6.5	0.1	2.4	2.6	10.3	13.7	2.3	2.0	34.9	1.2	3.4
Recommended value	5	5	5	5	5	5	5	5	5	5	5	5

Figure 20: Percentage of clinical malaria case trend, 2013-2017, Ethiopia

The reported clinical malaria case was high during the past five years in different regions as shown on the above figure. Somali and Gambella were the two far high clinical malaria reporting regions throughout the last five years. Oromia and Benishangul–Gumuz regions were among high clinical malaria reporting regions, though it is decreasing the last two years for the former and last one year for the last. The national clinical malaria trend was also high, but shows decrement during the past two years.

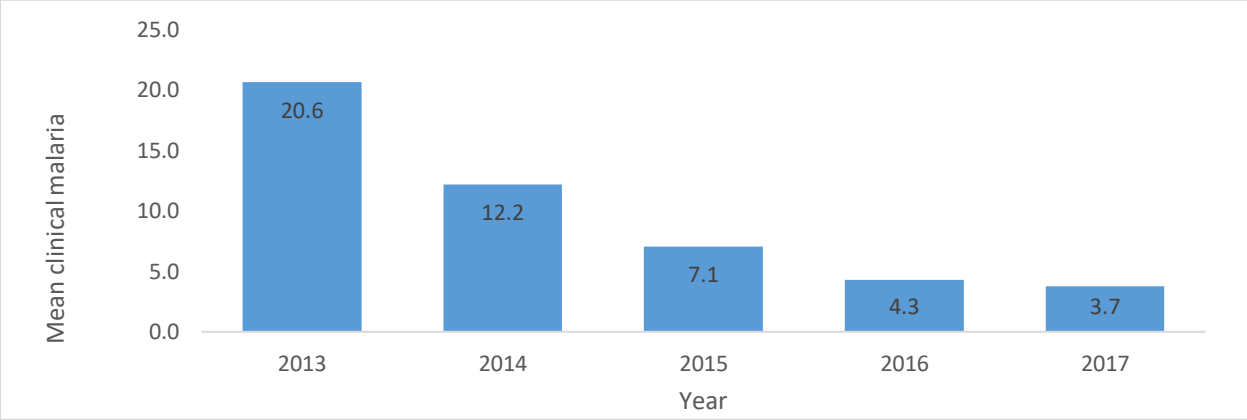


Figure 21: Average annual clinical malaria case trend by year, 2013-2017, Ethiopia

As observed from figure 21 average annual clinical malaria cases trend shows decrement from 20.6% in 2013 to 3.7% in 2017.

2.5.5. National malaria positivity rate trend by Time

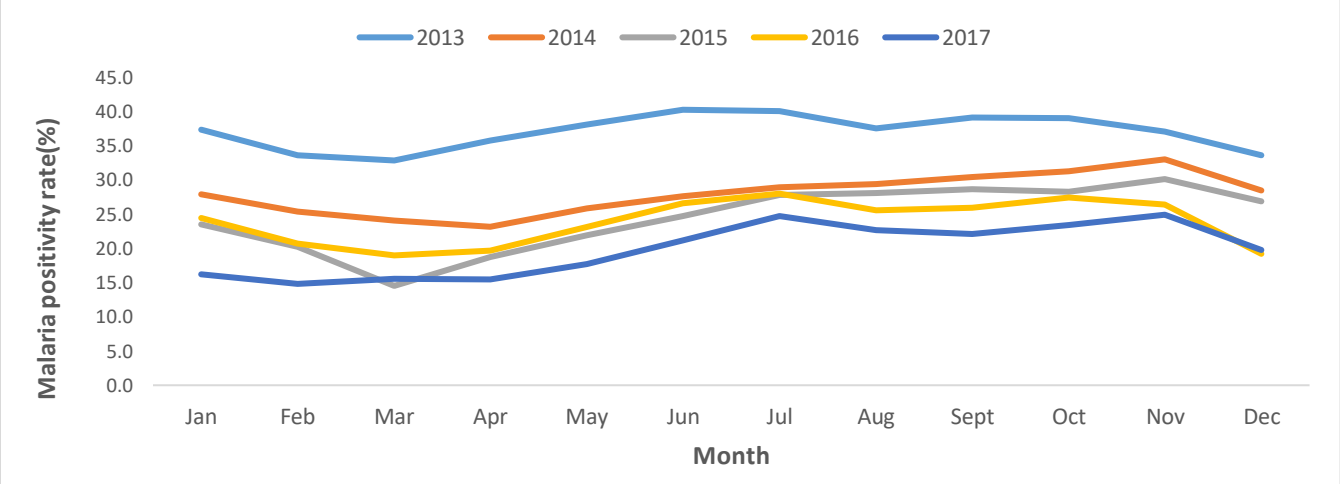


Figure 22: Monthly malaria positivity rate, from 2013-2017, Ethiopia

Malaria positivity rate is calculated as total confirmed malaria cases divided by total fever examined multiplied by 100%. Malaria positivity rate was decreased year to year from 2013 to 2017 as both confirmed malaria cases and total fever examined decreased.

2.5.6. Malarious regions' morbidity trend

2.5.6.1. Amhara regional state malaria cases trend

During the last five years totally 2,935,724 cases and 155 deaths with CFR of 0.0053% were reported from Amhara regional state. 941,149 (32.1%) of cases and 106(68.4%) of deaths were reported in 2013. The peak annual incidence rate was reached in this calendar year which is 48 cases per 1000 population. Which decreased to 14.3 cases per 1000 population in 2017.

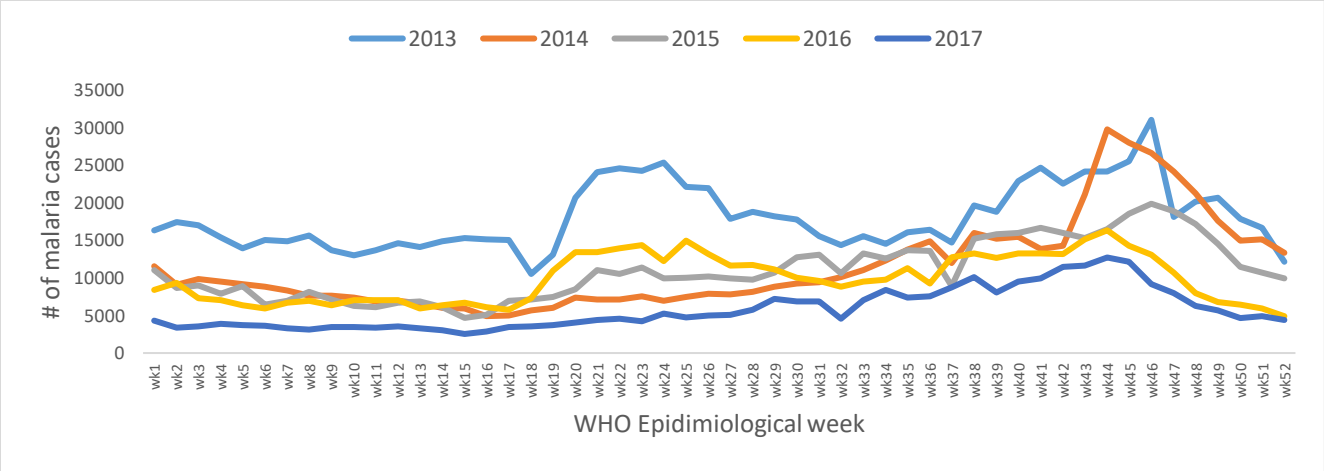


Figure 23: Total suspected and confirmed malaria cases trend by week, 2013-2017, Amhara regional state.

Similar to national malaria case trend Amhara regional states' malaria case trend shows decrement from 2013 onwards as shown on the figure 15 (941,149, 599,298, 570,946, 512,997 and 301,594) annual caseloads in 2013, 2014, 2015, 2016 & 2017 respectively.

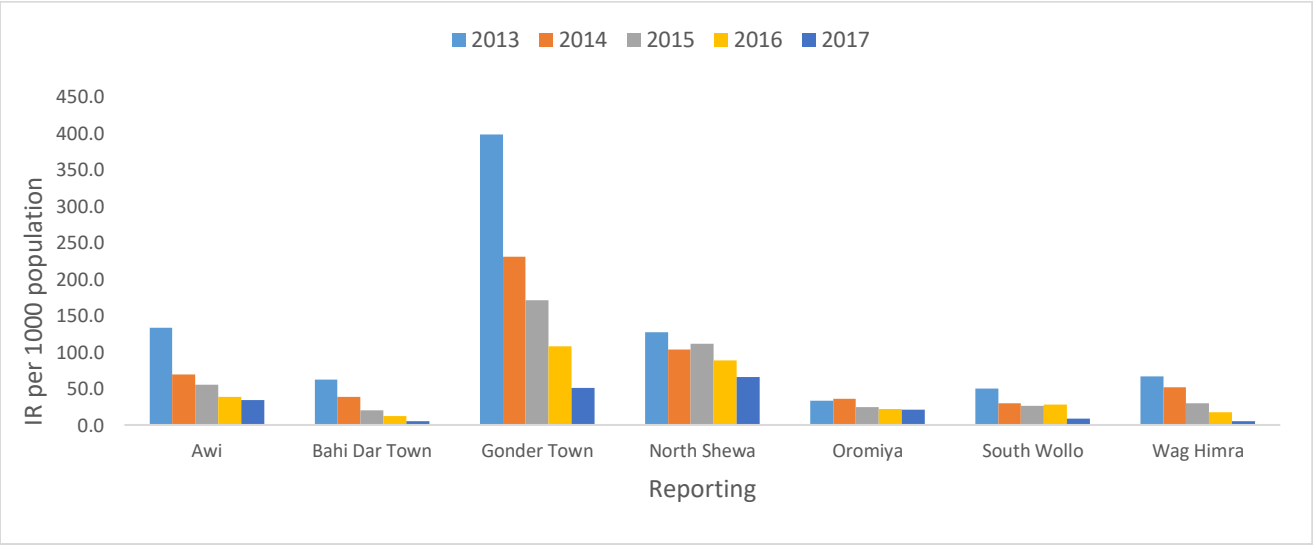


Figure 24: Malaria cases incidence rate per 1000 population by zone, 2013-2017, Amhara regional state.

Zonal malaria case trend was similar to that of national and regional case tends it's decreasing time to time from 2013 to 2017. Among Amhara regional state zones Gonder Town, North Shewa, Awi and Bahir Dar were among malarious zones/Towns.

2.5.6.2. SNNPR malaria Morbidity trend

During the last five years totally 2,202,587 cases and 133 deaths with CFR of 0.006% were reported from SNNP regional state. 986,300(44.8%) of cases and 60(45.1%) of deaths were reported in 2013. The peak annual incidence rate was reached in this calendar year with 56.7 cases per 1000 population.

Similar to total national malaria cases trend SNNP regional states' total malaria cases trend shows decrement from 56.7 cases per 1000 population in 2013 to 12.7 cases per 1000 population in 2017.

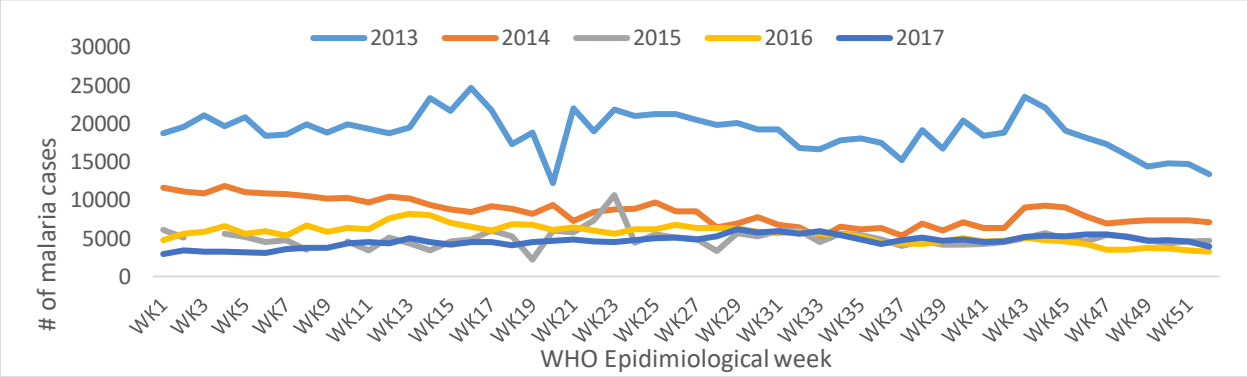


Figure 25: Total suspected and confirmed malaria cases trend by week, 2013-2017, SNNP regional state.

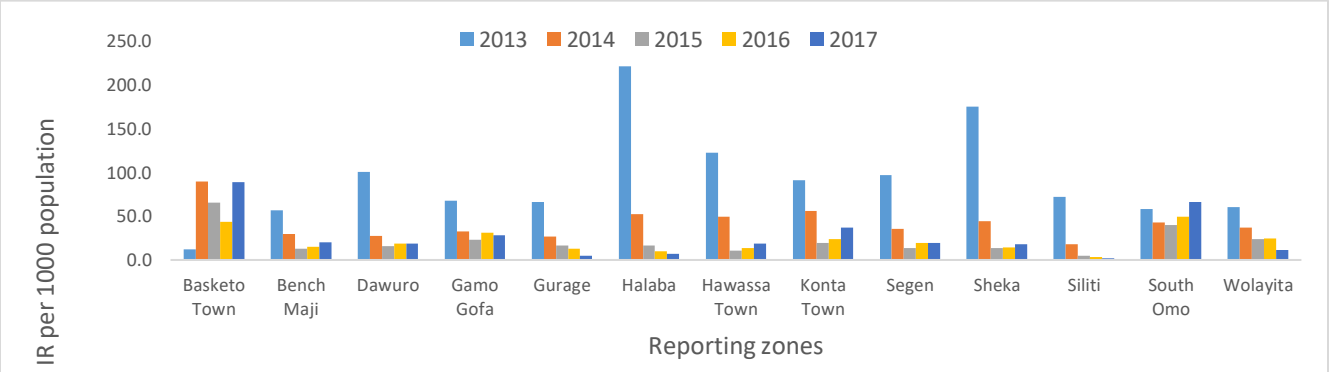


Figure 26: Malaria incidence rate per 1000 population by zones, 2013-2017, SNNP regional state.

As depicted on the figure 20 zonal malaria trend is also similar to that of national and regional case trend which peaks in 2013 and then decline thereafter. Among SNNPR zones Basketo, South Omo, Gamo Gofa and Wolayita are among highly malarious zones.

In 2013 Hadiya zone was with the highest incidence rate of 221.5 cases per 1000 population, followed by Sheka, Hawassa and Dawuro zones 175.5, 122.2 and 100.4 cases per 1000 population) respectively. Comparing it with 2017s' incidence rate Basketo was with the highest incidence rate of 88.6 cases per 1000 population, followed by South Omo, Konta town and Gamo Gofa zones 66.1, 37.2 and 28.3 cases per 1000 population respectively. Except south Omo zone which shows increment in incidence rate the remaining zones decreased dramatically time to time from 2013to 2017.

2.5.6.3. Oromia regional state malaria cases trend

During the last five years totally 1,527,945 cases and 267 deaths with CFR of 0.02% were reported from Oromia regional state. 601,915(39.4%) of cases and 36(13.5%) of deaths were reported in 2013. The peak annual incidence rate was reached in this calendar year which is 18.7 cases per 1000 population.

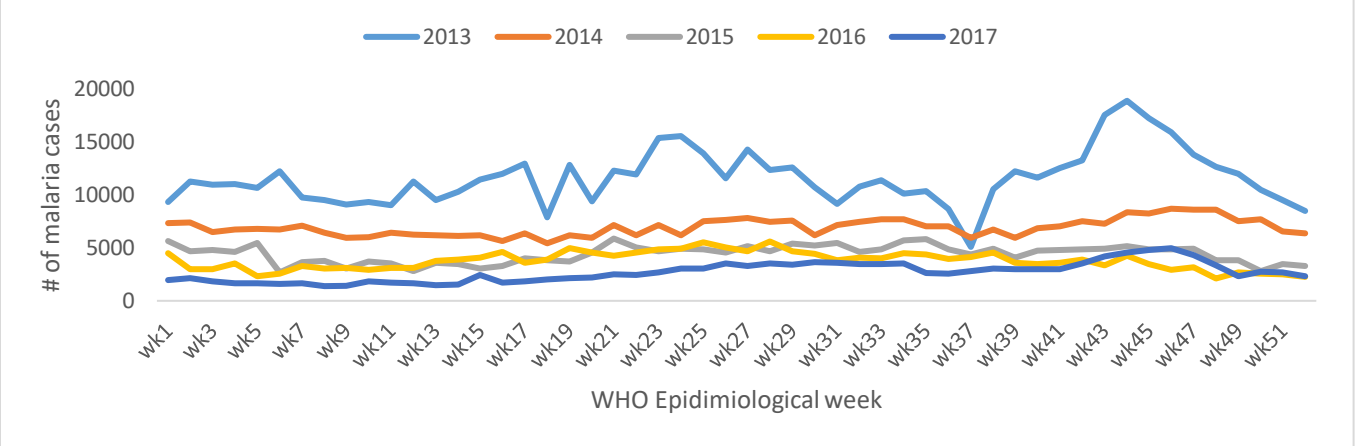


Figure 27: Total suspected and confirmed malaria cases trend by week, 2013-2017, Oromia regional state.

As clearly observed from the above figure the 2013s' malaria trend was the highest of all the remaining years oscillating over them and reached its' peak in the same year with 18,861 cases/week on week 44 (weekly incidence rate of 0.6 cases per 1000 population). The trend decreased time to time and the 2017s' trend was lowest of all during the last five years.

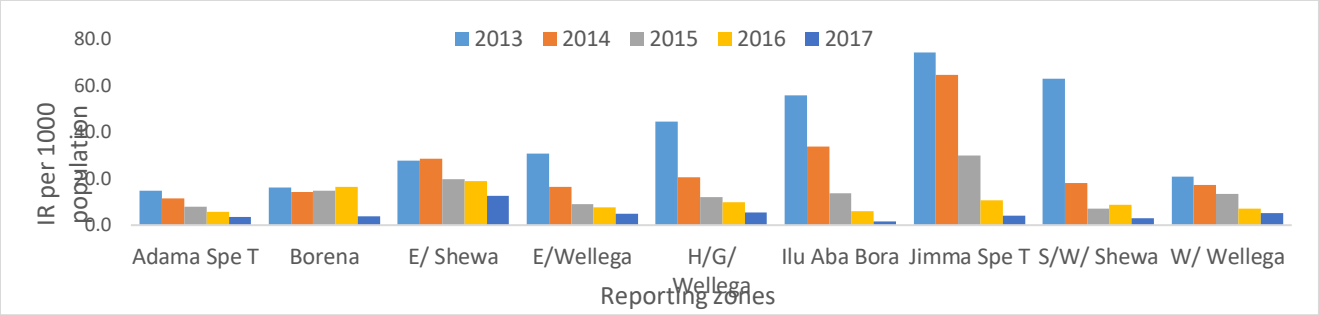


Figure 28: Malaria incidence rate per 1000 population by zones, 2013-2017, Oromia, Ethiopia.

Except East Shewa zone which peaks in 2014 all the remaining zones peak in 2013 and then decline sharply towards 2017. This is similar trend with that of national and regional trend which peaks in 2013 the decreases progressively towards 2017. During the last five years the peak zonal incidence rate was reached in 2013 from Jima special Town which was 74.2 cases per 1000 population. Though all zones were malarious, top three malaria reporting zones were Jima town, Ilu Aba Bora and East Shewa.

2.5.6.4. Tigray regional state malaria cases trend

During the last five years totally 1,237,984 cases and 37 deaths with CFR of 0.003% were reported from Tigray regional state. 288,386(23.4%) of cases and one (2.7%) of deaths were reported in 2013. The peak annual incidence rate was reached in this calendar year which is cases per 1000 population.

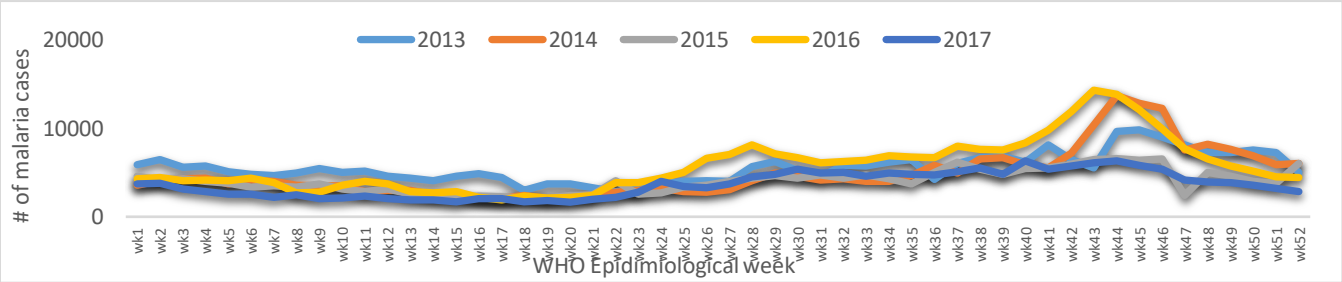


Figure 29: Total suspected and confirmed malaria cases trend by week, 2013-2017, Tigray regional state.

Tigray regions malaria case trend differs from national and other regions malaria case trend in that the 2013s' trend was highest up to week 21 then 2016s' trend over take the highest trend value up to week 44 then drops down. The peak incidence rate was 36.7 cases per 1000 population was

reached in 2016 in contrast to the national and other regions malaria case trend whose peak were in 2013.

2.5.6.4.1. Zonal malaria morbidity trend

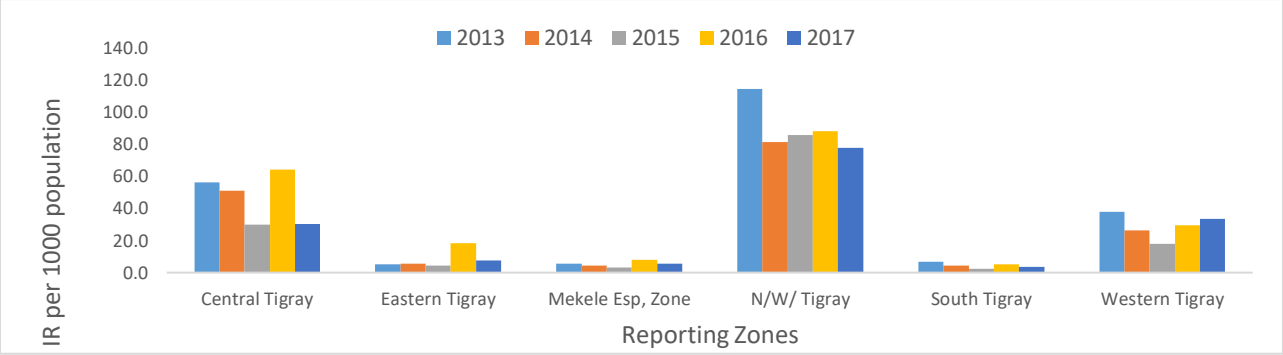


Figure 30: Malaria cases incidence rate per 1000 population by zone, 2013-2017, Tigray regional state.

As depicted on the figure 24 north western, central and western Tigray zones are top three malaria reporting Zones of Tigray region. Zonal trend was similar to the national and regional trends which peaks in 2013 and decline there after towards 2017. Peak incidence rate in 2013 was in north western Tigray zone with 114.4 cases per 1000 population followed by central and western Tigray zones 56 & 37.8 cases per 1000 population respectively. Comparing it with 2017s' incidence rate still north western Tigray zone is peak with incidence rate of 77.9 cases per 1000 population followed by western and central Tigray zones with IR of 33.3 & 30.1 cases per 1000 population.

2.5.6.5 Benishangul- Gumuz regional state malaria trend

During the last five years totally 1,184,886 cases and 90 deaths with CFR of 0.0076% were reported from Benishangul-Gumuz regional state. 252789(21.3%) of cases and 23 (25.6%) of deaths were reported in 2013. The peak annual incidence rate was reached in this calendar year.

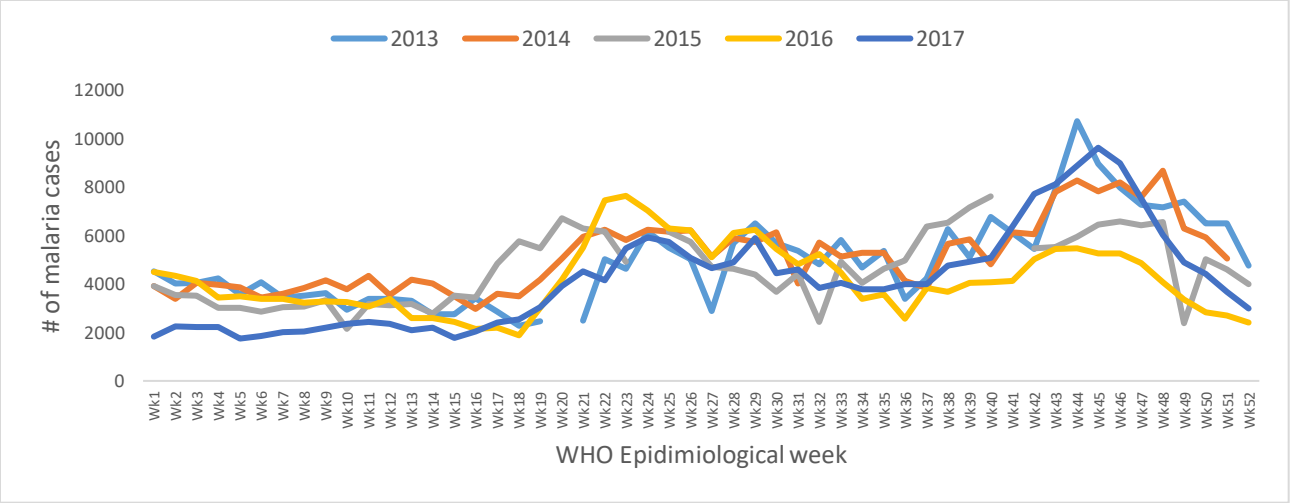


Figure 31: Total suspected and confirmed malaria cases trend by week, 2013-2017, Benishangul-Gumuz regional state.

Unlike national and other regions trend Benishangul- Gumuz regions' peak trend oscillates turn by turn; 2013s' trend was no more the highest and 2017s' trend was also not the lowest trend as in national and other regions trend.

2.5.6.5.1. Zonal to woreda level malaria morbidity trend

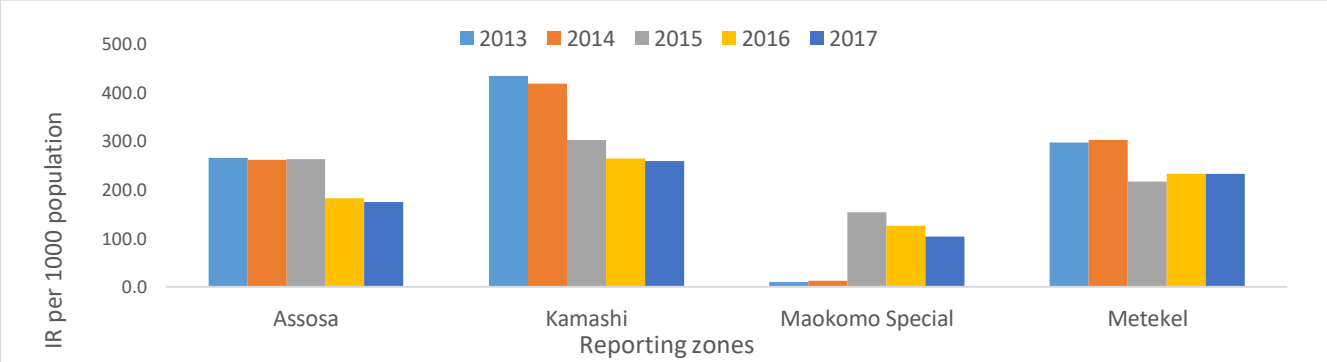


Figure 32: Malaria case incidence rate per 1000 population by zone, Benishangul- Gumuz regional state, from 2013-2017.

All zones of Benishangul- Gumuz region are malarious as shown on the above figure. Kemashi, Metekel and Assosa zones are top three malaria reporting zones.

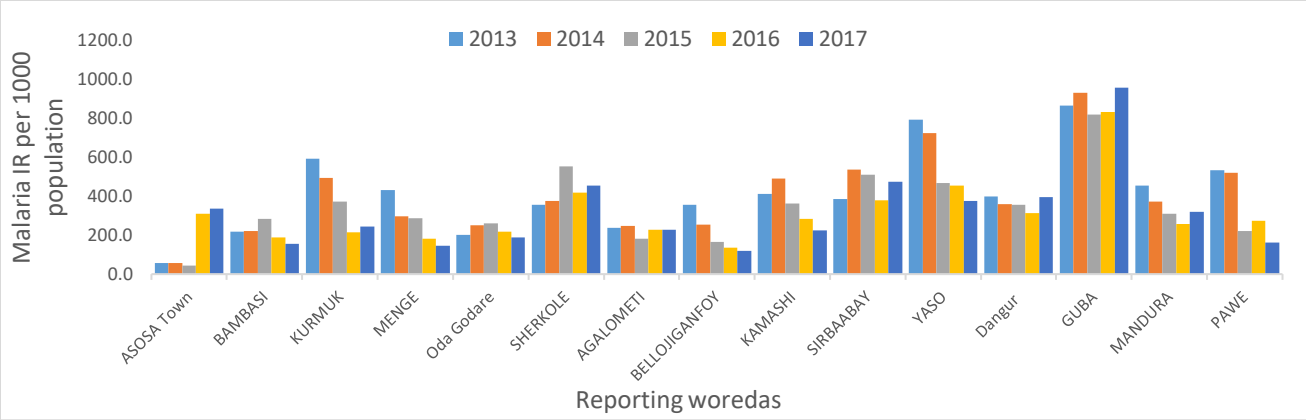


Figure 33: Malaria case incidence rate per 1000 population by woreda, Benishangul- Gumuz regional state, from 2013-2017.

Among Benishangul- Gumuz region woredas Guba, Yaso, kurmuk, sirba Abaya and sherkole woredas are top five malarious woredas.

2.5.6.6. Gambella regional state malaria morbidity trend

During the last five years totally 446,579 cases and 163 deaths with CFR of 0.004% were reported from Gambella regional state. The peak regional annual incidence rate was reached in 2013 calendar year which is 420 cases per 1000 population. Followed by 2014, 2016, 2017, 2015 which are 400, 281, 260 and 223 cases per 1000 population.

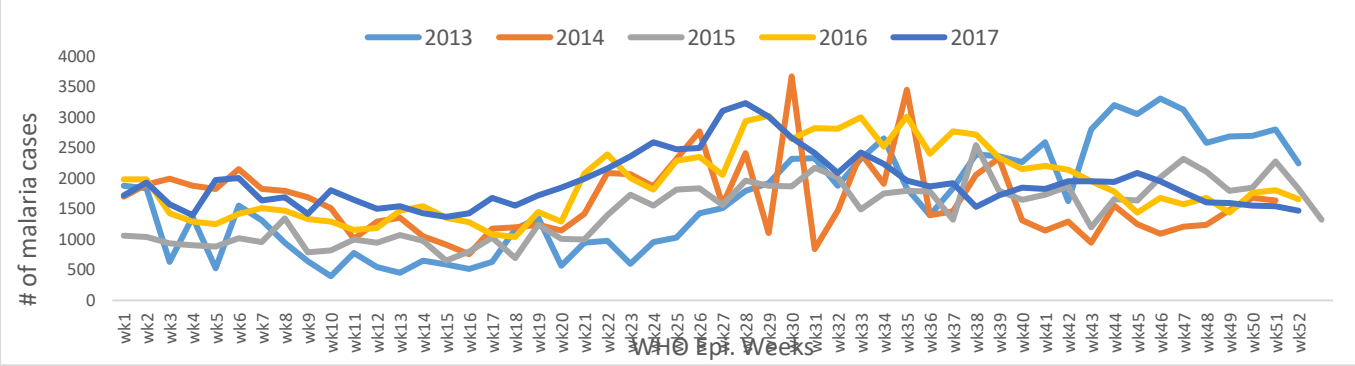


Figure 34: Total clinical and confirmed malaria cases trend by week, Gambella regional state, from 2013-2017

2.5.6.6.1. Zonal to woreda level malaria morbidity trend

During the last five years the highest malaria case incidence was observed in 2014 from Nuwer zone which is 987.6 cases per 1000 population. Followed by 2013 from Agnuak zone which is 893 cases per 1000 population.

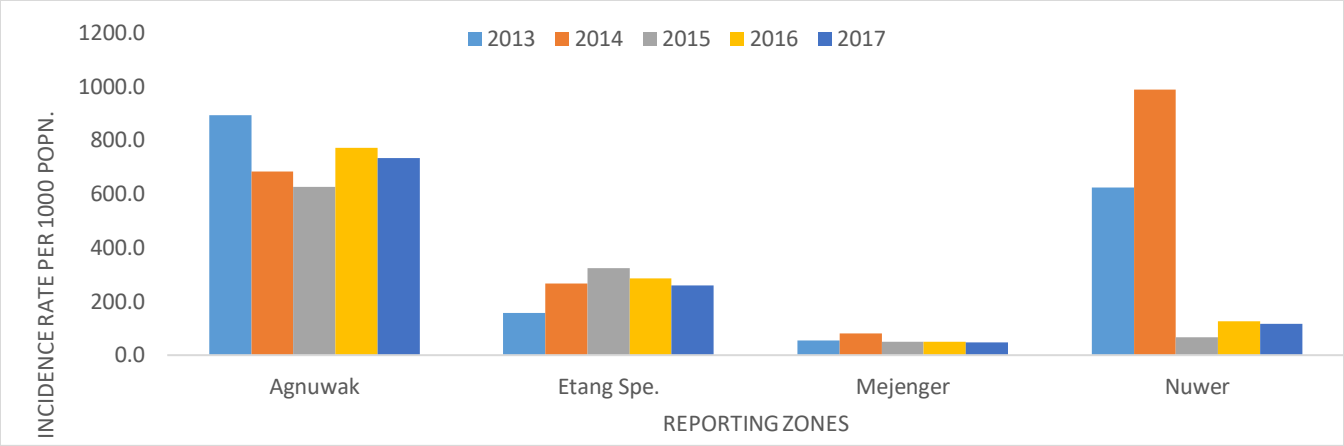


Figure 35: Malaria case incidence rate per 1000 population by Zone, Gambella regional state, from 2013-2017

During the past five years malaria incidence rate was high and no significant decrement was observed from time to time in Agnuwak Zone. In addition in Agnuwak Zone incidence rate was greater than 600 cases per 1000 population thought the last five years. In Nuwer zone it was high during 2013 & 2014 then declined sharply. Etang special shows increment from 2013 to 2017. Top three malaria reporting zones were Agnuwak, Nuwer and Etang special respectively.

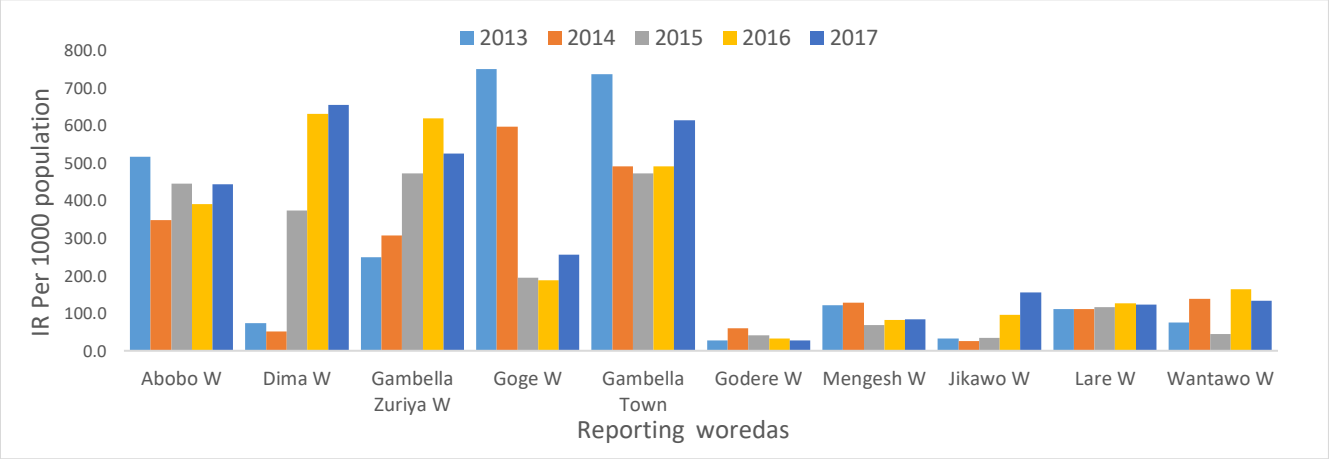


Figure 36: Malaria case incidence rate per 1000 population by woreda, Gambella regional state, from 2013-2017

Gambella Town, Gambella zuria, Abobo, Dima and Gog woredas are top five malarious woredas of Gambella region in the past five years. Dima woreda malaria incidence rate trend shows progressive increment after 2014 towards 2017. Similarly Gambella zuria woreda is increasing year to year from 2013 to 2017 unlike national and regional trends.

2.6. Discussion

Surveillance data completeness rate is one of the indicator of surveillance data quality. In the past five years the average national completeness rate was above WHO minimum requirement for Surveillance data completeness rate which is 80%. Though it was above WHO minimum requirement (80%) in some weeks it was far below minimum requirement in week 20 (54.7%) & week 37(74.7%) of 2013 and week 3(70.6%), week 9(67.8%) & week 11(70.5%) of 2015 and week 36(75.6%) of 2017 (2).

Nationally during the last 5 years about 10 million malaria cases (9,002,345 or 89.48% laboratory confirmed and 1,057,918 or 10.5% clinical malaria cases) and 788 deaths were reported. The FMOH's November 2014 annual review meeting report, which reported on PHEM data (July 2013- June 2014), stated that "out of the total 2,627,182 malaria cases reported 2,210,298 (84.1%) were confirmed by either microscopy or RDT, out of which 1,415,150 (64.0%) were P. falciparum and 795,148 (36.0%) were P. vivax." Although there are some differences in completeness and representativeness of these surveillance data, it is evident that the majority of malaria cases are now being laboratory confirmed, while surveillance systems continue to improve (1). This is almost similar with this study.

On average 2 million cases and 158 deaths were reported each year during the past five years. This is lower when compared to previous year's average annual case load which was an average of 5 million cases per year in 2005 [11]. The disease causes 70,000 deaths each year and accounts for 17% of outpatient visits to health institutions [1]. This decline might be due to the a program that Ethiopia has scaled-up since 2005 which is one of the largest and most ambitious malaria control programs in Africa, designed to support the country's Health Sector Development Plan (HSDP), the NSP and the national child survival strategy, in order to reduce under-five mortality rates by two thirds by 2015. The goal of the President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTP) [1]. In addition, there is under reporting of death in weekly surveillance data report though death due to malaria was decreasing progressively.

Annually about 3.3 million cases (33%) were reported only in 2013, but this decreased by 20% in 2017. The highest case fatality rate was observed during 2015 and the lowest in 2017. Although malaria remains among the leading causes of Ethiopian outpatient morbidity and inpatient morbidity, it is declining as a relative cause of inpatient mortality, especially among children under five years of age, according to HMIS data.

Since the most recent published surveillance data were from mid-2014, in the interim, the malaria situation in Ethiopia appears to be stable and steadily improving based upon the absence of reports of epidemics or focal case build-ups. Access to prompt rational malaria case management including near-universal laboratory-based diagnosis in remote rural areas has improved dramatically over the last decade. Concurrently, surveillance systems appear to be more accurately and nearly completely documenting public sector health facility malaria morbidity and mortality. These credible surveillance data and recently strengthened health information systems will be essential to guide malaria control efforts more rapidly and accurately, and the interpretation of malaria trends should be easier in future years than it was during the previous decade.

The past five years few admissions 0.75% & more outpatient cases 99.25% have been reported. During the last few years, there has been a large expansion in the number of health posts in the country, which diagnose and treat an increasing proportion of out-patient malaria cases (9). This could bias the number of out-patient cases seen at higher-level facilities downwards, although this factor may be counteracted if health post cases are reported through their supervisory health centre. However, health posts do not accept in-patients. It is possible that expansion of access to diagnosis and treatment through Health Extension Workers contributed to earlier and more effective care seeking and effective treatment, with consequent reduced incidence of severe malaria cases and mortality at health centers and hospitals. Since 2004, reports of outbreaks or epidemics due to malaria in the country have also been very low.

In addition to this the NMSP states that ACTs should be available at all public health facilities to treat all P. falciparum infections, whereas chloroquine continues to be first-line treatment for P. vivax cases. Quinine tablet remains the treatment of choice for uncomplicated P. falciparum for pregnant mothers during the first trimester of pregnancy, children under five kilograms body weight, and as second line for treatment failures. Rectal artesunate should be available at rural

health posts, and intravenous artesunate or intramuscular injection and intramuscular artemether (alternate) should be available at health centers and hospitals for the treatment of severe malaria. The introduction of dihydroartemisnin-piperaquine as second-line treatment for non-complicated P. falciparum and possibly to target mobile populations is being considered. The NMSP promotes primaquine for radical cure of P. vivax and also single dose treatment for gametocytocidal activity against P. falciparum, where appropriate. The NMSP aims to train 100% of the HEWs in the necessary skills to properly assess, classify, and manage as per iCCM guideline and protocols. The MIS 2011 survey suggests that about 29% of people initially receive care for febrile illnesses through the private sector. However, the capacity of the private sector to manage malaria well is limited, and they lack trained and competent health workforce, updated tools, and malaria commodities i.e., ACTs, RDTs, microscopy tools, as well as rectal and IV artesunate (1).

National and regional malaria trend decreased year to year from 2013 to 2017. This decrement is due to the a program that Ethiopia has scaled-up since 2005 which is one of the largest and most ambitious malaria control programs in Africa, designed to support the country's Health Sector Development Plan (HSDP), the NSP and the national child survival strategy, in order to reduce under-five mortality rates by two thirds by 2015. The goal of the President's Malaria Initiative (PMI) was to reduce malaria-related mortality by 50% across 15 high-burden countries in sub-Saharan Africa through a rapid scale-up of four proven and highly effective malaria prevention and treatment measures: insecticide-treated mosquito nets (ITNs); indoor residual spraying (IRS); accurate diagnosis and prompt treatment with artemisinin-based combination therapies (ACTs); and intermittent preventive treatment of pregnant women (IPTP). (1)

In Ethiopia, malaria is highly seasonal, Peak malaria transmission occurs between September and December in most parts of Ethiopia, after the main rainy season from June to August. Certain areas experience a second "minor" malaria transmission period from April to June, following a short rainy season from February to March. Malaria case trend increased slightly from April to June, then decreased from June to September and raised sharply from September to November, then felled onwards up to April to complete the cycle.

In line with this, President's Malaria Initiative (PMI) survey showed that malaria is highly seasonal in Ethiopia it increases sharply during September to December following main summer rain and the second season is from April to June following minor spring rain (1, 2, and 4).

Of the total laboratory confirmed malaria cases, the predominantly reported species was Plasmodium falciparum specious with 67% than 33% Plasmodium vivax specious was reported during the past five years nationally. Similar study conducted in Wolaita Zone southern Ethiopia shows that from the total confirmed malaria cases, the predominantly reported species was Plasmodium falciparum, accounting for (71.80%) of the overall prevalence, followed by Plasmodium vivax and mixed infection with Plasmodium falciparum and Plasmodium vivax, each constituting 24%, 4.3% (6). This is slightly higher but still plasmodium falciparum specious was predominantly reported species followed by Plasmodium vivax.

Another similar study conducted in Arbaminch Hospital also shows Plasmodium falciparum specious dominancy. Out of 400 patients clinically suspected to have malaria were examined with overall prevalence of malaria was 7% (28 malaria cases out of 400 patients) of which 18 (64.3%) were positive for Plasmodium falciparum and 7 (25%) for Plasmodium vivax; the remaining 3 (10.7%) showed mixed infections of Plasmodium falciparum and Plasmodium vivax (10).

The FMOH's November 2014 annual review meeting report, which reported on PHEM data (July 2013- June 2014), stated that "out of the total 2,627,182 malaria cases reported 2,210,298 (84.1%) were confirmed by either microscopy or RDT, out of which 1,415,150 (64.0%) were P. falciparum and 795,148 (36.0%) were P. vivax." Although there are some differences in completeness and representativeness of these surveillance data, it is evident that the majority of malaria cases are now being laboratory confirmed, while surveillance systems continue to improve. This is almost similar with this study.

In addition to this the 2007 Malaria Indicator Survey (MIS) indicated that Plasmodium falciparum constituted 77% of infections detected below 2,000 meters elevation with parasite prevalence (as measured by microscopy) was 0.7% and 0.3%, respectively, for P. falciparum and P. vivax below 2,000 meters altitude in Ethiopia (1).

Malaria positivity/slide positivity rate is calculated as total confirmed malaria cases divided by total fever examined multiplied by 100%. Malaria positivity/slide positivity rate shows the quality

of laboratory and skill of laboratory personnel. Malaria positivity rate was decreased year to year from 37% in 2013 to 19.9% in 2017 as both confirmed malaria cases and total fever examined decreased. This is higher when compared to 2011 malaria indicator survey which indicated that 1.3% were positive for malaria using microscopy and 4.5% were positive for malaria using RDTs below 2,000 meters, with only 0.1% prevalence above 2,000 meters elevation (1).

Clinical malaria is one of malaria surveillance indicator. The reported clinical malaria case was high 10.5% during the past five years in different regions. Somali and Gambella were the two far high clinical malaria reporting regions throughout the last five years. Oromia and Benishangul–Gumuz regions were among high clinical malaria reporting regions following Somali and Gambella regions. During the past five years clinical malaria was high ranging from 1%-31.8%. The highest clinical malaria was reported in 2013, which ranges from 12.2%-31.8% with median of 19.6% then decreased year to year thereafter. In contrast the lowest clinical malaria was recorded during 2017, 3.5 %(1%-11.9%) and below 5% in most of the weeks. The NMSP 2014–2020 aims for universal access to prompt malaria diagnosis and highly effective treatment services for the entire Ethiopian population, whether living in malaria-free or malaria endemic areas. The NMSP strategic objective for malaria diagnosis specifies that by 2017, 100% of suspected malaria cases are diagnosed using a RDT or microscopy within 24 hours of fever onset. The FMOH's policy is for microscopy to be the primary means of malaria diagnosis at hospitals and health centers, and for malaria RDTs to be the diagnostic method at rural health posts. The NMSP aims to train all HEWs and laboratory professionals in malaria laboratory diagnosis and provide all health posts with RDTs and health centers and hospitals with microscopy and other malaria laboratory commodities and conduct routine external quality assurances (1). In line with Ethiopia's long-standing policy that all patients with suspected malaria should receive a confirmatory diagnostic test before treatment with an antimalarial is prescribed, the FMOH has scaled up quality-assured diagnostic testing at both health facility and community level with support from PMI and the Global Fund. An analysis of micro-plan data indicates that Ethiopia has made significant progress in scaling-up diagnostic testing for malaria: the percentage of all suspected malaria cases reported that were diagnostically confirmed by either a RDT or microscopy increased from 59% in 2011 to 97% in 2014, leaving only 299,241 presumed malaria cases (i.e., "clinically treated" who were treated for malaria without laboratory confirmation).

2.7. Limitation of the study

Surveillance data lacks personal characteristics like age, sex; so data was analyzed by place and time.

Data quality issues like missing, coding error and shifting were observed. For example on week 20 of 2015, 641 malaria inpatient deaths were reported from Batu woreda; east Shewa zone of Oromia region. But, no case of malaria were reported in this week and the total fever examined were only 16; in addition confirmed cases were p. falciparum 17 and no P. vivax cases were reported. Sometimes confirmed malaria case was above total confirmed and clinical malaria cases due to data entry problem.

Malaria surveillance data has only P. falciparum and P. vivax specioses; so it is impossible to analyze the surveillance data by all specious.

2.8. Conclusion

In conclusion, the national and regional malaria trend shows decrement from year to year during the past five years. Regional malaria trend was almost similar to that of national trend except Tigray and Benishangul-Gumuz regions trend in most of the calendar years during the past five years. Majority of Malaria cases were treated at an outpatient department and the remaining cases were treated at inpatient department. On the other hand, the highest number of malaria cases and peak annual incidence rate were reached in 2013. In Ethiopia, malaria is highly seasonal, Peak malaria transmission occurs between September and December in most parts of Ethiopia, after the main rainy season from June to August. Certain areas experience a second "minor" malaria transmission period from April to June, following a short rainy season from February to March. Plasmodium falciparum specious trend is increasing steadily from time to time and that of Plasmodium vivax trend shows decrement.

Benishangul–Gumuz and Gambella were the top two malarious regions. Zonal trends were similar to regional and national trends. Gonder town, north showa and Awi from Amhara region; Basketo special, South Omo and Gamo Gofa from SNNPR; Jimma town, Ilu Aba Bora and East showa from Oromia; nourth western Tigray, central Tigray and western Tigray from Tigray region were top three malaria reporting zones in the last five years.

On average 2 million cases and 158 deaths were reported each year nationally during the past five years. The reported clinical malaria case is still high during the past five years in different regions. Somali and Gambella were the two far high clinical malaria reporting regions followed by Oromia and Benishangul–Gumuz regions. The national clinical malaria trend was also high, but shows decrement during the past two years. National malaria positivity rate trend also shows decrement year to year from 2013 to 2017.

The burden of malaria is still high in most of the regions. Ethiopia is far from national malaria elimination target which is less than 5 cases per 1000 population as most of the regions report high number of cases**.** To achieve this we need a lots of activities.

Data quality issue remains of great problem in public health emergency management data.

2.9. Recommendation

- Surveillance data lacks personal characteristics like age and sex; it's difficult to analyze surveillance data by person. So it's better if it includes personal characteristics.

- Strengthening prevention and control activities should be considered with special emphasis to Benishangul-Gumuz and Gambella regions.
- Though clinical malaria is decreasing from time to time during the past five years, it is still above recommended value; as clinical malaria increases it confuses with other febrile illnesses especially with arboviral diseases. At least RDT should be done for any suspected malaria cases at health post level and microscopy at health center/hospital level to achieve the NMSP.
- Further study should be conducted as P. falciparum trend increases progressively and P. vivax trend decreases time to time during the last five years (2013-2017).
- Malaria surveillance data has only P. falciparum and P. vivax speciouses; lacks other speciouses list like p. ovale, P. malaria and p. nili so it is impossible to analyze the surveillance data by all specious. It's better if all speciouses list should be included in the reporting form.
- Data quality issue in surveillance data is great problem and it needs improvement at each levels.

References

1. President's Malaria Initiative. Malaria Operational Plan (MOP) Ethiopia. 2016.
2. Ethiopian Public Health Institute. National PHEM guideline. 1st edition. February 2012.
3. Federal Ministry of Health. National malaria guideline. 3rd edition. January 2012.
4. Federal Ministry of Health. National Five Year Strategic Plan for Malaria Prevention and Control in Ethiopia, 2006–2010, Ministry of Health, Addis Ababa, Ethiopia. 2006.
5. World Health Organization. Epidemiological approach to malaria control, 2nd edition. 2013.
6. Deresse Legesse, Yusuf Haji, and Solomon Abreha. Trend Analysis of Malaria Occurrence in Wolaita Zone, Southern Ethiopia: Retrospective Cross-Sectional Study Arbaminch University, 2015.
7. Daddi Jima, Milliyon Wondabeku, Abebe Alemu, Admas Teferra, Nuraini Awel, Wakgari Deressa, Adamu Adissie, Zerihun Tadesse, Teshome Gebre, Aryc W Mosher, Frank O Richards and Patricia M Graves. Malaria Journal Analysis of malaria surveillance data in Ethiopia: what can be learned from the Integrated Disease Surveillance and Response System? September, 2012 Addis Ababa Ethiopia.
8. Federal Ministry of Health. 20 years envisioning plan for malaria and NTD research, 2018, Ethiopia.
9. Federal Ministry of Health, Ethiopia: HSDP IV Woreda Based Annual Core Plan. Addis Ababa, Ethiopia: Federal Democratic Republic of Ethiopia; 2010.
10. Belayneh Regasa. Magnitude of Malaria Infection in Ethiopia, Arbaminch University, 2014.
11. S. Gabriel and V. James, "Developing malaria earky warning system for Ethiopia," in 25th Annual ESRI International User Conference, National Center for EROS, San Diego, Calif, USA, Paper no. UC2409, 2005.
12. WHO. Global malaria burden 2008.
13. RBM/WHO/UNICEF. World Malaria Report. Global malaria burden. Geneva. 2005.
14. Getachew Geleta and Tsige Ketema. Severe Malaria Associated with Plasmodium falciparum and P. vivax among Children in Pawe Hospital, Northwest Ethiopia. February 2016.
15. Roll Back Malaria. The burden of malaria in Africa. The Africa Malaria Report–2003.
16. The Ethiopian Health and Nutrition Research Institute & partners. Ethiopia National Malaria Indicator Survey. September 2012.
17. CSA. Population survey 2009.

Chapter III: Evaluation of Surveillance System

3. Evaluation of Surveillance System of Guinea worm disease, Gambella region, western Ethiopia, April, 2018.

Abstract

Background: The evaluation of a surveillance system promotes the best use of health resources and assures that systems operate effectively. Dracunculiasis is one of the neglected tropical Diseases. In 1976, the WHO estimated a prevalence of 10 million dracunculiasis cases globally. Currently only Chad and Ethiopia remains endemic. This study was conducted to determine the status of core and supportive activities of the surveillance system, describe the specific attributes of the system and identify areas for improvements.

Method: Gambella regions' surveillance system was evaluated from March 20 to April 5, 2018. Descriptive cross sectional study design was used. Both the region and Woredas were selected purposively based on prevalence and risk of the disease. Data collection was conducted by principal investigator using semi-structured questionnaire.

Result: Average weekly surveillance data completeness and timeliness rate were 89% and 75% respectively. Data analysis was not practiced at health facility and health post level. From visited sites 66.7% of woredas analyzed surveillance data irregularly. All outbreaks that occurred in the region in the past six months were not responded within 72hrs as per the guideline. No specific supportive supervision due to budget limitation. None of the visited sites received feedback from higher level. Finding of the surveillance attribute results in overall mean of 4.48 out of 5 with 0.19 standard Deviation.

Conclusion: The overall functioning of public health surveillance system underway in Gambella region was not satisfactory to achieve its targeted goals of prevention and control. Using plus one principle is confusing. The implementation process of the surveillance system at different levels is not uniform.

Key words: Guinea worm, Dracunculiasis, surveillance, system, Evaluation, Gambella, Ethiopia.

3.1. Introduction

3.1.1. Background

The evaluation of a surveillance system promotes the best use of health resources and assures that systems operate effectively. Surveillance system evaluation allows us to define whether a specific system is useful for public health and is achieving that system's objectives. Surveillance system evaluation describes the evaluation of epidemiologic surveillance system. Its purpose is to promote the best use of public health resources through the development of effective and efficient surveillance systems. Epidemiologic surveillance is the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event. This information is used for planning, implementing, and evaluating public health interventions and programs. Surveillance data are used both to determine the need for public health action and to assess the effectiveness of programs. In addition, a surveillance system should be simple, flexible, acceptable, situation specific and should be established at the beginning of public health activities set up in response to an emergency [1, 2].

Thus, Public health surveillance systems should be evaluated periodically, and the evaluation should include recommendations for improving quality, efficiency, and usefulness. Surveillance needs to be linked to timely dissemination of the data, so that effective action can be taken to prevent disease. Surveillance mechanisms include compulsory notification regarding specific diseases, specific disease registries (population-based or hospital-based), continuous or repeated population surveys [1, 4]. While evaluating surveillance system, the evaluation of public health surveillance systems should include an assessment of usefulness of the system, system attributes, including simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability [5].

Efforts to establish disease surveillance system was initiated in Ethiopia in 1947 when the government issued quarantine rules. Subsequently several legal and administrative measures were taken to strengthen communicable disease surveillance. However, these efforts were not supported with appropriate resources thus; surveillance was limited in scope and usefulness. In the health sector, various institutional arrangements were implemented to strengthen surveillance services.

In 1948, an anti-epidemic service was established that later in 1951 identified 35 priority diseases for surveillance; those diseases were classified into first class disease (immediately notifiable) and weekly reportable second-class diseases. These arrangements continued with several minor changes until the 1994 health system reform. The health reform taking into account the resource constraints and the need for strengthening functional surveillance system selected nineteen priority diseases (including those under vertical programs) for surveillance [7].

Lack of functional surveillance system that can guide timely and effective health intervention has been a common problem to the African region. Thus, the African through the WHO Africa regional office (WHO/AFRO) made a resolution (resolution AFRO/RC48/R2) in September 1998 to develop an integrated disease surveillance and response (IDSR) initiative as a regional strategy to effectively control priority communicable diseases in the African region. IDSR emphasizes on capacity building at district level, integration and coordination of activities at all levels, timely feedback and use of information for action, improve laboratory capacity in support of surveillance, and community participation[7].

The FMOH adapted a comprehensive strategy recommended by WHO for member state during the 48th assembly in 1998 for improving communicable diseases surveillance and response through Integrated Disease Surveillance and response (IDSR) linking community, health facility, woreda and national levels [8]. Accordingly, as a first step a comprehensive assessment of the existing surveillance, epidemic preparedness and response system of the country was conducted in October 1999. The assessment revealed that most disease prevention programs have vertical surveillance systems, resources are scarce for surveillance at all levels, quality of surveillance is compromised by uncoordinated and multiple use of data collection tools, data are not processed timely and completely to guide health interventions, no data processing and utilization at the district level, there is hardly any feedback at all levels, and epidemic preparedness and management capability are weak [4].

Based on the findings of the assessment the FMOH developed a Five-year strategic plan and plan of action in 2000 for sustainable implementation of IDSR strategy in Ethiopia. Following that the MOH of FDRE has adopted the WHO/AFRO generic technical guidelines and training modules for integrated disease surveillance and response, established a National IDSR Taskforce, officially launched the IDSR strategy, strengthened the IDSR team, conducted a series of training from

national to district levels for trainers and focal persons, disseminated the IDSR technical guidelines, developed and distributed new reporting formats, developed and disseminated standard case definitions, distributed laboratory reagents, provided computers, and established feedback system using monthly bulletin and quarterly newsletter [3].

After the implementation of IDSR, The Government of Federal Democratic Republic of Ethiopia has embarked country wide reform initiative aimed at bringing effectiveness and efficiency in execution of various works using the Business Process Reengineering (BPR) as a tool in 2005. In line with this, the Federal Ministry of Health and Agencies under the ministry have identified 7 core processes that need reengineering in order to effectively fulfill sectorial visions and missions.

Accordingly, Public Health Emergency Management is one of the core processes identified by the Federal MOH for redesign. Public Health Emergency Management is defined as the process of anticipating, preventing, preparing for, responding to and recovering from the impact of epidemics and health consequences of natural and manmade disasters. The sub processes identified for the process include Preparedness, Early Warning, Response and Recovery. However, as the existing process focuses only on disease surveillance and epidemic response processes, the remaining processes mentioned above couldn't be shown in the As-Is part [9,11].

In BPR IDSR is included under PHEM core process and before BPR implementation 20 priority diseases included under IDSR by categorizing it three major groups which is Epidemic-Prone Diseases, Diseases Targeted for Eradication and Elimination, and Other Diseases of Public Health Importance [10]. However, after redesigning those priority disease modified in to 22 (14 are immediately reportable whereas 8 are weekly reportable). Those diseases are selected Based on: Diseases which have high epidemic potential, Required internationally under IHR 2005, Diseases targeted for eradication or elimination, Diseases which have a significant public health importance and Diseases that have available effective control and prevention measures for addressing the public health problem they pose [11].

Reporting Periodicity

The identified 22 disease and conditions are classified in to two reporting periods depending On their epidemic potential, diseases targeted for elimination and eradication as indicated;

Immediate reporting: Currently 14 diseases are identified to be reported immediately to next reporting level. For the immediately reportable diseases, a single suspected case is considered as a suspected outbreak.

Therefore, suspected outbreak of these diseases should be notified from level to level within

30 minutes of identifications follows:

- ✓ From community or health post or health center to woredas health office within 30
- ✓ minutes,
- ✓ From woreda health office to zone/region within another 30 minutes,
- ✓ From zone to regional office within another 30 minutes,
- ✓ From regional health bureau to federal level/ EPHI within another 30 minutes,
- ✓ EPHI to WHO within 24 hours of detection.

You can report the information verbally or by telephone, radiophone or use an electronic methods such as email, fax, mobile short message service.

Weekly reporting: Currently 8 diseases and conditions are identified to be reported weekly to the next reporting level. Reporting of the total number of cases and deaths seen within a week (Monday to Sunday) and should be reported to the next level as follows:

- ✓ Health facilities report weekly data /Monday to Sunday/ to woreda every Monday till midday;
- ✓ Woredas report to zone/region every Tuesday till midday;
- ✓ Zone (if applicable) report to region every Wednesday till midday;
- ✓ Region report to EPHI PHEM every Thursday;
- ✓ EPHI PHEM report to stakeholders every Friday.

The routine flow of surveillance data is usually from reporting sites to the next level up to the central level as indicated in figure 37.

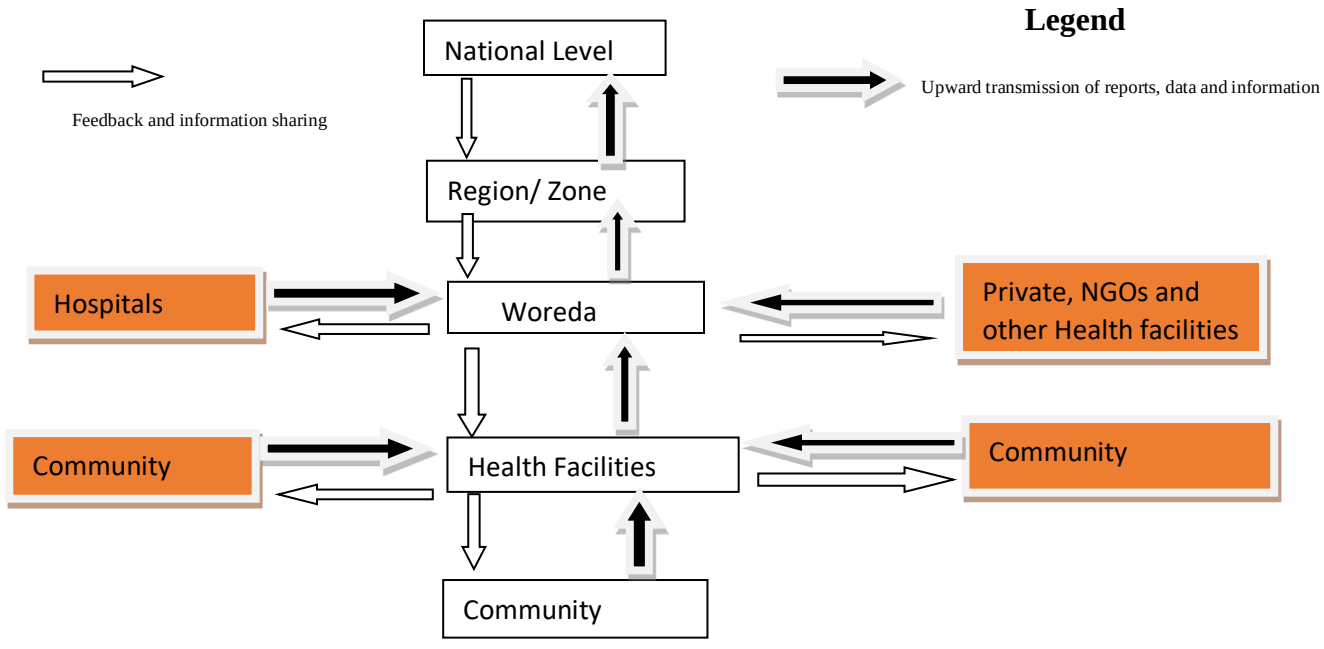


Figure 37: Diagram illustrating the formal and informal flow of surveillance data and information throughout a health system.

The community and health facilities especially health posts are the main source of information. The information collected from this site is compiled in standard forms, analyzed and then forwarded, to the woreda health office. Woreda level uses standard formats to compile aggregate, and send the data to zone/region, from which the central level receives. Feedback and information sharing will follow the same route.

Dracunculiasis, also named Guinea Worm Disease (GWD), is one of the Neglected Tropical Diseases. Dracunculiasis is a parasitic infection caused by a long, string like, female worm nematode Dracunculus medinensis. Its larval form infects an intermediate crustacean host (cyclops or water flea) that commonly infests shallow ponds or step wells used as sources of human drinking water. It is transmitted to humans via drinking contaminated water containing infective copepods. Given, its feasibility for eradication, the Guinea Worm Eradication Program (GWEP) was launched in 1980 with the aim of eradicating the disease. Since its inception, GWEP has made an extraordinary progress in interrupting transmission. Globally, the number of reported cases reduced from 3.5 million in 20 countries in 1986 to only 22 cases in 2015 from only four countries namely South Sudan, Mali, Chad and Ethiopia. Each endemic country has its own national Guinea Worm Eradication Program. Guinea worm disease (GWD) is an affliction of poverty, debilitating residents of remote and marginalized communities in Africa. Guinea worm disease negatively affects health, agricultural productivity, school attendance, and overall quality of life in the communities where it is found.

Ethiopia Dracunculiasis Eradication program (EDEP) is an oldest program in the country lasting almost 25 years. In Ethiopia a nationwide case search was conducted in 1993 to identify Dracunculiasis endemic areas, hence, six districts in Gambella region and one district in South Omo Zone of SNNP region found to be endemic for the disease. Then in 1994 Ethiopia Dracunculiasis Eradication program established and started implementation of active surveillance and interventions in endemic districts. In 1986 there were 20 countries endemic for GWD with about 3.5 million cases per year (90% of cases in Africa), when the World Health Assembly adopted a formal resolution calling for eradication of GWD. Currently 20 villages in four countries (South Sudan, Ethiopia, Mali and Chad) remain endemic for the disease. Since Mali has interrupted transmission of GWD in 2016, currently, the disease remains endemic in only three sub-Saharan African countries namely, South Sudan, Chad and Ethiopia.

3.1.2. Rationale of the study

In Gambella region surveillance system evaluation was not done before and the status of public surveillance system is not well known. Additionally, Outbreaks have occurred frequently and there is relatively delay in detection, reporting and response. Therefore, this study was conducted to determine the status of core and supportive activities of the surveillance system, describe the specific attributes of the system and identify areas for improvements. The purpose of evaluating public health surveillance systems is to ensure that problems of public health importance are being monitored efficiently and effectively.

3.2. Objectives of evaluation

3.2.1. General objective

To evaluate the surveillance system of Guinea worm disease in Gambella region, from March 20 to April 5, 2018.

3.2.2. Specific objectives

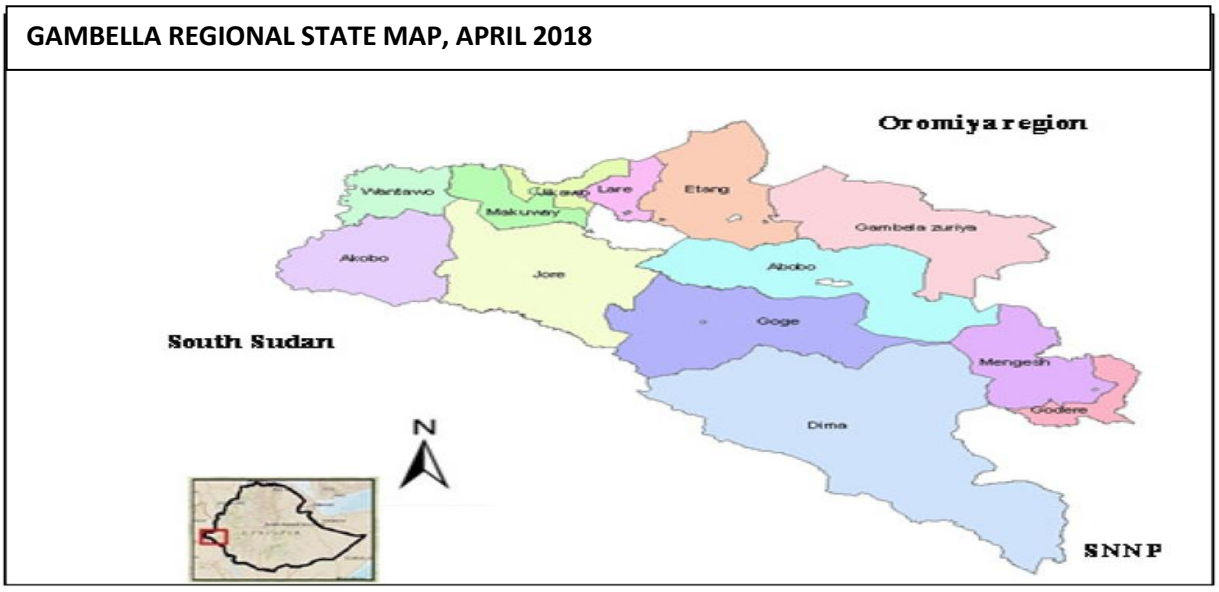
- To assess core activities of the surveillance system such as case detection, reporting, analysis, epidemic preparedness and response system in Gambella region, from March 20 to April 5, 2018.
- To assess supportive activities of the surveillance system such as feedback, supervision, training and availability of resources (logistics, data management and communication materials) in Gambella region, from March 20 to April 5, 2018.
- To evaluate the attributes of surveillance system of GWD in Gambella region, from March 20 to April 5, 2018.

3.3. Methods

3.3.1. Study Area and period

The study was conducted in Gambella region from March 20 to April 5. Gambella region is located 766 km from Addis Ababa in the southwest direction. It lies between 7-8° North longitude and 33-35° East latitude and share borders with Oromia to the North and East, SNNPR to the South, and the country of South Sudan to the west. The altitude of the region ranges from 300-2300 meters above sea level with an average annual rainfall between 800 to 2100mm and mean annual T° of 30.7°C. Its capital is Gambella. The Region is situated between the Baro and Akobo Rivers, with its western part including the Baro salient.

Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), the Gambella Region has total population of 307,096, consisting of 159,787 men and 147,309 women; urban inhabitants number 77,925 or 25.37% of the population. With an estimated area of 29,782.82 square kilometers, this region has an estimated density of 10 people per square kilometer. For the entire Region 66,467 households were counted, which results in an average for the Region of 4.6 persons to a household, with urban households having on average 3.8 and rural households 4.9 people. There are a number of refugee camps located in Gambella Region housing around 268,000 refugees from South Sudan.



Map 5: Map showing study area, Gambella regional state, April 2018.

3.3.2. Study subject

The study subjects were RHB, woreda health offices and health facilities (Hospitals, health centers and health posts) which lays in the region.

3.3.3. Sampling procedure

3.3.3.1. Selection of sites

a. Selection of region

The region was selected purposively out of 9 regional states and 2 town administrative based on the prevalence of GWD in the region and absence of system evaluation on GWD.

b. Selection of districts

From selected zones 5 rural woredas and one town administration (Abobo, Gambella Zuria, Gog, Lare, Gambella Town and Itang special) were selected purposively based on the disease prevalence and risk classification.

c. Selection of health facilities

Regarding health facilities there were a total of 137 health posts, 27 functional health centers and 4 Hospitals in the region. Therefore according to their distribution by woredas, from selected woredas 6 functional health posts one from each woreda, 12 health centers two from each woreda and 2 Hospitals were included in the assessment. Health facilities were selected by using simple random sampling method.

3.3.4. Data collection tools and procedure

Data collection was conducted by principal investigator. CDC system evaluation guideline of 2001 and WHO tools were used to interview regional, woreda, health facility and health post PHEM officers/focal person and practical observation of documents was also conducted in regional health office, woreda health office and health facilities (Hospital, health center and health post).

3.3.5. Case definition

3.3.5.1. Standard Case definition

Suspected

An individual exhibiting a skin lesion or lesions with emergence of one or more guinea worm (each individual should be counted only once in a calendar year)

Confirmed

A suspected case that is laboratory confirmed.

Picture showing blister of GW and emerging worm.

3.3.5.2. Community/ Health post level case definition

A person who has painful, burning blister OR A ruptured blister with the emergence of one or more guinea worms.

3.3.6. Operational definitions

Terms used in the evaluation were operationally mentioned as follows:-

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

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

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

Rumor of Dracunculiasis: information about an alleged case of Dracunculiasis (GWD) obtained from any source (informants).

Suspect: a person exhibiting signs and symptoms of GWD: localized itching, blister, swelling and skin lesion

A Case of Dracunculiasis: An individual exhibiting a skin lesion or lesions with emergence of one or more guinea worms (each individual should be counted only once in a calendar year).

Imported case: a case of GWD that was acquired in a place other than the village where it was detected and reported.

Indigenous case: a case of GWD that was acquired in a place where it was detected and reported.

Endemic village/district: a village/district with one or more active indigenous cases during the previous and/or current year.

Formerly endemic village: a village/district with zero case reports for three consecutive years

Elimination/Local eradication of Dracunculiasis: is the confirmed absence of clinical illness indicating interruption of dracunculiasis medinens in man, for three years or longer from a sizable geographical unit such as a country, with such a low risk of reintroduction of the parasite that preventive measures could be reduced to a strict minimum.

Eradication of Dracunculiasis: is the confirmed absence of clinical illness indicating interruption of Dracunculiasis medinensis in man, for three years or longer worldwide.

At-risk village: a village is considered to be at risk of local transmission of GWD if at least two of the following risk factors are associated:

- ✓ Past history of endemic transmission of GWD;
- ✓ Absence of safe drinking water sources and proximity to endemic villages;
- ✓ Unsafe sources of drinking-water shared with neighboring endemic village,
- ✓ Established degree of links/movement of population with endemic villages/areas

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

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

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

Usefulness: Usefulness of the surveillance system is reflected by documented changes in policies and procedures as a result of information generated by the system.

Simplicity: Simplicity denotes ease of the structure and operation of the surveillance system.

Flexibility: Flexibility of a surveillance system is its capacity to adapt to changing information needs or operating systems within minimal additional time, personnel and funding.

Quality: The quality of data reflects the completeness and validity of the data recorded in the Zonal Health Department.

Acceptability: Acceptability is the willingness of persons, institutions or organizations to participate in the surveillance system.

Sensitivity: Sensitivity refers to the ability of the system to detect cases or outbreaks through trends in the surveillance data.

Positive predictive value: Positive predictive value refers to cases that actually have the health condition in question.

Representativeness: Representativeness refers to the extent to which the surveillance system accurately describes the occurrence of medical condition over time and their distribution in the population by place and person.

Stability: Stability was assessed by questioning the surveillance officers on the consistency of the system.

According to national PHEM guideline, there are two types of case definitions: standard and community case definition.

Standard case definition: is a case definition that is agreed upon to be used by every health professional within the country. Standard case definition can be classified as confirmed, probable, and possible or suspected.

Community case definition: is a case definition of disease and Conditions adapted to suit to health extension workers (HEWs) and community. The community case definitions were modified for simplicity and ease of understanding by HEWs and the community. List of 14 diseases or

syndromes and conditions are identified to give simplified case definitions at community level. Even translation to local language was considered.

3.3.7. Data analysis

Data analysis was carried out by using Microsoft office excel 2013 to show trend of GWD over time, system attributes, completeness of surveillance data over time and Arc GIS version 10.4.1 to show study area, surveillance level & villages reporting GWD.

We interviewed study units at the regional PHEM, woreda PHEM, health facilities and health posts to measure the major attributes of the surveillance system. The responses to each question items were categorized into five groups. The groups includes; Strongly agree – coded as 5, Agree- coded as 4, Neutral- coded as 3, Disagree coded as -2 and strongly disagree coded as – 1 then the average score was calculated for each question item and attribute.

3.3.8. Ethical clearance

This study was conducted to assess the functionality of the surveillance system for Guinea worm disease. In addition the study subject was health institutions which were found in the region. Therefore Ethical clearance was not necessary for this study, because there is no direct contact with patients or community. However, latter of consent was written from EPHI and regional health department to visited woredas.

3.3.9. Dissemination of study result

The study result was disseminated to AAU school of public health, department of Ethiopia Field Epidemiology training program (EFETP), EPHI, RHB and visited woreda health offices in hard copy and soft copy.

3.4. Assessment findings

The surveillance system of Gambella region was evaluated. In this assessment a total of 27 sites were participated. The main focuses of the evaluation was the core activities, supportive functions and quality components of the surveillance system.

Trends of reported GWD since establishment of EDEP.

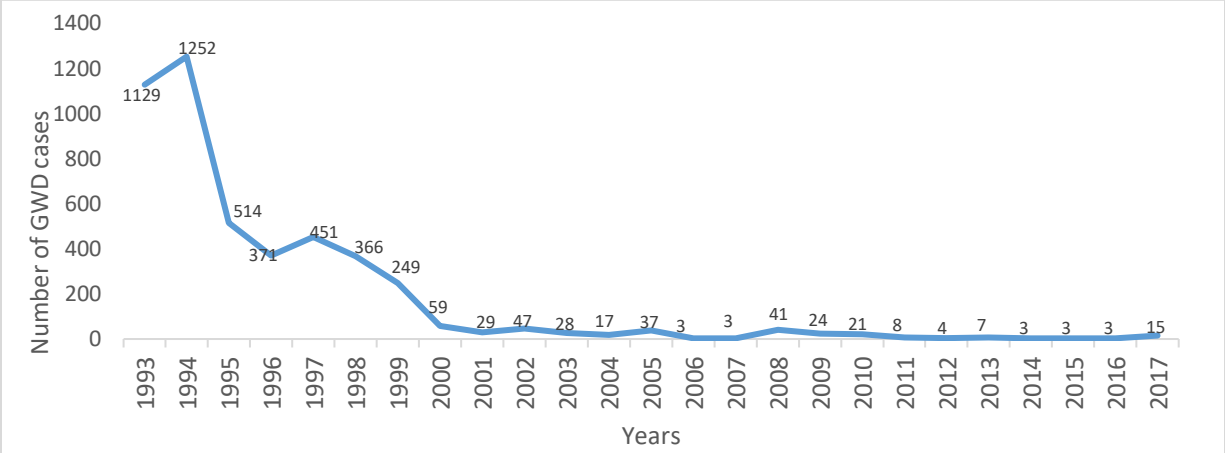
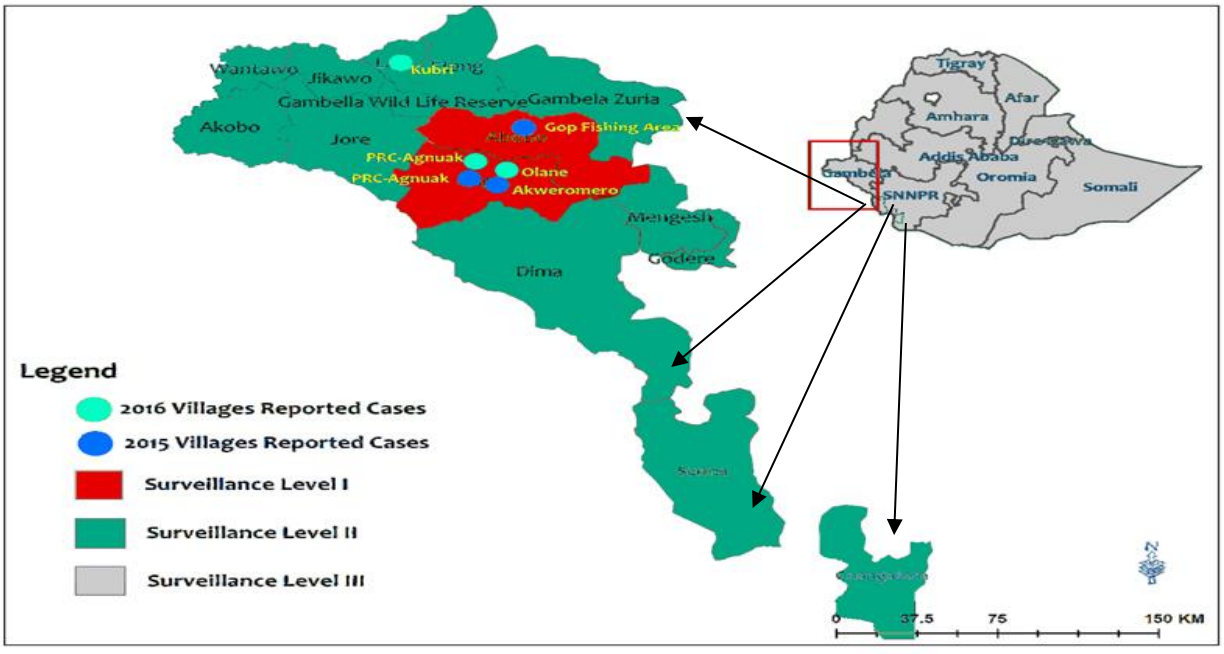


Figure 38: Annual human GWD cases trend, from 1993-2017, Ethiopia.



Data source: Synthesized from WHO online data base and EPHI PHEM data base.

Map 6 : Guinea worm levels of surveillance and villages reporting, Ethiopia, 2018

3.4.1. Targeted diseases under surveillance and included under this study

Resource is very scarce and it needs prioritization. Because of shortage of time and other resources surveillance could not be carried out for all diseases and conditions. For this reason, Federal ministry of health the public health emergency management core process given prioritization to those diseases that are of interest at national and international levels. Based on this PHEM core process selected 22 diseases to be included into the routine surveillance system. Of these, 8 diseases (malaria, meningitis, dysentery, typhoid fever, epidemic typhus, relapsing fever, SAM and scabies) are reported on weekly base and the rest 14 diseases (yellow fever, rabies, small pox, polio, NNT, measles, guinea warm, viral hemorrhagic fever, cholera, anthrax, avian human influenza, sever acute respiratory syndrome, pandemic influenza and Maternal death) are reported on immediately base. Of these targeted diseases under surveillance: GWD was covered in this study (table 15).

Table 15: List of immediately and weekly notifiable diseases/conditions, Ethiopia, 2018

S.No.	Immediately reportable	Weekly reportable
1	Acute Flaccid Paralysis (AFP) /Polio	Dysentery
2	Anthrax	Epidemic typhus
3	Avian Human influenza	Malaria
4	Cholera	Meningococcal Meningitis
5	**Guinea warm/ Dracunculiasis**	Scabies
6	Measles	Sever Acute Malnutrition
7	Maternal and perinatal death	Relapsing fever
8	NNT	Typhoid fever
9	Pandemic influenza (H1N1)	
10	Rabies	
11	Small pox	
12	Sever acute respiratory syndrome (SARS)	
13	Viral hemorrhagic fever (VHF	
14	Yellow Fever	

3.4.2. Availability of case definition, national surveillance manuals, Standard Operation procedure (SOP) and different forms (Case detection, registration, clinical registry and Case management procedure forms).

According to the assessment, from 27 visited sites 18 (67%) of them had case definition for GWD, 13(48%) had national guideline for PHEM, 18 (67%) of them had epidemic reporting form, 12(46%) integrated case search form and out of 18 respondents 14 (77.8%) of them had rumor register form, 17 (94%) of them had case management procedure form. However, none of the visited institutions had case definition for the rest priority diseases. On the other hand, Health practitioners and health extension workers who were interviewed during the assessment, 22/26(84%) of them, were understood the case definition clearly and apply the case definition accordingly as per the national guide line.

Table 16: Availability of guidelines, different forms and case definition in visited health institutions, Gambella 2018.

S.No.	Availability of	Health Post level	Health Center level	Woreda Health office	Regional PHEM department
1	National PHEM guideline	NA	58.3%	100%	Available
2	Integrated case search form	0%	50%	100%	Not available
3	Rumor register form	66.7%	16.7%	66.7%	Available
4	Case management procedure form	NA	83.3%	83.3%	Not available
5	line list, epidemic reporting form	33.3%	16.7%	100%	Available
6	Rumor investigation form	50%	62%	76%	Available
7	Case definition for GWD	66.7%	100%	100%	Available

3.4.2.1. Availability of surveillance formats

Even though reporting format is prepared and distributed from central level to regional and zonal health offices, there was shortage of reporting format in most of visited health facilities in the past 6 months. Due to this reasons all of the visited health facilities were using different types of reporting formats. In all visited health facilities and woredas they faced shortage of surveillance formats like weekly reporting formats, case based formats for different diseases, GWD case investigation forms, epidemic reporting format and line listing formats.

3.4.3. Weekly surveillance data report completeness and Timeliness rate

3.4.3.1. Weekly surveillance data report completeness rate

Gambella regional PHEM department were expected about 2,028 weekly surveillance reports in the past 3 months of 2018 from health posts, health centers, hospitals and other private health facilities. However, 1,805 (89%) report were received from woredas. Because of lack of infrastructure like telephone and internet services, most of the visited woredas were collecting weekly surveillance report from health facilities by reporting format (in hard copy). Whereas regional PHEM officers collect the weekly surveillance data from all woredas by using telephone. In the last 6 months, on average regional governmental health facilities reporting completeness rate was 89%.

Table 17: Number of reporting site by government and private institution in Visited sites, Gambella, 2018.

S.No	Visited Woredas	Government reporting site	Private reporting site	Total sites
1	Abobo	19	1	20
2	Itang	12	0	12
3	G/ Town	2	0	2
4	G/ Zuria	15	0	15
5	Goge	18	0	18
6	Lare	9	0	9
	Total	75	1	76

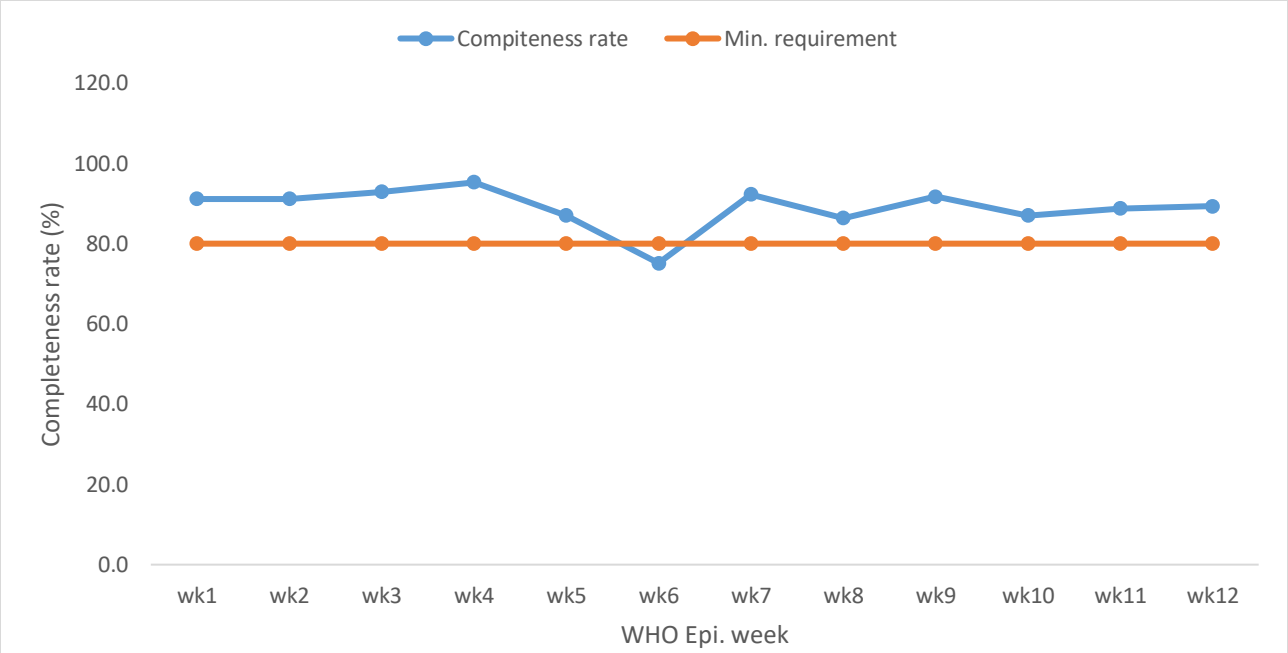


Figure 39: Weekly surveillance data Completeness rate, week 1-12/2018, Gambella regional state.

As depicted on the figure weekly surveillance data completeness is above the WHO minimum requirement which is 80% in most of the weeks during the first three months of 2018.

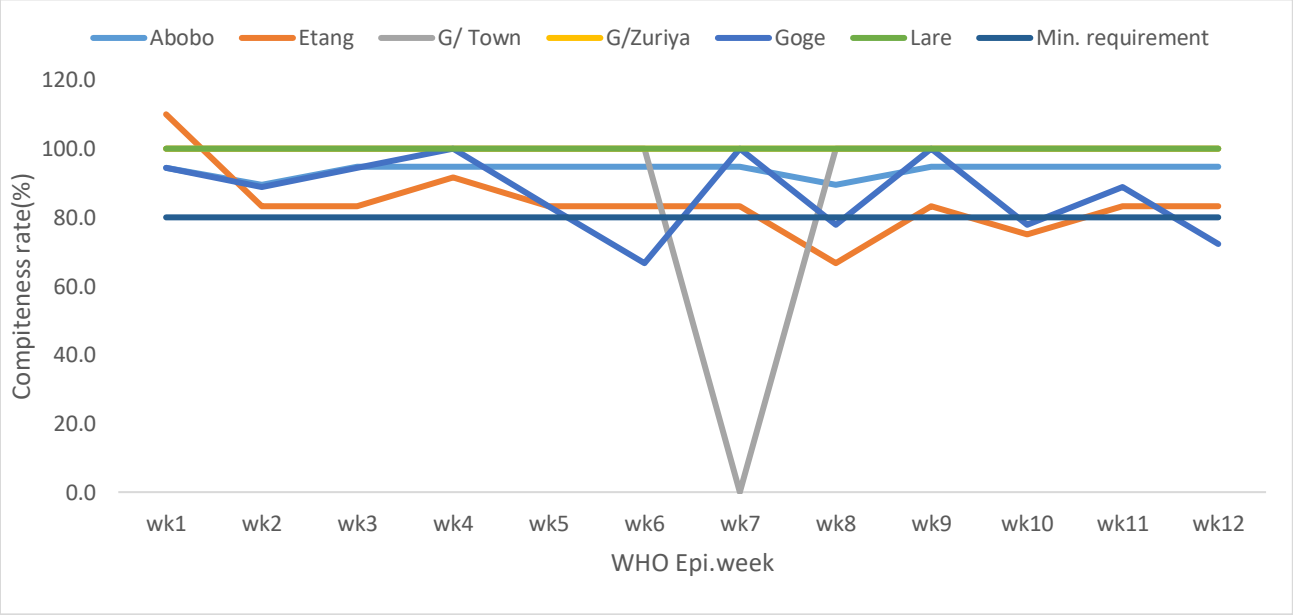


Figure 40: Weekly surveillance data Completeness rate by visited woreda, week 1-12/2018and Gambella regional state.

Table 18: Expected reporting sites, expected and received reports within 3 months, Gambella regional state, 2018.

S.No.	Woreda	Total expected reporting sites	Total expected report within 3 months	Total report received within 3 months	Completeness rate (%)
1	Abobo	19	228	213	93.4%
2	Akobo	1	12	0	0%
3	Dima	15	180	136	75.6%
4	Etang	12	144	119	82.6%
5	Gambella Town	2	24	22	91.7%
6	Gambella Hospital	1	12	12	100%
7	Gambella Zuriya	15	180	180	100%
8	Godere	16	192	174	90.6%
9	Goge	18	216	188	87%
10	Jikawo	12	144	112	77.8%
11	Jore	6	72	50	69.4%
12	Lare	9	108	108	100%
13	Makuwey	11	132	131	99.2%
14	Mengesh	21	252	247	98%
15	Wantawo	11	132	113	85.6%
	Regional	169	2028	1805	89%

As depicted on the table the weekly surveillance report completeness rate of government health facilities within three months (January to March); 11 out of 15 (73.3%) reporting sites have achieved. Akobo woreda haven't submitted weekly surveillance report (0%) completeness rate and three woredas achieved completeness rate below WHO minimum requirement; Dima 75.6%, Jikawo 77.8% and Jore 69.4%. On the other hand, three sites achieved average completeness rate of 100%; namely Gambella Hospital, Gambella Zuriya and Lare woredas. Furthermore, all woredas except Abobo were not linked private health facilities to surveillance system and they didn't receive weekly report from those private health facilities.

3.4.3.2. Weekly surveillance data timeliness rate

Weekly surveillance data average regional timeliness rate of three months (January to March) were 1523/2028*100 (75%).

3.4.4. Data analysis, frequency of analysis and ways of reporting

In all visited woreda health offices there were assigned PHEM officers for report compilation and data analysis; PHEM officers were the only responsible personnel for data analysis and compilation. Data analysis was not practiced at health facility and health post level. In most of visited sites, they had appropriate denominator for data analysis. In visited woreda health offices, including regional health department data analysis was not taken as usual routine activity. From visited woreda health offices only 66.7% of woredas were analyzing the collected surveillance data by time and place irregularly. However, none of visited health facilities and health offices were analyzing surveillance data by converting raw data in to rate for comparison and analysis purpose. In all visited health facilities and woreda health offices, they have action threshold for some national priority diseases.

Concerning ways of reporting. All woredas, 66.7% of health facilities and 83.3% of health posts report by telephone. The remaining 41.7% of health facilities and 50% of health posts report by paper or by both.

3.4.5. Outbreak investigation

All the respondents from assessed woreda health offices responded that, they had investigated different outbreaks. As a result they were used the findings for intervention, but there was neither written document nor standard procedures for outbreak investigation was seen during the assessment. Among six visited woredas three of them have investigated at least one outbreak in the last 6 months of 2017/18.

In addition, at regional level there were four outbreaks from those outbreaks three of them were investigated by regional and woreda health office experts but during the visit time there was no evidence or document available about the investigation.

3.4.6. Epidemic preparedness and response

In visited health offices 83.3% of them had not experienced shortage of emergency stocks of drugs at all time during the last one year. But 66.7% of them had experienced Shortage of vaccine and

other supplies in most last outbreak responses. All visited health offices had prepared written document for epidemic preparedness (EPRP).

In addition, all of them were established Rapid Response Team (RRT) and task force committee but it lacks continuous functionality in all health offices and they had no regular meeting. All outbreaks occurred in the region in the previous six months were not responded within 72 hours by regional and woreda health offices and none of visited health offices had outbreak investigation check list. All visited woreda health office and regional health department encountered shortage of budget and they didn't allocate budget for epidemic preparedness and response activities (table 19).

Table 19: Availability of epidemic preparedness plan and response resource in visited sites of Gambella, 2018**.**

S.No.	Availability	Regional level N=1	District level N=6	Total
1	Availability of Epidemic response and preparedness plan	1	6	7
2	Availability of Emergency stock of drugs and supplies	1	0	1
3	Availability Outbreak investigation check list	0	0	0
4	Availability of Rapid Response Team (RRT)	1	6	7
5	Availability of task force committee	1	6	7
6	# of epidemics responded within 72 hours	0	0	0
7	Availability of budget for epidemics/ emergency	0	0	0
8	Experienced shortage of drugs and supplies during last epidemics response	1	4	5

3.4.7. Supervisions and Feedback

To strengthen surveillance system in each level supportive supervision is the major activity. In all visited health institutions including regional health office, regular specific supportive supervision was not conducted to lower levels. But in most visited sites integrated supportive supervision was conducted every three month (quarterly) and some surveillance activities were included in the

check list. Because of shortage of resources any of visited institutions were not prepared specific supportive supervision plan for their lower level during six months.

In 2017/2018 from visited sites 54% (all WoHo, 41.6% H.C, and 33% H.P) of them were supervised by higher level either during integrated supportive supervision or during disease specific supportive supervision and none of them have surveillance supportive supervision checklist (table 20). In addition, during the assessment time all visited sites had not received specific PHEM feedback from higher level.

Table 20: Availability of supportive supervision, plan and feedback in visited sites during six months, Gambella, 2017/8.

S.No.	Variable	Regional Level N=1	District Level N=6	Health facility level N=12	Total
1	Specific supportive supervision to lower level during six months	2	2	2	6
2	Integrated supportive supervision to lower level	1	1	2	4
3	Availability of supervision plan	1	0	0	1
4	Availability supportive supervision checklist	0	0	0	0
5	Specific PHEM feedback to lower level	0	0	0	0
6	Specific PHEM feedback received from higher level	18	0	0	18

3.4.8. Training

All regional technical staffs working in PHEM department were trained short term training on selected priority diseases (such as GWD) by national PHEM. In visited sites, all woredas health office and health center PHEM officer/ focal person were trained on disease surveillance, on new approaches of public health emergency management (PHEM) and selected surveillance priority diseases. On the other hand, according regional PHEM department report, all health extension workers who are working in the region were trained on surveillance system and selected priority diseases.

3.4.9. Resources (logistics, data management and communication materials)

From visited Health offices, 3 (50%) of health offices and all of health centers 12/12 (100%) were compile weekly PHEM report manually. According to interviewed staffs response in regional PHEM department, all of regional PHEM officers can use Microsoft office applications (Micro soft word, Micro soft excel and power point); but most of them haven't enough clue on epi info, SPSS, Arc GIS software utilization to compile weekly surveillance data. On the other hand, from woreda health office and health facilities only 2/7(29%) and 20% of them have computer skill on Microsoft office application respectively. Regarding availability of computer and printer, regional PHEM unit have computer, printer and telephone for data management and communication. Moreover, none of the visited health centers had computer and printer. Availability of resources related to data management and communication in visited sites is presented in detail in table 21.

Table 21: Availability of logistics and data management materials for PHEM activates in visited sites, Gambella, 2017/8.

S.No.	Materials/ Items	Regional Level N=1	District Level N=6	Health facility level N=12	Total
1	Electricity	1	2	0	3
2	Bicycles	0	0	0	0
3	motor cycle	3	4	6	13
4	Vehicle	4	0	0	4
5	Computer	10	3	0	13
6	Printer	1	0	0	1
7	Fax	0	0	0	0
8	Telephone	5	6	12	23
9	Internet service	1	0	0	0
10	Poster	1	6	12	19
11	Megaphone	1	4	3	8
12	Projector	1	0	0	1

3.4.10. Prevention and control activities

There is no vaccine to prevent Guinea worm infection or immunity to GWD. The only way to avoid infection is to prevent exposure to the Guinea worm larvae in contaminated drinking water sources. Exposure to Dracunculiasis infection can be prevented by:

- ✓ Use of safe water sources for drinking purpose such as water from borehole wells, hand dug wells, and pipe water sources;
- ✓ Preventing contamination of drinking water sources (preventing patients from entering into drinking water sources with an emerging guinea worm);
- ✓ Treating contaminated drinking water sources with Abate chemical which kills copepods;
- ✓ Filtering drinking water with fine filters which removes copepods,
- ✓ Health educating people to implement the above preventive measures.
- ✓ Isolating the patient for management and to minimize the risk of contaminating water source

According to interview respondent's prevention and control activities like case containment, abation of contaminated and suspected to be contaminated ponds, health education and training of community volunteers have been conducted. According to assessment finding all GWD cases seen in the past three years have been contained. All contaminated and suspected to be contaminated have been abated but still there are cases of GWD. So using plus one principle/ the pond that the patient entered plus one other pond have been abated based on GWD SOP.

3.4.11. Description of attributes of the surveillance system

3.4.11.1. Simplicity

To measure the simplicity of the surveillance system we used seven question items and the response towards each individual question and the summary results are shown below.

Most of the responders reported that the system is simple for the users demand making the overall average score of 4.55 out of 5. Average score towards each question decreases from regional level to health post level figure 41.

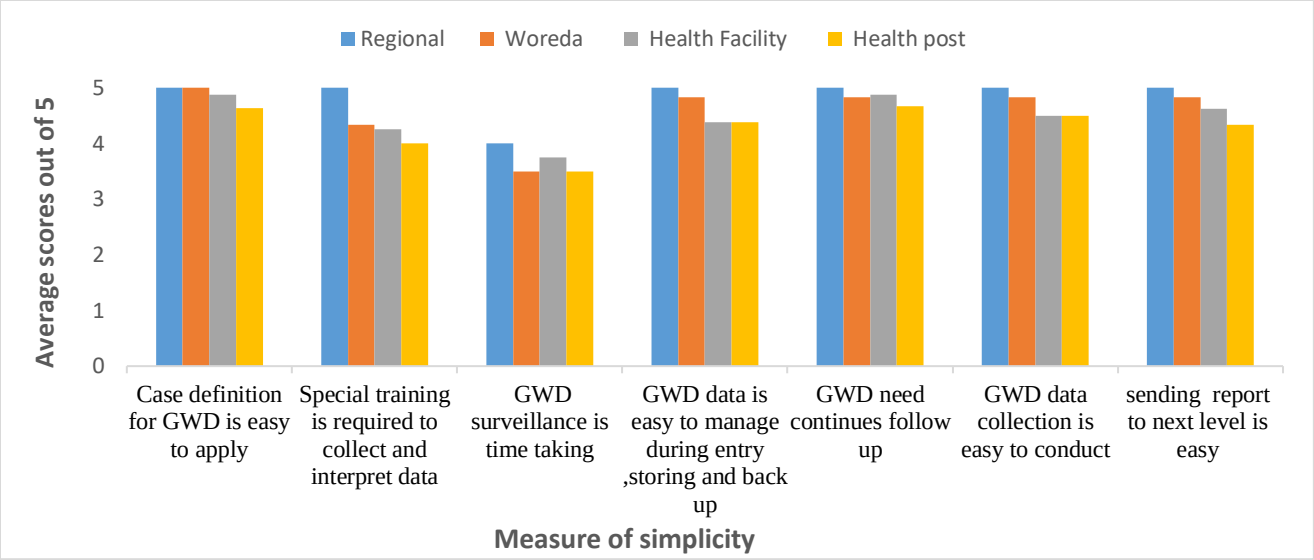


Figure 41: The Average score given to measures of Surveillance System of simplicity of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

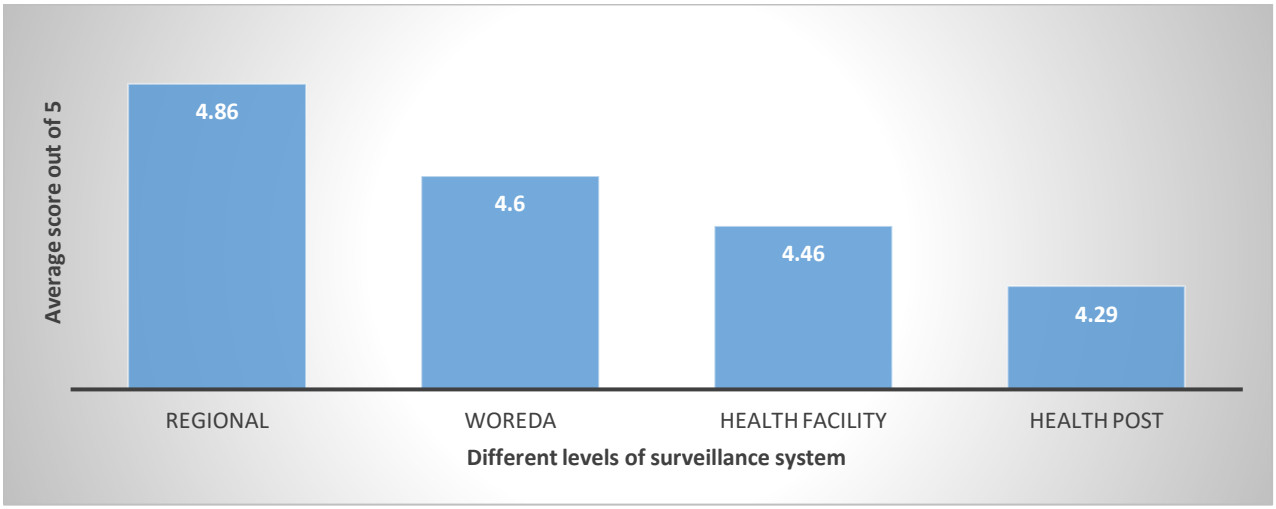


Figure 42: Summary result of the score given to the simplicity of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was simplest at regional level with average score of 4.86 out of 5 than other levels. Average score for simplicity was lowest at health post level.

3.4.11.2. Flexibility

To measure the flexibility of the surveillance system we used four question items and the response towards each individual questions and the summary results are shown below.

As shown in the figure below most of the responders reported that the system is flexible for the users demand making the overall average score of 4.31 out of 5. As we go from regional level to HP level average score given for flexibility decreases sharply.

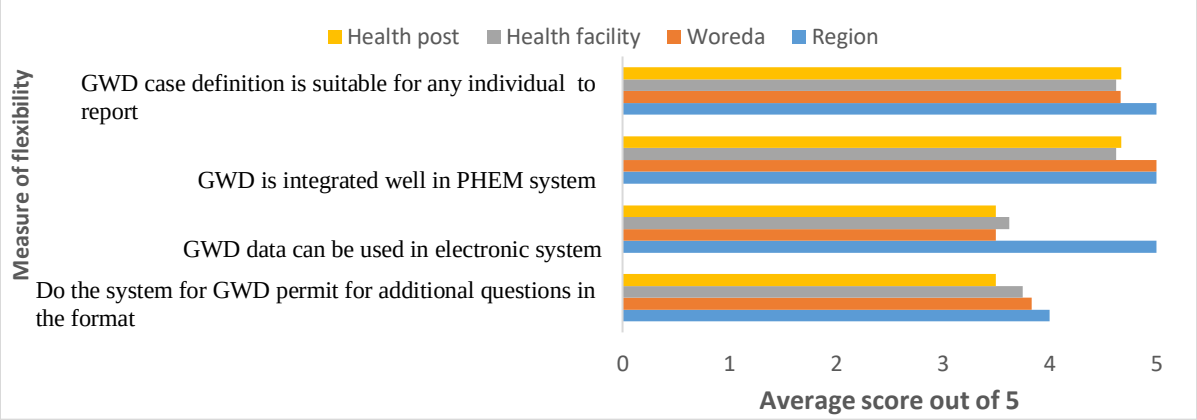


Figure 43: The average score given to measures of Surveillance System of flexibility of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

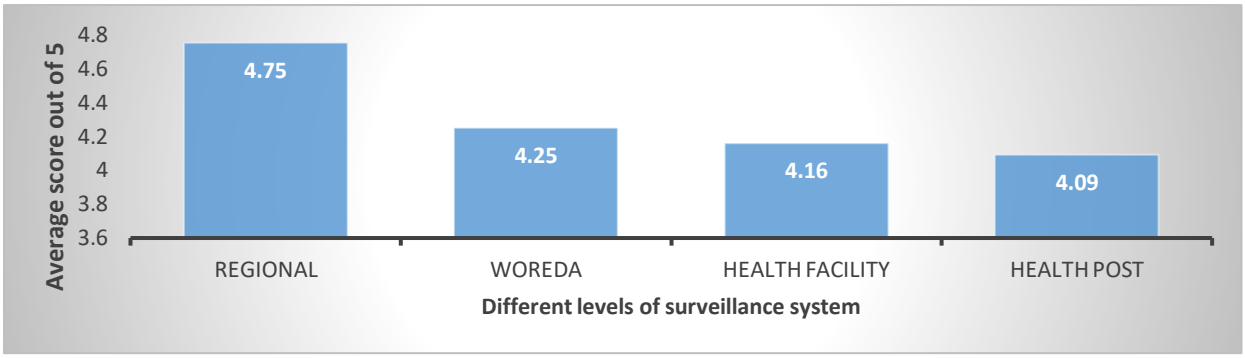


Figure 44: Summary result of the score given to the flexibility of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was more flexible at regional level with average score of 4.75 out of 5 than other levels. Average score for simplicity was lowest at health post level with 4.09.

3.4.11.3. Acceptability

To measure the acceptability of the surveillance system we used five question items and the response towards each individual question and the summary results are shown below.

As shown in the figure below most of the responders reported that the system is acceptable by users making the overall average score of 4.48 out of 5.

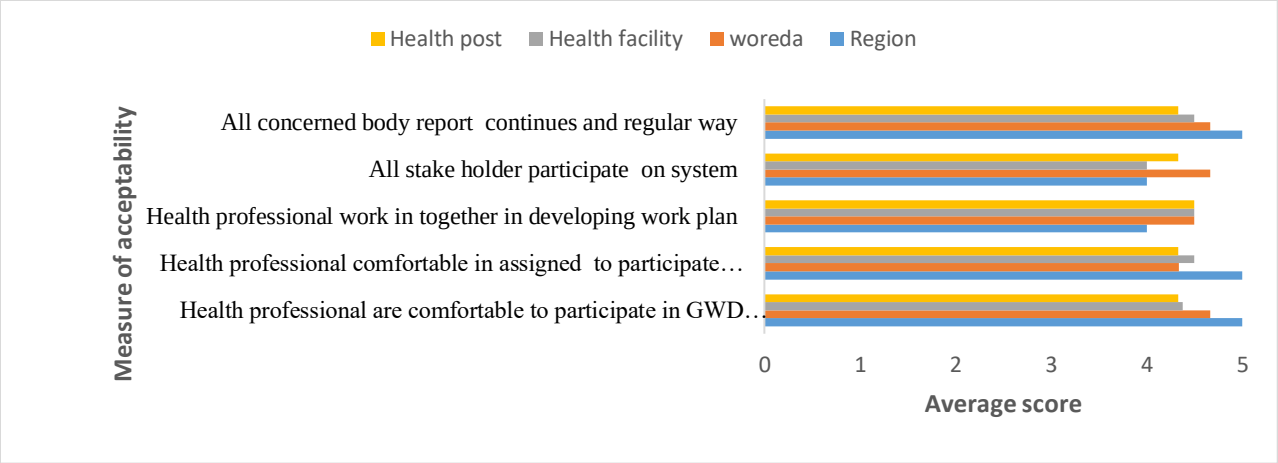


Figure 45: The Average score given to measures of Surveillance System of acceptability of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

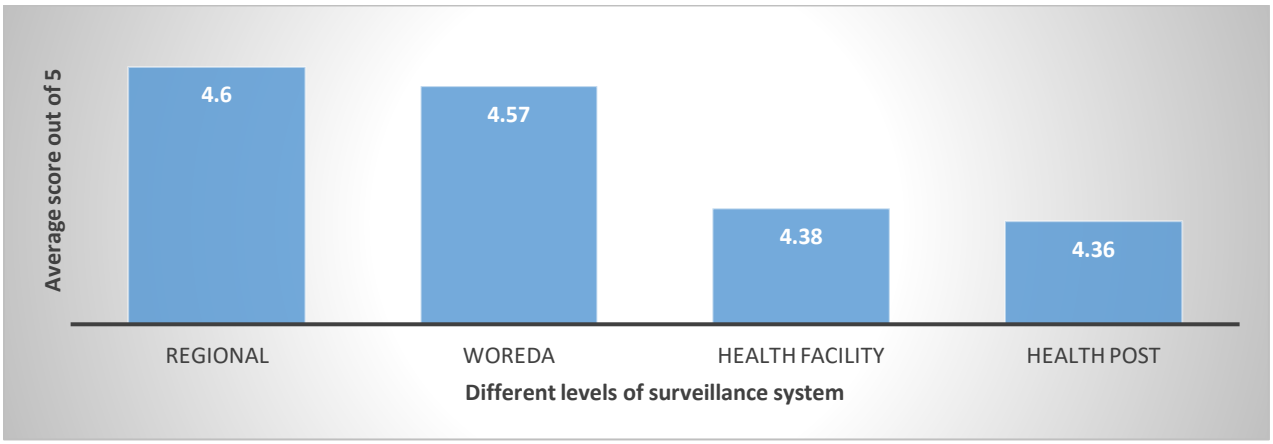


Figure 46: Summary result of the score given to the acceptability of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was more acceptable at regional level with average score of 4.6 out of 5 than other levels. Average score for acceptability was lowest at health post level with 4.36.

3.4.11.4. Sensitivity

To measure the sensitivity of the surveillance system we used three question items and the response towards each individual questions and the summary results shown below.

As shown in the figure below most of the responders reported that the system is sensitive by users making the overall average score of 4.52 out of 5.

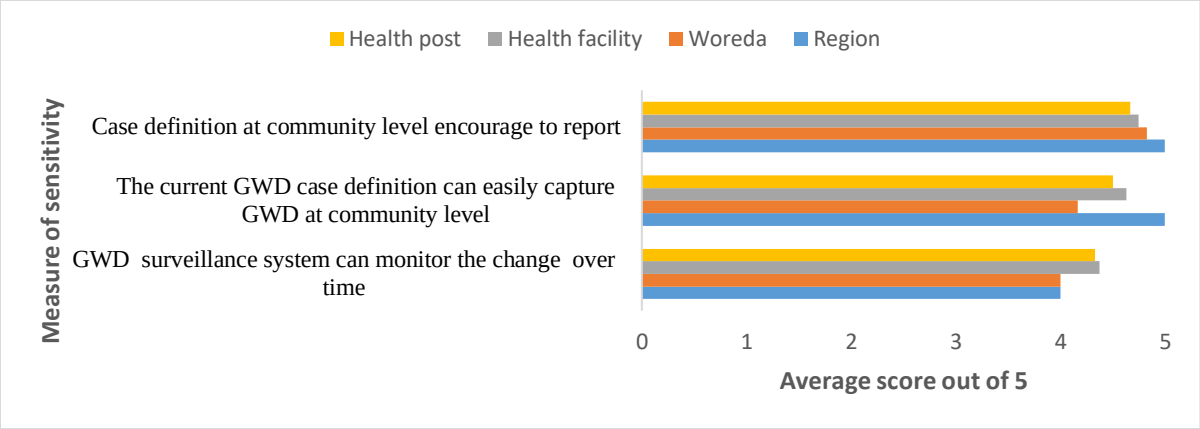


Figure 47: The Average score given to measures of Surveillance System of Sensitivity of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

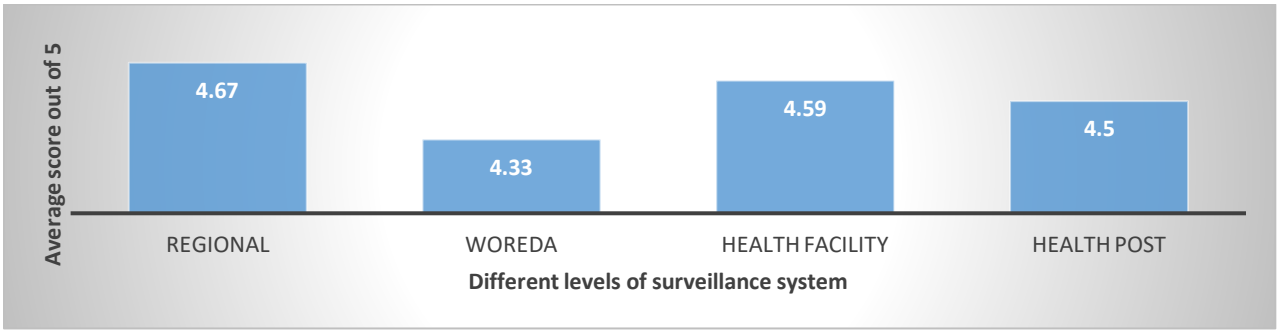


Figure 48: Summary result of the score given to the Sensitivity of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was more sensitive at regional level with average score of 4.67 out of 5 than other levels. Average score for sensitivity was lowest at woreda level with 4.33.

3.4.11.5. Predictive Value Positive

To measure the Predictive value positive of the surveillance system we used one question items and the response towards question and the summary results shown below.

As shown in the figure below most of the responders reported that the system can pick true GWD cases making the overall average score of 4.03 out of 5. Surveillance systems' PVP was highest at regional level with average score of 5 out of 5 than other levels. While the lowest was at Health post level with 3.3.

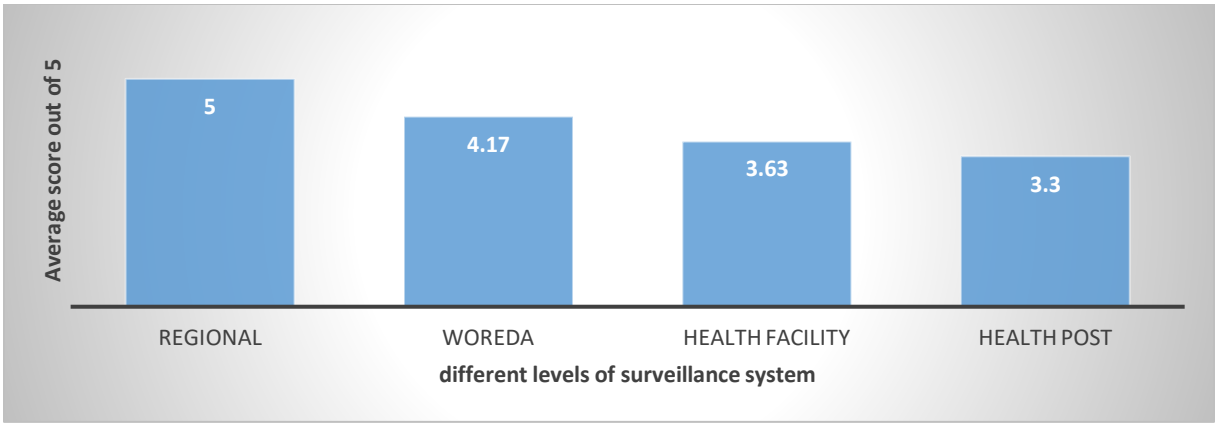


Figure 49: Summary result of the score given to the predictive value positive of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

3.4.11.6. Representativeness

To measure the representativeness of the surveillance system we used two question items and the respond towards each individual questions and the summary results shown below.

As shown in the figure below most of the responders reported that the system is representative making the overall average score of 4.63 out of 5.

Surveillance system was more representative at regional level with average score of 5 out of 5 than other levels. Average score for representativeness was lowest at health post level with 4.42.

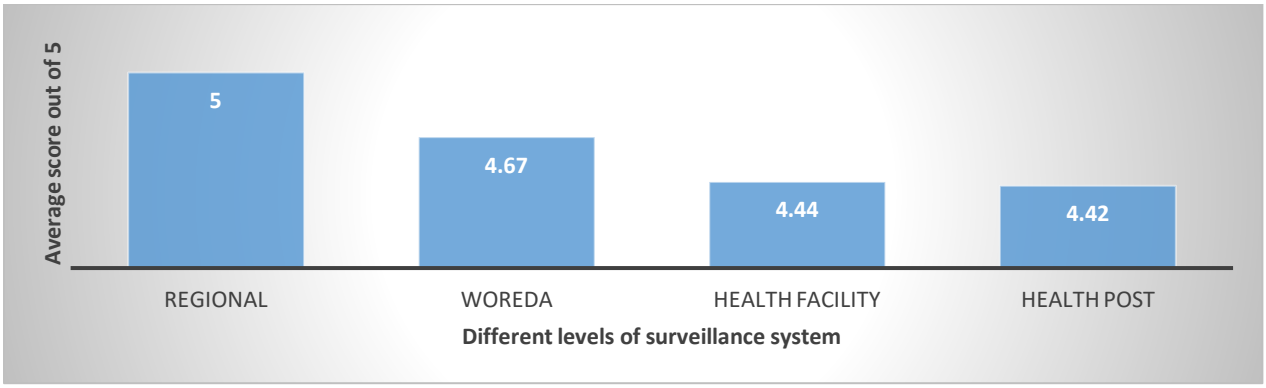


Figure 50: Summary result of the score given to the representativeness of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

3.4.11.7. Timelines

To measure the timeliness of the surveillance system we used three question items and the respond towards each individual questions and the summary result are shown below.

As shown in the figure below most of the responders reported that the system is timeline making the overall average score of 4.69 out of 5. Average score given to timeliness was high at regional level and decreases gradually towards health post level.

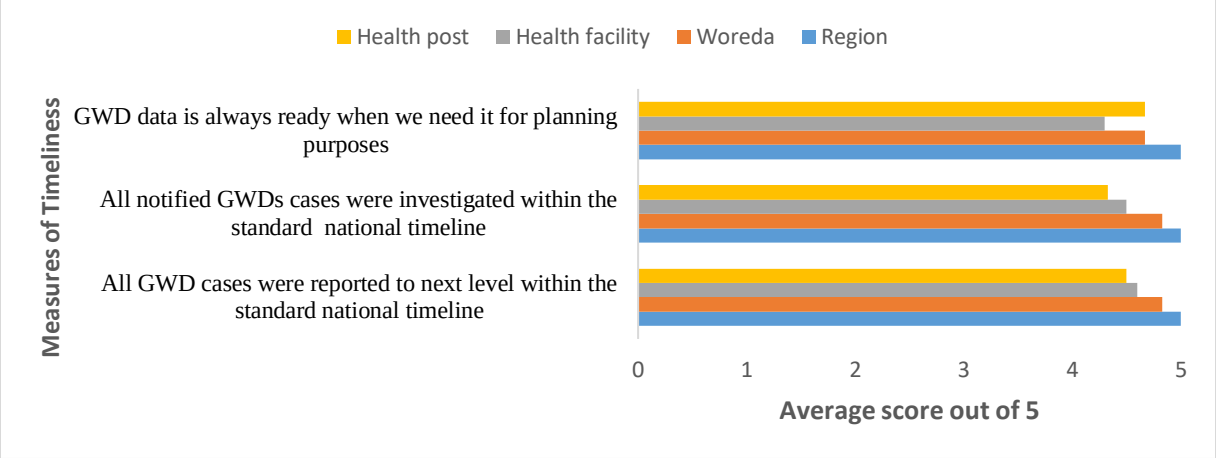


Figure 51: The Average score given to measures of Surveillance System of timeliness of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

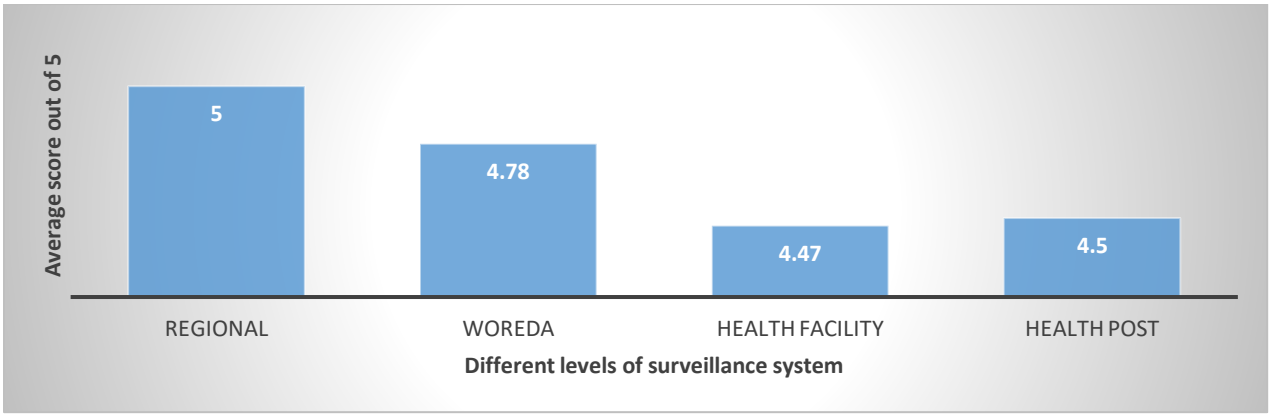


Figure 52: Summary result of the score given to the Timeliness of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was more timeline at regional level with average score of 5 out of 5 than other levels. Average score for timeliness was lowest at health facility level with 4.33.

3.4.11.8. Stability

To measure the stability of the surveillance system we used three question items and the response towards each individual question and the summary result shown below.

As shown in the figure below most of the responders reported that the system is stable making the overall average score of 4.48 out of 5.

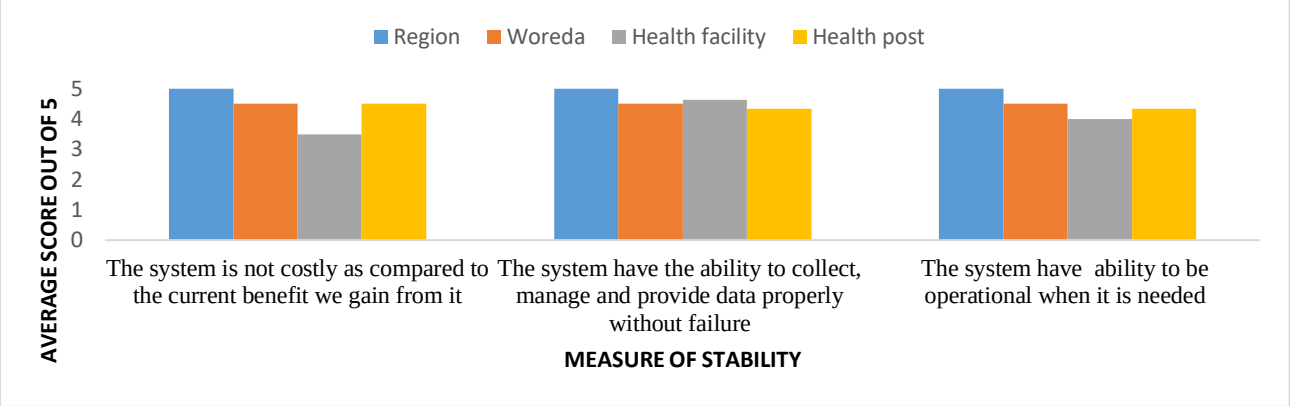


Figure 53: The Average score given to measures of Surveillance System of stability of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

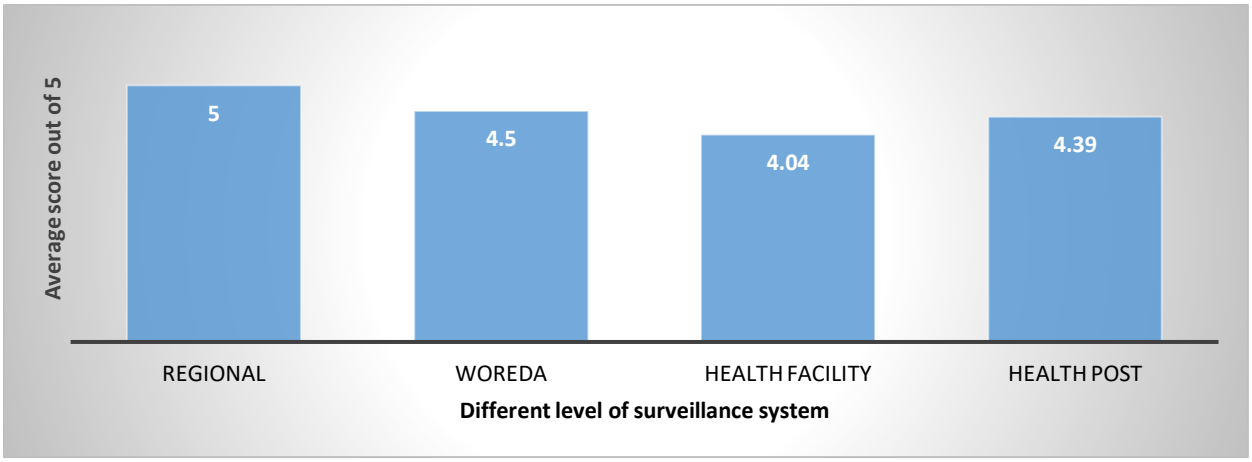


Figure 54: Summary result of the score given to the stability of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Surveillance system was more stable at regional level with average score of 5 out of 5 than other levels. Average score for stability was lowest at health facility level with 4.39.

3.4.11.9. Usefulness of the Surveillance System

Public health surveillance system is useful if it contributes to the prevention and control of adverse health related events, including an 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.

To measure the Usefulness of the surveillance system we used six question items and the response towards each individual question and the summary results are shown below.

As shown in the figure below most of the responders reported that the system can pick true GWD cases making the overall average score of 4.59 out of 5.

Surveillance system was more useful at regional level with average score of 4.83vout of 5 than other levels. Average score for usefulness was lowest at health post level with 4.42.

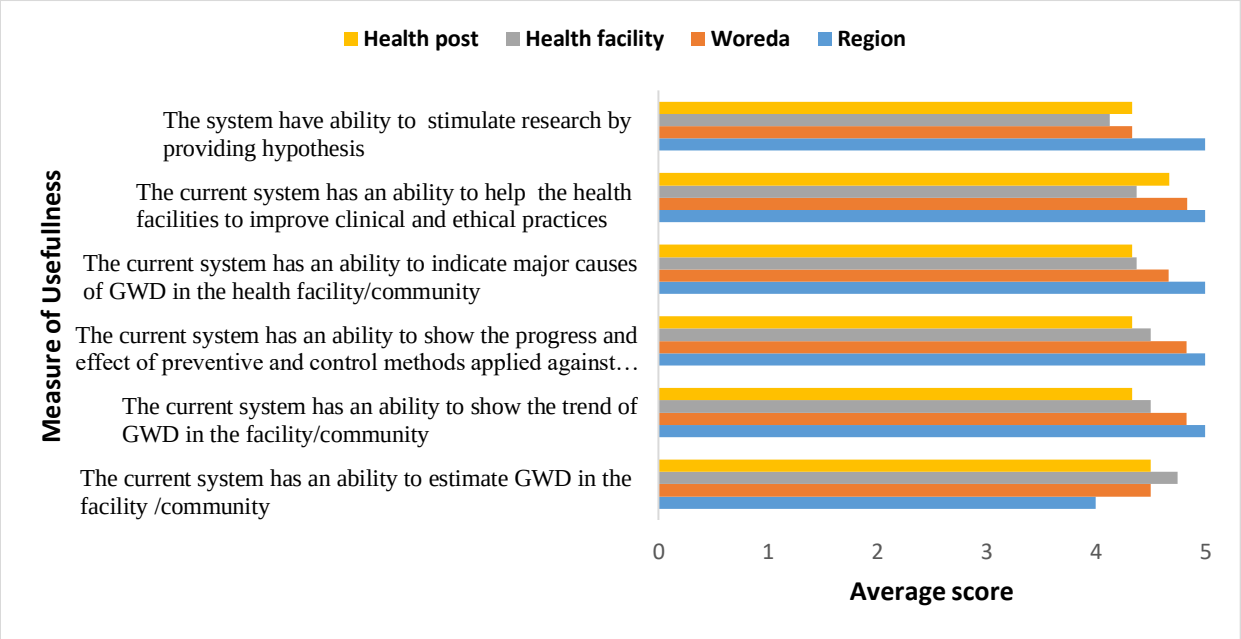


Figure 55: The Average score given to measures of Surveillance System of usefulness of GWD in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

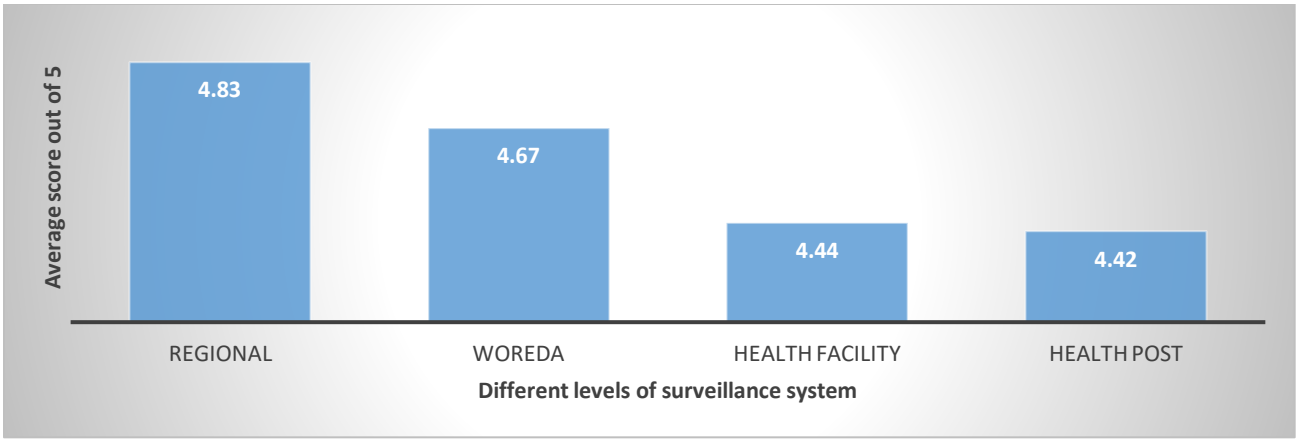


Figure 56: Summary result of the score given to the usefulness of GWD surveillance system by selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

Summarizing the overall finding of the surveillance attributes results in overall mean of 4.48 with 0.19 standard Deviation. On the other hand, predictive value positive and flexibility are the two attributes of the system which the responders give the least score 4.03 and 4.31 out of 5 respectively or attributes that achieve below the mean score which is 4.48 figure 21.

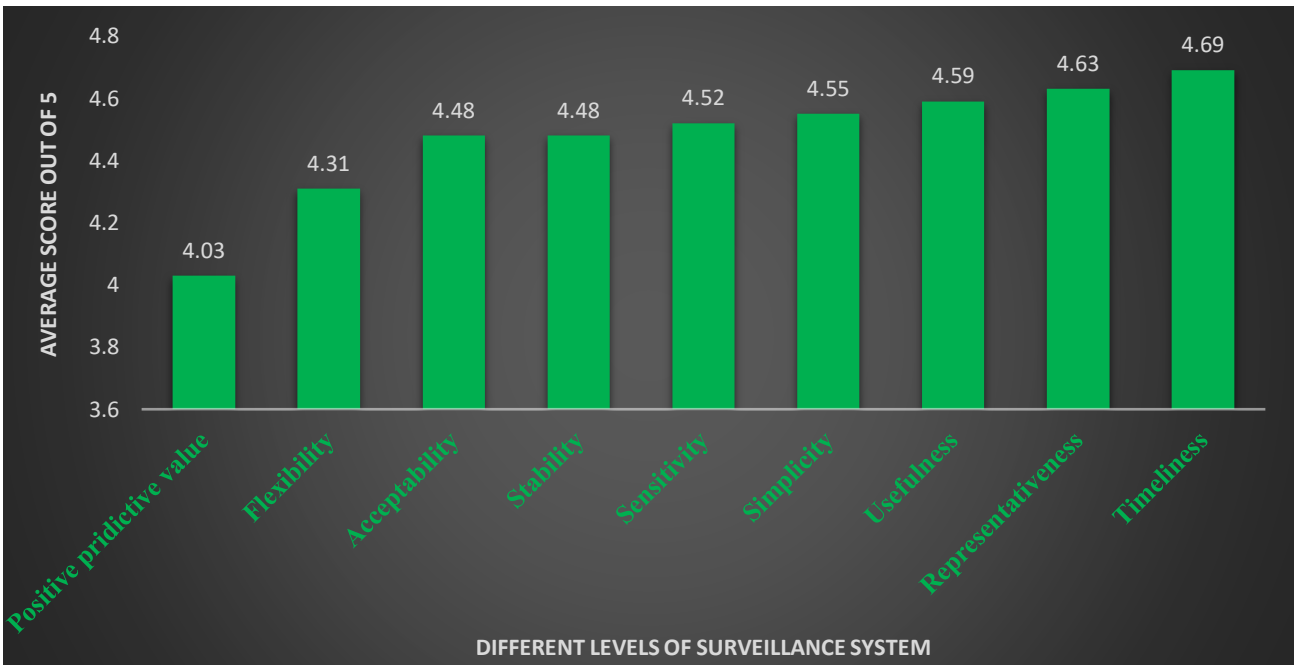


Figure 57: summary of the overall average scores given for each attribute of the GWD surveillance system in selected health posts, health facilities (HCs and HSPs) and woreda health offices of Gambella regional state, March 2018.

3.5. Discussion

We aimed to evaluate the surveillance system of Gambella region by describing the system and measuring the usefulness, simplicity, data quality, acceptability, representativeness, timeliness, positive predictive value, flexibility, sensitivity and stability of the system for the selected disease of GWD. Appropriate use of data and conclusions that can be drawn from surveillance data will depend on the quality of data collected. The data quality of the surveillance system as a whole depends on the compilation of the quality of all of the source [6].

Quality of data is influenced by the performance of the screening and diagnostic tests (i.e., the case definition) for the health-related event, the clarity of hardcopy or electronic surveillance forms, the quality of training and supervision of persons who complete these surveillance forms, and the care exercised in data management. A review of these facets of a public health surveillance system provides an indirect measure of data quality [5].

Report completeness rate is one of the indicator to determine whether the surveillance system is strong or not. Gambella regional PHEM department were expected about 2,028 weekly surveillance reports in 3 months (from January to March) of 2018 from health posts, health centers, hospitals and other private health facilities. However, 1,805 report were received from region which results 89% of weekly surveillance data report completeness rate. This is above WHO minimum requirement for weekly surveillance data completeness rate which is 80%. The weekly surveillance report completeness rate of government health facilities within three months (January to March); 73.3% of woredas found in the region have achieved completeness rate above WHO minimum requirement (80%). Akobo woreda haven't summited weekly surveillance report (0%) completeness rate and three woredas achieved completeness rate below WHO minimum requirement; Dima 75.6%, Jikawo 77.8% and Jore 69.4%. On the other hand, three sites achieved average completeness rate of 100%; namely Gambella Hospital, Gambella Zuriya and Lare woredas. Furthermore, all woredas except Abobo were not linked private health facilities to surveillance system and they didn't receive weekly report from those private health facilities. Because of lack of infrastructure like telephone and internet services, most of the visited woredas were collecting weekly surveillance report from health facilities by reporting format (in hard copy). Whereas regional PHEM officers collect the weekly surveillance data from all woredas by using telephone.

When reports are sent and received on time, the possibility of detecting a problem and conducting a prompt and effective response is greater. So that, Ethiopian public health Institute /Ministry of health prepared an indicator to measure the timeliness rate of the report and aimed to reach a target of 80% [11]. As indicated in the result, the regional reporting timeliness was 75% which is less than the national target. This is below WHO minimum requirement for weekly surveillance data timeliness rate which is 80%. This disparity will hamper the quality of work towards disease surveillance as the reporting weekly itself tells the sensitivity of surveillance system. Therefore, outbreaks can go undetected and opportunities to respond to public health problems/ emergencies will be missed, the outbreak results in extensive damage to human life and resource. This clearly illustrates that timely reports will give timely information which helps to predict future outbreaks, trends of diseases occurrence, cases for further studies, future impact of diseases surveillance and action for problems identified on time (1).

Surveillance is information for action. Analyzing and interpreting public health surveillance data are the links between the design and operation of a surveillance system and the use of data from the system to implement public health action and disease control program. Surveillance data are used to detect epidemics, suggest hypothesis, characterize trends in disease or injury, evaluate prevention program, and project future public health needs. In general, analyzing and interpreting surveillance data should be of primary importance, resisting the urge to allow the time consuming problems of collecting, managing and storing surveillance data to supersede the analysis itself. Thus, analysis should be implemented as part of a routine surveillance program so results can be monitored over time [6].

According to this, the practice of data analysis and trend of Gambella region for priority disease of GWD was seen. Accordingly, the practice of making data analysis and trend for GWD in the visited places was poor, particularly at regional health department, woreda health office and health facilities. In all visited woreda health offices there were assigned PHEM officers for report compilation and data analysis. In all of the visited woredas PHEM officers were the only responsible personnel for data analysis and compilation. Data analysis was not practiced at health facility and health post level. In most of visited sites, they had appropriate denominator for data analysis. In visited woreda health offices, including regional health department data analysis was not taken as usual routine activity.

From visited woreda health offices only 66.7% of woredas were analyzing the collected surveillance data by time, person and place irregularly. However, none of visited health facilities and health offices were analyzing surveillance data by converting raw data in to rate for comparison and analysis purpose. However, any data collected from the surveillance system (epidemic report and routine weekly surveillance report) should be analyzed by time, place and person regularly. In addition to that, trend of GWD should be followed regularly at each level to detect any unusual rising number of cases of health events or conditions at local, regional or higher level which indicate the occurrence of outbreak situations that require immediate investigation and intervention. Therefore, the absence of performing data analysis regularly may hinder early detection of health events and taking appropriate controlling and preventive actions before the events are causing more illness and disability in the community.

Correspondingly, in visited health offices 83.3% of them had not experienced shortage of emergency stocks of drugs at all time during the last one year. But 66.7% of them had experienced Shortage of vaccine and other supplies in most last outbreak responses. Though all established Rapid Response Team (RRT) and task force committee but it lacks continuous functionality in all health offices and they had no regular meeting. In the past three years though the respondents said they have been contained all GWD cases. Still there are cases of GWD. So using plus one principle/ the pond that the patient entered plus one other pond based on GWD SOP is somehow confusing which doesn't show even to which direction one should abate. Based on none published EPHI PHEM GWD guideline blanket abation/ abating all the water sources within the woreda/ is recommended to avoid this confusion and to be safer or not to miss any infected water source.

Because of lack of infrastructure like telephone and internet services, most of the visited woredas were collecting weekly surveillance report from health facilities by reporting format (in hard copy). Whereas regional PHEM officers collect the weekly surveillance data from all woredas by using telephone. Visited woreda health offices said they had prepared written document for epidemic preparedness (EPRP) but not verified. In addition, all of them were established Rapid Response Team (RRT) and task force committee but it lacks continuous functionality in all health offices and they had no regular meeting. All outbreaks occurred in the region in the previous six months were not responded within 72 hours by regional and woreda health offices and none of visited health offices had outbreak investigation check list. All visited woreda health office and

regional health department encountered shortage of budget and they didn't allocate budget for epidemic preparedness and response activities. Epidemic preparedness is essential and the basic action prior to the occurrence of any health related events. A public health emergency such as an acute outbreak or public health event calls for an immediate response. Being prepared to detect and respond to such an event is an essential role of the district. Examples of advanced preparations include: identifying key members of an event management team, mapping available resources, and estimating required supplies and procuring them. If these steps are carried out in advance of an event, the health system will be able to function promptly, effectively, and efficiently to prevent unnecessary deaths or disabilities due to the emergency [4].

Preparedness activities and tasks includes development of plans, procedures, protocols, and systems; establishment of mutual aid agreements and provision of training for health workers and concerned stake holders. The aim of preparedness is to strengthen capacity in recognizing and responding to public health emergencies through conducting regular risk identification and analysis, establishing partnership and collaboration, enhancing community participation and implementing community-based interventions and strategic communication during the pre-emergency phase and ensuring their monitoring and evaluation [11].

Establishing multi-sectorial PHEM committee and rapid response team is the primary steps of preparedness at each level [11]. In addition, this established committee should be oriented or trained on epidemic preparedness and response (especially for RRT). The committee should have a regular meeting as monthly basis for multi-sectorial committee and RRT will meet regularly when there is an outbreak. In the visited sites even though there is established multi-sectorial task force committee in all woredas it lacks functionality or regular monthly meeting in all levels. On the other hand, rapid response team/ technical committee were established and had meeting when there was an outbreak and most of team members were trained on epidemic preparedness and response.

Higher level officials should give special emphasis to strengthen lower level (health office and health facilities) capacities in developing emergency preparedness plan. This can be improved not only by giving on job training and continuous follow up for PHEM officers, but also needs administrative support for managers to allocate enough and necessary resources for emergency.

On the other hand, any outbreak should be detected, investigated and responded within the expected standard time frame (in 72 hrs.) [4, 11, and 12]. The benefits of a rapid and effective response are numerous. Rapid response limits the number of cases and geographical spread, shortens the duration of the outbreak and reduces fatalities. These benefits not only help save resources that would be necessary to tackle public health emergencies, but also reduce the associated morbidity and mortality. It is therefore important to strengthen epidemic response, particularly at woreda and community levels. However, in Gambella region none of the outbreaks occurred in year 2017/ 2018 were not early detected, investigated and given appropriate intervention to the affected communities based on the standard (within 72 hours). Therefore, Attention needs to be focused on response strategies and continuous monitoring and evaluation of these activities [11, 12].

Ensuring reliable reporting of surveillance data throughout the country is important so that program managers, surveillance officers and other health care staff can use the information for action. The community and health facilities especially health posts are the main source of information. The information collected from this site is compiled in standard forms, analyzed and then forwarded to the woreda health office. Woreda level uses standard formats to compile aggregate, and send the data to zone/region, from which the central level receives [11]. In addition to routine data transferring tools, there are also standardized surveillance formats like line listing, case based formats, GWD investigation format, rumor log book, epidemic reporting formats for every level of health institutions which should be available in every health institutions to record information as per standard during existence of outbreak or any health event suspects. However, the availability of surveillance formats is not sufficient and the utilization was also poor. In most of visited area they lack some important surveillance formats like line listing, case based, and weekly reporting formats. The problem was not only lack of surveillance format, but also because of absence of follow up and monitoring by higher level the utilization of format and their documentation system is poor. Therefore, to improve data quality, data analysis experience, report completeness and timeliness the standardized formats should be distributed to all woredas and health facilities and zonal PHEM officers and other concerned stake holder should follow and monitor the utilization.

For the success of surveillance program capacity building plays pivotal role. To increase the quality of early detection of diseases and reporting system formal or on job training for PHEM officers is necessary. Likewise, most of the regional and lower level PHEM officers were trained on disease surveillance of GWD. However, the practice of investigating an outbreak and conducting data analysis by regional and lower level PHEM officers was weak. This may affect the efficiency and effectiveness of the surveillance system to detect early and prevent health related harms. Regional PHEM officers should be well equipped and knowledgeable on public health surveillance system, because they are expected to support technically for their downward structure. Therefore, conducting refreshment training is important to update and upgrade the health workers knowledge. Furthermore, community surveillance is not given emphasis by regional and woreda health offices.

From visited health post most of health extension workers have no enough information about the surveillance of GWD. However, they are the peripheral source of surveillance report.

Any events that happened in the kebele were reported to woreda health office or the nearest health center through health extension workers. So that, they should be well familiar with different types of public health related events.

Laboratory-based surveillance is the key part of the overall surveillance system. Laboratory based surveillance helps to detect and control the outbreaks with rapid identification of the pathogens and their source of infection. Starting from the national level to the health post level, suspected outbreaks should be confirmed by laboratory investigation.

Out of 27 visited sites 18 (67%) of them had case definition for GWD, 13(50%) had national guideline for PHEM, 18 (67%) of them had epidemic reporting form, 12(46%) integrated case search form and out of 18 respondents 14 (77.8%) of them had rumor register form, 17 (94%) of them had case management procedure form. However, none of the visited institutions had case definition for the rest priority diseases. On the other hand, Health practitioners and health extension workers who were interviewed during the assessment, 22/26(84%) of them, were understood the case definition clearly and apply the case definition accordingly as per the national guide line.

Case definition is used to decide if a person has a particular disease or condition by specifying clinical criteria and limitations on time, place and person. Using standard case definitions ensures that every case is diagnosed in the same way, regardless of where or when it occurred, or who

identified it. This allows for comparing the number of cases of the disease or condition that occurred in one time or place with the number occurring in another time or place. Health staff should be aware of case definition of GWD that may afflict not only the local community but also have the potential for spread across geographic boundaries [4]. GWD standard case definition was available in most of visited area and most of the interviewed health staff were understood the case definition. However, almost in all visited health posts community case definitions were not available. To strengthen and to create a well stabled surveillance system in each level supportive supervision and feed backing system is major activity and must. Supervision and giving feedback should be conducted with a regular time interval. Similarly, because of resource related problems none of the visited woredas and health centers had plan to conduct supportive supervision. In 2017/2018 from visited sites only 54% (all WoHo, 41.6% H.C, and 33% H.P) of them were supervised by higher level either during integrated supportive supervision or during disease specific supportive supervision and none of them have surveillance supportive supervision checklist. In all visited health institutions including regional health office, regular specific supportive supervision was not conducted to lower levels. In addition, during the assessment time all visited sites had not received specific weekly surveillance data feedback from higher level.

From visited Health offices, 3 (50%) of health offices and all of health centers 12/12 (100%) were compile weekly PHEM report manually. According to interviewed staffs response in regional PHEM department, all of regional PHEM officers can use Microsoft office applications (Micro soft word, Micro soft excel and power point); but most of them haven't enough clue on epi info, SPSS, Arc GIS software utilization to compile weekly surveillance data. On the other hand, from woreda health office and health facilities only 2/7(29%) and 20% of them have computer skill on Microsoft office application respectively. Regarding availability of computer and printer, regional PHEM unit have computer, printer and telephone for data management and communication. Moreover, none of the visited health centers had computer and printer.

According to interview respondent's prevention and control activities like case containment, abation of contaminated and suspected to be contaminated ponds, health education and training of community volunteers have been conducted. According to assessment finding all GWD cases seen in the past three years have been contained. All contaminated and suspected to be contaminated have been abated using plus one principle/ the pond that the patient entered plus one other pond

based on GWD SOP. But this doesn't show even to which direction one should abate. Based one none published EPHI PHEM GWD guideline blanket abation is recommended to avoid this confusion and to be safer or not to miss any infected water source.

Concerning the major surveillance attributes, summarizing the overall finding of the surveillance attributes results in overall mean of 4.48 with 0.19 standard Deviation. On the other hand, predictive value positive and flexibility are the two attributes of the system which the responders give the least score 4.03 and 4.31 out of 5 respectively or attributes that achieve below the mean score which is 4.48, but still it was good score. As indicated most of the surveillance attributes achieve a mean score above the overall mean which 4.48 with SD of 0.19.

Furthermore, the case definition should be simple and have high ability to detect the true positive cases relative to confirmatory test. Predictive value positive (PVP) is the proportion of reported cases that actually have the health-related event under surveillance. The PVP reflects the sensitivity and specificity of the case definition (i.e., the screening and diagnostic tests for the health-related event) and the prevalence of the health-related event in the population under surveillance. The PVP can improve with increasing specificity of the case definition. In addition, good communication between the persons who report cases and the receiving agency can lead to an improved PVP. (13). The positive predictive value of the case definition of Gambella region is 4.03 out of 5 which is lower than overall mean. The problem of the case definition by itself or laboratory errors may affect the capacity of the case definition to detect true positive GWD cases.

Concerning simplicity of the surveillance system there was variation in mean score at different levels through region, woreda, health facility to health post level 4.86, 4.6, 4.46 & 4.29 respectively. The summary result of the score given to the simplicity of GWD surveillance system is 4.55. 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. Simplicity is closely related to acceptance and timeliness. Simplicity also affects the amount of resources required to operate the system (13).

Acceptability of a surveillance system reflects the willingness of persons and organizations to participate in the surveillance system. Acceptability of the surveillance system there was variation in mean score at different levels through region, woreda, health facility to health post level. The mean score decreases from regional level to health post level. Participants at lower levels were

asked the reason for low scoring and replied that no incentive even training was not considered at health facilities and health post.

In this study timeliness, representativeness and usefulness were attributes of the system which get the highest mean score of 4.69, 4.63 and 4.59 out of 5 respectively in which responders strongly agree or agree that this attributes are the strong side of the system.

According to the CDC update guideline representativeness of a surveillance system refers that accurately describes the occurrence of a health-related event over time and its distribution in the population by place and person. A public health surveillance system that is representative accurately describes the occurrence of a health-related event over time and its distribution in the population by place and person (13).

Timeliness reflects the speed between steps in a public health surveillance system. The timeliness of a public health surveillance system should be evaluated in terms of availability of information for control of a health-related event, including immediate control efforts, prevention of continued exposure, or program planning. The need for rapidity of response in a surveillance system depends on the nature of the health-related event under surveillance and the objectives of that system (13). In this study most of the responders strongly agree or agree that the system is timeline with the mean score of 4.69 out of 5.

A public health surveillance system is useful if it contributes to the prevention and control of adverse health-related events, including an improved understanding of the public health implications of such events (13). In this study most of the responders agree on the overall usefulness of the system. 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 in contributing to performance measures, including health indicators that are used in needs assessments and accountability systems. Usefulness might be affected by all the attributes of a public health surveillance system. For example, increased sensitivity might afford a greater opportunity for identifying outbreaks and understanding the natural course of an adverse health-related event in the population under surveillance. Improved timeliness allows control and prevention activities to be initiated earlier. Increased predictive value positive enables public health officials to more accurately focus resources for control and prevention measures. A representative surveillance

system will better characterize the epidemiologic characteristics of a health-related event in a defined population. Public health surveillance systems that are simple, flexible, acceptable, and stable will likely be more complete and useful for public health action (13).

A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds. Flexible systems can accommodate, for example, new health-related events, changes in case definitions or technology, and variations in funding or reporting sources. In addition, systems that use standard data formats (e.g., in electronic data interchange) can be easily integrated with other systems and thus might be considered flexible. Flexibility is probably best evaluated retrospectively by observing how a system has responded to a new demand. Simpler systems might be more flexible (i.e., fewer components will need to be modified when adapting the system for a change in information needs or operating conditions) (13). In this study the respondents report that the system is flexible to with mean score of 4.31 out of 5 adapt to changing information needs or operating conditions. The mean score decreases from regional level to health post level. This might be due to knowledge gap at lower levels.

The sensitivity of a surveillance system can be considered on two levels. First, at the level of case reporting, sensitivity refers to the proportion of cases of a disease (or other health-related event) detected by the surveillance system. Second, sensitivity can refer to the ability to detect outbreaks, including the ability to monitor changes in the number of cases over time. A literature review can be helpful in determining sensitivity measurements for a public health surveillance system. A public health surveillance system that does not have high sensitivity can still be useful in monitoring trends as long as the sensitivity remains reasonably constant over time. Questions concerning sensitivity in surveillance systems most commonly arise when changes in the occurrence of a health-related event are noted. Changes in sensitivity can be precipitated by some circumstances (e.g., heightened awareness of a health-related event, introduction of new diagnostic tests, and changes in the method of conducting surveillance). A search for such "artifacts" is often an initial step in outbreak investigations (13). In this study majority of the respondents strongly agree or agree that the system is sensitive to detect cases or outbreak with mean score of 4.52 out of 5.

Stability refers to the reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability of the public health surveillance system. A lack of dedicated resources might affect the stability of a public health surveillance system. For example, workforce shortages can threaten reliability and availability. Yet, regardless of the health-related event being monitored, a stable performance is crucial to the viability of the surveillance system. Unreliable and unavailable surveillance systems can delay or prevent necessary public health action (13). In this study majority of the respondents strongly agree or agree that the system is stable with mean score of 4.48 out of 5.

3.6. Conclusion

Some visited sites had not case definition for GWD, epidemic reporting form, below half (48%) had national PHEM guideline, integrated case search form, rumor register form. However, none of the visited institutions had case definition for the rest priority diseases.

Data analysis was not practiced at health facility and health post level. In visited woreda health offices, including regional health department data analysis was not taken as usual routine activity. In all visited sites they have action threshold for some national priority diseases but poor documentation of data.

Though all visited health offices declared they had prepared written epidemic preparedness response plan we hadn't verify it. In addition, Rapid Response Team and task force committee lacks continuous functionality.

All outbreaks occurred in the region in the previous six months were not responded timely. Shortage of budget and epidemic preparedness and response plan without budget were problems to all visited sites.

To strengthen surveillance system in each level supportive supervision is the major activity. However, in all visited sites regular specific supportive supervision was not conducted to lower levels due to resources limitations. But in most visited sites integrated supportive supervision was quarterly. In addition, all visited sites had not received specific PHEM feedback from higher level.

All regional PHEM officers can use Microsoft office applications (Micro soft word, Micro soft excel and power point); but most of them haven't enough clue on Epi info, SPSS, Arc GIS software utilization to compile weekly surveillance data.

There were shortage of reporting formats in most of visited health facilities. Due to this they were using different types of reporting formats. In all visited sites there were assigned PHEM officers for report compilation and data analysis PHEM officers were the only responsible personnel for data analysis and compilation.

In the past three years though the respondents said they had investigated and contained all GWD cases; still there are GWD cases. So using plus one principle/ the pond that the patient entered plus one other pond based on GWD SOP is somehow confusing which doesn't show even to which direction one should abate. Based on none published EPHI PHEM GWD guideline blanket abation is recommended to avoid this confusion and to be safer or not to miss any infected water source.

The implementation process of the surveillance system at different levels is not uniform. The timeliness, representativeness and usefulness were attributes of the system which identified as the strength of the surveillance system. On the other hand, predictive value positive and flexibility are the two attributes of the system which identified as areas demanding improvement.

After establishment of Ethiopia Dracunculiasis Eradication program and implementation of interventions, endemic transmission of the disease interrupted in south Omo zone in 2001 and the number of cases have been reduced significantly. The program uses both active and passive surveillance. In Gambella region only one district (Gog) is currently endemic for the disease where low intensity transmission is ongoing. All the remaining districts in Gambella except Godere and two districts in SNNP Region (Nyangatom and Surma) are classified as high risk areas in Ethiopia as most of them except Surma were formerly endemic plus there is population movement within these districts. In the case of Surma and Nyangatom districts, there is cross border population movement related to trade or market which may increase the risk of importation of GW cases from Eastern Equatorial State of South Sudan. EDEP started to document GWD infection among animals since 2013. More, recently it appears that infection in dogs is spreading fast.

3.7. Recommendations

The Gambella regional health office needs to strengthen the quality, core activities and supportive functions of the surveillance system at all levels of the health system. According to the assessment results this recommendation was given for some identified gaps as follows:

- Data analysis and interpretation should be performed regularly at all level for GWD.
- Weekly surveillance data report timeliness needs improvement at all level.
- To increase the representativeness of the surveillance system all private health facilities should be included in the system and the regional or woreda health offices should receive their weekly surveillance report regularly and timeliness of surveillance data also should be measured.
- Established Rapid Response Team (RRT) and task force committee needs continuous functionality in all health offices and they had to have regular meeting. On the other hand, the established committee (task force and RRT) should be functional as needed.
- EPRP should be prepared and updated every year at all level especially for GWD and other health related threats. In addition, Resources that are necessary for epidemic response such as vaccine and other logistics should be available in all woreda health office stores.
- Budget should be allocated for PHEM to strengthen early detection of health events and response system at all woredas.
- To strengthen community surveillance, all HEWs and CHWs should be trained on PHEM system and other selected priority diseases such as GWD and Community case definition should be distributed for all health posts.
- Updated Surveillance guidelines of GWD should be available in all health facilities and health offices rather than training handout or SOP.
- Plan for specific ISS for PHEM department should be prepared at regional and woreda health office levels and the supervision should be conducted every quarter based on the schedule. Similarly regular and supportive Feedback should be given to lower level based on the supervision findings.
- Any outbreak should be detected, investigated and responded within the expected standard time frame (in 72 hrs.).
- Strengthening Prevention and control activities should be considered based on blanket abation principle to avoid the confusion of plus one principle and to be safer or not to miss any infected water source.

References

1. WHO. Basic Epidemiology, 2nd edition.

2. WHO. Communicable Disease control in emergencies, a field manual, 2005.

3. FMOH. Integrated Disease Surveillance and response 2000-2005 strategic plan evaluation report, 2005.

4. WHO. Technical guide lines for IDSR in Africa region, 2nd edition, 2010.

5. CDC. "MMWR updated guidelines for evaluating public health surveillance system," 2001.

6. S. M. S. B. M. E. Lisa M. Lee, Principles & practice of public health surveillance, 3rd edition, 2010.

7. WHO. Protocol for the assessment of national communicable disease surveillance and response system, 2001.

8. FMOH. 2nd strategic plan on IDSR, January 2006.

9. FMOH. Public health emergency management PHEM core process, BPR, 2008.

10. FMOH. IDSR National technical guideline, 2002.

11. EPHI. Public Health Emergency Management guideline for Ethiopia, 2012.

12. Centers for Disease Control and Prevention (CDC). Overview of Evaluating Surveillance Systems. Atlanta, GA, 2013.

13. Centers for Disease Control and Prevention (CDC).Updated guideline for evaluating surveillance system. 2001.

14. FMoH, EPHI. The CARTER CENTER and WHO. Ethiopian Dracunculiasis Eradication program Training Handout, June 2016.

15. Greenaway, C., Dracunculiasis (guinea worm disease). CMAJ, 2004. 170(4): p. 495-500.Online.

16. Ruiz-Tiben, E. and D.R. Hopkins, Dracunculiasis (Guinea worm disease) eradication.

Adv Parasitol, 2006. 61: p. 275-309.Online.

17. Hopkins, D.R., et al., Dracunculiasis eradication: delayed, not denied. Am J Trop Med Hyg, 2000. 62(2): p. 163-8. Online.

18. Hopkins DR, Hopkins EM. Guinea Worm: The End in Sight. In: Medical and Health Annual, E. Bernstein ed. Encyclopedia Britannica Inc., Chicago 1991:10–27.Online.

19. Center for disease control and prevention (CDC).Progress Toward Global Eradication of Dracunculiasis, January 2015–June 2016, Weekly / October 14, 2016 / 65(40);1112–1116 online.

Chapter IV: Health profile description report

4. Health profile description of Suro Barguda woreda, west Guji zone, Oromia, March, 2018.

Abstract

Background: Health profile description is key for identifying and prioritizing health problem, for planning, implementation and evaluation of intervention activities. The aim of this study is to assess and describe health and health related issues like health status, health indicators and to identify problems for priority setting.

Methods: Descriptive cross-sectional study design was applied to develop the health profile description. Standard questionnaires were used and secondary data was reviewed. Data were obtained from Health, Education, Water, finance and economy, Agriculture, Culture and tourism and other sector offices from February 25/2018 to March 15/2018.

Result: The district is administratively classified in to 12 kebeles. Its total population is 69,274. There are 18 government schools, 17 primary and one high school. BCG coverage was 87% while OPV0 was 91%. Measles and fully vaccination coverage was 85% & 82% respectively. Contraceptive acceptance and prevalence rate were 32% and 69% respectively. First antenatal care coverage was 80% and 4th was 61%. Delivery coverage by skilled personnel was 68%. Early Post-natal care coverage was 76%. In 2009 EFY a total of 25 smear positive and 17 smear negative pulmonary TB patients were identified and started anti-TB. No extra PTB cases were identified. TB detection rate was 57% and On the other hand all TB patients were screened for HIV and 5 patients were positive. There was no leprosy patients who were on treatment.

Conclusion and recommendation: Health service utilization like ante natal care, Post-natal care, contraceptive acceptance rate, contraceptive prevalence rate, delivery service utilization, vaccination, low smear positive TB case detection rate, low TB treatment success rate, low TB cure rate were some of the major problems which needs improvement.

Key words: - Ethiopia, Health profile, Descriptive report Suro Barguda, Oromia, Ethiopia.

4.1. Introduction

4.1.1. Background

Health profile description is important to identify and prioritize major problems at any level of health system to make decision for action and to prepare plan. Health profile description include scanning of health system, problem identification, prioritization of identified problems by using prioritization criteria; public health importance, magnitude of the problem, severity or seriousness of the problem, community and political concern and feasibility of the interventions (1).

The Health Profiles provide a snapshot overview of health for each local authority. They are conversation starters, highlighting issues that can affect health in each locality. Health Profiles aim is to provide a consistent, concise, comparable and balanced overview of the population's health, and inform local needs assessment, policy, planning, performance management, surveillance and practice, primarily of use to joint efforts between local government and the health service to improve health and reduce health inequalities and empower the wider community. Traditionally the Health Profiles have been a 4 page pdf report. These reports have been produced annually since 2006 - all previous versions are available to download from the website. The most recent pdf report was published in September 2016 and contained 31 indicators. Indicators are reviewed regularly to ensure that they reflect important public health topics (1).

The Ethiopia country health profiles provide an overview of the situation and trends of priority health problems and the health systems profile, including a description of institutional frameworks, trends in the national response, key issues and challenges. They promote evidence-based health policymaking through a comprehensive and rigorous analysis of the dynamics of the health situation and health system in the country (2).

Health profile of a district is a comprehensive document that contains information about the history and location of the district, its accessibility, its cultural value, political and administrative setup, demographic characteristics of its population, general health status, health indicator, education and socioeconomic status of the district (2).

The purpose of the assessment is to describe health and health related issues in the given district (woreda) and communication of the local burden of morbidity, mortality, any disaster and other

public health related information of the district and it is very important document to be utilized by any stake holders in general and public health professionals in specific.

In the previous time in Suro Barguda woreda health office health profile description was not prepared and the health status of the woreda was not documented and known in compiled and organized way. In other word the planning and intervention program was not based on priority problem of the community.

Therefore, this study was conducted to prepare health profile of Suro Barguda woreda and to identify the major problems of the woreda on health system.

4.1.2. Rationale of the Description

Health profile generates data which can be used at community level. Describing health profile of Suro Barguda Woreda has enormous advantages to briefly illustrate current gaps in the area of public health and management of man power. Using this description as a baseline, decision makers of the woreda and the city administration at large may focus on addressing gaps stepwise or think to research on the general health problem otherwise. It may also be used as an indication for setting priority health problems, understand other aspects of the community such as, demographic, social and economical. The finding of this health profile description was disseminated to Suro Barguda woreda health office after finalization of the description report.

4.2. Objective

4.2.1. General Objective

To assess and describe health and health related issues like health status, health indicators, to identify problems for priority setting and to design action plan for identified health problems of Suro Barguda district in 2018.

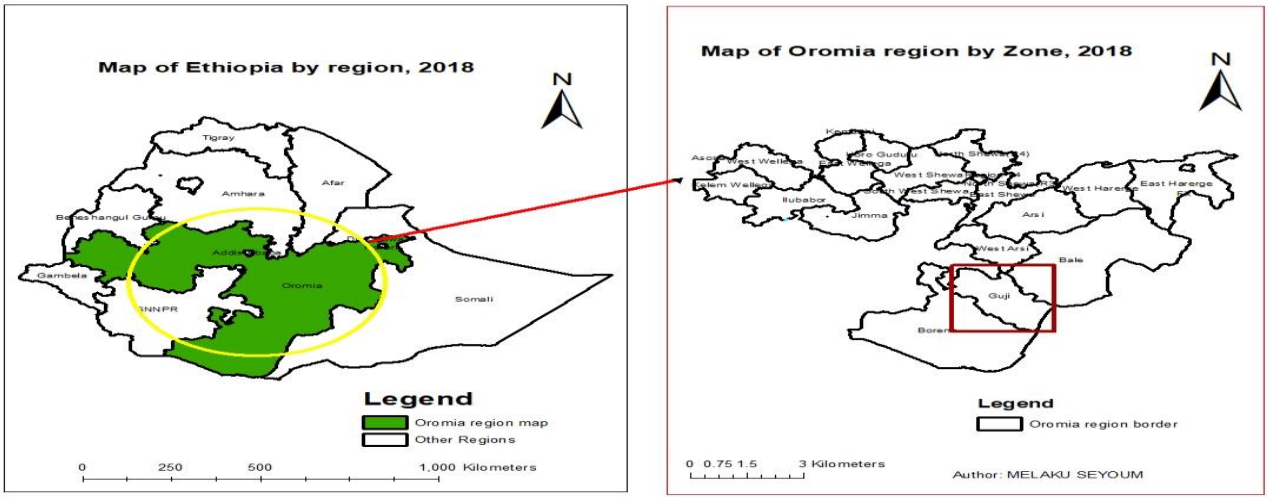
4.2.2. Specific objectives

- To identify the health service status of Suro Barguda District.
- To describe health status of the community through health indicators.
- To assess and describe health and health related issues.
- To assess the major causes of morbidity and mortality in the district.
- To identify priority health problems (health related gaps) in the community and design action plan for identified health problems or gaps.

4.3. Method

4.3.1. Study Area

Suro Barguda is one of the woreda among nine woredas in West Guji Zone of Oromia regional state. It was established in 2009 and named after known person called Suro. It is located 500 km in the southern direction from Addis Ababa capital city of Ethiopia and 30 km from Bule Hora Town the capital of the zone to the western direction. It is bounded by Gelana woreda to the North, Burji woreda of SNNPR to the south, Bule Hora to the East and Dugda Dawa woreda to the western direction. Its' total population is estimated to be 69,274 with 38,793 male and 30, 481 female composition.



Map 7: Map showing study area Guji zone of Oromia region, 2018

4.3.2. Study Period

The study was conducted from February 25, 2018 to March 10, 2018.

4.3.3. Study design

Descriptive cross-sectional study design was applied.

4.3.4. Sampling techniques:

Purposive sampling technique was used. The study area was selected by discussing with zonal health office and among 12 woredas found in the zone based on presence of IDP.

4.3.5. Data Source

To develop this health profile descriptive report data was collected and reviewed from the following district offices:-

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

By reviewing available data from those mentioned sectors using structured questioner and interviewing different concerned individuals from 25/02/2018 to 10/03/2018.

The study was conducted to document and show the woredas' image for planning by gathering information (performance) from different concerned offices and by using 2009 EFY or 2016/7 data of different sectors at woreda office level.

4.3.6. Data Management

Health and Health related data collected from the above organizations were entered, cleaned and analyzed using Microsoft Excel 2013 and the result is presented using tables, different figures and charts.

4.3.7. Ethical Consideration

A formal letter was submitted to the above mentioned organizations in order to get access to the data. As this study use secondary data consent and other ethical measures are not applicable.

4.3.8. Dissemination of Results

Analysis result of this woreda level health profile report was submitted timely to AAU School of public health department of EFETP, respective woreda and zone health offices by hard copy and electronic soft copy.

4.4. Result

4.4.1. Historical aspect of the Woreda

Suro Barguda woreda was established in 2009 EFY and named after known person called Suro. Previously it was under Bule Hora woreda as Suro kelebe. In 2004 EFY Guji and Borena were separated to form independent zone. Following this in 2009 EFY Suro Barguda was established as woreda.

4.4.2. Geographic and climatic conditions

Suro Barguda district is located 500 km from Addis Ababa and 30 km from Bule Hora Town which is the capital of the zone to the western direction. Its' mean annual temperature and mean annual rain fall is 29 0c and 450ml respectively.

4.4.3. Political and Administrative organization

The woreda is administratively classified in to 12 kebeles 2 urban and 10 rural. The nearest kebele is Suro Badya which is 5 km from woreda center and remote kebele is Walena which is 58 km from woreda center. The administrative center of the district is Suro town. All sectors of the district are found in the town. It is bounded by Gelana woreda to the North, Burji woreda of SNNPR to the south, Bule Hora to the East and Dugda Dawa woreda to the western direction.

4.4.4. Population and population structure /Demographic information/

The 2007 national census projected 2017 total population for this woreda was 69,274 with 35,330 male and 33, 944 female composition. Male to female ratio is about 1.04:1 which is almost similar with regional and national ratio. The woreda has a total of 11,545 households.

Concerning ethnic composition, all population living in Suro Barguda woreda are Oromo people. Both language of the woreda population and official/work/ language of the woreda is Afan Oromo. From population living in Suro Barguda woreda about 40% are wakefeta, 39% protestant, 12% Muslim, 4 % orthodox and 5% other religion followers. Of the total population, women of

reproductive age group (women 15-49 years of age) constitute 26% and 42.9% of the population were under 15 years of age. While 3.7% of the population were elderly (>64 years) and 3% were pregnant women. 11% of the population were infants and 22% were under five children. The overall dependency ratio is 80% with 73.6% young and 6.4% old dependency ratio respectively. Average household size was 6 and annual population growth rate was 2.4%.

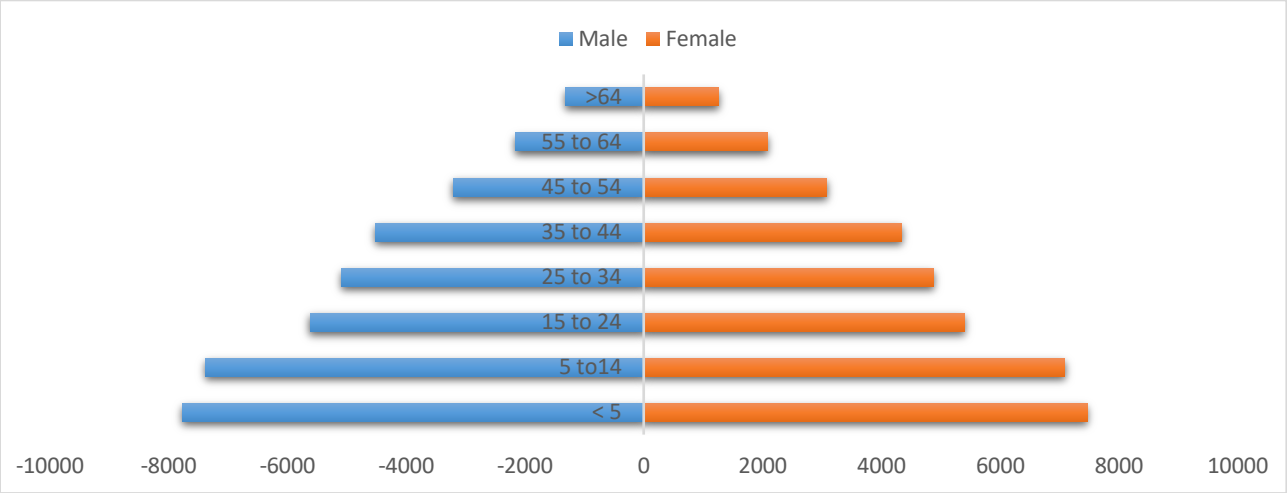


Figure 58: population pyramid of Suro Barguda woreda, West Guji Zone, Oromia Regional state, 2018.

4.4.5. Economy/ main stay of the economy/

Agriculture and livestock are the main stay of the economy of the woreda. Bimodal pattern /two cropping season/ of the rainfall gives a wide opportunity for the district to produce different types of crops and use the same land twice a year. That is for Meher /Gena the main rainy season and Belg /Hageya with short rainy season. However, Meher is the largest season in terms of both cultivated land area and crop production. Major and main food crops of the area are teff, wheat and Haricot bean. About 4728 hector land are cultivated land and 8221 hector land are grazing land of the woreda.

Fertilizers, improved seeds, herbicides and insecticides are very essentials agricultural inputs to improve crop production and productivity, to meet rapid increase of demand for food and industrial raw material. In Suro Barguda woreda farmers were using DAP and urea fertilizers to improve productivity.

Most inhabitants are farmers (dependents on seasonal agriculture and animal production) and the remaining are Government and private sector employee and have their own business.

Based on Suro Barguda woreda bureau of Finance and Economic Development (BoFED); 10% of the population are classified as high, 30% medium and 60% low economic status.

As depicted on the table cattles and Goats account majority of all livestock's of the woreda (96.9%).

Table 22: List of livestock's, Suro Barguda woreda of west Guji Zone, Oromia regional state, 2018

S.No.	Livestock's list	Number of livestock's	Percentage (%)
1	Cattle	301,765	65.7%
2	Sheep	6798	1.5%
3	Goat	143,213	31.2%
4	Camel	4398	0.96%
5	Donkey	1987	0.4%
6	Mule	987	0.2%
Total		459,147	100%

4.4.6. Education

In Suro Barguda woreda there are 18 government schools, 17 primary and one high school. No Kinder Garden, preparatory and TVET College in the woreda. In addition, No none governmental organization and private schools. From the total population of Suro Barguda woreda 28% are literate, 26% can read and write and the rest 46% are illiterate.

In 2010 EFY a total of 8,610 students were enrolled, 7,822 (90.85%) were primary students with 4478(57.2%) male & 3344(42.8%) female students. 788(9.15%) were secondary school students with 477(60.5%) male & 311(39.5%) female students were registered and started class. Of both schools enrollment 42.5% were females and there was a difference from grade to grade. Among Suro Barguda woreda students 20 (16 male and 4 female) are students with disability. See the detail in Table 23 below.

Table 23: School enrollment, Suro Barguda woreda of West Guji Zone, 2010 EFY

Type of school	Gender of students	# of students	percentage
Primary school (1-8)	**Male**	4,478	57.2%
	Female	3,344	42.8%
	Total	7,822	100%
Secondary school (9-10)	**Male**	477	60.5%
	Female	311	39.5%
	Total	788	100%
Total enrolment (both schools)	**Male**	4,955	57.5%
	Female	3,655	42.5%
	Total	8,610	100%

The district provides primary and secondary education by 118 (102 male and 16 female) teachers. The teacher to student's ratio is 1:73. This indicates that there is 1 teacher for every 73 students of Suro Barguda district. The total dropout rate is 15%. Students drop their class for different reasons like migration, illness, lack of support, they don't have interest to learn, marriage, changing living places, death and discipline. Because of lack of data we couldn't figure out the number of students with their reasons who discontinued their class. There is one school per kebele and 20% of the schools have access to water while 30% of schools have road access. Drought is the main reason for absence of water in majority of the schools. About 31% of the schools were with access to latrine facility and of these 41% had one block latrine for the school as a whole.

4.4.7. Water sources

Ponds, Elas and motorized water pumps were among available water sources of the district. Number of water schemes constructed during the 2009 EFY were two. Number of functional and non-functional water schemes during the year were 19 and 8 respectively. Average service year /duration of one water scheme is 8 to 10 years. Number of kebeles with protected water supply source were five. According to the district water bureau report 41.7% of the population uses improved water sources. The Possible water sources of uncovered population are river, ponds and

Ela. Possible reason for non-functionality of the water schemes is over loading. The average coast needed per water scheme for construction is 109,000 ETB.

4.4.8. Facilities and infrastructure (Transport, Telecommunication, power)

Road is the major infrastructure in day to day activities. The woreda has dry season only roads which connect different kebeles of the woreda as well as woreda to zone. But this dry season roads are difficult during rainy season. Only one out of three health centers have transportation access and none of the health posts have transportation. Regarding communication, all urban and rural kebeles have used mobile telephone services including health centers and health posts but with poor network. Only one out of three health centers and none of the health posts have access to safe water supply. There is one functional ambulance in the woreda.

In the district both kinds of Energy sources were used. Modern Energy sources like electricity, biogas, fossil fuel and solar energy and traditional source of energy like Charcoal, animal dug, farm residue and fire wood. All towns of the district had supplied with electric power. In rural and urban areas the dominant source of energy for cooking and other purposes are still the traditional one. In urban area, charcoal is most important energy source followed by fire wood, electricity, crop residues and animal dung were used most frequently.

On the other hand, fire wood is the major energy source in rural area followed by crop residue, animal dung and kerosene.

4.4.9. Disaster Status

In the last one year there were conflict which affects about 941 households. An estimated 5,990 population were displaced due to the conflict. Fortunately, despite displacement and uncomfortable life in IDP sites, no disease outbreak or other public health emergency have occurred.

4.4.10. Vital statistics and Health indicators

Data on infant mortality rate, child mortality rate, crude birth rate, crude death rate, maternal mortality rate, total live births, total still births and total neonatal deaths were unavailable both at woreda and health facility level.

Immunization coverage

BCG vaccination coverage was 87% while OPV0 was 91%. Penta 1 and PCV 1 coverage was both 92%. Measles and fully vaccination coverage was 85% & 82% respectively. At woreda level the dropout rate from Penta one to Penta three was 4.3% and from BCG to Measles was 2.3%. The detail is presented on figure 59 below.

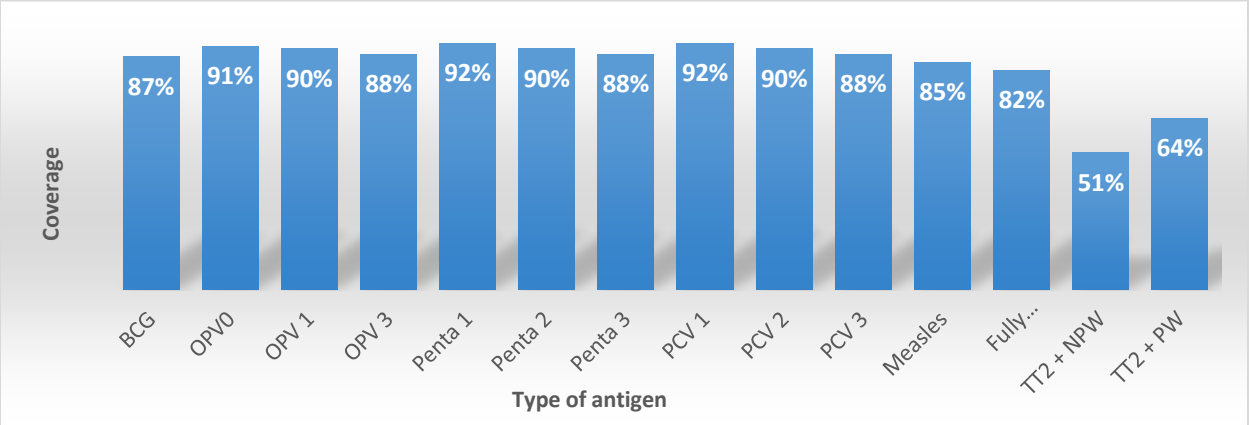


Figure 59: Immunization coverage by type of antigen, Suro Barguda district of West Guji zone, Oromia regional state, 2018

Maternal health services

To prevent unwanted pregnancy woreda health office is working on family planning services through health extension workers at each kebele level and also in all health center. During the 2017 the contraceptive acceptance rate was 69% and contraceptive prevalence rate was 32%.

Based on Suro Barguda woreda health office report, 1st visit antenatal care (ANC) coverage was 80% and 4th ANC coverage was 61%. On the other hand Delivery coverage by skilled personnel was 68%. Early PNC coverage was 76%.

4.4.11. Health service (Facility based)

The district had a total of 13 government health facilities with three health centers and 10 health posts. No hospital and NGO or private health facility were found in the district. Health center to population ratio is 1:25,000 and that of health post to population ratio is 1:6,944.

At the end of 2017 one health center serves 25,000 residents of the district and one health post was for 6944 residents.

In the beginning of 2018 a total of 51 health professionals and other supportive staff were employed and working at different level of health system. In all health centers there were 4 health officers, 12 nurses, 5 mid wife nurses, 6 medical laboratory personnel, 4 pharmacist & druggist, one environmental health professional and other paramedics and supportive staffs. In 10 health posts there are 19 health extension workers, which mean 2 health extension workers for each kebeles except walene health post. In the woreda health office a total of 6 health professionals were working at different department. Additional information regarding number of health professionals and other administrative staffs presented in table 3 as follows.

Table 24: Number of health professionals and other administrative staff employed in Suro Barguda woreda, 2018.

S.No.	Type of Profession	No. of Professionals	Remark
1	Health officer	4	one woreda health office staff
2	Nurses (Deg. and Dep.)	12	Two woreda health office staff
3	Mid wifery nurse (Deg. and Dep)	5	Two woreda health office staff
4	Lab. (Deg. and Dep)	6	One woreda health office staff
5	Pharmacist and druggist	4	One woreda health office staff
6	Environmental health	1	One woreda health office staff
7	Health Information Technologist (HIT)	0	
8	Health education	0	
9	Health Extension Worker	19	
Total		51	

Considering the health professionals to population ratio, all professionals were included who are working in health facility only. In Suro Barguda woreda 1 health officer served for 17,241 population, one nurse served for 8,333 population, one midwife served for 9,091 and one health extension worker served for 3,704 population.

Top ten causes of morbidity in outpatient department and the most frequently occurred disease was upper respiratory tract infection which accounts about 19% of total cases followed by Acute Febrile Illness in adults 15% and in under five children pneumonia was the leading course of morbidity which accounts about 14.6% of total cases followed by non-bloody diarrhea 13.8% and Acute upper respiratory tract infection 11.9% to list few. The detail of top 10 diseases is presented as follows in table.

Table 25: List of top ten leading causes of morbidity in both Adults and under five children, Suro Barguda worada, 2018.

S.No.	Adult OPD	case	Percentage	Under five OPD	cases	Percentage
1	URTI	1783	19%	Pneumonia	1041	14.6%
2	AFI	1010	15%	Diarrhea(non-bloody)	984	13.8%
3	UTI	871	10%	AURTI	847	11.9%
4	Diarrhea (non-bloody)	795	8%	AFI	758	10.6%
5	Dyspepsia	731	7.5%	Neonatal sepsis	620	8.7%
6	Helminthiasis	650	6%	Birth asphyxia	505	7.1%
7	Malaria	439	4%	SAM	310	4.3%
8	Anemia	398	2.9%	Malaria	199	2.8%
9	Diarrhea with blood (dysentery)	209	1.8%	Other or unspecified perinatal diseases	150	2.1%
10	Unspecified skin disease	189	1.5%	Prematurity	132	1.8%
	others	2314	24.65%	others	1597	22.4%
Total		9389	100%		7143	100%

Regarding financing all health centers were started health care financing and they started utilizing their money. On the other hand, worada administration allocated 4,046,336.82 birr (18%) of the

worada budget (22,479,649 birr) for health office including running cost, salary, and for drug in 2009 budget year. This budget allocation rate was almost the same for the last 3 years.

4.4.12. Community health service

At this time federal ministry of health implemented developmental army in each kebele starting from 2010. Therefore, all Community health workers are replaced by those developmental armies all over the country.

Maternal and child health/ Reproductive health (MCH/RH)

One component of the millennium development goal is reducing maternal and child death. To accomplish this goal in Suro Barguda woreda health office many activities were implemented which was included in the growth and transformation strategic plan. Family planning is one of activities done under reproductive health/ MCH services. In family planning service there are choice of methods like, long term family planning and short term family planning methods. In Suro Barguda woreda injectable and pills were mostly preferred methods and now a days the need of long term family planning is increasing but no permanent family planning methods were practiced.

The woreda health office also working to satisfy the community needs by trained 17 health extension workers out of 19 on long term family planning insertion and by supplying logistics at health post level. Based on this until January 2018 there were 565 (21%) users of long acting family planning methods.

4.4.13. Status of primary health care components

- **Endemic diseases**

- ✓ **Malaria**

Suro Barguda woreda has 3 malarious kebeles with at risk population of 11,447. The district health office performed different activities to prevent and control malaria transmission. From the performed activities in the fiscal year were case management, indoor residual spray, health

education on ITNs utilization and environmental management on mosquito breeding sites. In the fiscal year IRS was performed once and the coverage was 88% and all 3 kebeles were covered.

In addition to prevention measures, curative service also given for those who diseased with malaria. To diagnose malaria RDT and microscope were using in health posts and health centers. Within the fiscal year, a total of 969 cases were diagnosed and treated with anti-malarial drugs. Until now malaria epidemic was not occurred in the woreda.

- ✓ **TB & Leprosy**

In 2009 EFY a total of 25 smear positive and 17 smear negative PTB patients were identified and started anti-TB. No extra PTB cases were identified. TB detection rate was 57% and On the other hand all TB patients were screened for HIV and 5 patients were positive. There was no leprosy patients who were on treatment.

Table 26: Tuberculosis treatment indicators, Suro Barguda Woreda, 2018.

S.No.	Indicator	Rate
1	TB detection rate	57%
2	TB Rx completion rate	84%
3	TB defaulter rate	1.2%
4	TB cure rate	87%
5	TB Rx success rate	92%
6	Death on TB treatment	0%

- ✓ **HIV/AIDS**

In prevention and control measure of HIV/AIDS program, counselling and testing services, health education, condom distribution and others services were given to the community. In 2016 a total of 6,474 tests were performed in MCH, VCT room, OPD and other service units. In 2017 within six months a total of 4,573 tests were performed in different service units (Fig. 3).

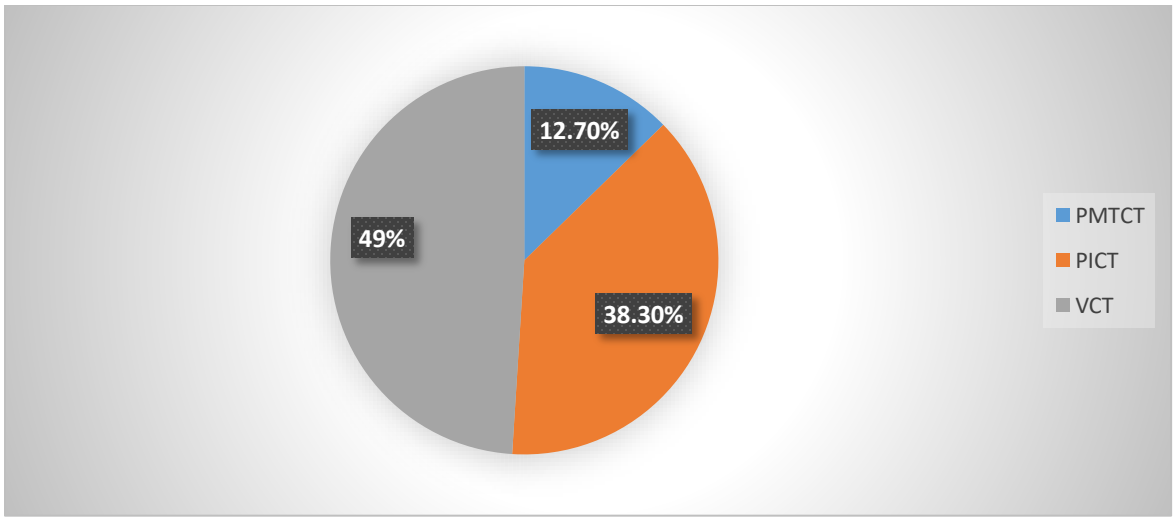


Figure 60**:** Percentage of HIV counseling and testing, in Suro Barguda woreda, 2018.

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

- ✓ **Nutritional status**

Even if the area is very fertile malnutrition problem is usual in this woreda. In 2010 EFY there were 13 OPT and 3 SC sites, which gives therapeutic feeding service. In OTP there were 195 new admission cases and 45 admission in stabilization center.

4.5. Discussion

We aimed to describe health profile of Suro Barguda district by assessing health and health related issues like health status, health indicators to identify problems for priority setting and to design action plan for identified health problems. Of the total population of the woreda 42.9% were under 15 years of age, this is lower when compared to national one which is 47% according to Ethiopian demographic health survey report of 2016. Average household size of the woreda was 6 it is higher compared to national one which is 4.6 according to Ethiopian demographic health survey report of 2016. According to Suro Barguda woreda education office report 28% of the population are literate, 46% have never attended school (illiterate) and the remaining 26% can read & write. This literacy rate was lower compared to national literacy rate which is 55.5% in average and the woredas' illiteracy rate was higher than national report which is 38% according to Ethiopian demographic health survey report of 2016.

Ethiopia is one of the countries with the lowest primary school enrollment rates in the world, thus attaining universal primary education in the country requires greater efforts. Furthermore, low quality of school and a high dropout rate, as well as gender and rural-urban disparities remain the major challenges of the country. School dropout rate of Suro Barguda district was 21% it is higher than the national dropout rate which is 12% according to Primary School Enrollment and Dropout in Ethiopia: Household and School Factors from 1992 to 2012 G.C a twenty years trend study as well as when compared to a study done in Oromia regional state Bale Zone titled as Prevalence of Primary School Dropout in Bale Zone Pastoralists of Oromia Region, Southeastern Ethiopia, 2016 which is 13% dropout rate.

According to the woreda water office report 41.7% of the population uses improved water sources. This is lower compared to national report of 2016 which is 65%.

Expanded immunization program is one of prevention and control measure performed under child health department. WHO set EPI coverage target for the control of vaccine preventable diseases. In the fiscal year Suro Barguda woreda overall EPI performance was less than the target. BCG immunization coverage was 87%, this is greater than regional and national performance according to 2016 EDHS, which was 59.7% and 69% respectively.

Penta 3 immunization coverage of the district was 88%, this is lower than both regional and national coverage which was 100% and 97% respectively. PCV 3 immunization coverage was 88% which is lower compared to regional 100% and national 96% coverage. Measles immunization coverage was 85% which is lower compared to regional coverage 96% and national coverage 94%. In addition, fully immunization coverage 82% was also less than regional and national coverage, which is 92% and 91% respectively. (9)

To reduce maternal mortality and to achieve millennium development goal, different activities are delivered at health post and health center level in the woreda. ANC service is one of the activities done in all health facilities and 80% of the pregnant women in the woreda were taken 1st visit ANC services within 2009 EFY. Contraceptive acceptance rate was 69% which is lower compared to both regional and national coverage which is 76% and 71% respectively. Contraceptive prevalence rate was 32% this is lower compared to national coverage and HSTP target which is 36% and 55% (9).

All over the country including Suro Barguda woreda, coverage of delivery services attended in health facility was very low. In addition to that, to increase utilization of delivery service federal ministry of health designed new approach. At this time the main emphasis of the government is the training of health extension workers on clean and save delivery, and simultaneously distribution of delivery kits to health facilities. Delivery attended in the fiscal year at health facilities in Suro Barguda woreda was 68% which was lower than regional performance which was 74% and national performance 71%. (9)

To give quality health service to the community and to get acceptance from the community health infrastructure is the major and key component. As HSTP plan, health post was constructed in each kebele but in Suro Barguda woreda all kebeles have not had health post yet. In Suro Barguda woreda one health post serve for 6,944 population and it exceeds the HSTP target (1:3000-5000 population) (6).

On the other hand, to give delivery and other services water supply and electric power is important. But none of health posts had water and electric power supply in the district. The other HSTP plan related to health facility was constructing one health center to serve 5 kebeles or 25,000 population. In Suro Barguda woreda one health center was served for 25000 population and it meets the national HSTP target. Furthermore, to give good services water and electric supply is must in each

health center as they give delivery service and are nutritional stabilization center too. But in Suro Barguda woreda only one health center has water supply and electric power in the health center. In addition, in the woreda primary hospital were not constructed yet.

Road is the major infrastructure in day to day activities. The woreda has dry season only roads which connect different kebeles of the woreda as well as woreda to zone. But this dry season roads are difficult during rainy season.

According to the assessment finding of the woreda at the beginning of 2018 the overall health worker to population ratio was about 4.47 per 10,000 population or 1 health worker for every 2,237 population (1: 2,237). In Suro Barguda woreda one health officer served for 17,241 population, one nurse served for 8,333 population, one midwife served for 9,091 and one health extension worker served for 3,704 population.

Furthermore, based on BPR human resource structure at health center level 2 health officer, 8 nurse (BSc and Diploma), 2 mid wife, 2 pharmacy, 2 laboratory and 1 health information technician (HIT) with a total of 17 health professionals are needed per each health center. Based on this BPR structure in Suro Barguda woreda in all health centers 6 Health officers, 24 nurses (BSc and Diploma), 6 mid wife, 6 pharmacy, 6 laboratory and 3 HIT a total of 51 health professionals are needed to give complete health services to the community. On the other hand the available health workers are 3 Health officers, 10 nurses (BSc and Diploma), 4 midwife, 3 pharmacists, 5 laboratory personnel and no health informatics a total of 25 health workers are working in health centers with 26 staff deficit.

In Suro Barguda woreda top ten causes of morbidity in adult outpatient department and most frequently occurred disease was upper respiratory tract infection it was 1st ranked in the national top ten morbidity list of diseases. Followed by acute febrile illness and urinary tract infection and in under five children pneumonia was the leading course of morbidity in Suro Barguda woreda but it was 2nd ranked in the national top ten morbidity list of under five children morbidity, followed by upper respiratory tract infection and diarrhea to list few (1).

In addition, the five top diseases were not only the major problems but also Malaria, TB, Leprosy and HIV/AIDS had their impact on the community health. However, those diseases have their prevention and control department in woreda health office. So far malaria cases were decreased

by 14% compared to last years' report. TB smear positive case detection rate was 57% and the detection rate is lower compared to regional and national performance of 2009 EFY, which was 64% both while the target is 85%. TB treatment success rate was 92%, the treatment success rate is lower compared to regional and national performance which was 96% and 94% respectively.

TB cure rate was 87%, this is lower than regional performance which is 91% and slightly higher than national performance. (9) On the other hand HIV counseling and testing was conducted in all health centers. But there was no trained health personnel on VCT in any of health centers. According to the guideline the counselor should take the training before counseling.

Strength of the health profile description

This document is help to simplify and communicate information on health indicator and the local burden of disease in a practical, accessible format for district health planning. It is intended for use by district health management team, federal/provincial/regional governments and development partners.

Limitations

Vital statistics like Infant mortality rate, neonatal mortality rate, under five mortality and maternal mortality rate were not available either at woreda health office or health institutions level. Sectors use different population as denominator instead of using the same population size. Getting the right on time in their office was very difficult situation.

4.6. Problem identification and Priority Setting

1. Resource limitation/ Low Economy

- ✓ Many population of the district live in lowest economic quantile……60%.
- ✓ Inadequate budget allocation for Health service from woreda council.
- ✓ Low literacy rate 46 percent of the population have never attended school (illiterate).
- ✓ High total school dropout rate……15%.
- ✓ There was no vehicle for health office and had shortage of motor cycle.
- ✓ There was shortage of clinical health workers (Health officer, nurses and midwife).
- ✓ There was a gap on training for technical staffs (inadequate refreshment training).

2. Poor infrastructure coverage

- ✓ No all season road in the district that connect kebeles within the district or with other woredas of the zone and with zones capital.
- ✓ Most health facilities had no electric power.
- ✓ 69 percent of the schools were without latrine facility.
- ✓ Low safe water coverage……41.7%.
- ✓ None of the health posts were with water supply access.
- ✓ Only one out of three health centers has water supply.
- ✓ Low Latrine coverage and utilization (65% and 41% respectively).
- ✓ Low solid waste disposal pits.

3. Low Maternal health coverage

- ✓ Low TT vaccination coverage for both pregnant and non-pregnant women 64% and 51% respectively.
- ✓ Low ANC1 coverage ……..……...…..... 80%
- ✓ Low ANC4 coverage ……..……...….....71%

- ✓ Low PNC coverage …… ……... 76%
- ✓ Low performance of Skilled Delivery service ……....68%
- ✓ Low F/P (Contraceptive acceptance rate) service utilization……..69%
- ✓ Low Contraceptive prevalence rate……32%

4. Low child health coverage

- ✓ Low penta1 vaccination coverage compared to the target……92%.
- ✓ Low penta3 vaccination coverage compared to the target …….. 88%.
- ✓ Low PCV1, PCV2 and PCV3 Coverage……92%, 90% & 88%
- ✓ Low Measles coverage compared to the target ……85%.
- ✓ Low fully vaccination coverage……82%

5. Low health service coverage

- ✓ Low pulmonary Tb detection rate in the woreda ……57%.
- ✓ High health worker to population ratio. The district has 26 additional staffs deficit

  (3 health officer, 14 nurses, 2 midwifes, one laboratory personnel, 3 pharmacists and 3 health in formatics).
- ✓ Inadequate ambulance service.
- ✓ Lack of experience sharing.
- ✓ Poor monitoring & evaluation (Incomplete, inaccurate and untimely reporting system).
- ✓ Lack of analysis and utilizations of data on sites.
- ✓ No feedback to concerned body on regular basis at all levels.

Table 27: Problem prioritization, Suro Barguda woreda, West Guji Zone, Oromia regional state, 2018.

S.No.	Problems	Magnitude	Severity	Feasibility	Community Concern	Gov't Concern	Total	Rank
1	Resource limitation/ Low Economy	4	4	3	5	4	20	4
2	Poor infrastructure coverage	4	4	4	5	4	21	3
3	Low Maternal health coverage	4	5	5	5	5	24	1
4	Low child health coverage	4	5	4	5	5	23	2
5	Low health service coverage	3	4	4	4	4	19	5

4.7. Conclusion

In conclusion, agriculture and livestock are the main stay of the economy of the woreda. Bimodal pattern /two cropping season/ of the rainfall gives a wide opportunity for the district to produce different types of crops and use the same land twice a year. Most of the population were living in the lowest wealth quantile even in need of support. The population were dependent on rain to grow their production. For majority them animal raring is the main stay of economy though some have also practice agriculture producing teff, maiz, mashila, wheat and the likes to support their daily lives. Cattles and Goats are the main livestock's of the woreda.

Universal access to primary education was one of the Millennium Development Goals (MDGs) envisioned by the United Nations, to be reached by 2015. Ethiopia is one of the countries with the lowest primary school enrollment rates in the world, thus attaining universal primary education in the country requires greater efforts. Furthermore, low quality of school and a high dropout rate, as well as gender and rural-urban disparities remain the major challenges of the country. Females' involvement in education is good but School dropout rate is still high in the woreda. Low literacy rate was observed and most schools were without latrine facility. Low safe water coverage. Only one health center and none of the health posts have water supply.

Concerning facilities and infrastructure; no all season road in the woreda that connect different kebeles of the district as well as to other woredas of the zone and woreda to zone capital Bule Hora. Most health facilities were without electric power. No vehicle for health office to perform different activities; especially public health emergency situations or events.

In Suro Barguda woreda health service utilization like ANC, Vaccination, contraceptive acceptance rate is fairly good but still lower compared to the national target. On the other hand, some health indicators are below the target or the standard and it needs improvement. Those gaps which needs improvements such as, low PNC and delivery service utilization, high health workers to population ratio, high health center to population ratio, health centers and health posts were without water and electric supply, inadequate budget allocation to health sector and no budget for public health emergency, low latrine coverage and utilization, low smear positive TB case detection rate were some of the major problems.

4.8. Action plan and Recommendations

4.8.1. Action plan

Table 28: Action plan based on identified and prioritized problems, Suro Barguda district, West Guji zone, Oromia regional state, 2018.

S.no.	Theme/ intermediate goal	Objectives	Tasks	Responsibility	Timeline	Evaluation
1	To see happy, prosperous and healthy community	To improve economic status of the community.	Communication of concerned bodies. Writing Proposal. Requesting for Budget Safety net programme. Microfinance services.	Regional, zonal and woreda gov't administrative. partners, NGOs	March to December 2018.	Communication with RB, ZO &Woreda office the accomplishment of the proposed project Ensuring improved economy based on indicators.
2	Improving infrastructure.	To construct all season roads. To repair and construct new water schems.	Communication of concerned bodies Writing Proposal Requesting for Budget Resource mapping. Repair available water schems and constructing new once. Suppling schools, HC & HPs with water.	Regional, zonal and woreda gov't administrative. Regional, zonal and woreda water bureau. Partners, NGOs.	March, 2017-February 2018	Communication with RBs, ZO, Woreda office & partners the accomplishment of the proposed project. Ensuring improved infrastructure based on indicators.
3	To have healthy and productive mothers.	To reduce maternal mortality. To improve maternal health.	Communication of concerned bodies. Writing Proposal for finance. Requesting for Budget. Health education. Strengthening MCH services like ANC, Delivery, PNC and family planning.	FMoH, RHB, ZHB, WoHo in collaboration with responsible partners.	March, 2017-February 2018.	Communication with FMoH, RHB, ZHB, Woreda office & partners the accomplishment of the proposed project. Ensuring improved maternal health based on indicators.
4	To have healthy children; i.e. healthy new generation.	To reduce neonatal mortality. To reduce infant mortality. To reduce child mortality.	Communication of concerned bodies Writing Proposal for finance Requesting for Budget Strengthening routine vaccination. Considering SIA to cover unreached community. Health education.	FMoH, RHB, ZHB, WoHo in collaboration with responsible partners like save the children, UNICEF and others.	March, 2017-February 2018.	Communication with FMoH, RHB, ZHB, Woreda office & partners the accomplishment of the proposed project. Ensuring improved child health based on indicators.
5	To have improved health service.	To improve health service.	Communication of concerned (bodies) Writing Proposal for finance Requesting for Budget Improve Laboratory capacity Improve laboratory personnels' skill. Hiring addition health personnel. Constructing additional HFs.	FMoH, RHB, ZHB, WoHo in collaboration with responsible partners.	March, 2017-February 2018	Communication with FMoH, RHB, ZHB, Woreda office & partners the accomplishment of the proposed project. Ensuring improved health service based on indicators.

4.8.2. Recommendations

- The woreda should allocate adequate budget for Health sector as a whole and for public health emergency conditions/ health related events.
- PSNP and other packages should be considered as most of the population falls in lowest wealth quantile.
- Woreda education office work towards increasing literacy rate and decreasing school dropout rate in collaboration with other sectors and partners. Construction of latrines is mandatory as majority of the schools were without latrine and those that have latrine have only one block; no separate latrine for male and female.
- Construction of new water schemes and repairing non-functional water schemes is required as the woreda has low safe water coverage. Health facilities should be supplied with safe water.
- All season roads should be constructed to connect different kebeles of the district and with other woredas of the zone as well as to zone capital Bule Hora.
- Increasing community awareness, accessibility and quality of health service is mandatory to improve maternal and child health such as vaccination, ANC and PNC service, delivery and family planning services.
- Strengthening routine vaccination service and conducting vaccination campaign should be considered to overcome low vaccination coverage of the woreda.
- Improving laboratory capacity to increase pulmonary TB detection rate as well as to achieve quality diagnosis for other diseases.
- Family health Services and other activities which were performed less than the target or expected during the study period should be improved within short period of time for better health of the community as well as to achieve national and global targets.

- Additional health professionals should be employed for health centers as per the standard of BPR or WHO guide line. At least 20 additional staffs are needed to achieve this standard/ guideline (2 health officer, 12 nurses, one midwifes, 2 pharmacists and 3 health informatics).
- On VCT sites health professionals should train on counseling and testing technique to provide quality VCT services to the customers.
- To minimize defaulter rate on ART users in other area due to different reasons and to minimize HIV positive deliveries ART and PMTCT services should be established in the woreda by communicating with concerned bodies.
- Availing additional two ambulances should be considered; at least one ambulances per health center to facilitate referral linkage as well as to improve maternal and child health and health system as a whole to achieve MDG.

References

1. Central Statistical Agency. "Ethiopia Demographic and Health survey," 2016.

2. FMoH. Health and Health related indicators, October 2016.

3. Central Statistical Agency. "The 2010/11 Ethiopian households' consumption expenditure (HCE) survey," 2012.

4. WHO. Strengthening human resources for health through information, coordination and accountability mechanisms, August 2013. (Online)

5. FMoH. Strengthening human resources for health, Ethiopia, 2012-2017(online)

6. FMoH. Health sector development plan, 2005.

7. Primary School Enrollment and Dropout in Ethiopia: Household and School Factors from 1984-2004 E.C/ 1992-2012 G.C.

8. Teshome Sirak, Gamechu Gishe. Prevalence of Primary School Dropout in Bale Zone Pastoralists of Oromia Region, Southeastern Ethiopia, 2016.

9. FMoH. Annual performance report, Ethiopia 2009 EFY or 2016/7**.**

10. FMoH. Health Sector Development Program IV, 2010/11 – 2014/15.

11. FMoH. Ethiopia national expanded programme on immunization, comprehensive multi-year plan 2016-2020.

Chapter V: Scientific Manuscripts for Peer reviewed Journals

5.1. "Measles outbreak investigation and response in pastoralist community-Hudet woreda, Somali region, Ethiopia, October 2018. "

[1]Melaku S, [2]Yimer S, [2]Abdulnasir A, [3]Mikias A, [1]Neamin T, [2]Adamu A,

Address: [1] Addis Ababa University college of health Science School of Public health Ninth cohort Ethiopian Field Epidemiology Training program Resident. [2]Addis Ababa University, college of health Science, School of Public health, department of preventive Medicine, Addis Ababa, Ethiopia, [3] Ethiopian Public health institute.

Email: Melaku Seyoum -seyoum.ms@gmail.com, Dr. Adamu Addissie -adamuaddissie@gmail.com, Yimer Said -yimer0505@gmail.com, Abdulnasir Abagero, Mikias Alayu-mikiasalayu7@gmail.com, Neamin Tesfaye -neamintesfaye2123@gmail.com.

Abstract

Background: Measles is a highly contagious vaccine-preventable disease. In 2010 an estimated 140,000 deaths occurred worldwide. The aim of the investigation was to describe the magnitude of measles, to identify risk factors and to undertake control measures.

Methods: Unmatched case-control study was conducted from October 1-20, 2018 in Hudet woreda. The outbreak was confirmed by using serological laboratory test. Sample size were determined based on similar studies. On case-control study a total of 116 data were collected using structured questionnaire. We used standard cases definition to identify cases. All 358 cases were line listed. Bivariate and multivariate analysis was conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS.

Results: A total of 356 cases (AR 597/100,000) and 13 deaths (CFR 4%) were identified. Infants were more affected (AR 1340/100,000). Statistically significant variables on multi-variate analysis were family size above four (AOR: 21.8; 95% CI: 2.14-222.2; P: 0.009), travel history to measles affected area (AOR: 16.3; 95% CI: 2.1-125.7; P: 0.007), being malnourished (AOR: 11.24; 95% CI: 1.21-104.5; P: 0.033), being vaccinated as protective factor (AOR: 0.11; 95% CI: 0.015-0.804; P: 0.03), knowing measles is vaccine preventable (AOR: 0.093; 95% CI: 0.011-0.82; P: 0.032).

Conclusion and recommendation: Infants were primarily affected by the outbreak. Malnutrition, low awareness level, inadequate and poor cold chain management and low vaccination coverage were likely contributed to the outbreak. Undertaking supplementary immunization, enhancing routine vaccination coverage, increasing community awareness, strengthening cold chain management and managing malnourished cases can reduce measles outbreak.

Key words: measles outbreak, Case control study, Hudet, Somali Region Ethiopia, 2018.

Introduction

Background

Measles is an acute, highly contagious viral disease caused by a measles virus. It is a vaccine preventable respiratory infection, but has been, and remains, a major killer disease of children around the world (1).

In developing countries with low vaccination coverage, epidemics often occur every two to three years (12).

Unvaccinated young children are at highest risk of measles infection and its complications, including death. Unvaccinated pregnant women are also at risk of measles infection. More than 95% of measles deaths occur in countries with low per capita incomes and weak health infrastructures (3).

Routine measles vaccinations for children, combined with supplementary mass immunization campaigns are key public health strategies to reduce measles morbidity and mortality. The measles vaccine has been in use for over 50 years. It is safe, effective and inexpensive.

In 2014, about 85% of the world's children received one dose of measles vaccine by their first birthday through routine health services up from 73% in 2000. Two doses of the vaccine are recommended to ensure immunity and prevent outbreaks, as about 15% of vaccinated children fail to develop immunity from the first dose (6).

Case-based measles surveillance was initiated in Ethiopia in 2003. The number of reported suspected measles cases has increased through the years and which could be partly due to the increased sensitivity of the surveillance system, rather than a failure of the control efforts. Although measles is one of the weekly reportable disease in Ethiopia; the number of reported cases represents only a small proportion of the expected cases. Measles case usually comes late to the health facilities and often after they have developed complication. As a result, the diagnosis given by the health workers tend to be one of the complication rather than measles itself, which is one of the reasons for under reporting of measles cases. A combination of poor quality of record keeping, failure to identify epidemics and improper filling of case based form as well as failure of mothers to bring children affected by measles to health facilities for treatment are among other contributing for under reporting (7).

According to the Assessment result of the 2010 global measles mortality reduction

goal: results from a model of surveillance data, estimate that, after more than 45 years of measles vaccine availability, the disease caused nearly 140, 000 deaths in 2010 (12).

Despite tremendous achievements towards global measles mortality reduction and measles elimination goals, globally, in 2010, there were 327,305 measles cases reported and an estimated 139,300 measles deaths (i.e., approximately 380 deaths/day). During 2009–2010, measles outbreaks were reported in Europe, Africa and Asia. In 2010–2011, Western Europe saw a rise in measles cases with at least 33 countries reporting more than 68,743 measles cases, resulting in importations into the Americas (1).

Globally, in 2015, there were 254,928 measles cases reported and an estimated 134,200 measles deaths (i.e., approximately 367 deaths/day). During 2015, measles outbreaks were reported in several countries in the African, European, and Eastern Mediterranean regions. Approximately one case of encephalitis and two to three deaths may occur for every 1,000 reported measles cases (18).

Measles is still a public health problem in many developing countries, particularly in parts of Africa and Asia. According to the World Health Organization (WHO), more than 20 million people are affected by measles each year with more than 95% of measles deaths occur in countries that have low per capita incomes and weak health infrastructures(3).

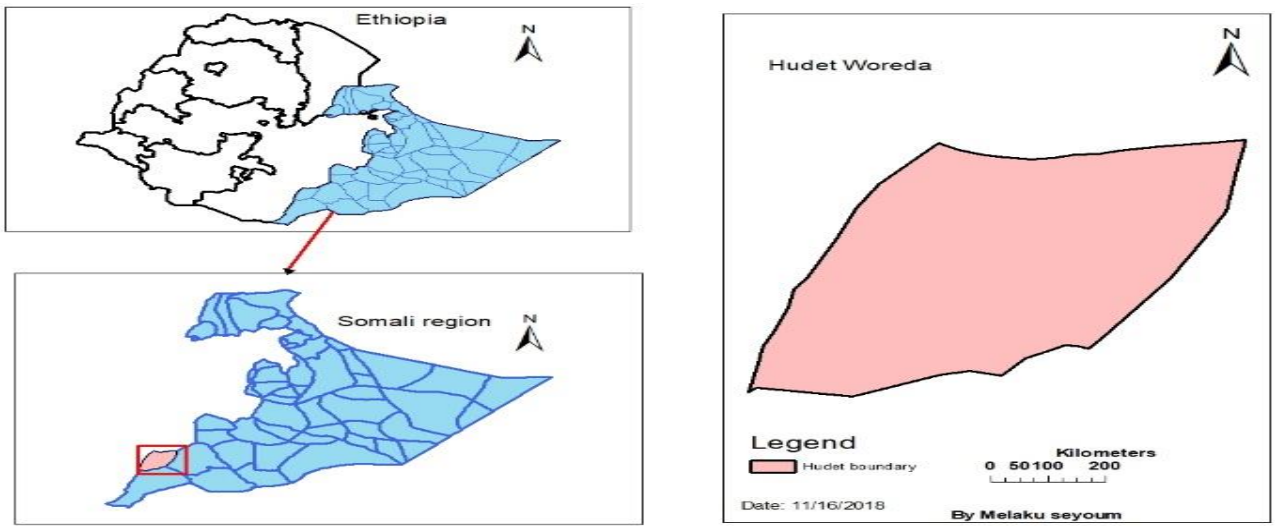
According to WHO report since 2006 through 2017 Ethiopia have reported 67,603 laboratory confirmed measles cases. From September 2017 to August 2018 the incidence rate of measles was 26.4 cases per 100,000 population among under one and 25.7 cases per 100,000 population among 1-4 age group. According to a study conducted in 2017 in Somali region the overall attack rate (AR) was 28.2 cases per 10,000 population. All age group were affected.

The aim of the study was to describe magnitude of measles outbreak, identify risk factors associated with it and undertake appropriate public health control measures in pastoralists of Hudet woreda.

Method: Unmatched case-control study with a case to control ratio of 1:2 was conducted from October 1-20, 2018 in Hudet woreda. We used standard case definition to identify cases and line listed all cases. We analyzed the collected line list by person, place and time. The outbreak was confirmed using serological test at national reference public health laboratory in Ethiopian public health

institute. Bivariate and multivariate analysis was conducted using odd ratio with 95%

confidence interval and P-value < 0.05 by using SPSS. Assumptions for sample size determination: - power of the study 80%, 95% CI, Control to case ratio 2, According to a study conducted in Abaya woreda of Oromia region and taking percent of controls exposed 46.3, odds ratio 3.5, percent of cases with exposure 53.7 gives 39 cases and 77 controls. Then Ethiopian public health institute (EPHI) gave directive and approval to investigate and respond to the outbreak. Verbal informed consent was obtained from participants or mothers/caregivers, any information related with personal identification was not used on the report. Cases were also referred to the nearby health facilities for medical care.



Map 8: showing study area Hudet woreda, Somali region, Ethiopia, 2018.

Result: From September 4 to November 5, 2018, which is considered as epidemic period, 356 cases of measles and 13 deaths were recorded on a line list throughout in Hudet woreda. Among these 5 blood samples were taken to identify the etiologic agent and confirm the outbreak. Accordingly, three samples were positive for measles IgM using the conventional Polymerase Chain Reaction (PCR). The median age of the cases is 15 years with a range of 2 months to 57 years. 56% of the cases were female.

The overall attack rate (AR) was 597 cases per 100,000 populations. The attack rate is high in females (602 cases per 100,000 populations) than males (592 cases per 100,000 populations).

Table 29: Distribution of measles cases by age group, Hudet woreda of Dawa zone, Somali Region, Ethiopia, 2018.

S.No.	Kebele	Age group															
		Frequency								Percentage							
		<1	1-4	5-14	15-24	25-34	35-44	45+	Total	<1	1-4	5-14	15-24	25-34	35-44	45+	Total
1	Chokorsa	14	47	10	54	16	4	0	145	10%	32%	7%	37%	11%	3%	0%	41%
2	Dheera	1	0	0	0	2	0	0	3	33%	0%	0%	0%	67%	0%	0%	1%
3	Dibe	11	12	2	13	11	0	2	51	22%	24%	4%	25%	22%	0%	4%	14%
4	Dirir	0	10	6	10	3	1	1	31	0%	32%	19%	32%	10%	3%	3%	9%
5	El-kala	1	22	10	18	14	0	1	66	2%	33%	15%	27%	21%	0%	2%	18%
6	Haloye	4	3	0	9	5	1	0	22	18%	14%	0%	41%	23%	5%	0%	6%
7	Hudet 01	0	0	2	2	0	0	0	4	0%	0%	50%	50%	0%	0%	0%	1%
8	Hudet 02	0	2	1	2	2	0	0	7	0%	29%	14%	29%	29%	0%	0%	2%
9	Hudet 03	0	2	0	1	1	0	0	4	0%	50%	0%	25%	25%	0%	0%	1%
10	M/guba	0	2	0	1	1	0	0	4	0%	50%	0%	25%	25%	0%	0%	1%
11	Q/hargesa	1	4	6	5	5	0	0	21	5%	19%	29%	24%	24%	0%	0%	6%
	Total	**32**	**104**	**37**	**115**	**60**	**6**	**4**	**358**	**9%**	**29%**	**10%**	**32%**	**17%**	**2%**	**1%**	**100%**

The overall attack rate (AR) of the case was 597 cases per 100,000 populations. The attack rate is high in females (602 cases per 100,000 populations) than males (592 cases per 100,000 populations). Less than one year of age group was more affected than the others (<1 year 1340 cases per 100,000 population), 1-4 years of age 1000 cases per 100,000 population and >5 years 450 cases per 100,000 population. The AR for less than 15 years of age was 674.7/100,000 and for greater than 15 years was 539.7/100,000.

The highest attack rate was registered in Chokorsa Kebele, 5938 cases per 100,000 populations and followed by Dibe, El-Kela and Haloye Kebeles, 2352, 1664 and 1062 cases per 100,000 populations respectively.

Thirteen deaths with the overall case fatality rate (CFR) of 4% were reported. The highest CFR 14% in Hudet 02 Kebele, followed by El-kela 6%.

Table 2: Measles Attack rate (AR) and case fatality rate (CFR) by kebele in Hudet woreda of Dawa zone, Somali Region, Ethiopia, 2018.

S.No.	Kebele	Total population	# cases	# deaths	Attack rate (AR per 100,000 population.	CFR
1	Chokorsa	2442	145	6	5938	4%
2	Dhedertu	3345	3	0	90	0%
3	Dibe	2168	51	2	2352	4%
4	Dirir	3499	31	0	886	0%
5	El-kala	3967	66	4	1664	6%
6	Haloye	2072	22	0	1062	0%
7	Hudet 01	5301	4	0	75	0%
8	Hudet 02	4240	7	1	165	14%
9	Hudet 03	3621	4	0	110	0%
10	Melka guba	1600	4	0	250	0%
11	Qal-Hargesa	2005	21	0	1047	0%
	Hudet woreda	**59,920**	**358**	**13**	**597**	**4%**

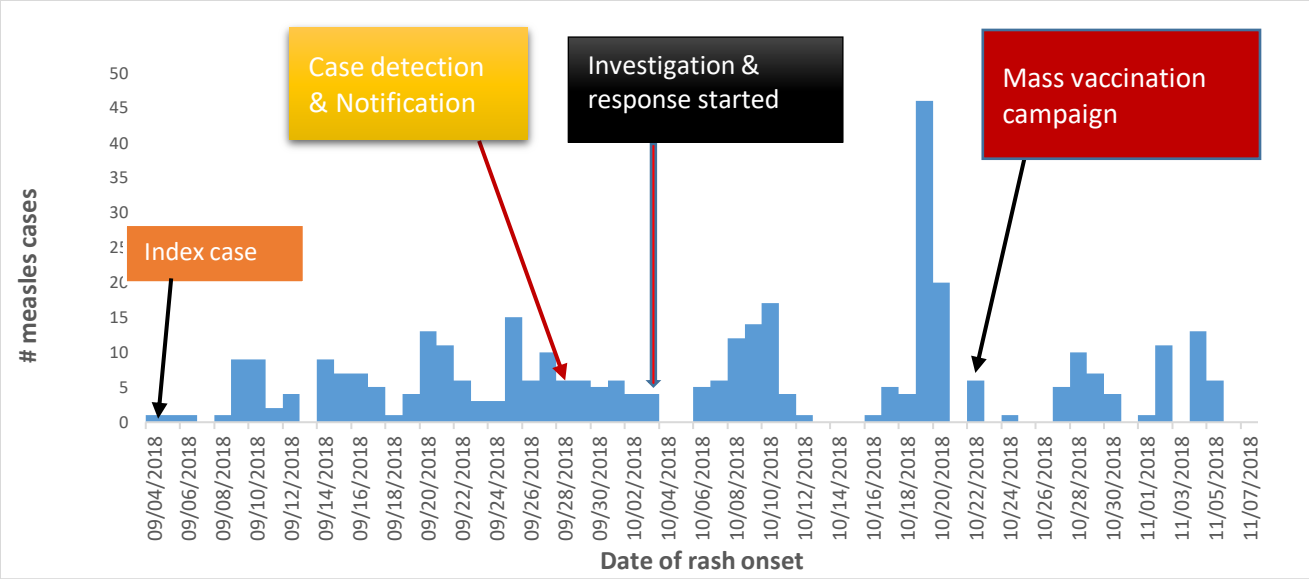


Figure 61: Epidemiologic curve of measles outbreak, Hudet woreda, Somali region, Ethiopia 2018

Onset of rash occurred between September 4, 2018 and November 5, 2018 was presented in figure1. The detection of the outbreak (the cases) was late by 3 weeks. The outbreak Continued for about 12 weeks (three months). This is due to delayed detection & notification, insufficient interventions covering all affected kebeles, security

problem, inadequate logistics and supplies. Most of the affected kebeles are far from main road. The case builds up gradually to reach its peak on October 19, 2018 and had multiple peaks.

Vaccination coverage of the woreda

The administrative measles vaccination coverage was 68%, in 2018. 254 (71%) of cases had not received any dose of measles vaccine. Moreover, 32% of the cases aged between 1-15 years, the age range in which a high level of vaccination coverage is to be expected, had not received any dose of the vaccine. Among the total cases, 25% of the patients had received one dose of measles containing vaccine (MCV1) and the rest 5% of them were received two doses of measles containing vaccine (MCV2). The highest unvaccinated cases were reported from Chokorsa Kebele which was 38% from the total unvaccinated cases and followed by El-Kela and Dibe which was 22% and 14% respectively.

Cold chain management: The woreda has 27 health posts and 5 health centers. These health posts have no functional refrigerator due to different reasons like shortage of fuel cost, shortage of spare part for the fridge and lack of technical skill. There is functional fridge at all health center.

Identified risk factors for measles

Bi-variate and multi-variate analysis were performed to determine strengthen of association. For exposures that were significant on bivariate analysis we verified whether the association was due to confounder, effect modification or real association. Statistically significant variables on Multi-variate analysis were Family size above four (AOR: 21.8; 95% CI: 2.14-222.2; P: 0.009), travel history to measles affected area (AOR: 16.3; 95% CI2.1-125.7; P: 0.007), being vaccinated as protective factor (AOR: 0.11; 95% CI: 0.015-0.804; P: 0.03), Knowing measles is vaccine preventable (AOR: 0.093; 95% CI: 0.011-0.82; P: 0.032), being malnourished (AOR: 11.24; 95% CI: 1.21-104.5; p: 0.033).

Intervention undertaken to contain the outbreak

The investigation team identified and characterized the measles outbreak. Technical assistance was given for health workers on case management, recording and reporting situation. Cases were treated to prevent further spread; and reduce morbidity and mortality attributed to measles. Routine surveillance was enhanced and the situation was closely followed at each level on a daily bases. Health education was given for the community members to prevent the

transmission of the disease, to motivate health seeking behavior and treatment if there is sign and symptoms of measles. Zonal health office in collaboration with deployed team have started working closely in the affected district and the entire neighboring districts to prevent/control the outbreak from spreading to these areas, and alarming the community, health extension workers and community leaders to strength the local surveillance system.

The outbreak was reported in the pastoral population and far from the main road challenged the routine immunization delivery system. During the outbreak investigation, it was witnessed that health posts in outbreak affected areas suffered from a lack of constant delivery of potent vaccine and regular maintenance of cold chain equipment. The outbreak occurred in remote kebeles with many hours walk on foot from the main road which makes it difficult to provide routine immunization service. Despite, the difficulties an outbreak response immunization (Mass immunization vaccination campaign) was conducted starting on October 22, 2018, targeting children from 6 months to 15 years. A total of 25045(98%) of under 15 age group population was vaccinated. Among this 8082(32%) were not vaccinated before. We used 2708 measles vaccine vial from total 2846 vial vaccine received. Total wastage rate was 7.9%.

Discussion: A prolonged measles outbreak was identified in Hudet Woreda of Somali region starting from September 4, 2018 to 5 November 2018. The crude attack rate was high compared with the attack rate of measles outbreak recorded nationally, 4.1 per 100,000 population, in 2008 (1). In addition, this finding is higher than outbreak investigations conducted in Jarar zone of Somali region, neighboring Guji zone, Abaya woreda of Borena zone of Oromia which were 282, 8, 390 cases per100,000 population respectively (17, 24 & 26). This could be due to delayed detection & notification, insufficient interventions covering all affected kebeles, security problem, unavailability of logistics and supplies and absence of health facilities in recommended distance range. But lower than other studies done in Kebridehar town of somali region and Solomon Iceland which was 790 and 1230 cases per 100,000 population respectively (27, 30).

Highly affected age group was less than one year of age which is comparable with the outbreak investigation conducted (17, 22, 30, and 31). The AR of under-one years was

1340 cases per 100,000 and it was higher than the attack rate reported on other study conducted in Abaya woreda (1160/ 100,000) of Borena zone (28). But lower than the study conducted in Solomon Iceland which was 2785 cases per 100,000 population (30). Deaths from measles occur mainly due to complications of measles. Infants and young children, especially those who are malnourished, are at highest risk of dying.

In Ethiopia, the expected case-fatality rate is between 3% and 6%; the highest case-fatality rate occurs in infants 6 to 11 months of age, with malnourished infants at greatest risk. These rates may underestimate the true lethality of measles because of incomplete reporting of outcomes of measles illness. In certain high-risk populations, case-fatality rates as high as 30% have been reported in infants aged less than 1 year of age. Malnutrition (including vitamin A deficiency), underlying immunodeficiency and lack of access to medical care are all factors leading to the high case-fatality rates observed in many parts of the world. Unless managed early and aggressively, complications may lead to death within the first month after the onset of rash. The case fatality from measles is estimated to be 3%-6% in developing countries but may reach more than 10% in outbreaks especially when it is compounded by malnutrition (1, 8, and 11).

In this study 4% measles case fatality rate (CFR) was recorded. This is higher compared to similar studies conducted in Kebridehar town and Jarar zone of Somali region, Abaya woreda of Borena zone, Guji zone of Oromia region and Sudan findings CFR of 1.8%, 1.2%, 0.4%, 0.2% and 0.9% respectively (17, 25, 26, 27 and 28). This high CFR could be due to delayed detection & notification, insufficient interventions covering all affected kebeles, security problem, unavailability of logistics and supplies and absence of health facilities in recommended distance range. Though it's high the measles case fatality rate (CFR) in this study was within expected range CFR in Ethiopia and sub-Saharan Africa (1, 2).

In this outbreak, eleven kebeles were affected with measles outbreak. An active case search and contact tracing was conducted. This help to identify the source of infection and determine whether other areas have been exposed or not. The index case was seen in chokorsa kebele on September 4, 2018 on 25 year's old unvaccinated female case.

Several factors contributed to the occurrence of this measles outbreak. 71% of measles

affected cases had not received measles vaccination. In other similar studies done in the Jarar zone of Somali region, Guji zone, Sudan, LAO, France, USA and Ireland also discovered that 86.2%, 75%, 50.4%, 99.6%, 69%, 65% and 91.2% of affected children by measles outbreak were unvaccinated (17, 18, 25, 26, 31,32 and 33).

Measles infection is more severe among children who are already malnourished. Moreover, measles may exacerbate malnutrition because of decreased food intake due to malaise, increased metabolic requirements in the presence of fever, or the mistaken belief of parents and health practitioners that a child's food should be withheld during an acute illness. Under nutrition may lead to or worsen vitamin A deficiency and keratitis, resulting in a high incidence of childhood blindness following measles outbreaks (12). My result showed that, there is strong association between malnourished children and measles cases.

Conclusion: We concluded that a prolonged measles outbreak September to November was occurred in Hudet woreda due to late detection and notification. Infants were primarily affected by the outbreak. The outbreak was confirmed based on laboratory diagnosis. A total of eleven kebeles were affected and resulted in 358 cases and 13 deaths. The highest attack rate was observed among children under the age of 5 years (38%). Unvaccinated infants were the most affected segment of the population. The case fatality rate was in acceptable range compared to national reference, but higher compared to other studies conducted in the Somali region, in different parts of the country as well as abroad. The highest attack rate was reported from Chokorsa kebele.

The woreda routine measles vaccination coverage was less than the expected national target for year 2018. Above 50% of the woreda kebeles, vaccination coverage was less than 90%. The lowest vaccination report was reported from Chokorsa kebele in 2018. On the other hand cold chain management was the major problem in the affected area. There was no functional fridge in all health posts except at health center level.

According to this study findings , low vaccination coverage of hard to reach kebeles, poor cold chain management, presence of high family members, unventilated housing condition, low community awareness on measles transmissions and prevention, and presence of health center at a long distance from households (>5km) were likely contributed

for the occurrence of this measles outbreak. In this outbreak all treated cases, were recovered from their illness. This shows that the case management was relatively good. However, the activities performed on community mobilization and providing the key massages for the community to control and prevent the outbreak was weak.

Recommendations

- Strengthen measles routine vaccination activities with the target of reaching more than 90% of infants of 9 to 11 months of age and the coverage should be monitored accordingly in each level.
- Consider second opportunity as a form of supplemental immunization activities in 2-3 year interval to improve population immunity.
- Regular analysis of routine immunization data and taking corrective action to ensure a sustained increase in the coverage of measles vaccination, concentrating on the communities/children not vaccinated.
- Social mobilization campaigns should be conducted to inform parents and community leaders about the importance of obtaining measles vaccination as soon as possible before one year age.
- Attention should be given for cold chain and functional fridge should be established for hard to reach health posts (specially affected kebeles).
- Establishing reaching every child (REC) strategy in Hudet woreda with particular emphasis too hard to reach areas to enhance the current immunization service, and furthermore to conduct data quality self-assessment or cluster coverage survey to verify the reported high vaccination coverage in some kebeles.
- There is a need to boost the sensitivity of case-based surveillance system to be able to early detect, confirm and react to future epidemics.

Competing interests

No competing interests.

Authors' contributions

Melaku Seyoum- concept, design, acquisition of data, analysis, interpretation and writing of manuscript.

Adamu A, Yimer S, Abdulnasir A, Mikias A, Neanim T – guidance and review of the manuscript.

Acknowledgements

My deepest gratitude goes to academic mentors and Lecturers Dr. Adamu Addissie and Mr. Yimer Seid, for their guidance and help during the development of the manuscript.

Many thanks goes to Abdulnasir Abagero, Mikias Alayu and Neamin Tesfaye for reviewing of the manuscript and contribution.

References

1. Ethiopian public health institute. Guideline on measles surveillance and outbreak management 4th edition, December 2016 Addis Ababa Ethiopia.

2. Mark A. Miller and John T. Sentz. Disease and Mortality in Sub-Saharan Africa, Chapter 12 Vaccine Preventable Diseases, 2nd edition, 2006.

3. Public Health Agency of Canada, guidelines for the prevention and control of measles outbreaks in Canada, October 2013.

4. World Health Organization, Measles and Rubella Strategic Plan, 2014

5. World Health Organization, Measles epidemiological record, NOVEMBER 2018, 93th year / November 2018.

7. Akalu HB. Review on Measles Situation in Ethiopia 2015; Past and Present. J Trop Dis 4: 193.

8. World Health Organization, Global Report on Measles and Rubella, 2014

9. Tikelaye Kidane, Mikceal Teki. Factors Influencing Child Immunization Coverage in a Rural District of Ethiopia, Ethiopian Journal of Health Development, 2000

10. Mekonen Getahun, Berhane Beyene, Ayesheshem Ademe, Birke Teshome, Mesfin Tefera, Anjelo Asha, Aklog Afework, Yoseph HaileMariyam, Esete Assefa, and Kathleen Gallagher. Epidemiology of laboratory confirmed measles virus cases in Amhara Regional State of Ethiopia, 2004–2014.

11. Geneva WHO. Manual for the Laboratory Diagnosis of Measles and Rubella Virus Infection. 2007.

12. Simons E FM, Fricks J, et al. Assessment of the 2010 global measles mortality reduction goal: results from a model of surveillance data. PubMed April 24.

13. WHO. Immunization, Vaccines and Biologicals 2014.

14. RC Fernandez NA, A Rammohan. Determinants of apparent rural-urban differentials in measles vaccination uptake in Indonesia. 2011.

15. WHO/AFRO. Measles elimination in Africa. 2009.

16. World Health Organization Rofs-eA. Measles and Rubella Surveillance and outbreak investigation guideline 2009.

17. Ketema Belda, Ayesheshem Ademe Tegegne, Amare Mengistu Mersha, Mekonnen Getahun Bayenessagne, Ibrahim Hussein, Belay Bezabeh. Measles outbreak investigation in Guji zone of

Oromia region, Ethiopia. The Pan African Medical Journal. 2017.

18. Preeta Kutty, Jennifer Rota, William Bellini, Susan B. Redd, Albert Barskey, Gregory Wallace, Vaccine Preventable Diseases Surveillance Manual, 6th Edition, 2013.

19. Tariq Khan, Javaria Qazi. Measles Outbreaks in Pakistan: causes of the tragedy and future Implications, Herbert Open Access Journal Epidemiology Reports 2014.

20. Central Statistical Agency (CSA) of Ethiopia. Summary and statistical report of the 2007 population and housing census. Addis Ababa, Ethiopia: CSA; 2008.

21. Amare Mengistu Mersha, Fiona Braka, Kathleen Gallagher, Aysheshim Ademe Tegegne, Aron Kassahun Argay, Mekonnen Admassu Mekonnen, Merawi Aragaw, Debritu Mengesha Abegaz, Etsehiwot Zeamlak Worku, Mekonen Getahun Baynesagn**.** Measles burden in urban settings: characteristics of measles cases in Addis Ababa city administration, Ethiopia, 2004-2014.

22. Munira Nasser Hassen, Abyot Bekele Woyessa, Mekonen Getahun, Berhane Beyene, Lucy Buluanger, Ayesheshem Ademe, Alemayehu Bekele, Adamu Addissie, Amha Kebede and Daddi Jima. Epidemiology of measles in the metropolitan setting, Addis Ababa, Ethiopia, 2005–2014: a retrospective descriptive surveillance data analysis.

23. Misganu Endriyas, Tarekegn Solomon, Bekele Belayhun and Emebet Mekonnen. Poor quality data challenges conclusion and decision making: timely analysis of measles confirmed and suspected cases line list in Southern Nations Nationalities and People's Region, Ethiopia.

24. Robert Kaos Majwala, Lydia Nakiire, Daniel Kadobera, Alex Riolexus Ario, Joy Kusiima, Joselyn Annet Atuhairwe, Joseph K. B. Matovu and Bao-Ping Zhu. Measles outbreak propagated by children congregating at water collection points in Mayuge District, eastern Uganda, July-October, 2016.

25. Fa´tima Coronado, Nisreen Musa, El Sayed Ahmed El Tayeb, Salah Haithami, Alya Dabbagh, Frank Mahoney, Robin Nandy and Lisa Cairns. Retrospective Measles Outbreak Investigation: Sudan, 2004.

26. Yusuf Mohammed and Ayalew Niguse. Measles Outbreak Investigation and Response in Jarar Zone of Ethiopian Somali Regional State, Eastern Ethiopia, 2017.

27. Yusuf Mohammed. Measles Outbreak Investigation & Response; Kebridehar Town, Ethiopia Somali Region, November 2013.

28. Birhanu Reda. Investigation of Measles outbreak –Abaya woreda, Borena zone, South Eastern Oromia, Ethiopia 2013.

29. World Health Organization. Measles supplementary immunization activities (SIAs)* and the delivery of other child health interventions, by region and country; African, Eastern Mediterranean, European, South-East Asia, and Western Pacific Regions, 2017.

30. Jason Diau,a Christopher Jimuru,a James Asugeni,a Lyndell Asugeni,a Mike Puia,a John

Maomatekwa, Humpress Harrington, David MacLaren, Rick Spearecd and Peter D Masseye. Measles outbreak investigation in a remote area of Solomon Islands, 2014.

31. Bounthanom Sengkeopraseuth, Bouaphanh Khamphaphongphane, Phengta Vongphrachanh, Anonh Xeuatvongsa, Sisouveth Norasingh, Chansay Pathammvong, Manilay Phengxay, Phanmanisone Philakongd and Siddhartha Sankar Dattad. Analysing the characteristics of a measles outbreak in Houaphanh province to guide measles elimination in the Lao People's Democratic Republic 2014.

32. Anne Bernadou1, Cyril Astrugue1, Matthieu Mechain, Valerie Le Galliard, Catherine Verdun-Esquer, France Dupuy, Julia Dina,Fatima Ait-Belghiti, Denise Antona, Stephanie Vandentorren. Measles Outbreak linked insufficient vaccination coverage in Nouvelle Aquitine region, France, October 2017 July 2018.

33. Peter Barrett1, Suzanne Cotter, Fiona Ryan1, Jeff Connel, Anthony Cronin1, Mary Ward, Rose Fitzgerald[5], Catherine Lynch, Tony Margiotta. A national measles outbreak in Ireland linked to a single imported case April to September 2016.

34. Shahrokh Izadi, Seyed-Mohsen Zahraie2 and Majid Sartipi. An Investigation into a Measles Outbreak in Southeast Iran 2012.

35. Fred Nsubuga, Lilian Bulage, Immaculate Ampeire, Joseph K. B. Matovu, Simon Kasasa, Patricia Tanifum, Alex Ario Riolexus and Bao-Ping Zhu. Factors contributing to measles transmission during an outbreak in Kamwenge District, Western Uganda, April to August 2015.

36. Kasidet Manakongtreecheep and Robert Davis. A review of measles control in Kenya, with focus on recent innovations, The Pan African Medical Journal. 2017.

37. Yu Hu, Ying Wang, Yaping Chen, Hui Liang and Zhiping Chen. Measles vaccination coverage, determinants of delayed vaccination and reasons for non-vaccination among children aged 24–35 months in Zhejiang province, China, 2018.

38. Rita Sá Machado, Mariana Perez Duque, Soraia Almeida, Ivo Cruz, Ana Sottomayor, Isabel Almeida, Júlio R Oliveira, Delfina Antunes. Measles outbreak in tertiary level hospital in Porto, Portugal: Challenges in post-elimination era.

39. Goncalo Figueiredo Augusto, Diogo Cruz, Andreia Silva, Natalia Pereira, Barbara Aguiar, Ana Leca, Elisabete Serrada, Paula Valente, Teresa Fernandes, Fernando Guerra, Paula Palminha, Elsa Vinagre, Silvia Lopo, Rita Cordeiro, Emma Saez-Lopez, Maria Neto, Paulo Jorge Nogueira, Graca Freitas. Challenging Measles case definition, three Measles outbreaks in three Health regions of Portugal, February to April 2018.

5.2. "Challenges of imported cholera cases among deportees in Ethiopia: from Saudi Arabia prisons, March 2019."

[1]Melaku Seyoum, [2]Yimer S, [2]Abdulnasir A and [2]Adamu A.

Address: [1] Addis Ababa University college of health science, School of Public health Ninth cohort Ethiopian Field Epidemiology Training program Resident. [2]Addis Ababa University, College of health science, School of Public health, Department of preventive Medicine, Addis Ababa, Ethiopia.

Abstract

Introduction: Cholera is an acute, diarrheal illness which could leads epidemic and mortality. We investigated the outbreak of cholera and described cases by person, place and time.

Method: We conducted a descriptive cross sectional study in Addis Ababa, from June 12, 2018 to March 16, 2019. We used standard case definition to identify imported cholera cases. We reviewed medical record and laboratory findings. All collected data were entered and analyzed using Microsoft excel 2013.

Result: From June 12, 2018 to March 16, 2019; the investigation team had screened 37,380 deportees from Saudi Arabia and identified 260 suspected imported cholera cases. The overall AR was 7 cases per 1000 populations with no death. The median age was 21 years (13 - 65 years). 93% of the cases were male and most cases were in the age group of 15-44. 38% of samples were positive for vibrio cholera by rapid diagnostic test (RDT). For 65 RDT positive cases stool culture were sent to reference laboratory. Accordingly, 16 out of 65(24.6%) of samples were culture positive for vibrio cholerea O1 serogroup and Ogawa serotype. Sixteen out of total 260 cases or 6% of cases were confirmed cases and the remaining cases were epidemiologically linked.

Conclusions: A confirmed cholera outbreak due to imported cases affected mostly age group less than 30 years' of age.

Recommendations: We recommend to the public health emergency management unit to strengthen cholera screening in the entry points and cross border responses.

Key words: Cholera, outbreak, imported, Investigation, deportee, Addis Ababa, Ethiopia, 2019.

Word count: 237

Introduction

Background

Cholera is an acute, diarrheal illness caused by infection of the intestine with the toxigenic bacterium *Vibrio cholerae serogroup* O1 or O139 (1, 2).

Cholera is one of the major epidemic diseases in Ethiopia and resulted, in times of the worst outbreaks, in a high rate of mortality. Both children and adults can be infected by cholera. It is one of the key indicators of social development and remains a challenge to countries where access to safe drinking water and adequate sanitation cannot be guaranteed (3, 5).

Cholera, largely eliminated from industrialized countries by water and sewage treatment over a century ago, still remains a significant cause of illness and death in many African countries (3).

In the twenty-first century, sub-Saharan Africa bears the brunt of global cholera. The region is broadly affected by many cholera cases and outbreaks that can spread across countries. The percentage of people who die from reported cholera cases remains higher in Africa than elsewhere. This reflects the lack of access to basic health care because of cholera's simple treatment of rehydration therapy (3).

Cholera has been prevalent worldwide since the early 19th century and the world is currently in the so-called 7th pandemic. The number of cholera cases has steadily risen worldwide due to cholera outbreaks. The world health organization (WHO) estimates that globally 3-5 million cases and 100 000-120 000 deaths occur annually. This disease is endemic in sub-Saharan African countries (2).

An estimated 2.9 million cases and 95,000 deaths occur each year around the world (3).

In Africa, most outbreaks are caused by the El Tor biotype, V. cholerae Serotype Inaba. However, about 98% of the cases isolated during the November 2008-april 2009 cholera outbreak in South Africa were serotype Ogawa. No V.cholerae O139 cases have been reported in Africa (2).

The seventh pandemic of cholera first reached West Africa in 1970 and has persisted as a public health problem in parts of Africa since that time. While the reported incidence of cholera has decreased significantly in Asia and Latin America over the past two decades, the incidence in sub-Saharan Africa has remained the same. In

2009, 98% of 221, 226 cholera cases and 99% of 4,946 cholera deaths reported to the World Health Organization (WHO) occurred in sub-Saharan Africa. CFR for all parts of the world outside of Africa has been below 0.4% since 2002, the overall CFR for Africa in 2009 was 2.3% (4).

Evidence reveals that Ethiopia encountered at least five cholera epidemics in the nineteenth and early twentieth centuries, several outbreaks coming in more than one wave. Outbreaks are thus reported between 1831-1836, during which time the cholera was thought to have made itself manifest on two separate occasions; in 1856 and 1866-7. During the great famine of 1889-1892 when it again seems to have struck twice; and, finally, in 1906 when the disease appears to have wrought relatively little damage (5).

Ethiopian Public Health Institute reported about 2,145 (nationally) and 25 (in Addis Ababa) suspected AWD cases as of 12 June 2016. In week 15 (week ending 16 April 2017), a total of 2,388 suspected cases of AWD/cholera were reported in Afar, Amhara and Somali regions of the country. While some decline has been observed in the trend in the last weeks [4,200 cases in week 14; 4,104 cases in week 13; 4,358 cases in week 12], Somali region remains the most affected, accounting for 99% of the new cases reported in the reporting week. On 20 April 2017, WHO elevated the outbreak of AWD/cholera and the humanitarian crisis in Ethiopia to grade 3 emergency. Since the beginning of 2017, a total of 37,459 cases including 784 deaths (case fatality rate 2.1%) have been reported from six regions of Somali, Oromia, Amhara, Afar, SNNP and Tigray. Eighty-nine percent of the reported cases and 96% of the deaths were reported in Somali Region alone (8).

In January 2018, nine regions in Ethiopia have been affected, and 73.6% of the total cases are from Somali region. Between January and December 2017, a cumulative total of 48,814 cases and 880 deaths (CFR 1.8%), have been reported from 9 regions. In 2018 only, a total of 98 cases have been reported from two regions, Somali and Dire Dawa regions. From week 1 to 23, 2018, a total of 728 cases with 18 deaths (CFR-2.5%) has been reported from the following regions: Somali (136 cases), Afar (537 cases with 18 deaths), Tigray (38 cases), and Dire Dawa City Administration (17 cases). A total of 3,090 cases have been reported in 2018 (8).

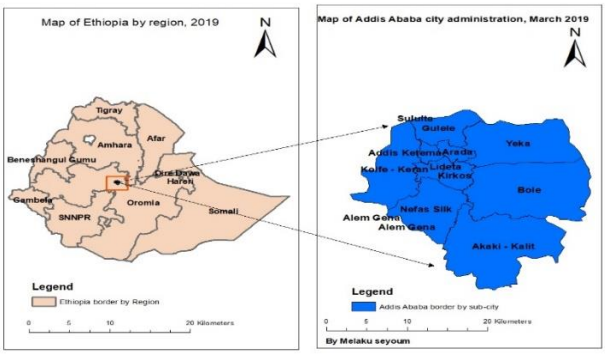
The world health organization (WHO) estimates that globally 3-5 million cases and

100,000-120,000 deaths occur annually in ninetieth century (2).

In 2018 an estimated 2.9 million cases and 95,000 deaths occur each year around the world. The infection is often mild or without symptoms, but can sometimes be severe (3).

The aim of this study is to describe epidemiology of imported cholera cases by person, place and time; to identify cases at point of entry and link them to CTCs in returnees' of prisons from Saudi Arabia in Ethiopia 2019**.**

Method: We conducted a descriptive cross sectional study in Addis Ababa, from June 12, 2018 to March 16, 2019. We used standard case definition to identify imported cholera cases at Bole airport. After filling a line list all suspected cases were referred to CTC. At CTC samples were collected for confirmation. We reviewed medical record and laboratory findings. All collected data were entered and analyzed using MS excel. Ethiopian Public Health Institute gave the directive and approval to investigate, respond and contain the outbreak locally. The manuscript of the report will be published in peer-reviewed journals to reach the scientific community.



Map 1: showing study area, Addis Ababa city Administration, Ethiopia, 2019.

Result: From June 12, 2018 to March 16, 2019 (10 months), the investigation team screened 37,380 deportees from Saudi Arabia prisons and identified 260 suspected imported cholera cases. Among these suspected cases 170 stool samples were taken and 65(38%) were positive for vibrio cholera by rapid diagnostic test (RDT). For 38 RDT positive cases stool culture were taken and transported to national reference laboratory to identify the etiologic agent and confirm the outbreak. Accordingly, 16 out of 65 or 24.6% of samples were positive for vibrio cholerea O1 serogroup and Ogawa serotype. Sixteen out of total 260 cases or 6% of cases were confirmed cases and the remaining cases were epidemiologically linked.

The median age of the affected deportees was 21 years with a range of 13 to 65 years. Ninety three percent of the cases were male

and most cases were in the age group of 15-44 years of age.

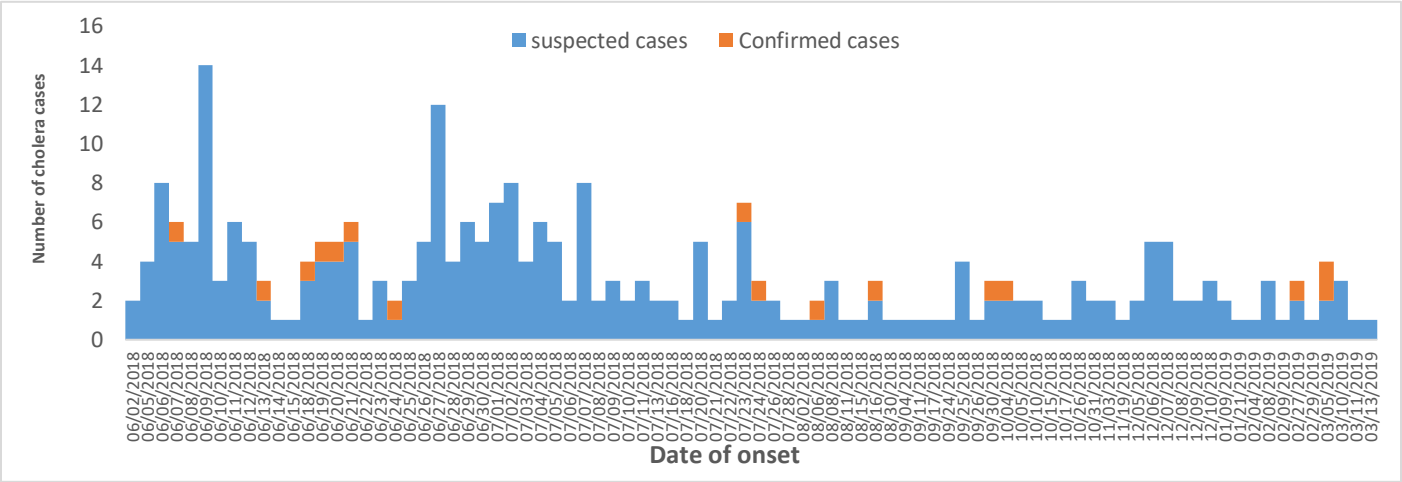


Figure 62: Epidemiologic curve showing suspected and confirmed imported cholera epidemics, Addis Ababa, Ethiopia, June 2018-March 2019.

The overall attack rate (AR) of the case was 70 cases per 10,000 populations (considering total deportees as denominator or as total population). There was no death and all cases were treated as inpatient. 215(83%) of cases have presented with watery diarrhea and 50 (19%) presented with vomiting. 203(78%) of cases were classified as some dehydration, 21% no DHN and the remaining 1% were sever DHN. The outbreak stayed for about 10 months and still ongoing as deportees came to Ethiopia. The peak of the outbreak was reached on 9th June 2018 with 14 suspected cases. As depicted on epidemiologic curve there were multiple peaks as it was ongoing outbreak. In 2018, we identified 235(90%) of cases and the remaining 25(10%) in the first three months of 2019. One hundred twenty (46.2%) of the cases were reported in June 2018. All cases/ deportees were from Saudi Arabia prison and has history of travel through Djibouti and Yemen as illegal migration; both were cholera affected countries at that time.

Interventions under taken to contain the Outbreak

Rapid response team activated, cholera treatment centers (CTCs) established, training provided to health workers, and a team was deployed to bole international airport deportees from Saudi Arabia prison. All suspected cases were treated by the case management team members and daily follow up of cases was also done by the same team members. All cases were classified and admitted to different wings of CTCs based on their DHN status.

EFETP residents from AAU and SPMMC were assigned to take history and use the case definition to identify cases at Bole international airport and link cases to CTCs. In addition Addis Ababa health bureau also assigned health professionals like nurses and medical doctors to assist screening.

Discussion: A prolonged cholera outbreak was identified in Addis Ababa due to imported cases from Saudi Arabia prisons deportees; from June 12, 2018 to March 16, 2019. The crude attack rate was 0.7% or 7 cases per 1000 population. It was lower compared to national reference which is about 200 per 1000 population or 20% of those who are infected develop acute watery diarrhea, 10-20% of these individuals develop severe, watery diarrhea with vomiting. It was also lower compared to similar study conducted in Guinea Bissau which was 20.4 cases per 1000 population. But higher compared to a study conducted in three zones of Oromia regional state (Bale, Guji and East Shewa) of Ethiopia which was 0.5% or 5 cases per 1000 population (1, 2, 11 and 14).

If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts (more than 10-20 liters/day in severe forms) can lead to severe dehydration and death within hours. Case fatality rate in this study was 0% as there was no death in the CTCs throughout. This was lower compared to other similar studies conducted in different African countries like Kenya, Guinea Bissau, Cameroon, Somali, Zimbabwe, Ethiopia itself (0.4%-1.9%, 3.7%, 12%, 0.67%, 5.7% and 1.11%) respectively. It was good achievement and this low CFR suggests good case management, early detection and referral to CTCs. For this low CFR not only the above mentioned reasons but also proximity of CTC to the airport, availability of ambulance service to get suspected cases to CTC, rehydration unit that we have at screening site for severely dehydrate cases, forced referral

of cases in case they refused to seek medical care and other factors also contributed. The overall response to this cholera outbreak was most impressive at all levels. Once the cholera outbreak had been identified in deportees, health care providers, EPHI, Addis Ababa health bureau, partners like MSF Spain, Ethiopian Red Cross society and international organization for migration responded to the outbreak in coordinated manner. This action resulted in a timelier and better coordinated response. Multiple nongovernmental organizations responded to the outbreak by supplying tents, providing medical supplies. The CTCs varied greatly with regard to their facilities and supplies. A combination of community and health-facility surveillance aided the response. Despite this low CFR, additional deaths may have been possible to prevent through better training of health center personnel. Patients died due to delays in rehydration or over-hydration; lack of experience in establishing intravenous infusions may have contributed to the outcome. Delays in rehydration may be reduced, in part, by additional emphasis on use of oral rehydration solution. Oral rehydration solution may be used to hydrate most dehydrated patients rapidly and safely.

Adequate patient monitoring during rehydration prevents over-hydration. To assist in monitoring of oral or intravenous rehydration, individual cholera treatment records (which were not used during this epidemic) might also help ensure quality care. Prevention of death in epidemic cholera is a formidable challenge, even for countries with longstanding experience with cholera," and rests upon two interrelated mechanisms: appropriate health education and proper treatment. Treatment facilities can help only those who seek care. The case-fatality rate in untreated cases may reach 30–50%.Treatment is straightforward (basically rehydration) and, if applied appropriately, should keep the case-fatality rate below 1% (1, 2, 3, 4, 11, 14, 16, 17 and 20).

At the time of this outbreak, cholera was not endemic to Ethiopia. Therefore, one would have anticipated that adults and children would be equally affected. Although the demographics seem to illustrate the contrary, the age group categories vary in length, making age distribution difficult to interpret. The data were collected by individual CTCs using these specific age categories, and the available demographics did not permit calculation of age-specific and sex- specific attack rates.

In this study 78% of the cases presented with some dehydration, 21% no dehydration and the remaining one percent severe dehydration. For severe dehydration it was lower than national one; which is 10–20% of these individuals develop severe, watery diarrhea with vomiting. If these patients are not promptly and adequately treated, the loss of such large amounts of fluid and salts (more than 10-20 liters/day in severe forms) can lead to severe dehydration and death within hours.

Severely ill cholera patients can lose up to 10% of their body weight in diarrhea and vomitus. In extreme cases, fluid losses can reach up to 1 liter per hour during the first 24 hours of illness. Patients who are severely dehydrated may develop hypovolemic shock. Such patients have a low blood pressure and a weak or absent radial pulse. They may appear drowsy or be unconscious. These patients must be rehydrated rapidly using intravenous fluids in order to prevent kidney failure or death (1, 2, 3, 6 and 7).

It is therefore important to improve the detection capacity of the surveillance system by involving all stakeholders (health facilities, private clinics, traditional healers, etc.) that deliver health services within the country's health system in the notification process. In Ethiopia, cholera is a mandatory, notifiable disease. All suspected cases of cholera must be reported immediately to the appropriate authority. Therefore, continuous surveillance of the disease should be carried out year round, at all levels. Based on the case definition, a health worker should suspect cholera upon encountering a single case of profuse, acute, watery diarrhea. This must be reported to the surveillance focal point or person in charge immediately for further investigation (1 and 2).

Conclusion: In conclusion a confirmed cholera outbreak due to imported cases identified in Addis Ababa from June 2018 to March 2019. Cases were identified with screening conducted at Bole international airport. Working in collaboration with stakeholders and partners have contributed to control the outbreak effectively before spreading further to other regions.

This outbreak prompts the need for increased local public health capacity to apply prevention strategies; establish active surveillance, receiving zero report from all sub-cities, activation of rapid response team, preparation of epidemic preparedness plan. Signatories to the World Health Organization International Health Regulations must report outbreaks of non-endemic diseases. Cholera

outbreak resulted primarily from insufficient access to clean water and poor sanitation. In this particular instance, the outbreak was brought under control by a prompt and effective response at all level. The medical management was generally appropriate. The use of community-based workers was a success and likely contributed significantly to the tapering of the outbreak.

Future efforts should focus on how to best use community based workers in outbreak and routine health care settings. The fact that cholera is not endemic to the city should prompt ongoing surveillance and adherence to International Health Regulations mandatory reporting.

Recommendations:

Ethiopian public health institute in collaboration with Ministry of health and regional health bureau should:

- Strengthen border and cross border health issue; to manage such kind of public health emergencies.
- Engage stakeholders like national disaster risk management commission (NDRMC), Agency for refuge and returnees Affairs (ARRA), ministry of foreign Affairs (MoFA) and others non – governmental organizations and partners.
- Collaborate partners in advance before the occurrence of public health emergencies.
- The Ministry of Health/EPHI supports each regional health bureau in developing a functional epidemic preparedness and response committee and a clearly defined epidemic preparedness and control plan as soon as possible.
- we recommend to the public health emergency management unit to ensure surveillance system detect outbreaks and notify in a timely manner with special attention to point of entry and cross border.
- We recommend enhancing screening at point of entry to minimize morbidity and mortality.
- We recommend onsite screening before deported to Ethiopia in order to minimize spread of infection.

Competing interests

No competing interests.

Authors' contributions

Melaku Seyoum - concept, design, acquisition of data, analysis, interpretation and writing of manuscript.

Adamu A and Yimer S -concept, guidance, review of the manuscript.

Acknowledgements

My deepest gratitude goes to academic mentors and Lecturers Dr. Adamu Addissie, Mr. Yimer Seid and Mr. Adulnasir Abagero for their guidance and help during the development of the manuscript. I would like to acknowledge AAU and SPMMC EFETP residents for their participation in screening of deportees and data collection. Lastly I would like to thank Addis Ababa health bureau PHEM, MoFA, Ethiopian Immigration office and EPHI. Special thanks to MSF Spain for their assistance in screening, case management and IPC, IOM for facilitation of screening and provision other humanitarian aids, Ethiopian Red Cross society for availing ambulance service, UNICEF for provision of CTC kit.

References

1. EPHI. National cholera guideline. May 2011 Addis Ababa Ethiopia.

2. Health department of South Africa. National guideline for cholera control, South Africa, 2014.

3. CDC. Cholera infection in Africa. Online. https://www.cdc.gov/cholera/africa/index.html. Accessed on March 18, 2019.

4. E. J. CARTWRIGHT, M. K. PATEL, F.X. MBOPI-KEOU, T. AYERS, B. HAENKE, B.H. WAGENAAR, E. MINTZ AND R. QUICK. Recurrent epidemic cholera with high mortality in Cameroon: persistent challenges 40 years into the seventh pandemic. Epidemiol. Infect. (2013), 141, 2083–2093. Cambridge University Press 2013 doi: 10.1017/S0950268812002932.

5. RICHARD PANKHURST. The history of cholerainEthiopia. https://www.cambridge.org/ core/services/ aop-cambridgecore/content/view/ S0025727300013302, online Accessed March 19/2019.

6. WHO. Cholera 2011. External Weekly Epidemiological Record. 2011; 87:289–304. https://www.cdc.gov/cholera/asia/index.html . Online Accessed on March 21, 2019.

7. WHO. Cholera fact sheet. https://www.who.int/news-room/fact-sheets/detail/cholera, 17 January 2019.

8. Relief web. Acute Watery Diarrhoea (AWD) Outbreak, Ethiopia, May 2016. https://reliefweb.int/disaster/ep-2016-000143-eth.

9. CDC Emerging infectious diseases. Lakes as Source of Cholera Outbreaks, Democratic Republic of Congo. EID journal, Volume 14 November 5 May 2008.

10. WHO. Ending Cholera, a Global Roadmap to 2030. https://www.who.int /cholera/publications/global-roadmap/en/. Online Accessed on March 22, 2019**.**

11. Susan A. Bartels, MD, MPH; P. Gregg Greenough, MD, MPH; M. Tamar, MD, MPH; Michael J. Van Rooyen, MD, MPH. Investigation of a Cholera Outbreak in Ethiopia's Oromia Region. Disaster Medicine and Public Health Preparedness. December 2010.https://www.researchgate.net/publication/49675071.

12. Penguele A, Djeintote M., Balekouzou A., Tembeti J, Feilema P, Kazambu D, Delissaint D. Cholera Outbreak Investigation in the Central African Republic, October – November 2011.

13. Didier Bompangue Nkoko, Patrick Giraudoux, Pierre-Denis Plisnier, Annie Mutombo Tinda, Martine Piarroux, Bertrand Sudre, Stephanie Horion, Jean-Jacques Muyembe Tamfum, Benoît Kebela Ilunga, and Renaud Piarroux. Dynamics of Cholera Outbreaks in Great Lakes Region of Africa, 1978–2008.

14. Geir Gunnlaugsson, PhD; Frederick J. Angulo, PhD; J6nina Einarsdbttir, BA;Alberto Passa, RN and Robert V: Tauxe, MPH. Epidemic Cholera in Guinea-Bissau: The Challenge of Preventing Deaths in Rural West Africa. Int J Infect Dis 1999; 4:8-13.

15. Center for Disease prevention and Control. Epi-Aid # 2010-074 Trip Report: Sierra Leone Cholera Outbreak Investigation, 2012.

16. Center for Disease prevention and Control. Epi-Aid # 2010-029 Trip Report: Nationwide Outbreak of Cholera in Kenya, 2009-2010

17. Qabale G; Sharmila Sh; Orkhan N; Abubakar H; Eliud W; Mark O; Daniel M; Raymond N. Musyoka; Hussein A; Maurice O; Rachael J; Willy K; John K; Munawwar S; Waqo B; Tura G; Sara A. Lowther; Bonventure J; Robert M; Newton W; Clayton O; Zeinab G; Marc-Alain Widdowson; Kevin M. DeCock; John W. Burton. Cholera Outbreak in Dadaab Refugee Camp, Kenya, November 2015–June 2016.

18. World Health Organization. Cholera outbreak. Assessing the outbreak response and improving preparedness. Geneva 2004.

19. Ezra J. Barzilay, M.D., Nicolas Schaad, M.P.H., Roc Magloire, M.D., Kam S. Mung, M.D., Jacques Boncy, M.D., Georges A. Dahourou, Pharm.D., Eric D. Mintz, M.D., Maria W. Steenland, M.P.H., John F. Vertefeuille, Ph.D., and Jordan W. Tappero, M.D. . Cholera Surveillance during the Haiti Epidemic, the First 2 Years. The new England journal *of* medicine February 14, 2013 vol. 368 no.

Chapter VI - Abstracts for Scientific Presentation

6.1. "Measles outbreak investigation and response in pastoralist community - Hudet woreda, Somali region, Ethiopia, October 2018."

Authors: [1]Melaku S, [2]Yimer S, [2]Abdulnasir A, [3]Mikias A, [1]Neamin T, [2]Adamu A.

Address: [1] Addis Ababa University college of health Science School of Public health Ninth cohort EFETP Resident. [2]Addis Ababa University, college of health Science, School of Public health, Department of preventive Medicine, Addis Ababa, Ethiopia. [3]Ethiopian Public health institute.

Abstract

Background: Measles is a highly contagious vaccine-preventable disease. In 2010 an estimated 140,000 deaths occurred worldwide. The aim of the investigation was to describe the magnitude of measles, to identify risk factors and to undertake control measures.

Methods: Unmatched case-control study was conducted from September to November, 2018 in Hudet District. The outbreak was confirmed by using serological laboratory test. Sample size were determined based on similar studies. On case-control study a total of 116 data were collected using structured questionnaire. We used standard cases definition to identify cases. All 358 cases were line listed. Bivariate and multivariate analysis was conducted using odd ratio with 95% confidence interval and P-value < 0.05 by using SPSS.

Results: A total of 358 cases (AR 597/100,000) and 13 deaths (CFR 4%) were identified. Infants were more affected (AR 1340/100,000). Statistically significant variables on multi-variate analysis were family size above four (AOR: 21.8; 95% CI: 2.14-222.2; P: 0.009), travel history to measles affected area (AOR: 16.3; 95% CI: 2.1-125.7; P: 0.007), being malnourished (AOR: 11.24; 95% CI: 1.21-104.5; P: 0.033), being vaccinated as protective factor (AOR: 0.11; 95% CI: 0.015-0.804; P: 0.03), knowing measles is vaccine preventable (AOR: 0.093; 95% CI: 0.011-0.82; P: 0.032).

Conclusion and recommendation: Infants were primarily affected by the outbreak. Malnutrition, low awareness level, inadequate and poor cold chain management and low vaccination coverage were likely contributed to the outbreak. Undertaking supplementary immunization, enhancing routine vaccination coverage, increasing community awareness, strengthening cold chain management and managing malnourished cases can reduce measles outbreak.

Key words: measles outbreak, Case control study, Hudet, Somali Region Ethiopia, 2018.

6.2. Challenges of imported cholera cases among deportees in Ethiopia: from Saudi Arabia prisons, March 2019.

Authors: [1]Melaku S, [2]Yimer S, [2]Abdulnasir A, [2]Adamu A.

Address: [1]Addis Ababa University College of health Science School of Public health Ninth cohort Ethiopian Field Epidemiology Training program Resident. [2]Addis Ababa University, college of health Science, School of Public health, department of preventive Medicine, Addis Ababa, Ethiopia.

Abstract

Introduction: Cholera is an acute, diarrheal illness which could leads epidemic and mortality. We investigated the outbreak of cholera and described cases by person, place and time.

Method: We conducted a descriptive cross sectional study in Addis Ababa, from June 12, 2018 to March 16, 2019. We used standard case definition to identify imported cholera cases. We reviewed medical record and laboratory findings. All collected data were entered and analyzed using Microsoft excel 2013.

Result: From June 12, 2018 to March 16, 2019; the investigation team had screened 37,380 deportees from Saudi Arabia and identified 260 suspected imported cholera cases. The overall AR was 7 cases per 1000 populations with no death. The median age was 21 years (13 - 65 years). 93% of the cases were male and most cases were in the age group of 15-44. 38% of samples were positive for vibrio cholera by rapid diagnostic test (RDT). For 65 RDT positive cases stool culture were sent to reference laboratory. Accordingly, 16 out of 65(24.6%) of samples were culture positive for vibrio cholerea O1 serogroup and Ogawa serotype. Sixteen out of total 260 cases or 6% of cases were confirmed cases and the remaining cases were epidemiologically linked.

Conclusions: A confirmed cholera outbreak due to imported cases affected mostly age group less than 30 years' of age.

Recommendations: We recommend to the public health emergency management unit to strengthen cholera screening in the entry points and cross border responses.

Key words: Cholera, outbreak, imported, Investigation, deportee, Addis Ababa, Ethiopia, 2019.

Word count: 237

Chapter VII - Narrative Summary of Disaster Situation

7. Rapid conflict impact and recovery assessment in internally displace population, west Guji and Borena zones, Oromia region, March, 2018.

Abstract

Background: Coordinating humanitarian need and community risk assessments is an important element in saving lives and restoring people's livelihood. The aim of this study was to conduct rapid assessment on different sectors in order to locally assess the situation and identify the basic needs that require immediate response in the conflict disaster victims.

Methods: Cross sectional descriptive study was conducted from March 15 to April 10, 2018. By the time of the assessment two zones (Borena, Guji) were covered. Seven woredas were selected for field visit; based on existence of IDPs from both zones. Semi-structured questioners was used to interview participants. Review of documents and reports obtained from woreda and zonal health offices, discussion with woreda and zonal preparedness and response task force officials, field visit in selected woredas and IDPs sites, interview of key informants and community leaders were conducted. Data was analyzed using Microsoft Excel 2013.

Result: Starting from August 2017 due to the conflict at Oromia and Somali regions border area life was lost, public and private assets have damaged. Among the damages internal displacement of population was the most important and thousands of people were displaced from their residency and lost their assets. Due to the conflict a total of 321,084 population with 157,047 Male and 164,037 Female were displaced from Borena and West Guji zones. This results in 63,526 households with 32,495 male and 31,031 female headed households.

Conclusion and recommendation: Multimillion birr infrastructure had damaged. Accordingly, in conflict affected woredas and kebeles education, health, farming and animal raring and other social and economic activities interrupted. In addition, food and water shortage affected the public. Government and non-governmental organizations should continue provision of food and non-food items. Mobile or temporary clinics needs to be established at IDP sites and establish referral linkage. Strengthen surveillance at all levels with special emphasis to IDPs.

Key words: Disasters, Internal displaced populations, Borena, West Guji, Oromia, Ethiopia.

7.1. Introduction

7.1.1. Background

A rapid assessment is the exercise of collecting information, in order to measure the damages and identify the basic needs that require immediate response in the aftermath of a disaster (1).

A rapid assessment is conducted immediately after the onset of a disaster in order to locally assess the disaster-affected areas and the needs of disaster victims. As medical providers, when one is faced with catastrophic disasters such as conflict displacement, Earthquake, flood, the first urge is to immediately go and provide assistance. However, one must fight that initial impulse, and first conduct an initial rapid assessment. This is separate from immediate lifesaving activities of the emergency search and rescue teams or disaster medical assistance teams. As indicate in the Sphere Standards, the first step in humanitarian response is to assess the needs of the affected population, and design a prioritized plan of action based on those needs. By doing so, this improves the quality and speed of response. Without a rapid assessment, significant gaps or overlaps in assistance may occur, which not only wastes precious resources at a time of great need, but can also be a cause of further burden to the affected population. The initial rapid assessment is conducted as early as a few hours after the onset of a disaster, and should be completed within 3 days at the latest. The purpose of this assessment is not to conduct a detailed survey, but to perform a broad assessment of the disaster and basic needs of the population in order to identify priorities for assistance. When performing the assessment, it is advised to collect information from as many sources as possible and to perform direct observation in order to verify the data. Due to time, resource, and/or security constraints, one is often forced to rely on reports from different sources. However, when one relies too much on secondary information, significant gaps can be missed. This is why it is important to perform direct observation and confirm with one's own eyes as much as possible. There are other limitations of the initial rapid assessment that responders need to keep in mind, and these are discussed in a later section (1).

Experience has shown that coordinating Humanitarian need and community risk assessments is an important element in saving lives and restoring people's livelihood. Along with emergency preparedness, the timeliness and quality of assessments help determine an effective humanitarian response.

A coordinated assessment is an assessment planned and carried out in partnership by humanitarian actors, in order to document the impact of a particular crisis and to identify the needs of affected population. Credible and accurate assessment results from the basis for needs-based strategic planning and system-wide monitoring (2).

The major public health risks identified in the Ethiopian health system from high priority to low priority are Epidemics of communicable disease, Drought conditions with malnutrition, Food contamination, Flood, Pandemic Influenza, Diseases that affect people during conflicts and in displaced populations, Accidents including chemical spills, Earthquake, volcanic eruptions and Bioterrorism (3).

7.2. Objectives

7.2.1. General objective

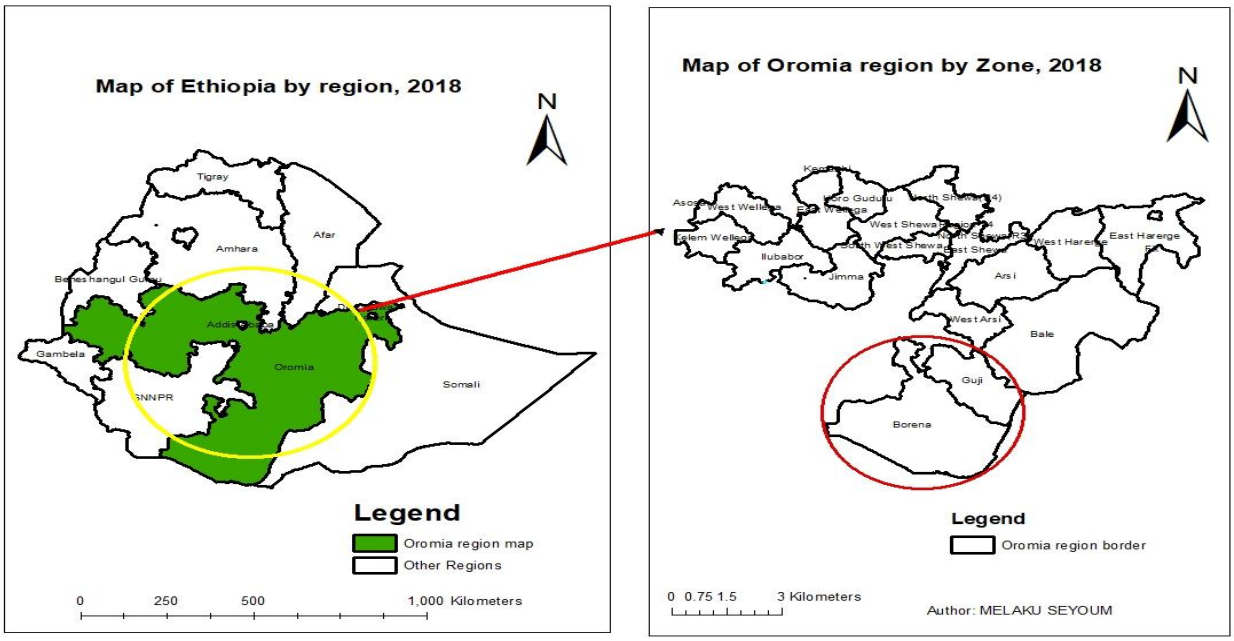
To conduct rapid assessment on different sectors in order to locally assess the situation and identify the basic needs that require immediate response in the conflict disaster victims, Borena and west Guji zones, Oromia, 2018.

7.2.2. Specific objectives

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

7.3. Methods

The study was conducted from March 15 to April 10, 2018. Multi-sectoral team from different ministries (MOH/EPHI, NDRMC, MoLF, MoWCA, MoWIE and MoE) were established and deployed. Cross sectional descriptive study was conducted. By the time of the assessment two zones (Borena and West Guji) were covered. Selection of woredas was made after discussion with zonal multi sectorial task force committee during the briefing time based on existence of IDPs from each zone were included. As the discussion, a total of seven woredas were selected for field visit. Before the assessment briefing was conducted for region and all zonal multi-sectorial task force committee at zonal level. By using semi-structured questioners interview method was conducted to collect data from zonal and woreda health offices. In addition to that, a review of documents and reports obtained from woreda and zonal health offices, discussion with woreda and zonal preparedness and response task force officials, field visit in selected woredas and IDPs sites, interview of key informants and community leaders were conducted. Data was analyzed using Microsoft Excel 2013. Finally, debriefing were also conducted at both zonal and woreda administration offices.



Map 9: Map showing study area Borena and Guji of Oromia, March 2018.

7.4. Assessment findings

7.4.1. Displaced population

Starting from August 2017 due to the conflict at Oromia and Somali border area life was lost, public and private assets have damaged. Among the damages internal displacement of population was the most important and thousands of people were displaced from their residency and lost their assets. For this IDPs regional and federal government including partners were supporting food and non-food items. In addition, to permanently resettle displaced population at federal level multi-sectoral team from different ministries were established to identify loss and damage for resettle. Due to the conflict a total of 321,084 population with 157,047 Male and 164,037 Female were displaced from Borena and West Guji zones. This results in 63,526 households with 32,495 male and 31,031 female headed households. IDPs were classified as those who displaced from Somali region due to conflict and reside in different woredas of Oromia region and those displaced from Oromia and Somali regions border areas due to fear of conflict reside in different woredas of Oromia region.

Those who displaced from Somali region 3,370 households or a total of 13,560 population with 6,410 male and 7,150 female were displaced and those displaced from Oromia and Somali regions border area due to fear of conflict 42,599 households or a total of 217,255 population with 106, 830 male and 110, 425 female were displaced. A total of 90,269 IDPs or 17,557 households were returned to their original residency area (Table 30).

Table 30: Distribution of internally displaced populations by zone, Oromia, March 2018.

S.No.	Region	zone	Type of IDPs	Households			Family		
				Male	Female	Total	Male	Female	Total
1	Oromia	Borena	Internal	19,101	20,096	39,197	99,557	102,606	202,163
			Outside the region	1,928	1,439	3,367	6,405	7,147	13,552
			Returned	8,626	7,225	15,851	38,433	41,557	79,990
		West Guji	Internal	1,960	1,442	3,402	7,273	7,819	15,092
			Outside the region	3	0	3	5	3	8
			Returned	877	829	1,706	5,374	4,905	10,279
Total				32,495	31,031	63,526	157,047	164,037	321,084

7.4.2. Damages on public services and infrastructure

7.4.2.1. Damages on schools

Due to the conflict majority of schools and teaching materials have been damaged. In the visited sites learning and teaching process was weak at the time of assessment. Though the government and partners tried to support continuation of learning and teaching process, but still not enough. Sixty three schools have been burnt or damaged (table 30).

7.4.2.2. Water services

Table 31: Number of damaged schools by zone, Oromia, March 2018.

S.No.	region	Zone	# schools	Type of damage	Estimated damage & loss by ETB
1	Oromia	Borena	19	Burnt and damaged	662,355
		West Guji	44	Burnt and damaged	1,513,200
	Total		63		2,175,555

Due to the conflict water services had damaged partially or fully. The damage of water services include generators and pump. Twenty one water schemes were damaged and their estimated damage and loss was 18,600,000 ETB. West Guji and Borena zonal safe water coverage were 41% and 36.72% respectively. In 5 woredas of Borena zone there were 15 dysfunctional water schemes while in West Guji in two woredas no functional water schemes previously; they use river water. Low safe water coverage and many dysfunctional water schemes prior to conflict; worsens the situation. For this reason, emergency water tracking done and water purifying chemicals were distributed. Though there were schools and health posts nears the IDP sites there were without water and sanitation problem.

Table 32: Safe water coverage by woreda IDPs, Oromia, 2018.

S.No.	Region	Zone	Woreda	Population size in 2009 EFY			Safe water provision in 2009 EFY			Coverage %		
				Rural	Urban	Total	Rural	Urban	Total	Rural	Urban	Total
1	Oromia	Borena	Araro	57,981	6,308	64,289	22,430	0	22,430	38.69	0	34.89
2			Moyale	82,135	5,774	87,909	22,534	3,965	26,499	27.44	68.67	30.14
3			Dhas	30,172	4,486	34,658	8,426	2400	10,826	27.93	53.5	31.24
4			Wachile	27,898	2,500	30,398	9,369	1,250	10,619	33.58	50	34.93
5			Guchi	39,256	2,000	41,256	7,066	1,000	8,066	18	50	19.55
6		West Guji	Surro Barguda	86,919	4,561	91,480	20,430	3,500	23,930	23.5	76.7	26.2
7			Gelana	95,867	10,145	106,012	45,880	4,500	50,380	47.9	44.4	47.5
			Total	420,228	35,774	456,002	136,135	16,615	152,750			

7.4.2.3. Agricultural and pastoral services centers

Due to conflict agricultural and pastoral services centers like animal health clinics, farmers training centers have been damaged. Thirty centers have been damaged (table 32).

Table 33: Number of damaged agricultural and pastoral service centers, Oromia, 2018.

S.No.	Region	Zone	# of damaged centers	Type of loss and damage	Damage & loss estimate by ETB	Remark
1	Oromia	Borena	5	Burnt and damaged	880,000	25% to 100% damage
		West Guji	8	Burnt and damaged	3,930,000	Fully or partially damage
	Total		13		4,810,000	

7.4.2.4. Damages on private and public resources

Due to conflict houses burnt and damaged, damage of harvest, theft of seed and money, theft and missing of animal. The impact of conflict on social, psychological and economy was high.

Table 34: Number of damaged agricultural and pastoral service centers, Oromia, 2018

S.No.	Region	Zone	Private resource		Type of damage	Estimated loss and damage by ETB
			Type	number		
	Oromia	Borena	Houses/permanent/	212	Burnt and damaged	4,240,000
			Houses/mobile/	17905	Burnt and damaged	53,715,000
			Domestic animals	5247	Lost and stolen	21,533,200
		West Guji	Houses/permanent/	195	Burnt and damaged	1,077,000
			Domestic animals	1107	Lost and stolen	2,172,000
			Seed by kuntal	1107	Burnt and stolen	2,146,200
Total				25,773		84,883,400

7.4.2.5. Other related issues

7.4.2.5.1. Psychological and social crises

Due to the conflict life was lost, physical disability, many have imprisoned, family dispersed; still there were family members separated. This results in psychological and mental disorder in the community, many lost hope. After the conflict reestablishment of IDPs was too late; the community lost confidence on government. In addition, support and response from the government side was inadequate. Though the community, government and non- governmental organizations support the IDPs; as their number were many it was impossible to satisfy them. The host community were also under social, economic and psychological stress.

7.4.2.6. Health and Nutrition

Due to the conflict 15 Health facilities burnt and damaged including drugs and logistics in Borena zone. The estimated damage and loss was 6,265,000 ETB. Temporary or mobile clinics at IDP sites were established.

Malaria outbreak was reported from Abaya woreda of West Guji zone; controlled at the time of assessment. Measles outbreak was also reported from different woredas of Borena zone; Guchi woreda 34 cases, Gomole woreda 28 and Moyale woreda 5 suspected cases. Totally 67 cases with one death were reported. Index case was seen on 21/4/2010 EFY. Psychological /mental problems assessment was not done. No available active/ functional coordination body and response team to control communicable diseases and epidemics like measles, acute watery diarrhea, dysentery diseases, acute respiratory infections, malaria and other vector borne diseases which will be anticipated at IDP sites. During assessment time the damages on women and children were assessed. Among this 50 eloping, rape and 123 missing of children were major one. No available health facility and services which can deliver primary health care for the conflict affected population. Pastoral nature of the population makes it difficult to establish health facility at IDP sites because they are scattered. No preparedness and response plan for health related problems intervention for displaced people in Borena. But they have Zonal preparedness and response plan. No clan and religious leader's engagement in behavioral change communication activities. There is no major gap concerning essential drugs and related supplies except malaria drug during outbreak in West Guji.

Major gaps were-

- Budget shortage
- Vehicle
- Essential drugs shortage
- water purifying chemicals shortage

Nutritional Screening

Nutritional screening for both under 5 children and PLW was conducted in the IDP sites. De-worming of children also conducted. All 5063 (100 %) of under five children in West Guji and 11206 (72 %) in Borena were screened for malnutrition. Among this 0.02% & 23 (0.2%) SAM and 61 (1.2%) & 1661 (14.8%) MAM cases were identified respectively. 926 (23%) Vitamin A distribution and 385(13%) deworming conducted. On the other hand 725(78%) in West Guji and in Borena 6540 (142%) of Pregnant and lactating mothers were Screened for nutritional problems; accordingly 99(13.6%) & 2036(31%) women were malnourished/MUAC below 23cm.

There is enough supplies like ready-to-use nutrition (RUTF), therapeutic milk to treat SAM children but multi-chart and routine medications to treat Secondary infections were challenges in nutritional response. There is no functional emergency nutrition coordination forums.

A total of 354 OTP and 79 SC sites, 192 (98%) of health facilities in West Guji were under OTP and 162 (98%) of health facilities are with CMAM services for OTP in Borena. Concerning SC services, 43 (97.7%) of health facilities are with CMAM services for SC in Borena and 36(82%) in West Guji. But average reporting health facilities are 77% for OTP and 47% for SC services, Government capacity to manage CMAM services is good. Signs of early malnutrition are seen in different woredas.

TSFP program at IDP

TFSP service is available. Currently no partner in place working on nutrition. Previously UNICEF and plan international were working in West Guji. IRC is supporting technically in 6 kebeles on nutrition. Previously, Care and Action against hunger were working in Borena. There is a monthly TSFP distribution, but only for four priority 1 woredas. The last distribution was in December 2018. Children discharged from OTP referred to TSFP still for priority 1

woredas in West Guji and Children discharged from OTP sometimes referred to TSFP in Borena.

Government capacity to manage CMAM services (full health facilities running daily services)

Any signs of early malnutrition (good if clearly indicate early sign of malnutrition).

Major challenges in health and nutrition emergency responses are:

- Training gaps (HEWs are not trained)
- No partner engagement
- National nutritional program (NNP II) was not launched yet
- Budget shortage and
- Lack of vehicle for transportation

Table 35: Distributed emergency logistics and supply, Borena, Oromia 2018.

S.no.	Items description	unit	Total stock received	stock to be distributed	M/Gafersa	Wachile HC	Borbor HC	Gofa HC	Moyale Hosp	Yabello Hosp	Balance at Zonal store
1	Adhesive plaster 12.5cmx10m	roll	42	27	3	3	3	3	7	8	15
2	Alcohol 70%	liter	10	8	1	1	1	1	2	2	2
3	Ampicillin 1gm injection of 50 vial	box	20	17	2	2	2	1	5	5	3
4	Ampicillin 500mg of 10x50 capsule	box	10	8	1	1	1	1	2	2	2
5	Ceftriaxone 1gm	vial	400	0	0	0	0	0	0	0	400
6	Chloramphenicol 250mg of 10x100	box	20	17	2	2	2	2	4	5	3
7	Cloxacillin 500mg of 10x50 capsule	box	10	8	1	1	1	1	2	2	2
8	Cotton 500gm	roll	47	31	4	3	3	3	9	9	16
9	Cutgut 2-0	dozen	5	5	0	0	0	0	2	3	0
10	Dextrose 40% of 20 ampule	box	60	42	4	4	4	4	13	13	18
11	Dextrose 5% of 1000ml	bag	420	264	24	24	24	24	84	84	156
12	Diclofenac 50mg of 10x10	pk	30	18	2	2	2	2	5	5	12
13	Diclofenac 75mg/3ml of 100 ampoule	box	1	1	0	0	0	0	0	1	0
14	Disposable glove of 100 pcs(M)	box	100	60	6	6	6	6	18	18	40
15	IV cannula (24G)	box	10	8	1	1	1	1	2	2	2
16	Methyl salicylate ointment	tube	58	48	5	5	5	5	14	14	10
17	Paracetamol 500mg of 10x100	box	10	8	1	1	1	1	2	2	2

18	Ringer Lactate of 1000ml with IV set	bag	420	264	24	24	24	24	84	84	156
19	Silk 2-0	dozen	15	15	0	0	0	0	7	8	0
20	Sodium Hypochlorite (Barekina) solution	bottle	1	1	0	0	0	0	0	1	0
21	Surgical gloves of 50 pair(6.5)	box	8	3	1	1	0	0	1	1	5
22	Surgical gauze 100mx90cm	roll	10	4	1	1	0	0	1	1	6
23	TAT 1500IU/ml	ampoule	64	53	5	5	5	5	16	17	11
24	Tramadol 50mg of 10x10	pk	20	17	2	2	1	2	5	5	3
25	Tramadol injection of 100 ampoule	ampoule	800	420	40	40	40	40	130	130	380
26	Water for inj of 100ampule	box	20	17	2	2	2	1	5	5	3
27	Gauze bandage 10cmx5m	dozen	100	67	7	7	6	7	20	20	33
28	PPF 4 MIU of 100 vial	box	3	3	1	1	1	0	0	0	0
29	Syringe 5ml o 100pcs	box	12	10	1	1	0	0	4	4	2
30	Ciprofloxacillin 500mg of 10x10	10x10	160	133	14	13	13	13	40	40	27
31	Cotrimoxazole 240mg/5ml	bottle	500	417	43	42	42	42	124	124	83
32	IV cannula (20G)	box	10	8	1	1	1	1	2	2	2
33	Plumpynut of 150 sachet	ctn	154	154	25	0	24	25	40	40	0

Table 36: Distributed emergency logistics and supply by with their price, Borena, Oromia 2018.

S/no.	Items description	unit	total stock received	unit price	total price
1	Adhesive plaster 12.5cmx10m	roll	42	58.0	2435
2	Alcohol 70%	liter	10	78.0	780
3	Ampicillin 1gm injection of 50 vial	box	20	109.6	2192
4	Ampicillin 500mg of 10x50 capsule	box	10	462.8	4628
5	Ceftriaxone 1gm	vial	400	7.3	2900
6	Chloramphenicol 250mg of 10x100	box	20	698.1	13962
7	Cloxacillin 500mg of 10x50 capsule	box	10	473.3	4733
8	Cotton 500gm	roll	47	25.1	1181
9	Cutgut 2-0	dozen	5	166.7	833
10	Dextrose 40% of 20 ampule	box	60	191.4	11484
11	Dextrose 5% of 1000ml	bag	420	21.0	8820
12	Diclofenac 50mg of 10x10	pk	30	11.0	331
13	Diclofenac 75mg/3ml of 100 ampoule	box	1	110.2	110
14	Disposable glove of 100 pcs(M)	box	100	82.6	8262
15	IV cannula (24G)	box	10	301.5	3015
16	Methyl salicylate ointment	tube	58	13.9	807
17	Paracetamol 500mg of 10x100	box	10	175.5	1755
18	Ringer Lactate of 1000ml with IV set	bag	420	23.0	9660
19	Silk 2-0	dozen	15	114.5	1718
20	Sodium Hypochlorite(Barekina) solution	bottle	1		0
21	Surgical gloves of 50 pair(6.5)	box	8	218.3	1746
22	Surgical guaze 100mx90cm	roll	10	283.1	2831
23	TAT 1500IU/ml	ampoule	64	22.3	1427
24	Tramadol 50mg of 10x10	pk	20	56.4	1129
25	Tramadol injection of 100 ampoule	ampoule	800	8.0	6400
26	Water for inj of 100ampule	box	20	49.3	986
27	Guaze bandage 10cmx5m	dozen	100	38.6	3856
28	PPF 4 MIU of 100 vial	box	3	630.5	1892
29	Syringe 5ml o 100pcs	box	12	100.4	1204
30	Ciprofloxacillin 500mg of 10x10	10x10	160	97.5	15600
31	Cotrimoxazole 240mg/5ml	bottle	500	12.8	6415
32	IV cannula (20G)	box	10	283.5	2835
33	Plumpynut of 150 sachet	ctn	154		0
				G/Total	**125,926.58**

7.5. Conclusion and Recommendations

7.5.1. Conclusion

Due to the conflict at Oromia and Somali region boarder life was lost, property/ assets damaged severely, the community displaced from their original place of residency. Multimillion birr infrastructure had damaged. Accordingly, in conflict affected woredas and kebeles education, health, farming and animal raring and other social and economic activities interrupted. In addition, food and water shortage affected the public. Though to solve this problems and provide emergency response the community, government and partners were working, basically problems were not solved. Considering this resettlement to their original place of residency and rehabilitative activities considered. There is ongoing displacement day to day. The current security of the woredas were not good.

7.5.2. Recommendations

- Government and non-governmental organizations should continue provision of food and non-food items.
- Mobile or temporary clinics needs to be established at IDP sites and establish referral linkage.
- Strengthen surveillance at all levels with special emphasis to IDPs.
- Provision of Supplementary feeding for PLW and under five children.
- Repair damaged schools and maintaining learning and teaching process.
- Repair damaged health facilities, in order to provide basic primary care.
- Consider adequate water trucking and provision of water purifying chemicals.
- Repair damaged and dysfunctional water schemes.

References

1. JMAJ. Rapid Assessment in Disasters**,** page 56(1): February, 19–24, 2013.

2. Committee, IASC- Inter Agency Standing.www.humanitarianinfo.org/iasc. [Online] 2012.

3. EPHI. Public health emergency management guideline. 2012.

4. Zonal rapid response team field assessment report, 2010 EFY.

5. Oromia disaster risk management commission field assessment report, Oromia, 2010 EFY.

6. IFRC, the Johns Hopkins. PUBLIC HEALTH GUIDE FOR EMERGENCIE.

7. Project, the sphere. Humanitarian charter and Minimum Standards in humanitarian response. 2011.

8. Management, center for public health emergency. A GUIDE TO RISK ASSESSMENT. 200.

Chapter VIII -Protocol/Proposal for Epidemiologic Research Project

8. Assessment of community based measles vaccination coverage and associated factors among children aged 12-23 months, Hudet woreda, Somali Region, Ethiopia 2019.

Summary

Background: Measles is one of the most infectious human viruses and a cause of childhood mortality. Herd immunity of around 95% is necessary to prevent ongoing virus transmission. The aim of this study is to assess the community based measles vaccination coverage and associated factors among children aged 12-23 months in Hudet district Somali region, Ethiopia 2019.

Method: a community based cross-sectional study will be conducted from July 1-30 2019. A total of 380 participant will be included in the study. An interviewer administered questionnaire will be used by data collectors after ethical clearance secured from the regional and district health office. Filled questionnaires will be checked for completeness and consistency daily by the principal investigator and incompletely filled questionnaires will be reevaluated by the data collectors .finally basic descriptive analysis such as mean, median, standard deviation, interquartile range and mean square will be computed in addition to bivariate and multivariate logistic regression with p-value of 0.05 will be used to ascertain the level of association.

Work plan: Data collection will be started on July 1st 2019 and ends on July 30th, 2019. The study will be completed in September 2019.

Budget: The required cost for the study is estimated to be 63,861 ETB.

Key words: Measles, vaccination coverage, Community based, Hudet, Somali, Ethiopia.

8.1. Introduction

8.1.1. Background

Measles is one of the most infectious human viruses and a significant cause of childhood mortality. Population immunity of around 95% is necessary to prevent ongoing virus transmission [1]. Significant advances have been made towards measles elimination through a cost-effective vaccine. The World Health Organization (WHO) strategy for reducing measles mortality [2] has been implemented by most WHO member states, including Ethiopia. This consists of four arms: (*i*) achieving sustained high routine first-dose vaccination coverage to infants; (*ii*) providing a second opportunity for measles vaccination for all children through routine services or mass campaigns; (*iii*) surveillance of measles and vaccination coverage; and (*iv*) improving management of complicated cases.

The Ethiopia childhood schedule recommends routine measles vaccination at 9 months of age. Non-selective mass vaccination campaigns (MVCs) that vaccinate all children in a specified target age group regardless of prior vaccination status have increased coverage, particularly in developing countries where routine health services are weak [3].

MVCs reach children who were not reached by routine program provide a second opportunity for those who did not initially seroconvert, and increase population immunity rapidly, potentially interrupting ongoing transmission [3, 4].

Despite considerable progress towards measles elimination, epidemics have recently occurred in 28 sub-Saharan African countries, including Ethiopia. In 2009/2010 approximately 200,000 cases were reported in sub-Saharan Africa. The underlying cause of these outbreaks is primarily insufficient coverage, but also logistics, including cold-chain maintenance [5].

Improving access to and utilization of routine immunization services are the best option for the prevention and control of vaccine preventable diseases (VPD). As a consequence, the expanded program on immunization (EPI) was launched in 1974 as a global program for controlling and reducing death from vaccine-preventable diseases [6].

Immunization is considered as one of the most powerful and cost-effective of all health interventions. It also believed to prevent debilitating illness and disability and saves millions of lives every year [7].

Measles immunization coverage is a useful indicator of the strength of immunization program and of child health program in general [8].

Immunization is a central pillar of universal health coverage, providing an infrastructure on which effective and equitable health systems can be constructed. Through this integration,

immunization can contribute to multiple Sustainable Development Goals as well as global health security and the battle against antimicrobial resistance [9].

The Global Vaccine Action Plan, developed by the immunization community and endorsed unanimously by the global health community at the World Health Assembly (WHA), set ambitious goals and targets to catalyze a concerted global drive to minimize the burden of vaccine-preventable diseases in every country. Global immunization partners – WHO, GAVI, the Vaccine Alliance, the Bill and Melinda Gates Foundation, UNICEF and the US National Institute of Allergy and Infectious Disease pledged to work together and with other immunization stakeholders to make this happen. Measles elimination took a step back in 2017 [9].

Various reports indicated that the death of children is more common in developing world. Particularly children living below sub-Saharan African die every year due to communicable diseases that can be prevented by immunization. This is substantially attributed to inadequate immunization coverage and challenges in sub-Saharan Africa. Because in many parts of Africa vaccine infrastructure has been suboptimal, especially for routine vaccination which is identified as the main factor for under vaccination [12].

A report from WHO revealed that around 60% of children's who were not reached with routine immunization services are from 10 countries where majority are from sub-Saharan African countries [10].

And five of those African regions including Ethiopia were the region that continues to even increase further the pool of unimmunized children [13].

Even though, in 1980, the government of Ethiopia initiated the implementation of EPI with goal of increasing vaccination coverage against the six childhood killer diseases by 10% each year to reach 100% coverage in 1990, this goal has largely remained unrealized even using different efforts [14].

As a result an estimated 472,000 children still die each year before their fifth birthday largely from vaccine preventable diseases. Despite the high prevalence of vaccine preventable diseases (VPDs) in the country, immunization coverage rates stagnated and remained very low for many years. It is known that the World Health Assembly in May 2012 endorsed the Global Vaccine Action Plan (GVAP) as a roadmap to prevent millions of deaths through more equitable access to vaccines. Under this plan countries hope to achieve vaccination coverage of at least 90% nationally and at least 80% in each district by 2020.Thus the government of Ethiopia is expected to do more to achieve GVAP plan [9].

8.1.2. Statement of the problem

Ethiopia childhood schedule recommends routine measles vaccination at 9 months of age. Non-selective mass vaccination campaigns (MVCs) that vaccinate all children in a specified target age group regardless of prior vaccination status have increased coverage, particularly in developing countries where routine health services are weak [3].

MVCs reach children who were not reached by routine programs provide a second opportunity for those who did not initially seroconvert, and increase population immunity rapidly, potentially interrupting ongoing transmission [3, 4].

The worldwide impact of MVCs on the incidence of measles has been documented and revised WHO policy includes MVCs as an outbreak response activity [1, 2].

Despite considerable progress towards measles elimination, epidemics have recently occurred in 28 sub-Saharan African countries, including Ethiopia. In 2009/2010 approximately 200,000 cases were reported in sub-Saharan Africa. The underlying cause of these outbreaks is primarily insufficient coverage, but also logistics, including cold-chain maintenance [5].

Measles immunization coverage is a useful indicator of the strength of immunization programs and of child health programs in general. By 2008, measles immunization coverage was 83% globally among children aged 12–23 months old. In low-income countries, 76% of children aged 12–23 months had received measles vaccination, compared with 82% in lower middle-income countries, 94% in upper middle-income countries, and 93% in high-income countries. During the 1990s, global measles immunization coverage stagnated at around 71%, but since 2000 there has been a steady increase to 83%, due to improved routine immunization activities, immunization campaigns and greater efforts to reach marginalized populations. Since 2000, all WHO regions have made progress, particularly the WHO African Region (from 56% to 73%) and the WHO South-East Asia Region (from 61% to 75%) [8].

Various reports indicated that the death of children is more common in developing world. Particularly children living below sub-Saharan African die every year due to communicable

diseases that can be prevented by immunization. This is substantially attributed to inadequate immunization coverage and challenges in sub-Saharan Africa. Because in many parts of Africa vaccine infrastructure has been suboptimal, especially for routine vaccination which is identified as the main factor for under vaccination [12].

A report from WHO revealed that around 60% of children's who were not reached with routine immunization services are from 10 countries where majority are from sub-Saharan African countries [10].

And five of those African regions including Ethiopia were the region that continues to even increase further the pool of unimmunized children [13].

Even though, in 1980, the government of Ethiopia initiated the implementation of EPI with goal of increasing vaccination coverage against the six childhood killer diseases by 10% each year to reach 100% coverage in 1990, this goal has largely remained unrealized even using different efforts [14].

As a result an estimated 472,000 children still die each year before their fifth birthday largely from vaccine preventable diseases. Despite the high prevalence of vaccine preventable diseases (VPDs) in the country, immunization coverage rates stagnated and remained very low for many years. It is known that the World Health Assembly in May 2012 endorsed the Global Vaccine Action Plan (GVAP) as a roadmap to prevent millions of deaths through more equitable access to vaccines. Under this plan countries hope to achieve vaccination coverage of at least 90% nationally and at least 80% in each district by 2020.Thus the government of Ethiopia is expected to do more to achieve GVAP plan. It is fact that, to amplify the child immunization coverage in the study area and as a whole within the country, the root causes why they do not immunize their children should be known [9].

8.1.3. Rationale of the study

The most crucial component of implementing the immunization program activities is strong monitoring and evaluation. To this effect, Federal Ministry of Health and the Regional Health Bureaus have a routine administrative and health information systems to track the implementation of the immunization program. Administrative estimates of vaccination coverage, reached by dividing the number of people vaccinated by the population in the target age group, are often biased due to inaccurate population figures, incomplete and false reporting. So that, WHO recommends conducting coverage survey to validate the administrative coverage figures and to identify areas that need strengthening.

Therefore, the purpose of this coverage survey was to provide the actual measles immunization coverage and validate it with administrative coverage figures. In addition, this survey will also provide information on the community's awareness, channel of social mobilization, challenges to access immunization services and side effects following immunization which are found to be highly instrumental for planning and establish evidence for further improvements of the program.

8.2. Literature Review

Measles is one of the vaccine preventable diseases that contribute a significant share of morbidity and mortality among children. It is a highly contagious, serious disease caused by a virus. In 1980, before widespread vaccination, measles caused an estimated 2.6 million deaths each year. The disease remains one of the leading causes of death among young children globally, despite the availability of a safe and effective vaccine. Approximately 134,200 people died from measles in 2015 mostly children under the age of 5. It is normally passed through direct contact and through the air. The virus infects the respiratory tract, and then spreads throughout the body. In populations with high levels of malnutrition and a lack of adequate health care, up to 10% of measles cases result in death. People who recover from measles are immune for the rest of their lives [26]. Five complementary strategies are recommended for accelerating measles control or achieving measles elimination. These are: routine immunization, supplementary immunization, enhanced surveillance, vitamin A supplementation and Adequate case management.

Measles vaccine is highly effective and safe and the major reason for the remaining disease burden is underutilization of the vaccine. A single dose of a live attenuated measles vaccine after 9 months of age, which can be combined with other live vaccines, will induce active immunity in >85% of susceptible individuals. A second dose may increase immunity levels to as high as 99%. Based on the success of measles elimination strategies developed by the Pan American Health Organization, regional measles elimination goals have been established in the American Region (AMR) by 2000, the European Region (EUR) by 2007, and the Eastern Mediterranean Region (EMR) by 2010. In 2010, the World Health Assembly established 3 milestones towards the future eradication of measles to be achieved by 2015:

- ✓ Increase routine coverage with the first dose of measles-containing vaccine (MCV1) by more than 90% nationally and more than 80% in every district or equivalent administrative unit for children aged 1 year;
- ✓ Reduce and maintain annual measles incidence to less than 5 cases per million; and
- ✓ Reduce estimated measles mortality by more than 95% from the 2000 estimate.

Measles Control Strategies in Ethiopia

The Expanded program on immunization (EPI) was launched in Ethiopia in 1980 with the aim of reducing mortality and morbidity of children and mothers from vaccine preventable diseases. The target group when the program started were children under two years of age until it changed to under one year in 1986 to be in line with the global immunization target. Since its

inception, the traditional six antigens were used to be given in both the public and few private health facilities. In 2007, penta-valent formulations containing DPT-HepB-Hib was introduced. Later in October 2011 and November 2013, PCV and Rotavirus vaccine were introduced into the routine immunization program respectively. Currently, the number of total antigens available to infants comprise to ten (DPT-HepB Hib, PCV, BCG, Polio, measles and Rota) [10, 27]. In most African countries, including Ethiopia, measles control activities have significantly reduced morbidity and mortality; however, where the vaccine coverage is sub-optimal, frequent outbreaks of measles still occur. Despite considerable improvement in measles immunization coverage in Ethiopia, Measles outbreaks continue to occur in most parts of the country. Low sub national routine measles coverage, prevailing poor nutritional conditions, accumulation of unvaccinated children in highly populated areas accompanied by seasonal hot weather between December and February have contributed for the frequent measles outbreaks occurring in different parts of the country [28].

Outbreaks can be prevented through a high level of population immunity achieved through routine immunization activities as well as through high quality immunization campaigns. Campaigns are also referred to as supplemental immunization activities (SIAs). Immunity is optimal if children are vaccinated at the appropriate age, with effective vaccines [29, 30]. In Ethiopia, two doses of measles vaccines are provided, the first through routine immunization at nine months of age, and the second when the child is under-five years of age, through a supplementary immunization activity (SIA) or campaign.

In September 2011, the Sixtieth Regional Committee, by its Resolution AFR/RC61/R1, adopted a goal of measles elimination for the African Region by the year 2020. In line with global targets to achieve the MDGs, the FMOH has adapted this resolution; and currently, Ethiopia is working towards the global targets to be achieved as part of the health sector efforts to further reduce child morbidity and mortality. In 2012, Ethiopia developed a measles strategic plan outlining the key activities that will be implemented to ensure the goals and targets for measles elimination are achieved.

Ethiopia, with the rest of the African Region has adapted the measles elimination targets and aimed to achieve the following by 2020:

- ✓ Achieve at least 90% measles vaccination coverage nationally and at least 80% in every woreda by 2020.
- ✓ Achieve at least 95% coverage during periodic measles SIA in all woredas.

- ✓ Achieve measles incidence of less than one confirmed measles case reported per million populations per year.
- ✓ Achieve the surveillance performance targets of at least one suspected case reported per 100,000 populations per year in at least 80% of zones; serum samples adequate for detecting measles IGM collected in at least 80% of suspected measles cases [31].

The Ethiopia childhood schedule recommends routine measles vaccination at 9 months of age. Non-selective mass vaccination campaigns (MVCs) that vaccinate all children in a specified target age group regardless of prior vaccination status have increased coverage, particularly in developing countries where routine health services are weak [27]. MVCs reach children who were not reached by routine programs provide a second opportunity for those who did not initially seroconvert, and increase population immunity rapidly, potentially interrupting ongoing transmission [27, 28]. The worldwide impact of MVCs on the incidence of measles has been documented and revised WHO policy includes MVCs as an outbreak response activity [26, 33]. Despite considerable progress towards measles elimination, epidemics have recently occurred in 28 sub-Saharan African countries, including Ethiopia. In 2009/2010 approximately 200,000 cases were reported in sub-Saharan Africa. The underlying cause of these outbreaks is primarily insufficient coverage, but also logistics, including cold-chain maintenance [29].

Unquestionably improving access to and utilization of routine immunization services are the best option for the prevention and control of vaccine preventable diseases (VPD).

As a consequence, the expanded program on immunization (EPI) was launched in 1974 as a global program for controlling and reducing death from vaccine-preventable diseases. Universal immunization of children against six preventable diseases (tuberculosis, diphtheria, Pertussis, tetanus, polio and measles) is crucial to diminish childhood mortality and morbidity across the world [30]. Immunization is considered as one of the most powerful and cost-effective of all health interventions. It also believed to prevent debilitating illness and disability and saves millions of lives every year [31].

Measles immunization coverage is a useful indicator of the strength of immunization programs and of child health programs in general. By 2008, measles immunization coverage was 83% globally among children aged 12–23 months old. The lowest rates were in the WHO South-East Asia (75%) and African (73%) regions. The highest rate was in the WHO European Region (94%). In low-income countries, 76% of children aged 12–23 months had received measles vaccination, compared with 82% in lower middle-income countries, 94% in upper middle-income countries, and 93% in high-income countries. During the 1990s,

global measles immunization coverage stagnated at around 71%, but since 2000 there has been a steady increase to 83%, due to improved routine immunization activities, immunization campaigns and greater efforts to reach marginalized populations. Since 2000, all WHO regions have made progress, particularly the WHO African Region (from 56% to 73%) and the WHO South-East Asia Region (from 61% to 75%) [10].

Outbreaks in North America and in Europe emphasize that measles can easily spread even in countries with mature health systems. Due to ongoing outbreaks, measles is again considered endemic in Germany and Russia. Measles outbreaks have been seen in countries reporting good national vaccine coverage, evidence of immunization gaps and highlighting the need to ensure high sub-national coverage, particularly among vulnerable populations [9].

There are also concerns about the widespread use and quality of supplementary immunization activities (SIAs). While nearly 200 million children were reached through SIAs in 2017, in less than half were coverage rates in excess of 95% achieved. Although they can be an important way of immunizing remote populations and rapidly addressing coverage gaps, SIAs are costly and labor-intensive; strengthening routine immunization systems would reduce the need for SIAs, as well as the costs associated with treatment of measles and resulting lost productivity – the cost of dealing with an outbreak can be 20 times the cost of the vaccinations that could have prevented it. More positively, global coverage of a second dose of measles-containing vaccine (MCV2) increased to 67% in 2017 and 86% of countries have introduced MCV2 into their national immunization program. However, coverage rates globally remain inadequate to effectively control measles [9].

Between 2000 and 2016, measles vaccination prevented an estimated 20.4 million deaths globally. A core principle of immunization is that everybody has an equal right to immunization services, no matter who they are or where they are from. Despite some progress, this goal is far from being achieved [9].

Conceptual frame work for Comparison of community based and administrative measles immunization coverage

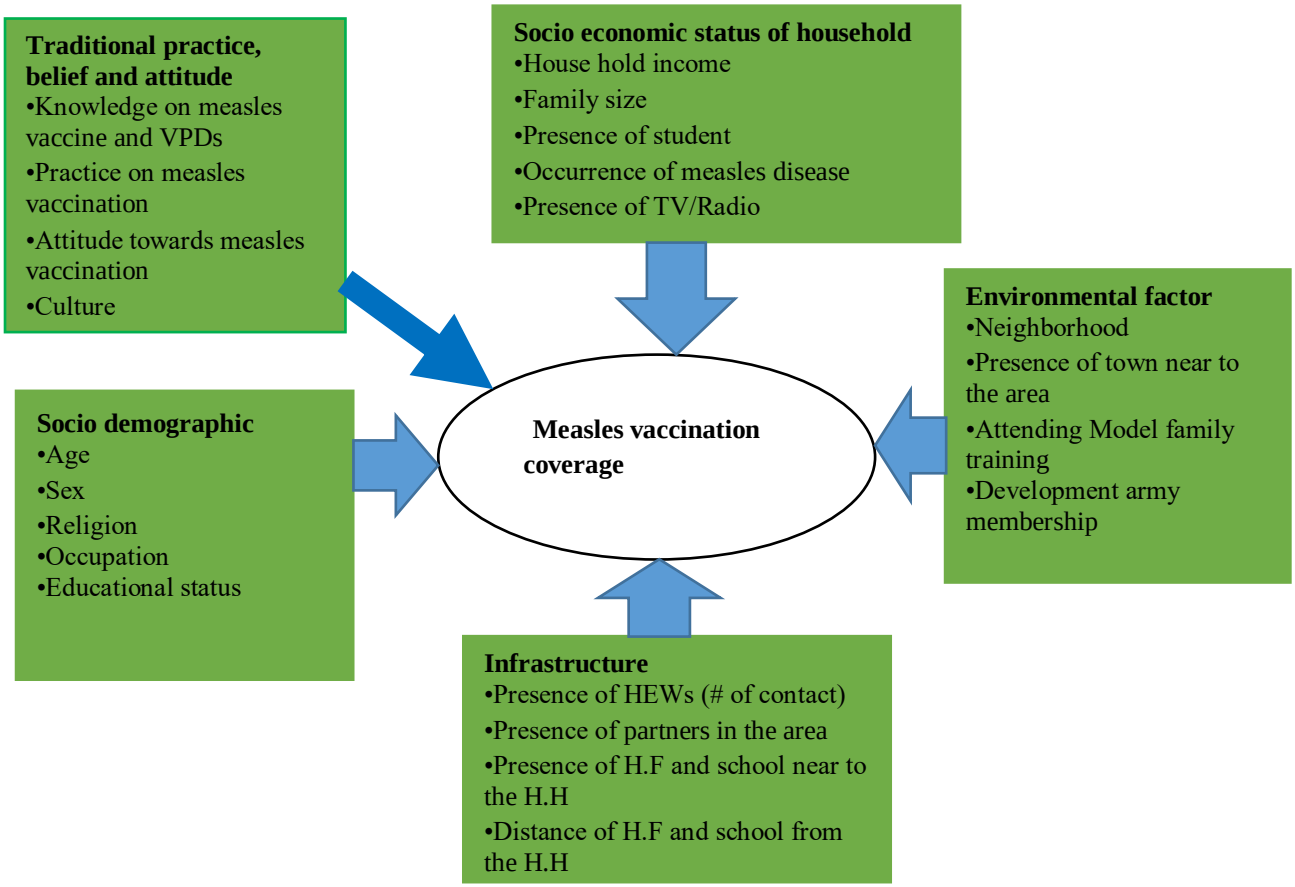


Figure 63: Study frame work for validation of measles immunization coverage of Hudet district of Somali Region, Ethiopia, 2019.

Research questions

Is there a gap between community based and administrative measles vaccination coverage?

(What is the real/community based measles vaccination coverage of the district and associated factors with measles vaccination?)

8.3. Objective

8.3.1. General objective

To assess the community based measles vaccination coverage and associated factors among children aged 12-23 months in Hudet district, Somali region, Ethiopia 2019.

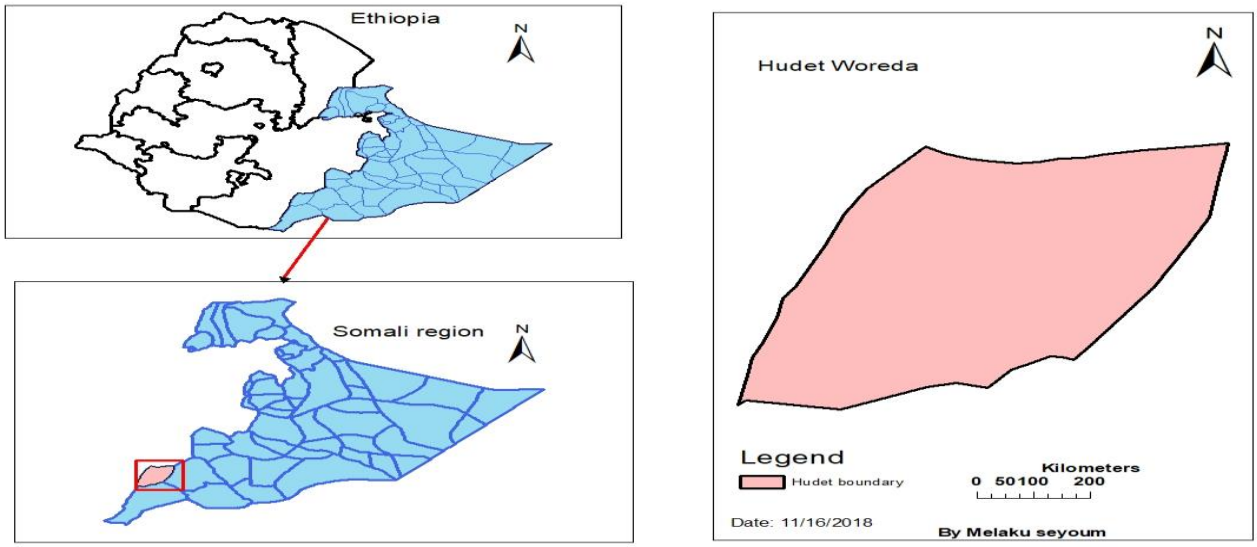
8.3.2. Specific objectives

- To assess community based measles vaccination coverage in Hudet district.
- To identify associated factors with measles vaccination coverage in the district.
- To propose appropriate recommendations on measles vaccination coverage.

8.4. Method

8.4.1. Study Area

The study will be conducted in Hudet district, Somali region. It is 712km far from Addis Ababa and 1440 Km from Jigjiga capital town of the region. The woreda has 21 rural and 4 urban kebeles. According to the 2007 population census, the projected estimated population of the woreda in 2018 is to be 59,920 which constitute 26,365(44%) male and 33,555(56%) female. It is bounded by Filtu woreda of Somali region to the east, Liben woreda of Oromia at North, Moyale woreda of Somali region at South and Arero woreda of Oromia region at West. 10.46% are urban inhabitants and 72.21% are pastoralists. 99.35% of the population are Muslim. The woreda has an average temperature and an average rain fall of 25^0c-40^0c & 100mm-400mm respectively. Hudet woreda is located at Latitude of 4° 45' 00" N and 39° 14' 00" E Longitude.



Map 10: showing study area Hudet woreda, Somali region, Ethiopia, 2019.

8.4.2. Study period

The study will be conducted from July 1 to 30, 2019.

8.4.3. Source/Target Population

All children aged 12 to 23 months with their mothers/caretakers living in Hudet district were the source population.

8.4.4. Study population

Children aged 12 to 23 months with their mothers or caretakers that will be sampled from source population were the study population.

8.4.5. Sampling Unit

Individual households found in the district and district health office in 2019.

8.4.6. Study Unit

Mothers or caretakers of children aged 12 to 23 months living in Hudet district and district health office EPI officer.

8.4.7. Sample size calculation

The sample size required will be determined based on single proportion population formula with the assumption of 5% margin of error (d), 95% confidence level (Z), and measles immunization coverage assumed to be 54% by history and vaccination card which is taken from EDHS 2016, to get the possible sample size. The sample size was calculated as follows:

$$n = (Z_{\alpha/2})^2 \left(\frac{P\,(1-P)}{d^2} \right),$$

$$n = (1.96)^2\ 0.54\ (1-0.54)/\ (0.05)^2,$$

$$n = 382,$$

Where,

P is proportion of measles immunization coverage (54%);

d is margin of error = 0.05;

$Z\ \alpha/2$ is confidence level required and $Z\ \alpha/2$ at 95% CI= 1.96;

n is minimum sample size.

Since the total eligible children for this study in study area is less than 10,000 which is 3518, by using the following population correction formula the sample size became 345.

$$n = \frac{n_0}{\left(1 + \frac{n_0}{N}\right)}$$

Where n_0 is the initial sample size (calculated sample size); nf is the final sample size; N is the total no of eligible children. Then by considering 10% nonresponse rate the final sample size was 380.

8.4.8. Study design

Community-based Cross-sectional vaccination coverage survey will be conducted.

8.4.9. Sampling procedure

Systematic random sampling technique will be used to take the appropriate sample. The sampling frame will be obtained from health extension workers registration books. The first household with eligible child will be selected randomly by lottery method from numbers 1-9. Then every 9^{th} household will be selected. One child will be selected randomly from those households having two and more eligible children.

K=N/n =3518/380 =9, where k is interval, N is total 12-23 months population, n is required sample size.

8.4.10. Eligibility criteria

8.4.10.1. Inclusion Criteria

(i) Children with their mothers or caretakers living in Hudet district for at least 12 months before the date of data collection and child aged between 12 and 23 months will be included in this study.

(ii) Caretakers aged 18 years and above will be included in this study.

(iii) Mothers/caretakers able to be interviewed will be included in this study.

8.4.11. Data Collection procedure

An interviewer-administered structured questionnaire will be used to obtain the required data. The data collection tool will be constructed from a review of available literature on immunization coverage, WHO questionnaire and EDHS for immunization coverage and will be translated into local language. We will use 5 data collectors with health background. Households (mothers/caretakers) with eligible children in selected kebeles will be visited by all 5 data collectors until the proportionally allocated sample size in each kebele will be achieved. Mothers or caretakers will be asked to show immunization cards, and then vaccines received will be copied. For those mothers/caretakers who had no vaccination card, different appropriate questions will be asked in order to determine the vaccination status of the child for each specific vaccine. In order to reduce recall bias for mothers/caretakers history, remainder such as site of administration (whether it is taken as injection or orally, presence of scar, and also at what age they vaccinate) was included in instruments.

Finally, we will review administrative measles vaccination coverage figures of the woreda.

8.4.12. Data Quality control

Questionnaire was prepared initially in English by principal investigator and then will be translated to Somali language and another translator retranslates to English to check its consistency. Before the actual data collection, the questionnaire will be pretested on 5% of children whose age are between 12 and 23 months in one neighboring woreda. After pretesting, necessary amendments will be made accordingly, including on ambiguities of the questions, wording, logic sequence, and skipping order. One day training will be given to data collectors on the study tool and data collection procedure before data collection time. The collected data will be checked for completeness and corrective measures will be taken accordingly. The collected data will be cleaned, coded, and explored before analysis. Daily supervision will be conducted by 2 supervisors in addition to principal investigator.

8.4.13. Variables

8.4.13.1. Dependent Variable

(i) Vaccination Status

8.4.13.2. Independent Variables

(i) Socio-demographic characteristic of mother/caretaker (age, sex, marital status, religion, occupation, educational status, and family income)
(ii) Knowledge of mother on measles vaccine and vaccine preventable diseases
(iii) Maternal health care utilization
(iv) Time of travel to reach nearest health facility
(v) Characteristics of the child (age, birth order, and place of delivery)

8.4.14. Operational Definition

Unvaccinated: A child aged 12–23 months who did not received any doze of measles vaccine before this study will be considered to be unvaccinated.
Coverage by Card Only: Coverage by card only meant coverage calculated with numerator based only on documented doze, excluding the numerator of those vaccinated by history.
Coverage by Card plus History: Coverage by card plus history meant coverage calculated with numerator based on card and mother's report.

Good Knowledge: participant who score greater or equal to the mean score will be considered good knowledge.

Poor Knowledge: If the participant score less than the mean score will be considered poor knowledge.

Caretakers: Caretaker is any responsible person that provides care for the child and who will be part of the study.

Index Child: Index child refers to a child that is included in the study from a household to have information on the demographic and immunization status.

Literate: Mothers/caretakers/fathers with formal education or able to read and write are considered literate.

8.4.15. Data Analysis

The collected data will be entered in to epi info version 7.2.0.1 after checking for completeness and consistency then will be cleaned, and analyzed using Statistical software for social science (SPSS) version 23. Basic descriptive analysis like mean, median, mean score with standard deviation and interquartile range will be computed. In addition using bivariate logistic regression all independent variables with p-value less than 0.2 will be included to multivariate logistic regression to determine the association. Finally p-values less than 0.05 will be used to ascertain the association.

8.4.16. Ethical Consideration

An ethical clearance will be obtained from Addis Ababa University College of health science and school of public health institutional review board (IRB) and letter of cooperation will be obtained from Ethiopian public health institute to Somali regional health bureau for smoothening of the data collection process; with letter of permission from the region to the Hudet district health office. Informed consent will be obtained from all the participant before the actual data collection and all subject specific variables will be anonymous and the data will be used for the intended purpose only and will not be transferred to third party.

8.5. Work Plan

Table 37: Research project implementation Work Plan Hudet district, Somali region, Ethiopia, March 2019.

S.No	Planned Activities	March 2019				April 2019				May 2019				June 2019				July 2019				August 2019				September 2019			
1	Prepare proposal and submit to donors																												
2	Review of Proposals and Approval of Projects																												
3	Select data collectors and research assistants																												
4	Conducting training for data collectors and supervisors																												
5	Pre-testing of the survey instrument																												
6	Prepare for field Work																												
7	Data collocation																												
8	Data entry and cleaning																												
9	Data analysis and interpretation																												
10	Report writing and submission																												

8.6. Budget Break Down

Table 38: Budget breakdown of comparison of community based and administrative measles routine immunization coverage among children aged 12-23 months in Hudet district, Somali region, Ethiopia, March 2019.

S.No.	Budget Category	Daily perdiem	Quantity	Total days	Total Cost in Birr
1	Training				
	Principal investigator	300	1	1	1*1*300=300
	Field Supervisors	300	2	1	2*1*300=600
	Data collectors	300	5	1	5*1*300=1500
	Data entry clerk	300	2	1	2*1*300=600
	Personnel Total			Sub total	3,000
2	Supplies	Unit Cost	Quantity		Total Cost in Birr
	Flip chart paper	100	1		1*100=100
	Pencil	2	10		10*2=20
	Eraser	5	5		5*5=25
	Sharper	5	5		5*5=25
	Marker(pack)	50	1		50*1=50
	Pen (pack)	100	2		2*100=200
	Printing paper (pack)	200	2		2*200=400
	Supplies Total			Sub total	820
3	Field Work	Daily perdiem	Quantity	# of days	Total Cost in Birr
	Project coordinator	300	1	30	1*30*300=9000
	Field supervisor	300	2	30	2*30*300=18,000
	Data collectors	200	5	30	5*30*200=30,000
				Sub Total	57,000
				Total	60,820
				Contingency 5%	3041
				Grand Total	63,861

Reference

1. Strebel PM, Papania MJ, Dayan GH, Halsey NA. Measles vaccine. In: Plotkin S, Orenstein W, Offit P, eds. Vaccines. 5th ed. Philadelphia: Saunders Elsevier, 2008:352-398.
2. World Health Organization. Response to Measles Outbreaks in Measles Mortality Reduction Settings (WHO/IVB/09.03). Geneva: WHO, 2009.
3. Global Program for Vaccines of the World Health Organization. Role of mass campaigns in global measles control. Lancet 1994; 344:174-175.
4. Biellik R, Madema S, Taole A, et al. First 5 years of measles elimination in southern Africa: 1996-2000. Lancet 2002; 359: 1564-1568. [http://dx.doi.org/10.1016/S0140-6736 (02)08517-3]
5. Strebel PM, Cochi SL, Hoekstra E, et al. A world without measles. J Infect Dis 2011; 204 (suppl 1):S1-3. [http://dx.doi.org/10.1093/infdis/jir111]
6. L. Wolfson, F. Gasse, S. P. Lee-Martin et al., "Estimating the costs of achieving the WHO–unicef global immunization vision and strategy, 2006–2015," World Health Organization (WHO), Weekly Epidemiological Record, vol. 81, no. 9, pp. 189–196, 2006, Challenges in global immunization and the global immunization vision and strategy 2006– 2015.
7. O. Olumuyiwa, A. Ewan, P. Francois, and I. Vincent, "Determinants of vaccination coverage in rural Nigeria," BMC
Public Health, vol. 8, pp. 381–388, 2008.
8. World Health Organization (WHO). Global Health Observatory. Measles immunization coverage, 2008.

9. World Health Organization (WHO) Global Vaccine Action Plan 2011–2020. Geneva: World Health Organization, 2013.
10. EPHI. "Guideline on measles surveillance and outbreak management." 2012, Addis Ababa, Ethiopia.
11. WHO/UNICEF. Coverage estimates and estimation of number of children vaccinated or not vaccinated. [Online], 2016 http:// apps.who.int/immunization monitoring/global summary/time series/ tswucoveragebcg.
12. T. K. Ryman, V. Dietz, and K. L. Cairns, "Too little but not too late: results of a literature review to improve routine immunization programs in developing countries," BMC Health Services Research, vol. 8, pp. 134–148, 2008.
13. A. Gentile, "Pediatric disease burden and vaccination recommendations: understanding local differences," International Journal of Infectious Diseases, vol. 30, pp. 1019–1029, 2010.
15. World health organization (WHO), Children and the millennium development goals progress towards a world fit for children, 2007.
16. Y. Berhane, "Universal childhood immunization: a realistic yet not achieved goal," The Ethiopian Journal of Health Development, vol. 22, no. 2, pp. 146-147, 2008.
17. Central statistical agency (CSA), Ethiopian demographic health survey, Addis Ababa, Ethiopia, 2016.

18. World health organization (WHO), Immunization coverage cluster survey reference manual, Immunization, Vaccines and Biologicals, 2005.
19. D. Sebahat and B. Nadi, "Vaccination coverage and reasons for non-vaccination in a district of Istanbul," BMC Public Health, vol. 6, pp. 125–132, 2006.
20. K. Abdel, T. Drissa, and H. Fatouma, "Evaluation of immunization coverage within the expanded program on immunization in kita circle," BMC International Health and Human Rightsm, vol. 9, no. 1, pp. 13–19, 2009.
21. M. Mohammed and A. Atomsa, "Assessment of child immunization coverage and associated factors in oromia regional state," Science, Technology and Arts Research Journal, vol. 2, no. 1, pp. 36–41, 2013.
22. UNICEF. National EPI Coverage Survey in Somaliland. July, 2008.
23. H. Perry, R.Weierbach, I.Hossain, and R. U. Islam, "Childhood immunization coverage in zone 3 of Dhaka City: The challenge of reaching impoverished households in urban Bangladesh," Bulletin of theWorld Health Organization, pp. 565–573, 2009.
O. J. Awino, Determinants of immunization coverage among children aged 12-23 months in kenya, 2016.
24. B. Ayano, "Factors affecting fully immunization status of children aged 12–23 months in Hosanna Town, South Ethiopia," Journal of Pregnancy and Child Health, vol. 2, no. 185, 2015.
25. E. Legesse and W. Dechasa, "An assessment of child immunization coverage and its determinants in Sinana Districtm," BMC Pediatrics, vol. 15, no. 31, 2015.
26. WHO, "Measles Fact Sheet." Geneva, 2016.
27. FMOH, "National Expanded Program on Immunization Implementation Guideline." 2015.
28. H. B. Akalu, "Review on Measles Situation in Ethiopia; Past and Present," J. Trop. Dis., vol. 4, no. 2, pp. 2–7, 2015.
29. F. T. Cutts and F. Dabis, "[Measles control in developing countries]," Santé (Montrouge, France), vol. 4, no. 3. pp. 163–71, 1990.
30. F. T. Cutts, R. H. Henderson, C. J. Clements, R. T. Chen, and P. A. Patriarca, "Principles of measles control," Bull. World Health Organ, vol. 69, no. 1, pp. 1–7, 1991.
31. FMOH, WHO and UNICEF. "Implementing Best Practice Measles SIAs. The Ethiopia Experience," no. May. 2011.
32. WHO, "world health organization vaccination coverage cluster surveys: Reference Manual," 3, 2015.
33. WHO, "Immunization." Geneva, 2016.

Chapter IX -Other Additional Output Reports

9. Woreda and hospital level PHEM officers/focals EFETP frontline workshop1 training, Tigray region, November 2018.

9.1. Introduction

Field epidemiology training program-Frontline is a 3-month, in-service training, that aims to strengthen prevention, detection of and response to diseases and events of public health importance or international concern. Adopted in Ethiopia in 2015. Organized by EPHI-PHEM EPHI: Director and RA. Implemented through RHBs and ZHDs. RHBs/ZHDs are involved in Mentorship. Collaborating Partners are CDC and WHO. Training and development play an important role in the effectiveness of organizations and to the experiences of people in work. Training has implications for productivity, health and safety at work and personal development. All organizations employing people need to train and develop their staff. Most organizations are cognizant of this requirement and invest effort and other resources in training and development. Such investment can take the form of employing specialist training and development staff and paying salaries to staff undergoing training and development.

The purpose of training and management development programs is to improve employee capabilities and organizational capabilities. When the organization invests in improving the knowledge and skills of its employees, the investment is returned in the form of more productive and effective employees. Training and development programs may be focused on individual performance or team performance.

Expected Impact

- ✓ Improved timeliness and completeness of surveillance reports from reporting sources
- ✓ Improved capacity & skill to conduct regular site visits, data quality audits, and feedback to reporting sites
- ✓ Regular analysis of surveillance data
- ✓ Regular production of surveillance summary reports
- ✓ Better use of data in PH decision-making
- ✓ More frequent and better case and outbreak investigations
- ✓ Root causes of problem identified by use of fishbone diagrams to analyze problems and target interventions.

9.2. Objective

9.2.1. General objective

To strengthen PHEM focal persons on general PHEM activities and outbreak investigation on selected epidemic prone diseases, to improve the recording, reporting and case managing abilities of zonal and woreda focal persons.

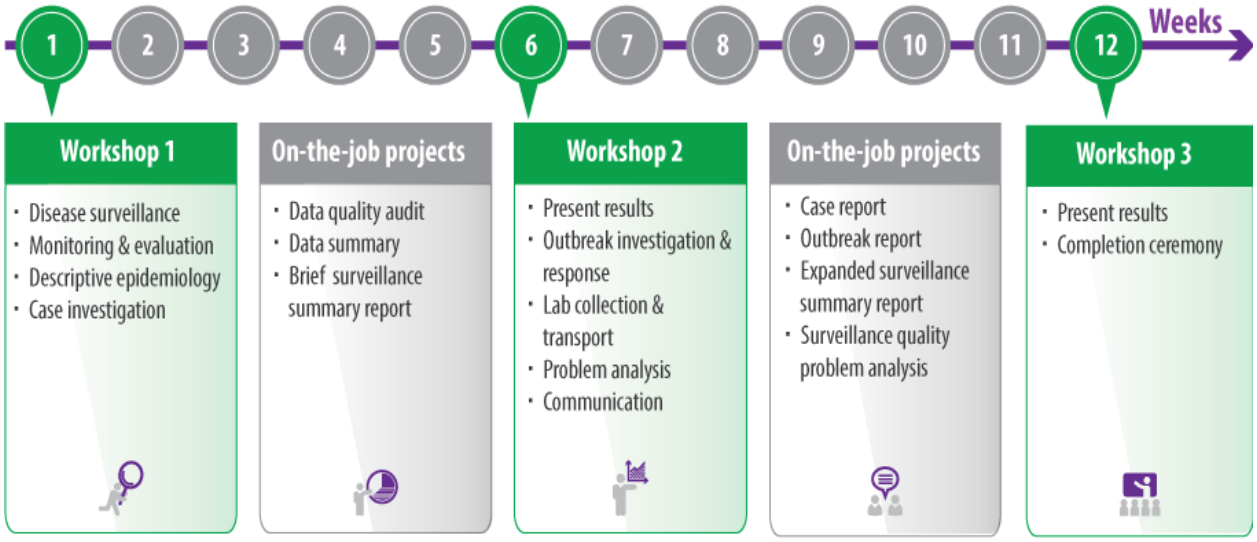
9.2.2. Specific objectives

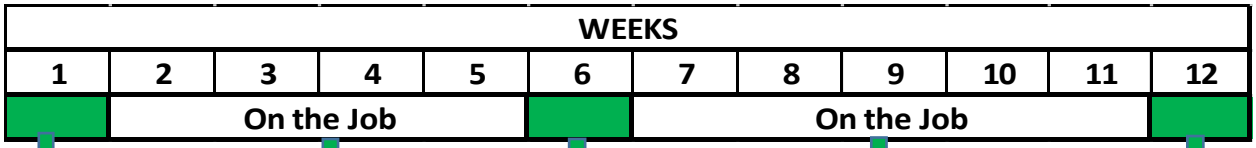
- ✓ To enable participants to develop the skills necessary to support district and health Facilities on surveillance systems and outbreak investigation.
- ✓ To improve the health workers ability on case management of selected epidemic prone Diseases
- ✓ To strengthen the recording and reporting capabilities of the health workers.

9.3. Methods and materials

- ✓ Prior to the presentations pre-test was administered to identify the level of awareness of participants about public health surveillance related activities.
- ✓ PPT presentation, LCD, flip chart and computer were used to conduct the training.
- ✓ Group work
- ✓ General discussion
- ✓ Evaluating their level of awareness at the end of the training through administration of post-test

FETP-Frontline Program Schedule





Field Work 1 On-the-Job projects

-Site visits / data quality audits

-Surveillance data analysis, brief surveillance summary report

Field Work 2 On-the-Job projects (Choose 2)

- Case report
- Outbreak report
- Expanded surveillance summary report
- Surveillance quality problem analysis report

Workshop 1 Topics

-PH surveillance

-PHEM Data Collection

-Case investigation

-Data Quality

-Descriptive epidemiology & Statistics

-Optionally, MS Excel®/PPT/Word/E-mail

-Monitoring & evaluation

Workshop 2 Topics

-Present results

-Outbreak investigation and response

-Lab specimen collection, transport

-Problem analysis

-Oral presentation skills

Workshop 3 Activities

- Present results
- Completion ceremony

9.4. Result

9.4.1. Tasks accomplished before the training

Prior to the training, gap was identified (priority was set). Based on the priority this training is prepared. A selection criterion was also prepared such as the trainee must be PHEM focal person who is permanently working at woreda health office. Invitation letter was written to Tigray region health bureau to call trainees and other administration issues also managed.

A total of 50 woreda PHEM officers and Hospital PHEM focal persons were selected and joined the training. The training was held at Mekele Town and conducted from 28th November-3rd December 2018. The participants were from Western, Eastern, North Western, South Western, South Eastern, Mekele Town and Central Tigray zones. The majority of the participants 48 (96%) were from woreda PHEM, the remaining 2 were from hospitals. Daily attendance of the trainees, morning recap of daily topic learnt, pre and post training were some of important strategies conducted to insure the quality of the training. All soft copies of power points presented by trainers and other important reference materials were provided for the trainees.

A total of 11 trainers and facilitators, 8 from EPHI (PHEM staff and EFETP resident), two from Tigray RHB PHEM and one from WHO have been participated.

9.4.2. Contents of the training

Different topics were presented by different trainers, particularly on introduction to EFETP Frontline, introduction to PHEM, public health surveillance/IHR, PHEM data collection, case definition and PHEM formats, PHEM data quality, descriptive statistics and epidemiology, data presentation, interpretation, introduction to MS excel and PPT, data communication and taking action, Monitoring & Evaluation and Guinea worm briefing components were included.

9.4.3. Output of the Training

Pre and post test result

Table 39: Pre and posttest mark and percentage of EFETP training for woreda PHEM officers and Hospital PHEM focal person from November 28- December 03, 2018**.**

Category	Frequency of pretest	Percentage of pretest	Frequency of posttest	Percentage of posttest
>=85	0	0%	0	0%
70-84.9	0	0%	3	6.5%
50-69.9	8	17%	26	56.5%
<49.9	38	83%	17	37%
Total	46	100%	46	100%

Table 40: Pre and post test result category of EFETP workshop one training, Tigray, November, 2018.

	Pre test		Post test			Pre test		Post test	
	Points	Grade	Points	Grade		Points	Grade	Points	Grade
ID	20.0	100%	20.0	100%	ID	20.0	100%	20.0	100%
TG1	7.0	35%	13.5	68%	TG24	5.2	26%	4.7	24%
TG2	4.2	21%	8.3	42%	TG25	4.2	21%	9.0	45%
TG3	5.2	26%	6.2	31%	TG26	10.6	53%	9.3	47%
TG4	7.0	35%	13.3	67%	TG27	5.2	26%	8.2	41%
TG5	7.1	36%	11.8	59%	TG28	11.7	59%	10.5	53%
TG6	12.3	62%	13.0	65%	TG29	4.2	21%	14.4	72%
TG7	6.7	34%	8.2	41%	TG30	7.7	39%	12.5	63%
TG8	6.7	34%	12.8	64%	TG31	4.2	21%	12.5	63%
TG9	11.2	56%	14.0	70%	TG32	4.7	24%	9.7	49%
TG10	6.2	31%	9.2	46%	TG33	7.2	36%	8.2	41%
TG11	4.5	23%	10.2	51%	TG34	8.8	44%	11.6	58%
TG12	5.7	29%	9.7	49%	TG35	3.7	19%	6.2	31%
TG13	7.4	37%	13.0	65%	TG36	7.7	39%	11.3	57%
TG14	7.7	39%	9.7	49%	TG37	8.2	41%	11.2	56%
TG15	7.2	36%	11.3	57%	TG38	10.3	52%	10.5	53%
TG16	8.2	41%	13.4	67%	TG39	5.2	26%	5.2	26%
TG17	13.6	68%	12.6	63%	TG40	7.6	38%	10.1	51%
TG18	3.7	19%	7.7	39%	TG41	12.2	61%	12.5	63%
TG19	4.2	21%	12.2	61%	TG42	6.2	31%	7.2	36%
TG20	4.9	25%	10.1	51%	TG43	7.2	36%	9.2	46%
TG21	5.2	26%	13.5	68%	TG44	7.7	39%	12.0	60%
TG22	5.2	26%	7.7	39%	TG45	6.3	32%	13.0	65%
TG23	6.7	34%	9.7	49%	TG46	13.2	66%	13.5	68%

Note: Four late comer participants didn't take pre-test.

The pre-test result showed that the majority (83%) of the trainees achieved lowest grades less than 49.9%. None of the trainees achieved a score above 70%. This shows that most of the trainees had knowledge gap on PHEM related activities, though most of them were working in PHEM activities. The result of the posttest following the conclusion of the training showed that the improvement made was significant. A total of 29(63%) of the trainees achieved 50% and above marks as shown in table 39.

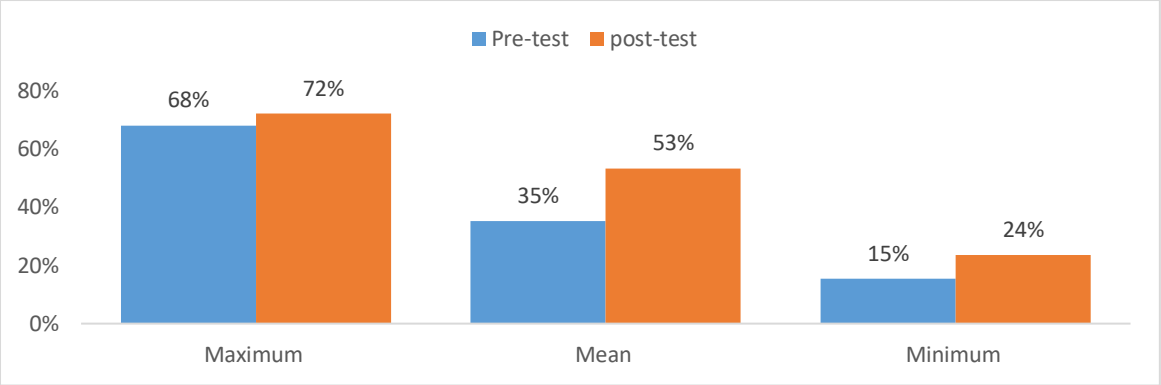


Figure 64: Pre-posttest compression of EFETP Workshop one training, Mekele, November 2018.

When comparing pre-test and post-test point scores for the group, the mean pre-test percent was **68(SD:13.1%)** and the mean post-test percent was **72(SD:12.3%%)**, showing a positive percent difference of **4**. All maximum, mean and minimum showed improvements.

9.5. Discussion

For the group the difference between the pre-test mean score and the post-test mean score was significant. Mean difference of 4% was observed. This showed how trainees had developed skill and acquired new knowledge. Moreover, the majority of the trainees 29(63%) scored, grades of 50% and above in the post test. This is significantly different from the pre-test where 8(17%) achieved grades 50% and above. This gave proof that a significant change witnessed that how change or improvement was seen.

9.6. Conclusion and recommendation

The training was effective and had influence on the trainees in increasing knowledge and skill on PHEM activities and core components. After the training the trainees gained and shared good experience from the training. Regional health bureau should maintain and follow the trainees to complete all the three workshops of the training to achieve the intended objective.

9.2. Weekly epidemiological bulletin of SNNPR, week 44, 2017

ETHIOPIAN PUBLIC HEALTH INSTITUTE

PUBLIC HEALTH EMERGENCY MANAGEMENT

Prepared by: Melaku Seyoum

[1]Ethiopian Public Health Institute, Public Health Emergency Management

Telephone: 011-275-88-96, Tall Free: 8335/8665, Fax: 0612758634,

Email: PHEMcenter@ephi.gov.et, Website: www.ephi.gov.et, P.O. Box: 1242,

Swaziland Street, Addis Ababa

Weekly Surveillance Report Feedback, SNNPR, Week 44/ 2017

Highlights of the week

- **Both Completeness and Timeliness rate were 96%.**
- **Aman Hospital, South Bench, Bero and Geta Woreda Health offices did not send the weekly report**
- **Basketo, Surma, Enidguagn, Adiyo, Konso and Salamago woredas health offices achieved completeness below the minimum requirement (80%).**
- **4 suspected measles cases were reported.**
- **20 dog bites were reported.**
- **Two AFP cases were reported.**
- **One rabies case was reported.**
- **No AWD case was reported.**
- **One maternal death was reported.**
- **5306 malaria and 744 malnutrition cases were reported.**
- **2544 scabies cases were reported.**

1. Surveillance Report Completeness

The report completeness rate of the week is 4452/4635(96%) which showed a slight decrement from the previous week. Aman Hospital, South Bench, Bero and Geta Woreda Health offices did not send a report.

Additionally Basketo, Surma, Enidguagn, Adiyo, Konso and Salamago woredas health offices achieved completeness below minimum requirement (80%).

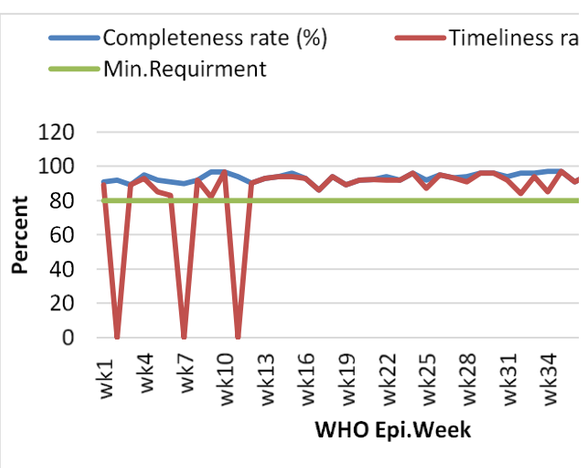


Figure 65 Weekly report completeness and timeliness, SNNPR, Week1-44/2017

As you can infer from figure 2 below, all zones/special woredas have submitted weekly report. However Bench Maji and Basketo zones achieved completeness below minimum requirement (80%).

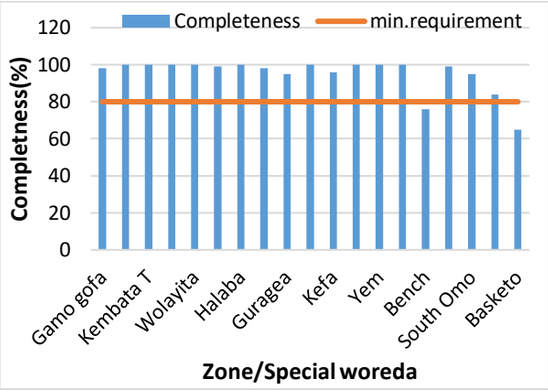


Figure 66: Weekly report completeness by zone/special woreda, SNNPR, Week 44/2017

2. Surveillance Report Timeliness

The report timeliness is 4452/4635(96%) in this week.

3. Data Quality

Table1.Woredas that achieved completeness below minimum requirement,SNNPR, Week 44/2017

Woredas	Completeness (%)
Basketo	65%
Surma	50%
Enidguagn	79%
Adiyo	63%
Konso	68%
Salamago	74%

4. Immediately reportable diseases/Conditions

AWD/Cholera

No case of AWD was reported in this week.

Measles

In this week 4 suspected measles cases were reported from Aleta Wondo Hospital of Sidama Zone.

AFP

A total of two AFP cases were reported from Arbaminch zuria and Yirgalem Hospital.

Rabies

A suspected rabies death was reported from Arbaminch hospital.

Dog Bite

A total of 20 dog bites were reported from Arbaminch hospital(9),Dilla Town(6) and Tercha hospital(5).

Maternal Death

One maternal death was reported from Kele hospital of Segen zone.

All the remaining immediately reportable diseases were reported zero.

5. Weekly Reportable Diseases/ Conditions

Malaria

A total of 5306(5273 outp and 33 Inp) clinical and confirmed malaria cases with no death were reported from the region.

High case contributing zones were: South Omo 1395(26%), Gamo Gofa 842(16%) and Wolayita 333(6%).

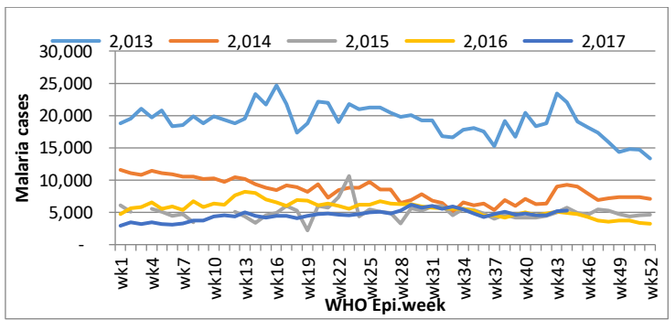


Figure 67: Malaria cases trend by week,2013-2017, SNNPR

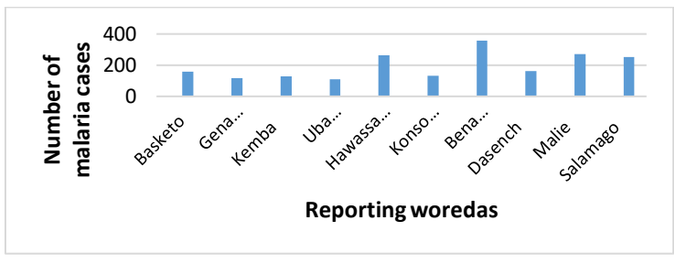


Figure 68: Top 10 malaria reporting woredas, SNNPR, week 44/2017.

Meningitis

In this week a total of 13 inpatient meningitis cases with no death were reported from the region, with 5 cases each from Dilla and Bona hospitals.

Malnutrition

In this week a total of 744(627 outp. and 117 Inp) malnutrtion cases with 3 deaths were reported from Gedole,Werabe and Jinka hospitals.

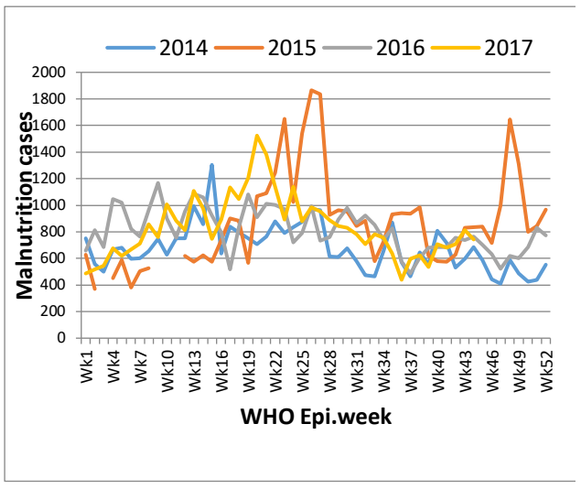


Figure 69:Malnutrition cases trend by week,2014- 2017, SNNPR.

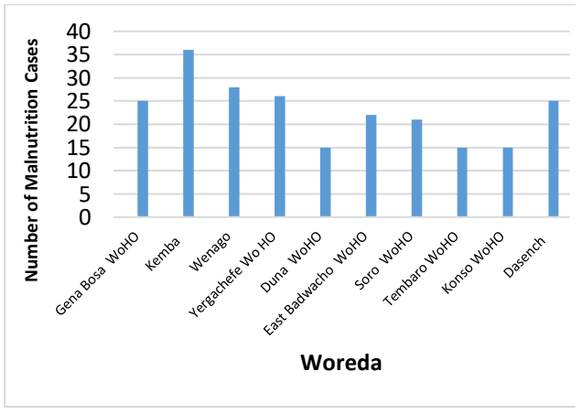


Figure 70: Top 10 Malnutrition reporting woredas,SNNPR,week 44/2017

Epidemic Typhus

A total of 2864 Outpatient Epidemic typhus cases with no death were reported in this week.

Typhoid fever

A total of 8364 (8354 outp and 10 Inpt) typhoid fever cases were reported.

Dysentery

A total of 597 outpatients and 1 in patient dysentery cases with no death were reported from the region in the week.

Scabies

In this week 2,544 scabies cases were reported from the region.

Table 2: Top ten Scabies reporting woredas, SNNPR, Week 44/2017.

Zone	Woreda	Number of cases
Hadiya	Anne Lemo	62
G/Gofa	Arbaminch zuria	235
Hadiya	East Badwacho	207
Hadiya	Gibe	268
Wolayita	Boditi	89
Hadiya	Lemo	185
Wolayita	Damot Gale	387
Hadiya	Shashego	511
Kembata	Sheshicho	284
Wolayita	Offa	90

6. Recommendation

- The overall completeness and timeliness rate of the region is good and needs to be maintained.
- Regular monitoring and follow up of zones and woredas achieving completeness below minimum requirement and not sending report is needed.
- Malaria and malnutrition prevention and control activities needs strengthening as cases have increased week to week.
- Scabies outbreak control and prevention activities need strengthening as cases are still increasing.
- As line list is very important for action at National level; line list of any outbreak should be sent to National level for prompt action.
- Laboratory for measles cases from Aleta wondo hospital should be taken and sent to EPHI.

List of Annexes

Annex 1: Questionnaires for Case - control study on Measles outbreak Somali Region, October 2018

Patient Name_____ Respondent Status: A. Case B. Control

Date of data collection_____ Region_____ Zone_____

Woreda_____ Kebele _____ Got _____ Phone_____

Location: Longitude: _____ Latitude: _____

I. Socio-demographic Characteristics

S.No.	Questions	Alternatives
1.1	Sex	1. Male 2. Female
1.2	Age	years_____ Months_____
1.3	Occupation of the patient	1. Farmer 5. Daily laborer 2. House wife 6. Merchant 3. Student 7. Gov't employee 4. Unemployed 8. Other (specify)_____
1.4	Family Occupation	1. Farmer 5. Daily laborer 2. House wife 6. Merchant 3. Student 7. Gov't employee 4. Unemployed 8. Other (specify)_____
1.5	Educational level of the patient	1. Illiterate 4. Secondary 2. Read and write 5. Above secondary 3. Elementary 6. Under school age
1.6	Educational level of the family	1. Illiterate 4. Secondary 2. Read and write 5. Above secondary 3. Elementary
1.7	Marital status of the patient	1. Single 4. Widowed 2. Married 3. Divorced
1.8	Family size	_____
1.9	Is there any sick person with rash, fever, running nose In the family?	1. Yes 2. No
1.10	If yes, number of sick person	

II. Clinical History of Diseases:

2.1	What was the symptom?	1. fever 2.Rash 3.cough 4.coryza (runny nose), 5. Conjunctivitis (red eyes) 6. Others_____
2.2	ONLY if complication	a) Pneumonia: 1. yes 2. no b) Cornea: 1. yes 2. no c) Blindness: 1. yes 2. no d) Convolution 1. Yes 2. no e) Otitis media (ear discharge): 1. yes 2. no f) Diarrhea: 1. yes 2. no g) Feeding problem 1. Yes 2. no
2.3	Date of onset of rash	_____/____/_____
2.4	Duration of rash_____	
2.5	Date seen at health facility	____/_____/____
2.6	Illness duration before visiting the health facility	_____in days/hours
2.7	Did you (he/she) take treatment?	1.Yes 2.No
2.8	If yes, treatment taken	1. ORS 5. TTC ointment 6.Anti pyretics 7.Others given_____

		2.Antibiotics 3.Vitamin A 4.Supplementary food
2.9	Did you recovered after the treatment?	1.cure 2. partially 3. deteriorated/disabled 4.death

III. Risk factor

3.1	Did you ever vaccinated for measles?	1. Yes 2. No 3. Unknown 4. Not applicable
	Is there vaccination card	1. Yes 2. No
	If yes last vaccination date	1.patient recall____/____/____ dd/mm/yy 2. Vaccination card____/____/____dd/mm/yy 3. I don't remember
3.2	Number of vaccine doses received	1.Zero dose 2. one dose 3. two and above
3.3	Age at first vaccination.	_____
3.4	If not vaccinated why?	1. lack of knowledge about vaccination campaign, 2. absence during vaccination campaign, 3. Religious exemptions 4. other, specify
3.5	Did you have any travel history 7-18 days to areas with active measles cases before onset of symptoms?	1.Yes 2.No
	If Yes, (where) place of travel	1.School 3.Market 2.Neighbor 4.Other_____
3.6	Did you contact with a person with measles symptoms within the last 2- 3 weeks?	1.Yes 2.No
3.7	Do you have any travel history four days before and after rash onset	1.Yes 2.No If Yes where _____
3.8	Do you have any contact history with someone else four days before and after rash onset	1.Yes 2.No If Yes with whom _____
3.9	Do you know modes of transmission for measles?	1. Yes 2. No 3. If yes specify_____
3.10	Nutritional status of the cases/control	1. Normal 3.Severely malnourished 2. Moderate
3.11	What is the estimated area of the house?	_____
3.12	House condition?	1. ventilated 2. not-ventilated
3.13	Distance from house to HC?	1.greater than 5 km 2. equal or less than 5 km
3.14	Where did you go first when you get ill?	1. Health Facility 2. Traditional Healers 3. Holy Water 4. Stayed at home

		5. Other :(Specify)_____
3.15	How do you think people get measles?	1. Contact with a virus from ill person 2. From God 3. Bad attitude of other people 4. Other(Specify)
3.16	Do you Know measles is vaccine preventable?	1. Yes 2. No 3. Don't Know
3.17	Who do you think can be affected by measles?	1. Children of aged less than 5 years 2. Children of aged less than 18 years 3. Women of any ages 4. Any age groups of both male and women 5. Other (specify):_____
3.18	How do you think measles can be cured?	1. Using modern medicine 2. Using traditional Medicine 3. Holy water 4. By feeding nutritious foods 5. Keeping the sick person indoor 6. Other(Specify)_____

Annex 2: Surveillance System EVALUATION Data Collection Tool

Date of Interview: ----/------/------Region ----------Woreda----------

Interviewer: ---------- Interviewee: ----------

Responsibility: ---------- contact Address----------

I. DISTRICT (WOREDA) LEVEL QUESTIONNAIRE

Availability of national surveillance manual

1. Is there national guideline for PHEM at this site?

1. Yes 2. No 3. Unknown 4. Not Applicable

2. Does the district have line list, epidemic reporting form, and rumor log book?

1. Yes 2. No 3. Unknown 4. Not Applicable

Case detection and registration

1. Do you have Integrated case search form?

1. Yes 2. No 3.Unknown 4.Not applicable

2. Do you have rumor register form at facility level?

1. Yes 2.No 3.Unknown 4.Not applicable

3. Do you have case management procedure form?

1. Yes 2.No 3.Unknown 4.Not applicable

4. Do you have SOP for overall GWD surveillance and case management?

1. Yes 2.No 3.Unknown 4.Not applicable

Data reporting:

1. Have you lacked of forms recommended for the country at any time during the last 6 months?

1. Yes 2. No 3. Unknown 4. Not applicable

2. Number of reports received in the last 3 months compared to expected number

Weekly: _____ /12 times the number of health facilities

Immediately: _____/----- times the number of health facilities. On time (use national deadlines)

3. Number of weekly reports submitted on time: ____/12 times the number of health facilities 4. Number of immediately reports submitted on time: _____/3 times the number of health facilities

4. How do you report in case you found cases (Multiple answers are possible):

1. Mail 2. Telephone 3. Fax 4. Electronic

5. Radio 6. Others (specify)……..

5. How can reporting be improved?

_____

_____

Data Analysis:

1. Percent of sites that: Describe data by person, time and place (case based, outbreaks, and Sentinel)

1. Yes 2.No 3.Unknown 4.Not applicable

2. Do you have an action threshold for any of the country priority diseases?

1. Yes 2.No 3.Unknown 4. Not applicable

3. If yes, what is it? _____cases _____% increase _____rate

_____

4. Do you have appropriate denominators? Observe presence of demographic data at site (E.g. Population <5 yr., population by village)

1. Yes 2.No 3.Unknown 4.Not applicable

5. Who is responsible for data analysis? _____

6. How often do you analyze the collected data?

1. Daily 3. Every two weeks
2. Weekly 4.Monthly
5. Quarterly 6. As needed

Outbreak investigation:

1. Number of outbreaks suspected in the past 6 months: _____
2. Observe: Of those, number investigated (Observe reports and take copies if possible): _____
3. Has your district ever investigated an outbreak?

1. Yes 2.No 3.Unknown 4.Not applicable

Epidemic Preparedness

4. Existence of epidemic preparedness and response plan at district level

1. Yes 2.No 3.Unknown 4. Not applicable

5. Do the districts have written plan of epidemic preparedness and response

1. Yes 2.No 3.Unknown 4. Not applicable

6. Has the district had emergency stocks of drugs and supplies at all times in past 1 year?

1. Yes 2.No 3.Unknown 4. Not applicable

7. Has the district experienced shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)?

1. Yes 2. No 3.Unknown 4. Not applicable

8. Is there budget line or access to funds for epidemic response?

1. Yes 2. No 3.Unknown 4.Not applicable

9. Percent of districts that have an epidemic management committee

Observation: Observe minutes (or reports) of meetings of epidemic management committee

1. Yes 2.No 3.Unknown 4.Not applicable

10. Does the district have rapid response team for epidemics?

1. Yes 2. No 3.Unknown 4. Not applicable

Responses:

1. Has the district implemented prevention and control measures based on local data for at least one reportable disease or syndrome?

1. Yes 2.No 3.Unknown 4.Not applicable

2. Does the district responded within 48 hours of notification of most recently reported outbreak (From written reports)

1. Yes 2.No 3.Unknown 4.Not applicable

3. Has epidemic management committee evaluated their preparedness and response activities during the past year? (Observe written report to confirm)

1. Yes 2.No 3.Unknown 4.Not applicable

Feedback:

1. Is there written feedback reports has the district produced in the last one year?

1. Yes 2.No 3.Unknown 4.Not applicable

2. How many feedback bulletin or reports has the district received in the last year? _____

3. Supervision_____

4. How many times have you been supervised in the last 6 months?

5. How many supervisory visits have you made in the last 6 months? _____

(Obtain required number of visits from central level)_____

6. The most usual reasons for not making all required supervisory visits.

Reason 1_____

Training

7. Percent of health personnel (in position of responsibility) trained in disease surveillance

8. Have you been trained on disease surveillance?

1. Yes 2.No 3.Unknown 4.Not applicable

9. If yes, specify when, where, how long, by whom?

_____

10 .What percent of your personnel in the district have been trained in surveillance and epidemic management? _____

Resources:

Percent of sites that have:

1. Logistics

1. Electricity 2. Bicycles 3.Motor cycles 4. Vehicles

2. Data management

1. Stationary 2. Calculator 3. Computer 4. Printer

3. Communication

1. Telephone service 3. Fax

2. Radio 4.Computers that has modems

4. Information Education and Communication materials

1. Posters 2. Megaphone 3. Generator 4. Screen

5. Projector (Movie) 6. Others (specify):_____

5. Hygiene and sanitation materials

1. Spray pump 2.Disinfectant

6. Surveillance coordination: _____

7. Is there a surveillance co-ordination focal point within the district epidemic management committee?

8. Are you satisfied with the surveillance system?

1. Yes 2.No 3.Unknown 4.Not applicable

9. If no, how can the surveillance system be improved?

_____

10. Prevention and control activities conducted towards GWD

_____

_____

_____

List of surveillance attributes

List of attributes measure		scale of measurement				
1. SIMPLICITY		Strongly Agree(5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree(1)
1.1	Case definition for GWD is easy to apply					
1.2	Special training is required to collect and interpret data					
1.3	GWD surveillance is time taking					
1.4	GWD data is easy to manage during entry, storing and back up					
1.5	GWD need continues follow up					
1.6	GWD data collection is easy to conduct					
1.7	sending report to next level is easy					
2. Flexibility						
2.1	Do the system for GWD permit for additional questions in the format					
2.2	GWD data can be used in electronic system					
2.3	GWD is integrated well in PHEM system					
2.4	GWD case definition is suitable for any individual to report					
3. Acceptability						
3.1	Health professional are comfortable to participate in GWD surveillance system					
3.2	Health professional comfortable in assigned to participate in active case search for GWD					
3.3	Health professional work in together in developing work plan					
3.4	All stake holder participate on system					
3.5	All concerned body report continues and regular way					

4. sensitivity						
4.1	GWD surveillance system can monitor the change over time					
4.2	The current GWD case definition can easily capture GWD at community level					
4.3	Case definition at community level encourage to report					
5. Predictive value positive.						
5.1	Reported GWD cases are actually case					
6. Representativeness						
6.1	GWD system tell distribution Of disease by place, time and person.					
6.2	Notified GWDs cases represent the cases in the community					
7. Timeless						
7.1	All GWD cases were reported to next level within the standard national timeline					
7.2	All notified GWDs cases were investigated within the standard national timeline					
7.3	GWD data is always ready when we need it for planning purposes					

List of attributes measure		scale of measurement				
8. Stability		Strongly Agree(5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree(1)
8.1	The system is not costly as compared to the current benefit we gain from it					
8.2	The system have the ability to collect, manage and provide data properly without failure					
8.3	The system have ability to be operational when it is needed					
9. Usefulness						
9.1	The current system has an ability to estimate GWD in the facility /community					
9.2	The current system has an ability to show the trend of GWD in the facility/community					
9.3	The current system has an ability to show the progress and effect of preventive and control methods applied against GWD					
9.4	The current system has an ability to indicate major causes of GWD in the health facility/community					
9.5	The current system has an ability to help the health facilities to improve clinical and ethical practices					
9.6	The system have ability to stimulate research by providing hypothesis					

II. FACILITY LEVEL /HEALTH CENTER & HOSPITAL/ QUESTIONNAIRE

Date of interview: -----/------/---------Region----------Zone _____

Woreda---------- Name of Health Center/HSP----------

Interviewer: ---------- Interviewee: ----------Responsibility: ----------
contact address ----------

Availability of a national surveillance manual

1. Is there national manual for surveillance and GWD at this site?

1. Yes 2.No 3.Unknown 4.Not applicable

Case detection and registration

2. Do you have Integrated case search form?

1. Yes 2. No 3.Unknown 4.Not applicable

3. Do you have rumor register form at facility level?

1. Yes 2.No 3.Unknown 4.Not applicable

4. Do you have case management procedure form?

1. Yes 2.No 3.Unknown 4.Not applicable

5. Do you have SOP for overall GWD surveillance and case management?

1. Yes 2.No 3.Unknown 4.Not applicable

6. Percent of health facilities that correctly register cases filling of the clinical register during the previous 30 days

1. Yes 2.No 3.Unknown 4.Not applicable

7. Do you have a standard case definition for: GWD?

1. Yes 2.No 3.Unknown 4.Not applicable

Data reporting

8. Have you faced lack appropriate surveillance forms at any time during the last 6 months?

1. Yes 2.No 3. Unknown 4.Not applicable

9. Is the last monthly report agreed with the register for GW diseases; major public health importance Observation: GWD

1. Yes 2.No 3.Unknown 4.Not applicable

10. Percent of sites that reported each reporting period to the next higher level during the past 3 months Number of reports in the last 3 months compared to expected number

Observe Weekly: _____/12 times the number of sites

Observe immediately: _____ /12 times the number of sites

11. on time (use national deadlines)

Observe: Number of weekly reports submitted on time:-_____ /12 times the number of sites
Observe: Number of immediately reports submitted on time: ___/12 times the number of sites

12. How do you report?

1. Mail 2. Fax 3. Telephone 4. Radio

5. Electronic 6.Other (specify):_____

Strengthening reporting

How can reporting be improved?

Data analysis

Percent of sites that:

5. Describe data by person, place and time----------

16. Do you have an action threshold for any of the Country priority diseases?

1. Yes 2.No 3.Unknown 4. Not applicable

17. If yes, what is it (Ask for malaria diseases)? _____cases ____ % increase _____rate

18. Who is responsible for data analysis? _____

19. How often do you analyze the collected data?

1. Daily 2. Weekly 3. Every 2 weeks

4. Monthly 5. Quarterly 6. As needed…

20. Do you have appropriate denominators? Observe demographic data at site

(E.g. population <5 yr., population by village, total population)

1. Yes 2.No 3.Unknown 4.Not applicable

Epidemic preparedness and response

21. Is there written case management protocol for malaria epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

22. Has the health facility implemented prevention and control measures based on local data for at least one epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

Feedback and supervision

23. How many feedback bulletins or reports has the health facility received in the last one year?

_____

24. How many meetings has this health facility conducted with the community members in the past six months? _____

25. How many times have you been supervised in the last 6 months? _____

Training:

26. Have you been trained in disease surveillance and epidemic management?

1. Yes 2. No

27. Prevention and control activities conducted towards GWD

_____

_____

List of surveillance attributes

List of attributes measure		scale of measurement				
1. **SIMPLICITY**		Strongly Agree(5)	Agree(4)	Neutral(3)	Disagree(2)	Strongly Disagree(1)
1.1	Case definition for GWD is easy to apply					
1.2	Special training is required to collect and interpret data					
1.3	GWD surveillance is time taking					
1.4	GWD data is easy to manage during entry ,storing and back up					
1.5	GWD need continues follow up					
1.6	GWD data collection is easy to conduct					
1.7	sending report to next level is easy					
2. Flexibility						
2.1	Do the system for GWD permit for additional questions in the format					
2.2	GWD data can be used in electronic system					
2.3	GWD is integrated well in PHEM system					
2.4	GWD case definition is suitable for any individual to report					
3. Acceptability						
3.1	Health professional are comfortable to participate in GWD surveillance system					
3.2	Health professional comfortable in assigned to participate in active case search for GWD					
3.3	Health professional work in together in developing work plan					
3.4	All stake holder participate on system					
3.5	All concerned body report continues and regular way					

List of attributes measure		scale of measurement				
4. sensitivity		Strongly Agree(5)	Agree(4)	Neutral(3)	Disagree(2)	Strongly Disagree(1)
4.1	GWD surveillance system can monitor the change over time					
4.2	The current GWD case definition can easily capture GWD at community level					
4.3	Case definition at community level encourage to report					
5. Predictive value positive.						
5.1	Reported GWD cases are actually cases					
6. Representativeness						

6.1	GWD system tell distribution of disease by place, time and person.					
6.2	Notified GWDs cases represent the cases in the community					
7. Timeless						
7.1	All GWD cases were reported to next level within the standard national timeline					
7.2	All notified GWDs cases were investigated within the standard national timeline					
7.3	GWD data is always ready when we need it for planning purposes					

List of attributes measure		scale of measurement				
8. Stability		Strongly Agree(5)	Agree (4)	Neutral (3)	Disagree (2)	Strongly Disagree(1)
8.1	The system is not costly as compared to the current benefit we gain from it					
8.2	The system have the ability to collect, manage and provide data properly without failure					
8.3	The system have ability to be operational when it is needed					
9. Usefulness						
9.1	The current system has an ability to estimate GWD in the facility /community					
9.2	The current system has an ability to show the trend of GWD in the facility/community					
9.3	The current system has an ability to show the progress and effect of preventive and control methods applied against GWD					
9.4	The current system has an ability to indicate major causes of GWD in the health facility/community					
9.5	The current system has an ability to help the health facilities to improve clinical and ethical practices					
9.6	The system have ability to stimulate research by providing hypothesis					

III. HEALTH POST LEVEL QUESTIONNARE

Date of Interview: ----/-----/-------Region ----------Woreda ----------

Name of Health Post: ---------- Interviewer: ---------- Interviewee: ----------

Responsibility: ----------

Availability of National surveillance Manual

1. Is there national manual for GWD surveillance at this site?

1. Yes 2.No 3.Unknown 4.Not applicable

Case detection and registration

2. Do you have GWD Integrated case search form?

1. Yes 2. No 3.Unknown 4.Not applicable

3. Do you have GWD rumor register form at facility level?

1. Yes 2.No 3.Unknown 4.Not applicable

4. Do you have GWD case management procedure form?

1. Yes 2.No 3.Unknown 4.Not applicable

5. Do you have standard case definition for GWD?

1. Yes 2.No 3.Unknown 4.Not applicable

Data reporting

4. Have you faced lack of appropriate surveillance forms at any time during the last 6 months?

1. Yes 2. No 3. Unknown 4. Not applicable

5. Percent of sites that is accurately reported cases from the registry into the summary report to go to higher level? _____

6. Percent of sites that reported each reporting period to the next higher level during the past 3 months Number of reports in the last 3 months compared to expected number Observe Weekly:

Observe Immediately:

7. Percent of HF that have means for reporting to next level by e-mail, telephone, fax or radio?

_____

8. How do you report?

1. E-mail 2.Fax 3. Telephone 4. Radio 5. Electronic 6. Other (specify):_____

Data analysis

9. Performing trend analysis observed line graph of cases by time

1. Yes 2.No 3.Unknown 4.Not

Epidemic response

10. Has the health facility implemented prevention and control measures based on local data for at least one epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

Feedback and supervision

11. How many feedback bulletins or reports has the health facility received in the last year? _____

12. How many meetings has this health facility conducted with the community members in the past six months? _____

13. How many times have you been supervised in the last 6 months? _____

Training

14. Have you been trained in disease surveillance and epidemic management?

1. Yes 2.No 3.Unknown 4.Not applicable

15. If yes, specify when, where, how long, by whom? _____

Resources

Percent of sites that have:

16. Logistics

1. Electricity 2. Bicycles 3. Motor cycles 4. Vehicles

17. Data management

1. Stationery 2. Calculator 3.Computer 4. Printer

18. Communications

1. Telephone service 2.Radio call 3. Fax 4. Computers with modems

19. Information education and communication materials

1. Posters 2. Megaphone 3. Flipcharts or Image box 4.Screen

5. Projector (Movie) 6. Other (specify):_____

20. Hygiene and sanitation materials

1. Spray pump 2. Disinfectant

21. List protection materials _____ _____ _____

_____

Satisfaction with surveillance system

22. Are you satisfied with the surveillance system?

1. Yes 2.No 3.Unknown 4.Not

23. If no, how can the surveillance system be improved? _____

_____

What opportunities are there for integration of surveillance activities?

_____

_____

_____

24. Prevention and control activities conducted towards GWD -

_____

_____

_____

List of surveillance attributes

List of attributes measure		scale of measurement				
1. SIMPLICITY		Strongly Agree(5)	Agree(4)	Neutral (3)	Disagree (2)	Strongly Disagree(1)
1.1	Case definition for GWD is easy to apply					
1.2	Special training is required to collect and interpret data					
1.3	GWD surveillance is time taking					
1.4	GWD data is easy to manage during entry ,storing and back up					
1.5	GWD need continues follow up					
1.6	GWD data collection is easy to conduct					

1.7	sending report to next level is easy					
2. Flexibility						
2.1	Do the system for GWD permit for additional questions in the format					
2.2	GWD data can be used in electronic system					
2.3	GWD is integrated well in PHEM system					
2.4	GWD case definition is suitable for any individual to report					
3. Acceptability						
3.1	Health professional are comfortable to participate in GWD surveillance system					
3.2	Health professional comfortable in assigned to participate in active case search for GWD					
3.3	Health professional work in together in developing work plan					
3.4	All stake holder participate on system					
3.5	All concerned body report continues and regular way					

List of attributes measure		scale of measurement				
4. sensitivity		Strongly Agree(5)	Agree(4)	Neutral(3)	Disagree(2)	Strongly Disagree(1)
4.1	GWD surveillance system can monitor the change over time					
4.2	The current GWD case definition can easily capture GWD at community level					
4.3	Case definition at community level encourage to report					
5. Predictive value positive.						
5.1	Reported GWD cases are actually cases					
6. Representativeness						
6.1	GWD system tell distribution of disease by place, time and person.					
6.2	Notified GWDs cases represent the cases in the community					
7. Timeless						
7.1	All GWD cases were reported to next level within the standard national timeline					
7.2	All notified GWDs cases were investigated within the standard national timeline					
7.3	GWD data is always ready when we need it for planning purposes					

List of attributes measure		scale of measurement				
8. Stability		Strongly Agree(5)	Agree(4)	Neutral(3)	Disagree(2)	Strongly Disagree(1)
8.1	The system is not costly as compared to the current benefit we gain from it					
8.2	The system have the ability to collect, manage and provide data properly without failure					
8.3	The system have ability to be operational when it is needed					
9. Usefulness						
9.1	The current system has an ability to estimate GWD in the facility /community					
9.2	The current system has an ability to show the trend of GWD in the facility/community					
9.3	The current system has an ability to show the progress and effect of preventive and control methods applied against GWD					
9.4	The current system has an ability to indicate major causes of GWD in the health facility/community					
9.5	The current system has an ability to help the health facilities to improve clinical and ethical practices					
9.6	The system have ability to stimulate research by providing hypothesis					

Annex 3: Data Collection Tool for Health Profile Description, January, 2018.

Name of the data collector: ----------

Date: ----------Respondent name(s):----------

1. **Historical Aspects of the area (only if relevant)**

Woreda Name_____

When was the woreda established_____?

How & why the name given_____

Any other historical aspect_____

_____

2. Geography and Climate (including map, altitudes, agro ecological zones etc…)

- Location _____ _____ _____
- Location (distance from AA) _____Direction _____
- Altitude _____
- Mean annual rain fall_____
- Mean annual temperature in 0C _____
- Surface Area _____(_____% from the zone)
- Town _____rural _____(land)
- Geographical coordinate
  - ✓ Latitude _____Longitude _____
  - ✓ Annual rain fall(Max and min)_____Annual temp(average)_____
  - ✓ Climatic zones_____ (Highland %) _____ (Midland %) _____ (Lowland %)
- The major crops in the area _____, _____, _____
- Main food crops of the area_____, _____, _____

3. Political and Administrative Organization

- No of Kebeles----------Urban----------Rural----------
- Nearest Kebele ---------- (---------Km from the Woreda center)
- Remote Kebele---------- (----------km from the Woreda center)
- List their names _____
- _____
- Woreda boundary

North ----------South----------East----------West----------

4. Population and population structures

- Total population_____ Total HHs ----------
- Population by Kebele ----------
- Male _____Female _____
- Under 1yrs _____Under 5yrs------,5-14_____, 15-24_____, 25-34_____, 35-44____, 45-54_____, 55-64_____, >64_____
- Women of childbearing age (15-49years) ---------, pregnant women -------
- Sex ratios_____ urban_____ rural_____
- **Ethnic composition** _____, _____, _____
- Languages of the district----------, ----------,----------
- Official language (Work language) ----------
- **Religion** – Orthodox--------- (%), Muslim-------- (%), Protestant---------- (%) catholic ------- (%), others------- (%).

5. **Economy (mainstay of the economy, average income levels etc)**

- **Main income sources**
  - ✓ Agriculture
    - Cultivated area_____
    - Grazing area_____
    - Cropping seasons_____

- Land density_____
- ✓ Livestock
- ✓ Tourism
- ✓ Trade
- ✓ Other business

Average income/year_____ Source

- **Economic status**

High----------Low----------Medium---------- other
Productivity----------

6. Education

6.1. Total number of schools ---------Gov. ----------NGOs --------- Private Schools--------

KG: Gov. ----------NGO----------Private Schools----------Total
Primary: Gov. ---------- NGO----------Private Schools---------- Total
Secondary: Gov. ---------- -NGO---------- Private Schools---------- Total
Preparatory: Gov. ---------- NGO---------- Private Schools----------Total
TVET_____
College/ University_____
6.2 Enrollment
Total School Age Children (target) _____
KG : M----------F---------Total-------
Primary: M---------- F--------Total--------
Secondary: M--------- F--------Total---------
Preparatory: M--------- F--------Total----------
Total: M----------F--------Grand Total-------
Students with disability M------F--------Total--------
Number of teacher in the district_____Male_____Female_____
6.3. School distribution by Kebele----------
6.4. Number of Schools with access to water ----------
6.5. Reasons for absence of water for certain schools----------
6.6. Types of School clubs Available (Number & Name)
6.7. School clubs (activities) other than education and their major and current functionalities.
A.
B.
C.
6.8. Schools access to road----------Access to Tel. ----------Access to electricity (Main and/ or Generator Supply) --------
6.9. Literacy status Literate (%) ---------- can read and write (%) ---------, Illiterate (%) -------6.10. Schools with Access to Latrine Facility:
A. One Block Latrine for the school as a whole:
B. Two Block Latrine for Male & Female Separated:
C. No Latrine at all:
6.11. Total Dropout (Total Registered during the year - Total Completed) =----------
6.12. Total Dropout rate----------
6.13. Proportion of Female dropout rate----------
6.14. Possible reasons for dropout ----------

7. Facilities (Transport, Telecommunication, Power supply)

Woreda health structure

7.1 Total number of health facilities in the district (Gov., NGOs, Private) ----------
Gov. ----------NGOs ----------Private----------
HSP ----------, HSP/Pop ratio--------- -------
HCs ----------, HC/ Pop ratio--------- --------
HPs ----------, HP/Pop ratio--------- --------
7.2 How many of the health centers have access to:
Transportation_____ (%), telecommunication---------- (%), Electricity_____ (%)
Safe water supply _____ (%)
7.3 How many HPs have access to transport-------, telephone---------- power --------- water ------?

7.4 How many functional ambulances do you have in the woreda? ----------.
7.5 Is there any health facility without ambulance service? A, Yes B. No
7.6 If yes, how many----------
7.7 Reason for absence----------

8. Water Sources

8.1. Types of available Water Sources: ----------, ----------, ----------
8.2. Number of Water schemes Constructed during 2009 E.C: ----------
8.3. Number of functional water schemes during the year----------
8.4. Number of non-functional water schemes during the year----------
8.5. Reason for non-functionality----------
8.6. Average cost needed per Water scheme for construction: ----------
8.7. Average service year/duration of one Water scheme: --------
8.8. Number of Kebeles with Protected water supply source: (Lists of these Kebeles) ----------
---
8.9. Safe water supply coverage of the Woreda during 2009 E.C:----------
8.10. What are the Water sources of population uncovered in the supply? ----------
---
8.11. Possible reasons for the shortage of water----------

9. Vital Statistics and Health Indicators

9.1 Infant Mortality Rate----------Child Mortality Rate----------
9.2 Crude Birth Rate----------Crude Death Rate----------
9.3 Maternal Mortality Rate----------Contraceptive Prevalence rate_____
9.4 Total live Births_____ Total still births_____ Total neonatal deaths_____
9.5 Contraceptive Prevalence rate _____Contraceptive acceptance rate _____

9.6. ANC coverage----------

- ANC rate (how many of the total expected pregnancies attended 1st ANC) _____
- ANC rate (how many of the total expected pregnancies attended 4th ANC) _____
- Delivery coverage----------
- Percentage of deliveries attended by skilled birth attendants_____
- Percentage of deliveries attended by HEWs_____
- Percentage of deliveries attended by TBA _____
- PNC coverage ----------

9.7 Immunization Coverage (for children and Women);

- ✓ BCG _____ (__ %).
- ✓ OPV0____ (____ %), OPV1_____ (___ %), OPV3_____ (___ %)
- ✓ Penta1_____ (___ %), penta2 _____ (___ %) penta3_____ (___ %)
- ✓ Measles_____ (___ %).
- ✓ PCV-1_____ (__ %), PCV-2_____ (___ %), PCV-3_____ (___ %),
- ✓ TT coverage_____
- ✓ TT2+P.W_____ (__ %),
- ✓ TT2+ N.P.W_____ (___ %)

9.8 Health staff to population ratio for each profession (calculate)
# of Specialists_____# of GP_____
Of HO _____, # of Nurses (Dep. Vs Deg.)_____, # of Midwifes Dep. Vs Deg.)_____
Of Medical lab. (Dep. Vs Deg.)_____, # of Pharmacist &druggist_____, Env'tal heath professional_____,
Of HEWs, rural _____Urban_____

- Doctor: pop. Ratio _____Nurse: pop. Ratio____
- Mid. Wife: pop. Ratio _____HEW: pop. Ratio_____

10. Health Services

Health institution to population ratio_____ Health service coverage: _____

Top 5 and leading causes of OPD visit in adults and children

	Adult	Under 5 years
1		
2		
3		
4		
5		

Health budget allocation:

- **Government**
  - ✓ Annual budget allocated for the woreda(in ETB) _____
  - ✓ Annual budget allocated for health or health institutions _____ (_____ %)
  - ✓ Annual budget allocation increment percent comparing to the previous year_____%
  - ✓ Health budget for emergency condition---------
- **Funds from NGO**
  - ✓ Total _____ (purpose/programs)_____

11. Community Health Services;

Status of services provided by community health workers namely:
# of TBAs/ TTBAs _____
# of CHWs/ Dep't army_____
# of HEWs _____
Other _____

12. Status of Primary Health Care Components – with focus on the eight PHC elements MCH/FP trend 3 or 5years (recent to last) and MDG.

- MCH (Delivery, ANC, PNC)
  _____
- FP(Methods, Contraceptive prevalence rate, Contraceptive acceptance rate _____
- EPI(outreach service, cold chain, vaccine) _____
- Environmental Health & sanitation.
  - ✓ Latrine coverage_____ & utilization rate_____
  - ✓ Solid waste management_____
  - ✓ Liquid waste management _____
- **Endemic diseases;**
  - **Malaria:**
    - ✓ Total malarious kebeles_____ & estimated Pop. at risk_____
    - ✓ ITNs coverage (including current district)_____
    - ✓ Is there IRS this year(No of kebeles)_____HH covered _____population covered_____
    - ✓ Total cases/yr._____ deaths/yr._____,<5yr cases_____ deaths(<5)_____
    - ✓ Malaria supplies (Arthisunate, Quinin, Coartem, RDT, etc.) shortage
      _____
    - ✓ Other issues_____
  - **TB/Leprosy**
    - ✓ Total TB cases_____ PTB negative_____ PTB positive____ Extra PTB _____
      TB detection rate _____ TB Rx completion rate _____TB cure rate _____
      TB Rx success rate _____TB defaulter rate_____
    - ✓ Death on TB Rx_____
    - ✓ Total TB patients screened for HIV_____
    - ✓ Total Leprosy cases _____on Rx_____
  - **HIV/AIDS;**
    - ✓ Total people screened for HIV (last one year)_____
    - ✓ VCT_____ PITC_____PMTCT_____
    - ✓ HIV prevalence_____ HIV Incidence (new cases/yr.)_____
    - ✓ Total PLWHA_____ On ART _____on Pre-ART_____
    - ✓ Other HIV prevention activities_____

- **Nutrition (malnutrition related OTPs, SC,TSF,CBN and PSNP activities)/HO & Early warning**
  - ✓ Total OTP sites_____, total admissions to OTP/yr._____
  - ✓ Total SC sites,_____, Newly opened/yr._____, total admissions to SC/yr_____
  - ✓ Is there TSF (targeted supplementary feeding) program in the woreda_____
  - ✓ CBN program_____ PSNP _____other_____
  - ✓ General food security condition_____
- **Essential drugs/Supplies(shortage):-**
  _____
  _____

13. Disaster situation in the woreda

- Was there any disaster (natural or manmade) in the woreda in the last one year? _____
- Any recent disease outbreak/other public health emergency_____
- If yes cases_____ and deaths_____
- Any recent disease outbreak/ public health emergency_____
- If yes, cases_____ and deaths_____

Annex 4: Questionnaire for Community based Measles vaccination coverage, Hudet district, Somali Region, March 2019.

Respondent's ID._____ Date of data collection____/____/____

Region_____ Zone_____ Woreda_____ Kebele _____

Got _____ Phone_____ Location: Longitude: _____ Latitude: _____

I. Sociodemographic Characteristics		
S.No.	Questions	Alternatives
1.1	Sex of the child	1. Male 2. Female
1.2	Age of the child	years_____Months_____
1.3	Age of respondent/ care taker	_____years
1.4	Religion of respondent/ care taker	1. Orthodox Christian 2. Muslim 3. Protestant 4. other specify
1.5	Occupation of the respondent/ care taker's	1. Farmer 2. House wife 3. Student 4. Retired/on pension 5. Private Skilled worker 6. Unemployed/ job seeker 7. Non-government Employee 8. Daily laborer 9. Merchant 10. Gov't employee 11. Other (specify)_____
1.6	Educational level of the respondent/ care taker	1. Unable to read and write 2. Read and write 3. Primary school (1-8) 4. Secondary school (9-12) 5. College diploma/TVET (any10+) 6. Degree and above 7. Refused
1.7	Marital status of the respondent/ care taker	1. Single 2. Married 3. Divorced/separated 4. Widowed
1.8	Family size	_____
1.9	Who is the head of the Household	1. Husband 2. Wife 3. Other specify_____
1.10	Annual household income	_____ETB
1.11	Residency	1. Urban 2. Rural
1.12	Households distance from the nearest functional health facility.	1. Greater than 5 km or _____minute 2. equal or less than 5 km or _____minute
II. Vaccine Hesitancy Questions		
2.1	Do you believe that vaccines can protect children from serious diseases?	1. Yes 2. No 3. Don't know
2.2	Have you ever refused a vaccination for your child?	1. Yes 2. No
2.3	Do you think it is difficult for some ethnic or religious groups in your community / region to get vaccination for their children?	1. Yes 2. No 3. don't know
2.4	Do religious leaders in your community support vaccines for infants and children?	1. Yes 2. No 3. Don't Know

2.5	Do political/administrative leaders in your community support vaccines for infants and children?	1. Yes 2. No 3. Don't Know
2.6	Do teachers in your community support vaccines for infants and children?	1. Yes 2. No 3. Don't Know
2.7	Do health care workers leaders in your community support vaccines for infants and children?	1. Yes 2. No 3. Don't Know
	III. Vaccination coverage	
3.1	Was the child living here during past one year?	1. Yes 2. No
3.2	Did the child vaccinated for measles?	1. Yes 2. No 3. Unknown
	If yes, is there vaccination card	1. Yes 2. No
3.3	When was the last vaccination date?	1. Respondents' recall____/____/____ 2. Vaccination card____/____/____ 3. I don't remember
3.4	Number of vaccine doses received	1. Zero dose 2. One dose 3. two and above
3.5	Age at first vaccination.	_____months
3.6	If not vaccinated. Why?	1. Lack of knowledge about vaccination 2. Religious exemptions 3. other, specify_____
3.7	Do you Know measles is vaccine preventable?	1. Yes 2. No

Annex 5: Workshop 1 Pre/post-test of EFETP Frontline training

Name of participant: _____Woreda name: _____zone name: _____

Region: _____ Responsibility: _____ Contact address: _____

Instructions: Choose ONE best answer, unless question states otherwise.

_____ 1. Which one of the following statements about the public health surveillance cycle is true?

A. Clinical diagnosis is outside the surveillance cycle
B. Communication is outside the surveillance cycle
C. Action is outside the surveillance cycle
D. The surveillance cycle includes diagnosis, communication, and action

_____2. According to the International Health Regulations, because each country is a sovereign nation, each country can decide which diseases to report to the World Health Organization.

T. True
F. False

_____3. The primary reason to collect timely and high quality surveillance data at the local level is because the data must be reported up to higher levels of the Ministry.

T. True
F. False

_____ 4. Underreporting of surveillance information is a problem in many countries. The one best way to improve reporting is to:

A. Provide a copy of the IDSR Manual to every health care facility
B. Conduct a training session for community workers and clinical staff on the importance of reporting
C. Provide computers and internet access to each facility so they can submit reports electronically Conduct ongoing monitoring and feedback to the facilities

5. **Chikungunya** is a viral disease spread by mosquitoes, characterized by rash, fever and joint pain. Outbreaks have occurred in Africa, Asia, and Europe, and the disease has been spreading globally. The case definition for Chikungunya is as follows:

Suspected case: Any person with rash, acute onset of fever ≥ 38.5 ºC, and severe arthralgia / arthritis (joint pain) not explained by other medical conditions

Confirmed case: A suspected case with laboratory confirmation

For each patient listed in Table 1 below, assign the "Case Classification" as one of the following:

- Not a case
- Suspected case
- Confirmed case

Table 1. Suspected Cluster of Chikungunya, Woreda 9, May 2015

			Symptoms				Lab	
Patient No.	Age (yrs)	Zone	Rash (Y/N)	Highest Temp. (°C)	Arthralgia, Arthritis	Other condition	Confirm. Test	Case Classification
1	54	1	Y	38.5	Severe	N	Not done	
2	31	1	Y	38.3	Severe	N	Pending	
3	61	1	Y	38.8	Severe	N	Y	

_____ 6. In the context of surveillance, Table 1 could best be called a:

A. Line list
B. Spreadsheet
C. Summary surveillance report
D. Two-variable table

_____ 7. What are some consequences of bad data quality? (Choose ALL that apply.)

A. Missed identification of cases or events of public health importance, resulting in more cases
B. Waste of additional program resources in order to correct errors
C. Late or poor reporting to stakeholders
D. Reduced confidence and support for the Woreda Health Authority
E. Misguided policy decisions that could result in additional deaths

Table 2. Number of new confirmed tuberculosis cases at Health Facility A by month, Kolongo, 2015

Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec
0	1	1	2	5	4	3	1	0	1	0	1

_____ 8. Calculate the **median** number of new confirmed tuberculosis cases by month at Health Facility A in 2015.

____ 9. Which measure refers to the number of existing tuberculosis cases in a population, regardless whether the onset was recent or in the distant past?

A. Prevalence
B. Incidence
C. Ratio
D. Rate
E. None of the above

_____ 10. Two (2) of the confirmed tuberculosis cases listed above died from the disease. Calculate the case-fatality rate for tuberculosis cases at Health Facility A in 2015.

_____ 11. The primary reason for preparing and sharing surveillance summary reports on a regular basis is to:

A. Develop a library of reports that can be used as historical reference documents
B. Provide current information on disease occurrence to public health officials responsible for response and to clinicians responsible for diagnosis
C. Document and justify the Ministry of Health budget spent on surveillance
D. Comply with requirements of WHO's International Health Regulations.

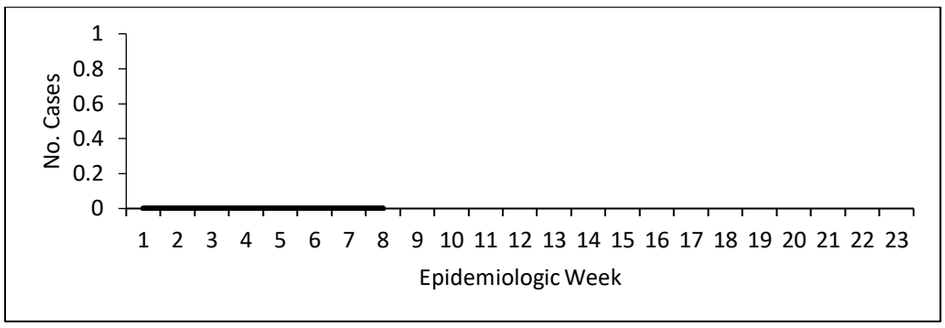


Figure 1. Number of cases of Diarrheal Disease among Children < 5 Years

_____ 12. The title in Figure 1 could be improved by adding what two elements?

_____ 13. In Figure 1, the increased number of cases seen during weeks 21–23 could be the result of: (Choose ALL that apply.)

A. Change in case definition
B. Epidemic
C. Seasonal pattern seen every year
D. Sudden decrease in size of population

14. The table below depicts reporting practices for health facilities in the Western Woreda. Each month, the woreda records whether the surveillance reports from each facility arrive on time, arrive late, or are not received. Use the information above to calculate the timeliness and completeness of reports from reporting sites in the Western Woreda, 2014.

Legend: *T = arrived on time* *L = arrived late* *M = report missing/not received*

Table 2: Health Facility Reporting in the Western Woreda, 2014

Health Facility	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	Timeliness (%)	Completeness (%)
A	T	T	M	L	T	L	L	M	T	T	M	T		
B	T	M	M	T	L	T	T	T	L	T	M	T		

Frontline Field Epidemiology Training Program Workshop 1 Schedule Mekele, November 28- December 03, 2018. Ethiopian Public Health Institute in Collaboration with RHB, WHO and US CDC.

	Day 1	Day 2	Day 3	Day 4	Day 5
08:30-09:00	Registration (Habtamu T & Tesfahun A)	Quiz, Review (Tesfahun A)	Quiz, Review (Tesfahun A)	Quiz, Review (Tesfahun A)	Quiz, Review (Habtamu T & Tesfahun A)
09:00-09:30	Welcoming Note (Getaneh A/Samuel A) Pre-Training Tests (Habtamu T & Tesfahun A) Opening Speech (EPHI/RHB)	Presentation & Discussion on Exercises on Review of Reporting Formats & Case Definitions (Desta B/Ketema M)	Data Presentation (Desta B)	Introduction to MS PPT (Tesfahun A)	Dengue Case Study: C-F (Ketema M/Hanna M)
09:30-10:00	FETP-F Introduction (Tolcha K)				

10:00-10:30	PHEM Introduction (Melaku Seyoum)				
10:30-11:00	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)
11:00-12:00	PH Surveillance/IHR (Melaku Seyoum)	PHEM Data quality (Kisanet T)	Interpreting Data (Ketema M)	Denue Fever Case Study A-B (Hanna M)	Monitoring & Evaluation (Melaku seyoum)
12:00-12:30					
12:30-14:00	LUNCH (Private)	LUNCH (Private)	LUNCH (Private)	LUNCH (Private)	LUNCH (Private)
14:00-14:30	PHEM Data Collection (Samuel A)	Descriptive Statistics and Epidemiology (Melaku Seyoum)	Introduction to MS Excel (Tolcha K)	Denue Fever Case Study A-B Cont ...(Hanna M/Ketema M)	M&E Exercise & Discussion (Kassahun.D/Samuel A)
14:30-15:00	Case Definitions & PHEM Formats: (Desta B)				Project Work 1 Introduction (Tolcha K)
15:00-15:30					Guinea Worm Briefing (Getaneh A)
15:30-16:00	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)	Health Break (Organizers)
16:00-16:30	Exercise and Discussion PHEM Reporting Formats & Case Definitions (Desta B/Ketema M)	Descriptive Statistics and Epidemiology Cont ... (Melaku Seyoum)	Introduction to MS Excel Cont ... (Tolcha K)	Comm & Taking Action (Melaku Seyoum)	Post Test & W1 PE (Habtamu T & Tesfahun A)
16:30-17:00	Review, Wrap up (Habtamu T & Tesfahun A)	Review, Wrap up (Tesfahun A)	Review, Wrap up (Habtamu T & Tesfahun A)	Review, Wrap up (Habtamu T & Tesfahun A)	
Database Mgt	Facilitators	Trainers	Organization	Opening Remark	Closing Remark
Ketema M (G1)	Habtamu Tilahun (G1)	Getaneh Abraha	EPHI-cPHEM	EPHI-cPHEM	EPHI-cPHEM
Kisanet T (G2)	Tesfahun Abiye (G2)	Hanna Mekonnen	EPHI-cPHEM	Tigray RHB-PHEM	Tigray RHB-PHEM
		Wubayehu Kassa	EPHI-cPHEM		
		Ketema Misganaw	EPHI-cPHEM		
		Melaku Seyoum	EPHI-cPHEM		
		Tolcha Kebebew	WHO		
		Samuel Aregai	Tigray RHB		
		Desta Birhane	Tigray RHB		
		Kisanet Tesfay	Tigray RHB		

Declaration

I, the undersigned, declare that this is my original work and has 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.

Name: _____

Signature: _____

Place: _____

Date of Submission: _____

The thesis has been submitted for examination with my approval as a university advisor.

Name of advisor: _____

Signature: _____

Date: _____