Addis Ababa University College of Health Sciences School of Public Health

Ethiopia Field Epidemiology Training Program (EFETP)

Compiled Body of Works in Field Epidemiology

By
Wadu Marshalo Anebo (BPharm)

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

June 2017
Addis Ababa

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Advisors
Wondimu Ayele (MSc, PhD Candidate)
Alemayehu Bekele (MPH, PhD)

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Approval by Examining Board

_____ _____
Chairman, School Graduate Committee

_____ _____
Advisor

_____ _____
Examiner

_____ _____
Examiner

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Abbreviation and Acronyms

AAU	Addis Ababa University
AFI	Acute Febrile Illness
AFP	Acute Flaccid Paralysis
WHO-AFRO	World Health Organization Regional Office for Africa
ANC	Antenatal Care
AOR	Adjusted Odds Ratio
AR	Attack Rate
AWD	Acute Watery Diarrhea
CBN	Community Based Nutrition
CDC	Center for Disease Control
CFR	Case Fatality Rate
CSA	Central Statistics Agency
CSF	Cerebrospinal Fluid
DHS	Demography and Health Survey
DPHP	Disease Prevention and Health Promotion
EC	Ethiopian Calendar
eIDSR	Electronic Integrated Disease surveillance and Response
EPHI	Ethiopian Public Health Institute
EPI	Expanded Preprogram for Immunization
EPRP	Early Preparedness and Response Plan
Epi-Wk	Epidemiological Week
EWR	Early Warning and Response
FDRMFSS	Federal Disaster Risk Management and Food Security Sector
FMOH	Federal Ministry of Health
GC	Gregorian calendar
GO	Governmental Organization
HC	Health Center
HAD	Health Development Army
HEW	Health Extension Worker

HIV	Human Immune Virus
HMIS	Health Management Information System
HP	Health Post
HR	Human Resource
IDSR	Integrated Disease Surveillance and Response
IgM	Immunoglobulin M
IRS	Indoor Residual Spray
IRB	Institutional Review Board
ITNs/LLITNs	Insecticide Treated Nets /Long Lasting ITNs
IRS	Indoor Residual Pray
MDG	Millennium Development Goal
MMR	Maternal Mortality Ratio
NGO	Non-Governmental Organization
NNT	Neonatal Tetanus
OPD	Outpatient Department
OR	Odds Ratio
PCR	Polymerase Chain Reaction
PHCU	Primary Health Care Unit
PHEM	Public Health Emergency Management
RHB	Regional Health Bureau
RRT	Rapid Response Team
SAM	Sever Acute Malnutrition
SIA	Supplementary Immunizations
SNNPR	Southern Nations and Nationalities People Region
UNICEF	United Nation Children's Fund
WHO	World Health Organization

Executive Summary

The Ethiopia Field Epidemiology Training Program (EFETP) started in 2009. The EFETP is an in-service training program in field epidemiology adapted from United States Center for Disease Control and prevention (CDC) Epidemic Intelligence Service (EIS) program. The EFETP has two main components, 25% a classroom learning and 75% practical attachments or field base components, which contribute the award of the Master degree.

During my field base attachment, I conducted on outbreak investigations, surveillance data analysis, surveillance system evaluation, district health profile description, participating in disaster situation analysis, writing a project proposal development, abstracts writing for scientific conference, peer review journal writing, public surveillance training and preparing weekly bulletin for regional PHEM. I produced outputs that are compiled in this Body of Work.

Outbreak Investigation I-1: Measles Outbreak in Konta special district, Southern Nation Nationalities and Peoples Region, Ethiopia, from February 22 to March 20, 2016. We identified 1068 cases (AR = 926 cases per 100,000 population) and 115 deaths (CFR=10.77%) with 6 IgM+ measles cases. The case-control study revealed persons who were vaccinated for measles before were 68.63% less likely to develop measles disease as compared to non-vaccinated persons (AOR = 0.31; 95% CI = 0.12, 0.83 with p-value = 0.0203). The odds of being a case of measles were 5.53 times more likely among those who were living with cases of measles than those who did not (AOR=5.53; 95% CI = 2.51, 12.13 with p-value 0.000001). Malnourished children had 3.51 times more likely suspected to develop measles (AOR = 3.51, 95% CI = 1.46, 8.44 with the p-value of 0.0051) as compared to normal children.

Outbreak Investigation I-2: We conducted an epidemic of leg swelling of unknown etiology in Mizan prison, Bench Maji Zone, Southern Nations, Nationalities and Peoples Region, Ethiopia, from October 26 to November 19, 2016. We identified 116 suspect cases with leg swelling of unclear etiology. Eight of the suspect cases were examined senior clinicians and 7 met clinical criteria for scurvy. Three cases had non-detectable levels of vitamin C in their blood. Eleven deaths were identified. The attack rate for the prison was 4.2%, and the case fatality rate was 9.5%. Clinical confirmed cases had symptoms of fatigue, myalgias, arthralgia and signs of

follicular hyperkeratosis, petechiae, peripheral edema, and/or oral lesions. All clinical confirmed and 16 suspected cases had severe anemia with hemoglobin <8g/dl. Regular consumption of fruits prior to imprisonment,(OR = 0.40,(95% CI;0.23 - 0.69)), and consumption of fruits or vegetables while in prison were protective of disease (OR = 0.122; 95% CI = 0.024-0.628)**.** Prior consumption of alcohol (OR = 2.86,(95%CI: 1.21 – 6.78); use of tobacco (OR = 2.47,(95%CI: 1.33 - 4.61)); and history of a chronic illness (AOR: 4.42,(95%CI: 2.02 – 9.66)) were risk factors for developing leg swelling.

Surveillance Data Analysis Report II: Five years (2012 - 2016) Measles surveillance data of SNNPR was analyzed. From 2012 to 2016, the region reported 13,178 (AR=15/100,000 population) both lab confirmed and epidemiological linked Measles cases with 157 deaths (CFR=1.19%). Of them, 3,370 (25.6%) cases reported through case-based reporting and others reported via line list. About 7,841 (59.5%) with AR=267/100,000 under 5 children and 12,389 (94%) with AR=138 per 100,000 under 15 population and above 15 years contributed only 789 (AR=11 per 100,000) measles cases. About 6780 (51.3%) and 6418 (48.7%) of the total cases were males and females respectively. In 2014, about 3046 (88.7%) of the total cases was under five children. Age specific incidence was highest for under five years in 2014, about 137 per 100,000 population. About 5323 (40%) out of total cases were not vaccinated for measles and 2957 (22%) cases had not valid measles vaccination history provided that routine measles vaccination coverage reached 98.2%. In 2015/16, totally 18 confirmed measles outbreaks occurred in six Zones and one special Woreda in the region. One hundred thirty four kebeles affected by these confirmed measles outbreak.

Evaluation of Surveillance System III: The public health surveillance system is evaluated to ensure that problem of public health importance are being monitored efficiently and effectively. Therefore, we conducted evaluation of Wolaita zone maternal death (MDSR), Measles and AFP surveillance system from January 24 to February 16, 2017. In 2016, the surveillance system reported 42 maternal deaths, 17-suspected measles and 25 non-polio AFP cases. In 2015/16, there was 24 (0.68%) maternal deaths in Wolaita Soddo University Teaching and Referral Hospital out of 3511 total deliveries and in 2016/17 up to 2nd quarter, there were 12 (0.62%) maternal deaths out of 1938 deliveries. All evaluated units (N=13) have no habit of data analysis. Compeleteness of recorded data for maternal death, measles and AFP was 83%, 71%

and 56% respectively. timeliness of weekly report was 100% at zonal level while it cannot be determine for health facility level. Maternal death surveillance and response system could not capture both community and health facility deaths.

Health Profile Description Report IV: Health profile provides a snapshot of the overall health of the local population. However, in low-income countries like Ethiopia such information especially at district level usually not available. Therefore, a study was conducted to provide health profile description of Kindo Didaye district of Wolaita zone that will help for health planning. The total population of the district in 2016 is estimated as 122,062 based on a projection of 2007 census with 60726 (49.75%) males and 61336 (50.25%) females. The dependency ratio of the district is estimated about 79%. The employment ratio of the district is estimated as 1.44:1. About 23 (82%) health facilities and 18 (85.7%) kebeles have access to roads of local type. There were a landslide, ice and fire disasters in the district in the past two years ago. The recent landslide disaster affected nine kebeles with 37 deaths, 344 households displaced and more than 275 million birrs estimated property lost. The district has 1 primary hospital, 3 health centers, 24 health posts and 4 private clinics. Malaria and pneumonia were the first top adult and pediatric morbidity and mortality cases respectively. The district has 82% health service coverage, 100% primary school coverage, 100% latrine coverage and 69.64% safe drinking water coverage in 2015. The district sustained 100% coverage for most Expanded Program of Immunization activities. Contraceptive acceptance rate and skill birth attendant was 66.12% and 44.3% respectively in 2014/15.

Scientific Manuscript for Peer Reviewed Journal V: Reports of new research/study findings are important to fuel innovative assumptions through scientific communication. Scientific journals are an exact means for this communication. Therefore, we prepared a scientific manuscript for peer review journal on a disease entitled "An epidemic of leg swelling of unknown etiology in Mizan prison, Bench Maji Zone, Southern Ethiopia, 2016."

Abstracts for Scientific Presentation VI: During residency period, two abstracts were prepared for scientific presentation. Of them, "An epidemic of vitamin C deficiency in Mizan prison, Southern Nations, Nationalities and Peoples' region, Ethiopia, 2016" was submitted to TEPHINET for oral presentation via Ministry of Health, Ethiopia.

Narrative Summary of Disaster Situation Visited VII: I was participated two disaster situation visits: Belg Humanitarian, Health and Nutrition Assessment and Rapid Need Assessment following landslide disaster. Rapid Belg assessment was conducted in six woredas of Wolaita and Dawuro zones from June 6 – 23, 2016; four woredas from Wolaita and two woredas from Dawuro. I also conducted Rapid Need Assessment (RNA) and Emergency Prepared and Response Plan (EPRP) following 9th May 2016 Landslide in Kindo Didaye district, SNNPR. Ethiopia. This Landslide affected nine kebeles' highland areas with impact of 37 deaths, 461 households' and 2882 populations' displacement, and above 275 million birr estimated property lost.

Protocol/Proposal for Epidemiologic Research Project VIII: During residency, I prepared protocol for epidemiologic research project on title "Describing Maternal Death and Exploring Factors Affecting Implementation of Maternal Death Surveillance and Response in Wolaita zone, Ethiopia - 2017." The purpose of the study is most maternal deaths occurred due to direct obstetric causes, and these can be prevented by providing effective information for action. Ethiopia launched MDSR system, which provides information for action on preventable maternal death, through PHEM structure, but above 80% of maternal death was not reported via this structure in the zone. Therefore, this study was designed to describe maternal death, assess data quality and to explore factors affecting for implementation of MDSR at public health facility level.

Other additional outputs IX: There were four additional outputs were done during the period of residency: Investigation of Acute Febrile Illness Outbreak in South Omo zone, SNNPR, Ethiopia, from May 14 – 27, 2016, public health surveillance training on topics of PHEM overview, epidemiology, pathogenesis, clinical features and outbreak management of AWD/cholrea and scabies outbreak response, Rapid Need Assesssment and Response Plan following May 2016 Landslide in Kindo Didaye district and PHEM Weekly Bulletin for epidemiological weeks 40 and 46, 2016 and week 10, 2017.

Chapter I- Outbreak/Epidemic Investigations

1.1 Measles Outbreak in Konta special district, Southern Nation Nationalities and Peoples Region, Ethiopia, 2016 – Case-control study

Abstract

Introduction: Globally, measles accounts for 44% of total deaths due to vaccine preventable diseases among children less than 15 years, the highest mortality occurring in poor communities with malnutrition, overcrowding and low vaccination coverage. The Southern Ethiopia regional health bureau received measles outbreak rumor on 18 February 2016 in Konta special district with some deaths. The aim of study is to investigate the outbreak and assess risk factors.

Methods: Outbreak investigation was conducted in Konta special district, SNNPR from February 22 to March 20, 2016. Descriptive cross-sectional with unmatched case control study design were conducted. Six blood camples were collected from active measles cases and examined by regional public health laboratory. Data was analyzed using excel and Epi Info version 7.1.4.0.

Result and Discussion: Totally 1068 (AR = 926 cases per 100,000 population) measles cases were reported from the district with 6 IgM+ measles cases. Case fatality of the outbreak was 115 deaths (CFR=10.77%). The study revealed persons who were vaccinated for measles before were 68.63% less likely to develop measles disease as compared to non-vaccinated persons (AOR = 0.31; 95% CI = 0.12, 0.84). The odds of being a case of measles were 5.53 times more likely among those who were living with cases of measles than those who did not (AOR=5.53; 95% CI = 2.51, 12.13). Children who were malnourished children had 3.51 times more likely suspected to develop measles (AOR = 3.51, 95% CI = 1.46, 8.44) as compared to normal children.

Conclusion and recommendation: measles outbreak was confirmed in the district by laboratory and epidemiological linkage. The outbreak was significantly associated with low routine measles vaccination coverage. Routine measles vaccination should be strengthening to achieve above 95% and SIAs should be continued for second doses for measles.

Key words: Measles, outbreak investigation, case-control, Ethiopia

Introduction

Measles is highly contagious outbreak-prone acute viral human diseases caused by virus called member of Morbillivirus paramyxoviridae. Morbillivirus is a genus of viruses in the order Mononegavirales, in the family paramyxoviridae. There are currently six species in this genus, including the type species Measles virus which is a single stranded, negative-sense, enveloped (non-segmented) RNA virus of the genus and humans are the only natural hosts of this virus; no animal reservoirs are known to exist. The Measles virus is the cause of measles, an infection of the respiratory system and characterized by maculopapular rash with 7 – 18 days incubation period and highly infectious four days before and after onset of rash (1 – 3).

Measles is the leading case of children morbidity and mortality worldwide (7). Globally, it accounts 44% of total deaths due to vaccine preventable diseases among children less than 15 years, the highest mortality occurring in poor communities with malnutrition, overcrowding and low vaccination coverage. Measles is one of vaccine preventable diseases in which vaccination is the most effective measles diseases prevention and control activities. As routine measles vaccine coverage increases, it becomes more important to identify risk factors for measles and target SIA at high-risk groups to provide high quality of immunization services as the program expected. Measles vaccine will be effective about 85% when children get the vaccine at the age of 9 months provided that other influencing factors like cold chain, child and service related factors maintained normal as different scholars believed. The peak antibody response occurs 6 to 8 weeks after infection or vaccination. Immunity deliberated by vaccination against measles has been shown to persist for at least 20 years and is generally thought to be life-long for most individuals. Infants born to mothers who have either had measles or been vaccinated are protected by trans-placental transferred antibody and this antibody can protect the infants about 5 to 9 months of age (2, 11).

A second opportunity for vaccination is giving the chance for immunization of measles for the second time to children who may not have got the vaccine or failed to develop protection. The second opportunity can be provided through supplementary immunization activities (SIA). According to Sustainable Development Goal 3.2 (SDG target 3.2), under

five year children mortality not expected more than 25 per 1000 live births at the end of 2030. So that quality and coverage of immunization for achievement of SDG target 3.2 is the bench mark for reduction of child mortality in the country and percent of children receiving full immunization is taken as an indicator.

Measles is the main public health problem that results in high morbidity and mortality in under five children that needs global measles initiatives. This initiative is a collaborative effort of different relevant partners and government bodies in order to achieve two doses of measles at the age of 12 to 15 months, effective surveillance, rapid and efficient measles outbreak response and effective treatment of measles cases and mitigation of the outbreak impact. Measles outbreaks occur where the immunization coverage is low when the number of susceptible measles cases in a population/community elevates above a critical threshold of the disease (4).

Forty years after effective vaccines were licensed; measles continues to cause death and severe disease in children worldwide. Complications from measles can occur in almost every organ system. Pneumonia, croup, and encephalitis are common causes of death; encephalitis is the most common cause of long-term sequelae. Measles remains a common cause of blindness in developing countries. Complication rates are higher in those <5 and >20 years old, although croup and otitis media are more common in those <2 years old and encephalitis in older children and adults. Complication rates are increased by immune deficiency disorders, malnutrition, vitamin A deficiency, intense exposures to measles, and lack of previous measles vaccination (4). Case-fatality rates of developed countries have been decreased with improvements in socioeconomic status but it remains high in developing countries (7).

In spite of African regional goal to achieve measles elimination by 2020 in which incidence of measles <1 case per million per year, globally 9 countries, including Ethiopia, reported >1000 measles cases with onset date from June 2015 to November 2015. European Center for disease control and prevention reported 2550 positive measles cases during January to December 2014 with high number of Italy that accounts 1010 positive cases in the year. In the region, European, measles cases from 2010 to 2015

accounted in 30265 cases; in 2011, there were 30567 cases. From 2012 to 2015, measles cases were declined radically and about 8230 cases, 10533 cases, 3637 cases and 4111 cases respectively in the region.

In the WHO African region, measles cases increased from 2002 to 2009 as the reporting country members increased. In 2002, only 15 African countries reported 4836 measles cases and the region countries participation increased to report measles cases from 15 to 40 countries that reporting 21199 total measles case to 35657 cases from year of 2003 to 2009. This implies that the measles disease burden worsened on the developing countries as the main public health problem due to low measles vaccination coverage in the region (2-4).

According to reported measles cases and incidence rates by WHO member states as of 11 February 2015, Ethiopia has reported 6137 and 14100 totally confirmed measles cases with their respective incidence rates of 6.52 and 14.61 in 2013 and 2014 respectively. Ethiopia has faced high number of measles outbreaks every year with increasing morbidity of especially under five children that increased the public health challenge to achieve the reduction of the child morbidity and mortality rate significantly. As the preliminary report of FMOH, suspected measles cases were increased currently from 2014 to 2016 of third quarter (7 – 10).

Regional Health Bureau received Measles outbreak rumor in Konta Special district on February 18, 2016 and outbreak investigation team was organized soon from SNNPR PHEM, partners, Konta special district health office and EFETP residents to the first affected two Kebeles to search additional cases, identify possible risk factors, control the outbreak and provide information for future disease prevention planning. An unmatched case-control study was used to identify contributing risk factors of the outbreak.

Statement of the problem

In 2015/16, different zones, districts and kebeles in SNNPR were affected by measles outbreak. However, there was outbreak of measles in Konta special district about 1068 cases with 115 deaths. Of them, 983 measles cases with five cases were IgM+ for measles and 115 community deaths were registered only in two kebeles of the district: Albe Agare and Bake Sada. The outbreak investigation was held in the district by great

attention of regional health bureau in addition to other higher officials. The severity of the outbreak enforced to conduct catch-up measles vaccination of all under 15 children in two most affected kebeles and all under 5 in all rest kebeles of the district after confirmation of measles virus.

Literature Review

Measles is the leading case of children morbidity and mortality worldwide. Globally, it accounts 44% of total deaths due to vaccine preventable diseases among children less than 15 years (4), the highest mortality occurring in poor communities with malnutrition, overcrowding and low vaccination coverage. Measles is one of vaccine preventable diseases in which vaccination is the most effective measles diseases prevention and control activities (7, 11). As routine measles vaccine coverage increases, it becomes more important to identify risk factors for measles and target SIA at high-risk groups to provide high quality of immunization services as the program expected. Measles vaccine will be effective about 85% when children get the vaccine at the age of 9 months provided that other influencing factors like cold chain, child and service related factors maintained normal as different scholars believed (11).

Measles has been the leading cause of child mortality and morbidity in Ethiopia (12). Unvaccination rate is the most revealed/confirmed risk factors for development of measles diseases in the different areas of the country (12-15). In 2015, totally 61 measles outbreaks occurred with 929 laboratory confirmed positive measles cases in Ethiopia (21). Measles immunization campaign recommended as SIAs to prevent measles related children mortality in Ethiopia as SIA averted children mortality twice as compared to routine EPI (22). The study conducted in Ethiopia explained contributing risk factors for measles outbreaks include gaps in routine immunization coverage, delay in supplemental measles immunization activities (SIAs) and high cross contact of measles active cases (23).

Objectives

General Objective

To investigate measles outbreak, describe magnitude of cases and asses risk factors of disease in Konta Special district, Southern Ethiopia - from February 22 - March 20, 2016

Specific objectives

To determine the occurrence of the outbreak

To identify the etiology of measles infection

To describe the magnitude of the outbreak

To identify risk factors for measles

Methods and Materials

Study Area and Period

Unmatched case-control study was conducted in Konta special district where it is located South West of the region 425 KM far apart from Hawassa town, capital city of the region. In 2015/16, the district has a population of 115,318 (2007: Census projection) and administered with 42 rural and 04 urban kebeles. The estimated population of six months to under fifteen and under five years were 53,277(46.2%) and 18,000 (15.6%) respectively. the district has one primary hospital, three health centers and 42 health posts. In the district, two settlement areas and one national park namely Chabara Churchura. The district is located in a place where Gibe IV Hydroelectric Power dam construction project planted.

The study was conducted from February 22 to March 20, 2016 in two kebeles where high number of measles cases present.

Study design

Descriptive cross-sectional with unmatched case control study was conducted with qualitative assessment of cold chain management and vaccine handling and service delivery of health extension workers to identify magnitude of the outbreak, effectiveness of the response (case management) and risk factors of the disease.

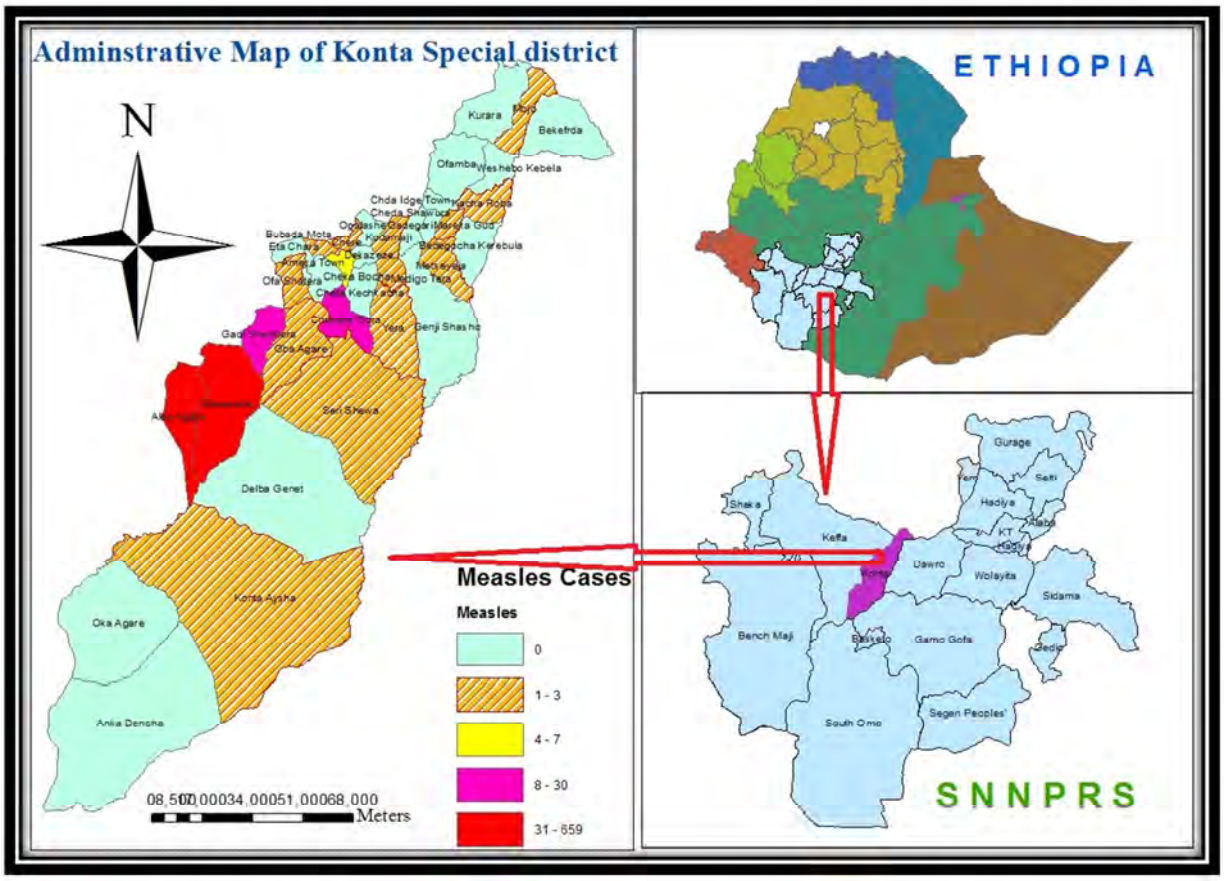

Figure 1 Administrative Map of Konta Special district, SNNPR, Ethiopia

Source population

The source population was the population of Konta special district who lived in 42 rural and 04 urban kebeles.

Study subjects

Study subjects were persons who admitted with or treated for measles in Bake Sada satellite Clinic (at Health Post), Albe Agare health post for temporary site and Ameya primary district hospital during the period of data collection and their control with the ratio of 1:2 from Konta special district residents who lived in measles affected kebeles. Cases were taken from active measles cases during data collection for retreatment and/or treatment at Albe Agare and Bake Sada Satellite clinics.

Assumptions for Sample size determination

The sample size was calculated based on power requirements for both cases and control. Based on the same study conducted in Soddo Town, Wolaita Zone of SNNPR Ethiopia in

2013, we used 85% power, 10% controls exposed, confidence interval 95%, Odds ratio of 3.19 from Epi Info version 7.1.4. There was 68 cases and 136 controls for 1:2 cases to control ratio.

Standard Case definition of the measles

A Suspect case can be defined as any person in whom a clinician suspects measles OR any person with fever, AND generalized maculopapular (i.e. non-vesicular) rash, AND cough, coryza (i.e. runny nose) or conjunctivitis (i.e. red eyes).

Confirmed case was defined as a suspected case with laboratory confirmation (positive IgM+ for measles) or epidemiological link to confirmed cases during an epidemic period.

Operational case definition:

A case was defined as any person in Konta special district who met with the standard case definition of measles whether suspect or confirmed from the period November 11, 2015 to March 13, 2016 (Epi-Wk 46, 2015 to Epi-Wk 10, 2016).

A control groups were persons who did not develop or had no history of measles residing in the same community of the cases and no cases present in their family in the same period.

Outbreak threshold was defined an outbreak of measles as the occurrence of three or more IgM positive measles cases treated/detected in a health facility / community or district within one month OR the occurrence of 5 or more reported suspected cases by clinicians as measles in a health facility/district within a month.

Data collection procedures

Data was collected by using outbreak investigation checklist, by observation and records review of Albe Agare health post and Bake Sada satellite clinic. For case control study, data was collected from 68 active measles cases and 136 controls by interviewing by using structured questionnaire and by measuring MUAC of children less than five years of age. The checklist contained socio-demographic variables, clinical history of disease and measles disease related risk factors. Parents and/or caregivers were interviewed for cases and controls for children below 15 years old. The line list of outbreak was filled retrospectively from medical records in the health posts. Data for deaths were collected by conducting retrospective verbal autopsy using standard case definition of measles

disease. Routine measles vaccination comparison was done using manually developed format after consensus between investigation team members. Integrated family health card, tally sheets and monthly reports were reviewed using data quality checking formats. For qualitative part, cold chain management and vaccine handling, response of outbreak, surveillance of integrated diseases, preparedness and response plan and health service delivery was done by interviewing key informants and observational during the period of data collection.

Inclusion and Exclusion Criterion

A person with active measles disease was included as case during data collection for case-control study. Children under 9 months of age were excluded in which they were not eligible for routine measles vaccination. Persons who suffered from comorbidity of scabies at the time of data collection were excluded from control even though they were not measles case to minimize bias.

Data processing and Analysis

Data was entered and analysed using Epi Info version 7.1.4.0. Frequency and percentage of age, vaccination status, rates, proportion and ratios, cross tabulation was done and apply logistic regression.

Ethical consideration

Due to purpose of the study and type of problem, IRB was not delivered for study but verbal consent was obtained from respondents since the outbreak investigation was a public health practice/problem to solve and protect the community from the consequences of the outbreak. Participants were asked their willingness for interview and gave them freedom not to respond and/or any time to interrupt interview if any unwanted condition happened.

Result

Descriptive epidemiology

Socio-demographic Characteristics

The index measles case was 3 years old female child. She was died on November 18, 2015 after a week suffered from rash, fever and cough at Albe Agare Kebele in the Chama village where the place located west Southern far apart from the health post (Albe Agare Kebele) about 15 Kms. She had no history of traveling before the onset of rash to place where active or suspect measles cases from her residency. Moreover, she had no clear contact history with either confirmed or suspect active measles cases. She was not vaccinated for measles and the family has no knowledge about the use of measles vaccine for children as the member of her family interviewed. Her household head was farmer and have no formal education with no aware of measles mode of transmission. Her parents were divorced and she lived with her father.

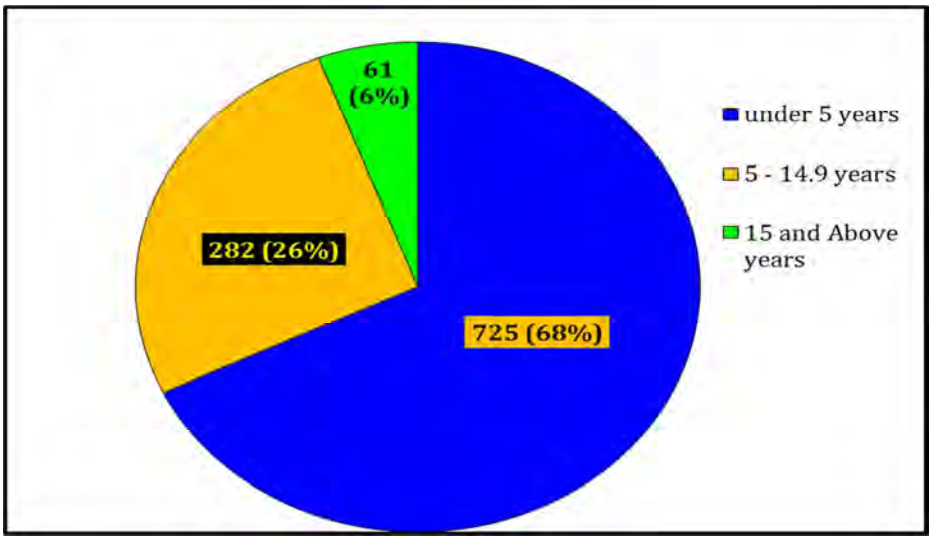

Figure 2 Measles cases (N=1068) by Age group, Konta Special district, SNNPR, Ethiopia - 2016

Totally 1068 (AR = 926 cases per 100,000 population) measles cases were reported from the district including six IgM+ cases for measles when examined at regional public health laboratory and 115 community deaths (CFR = 10.77%) from week 46, 2015 to week 12, 2016 (November 10, 2015 to March 18, 2016). From 46 kebeles of the district, 50% of the total kebeles were affected by measles in the period. The most affected age groups

were under five years which accounts 725 (67.9%) with age specific attack rate 402 cases per 10,000 under five populations followed by age of 5 – 14 years old (282 /26.4%/). The data shows about 94.3% of measles cases are under 15 years of age. The rest 61(5.7%) of the cases were the age above 15 years old.

About 747 (70%) of cases developed complication; Pneumonia 562 (52.6%), Diarrhea 107 (10%), Malnutrition 32 (3%) and Otitis media 6 (0.6%).

About 616 (58%) of the total cases have no measles vaccination history with 38 (3%) unknown vaccination status. Measles attack rate of the district was accounted 923 cases per 100,000 populations (AR from risk population, who have been living in 23 kebeles, is 21 cases per 1,000 populations).

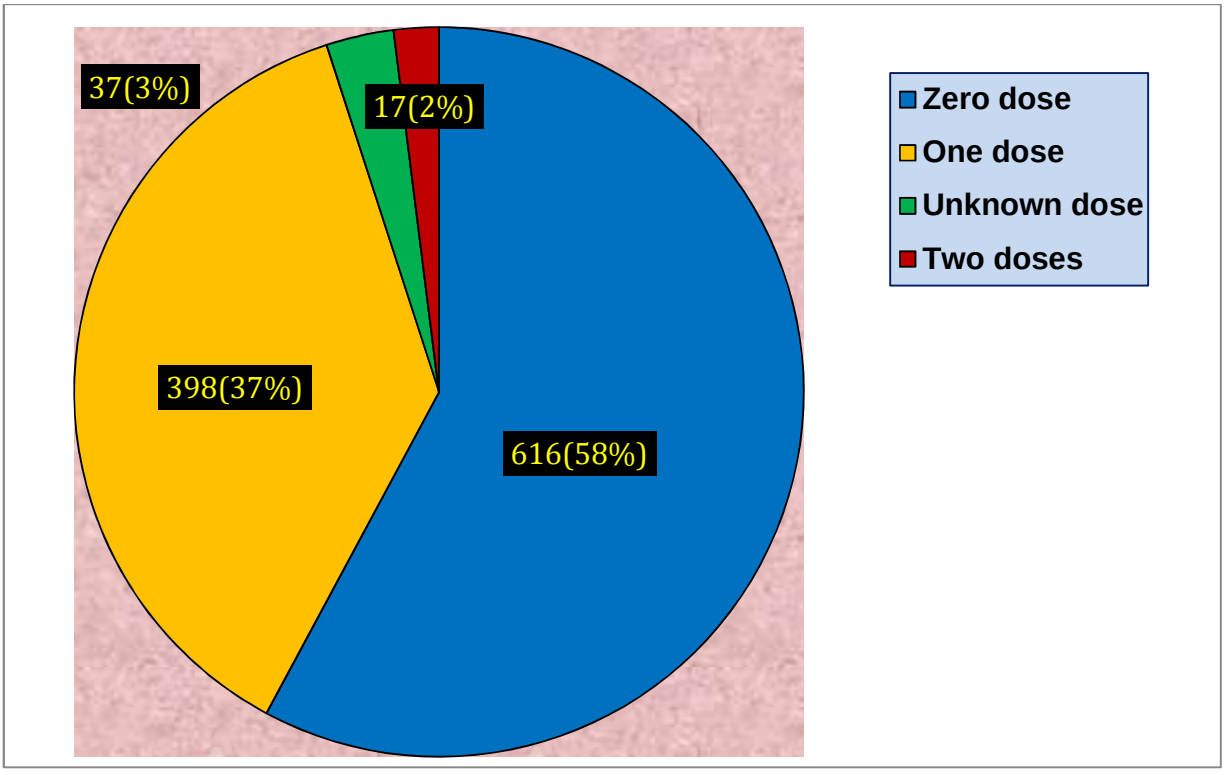

Figure 3 Vaccination status of measles cases (N=1068) in Konta special district, SNNPR, Ethiopia, 2016

Table 1 Summary of Number of Measles Cases and deaths in each kebeles of Konta Special district in SNNPR, Ethiopia – 2016

Serial Number	Name of Affected Kebeles	Total Population	Total Cases	Death	AR from 1,000 popu.	CFR
1	Albe Agare	2626	659	76	251	12
2	Amaya 01	2534	3		1	0
3	Amaya 02	2167	2		1	0
4	Amaya 03	1743	2		1	0
5	Bake Sada	3206	324	39	101	12
6	Bitseti	2512	4		2	0
7	Chabera	2684	20		7	0
8	Chare Duka	2583	1		0	0
9	Chata	4061	30		7	0
10	Duka	1091	2		2	0
11	Dupa kechkecha	1350	1		1	0
12	Gada Shembara	1543	3		2	0
13	Gimba	2489	2		1	0
14	Gora	757	1		1	0
15	Grawa	1601	1		1	0
16	Kacha	3011	1		0	0
17	Koysha Dilla	2649	1		0	0
18	Kuta	625	5		8	0
19	Madi	2035	1		0	0
20	Modjo	3353	1		0	0
21	Seri	980	2		2	0
22	Sheta Chare	2846	1		0	0
23	Yora	3245	1		0	0
	Grand Total	**51691**	**1068**	**115**	**21**	**11**

Most of the cases (627 mild and 191 severe cases) were treated at Albe Agare and Bake Sada Kebeles satellite clinics due to cluster hospital, Ameya district hospital, far apart 55 – 60 Kms to manage the severe cases. Age specific attack rate (AR) and case fatality rate (CFR) of Albe Agare and Bake Sada was 75 per 100 under five years children and 13% respectively. The rest 21 kebeles contribute only 6 cases per 1,000 under five children of the same age group without death.

Table 2 Number of Measles cases and deaths by age groups of Konta Special district, SNNPR – Ethiopia, March 2016

Age Groups	Cases		Death		Remarks
	By number	Percent	By number	Percent	
under 5 years	725	68%	88	77%	
5 – 14 years	282	26%	21	18%	
15 and Above years	61	6%	6	5%	
Total	**1068**	**100%**	**115**	**100%**	

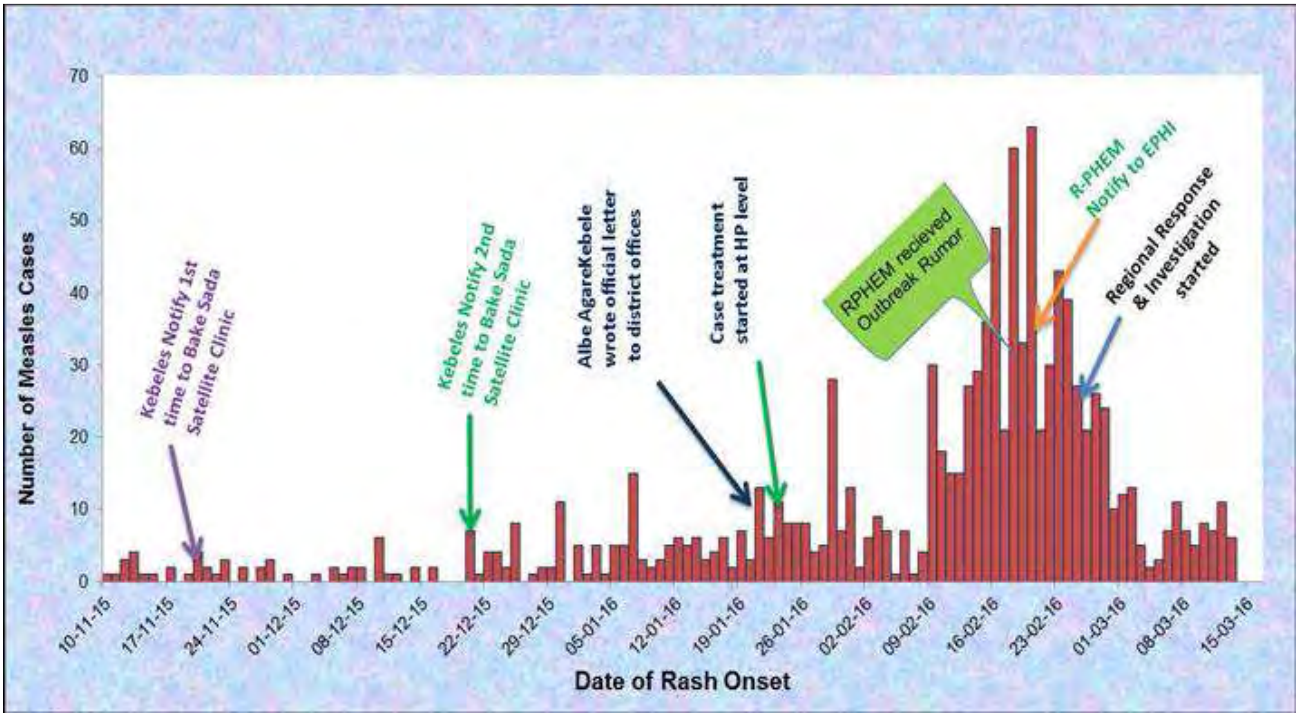

Figure 4 Epidemic Curve of Measles Cases by Date of Rash Onset, Konta Special district, SNNPR, 2016

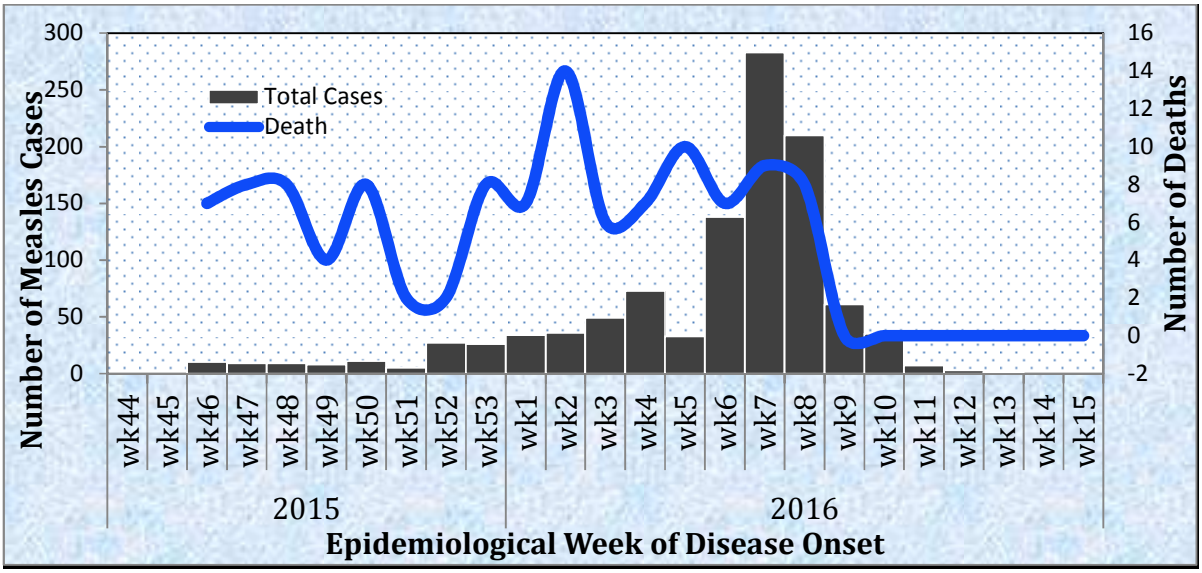

Figure 5 Epidemic Curve of Measles Cases and Deaths by Epi-week, Konta Special district, SNNPR, 2016

The epidemic curve was peaked on week 4 & then in week 7 and lasted through week 13, 2016 due to lack of standard intervention to control measles outbreak and late notification of the outbreak for next level to take relevant response.

As indicated by figure 5, the district was under measles epidemic from epi week 46, 2015 (Nov. 10, 2015), but no intervention was done up to week 4, 2016 (January 22, 2016). Albe Agare kebele chairperson notified orally suspect measles cases to Bake Sada satellite clinic after 9 community deaths on 10/3/2008 E.C (Nov. 20, 2015). Secondly, two kebeles' chairpersons notified orally on 13/4/2008 E.C (Dec. 23, 2015) after the death of 20 children by the same case within few weeks. Then, Albe Agare chairperson wrote official letter to the district health office on 9/5/2008 E.C (January 18, 2016) by copying to education office, main administration office and other officials after 2 months of index case. The district tried to manage the cases by not identifying the epidemic and not following measles outbreak management protocol starting on 13/5/2008 E.C (January 22, 2016). At the time of case management, there was no surveillance, cases based reporting form and also no notification to regional PHEM until the rumor had been heard at regional from community on 10/6/2008 E.C (February 18, 2016).

Number of community deaths was high at week 2, 2016 and most of the community deaths, about 77 (70%), was occurred from the beginning of January to the end of February 2016.

We reviewed the routine measles vaccination performance of the district for six consecutive years. The measles vaccine coverage of 2009/10, 2010/11, 2011/12, 2012/13, 2013/14 and 2014/15 were 70.2%, 88.3%, 79.6%, 87.6%, 80.4% and 88.8% respectively.

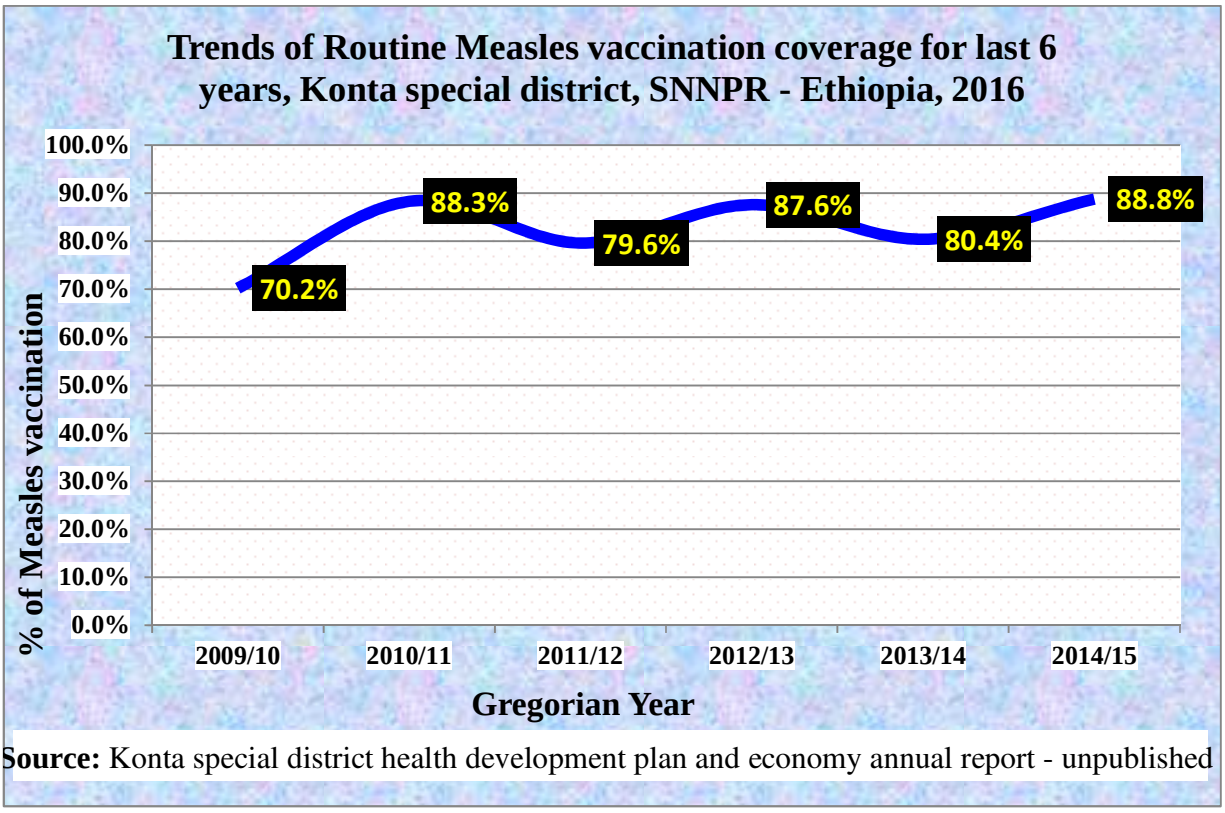

Figure 6 Measles Vaccination coverage of Konta special district for last six consecutive Ethiopian Fiscal Years, SNNPR, Ethiopia-2016

The measles vaccination coverage of two kebeles, Albe Agare and Bake Sada, of the district in the year 2013/14, 2014/15 and 2015/16 were 22%, 90% and 120% respectively according to the district annual report of respective fiscal years. On the other hand, data collected from these two kebeles using their monthly report, tally sheet and registration book/family cards showed that measles vaccination coverage in these years were 27%, 68% and 49% respectively. However, the data collected from kebeles' monthly report did not match with data collected from registration book and/or tally sheet; for instance, Albe

Agare Kebele 2014/15 report fallacy displayed by the table 3 below. There was a big discrepancy on vaccination coverage from district to health facility level.

Table 3 Comparison of reports of district and Kebeles Annual Measles vaccination coverage, Konta special district, SNNPR, Ethiopia – 2016

Reporting Year	*Name of Kebeles*	*District Report (%)*	*Kebeles Report (%)*	*Difference (by %)*	*Remark*
2013/14	Albe Agare	48%	56%	8%	Under reporting
	Bake Sada	0	8%	8%	Under reporting
2014/15	Albe Agare	75%	82%	7%	Under reporting
	Bake Sada	102%	58%	44%	Over reporting
2015/16	Albe Agare	82%	76%	6%	Over reporting
	Bake Sada	151%	30%	121%	Over reporting

Table 4 EPI data quality checking for 2014/15, Albe Agare Kebele of Konta special district, SNNPR, Ethiopia, 2016

Months	Vaccine	Report	Tally	Registration	Remark
July	Penta 1	12	0	12	
	Penta 2	8	0	8	
	Measles	9	0	7	
August	Penta 1	0	0	7	
	Penta 2	0	0	0	
	Measles	0	0	0	
September	Penta 1	5	0	5	
	Penta 2	10	0	5	
	Measles	10	0	3	
October	Penta 1	10	0	10	
	Penta 2	11	0	10	
	Measles	7	0	8	
November	Penta 1	0	0	7	
	Penta 2	0	0	3	
	Measles	0	0	9	
December	Penta 1	8	0	11	
	Penta 2	7	0	9	
	Measles	7	0	7	
January	Penta 1	28	0	8	
	Penta 2	0	0	13	
	Measles	7	0	17	

February	Penta 1	8	0	9	
	Penta 2	7	0	0	
	Measles	11	0	5	
March	Penta 1	15	0	0	
	Penta 2	15	0	0	
	Measles	0	0	6	
April	Penta 1	10	0	9	
	Penta 2	8	0	12	
	Measles	8	0	4	
May	Penta 1	7	0	0	
	Penta 2	15	0	1	
	Measles	15	0	12	
June	Penta 1	0	0	0	
	Penta 2	0	0	0	
	Measles	0	0	0	
Total	**Penta 1**	**103**	**0**	**78**	
	Penta 3	**81**	**0**	**61**	
	Measles	**74**	**0**	**78**	

Source: *Data from kebele's report, service tally sheet and integrated family health card*

Public health interventions

Social mobilization team conducted counselling and social support work to settle the community who missed lives due to outbreak since the community took the cause of the diseases as evil spirit and they believed the disease cannot be prevented by public health intervention. Six samples from active measles cases were collected and sent to regional public health laboratory for confirmation in addition to active case search activities. Case management was done according to national protocol of measles outbreak management in temporarily established satellite clinics in Bake Sada and Albe Agare kebele health posts for the cases of both Albe Agare and Bake Sada kebeles since the catchment hospital, Ameya primary hospital, far more than 55 KMs apart. After the lab confirmation, mass measles vaccination was done for all under 5 years children who live in 46 kebeles of the district. Totally 20,984 (98.7%) under 5 years of 44 kebeles and all less than 15 years of Albe Agare and Bake Sada kebeles were vaccinated during mass measles vaccination campaign following the outbreak and of them 6025(28.7%) children were not vaccinated before the campaign.

Meanwhile, 31,940 populations were participated during community mobilization in reducing contact with active cases and early visiting health facility if there is suspected measles case. Based on the finding and activities, daily evaluation and monitoring was done to improve case management, to enhance active case search and surveillance capacity, to mobilize logistic gaps and to increase community awareness on measles prevention and control activities.

About 509 under 5 children cases were screened for malnutrition by using Measuring Under Arm Circumference (MUAC) tape and the MUAC of 55 children measured 11 – 12 cm (moderate - MAM) and that of 58 children measured below 11 cm (Severe - SAM). All mild and severe measles cases were treated by antibiotics (Amoxacillin syrups, Ceftriaxone IM/IV, Crystalline Pencillin G, IV fluid like dextrose 5%, normal saline), vitamin A and supplemental food therapy (Moderate Acute Malnutrition whose MUAC measured 11 – 12 cm = 55, Oral Theraphy Program (OTP) for those their MUAC measured below 11 cm and passed feeding test = 54, Stablization Center (SC) for those who failed during feeding test = 6). and some malnutrition complications like bilateral pitting oedema, cough, vomiting was managed and referred to next health facility level.

Cold chain management and vaccine handling

The district has 32 functional and 8 nonfunctional vaccine refrigerators as the district cold chain officer replied. Practically, no functional vaccine refrigerator for cold chain management at health post level due to power supply and kerosene shortage. Even though 50 to 60 KMs far apart from catchment PHCU, most health facilities like Albe Agare and Bake Sada remotest health posts have no functional refrigerator. Thus the health extension worker and other health professionals have been travelling more than 50 KMs by carrying vaccines with vaccine carrier to give vaccination. During rainy season, they spent more than 13 hours on travelling to reach even expected vaccination site. Most of the district area covered by desert and attached by chain of mountain which rise great temptation in quality of all EPI coverage. Most of kebeles have no road access for transportation; the community used animal back for only goods and material transportation.

Observed gaps as qualitative data

Meases cases were not managed according to case management protocol. Regarding to coordination, there was no supportive supervision, follow up and monitoring and evaluation system at district level. For instance; Albe Agare health post has not been supported, monitored and evaluated for last six years from district and /or catchment primary health care unit (PHCU) levels to strengthen the capacity of health extension workers.

Emergency preparedness and response plan was not developed and risk mapping was not done at district level for 2015/16. There was no responsible body for district public health emergency management core process; the delegate person for the core process has not trained and skill gap for intensive organization. Report formats like weekly report format, case based, line list and guidelines were not distributed to health facilities rather than placed on the shelf in district health plan and economy office. The surveillance system was not strong enough to respond the outbreak. There was no well-established rapid response team and task force to mobilize the resource for outbreak response.

There was no cold chain management system in both Bake Sada and Albe Agare health posts. These two health posts were not reporting weekly IDSR report to their catchment health facility. Routine EPI program was not reach to those hard to reach areas in each kebele; the service restrict in health posts and nearby villages. There was no performance review meeting at any of the two kebeles. Health extension workers took EPI vaccines from Ameya primary hospital by travelling 55 – 60 kilo meters on foot. There was no outreach program at catchment PHCU level to capacitate the skill of health extension workers, no integrated supportive supervision, no monitoring and evaluation, no performance review with catchment health posts and no follow up at PHCU level.

There was no trained health worker for measles cases management and surveillance system in the district Case management was not done according to national guideline and cases were not recorded by line list.

Health extension workers have lack of awareness on surveillance system for measles as immediately reportable disease, no monthly performance review, no annual activities plan for basic indicators, no weekly report of integrated diseases surveillance and response (IDSR), no tally sheet use, no home-to-home visit even before measles outbreak. The health service seek at community level was very low and traditional beliefs on measles outbreak in which they considered the cause of this outbreak came from God/god/creator punishment and they took the disease as catastrophic event.

Case –control / Analytical Epidemiology /

For the case control study, data was collected from 68 cases and 136 controls using outbreak investigation checklist. Minimum and maximum ages of case are 1 to 29 years and that of control is 1 to 30 years. Mean, median, first quartile and third quartile age 7, 5, 3 and 9 years respectively and mean, median, first quartile, third quartile, minimum and maximum ages of the controls were 9, 7, 4, 14.5, 1 and 30 years respectively with mode 4 years. Standard deviations of age of cases and controls were $\pm$6 and $\pm$6.9 years respectively. Sex distribution of case is 39(57.4%) female and 29(42.6%) male and that of control group is 74 (54.4%) female with 62 (45.6%) male.

Table 5 Socio-demographic characteristics of Case-control study of Measles, Konta, SNNPR, Ethiopia, 2016

Variables		Case (N=68)	Control (N=136)	Remarks
Sex	Female	39(57.35%)	74(54.41%)	
	Male	29(42.65%)	62(45.59%)	
Age	< 5 years	29(42.65%)	40(29.41%)	
	5 – 14 years	33(48.53%)	62(45.59%)	
	≥ 15 years	6(8.82%)	34(25%)	
Occupation of Household head	Farmer	67(98.53%)	129(94.85%)	
	House wife	1(1.47)	4(2.94%)	

	Student	0	1(0.74%)	
	Employer	0	1(0.74%)	
	Merchant	0	1(0.74%)	
Religion	Orthodox	45(66.18%)	60(44.12%)	
	Protestant	19(27.94%)	23(16.91%)	
	Others	4(5.88%)	53(38.97%)	
Ethnicity	Konta	47(69.12%)	79(58.09%)	
	Kafa	5(7.35%)	12(8.82%)	
	Bacha	9(8.82%)	30(22.06%)	
	Manja	6(8.82%)	12(8.82%)	
	Others	1(1.47%)	3(2.21%)	
Educational status of household head	Non-formal	57(83.82%)	115(84.56%)	
	Read and write	8(11.76%)	14(10.29%)	
	Elementary	2(2.94%)	6(4.41%)	
	Above secondary	1(1.47%)	1(0.74%)	
Marital Status of Respondent	Single	1(1.47%)	9(6.62%)	
	Married	63(62.65%)	119(87.5%)	
	Divorced	2(2.94%)	1(0.74%)	
	Separated	1(1.47%)	1(0.74%)	
	Widowed	1(1.47%)	6(4.41%)	
Family size	Below 5 persons	19(27.94%)	33(24.26%)	
	≥5 persons	49(72.06%)	8(75.74%)	

During case control study, about 106 (52%) respondents believed that any age groups of both male and female are the most vulnerable population of measles. About 43 (21.1%), 20 (9.8%), 4 (1.9%) and 1(0.5%) of respondents believed that the most vulnerable population for measles infection are under 5, age between 5 – 18, pregnant /lactating mothers and under 1 year children respectively. About 30 (14.7%) respondents were did not know who are the most vulnerable populations for measles infection.

Table 6 Bivariate Analysis and Adjusted Odds Ratio for Associated risk factors for Measles outbreak, Konta, SNNPR, Ethiopia – 2016

variables		Case (N=68)	Control (N=136)	COR*(95%CI†)	AOR**(95% CI)
Ever vaccinated for measles before	Yes	9	42	**0.34 (0.15, 0.75)**	**0.31 (0.12, 0.84)**
	No	59	94		
House well ventilated	Yes	23	67	0.53 (0.29, 0.96)	0.67 (0.32, 1.40)
	No	45	69		
Is there contact history with active measles cases	Yes	33	19	**5.81 (2.94, 11.45)**	**5.53 (2.51, 12.13)**
	No	35	117		
Received Vitamin A within 6 months	Yes	10	47	**0.33 (0.15, 0.69)**	**0.37 (0.18, 0.79)**
	No	58	89		
Nutritional Status (Malnourished/Normal)	Malno-urshed	23	14	**4.45 (2.11, 9.40)**	**3.51 (1.46, 8.44)**
	Normal	45	122		
Distance from Health post/HF	<7 KM	9	45	0.31 (0.14, 0.68)	0.49 (0.19, 1.24)
	≥7 KM	59	91		

COR = Crude Odds Ratio, AOR** = Adjusted Odds Ratio, CI† = Confidence Interval*

Discussion

The cumulative incidence (attack rate) of measles in Konta special district in 2016 was highest in total population (926 per 100,000 total populations). This is very high AR as compared to that of Kindo Didaye (478 per 100,000) in Wolaita Zone and Shey Bench (331 per 100,000 populations) in Bench Maji zone of SNNPR in 2013 (16, 19). Moreover, the AR is higher as compared to the AR of Abaya district of Oromia Region

(AR 390/100,000), Gambella region (473 per 100,000 under 5 populations) in 2013 and China (less than 30 per 100,000 populations) in 2013 (20, 22). The case fatality rate of the district (10.77%) was high as compared to that of national (3% to 6%) in 2013/14 (8, 18). The activities which were implemented to reduce the mortality of measles strategy was not implemented at Konta district since the mortality during the outbreak was highest in the region as compared to CFR of measles from 2012 to 2015 in different districts of the region (14 - 16).

In addition to data fallacy and routine measles vaccination coverage report of the district varied at each stage of the health facilities, the district EPI coverage for the last six years was below 90%, On the other hand, the vaccination coverage of the cases was 13.24% whereas that of controls was 30.88%. This shows that high number children in the district may not be vaccinated for measles during routine program and the situation may brought favorable condition for the occurrence of the outbreak.

Our case-control study revealed that persons who were vaccinated previously for measles were 68.63% less likely to develop measles disease as compared to non-vaccinated persons (AOR = 0.3137; 95% CI = 0.1178, 0.8354 with p-value = 0.0203) even though the coverage was very low.

The person who lived with active measles cases within the same house had 5.53 times more susceptible to develop measles infection as compared to persons who have no contact (AOR=5.5342; 95% CI = 2.5114, 12.1295 with p-value 0.000001). Malnutrition had significant association with measles disease as compared with nutritionally normal children in which our case-control revealed. The study revealed that malnourished children are 3.51 times more likely to develop measles (AOR = 3.5059, 95% CI = 1.4568, 8.4371with the p-value of 0.0051) as compared to normal children.

Late detection and notification of the outbreak resulted in high mortality of measles in the district in addition to improper case management. National guideline for measles outbreak case management recommended not more than 1 – 2 deaths per 1,000 cases in the case of proper measles case management. But in the case of Konta's measles outbreak, 42 community deaths were verified by the regional team after 4th week 2016 when the case management was started at district level. Community deaths were verified

by using cross checking of medical registration book, village leaders, funeral attendance lists, oral discussion with local 'Idir' leaders and asking their families and looking burial places only.

Limitation

Immunization cards were missed in the community for confirmation at what age the vaccination was given to child even they took measles vaccine. Line list of 685 cases was copied from medical registration retrospectively after the case treatment passed weeks ago. Nasophargeal swab examination was not done for detection of measles strands of the area. Line list included few number of cases from 21 kebeles that might be resulted in high case fatality rate.

Conclusion

Measles outbreak in Konta Special district was confirmed by laboratory result and epidemiological linkage. The outbreak was directly associated with low coverage of measles vaccination in the district at the recommended age of infants in addition to cold chain management problems. Magnitude of the outbreak was intensified due to late detection and notification of the outbreak and community deaths were increased because of lack of organized response and mismanagement of case according to national protocol of measles outbreak management. The late notification to the next level accordingly was resulted in 115 deaths, some disabilities and other social and economic impact after the outbreak in the community.

Recommendation

The district should conduct mass measles vaccination campaign for all under 15-year's children. The routine immunization coverage should be strengthening to address at least 95% of under one-year children. National protocol of measles outbreak case management should be followed/maintained during case management when measles outbreak occurred. Regional health bureau should arrange training on measles surveillance and case management for the district.

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1.2 An epidemic of Leg Swelling of Unknown Etiology in Mizan prison, Bench Maji Zone, Southwestern Ethiopia, 2016

ABSTRACT

Introduction: Leg swelling generally occurs because of an abnormal accumulation of fluid in the tissues of the lower extremity by different causes. In October 2016, we received reports of five deaths among prisoners with leg swelling of unknown etiology housed in a prison in southwestern Ethiopia. We investigated to describe the magnitude of cases, identify risk factors and propose control measures.

Method: We conducted a descriptive cross-sectional study followed by an unmatched case-control study. A case was defined as a prisoner with onset of leg swelling of unknown etiology that developed between 5/18/2016 to 10/29/2016. A control was a prisoner without leg swelling during the same study period. Data was collected from 103 cases and 206 controls using a structured questionnaire and analyzed using Epi Info. Eight suspect cases were transferred to Addis Ababa for specialized medical evaluations. The three frozen samples were transferred by air to Bioscientia Institute for Medical Diagnostics, Ingelheim Germany. High Performance Liquid Chromatography analysis for vitamin C levels was performed.

Results: We identified 116 cases with leg swelling of unclear etiology. Eight of the suspect cases were examined by senior clinicians, interensits, in Addis Ababa and 7 met clinical criteria for scurvy. Three cases had non-detectable levels of vitamin C in their blood. Eleven deaths were identified. The attack rate for the prison was 4.2%, and the case fatality rate was 9.5%. All clinical confirmed and eight suspected cases had severe anemia with hemoglobin < 8g/dl.

The diet provided by the prison consisted entirely of cereals, as fruits and vegetables had been suspended for three months prior to the investigation due to an outbreak of acute watery diarrhea. A clinical diagnosis of scurvy was made, and vitamin C supplementation promptly initiated. All symptomatic prisoners improved and no further cases were identified in a four weeks follow up period of active surveillance after vitamin C supplementation.

Regular consumption of fruits prior to imprisonment,(OR = 0.40,(95% CI;0.23 - 0.69)), and consumption of fruits or vegetables while in prison were protective of disease (OR = 0.122; 95% CI = 0.024-0.628). Prior consumption of alcohol (OR = 2.863,(95%CI: 1.21 – 6.78); use of tobacco (OR = 2.47,(95%CI: 1.33 - 4.61)); and history of a chronic illness (AOR: 4.42,(95%CI: 2.02 – 9.66)) were risk factors for developing leg swelling.

Conclusion: We identified an outbreak of leg swelling in a prison. The study showed an indication of vitamin C deficiency as possible cause for leg swelling. Surveillance systems that can detect diseases associated with micronutrient deficiencies such as

vitamin C should be established for high-risk populations. Further clinical case studies should be done to identify other clinically asymptomatic cases and to find out other risk factors.

Keywords: Leg swelling, unknown etiology, Vitamin C deficiency, Prison, Mizan

Introduction

Leg swelling generally occurs because of an abnormal accumulation of fluid in the tissues of the lower extremity by different causes. Leg swelling can be symptoms of pitting and/or physiological edema. Scurvy is the ancient diseases of human being caused by vitamin C deficiency (1). Conditions like allergic reaction, obstruction of the flow, nutritional deficiency, pregnancy, and microorganism infection, imbalance of body substances in the blood, trauma, chronic smoking and alcohol drinking are the most common contributing factors of the swelling. For instance smoking impairs the absorption of vitamin C that leads the deficiency (1, 2).

Scurvy is one of nutritional deficiency disease which can cause the leg swelling, which is primary disease mainly caused vitamin C. Gingivitis, fatigue, metabolic effect, increased risk of infection, anemia, slower tissue, bone and cartilage repair, weakened tooth enamel are the major dangers and health risks following vitamin C deficiency (3, 4). The document stated that dry and splitting hair, constant bruising, frequent nosebleeds, rough, scaly, dry skin and aching joints are signs and symptoms of vitamin C deficiency. The person with other chronic diseases like cancer, liver disease, kidneys, lungs and blood related diseases is more vulnerable for vitamin C deficiency as the study revealed (4).

Supply of vitamin C reach nutrients is an immediate solution for prevention and control of scurvy in addition to management of secondary infections. Without exception, the best way to get enough vitamin C is through diet like fresh (organic) fruits and vegetables (5)

The prevalence of vitamin C deficiency will be high in persons live under institutions and eating only limited type of food items due to some sort of stress in the institution (6-8). On October 24, 2016, we received a report of an outbreak of leg swelling with unknown etiology that included five deaths among prisoners at Mizan-Aman prison in southern

Ethiopia. We investigated to describe the magnitude of the outbreak, identify risk factors and etiology, and propose control measures.

Problem statement

A common challenge for primary care physicians is to determine the cause and find an effective treatment for leg swelling of unclear etiology (4). Public health surveillance system is also unfamiliar with leg swelling to detect, notify and to take proper public health interventions (6, 14). Leg swelling can be caused by vitamin C deficiency, called scurvy. Scurvy is a condition which caused by the deficiency of vitamin C for a long time. Vitamin C can be provided from vegetables and fruits easily. Despite the widespread availability foods rich in vitamin C in Southern Ethiopia, scurvy continues to be a condition for which every concerned body needs to be vigilant, particularly in our ageing population who lived in crowded area temporarily and/or permanently. The diagnosis of scurvy can be difficult to establish and if untreated scurvy can be fatal (8, 9).

Scurvy characterized by leg swelling and other sign and symptoms in which it can be happened as outbreak in everywhere; but the studies conducted were mostly on case report based (10-13). The findings from case report based study might not help to take public health intervention similarly at all levels. Nevertheless, leg swelling and other causes and fatality that resulted in scurvy was not emphasized prior from impact of the problem (14-16).

In Ethiopia, few studies conducted on vitamin C deficiency disease in which to explore risk factors for disease. This study aimed to identify etiology of leg swelling and explore risk factors for the identified etiology.

Significance of the study

Leg swelling with unspecified etiology is very difficult to diagnose by clinicians to identify easily and vitamin C deficiency is ancient human kind disease. Identifying contributing risk factors is need to forward the prevention and control measures of the diseases in which the study designed to find risk factors, etiology of disease and magnitude of the disease. The study need to propose the introduction of nutritional

protocols in camps like prison, schools, military camps for prevention of nutritional deficiency causing diseases.

Exploring the risk factors and identifying etiology will provide a comprehensive understanding of the issues surrounding utilization of national nutrition protocols in prisons and help programmers and policy makers to make evidence based decision on the program planning and scale up process ultimately helping to improve standard case definition for vitamin C deficiency. Lack of surveillance system and relatively high case fatality in the prison triggered us to conduct epidemic investigation. The primary beneficiaries of this study will be 23 prison institutions which found in Southern Regional State Ethiopia. In addition, the study findings will serve as a reference for further studies.

Literature review

Leg swelling (edema) can be classified venous edema and lymphedema as well as lipedema. The former edema characterized by excess low viscosity, protein-poor interstitial fluid resulting from increased capillary filtration that cannot be accommodated by a normal lymphatic system whereas others characterized as excess protein-poor interstitial fluid resulting from increased capillary filtration that cannot accommodated by a normal lymphatic system. Lipedema occurred as form of fat maldistribution rather than true edema (4). Deep vein thrombosis was common cause of leg edema for unilateral acute cause in United States of America whereas chronic bilateral edema can be caused by venous insufficiency, pulmonary hypertension, heart failure, idiopathic edema, drugs, premenstrual edema, pregnancy and obesity (4).

A case study on 48 years old man with cough and leg swelling showed that hypertensive emergency could cause leg swelling (7). Acute swelling of leg over a period of less than 72 hours is more characteristic of deep vein thrombosis (DVT), cellulitis, ruptured popliteal cyst, trauma or drug; but the chronic one is due to the onset or exacerbation of chronic systemic conditions like congestive heart failure, renal or hepatic diseases (7). Scurvy is one of the oldest human diseases. Descriptions of scurvy have been found in the Old Testament, the writings of Pliny, and in 3500 years' old Egyptian medical scrolls

(17, 18). Evidence of the disease has been found in human skeletons from ancient Native American archeological sites(19).

The disease is caused by a deficiency of vitamin C (ascorbic acid). Humans - along with monkeys and guinea pigs - are one of the few species unable to synthesize vitamin C. Stores of vitamin C also are limited in humans, and clinical disease becomes evident within 2-4 months of inadequate intake (20-22).

Scurvy characteristically has been associated with extended sailing expeditions, and has previously caused a large burden of disease among sailors and explorers. It is estimated that two million sailors died of scurvy from the 16^{th} – 19^{th} centuries(23). "Land scurvy" also has been known to affect vulnerable populations on land during times of war and famine, such as during the American Civil War and the Irish potato famine(24, 25).

With the finding that citrus fruits could prevent scurvy in 1747 and recommendations by the British Navy to add lemon juice to voyages, the global incidence of scurvy declined through the 19^{th} century(26). After the discovery of vitamin C in 1928(27), scurvy became a relatively rare disease and few practicing physicians today have encountered a case.

Nonetheless, given the inability to synthesize vitamin C, humans remain at risk for scurvy when diets are limited. The medical literature is replete with case reports from many continents describing isolated cases of scurvy associated with chronic disease, alcohol dependence, mental illness, or social disruption(28-32).

Large outbreaks of scurvy still occur, especially among vulnerable populations such as refugees and prisoners. It is estimated that scurvy affected more than 100,000 refugees in Somali and Sudanese camps during the 1980s. Outbreaks of scurvy in the camps typically peaked about 4 months after taking a diet of vitamin C deficient food (33).

Because of its rarity and unfamiliarity among clinicians and public health workers, there often can be a delay in diagnosing and treating scurvy (34, 35). In 2002 an epidemic of scurvy in rural Afghanistan was initially misdiagnosed as an outbreak of Crimean-Congo Hemorrhagic Fever. Aid workers were evacuated and intervention delayed until a World Health Organization investigation determined the cause to be scurvy (36, 37).

More recently, scurvy was identified in 38 patients from a prison in southern Ethiopia in 2010. All 38 patients had been referred to a local hospital for evaluation of leg swelling and found clinically to have scurvy. Prisoners who had been imprisoned for more than eight months were found to develop symptomatic scurvy. In addition to leg swelling, these patients frequently were noted to have cough, gum hypertrophy, hyperpigmentation, and anemia (38).

Objectives

General Objective

To conduct investigation of leg swelling epidemic of unknown etiology in Mizan prison institute in October 2016, SNNPR, Ethiopia

Specific objectives

To verify the existence of epidemic of leg swelling of unspecified etiology

To describe the magnitude of the cases by place, person and time

To identify the etiology of leg swelling

To assess risk factors associated for leg swelling

Methods

Study design

Descriptive cross-sectional study design was conducted to identify magnitude of disease and to generate hypothesis followed by unmatched case-control analytical design to find out the associated risk factors.

Study area and Period

The study was conducted in Mizan-Aman town, which is capital city of Bench Maji zone, from October 26 to November 19, 2016. Bench Maji is one of 15 zonal and 4 special districts administration of Southern Nations, Nationalities and Peoples' Regional state located in Western part of the region capital city, Hawassa. The zone located at North West of Addis Ababa far apart 590 km and 683 km from Hawassa. The zone comprised of 1 town administration and 11 rural Woredas. The zone bordered at North parts of Keffa and Sheka zones, at South parts of South Omo zone and South Sudan country, at

West South Sudan and at East parts of Keffa and South Omo zones. According CSA of Ethiopia, 2016 adjusted total population of Bench Maji zone is about 818,515 (2007: Census projection) with 410,894 male and 407,621 female populations.

Menit, Bench, Surma and Sheko are the main popular ethnic groups live together peacefully in Bench Maji zone. The main occupation of the zone is farming followed by pastoralists. Coffee and spices are known cash crops in the zone next to cereals and vegetables. Agro-ecological situation of the zone is mainly temperate and tropical.

Mizan prison institute is located at the capital city of Bench Maji zone in Mizan-Aman Town administration. The institute is one of regional prison institutes governed by regional prison institutes commission. The location of Mizan prison institute is found on $35^0$34’51.35’’E longitude, $6^0$59’43.35’’N latitude and 1421m altitude as GPS was measured at the in front of prison clinic. As counted on 04 November 2016 at 5:45 pm, totally 2677 adult male, 88 adult female and 25 children (with their mothers) prisoners found in the prison. The number of prisoners increased month to month as administrative bodies explained. The prisoners live in 18 rooms including female rooms which located between $35^0$34’52.20’’E longitude, $6^0$59’46.46’’N latitude and 1401m altitude and $35^0$34’51.47’’E longitude, $6^0$59’44.71’’N latitude and 1406m altitude.

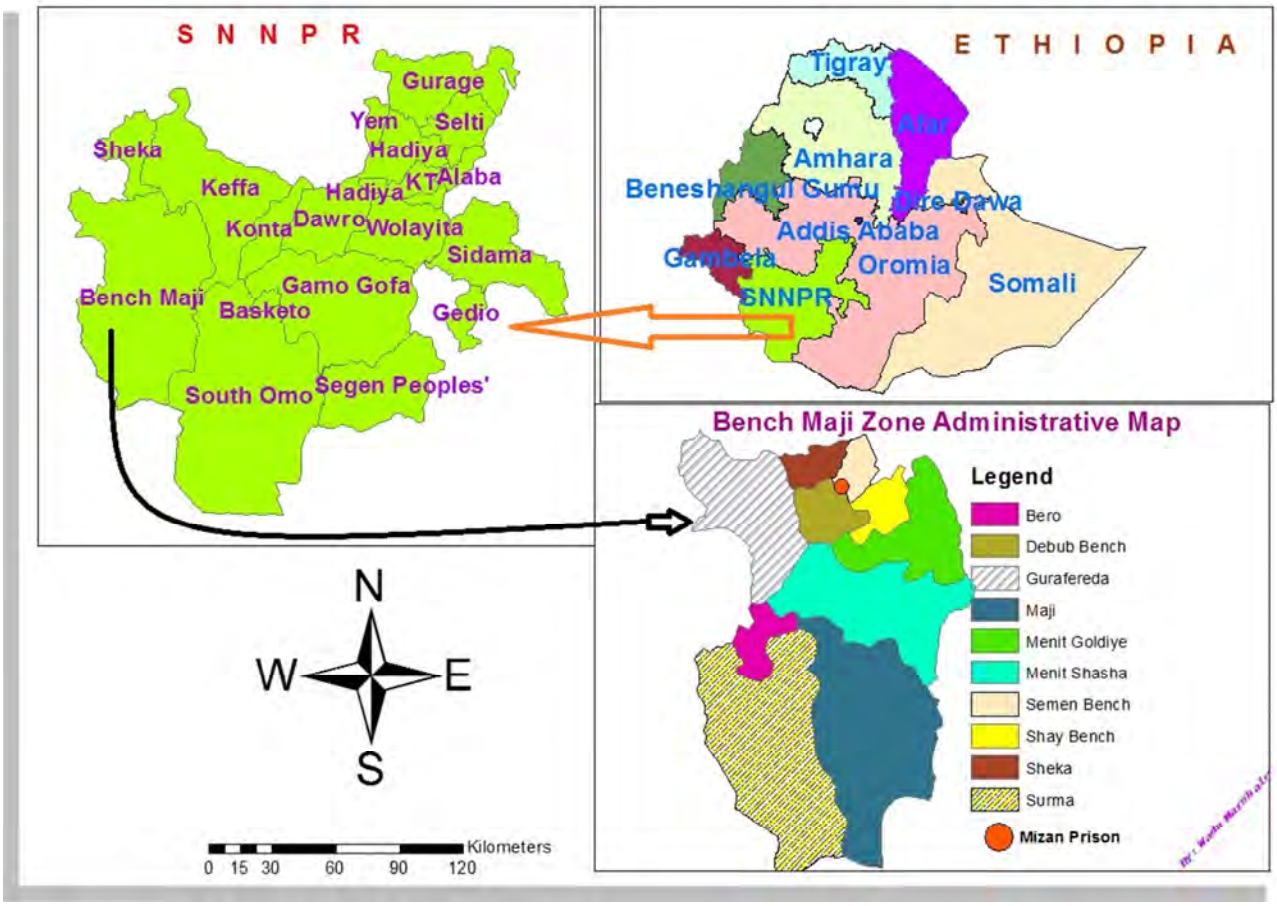

Figure 7 Administrative map of Bench Maji Zone, SNNPR – Ethiopia, November 2016

The prison has 24 hours clinic service for health care of prisoners. The clinic has four rooms; examination room, dispensary, dressing and injection room and laboratory. Totally 1 health officer, 4 diploma nurses, 1 health assistance, 1 lab technician and 1 pharmacy technician are providing primary health care services for prisoners, technical and administrative staffs of the prison.

Source Population

All Bench Maji zone populations who live in 11 rural Woredas and 1 town administration were used as the source population of the study.

Study population

All the prisoners found in the Mizan prison institute at the period of data collection were used as study population.

Study Subjects

All the persons in the prison with leg swelling with unclear etiology are the study subjects

Operational Definitions

There were no standard case definitions for leg swelling and vitamin C deficiency. However, we set operational definitions for study purpose

Cases are prisoners who suffered from unspecified leg swelling with active illness at the time of data collection in Mizan prison institute from October 26 to November 19, 2016.

Controls are prisoners who free from leg swelling illness in the Mizan prison institute in the study period.

Confirmed cases are patients who diagnosed clinically by senior clinicians (internsits) at Jimma, Addis Ababa and Mizan-Tepi hospitals and who met sign and symptoms of scurvy.

Suspected cases are cases who are suffered from leg swelling with unspecified etiology and clinically not diagnosed by senior clinicians.

Scurvy can be used interchangeably with vitamin C deficiency for this study

Sampling Procedure

All prisoners who suffered from leg swelling with unknown etiology were selected as case. Two control groups selected for one case from the same dormitory by simple random sampling method by using list of prisoners as sample frame. For one Menit case, two Menit control groups were selected from the same dormitory and the same procedure followed for other ethnic groups due to language barriers and difference in their culture.

Data collection

For case-control study data was collected from cases and controls using interview administered structured questionnaire. Observation of prisoners' resident, working areas and sleeping bed and/or floor was conducted for semi-qualitative data. Regional health bureau, Bench Maji zonal health department, Mizan town administrators and Mizan prison administrators asked for some of risk factors and interventions using informal questions based on their duties.

Data processing and Analysis

Data obtained through interview administered questionnaire and line list was entered to Epi Info version 7.1.4.0 for calculating rates, proportion and ratios. Bivariate analysis was conducted to identify factors that associated with outcome variable. Those varaiables siginficatly associated at bivariate analysis were included into multivariate analysis. Statiststical significance was declared with cut point of 5 %siginficance levele and final result was report OR and 95% confidence interval and p-value less than 0.05.

Ethical clearance

Since it was a public health problem, we need not to have IRB. Official letter wrote from regional PHEM to conduct outbreak investigation and informed consent was obtained from each respondent. There was no name and other personal identifications related to participants wrote on the data collection tools confidentiality of participants. All participants were provided informed consent and asked their willingness to respond for the interview. We gave them freedom not to respond and/or any time to interrupt interview if any unwanted condition happened. Data was maintained not to display personal identification of respondents and will be kept under the control of principal investigator until the findings disseminated to relevant bodies. Then, the tool will be disposed by firing.

Result

Descriptive epidemiology

Totally 116 suspected leg-swelling cases (AR = 4.5%) with 11 deaths (CFR = 9.5%) were line listed. Totally 11 deaths recorded in the duration of five months (18 May to 29 October 2016) by unknown cause of leg swelling and other medical problems. Of them 8 were died within one month (October 16 to 29, 2016). The number of prisoners counted 2790 including 88 women and 25 children with their mothers. The sex of all cases is male. Nine of the cases were developed leg swelling prior to entry to prison as they complained.

Table 7 Number of Cases by ethnic group present in each dormitory as of 03 November 2016, Mizan prison, SNNPR - Ethiopia

Dormitory Number	Bench	Menit	Sheko	Surma	Total
1	1	5	0	0	6
2	0	4	0	0	4
3	4	9	0	2	15
4	1	2	0	2	5
5	5	3	1	1	10
6	2	7	0	0	9
7	3	5	0	0	8
8	3	4	0	2	9
9	2	3	0	0	5
10	0	2	1	0	3
11	3	7	0	0	10
12	1	2	0	0	3
13	1	4	0	0	5
14	1	7	0	0	8
15	4	3	1	0	8
16	3	5	0	0	8
Total	**34**	**72**	**3**	**7**	**116**

The first similar case was treated first time in 2011 before imprisonment and the disease relapsed in 2016 within 7 months duration of stay in the prison.

Among 17 different referrals in the case of leg swelling of unknown etiology from Mizan prison to Hawassa prison during 13 July to 24 October 2016, four Menit ethnic groups

28, 36, 45 and 50 years old men and 2 Bench ethnic groups with 25 and 45 years old men were diagnosed for similar cause of disease as St. Paulos hospital diagnosed eight cases.

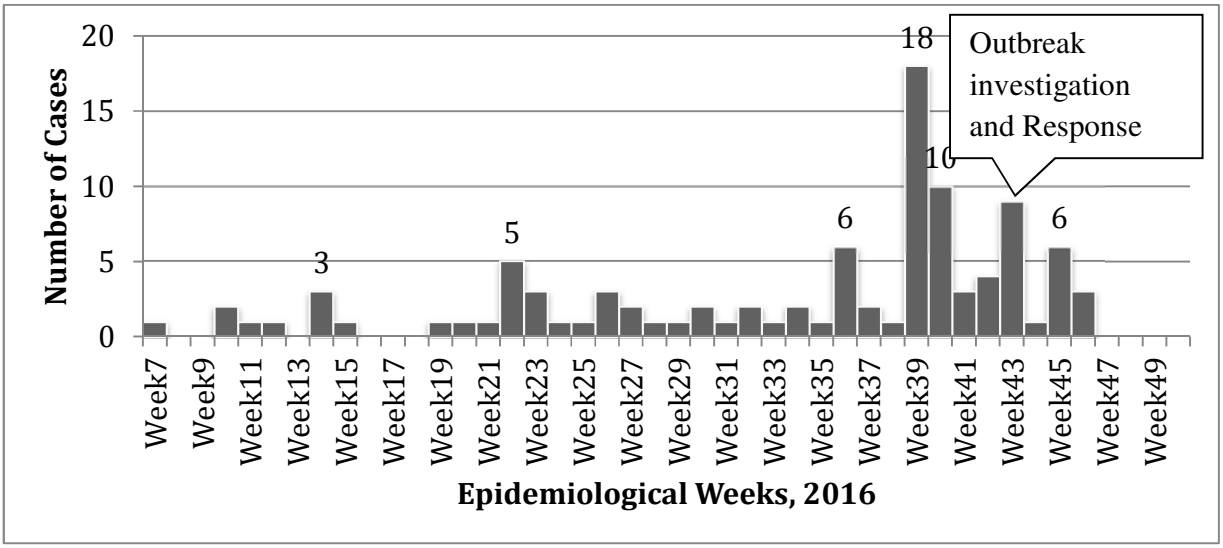

Figure 8 Epidemic curve of Onset of Leg swelling by epidemiological weeks in Mizan prison, SNNPR, Ethiopia, 2016

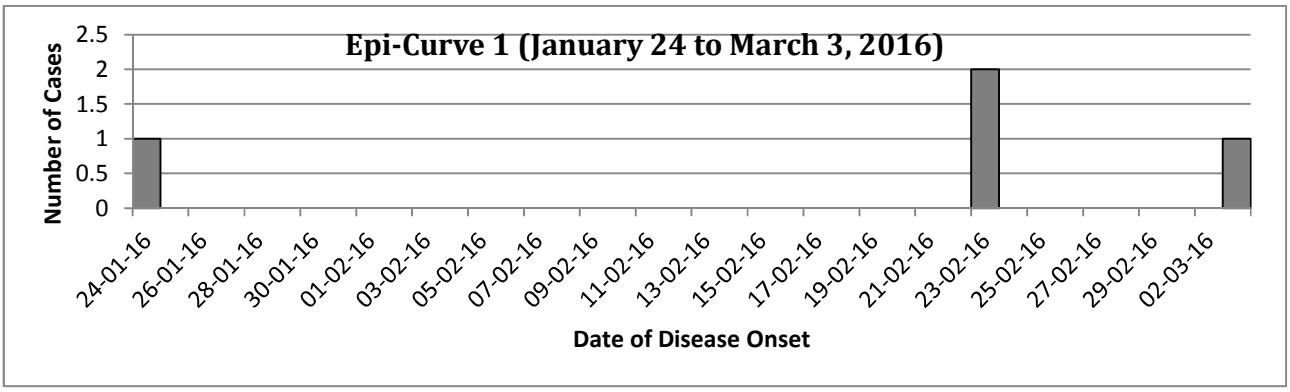

Figure 3.1 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

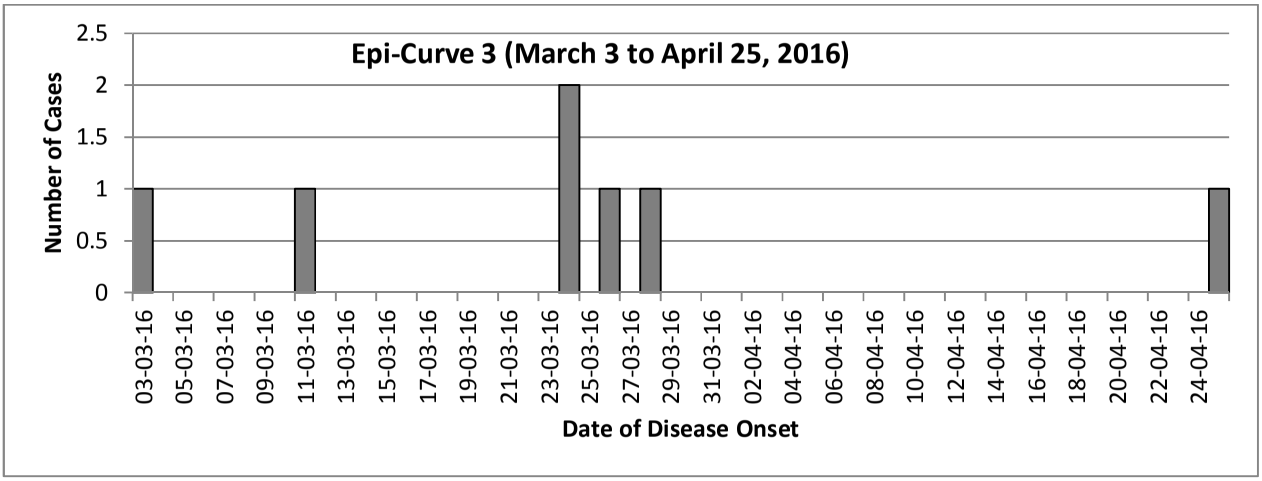

Figure 3.2 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

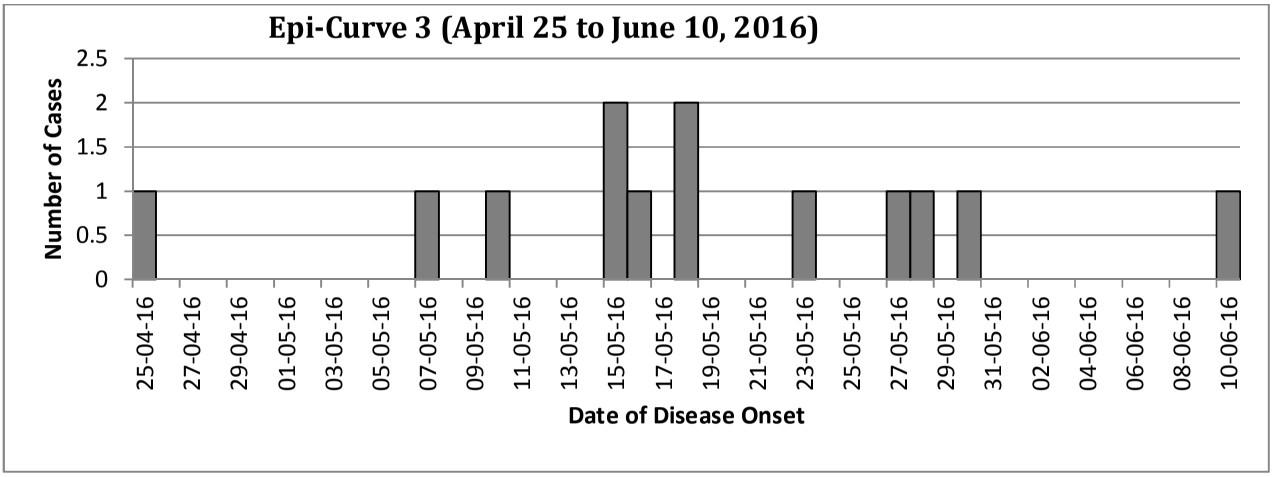

Figure 3.3 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

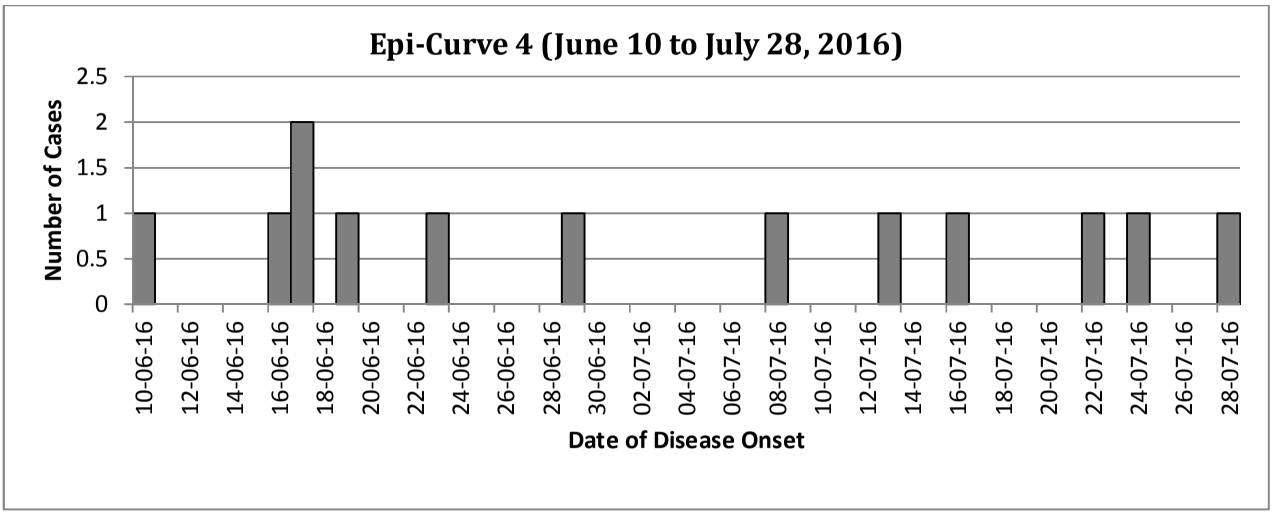

Figure 3.4 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

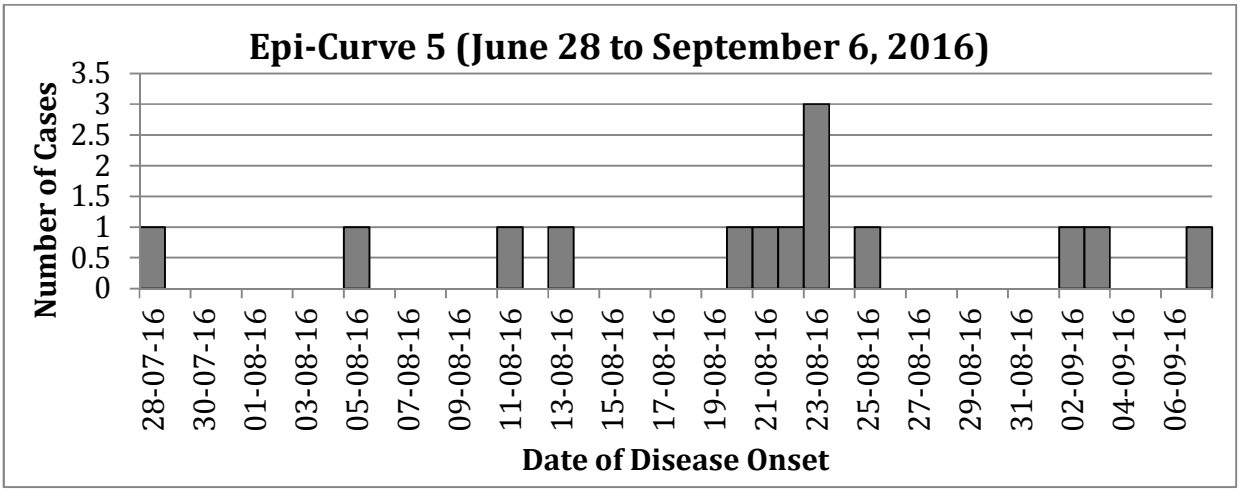

Figure 3.5 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

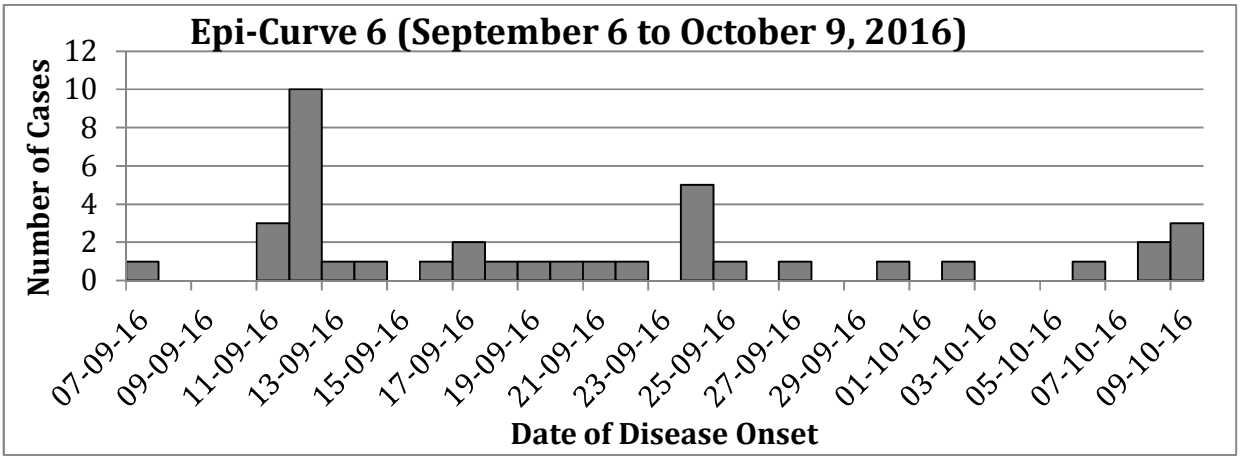

Figure 3.6 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

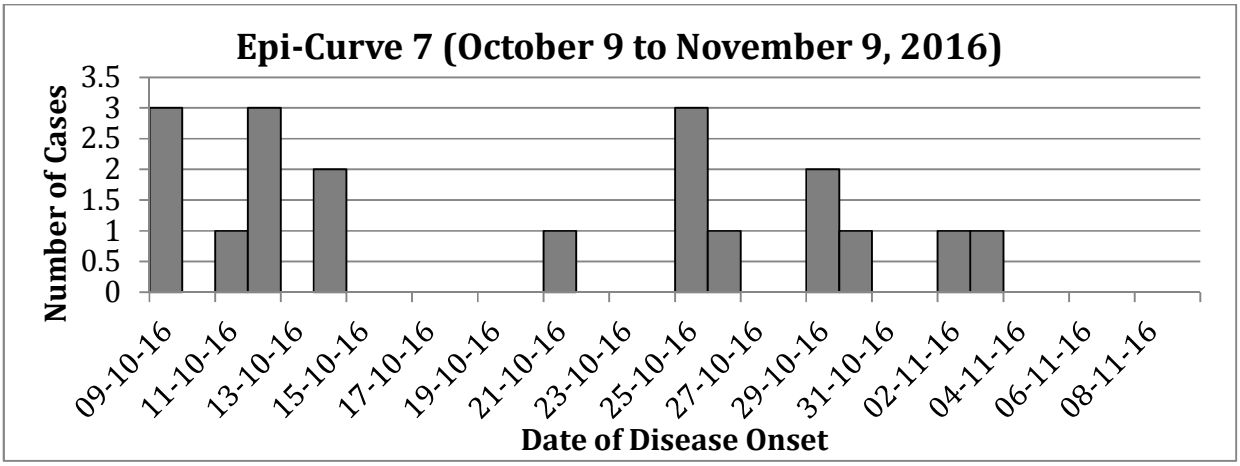

Figure 3.7 Epi-Curve by date of leg swelling onset in Prison, SNNPR, Ethiopia 2016

Zonal health department started to take public health intervention as soon as the number of cases and deaths increased.

In addition to leg swelling, totally 145 cases were treated and tried to diagnosed at different physicians and line listed who suffered from different medical illness. Of the total 145 cases, 29 were ruled out with known cause of disease like lymphatic Fliarisis (LF), elephanthiasis, viral disease, etc. and 8 were died and 3 were displaced since they finished criminal time.

The most affected age groups are less or equal to 30 years old as described in the figure below. As the age increased, the incidence of the disease decreased with increasing age.

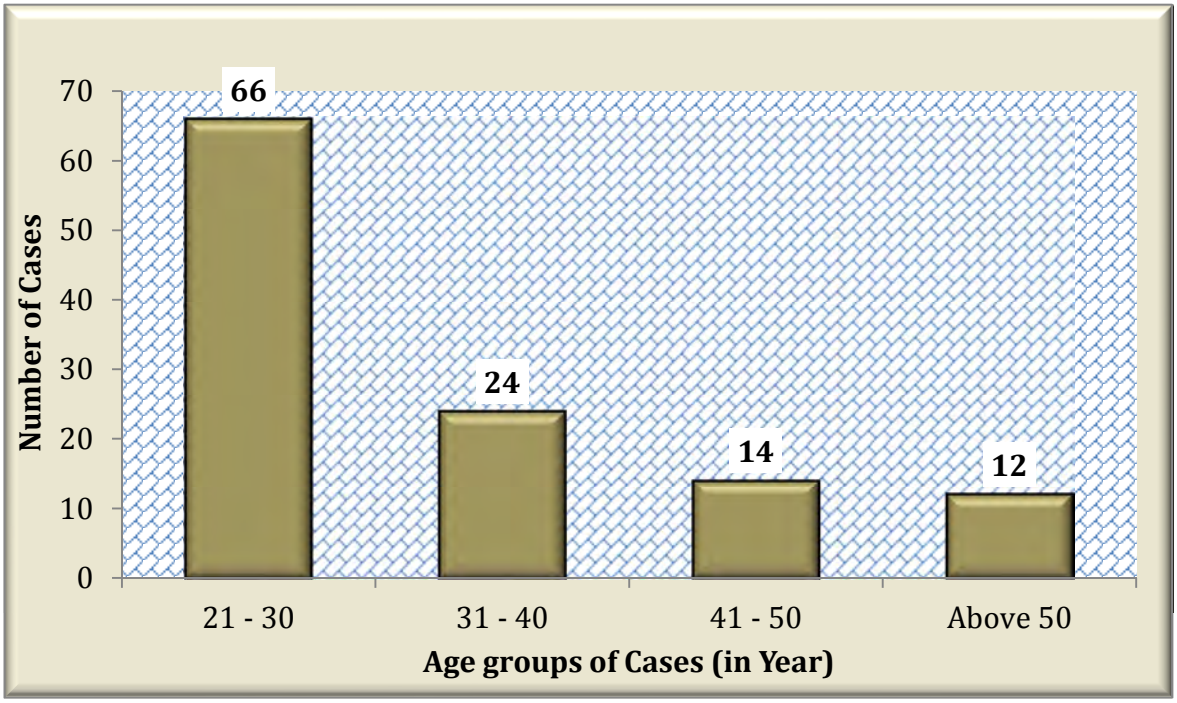

Figure 9 Distribution of Leg swelling cases in Mizan prison by age groups, SNNPR, Ethiopia - 2016

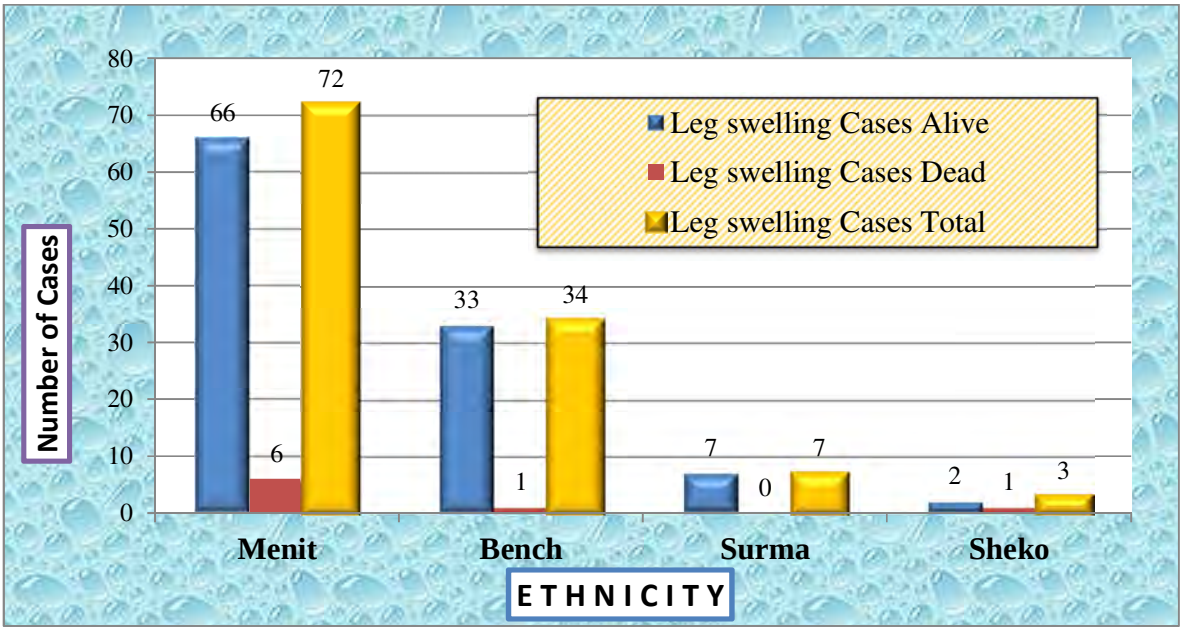

Figure 10 Distribution of leg swelling cases and deaths by ethnic groups, November 2016,

The most affected ethnic group is Menit (62%) followed by Bench (29%) and Surma (6%) ethnicity. Ethnicity specific attack rate (AR) of Menit and Bench are 8.2% and 2.8% respectively. Case fatality rate of Menit ethnic group was highest (CFR = 8.9%) and that of Bench was 2.9%.

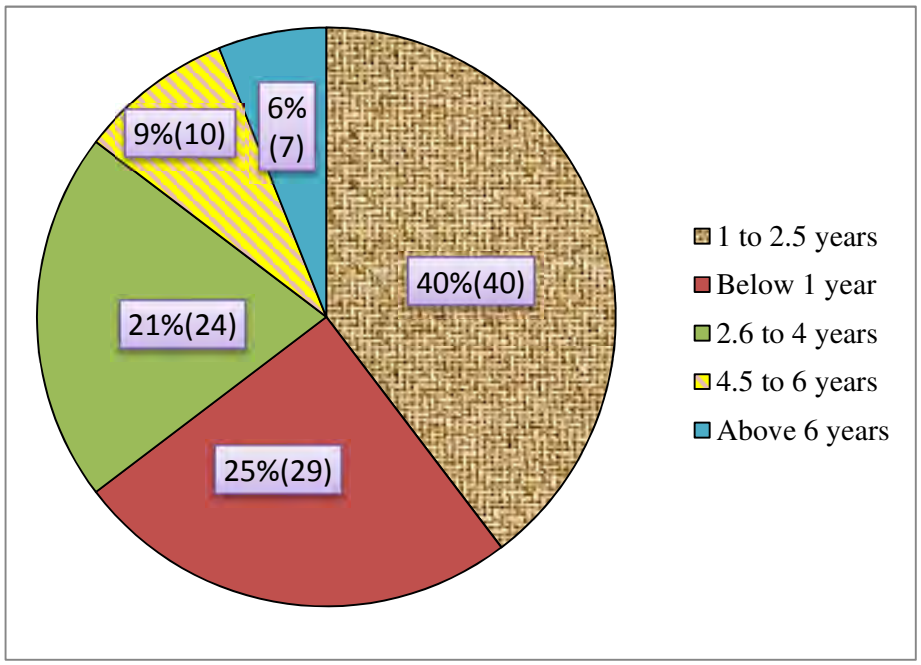

Figure 11 Pie chart for length of years cases stay at prison, Bench Maji zone, SNNPR, Ethiopia, 2016

About 65% of total cases were contracted the disease within duration of 2.5 years' stay at the prison. Like an age, as the duration of stay in the prison increased, the number of leg swelling cases with unknown etiology increased untill the cause of epidemic confrimed as vitamin C (ascorbic acid) deficiency by laboratory confirmation.

Before clinical and laboratory indication of scurvy, some of the leg swelling cases were diagnosed as deep vein thrombosis (DVT) 52(45.7%), Cellulitis 10(15.5%), septic and rheumatoid arthritis 9(14.6%), thrombophlebitis, pyomytis, pulmonary thromoembolism (PTE), lymphatic filariasis (LF), bursitis and spondylitis based on physical examination and clinical manifestations of the patients.

Above 45% of leg swelling cases were diagnosed as DVT and DVT with others by clinicians. For eight referred patients, the diagnosis was vitamin C deficiency. For 37 (32%) patients, the diagnosis was unspecified.

Public health Interventions

Epidemic investigation team was formed from regional, zonal and hospital health professionals of different disciplines. The team was comprised of an epidemiologist, occupational and environmental health expert, clinician, lab technologist, field epidemiology residents, environment health and health officers. Case management, logistic and supply, surveillance, social mobilization and coordination sub-teams were formed to control the epidemic. Two general practitioners and 3 nurses were recruited for intensive follow-up inpatient cases at hospital level.

Zonal health department and zonal administration sent eight severely ill cases to St. Paulos specialized hospital for advanced clinical diagnosis and diagnosis by covering all expenses of prisoners, policemen, drivers and fuel for two ambulances.

Routine laboratory examination was done for all 26 inpatients in Mizan-Tepi university teaching hospital to identify and treat co-morbidity of secondary infection. Totally 42 units of blood supplied from central blood bank. Drugs like IV fluids, IV/IM antibiotics and analgesics supplied from regional health bureau.

Vitamin C tablet mass distribution was done for all 2677 male and 88 female prisoners Since clinical diagnosis and 3 lab confirmed cases indicated the epidemic as vitamin C deficiency. Formal letter was written to prison from Mizan-Tepi university teaching hospital to add food items that enrich with vitamin C. Health education for 2411 male and 76 female prisoners and debriefing about the cause of the disease and prevention mechanisms for all prisoners' team leaders and health committees after laboratory confirmation of scurvy.

Observational /Semi-qualitative Data/findings

There was no in-service training for health professionals of prison clinic for capacity building to identify and detect the cause of disease early. Medical records and data in the prison clinic were not organized and computerized for further data analysis.

Table 8 Measure of 6 rooms of prisoners to know area and volume of each room, Mizan prison in SNNPR, Ethiopia - 2016

Room #	# of prisoners*	Area of the room(m^2)	Volume of Room (m^3)	Area per prisoner (m^2)	Prisoner per Volume(m^3)	Remarks
1	139	60	300	0.43	2.16	
2	151	100	250	0.66	1.66	
6	162	120	300	0.74	1.85	
7	162	120	300	0.74	1.85	
13	131	120	300	0.92	2.29	
16	254	200	600	0.79	2.36	
Total	999	720	2050	0.72	2.05	

Source: *Zonal health department measured to identify the risk factor before*
** Number of prisoners was taken just after count on 04 November 2016 at 6:00PM (25/2/2009 E.C, 12:00PM local time)*

The prison is suffocated with narrow rooms for those huge numbers of prisoners; prison is not sufficient for all prisoners, see table 9.

The number of prisoners increased from 1592 in 2013 to 2790 in 2016 year to year even month to month without any expansion of the room. The prison was rebuilding room number 12 for renewing the building. The sewage system is very low and there was bad odor of toilet around room number 10, 16, isolation room and working areas. The toilet outlet was leaking to the outside community. Bud bug and fleas present around sleeping areas despite the prison conducted chemical spray at every month. The floor of all rooms

is not cemented but there was some prisoners sleeping on the floor using local carpet (Selen).

Prisoners can move freely in the prison from morning 7:00 AM to afternoon 5:30PM. Weaving, local baggage (‘Zenbil’) work, local tray for bread (‘Mesob’) work, rope working, local carpet working and kitchen area present with sufficient availability of air and light. Working habit of shepherds, gardeners, rope and local carpet workers and cookers and bakers is by standing with freely possible movement whereas that of weavers, local baggage (‘Zenbil’) and bread tray (‘Mesob’) is sitting with freely possible movement for 6 – 9 hours per day. There was separate room to isolate prisoners with pulmonary TB and hepatitis but no special care for them regarding feeding and sleeping area since they slept on the floor.

Breakfast, lunch and dinner supplied on time for all prisoners but animal product, fruit and roasted vegetable food items were not incorporated in their meal during 15 days of observation; they feed cereals only. The prisoners have been complained that lack of sufficient movement or physical exercise, climate condition change, cold weather condition at prison, crowdedness and sleeping on one side due to shortage of place are responded as the major causes of the disease. Fruits and vegetables banned from entering into prison any means due to acute watery diarrhea outbreak three months ago.

Case –control study

For case-control study, data collected from 103 cases and 206 controls.

Table 9 Socio-demographic characteristics of Case (N=103) and Controls (N'=206) of Mizan prison, SNNPR, Ethiopia - 2016

Socio-demographic Variables		Case	Control	Total
Age groups	≤35 years	72(23.3%)	169(39.48%)	241(78%)
	> 30 years	31(10.03%	37(11.97%)	68(22%)
Educational level	Illiterate	64(20.71%)	54(17.48%)	118(38.19%)
	Can read & write	5(1.62%)	4(1.29%)	9(2.91%)
	Elementary (1- 8)	34(11%)	129(41.75%)	163(52.75%)
	Secondary (9 - 12)	0	16(5.18%)	16(5.18%)
	Technical (TVET)	0	3(0.97%)	3(0.97%)
Ethnicity	Menit	60(19.42%)	120(38.83%)	180(58.25%)
	Bench	33(10.68%)	66(21.36%)	99(32.04%)
	Sheko	2(0.65%)	4(1.29%)	6(1.94%)
	Surma	6(1.94%)	12(3.88%)	18(5.83%)
	Keffa	1(0.32%)	2(0.65%)	3(0.97%)
	Others	1(0.32%)	2(0.65%)	3(0.97%)
Marital status	Single	16(5.18%)	54(17.48%)	70(22.65%)
	Married	84(27.18%)	145(46.93%)	229(74.11%)
	Divorced	2(0.65%)	5(1.62%)	7(2.27%)
	Widowed	1(0.32%)	2(0.65%)	3(0.97%)
Religion	Orthodox	7(2.27%)	29(9.39%)	36(11.65%)
	Protestant	74(23.95%)	144(46.60%)	218(70.55%)
	Muslim	0	2(0.65%)	2(0.65%)
	Others	22(7.12%)	31(10.03%)	53(17.15%)

The median age of case is 30 years with 15 interquartile age and that of control groups is 26 years with 11 interquartile range. The most affected age groups is below or equal to 35 years old (72(70%) of cases).

Table 10 Socio-demographic characteristics continued from Table 4

Socio-demographic Variables		Case	Control	Total
Occupation	Farmer	90(29.13%)	161(52.1%)	251(81.23%)
	Pastoralist	2(0.65%)	4(1.29%)	6(1.94%)
	Mining	2(0.65%)	0	2(0.65%)
	Employee	2(0.65%)	10(3.24%)	12(3.88%)
	Merchant	1(0.32%)	11(3.56%)	12(3.88%)
	Others	6(1.94%)	20(6.47%)	26(8.41%)
Previous Resident: Woreda	Bero	1(0.32%)	1(0.32%)	2(0.65%)
	Debub Bench	7(2.27%)	17(5.5%)	24(7.77%)
	Guraferda	6(1.94%)	12(3.88%)	18(5.83%)
	Menit Goldia	34(11%)	68(22.01%)	102(33.01%)
	Menit Shasha	18(5.83%)	31(10.03%)	49(15.86%)
	Mizan-Aman Town	2(0.65%)	3(0.97%)	5(1.62%)
	Semen Bench	6(1.94%)	29(9.39%)	35(11.33%)
	Shebench	17(5.5%)	26(8.41%)	43(13.92%)
	Sheko	6(1.94%)	7(2.27%)	13(4.21%)
	Surma	5(1.62%)	11(3.56%)	16(5.18%)
	Yeki	1(0.32%)	1(0.32%)	2(0.65%)
Annual Income (in Birr)	Below 1000	5(1.62%)	1(0.32%)	6(1.94%)
	1000 - 5000	59(19.09%)	110(35.6%)	169(54.69%)
	5001 - 10000	18(5.83%)	43(13.92%)	61(19.74%)
	Above 10000	21(6.8%)	52(16.83%)	73(23.62%)

About 251(81%) of both case and control respondents are farmers before imprisonment. Average staying date of cases at police station before entry of prison is 36 days with 2 days minimum and 120 days maximum stay. Whereas minimum, average and maximum stay duration of controls is 1, 44 and 180 days at police station before imprisonment.

Table 11 Personal hygiene related variable of cases (N=103) and controls (N'=206) in Mizan prison, SNNPR, Ethiopia – 2016

Variables		*Case (N=103)*	*Control(N=206)*	*Total*
Washing limbs everyday	Yes	98(31.72%)	197(63.75%)	295(95.47%)
	No	5(1.62%)	9(2.91%)	14(4.53%)
History of Barefoot walking	Yes	38(12.3%)	35(11.33%)	73(23.62%)
	No	65(21.04%)	171(55.34%)	236(76.38%)
Shoes covered ankle	Yes	5(1.62%)	53(17.15%)	58(18.77%)
	No	58(18.77%)	113(36.57%)	171(55.34%)
Do you have any insect bite history	Yes	75(24.27%)	149(48.22%)	224(72.49%)
	No	27(8.74%)	56(18.12%)	83(26.86%)
Doing physical exercise regularly	Yes	4(1.29%)	28(9.06%)	32(10.36%)
	No	99(32.04%)	178(57.61%)	277(89.64%)
Have you any job in the prison	Yes	50(16.18%)	112(36.25%)	162(52.43%)
	No	53(17.15%)	94(30.42%)	147(47.57%)
Work time in the prison	< 3 hours	7(2.27%)	15(4.85%)	22(7.12%)
	3 to 6 hour	12(3.88%)	43(13.92%)	55(17.8%)
	6 to 9 hours	22(7.12%)	44(14.24%)	66(21.36%)
	>9 hours	1(0.32%)	9(2.91%)	10(3.24%)
Where do you sleep?	Bed	57(18.45%)	144(46.6%)	201(65.05%)
	Floor	46(14.89%)	62(20.06%)	108(34.95%)
Do you have any discomfort during sleeping?	Yes	71(22.98%)	132(42.72%)	203(65.7%)
	No	32(10.36%)	73(23.62%)	105(33.98%)
Can rotate body sides during sleeping	Yes	61(19.74%)	120(38.81%)	181(58.58%)
	No	42(13.59%)	83(26.86%)	125(40.45%)
Mosquito infestation at night	Yes	35(11.33%)	58(18.77%)	93(30.1%)
	No	68(22.01%)	148(47.9%)	216(69.9%)

From total cases and controls, 167(54%) respondents have clean limbs with 99(32%) temporary dusted lower limbs when observed during the date of data collection. From the total respondents, 57(88%) cases and 101(59%) controls wear slipper shoes which cannot cover the whole feet followed by 6(9%) cases and 44(26%) controls wear 'shara' shoes. Only 22(13%) of the control groups wear leather shoes on the date of data collection.

About 64(62%) cases and 70%(144) controls spent 2 to 9 hours of their time by watching TV. Moreover, 48(46.6%) cases and 116(56.6%) controls were sleeping on the bed with mattress; but 43(41.7%) cases and 61(29.6%) controls were sleeping on floor with or without mattress as they responded.

Table 12 Type of works in prison case (N=50) and Controls (N'=112) in Mizan prison

S. No	Type of works in the prison they do	Case	Control	Total
1	Baking Enjera and local baggage works	0	1	1
2	Carpenter	0	1	1
3	Cooking in the kitchen	1	2	3
4	Cultural Cape work	1	0	1
5	Daily laborer	0	2	2
6	Handcraft work	0	2	2
7	Jewelry work	0	1	1
8	Local Baggage (Zenbil) work	15	40	55
9	Local Carpet (Selen) work	1	6	7
10	Local tray for Enjera/bread (Mesob)	7	22	29
11	Merchant	0	2	2
12	Rope work	22	26	48
13	Selen and baggage worker	1	0	1
14	Shoe polisher	0	1	1
15	Student	1	3	4
16	Others	1	3	4
	Total	**50**	**112**	**162**

There was no family history of leg swelling disease among the respondents. Eighty-two respondents believed that the disease can be prevented by different mechanisms such as keeping personal hygiene and environmental sanitation (20.7%), eating balanced diet and good health care (16%), doing physical exercise and frequent movement (6.5%), cultural and traditional practice (8.5%) and providing sufficient sleeping area (5.6%). However,

46.3% of the respondents answered that modern medical treatment is the only solution for disease.

Table 13 Dietary assessment variables of cases (N=103) and controls (N'=206) in Mizan prison, SNNPR, Ethiopia - 2016

Variables			Case	Control	Total
Ate before imprisonment	Cereals	Yes	102(33.01%)	205(66.34%)	307(99.35%)
		No	1(0.32%)	1(0.32%)	2(0.65%)
	Leguminous	Yes	12(3.88%)	41(13.27%)	53(17.15%)
		No	91(29.45%)	165(53.4%)	256(82.85%)
	Vegetables	Yes	32(10.36%)	91(29.45%)	123(39.80%)
		No	71(22.98%)	115(38.19%)	186(60.20%)
	Fruits	Yes	23(7.44%)	87(28.15%)	110(35.60%)
		No	80(25.89%)	119(38.51%)	199(64.40%)
	Animal products	Yes	40(12.94%)	89(28.8%)	129(41.75%)
		No	63(20.39%)	117(37.86%)	180(58.25%)
	Others	Yes	12(3.88%)	36(11.65%)	48(15.53%)
		No	91(29.45%)	170(55.02%)	261(84.47%)
Do you have access to family served food in prison		Yes	6(1.94%)	26(8.41%)	32(10.36%)
		No	96(31.07%)	178(57.61%)	274(88.67%)
Ate in the prison	Cereals	Yes	98(31.72%)	199(64.4%)	297(96.12%)
		No	5(1.62%)	7(2.27%)	12(3.88%)
	Leguminous	Yes	2(0.65%)	2(0.65%)	4(1.29%)
		No	101(32.69%)	204(66.02%)	305(98.71%)
	Vegetables	Yes	2(0.65%)	4(1.29%)	6(1.94%)
		No	101(32.69%)	202(65.37%)	303(98.06%)
	Fruits	Yes	2(0.65%)	27(8.73%)	29(9.38%)
		No	101(32.69%)	179(57.93%)	280(90.62%)
	Animal products	Yes	1(0.32%)	4(1.29%)	5(1.62%)
		No	102(33.01%)	202(65.37%)	304(98.38)
Habit of eating fruit in the prison		Yes	2(0.65%)	27(8.74%)	29(9.38%)
		No	101(32.69%)	179(57.93%)	280(90.61%)
Do food items preparing changed recently		Yes	26(8.41%)	52(16.83%)	78(25.24%)
		No	76(24.6%)	152(49.19%)	228(73.79%)

About 5(4.8%) of cases and 9(4.4%) of controls have past history of systemic illness like kidneys diseases. Whereas 5(4.8%) of cases and 8(3.9%) of controls have history of lungs diseases for 1 to 4 years past. Four (3.9%) of cases and 12(5.8%) of controls complained that they had history of other chronic illness like asthma, hypertension, epilepsy, extra

pulmonary TB, PUD, mental illness and skin infection. Totally 36(34.95%) of cases and 19(9.22%) of control groups responded as they suffered from other chronic illness like hypertension, diabetes etc.

Table 14 Health status, lifestyle and knowledge related Assessment variables in Mizan prison, SNNPR, Ethiopia - 2016

Variables			Case	Control	Total
	Have you ever heard leg-swelling disease?	Yes	5(1.62%)	7(2.27%)	12(3.88%)
		No	95(30.74%)	193(62.46%)	288(93.2%)
Possible cause of disease suggested by respondents	Lack of personal hygiene	Yes	1(0.32%)	8(2.59%)	9(2.91%)
		No	102(33.01%)	198(64.08%)	300(97.1%)
	Walking on barefoot	Yes	0	4(1.29%)	4(1.29%)
		No	103(33.33%)	202(65.37%)	305(98.71%)
	Change of eating habit in the prison	Yes	4(1.29%)	7(2.27%)	11(3.56%)
		No	99(32.04%)	199(64.4%)	298(96.44%)
	Hereditary problem	Yes	1(0.32%)	2(0.65%)	3(0.97%)
		No	102(33.01%)	204(66.02%)	306(99.03%)
	Cultural belief	Yes	8(2.59%)	26(8.41%)	34(11%)
		No	95(30.74%)	180(58.25%)	275(89%)
	Lack of balanced diet	Yes	9(2.91%)	23(7.44%)	32(10.36%)
		No	94(30.42%)	183(59.22%)	277(89.64%)
Do you think the disease is preventable?		Yes	18(5.83%)	65(21.04%)	83(26.86%)
		No	26(8.41%)	50(16.18%)	76(24.6%)
		DK	56(18.12%)	90(29.13%)	146(47.25%)
Contact history with leg swelling		Yes	11(3.56%)	32(10.35%)	43(13.91%)
		No	91(29.45%)	171(55.34%)	262(84.79%)
Have history of leg swelling disease		Yes	2(0.65%)	3(0.97%)	5(1.62%)
		No	100(32.36%)	202(65.37%)	302(97.73%)
Have history of dermatitis		Yes	6(1.94%)	7(2.27%)	13(4.21%)
		No	97(31.39%)	198(64.08%)	295(95.47%)
Have history of other chronic diseases		Yes	36(11.65%)	21(6.80%)	57(18.45%)
		No	67(21.68%)	185(59.87%)	252(81.55%)
Daily Tobacco smoking history		Yes	61(19.73%)	51(16.5%)	112(36.25%)
		No	42(13.59%)	155(50.16%)	197(63.75%)
Daily alcohol drinking		Yes	94(30.42%)	129(41.75%)	223(72.17%)
		No	9(2.91%)	77(24.92%)	86(27.83%)
History of trauma/physical torture		Yes	11(3.56%)	25(8.09%)	36(11.65%)
		No	92(29.77%)	181(58.25%)	273(88.35%)

Clinical history of illness and Environmental condition

From total cases, 93(60.3%) got treatment by fortified vitamin C tablets, ceftriaxone IV/IM other IV antibiotics, blood transfusion: at Hawassa referral hospital 4(3.9%), Mizan Health Center 6 (5.8%), St. Paulos hospital – Addis Ababa 8 (7.8%), Mizan-Tepi university teaching hospital 25 (24.3%) and prison clinic 50 (48.5%). Among treated cases, 47(50.6%) were improved, 41(44%) were not improved and 5(5.4%) were aggravated. The distribution of leg swelling was unilateral for 49(48%), bilateral for 50 (48.5%) and generalized for 3 (2.9%) cases with 1 (0.9%) unspecified distribution. The main sign and symptoms of the cases were pain 87(84.5%), fever 39(37.9%), myalgia 37 (35.9%), arthralgia 17 (16.5%), loss of appetite 17 (16.5%), back pain 13 (12.6%), weakness and joint pain (fatigue) 9 (8.7%) and others 10 (8.7%).

All clinical confirmed cases had findings of petechial of varying sizes mostly over the legs and feet, and 19 had hyperkeratotic follicular papules. Thirteen of total had bleeding gums and/or halitosis. Nine of patients among diagnosed in Mizan-Tepi hospital and four of patient among diagnosed in Addis Ababa had signs of jaundice.

Twenty-seven of total cases were unable to walk without the use of a cane or support, and four were unable to sit upright or rise from the bed without complete assistance.

About 99(96%) of cases responded that the illness was occurred in the prison and their last meal and drink were ‘Injera’ with ‘wat’ and pipe water supplied from Roto tanker in the prison.

Table 15 Bivariate Analysis and Adjusted Odds Ratio of risk factors in prison, SNNPR, Ethiopia - 2016

Variable		Case (N = 103)	Control (N = 206)	COR (95%CI)	AOR (95%CI)
Age groups	<35 years	62	156	0.48 (0.29, 0.81)	0.59 (0.26, 2.08)
	≥35 years	41	50		
History of chronic illness	Yes	36	21	4.73 (2.58, 8.68)	4.42 (2.02, 9.66)
	No	67	185		
Tobacco smoking previous history	Yes	61	51	4.41 (2.66, 7.31)	2.47 (1.33, 4.61)
	No	42	155		
Having history of Alcohol drinking	Yes	94	129	6.23(2.97, 13.06)	2.86 (1.21, 6.78)
	No	9	77		
Fruit eating access in the prison	Yes	2	27	0.13 (0.03, 0.56)	0.12 (0.02, 0.63)
	No	101	179		
Fruit eating habit before imprisonment	Yes	23	87	0.39 (0.23, 0.67)	0.39 (0.14, 0.50)
	No	80	119		
Vegetable eating habit before imprisonment	Yes	32	91	0.57 (0.35, 0.94)	0.40 (0.24, 0.69)
	No	71	115		
History of Barefoot walking	Yes	38	35	2.86 (1.66, 4.91)	1.98 (0.99, 3.93)
	No	65	171		
Doing physical exercise regular	Yes	4	28	0.26 (0.08, 0.75)	0.69 (0.20, 2.40)
	No	99	178		
Place of sleeping in prison	On floor	46	62	1.87 (1.15, 3.06)	1.46 (0.79, 2.71)
	On bed	57	144		
Formal educational history of household head	Yes	34	148	5.18 (3.11, 8.63)	0.24 (0.13, 0.44)
	No	69	58		

Discussion

Early detection of events or diseases abnormal increment gives an opportunity to save life. In case of leg swelling in Mizan prison, the disease was not detected for 5 – 6 years even within prison. Due to this, some deaths were occurred before the disease recognized as epidemic as the officials replied. After public health response, supplementation of fortified vitamin C tablets, there were no more deaths due to leg swelling unknow etiology. This may happen due to lack of surveillance system in the prison and shortage of in-service training for prison clinic health professionals to identify and notify unknown or abnormal increasing of event.

Clinical diagnosis and three lab confirmed cases indicated the cause of leg swelling as vitamin C deficiency. The study showed that 31 – 77% of the cases who haven't history of fruit eating habit before imprisonment were at risk of developing leg swelling as compared to prisons who have (OR = 0.40, 95% CI = 0.23,0.69, P-value = 0.0008). Fruits and vegetables eating history before imprisonment and in the prison have a significant correlation with leg swelling to indicate the cause of the disease would be vitamin C deficiency.

As the study confirmed that 14 cases developed the disease after 1 – 6 months after imprisonment and 9 cases contracted the disease before entry to prison. This indicates root cause of leg swelling is not only feeding problem at prison but also there may due to lack of eating vitamin C enrich food stuffs at their entire community level. In the prison, eating cereals only might aggravate the disease at prison.

According to the study findings, marriage, literacy, occupation history and duration of staying at police station before imprisonment have not statistically significant association with diseases directly. Moreover, working environment in the prison, contact history with leg swelling, family history of leg swelling, inset biting history, situation of prison except place of sleeping and physical exercise in the prison, personal hygiene and environmental health have no significant association with leg swelling disease..

History of chronic diseases like pulmonary and extra pulmonary TB, CHF, kidneys illness and PUD has statistically significant association with leg swelling diseases (AOR

= 4.42, 95% CI = 2.02, 9.66 P-value = 0.0021) as the result of our case control study and physical examination confirmed. History of daily alcohol drinking (AOR = 2.86, 95% CI = 1.21, 6.78 P-value = 0.00019) and history of daily tobacco smoking (AOR = 2.47, 95% CI = 1.33, 4.61 P-value = 0.0041) habits of respondents has also statistically significant association with the disease. This showed other systemic illness, daily alcohol drinking and tobacco smoking are the associated risk factors for leg swelling. In addition to that logistic regression showed barefoot walking history as risk factor for the disease.

Limitation

The exact number of persons who were affected by vitamin C deficiency in this outbreak is not known, as we relied on a narrow case definition for suspect cases (edema) and utilized primarily prison and local health records to identify suspect cases. Logistically it was not possible to conduct clinical examinations for all cases by senior internists. Persons who had only subtle or early findings of scurvy, such as fatigue or dermatologic changes, would not have been included as cases. We also could only infer from the health records that prisoners who died from an unknown cause and had leg swelling documented during the period of the investigation died from the disease.

Conclusion

We identified an outbreak of leg swelling in a prison. Identified risk factors, laboratory findings and clinical signs and symptos indicated that vitamin C deficiency as possible cause of leg swellin. Lack of nutritional value or dietary intake of vitamin C enrich food items, lifestyle of persons and health status of the individuals were identified risk factors of leg swelling epidemics. The magnitude of the disease morbidity and mortality increased due to lack of integrated public health interventions, lack of case magement protocol and late detection of the case.

Recommendations

Surveillance systems that can detect diseases associated with micronutrient deficiencies such as vitamin C should be established for high-risk populations.

The prison should add vitamin C enrich food items at least twice per week for all prisoners to prevent morbidity and mortality due to scurvy at prison level.

The expansion of rooms highly recommended preventing overcrowding of prisoners from sleeping on the floor with discomfort condition.

Institution based diseases surveillance should be strengthened by providing on job trainings for prison clinic health professionals; so that prison clinic should be considered during scheduling of health facility based on job trainings at zonal health department and regional level.

Community level nutritional assessment studies should be done to determine the prevalence rate of vitamin C deficiency in the community of Menit and Bench ethnic groups, and community awareness should be increased on source of vitamin enrich food items through health education.

Further clinical case-based studies should be done to identify other clinically asymptomatic cases and to find out other risk factors.

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Chapter II-Surveillance Data Analysis Report

2.1 Measles Surveillance Data Analysis Report of South Nations, Nationalities and Peoples' Region, 2012-2016, Ethiopia

Abstract

Introduction: Measles is the leading case of children morbidity and mortality worldwide. It accounts 44% of total deaths among vaccine preventable diseases for children despite effective vaccine present. This surveillance data analysis was done to describe measles epidemiology within the region, characterize the disease burden, and develop guidance to improve measles control efforts for the repeated occurrence of measles disease in the Southern Ethiopia.

Methods: We reviewed five years case-based measles surveillance data and regional health bureau Expanded Program of Immunization records from 2011/12 – 2015/16. Descriptive cross-sectional retrospective data analysis used to describe surveillance data in terms of person, place and time. We reviewed data of measles cases from case-based report of World Health Organization surveillance data record, line list from regional surveillance unit and vaccination data. Data was processed, organized and anayzed by using Microsoft Office Excel 2010 and ArcGIS.

Result: From 2012 to 2016, the region reported 13,178 (AR=15/100,000 population) both lab confirmed and epidemiological linked Measles cases with 157 deaths (CFR=1.19%). Of them, 3,370 (25.6%) cases reported through case-based. About 7,841 (59.5%) with AR=267/100,000 under 5 children and 12,389 (94%) with AR=138 per 100,000 under 15 population (4548 (34.5%) of total was 5 -14 years age children) and above 15 years contributed only 789 (AR=11 per 100,000) measles cases. About 6780 (51.3%) and 6418 (48.7%) of the total cases were males and females respectively. Age specific incidence was highest for under five years in 2014, about 137 per 100,000 population. About 5323 (40%) out of total cases were not vaccinated for measles. In 2015/16, totally 18 confirmed measles outbreaks occurred in six Zones and one special Woreda in the region.

Discussion: In contrast to increasing routine measles vaccination of the region, there was circulation of measles outbreak in the year 2013 to 2016 since IgM+ rate for measles was above 10% in the years. There was evidence for measles unvaccination rate was responsible for the circulation of measles outbreak in the region every year. The Supplementary Immunization Activities for measles vaccination should be continued for all under 15 years of age in the region to increase chance to get more measles vaccine doses for children. Ser-prevalence and other studies should be done for further study.

Keywords: Measles, surveillance data analysis, southern Ethiopia

Introduction

Measles is highly contagious outbreak-prone acute viral human diseases caused by virus called member of Morbillivirus paramyxoviridae (1). The Measles virus is the cause of measles, an infection of the respiratory system and characterized by maculopapular rash with 7 – 18 days incubation period and highly infectious four days before and after onset of rash (2). It is highly contagious and transmitted from person to person by air droplet (2, 3).

Measles is the leading case of children morbidity and mortality worldwide (4, 7). It accounts 44% of total deaths among vaccine preventable diseases for children despite effective vaccine present. In 2015, WHO reported 134,000 estimated measles deaths that showed 367 deaths in every day or 15 deaths per hour worldwide. The report revealed totally 85% of children vaccinated for measles in 2015 and this helped to drop measles related death by 79% as compared to that of 2000 (651,600 measles deaths occurred). About 20.3 million deaths prevented by measles vaccination during 2000 to 2015 as the WHO report (7).

European Center for disease control and prevention reported 2550 positive measles cases during January to December 2014 with high number of cases reported from Italy, which accounts 1010 positive cases in the year (2, 6). In the region, European, measles cases from 2010 to 2015 accounted in 2010 there were 30265 cases. In 2011, there were 30567 cases and from 2012 to 2015 measles cases were declined radically from 8230 to 4111 (6).

In 2014, America faced measles outbreak due to large unvaccinated community in Ohio (8). This shows that measles unvaccination rate is the main reason for an increase in case from 63 to 667 cases in 2010 and 2014 respectively (8, 15). The importance of measles vaccination for control and prevention of measles disease also revealed by the study conducted in Disneyland measles outbreak investigation. This study showed that 90% of unvaccinated children contracted measles during outbreak (8).

In the WHO African region, measles cases increased from 2002 to 2009. In 2002, only 15 African countries reported 4836 measles cases and the region countries participation increased to report measles cases from 15 to 40 countries that reporting 21,199 total measles case to 35657 cases from year of 2003 to 2009 (5). This implies that the measles

disease burden worsened on the developing countries as the main public health problem due to low measles vaccination coverage in the region (4, 5).

In spite of African regional goal to achieve measles elimination by 2020 in which incidence of measles <1 case per million per year, globally 9 countries, including Ethiopia, reported >1000 measles cases with onset date from June 2015 to November 2015. According to WHO measles case-based report, total of 6137 and 14100 confirmed measles cases documented in 2013 and 2014 respectively. Measles incidence rate was 6.52 in 2013, which increased to 14.61 in 2014 (5).

Measles is one of immediately reportable diseases in Ethiopia. During 2000 – 2015, Ethiopia contributed 9% deaths due to measles to the global next to Nigeria and India where they contributed 13% and 31% respectively (14). Ethiopia faced high number of measles outbreaks in 2015/16 with increasing under five children morbidity. This situation increased the public health challenge to achieve the reduction of the child morbidity and mortality rate significantly (7, 8). As the preliminary report of FMOH, suspected measles cases were increased currently from 2014 to 2016 of third quarter (9). Ethiopia has reported 6137 and 14100 totally confirmed measles cases with their respective incidence rates of 6.52 and 14.61 in 2013 and 2014 respectively (1, 9).

In 2015/16, totally 17 rural Woredas and 1 town administration were affected by measles outbreak in the Southern Nations, Nationalities and Peoples' region. In spite of increased measles vaccination, suspected measles cases were increased currently from 2013 to 2016 (10).

Ongoing analysis of surveillance data is vital to understand unusual increase of events and/or diseases in order to take relevant action before its social, economic and political impact. The analysis helps to anticipate the occurrence of outbreak so that policy makers and decision makers utilize the information for action. For this purpose, descriptive cross-sectional study was conducted to generate information from five years measles case-based and line list data analysis of SNNPR where measles is considered as great public health intelligence.

SNNP Region is among the nine regional states of Ethiopia, comprised of 15 Zones and 4 Special Woredas, with a total population of 19,172,754; with a sex ratio of 50.7% male and 49.3% female to date as adjusted population with CSA 2007. The vulnerable age groups for the measles are, 2,992,867(15.6%) are under five, while 9,177,998(47.87%) of the population are under 15 years of age. The Region has 4,889 health facilities (35 government Hospitals, 714 Health Centers, 3,865 Health Posts, 51 NGOs and 224 private health facilities); which are expected to report all priority disease under surveillance on immediate and weekly basis. Outbreaks of measles are reported in the region every year, but the regional measles vaccination coverage increases from 92.4% to 97% in 2012 to 2016.

Rationale for the Analysis

Despite improved passive and active measles surveillance, measles outbreak continued in the region. The surveillance data (both case-based and line list data) analysis needed to describe magnitude of measles and to identify most at risk age groups that help to take relevant measure to prevent frequent recurrence of the measles outbreak in the region. Therefore, this surveillance data analysis was done to describe measles epidemiology within the region, characterize the disease burden, and develop guidance to improve measles control efforts for the repeated occurrence of measles disease in the Region. The regional health bureau, 15 zones and four special district aill be used the findings of this study. Based on the finding, relevant bodies will take part to control and/or minimize morbidity and mortality associated with measles diseases in the region.

Objectives

General Objective

To describe five years measles morbidity and mortality trend in Southern Nations, Nationalities and People Region from 2012 to 2016.

Specific objectives

To describe measles surveillance data in terms of time, place and person characteristics

To describe the trend of measles morbidity and mortality in the region

To characterize vaccination status of the cases

Methods and materials

Study design: Descriptive cross-sectional retrospective data analysis used to describe surveillance data in terms of person, place and time.

Data Collection and procedures: we reviewed data of measles cases from case-based report of WHO surveillance data record for SNNPR, line list from regional PHEM and EPI data.

Data processing and analysis: Data was processed, organized and anayzed by using Microsoft Office Excel 2010 and ArcGIS. The finding was presented by using tables, graphs, charts, proportions and rates.

Data Dissemination: Findings of the data was reported to SNNPR regional health bureau and Addis Ababa University School of Public Health EFETP, and shared to EFETP Resident advisor and coordinator of Addis Ababa University.

WHO Case definition

Community cases definition of Measles: Any person presented with fever and vesicular, maculopapular or pustular rashes on any part of the body.

Suspected measles case definition: is 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 measles case definition: Cases with a positive laboratory result for measles specific immunoglobulin (IgM) antibody testing that had not received measles vaccination within the 4 weeks before the specimen collection.

Result

In 2012 to 2016, the SNNPR reported 13,178 (AR=15/100,000 population) both lab confirmed and epidemiological linked Measles cases with 157 deaths (CFR=1.19%). Of them, 3,370 (25.6%) cases reported through case-based and the rest by line list. About 7,841 (59.5%) with AR=267/100,000 under 5 children and 12,389 (94%) with AR=138 per 100,000 under 15 population (4548 (34.5%) of total was 5 -14 years age children) and above 15 years contributed only 789 (AR=11 per 100,000) measles cases. About 6780 (51.3%) and 6418 (48.7%) of the total cases were males and females respectively.

Table 16 Number of IgM+ cases for Measles from total cases in the year, SNNPR, Ethiopia, 2011/12 – 2015/16

Years	Region Total Pop.	Number of Lab confirmed + Epi linked	AR per 100,000 popul[n]	Number of Deaths	CFR	IgM+ Cases
2012	17,353,928	2,987	17	8	0.27	109
2013	17,857,192	2,927	16	14	0.48	345
2014	17,933,401	3,436	19	13	0.38	291
2015	18,368,105	1,346	7	54	4.01	260
2016	18,813,345	2,482	13	68	2.74	138
Grand Total	**90,325,971**	**13,178**	**15**	**157**	**1.19**	**1143**

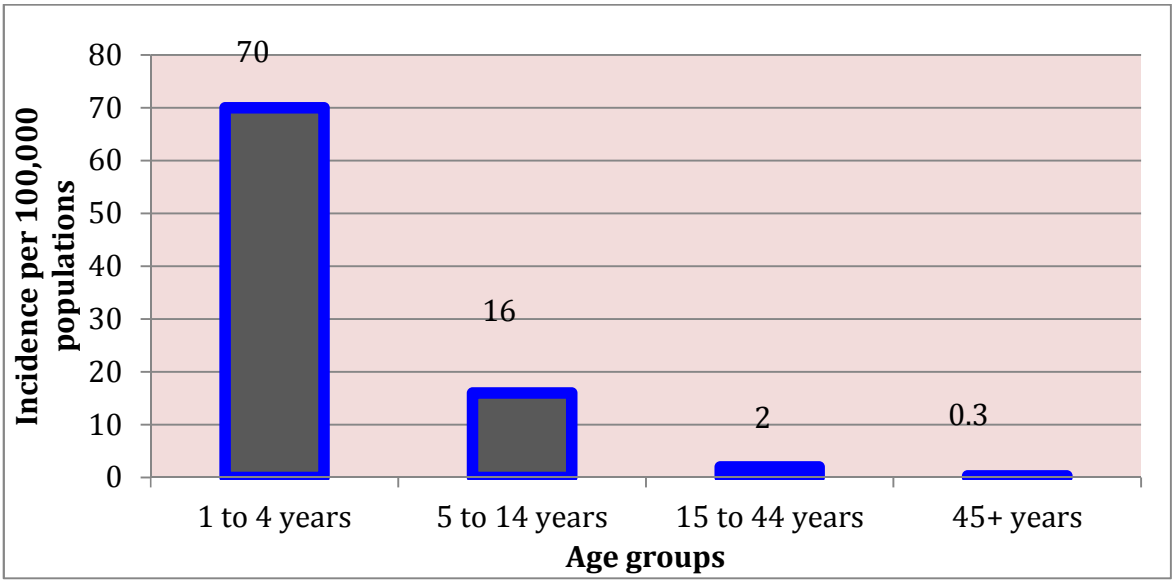

Figure 12 Distribution of Age specific Incidence Rate of Measles cases in 5 years, SNNPR, Ethiopia - 2012 to 2016

Table 17 Number of Measles cases reported in each year with their vaccination history, SNNPR, Ethiopia, 2012 – 2016.

Years in G.C	Number of Cases	Measles vaccination Status				Remarks (Missed data for vaccination status)
		Zero dose	One dose	2 and above	Unknown Status (99)	
2012	2987	1754(58%)	676(23%)	114(4%)	375(13%)	68(2%)
2013	2927	694(24%)	847(29%)	427(15%)	802(27%)	157(5%)
2014	3436	1174(34%)	668(19%)	374(12%)	1138(33%)	82(2)
2015	1346	550(41%)	238(18)	83(6%)	462(34%)	13(1%)
2016	2482	1151(46%)	920(38%)	104(4%)	180(7%)	127(5%)
Total	**13178**	**5323(40%)**	**3349(26%)**	**1102(9%)**	**2957(22%)**	**447(3%)**

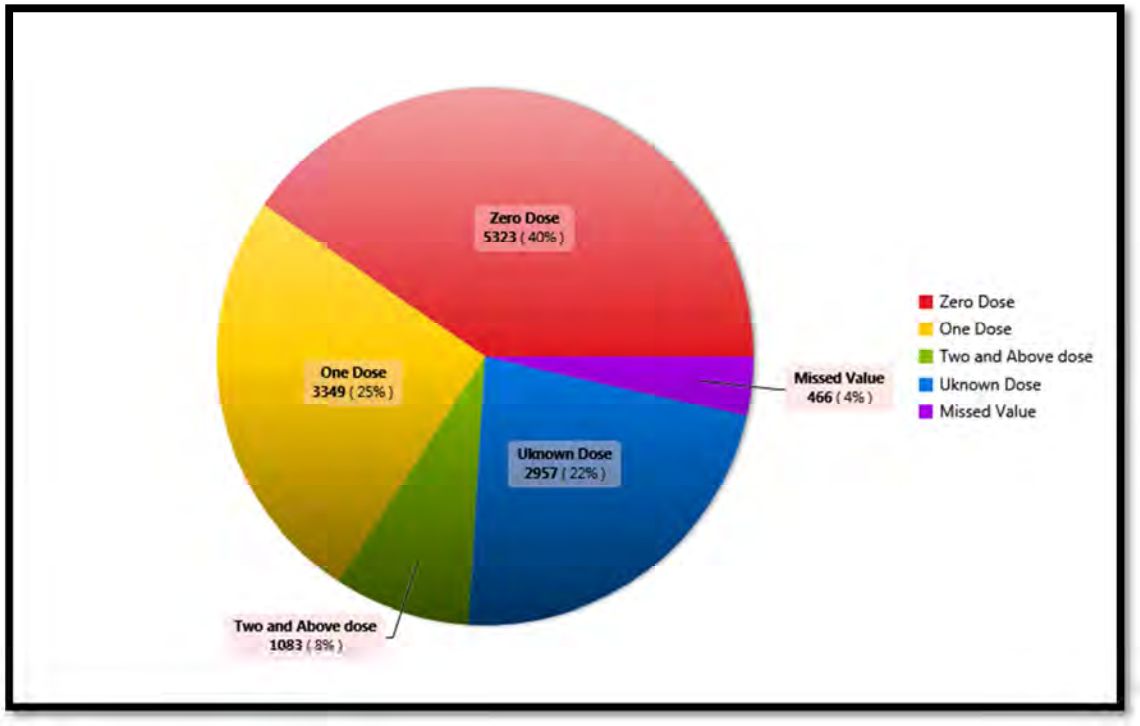

Figure 13 Vaccination Status of total Measles Cases from 2012 – 2016, SNNPR-Ethiopia

In 2014, about 3046 (88.7%) of the total cases was under five children. There was no measles case in 2013 above the age of 44 years. About 5323 (40%) out of total cases were not vaccinated for measles and 2957 (22%) cases had not valid measles vaccination history.

Table 18 Number and Incidence rate of Measles cases of case-based and Line list report by age groups in each year, SNNPR, Ethiopia, 2012 – 2016

Years in G.C	1 - 4 years		5 - 14 years		15 - 44 years		45+ years	
	Number	Incidence	Number	Incidence	Number	Incidence	Number	Incidence
2012	1278	59	1500	27	202	3	7	0.5
2013	1410	64	1321	23	196	2	0	0.0
2014	3046	137	321	6	67	1	2	0.1
2015	612	27	592	10	139	2	3	0.2
2016	1495	64	814	13	163	2	10	0.7
Total	**7841**	**70**	**4548**	**16**	**767**	**2**	**22**	**0.3**

Incidence rate is calculated cases of the age group divided by populations of the same age group per 100,000 Populations.

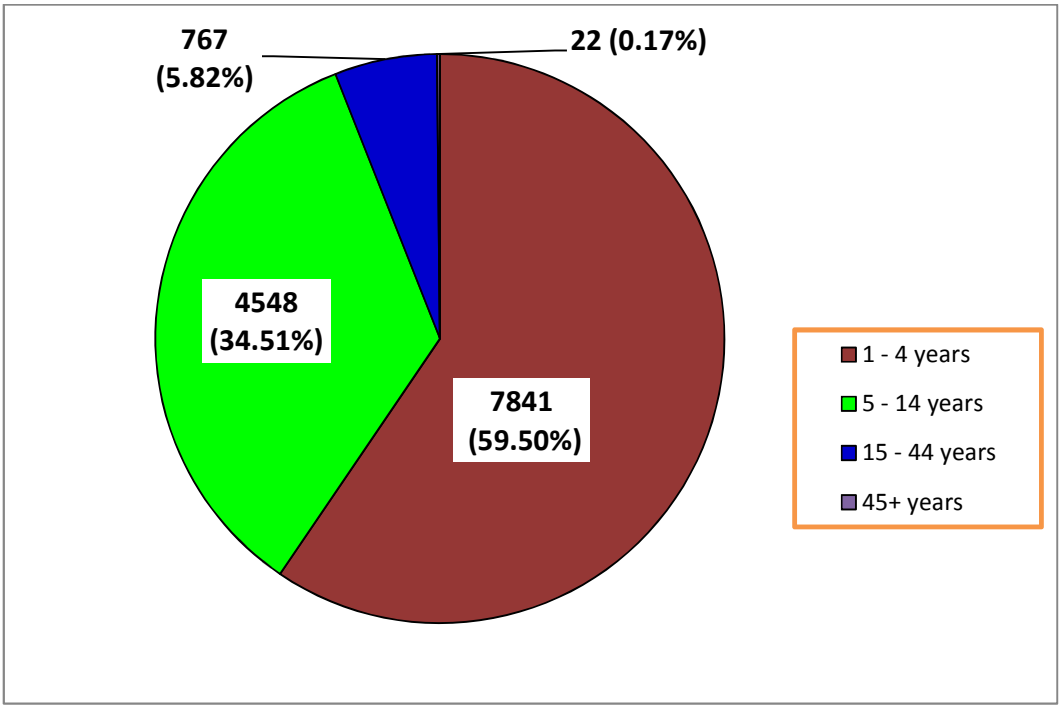

Figure 14 showed Age category of Measles cases in five years, SNNPR, Ethiopia – 2012 to 2016.

All Case-based reported cases were investigated with blood specimens for the last 3 years. In 2013, the incidence of measles was highest and the incidence decreased gradually from 2013 to 2016. However, in 2014, age specific incidence rate was the highest for age 1 – 4 years children, 137 per 100,000 populations. Lab confirmed cases were high in 2014 in which 52.7% were IgM+ for measles.

Table 19 Indicators status of the surveillance in each year, SNNPR, Ethiopia – 2012 to 2016

Indicators	2012	2013	2014	2015	2016
Total number of suspected cases reported	2987	2927	3436	1346	2482
Proportion of reported cases investigated with blood specimens (target: >80%)	97	96	100	100	100
% of lab confirmed cases (target :< 10%)	3.7	35.9	52.7	48.2	25.6
Total number of confirmed measles cases	109	345	291	260	138
Incidence of confirmed measles per 100,000 Population	0.63	1.93	1.62	1.41	0.73

The caseload was highest in 2014 which accounts 3436 (26.07%) of total cases next to 2012. About 5352 (40.6%) cases have the history of non-vaccination status for measles. Of the total cases, 2952 (22.4%) cases have unknown vaccination status followed by 447 (3.4%) cases with missed value of vaccination history. Only 4451 (33.8%) of total measles cases in the last five years have the history of at least one valid measles dose vaccination.

Except 2013, caseload elevated starting from October to February in every year. The highest cases, 3709 (28%), were reported in the month of January. Of them, 1888 (50.9%) were reported in 2012 on the same month. The lowest cases 371 (2.8%) were reported on the month of August.

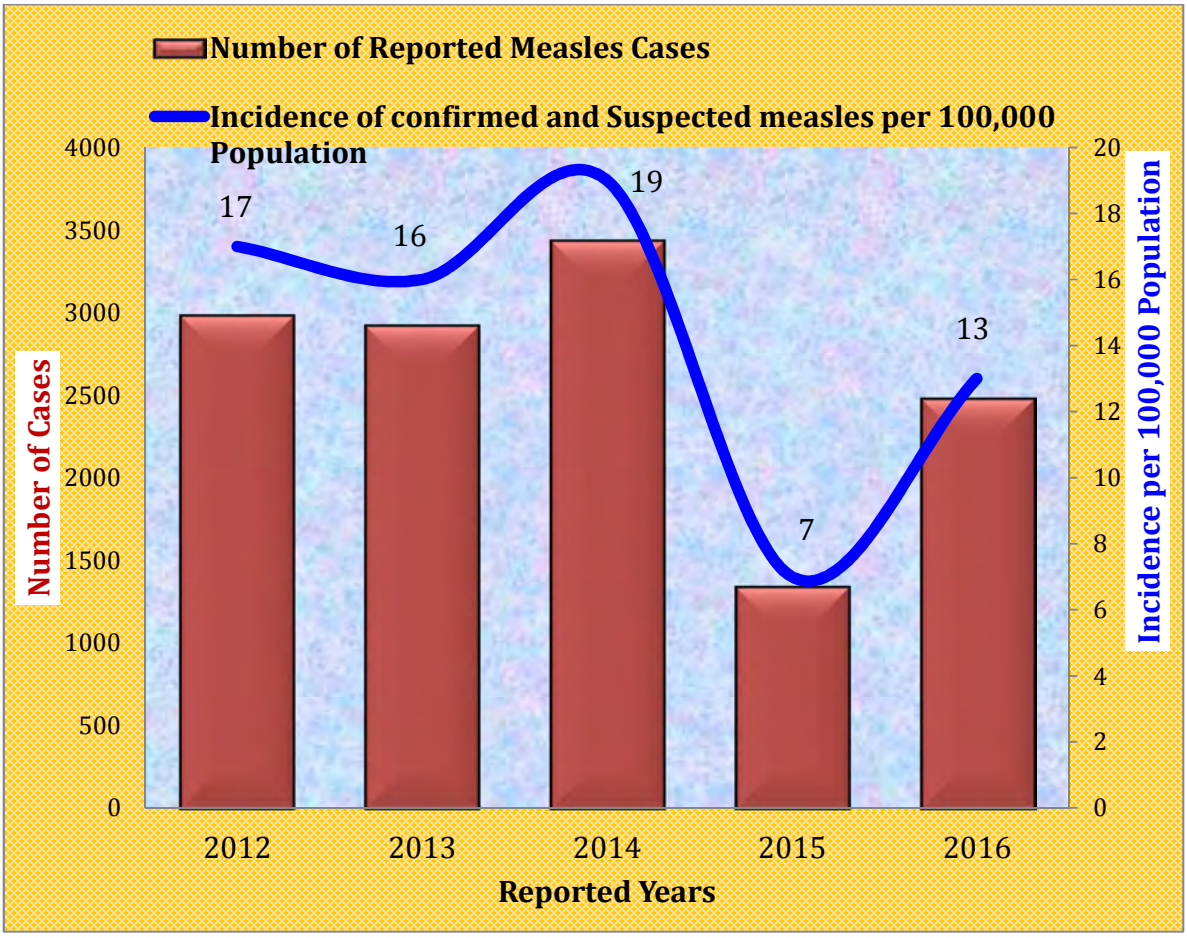

Figure 15 Number and Incidence rate of Measles cases load by year, SNNPR, Ethiopia, 2012 to 2016

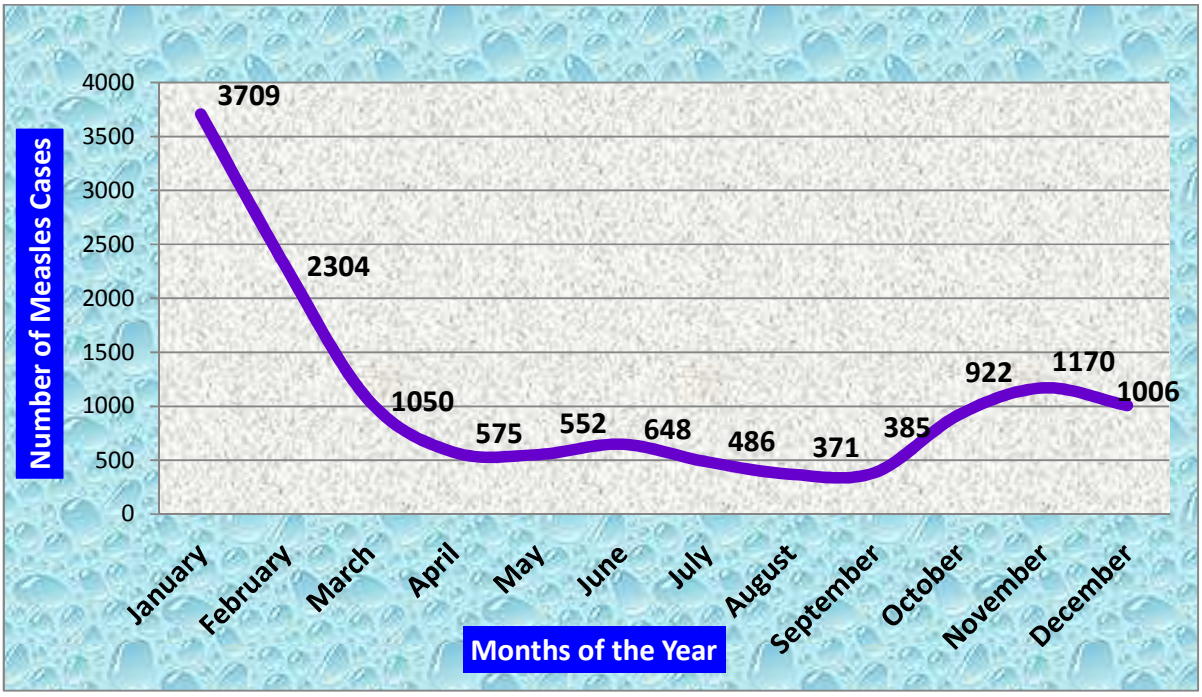

Figure 16 Measles cases trend in the month in the last five years, SNNPR, Ethiopia - 2017

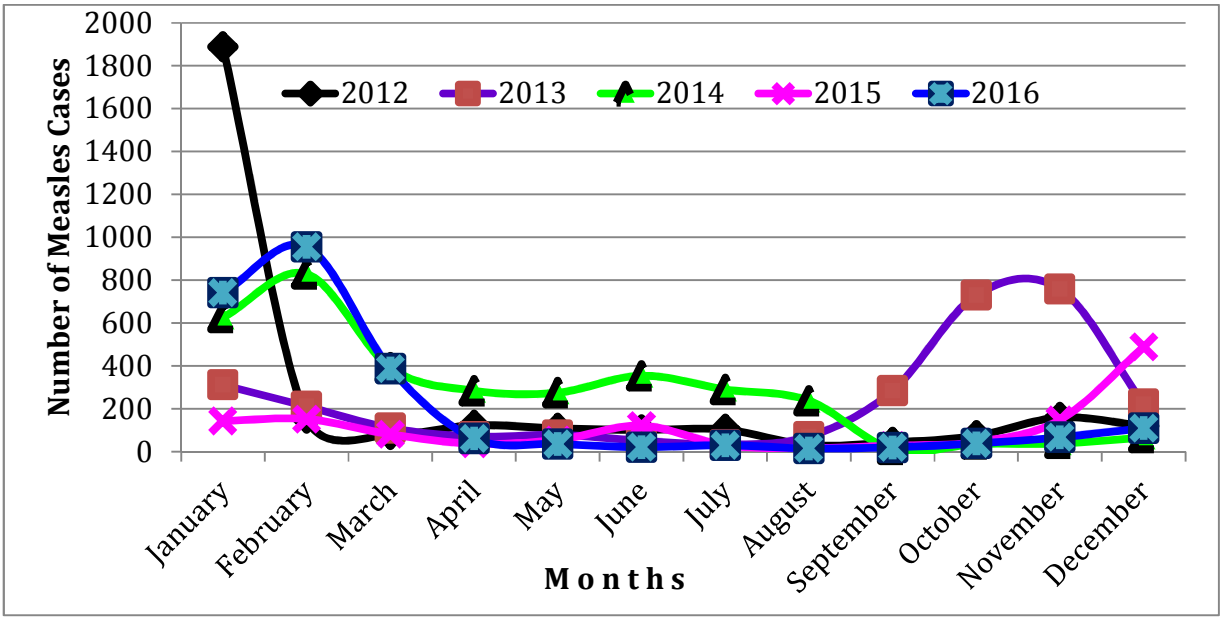

Figure 17 Trends of measles cases by months in each year, SNNPR, Ethiopia, 2012 – 2016

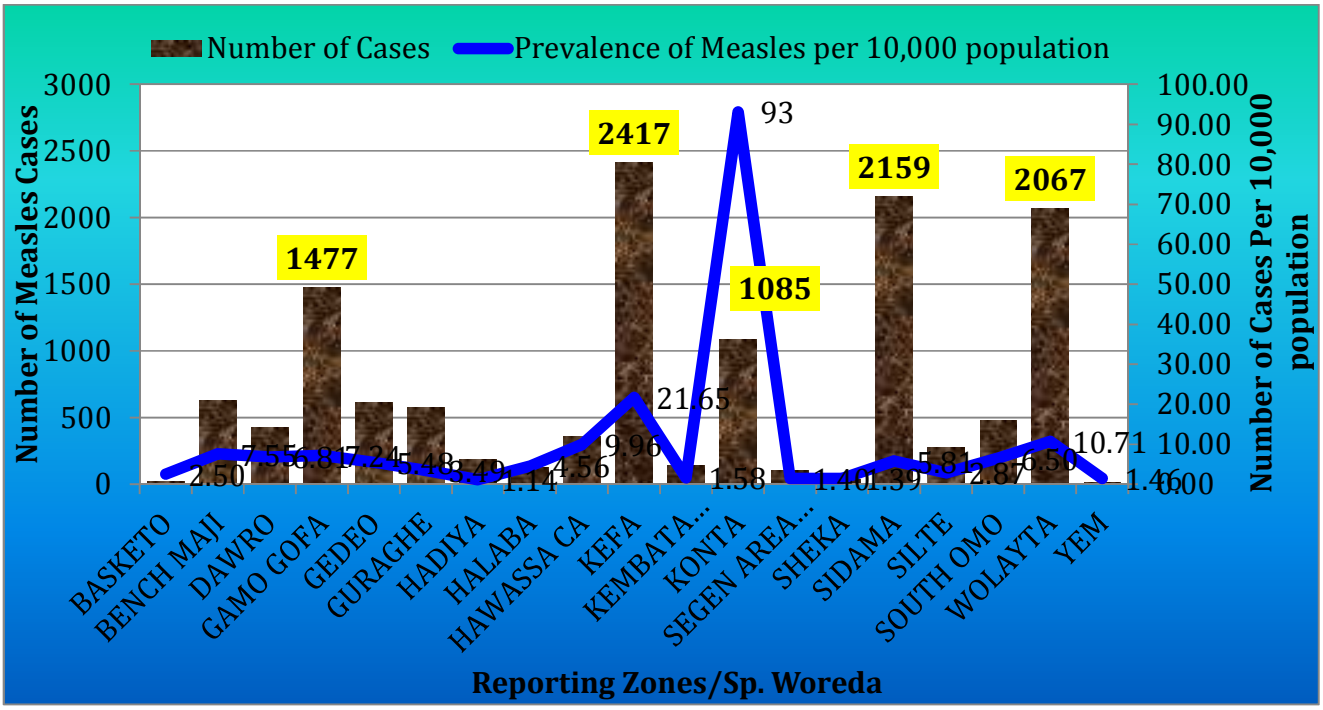

Figure 18 Total measles cases by Reporting zones/special woredas of five years in SNNPR, Ethiopia, from 2012 – 2016

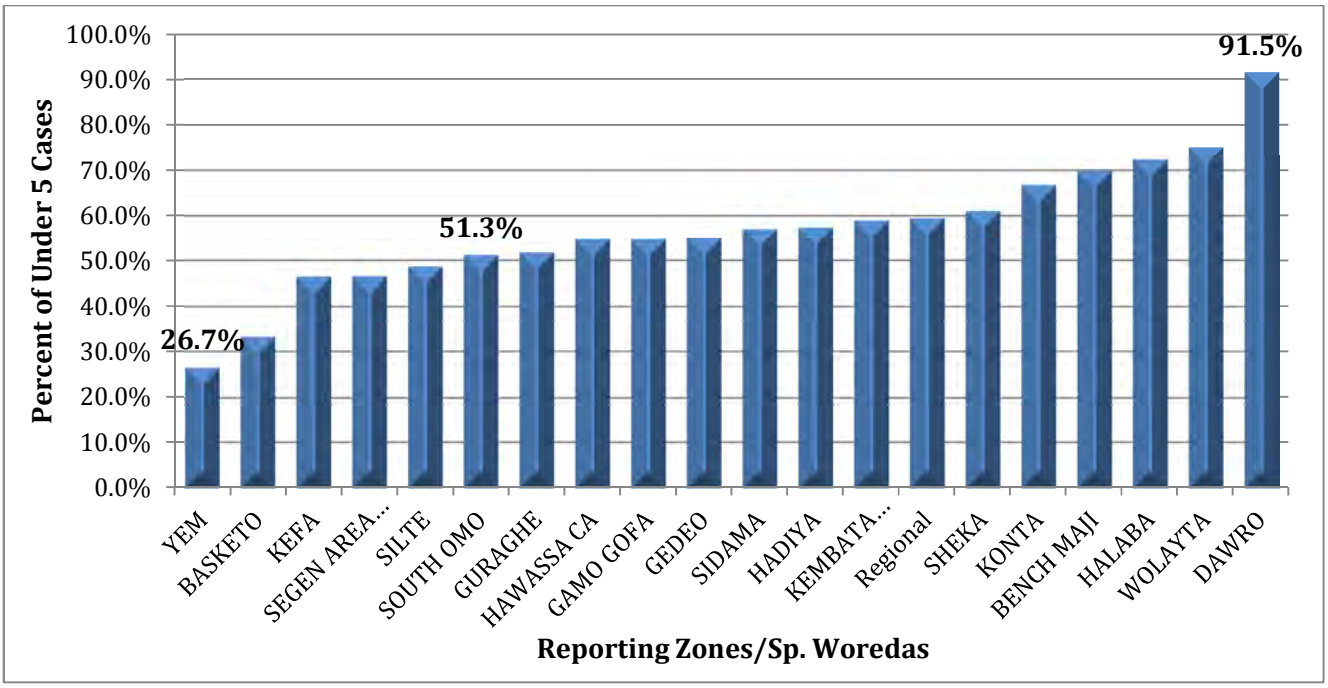

Figure 19 Percent of under 5 measles cases by reporting zone/sp. Woredas, SNNPR, Ethiopia, 2012 – 2016

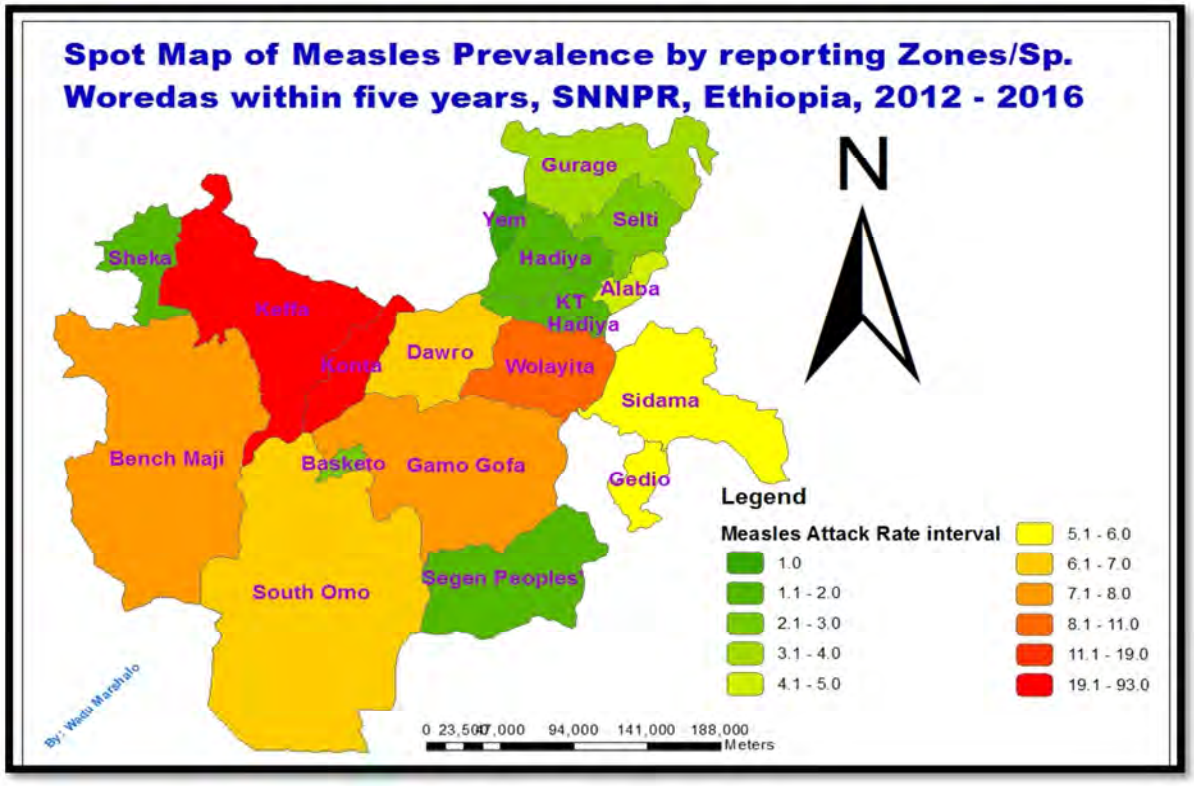

Figure 20 Spot map of Measles diseases prevalence in SNNPR from 2012 to 2016.

Table 20 Measles Vaccination Coverage of administrative report, SNNPR, Ethiopia

Zone/Sp. Woreda	2011/12	2012/13	2013/14	2014/15	2015/16	Average
Bench Maji	84.9	103.9	98	93	92	94.36
Dawuro	100.1	101.3	91	78	89	91.88
Gamo Goffa	93.8	98	99	100	100	98.16
Gedeo	89.1	105.8	106	104	99	100.78
Guraghe	97.3	102.4	107	103	102	102.34
Hadiya	92.2	102	101	96	93	96.84
Keffa	106.2	98.5	90	90	91	95.14
Kembata Tembaro	99.6	103.5	100	100	99	100.42
Sheka	71.8	82.8	63	51	51	63.92
Sidama	95.3	95	101	97	100	97.66
Silte	106.4	109.8	116	107	107	109.24

South Omo	93.8	110.6	112	103	108	105.48
Wolaita	99.6	105.7	100	100	98	100.66
Halaba Sp. Woreda	95.3	92.1	100	92	91	94.08
Segen Area Peoples	94.2	98.4	106	102	68	93.72
Basketo Sp. Woreda	58.3	77.4	80	77	75	73.54
Konta Sp. Woreda	66.7	88.3	88	88	91	84.4
Yem Sp. Woreda	77.8	70.2	86	71	74	75.8
Hawassa CA	96.2	103.8	108	105	117	106
Regional	**95.4**	**100.6**	**101**	**97**	**97**	**98.2**
Source: Regional Health Bureau 2004 to 2008 EFY Annual Report, unpublished.						

Keffa (2417 (18.3%)), Sidama (2159 (16.4%)), Wolaita (2067 (15.7%)), Gamo Goffa (1477 (11.2%)) zones and Konta special Woreda (1085 (8.2%)) were top five areas to report measles cases in the years. Konta special woreda has highest attack rate (93 per 10,000 populations), see figure 18 on page 75. In the year 2012 to 2016, Hadiya, Kembata Tembaro, Segen Area Peoples' and Sheka Zone, and Basketo and Yem special Woredas' AR was below 2 per 10,000 populations.

In 2015/16, totally 18 confirmed measles outbreaks occurred in six Zones and one special Woreda in the region. One hundred thirty four kebeles affected by these confirmed measles outbreak. From July 2015 to June 2016 (2008 EFY), totally 2775 measles cases line listed. Of them, 1627 (58.6%) and 154 (5.6%) were unvaccinated and with unknown vaccination status respectively.

Aroressa, Chire, Benssa and Arbegona woredas of Sidama zone; Gedeb, Kochore and Yirgachefe woredas of Gedeo zone; Arbaminch zuria, Bonke and Kemba woredas of Gamo Goffa zone; Shashogo woreda of Hadiya zone; Adiyo, Cheta, Decha and Tello woredas of Keffa zone; Maji woreda of Bench Maji zone and Konta special woreda were affected by the outbreak in the year.

In the last five years, 2011/12 to 2015/16, measles vaccination coverage was increased from 95.4 to 97% in the region (highest coverage in 2012/13 and 2013/14) and the average coverage was 98.2% (see table 20).

During in the years, 2011/12 to 2015/16, average routine measles vaccination coverage of Sheka zone, Basketo and Yem special woredas have below 80% while that of Guraghe, Silte, Kembata Tembaro (KATE), Wolaita, Gedeo, South Omo zones and Hawassa City administration was above 100%. Konta special woreda reported 83.8% average routine measles vaccination coverage in the period (See figure 21).

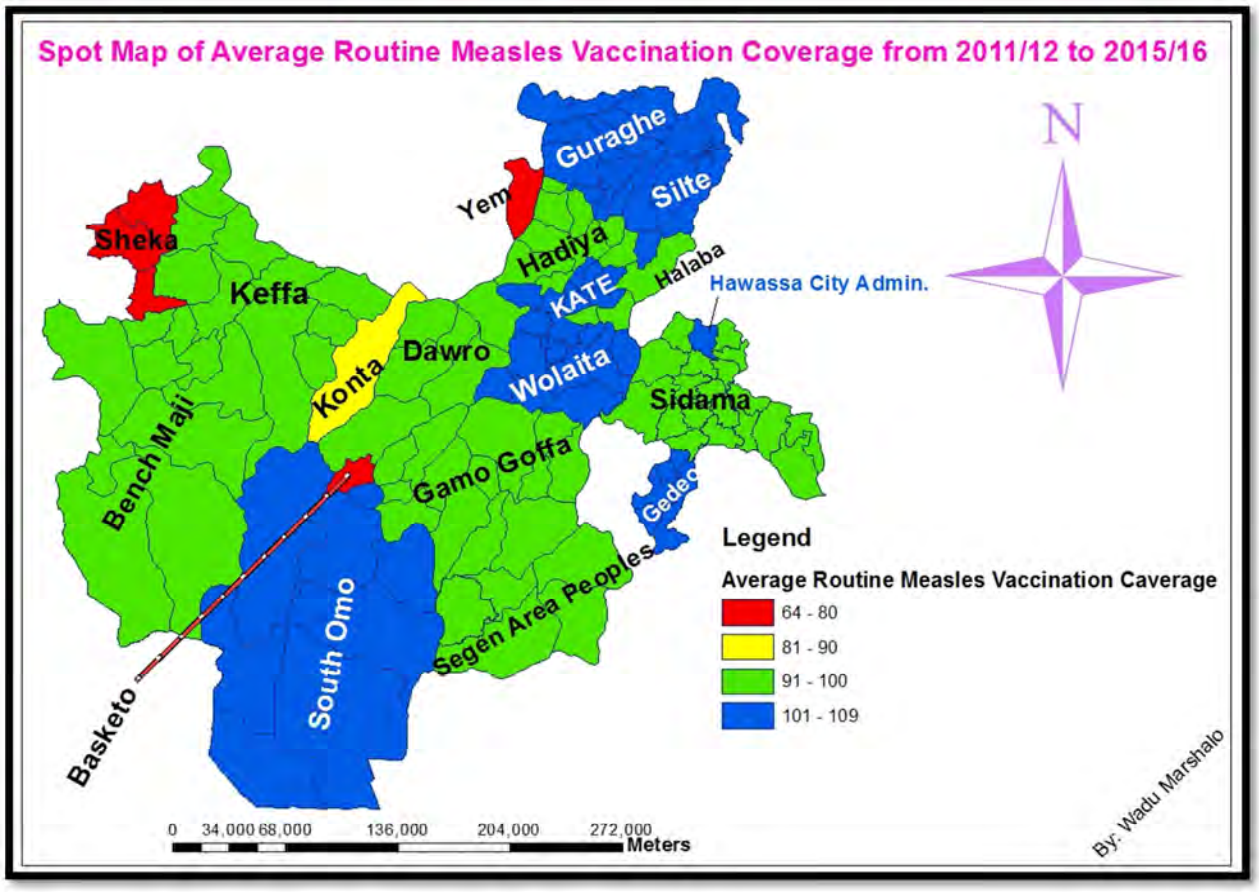

Figure 21 Spot Map of Average Routine Measles Vaccination Coverage of SNNPR, Ethiopia, 2011/12 – 2015/16.

Discussion

During in the year 2012 to 2016, measles attack rate of the region was low when compared with that of 2008 to 2011 report of surveillance data analysis. Case fatality rate was decreased significantly as compared to that of 2011 and it was below country expected case fatality (3% to 6%) for measles (1, 13). In contrast to increasing routine measles vaccination of the region (10), the surveillance data analysis showed that there was circulation of measles outbreak in the year 2013 to 2016 since IgM+ rate for measles was above 10% in the years. WHO recommends that there should be more than 90% of routine measles vaccination to decrease under 5 years morbidity and mortality of measles infection (1, 2).

There was only 790 (26.4%) out of 2987 cases and 321 (23.8%) out of 1346 cases received at least one measles dose in 2012 and 2015 respectively. Similarly, vaccination rate in 2013, in 2014 and in 2016 was 1274 (43.5%), 1042 (30.3%) and 1024 (41.3%) respectively from out of the respective year cases. So that, this is evidence for measles unvaccination rate was responsible for the circulation of measles outbreak in the region every year as the study revealed like the same study conducted in Disneyland in 2015 to show the importance of vaccine (8).

This surveillance data analysis showed that the age below 5 years was highly affected by measles outbreak in every years followed by 5 – 14 years age groups. Nearly 60% and 35% of the total cases were children under 5 and 5 – 14 years age groups respectively. The findings of this study revealed that under fifteen year age groups were risk populations for measles outbreak in the region as described by the Afro WHO regional challenge for measles elimination (1, 5).

The magnitude of the measles cases increased in the dry season of Ethiopia; i.e. from month of October to end of February in the region. In 2014, there was high measles caseload, 3436 (26%), in the region with relatively high AR for the year that placed the region at the second most at risk area for measles in the country next to Oromia region (9). Starting from the month October to the end of month February, measles cases increased; January was pick month for the case in the region as same as the country pick

in the year 2013/14 (9). There was a sharp decrease from month March to April in the year as similar to Ethiopia HSDP-1 report (12).

Despite their consecutive five years routine measles vaccination report was above 90%, Keffa, Sidama, Wolaita and Gamo Goffa zones were the top five affected areas by measles outbreak. In contrast, their administrative reports of measles vaccination coverage for the last five years were below 80%, Sheka zone, Yem, and Basketo special woredas have very low measles attack rate in the years. Almost all zones and special woredas reported suspected measles cases in which above 50% of their total cases were contributed under five years. This implies that there was no evidence for age shift of measles infection in the region unlike ministry of health reported measles outbreaks with age shifting as challenge for elimination of measles disease even at low routine immunization performance areas (12).

Limitation

Measles routine immunization data quality was not included in the study to assure that administrative vaccination report with reliable performance and much enough to prevent measles outbreaks. Since the study used retrospective descriptive design and surveillance data analysis from secondary data, seroconversion test for measles vaccination was not done for confirmation to answer the question why vaccinated children suffered from the measles infection.

Conclusion

Measles outbreak was left over as high burden for health sector in the region in the last five years. The age under 15 years are the most risk age groups for measles outbreak in SNNPR. The dry seasons are the most known times for high magnitude of measles outbreak in the region. There was controversy between administrative immunization report for measles vaccination and the outbreak that need routine vaccination data quality control versus actual performance for. This surveillance data analysis revealed that there was measles outbreak circulation in the region in contrast to administrative report of routine measles vaccination coverage.

Recommendation

The region should enforce active surveillance for measles so as for early detection of outbreak to decrease measles morbidity and mortality in the region.

The region should conduct EPI data quality and reliability check before administrative immunization report to avoid controversy of burden of measles outbreak and vaccination coverage that seems enough for measles elimination strategies.

Further study is recommended at the area where there was no measles outbreak within five years despite their routine measles vaccination coverage was below 80%.

The region should give intensive support for areas where the routine measles vaccination coverage is below 90% for children at age between 9 to 11 months.

We recommended assessment of sero-prevalence of measles specific antibody for under five year children.

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Chapter III-Evaluation of Surveillance System

3.1 Evaluation of Maternal death, Measles and AFP Surveillance System of Wolaita zone, SNNPR, 2017

Abstract

Introduction: The surveillance system designed to gather pertinent information of public health threats and/or events for decision makers to take relevant action: surveillance is information for action. Maternal Death Surveillance and Response system is designed to gather information that helps to alleviate further maternal death from the same cause as previous one. The study was conducted in Wolaita zone to deliver relevant information that will show clear image of the system status of zone.

Method: A descriptive cross-sectional study design was conducted by using the Center for Disease prevention and Control Updated Guidelines for Evaluating Public Health Surveillance Systems as a framework. Totally 13 surveillance units were selected purposively. Data was collected by interviewing surveillance officers and/or focal person using opened and semi-structured questionnaire. Data was analyzed using Microsoft Excel 2010 and ArcMap 10.2.2.

Result: All 13 surveillance units do have current version of Public Health Emergency Management, Measles and Maternal Death Surveillance and Response guidelines. Totally 416 health facilities reported weekly surveillance report: 412 public (342 Health Posts, 65 Health Centers and 5 Hospitals) and 4 other (3 Non-Governmental Organizations, one private) health facilities. However, there was no means to take daily and/or weekly surveillance data report from 234 different level private health facilities. In 2016, totally 24 (10.06%) maternal deaths, 24 (60%) measles and 25 (100%) Acute Flaccid Paralysis cases were reported in the zone. Only nine (60%) districts assigned permanent surveillance units officers; there was no legal surveillance structure at town level. Only 5(15.15%) of zonal, 35(22.4%) of Bolosso Sore, 56(33.7%) of Damot Pulassa and 63(37.5%) of Kindo Koysha districts' health professionals trained on surveillance system.

Discussion: All respondents (N=13) argued that the surveillance system for maternal death was challenged to fill data by most health professionals. Surveillance data formats have missed important variables like age, sex, address and sign and symptoms for all national priority disease. Completeness of recorded data was 56%, 71% and 83% for Acute Flaccid Paralysis, Measles and Maternal Death respectively. The zone reached 95.4% health service coverage and 64.8% utilization rate. Surveillance report timeliness was 100%, no notification for maternal death. It was difficult to determine timeliness of the health facilities since there was no recorded data.

Keywords: Maternal death, surveillance, evaluation, Ethiopia

1. Introduction

1.1.Background

According to WHO and CDC, Epidemiologic Surveillance is defined as systematic ongoing collection, analysis and interpretation of outcome specific data and the provision of information for action (1). The surveillance system designed to gather pertinent information of public health threats and/or events for decision makers to take relevant action: surveillance is information for action (2).

Maternal Death Surveillance and Response (MDSR) is also a continuous process of identification, notification and maternal death review followed by actions to improve quality of health care and prevent future death by the same case(s) (6, 8). Maternal death is defined as a death of women at the age between 18 – 49 years old during pregnancy and/or within 42 days after termination of pregnancy irrespective of the duration and site of pregnancy.

Maternal Death Surveillance and Response (MDSR) system is designed to gather information that helps to alleviate further maternal death from the same cause as previous one in which accountability and responsibility increased by inter-facility level. it is also a form of continuous way of gathering information for action by means of regular identification, notification, quantification and determination of causes and avoid ability of all maternal deaths (7).

1.2.Statement of the problem

Globally, the maternal mortality ratio decreased by 44% during the era of MDG that representing an average annual reduction by 2.3% between 1990 and 2015 (4). The high contribution of MMR reduction was from Southern Asia unlike Sub-Saharan Africa which contributed about 64% and 49% reduction respectively between 1990 and 2013 (3, 4). Despite different interventions have been taken, maternal mortality ratio reduction was not met MDGs especially in Africa region. As the information of World Health Statistics, Cabo Verde has low MMR, 42 per 100,000 live births while Sierra Leone has very high MMR, 1360 per 100,000 live births in 2013 at the region (3). This showed that more than 99% of maternal death was contributed from Africa region currently. Developing countries MMR reduction has above twenty times less as compared to

developed regions (4). Ethiopia is one of the country where significant maternal mortality ratio reduction has been occurred during the era of MDGs, 350 per 100,000 live births between 1990 and 2010 (4, 5); but the ratio inclined to 670 as DHS 2011 described (6) and 420 at the end of 2013 (3).

The main principle of MDSR is to increase the accountability and awareness of maternal mortality from community to higher level of health facility that forwards practical actions to prevent further maternal death by tackling contributing risk factors. (1, 8, 9)

The MDGs of maternal mortality ratio reduction was not achieved in most of developing country, as their contribution is higher as compared to developed ones. Sub-Sahara Africa like Nigeria; and Asia like India contributed higher maternal death globally. They contributed 1/3rd of total maternal death burden to the World (2, 10). Despite actions taken to reduce MMR, Ethiopia estimated to contribute 11,000 to 16,000 maternal deaths in 2015 (4, 8)

Most of maternal deaths are preventable that resulted from either obstetric complications or indirect causes (5). MDSR is designed to prevent theses avoidable maternal death through timely facility level maternal death review and take relevant actions to prevent further death by the same death of reviewed one (5, 11).

Ethiopia launched MDSR system in 2013 but the effectiveness and impact of the system to decrease MDSR system has not evaluated yet; especially in Wolaita zone.

Even though most of maternal deaths reported from hospitals, the deaths by the same cause has not been decreased as expected and that need evaluation of health facility level MDSR system to produce the information for action and decision making (5). In addition to that only 25 maternal deaths reported from the health facilities of Wolaita zone in 2015/16 through MDSR report but regional health bureau annual report showed that institutional maternal death is about 43 (12). This fallacy of the two reports initiate to conduct MDSR system evaluation and data analysis for this region.

1.3.Significance of the study

Strengthening MDSR system is the key of information making process that provides action-taking areas to prevent further maternal death at health facility level. Preventing avoidable maternal death at facility level needs relevant information about implication of maternal death. This study will deliver relevant information that will show clear image of MDSR status of Wolaita zone in Southern Ethiopia. The regional health bureau and zonal health department as well as health facilities will be informed on gaps of MDSR. The findings will help them to take relevant actions to prevent avoidable maternal death. We will identify risk factors based on the finding of the study that is incredible way of decreasing national, regional and zonal maternal mortality ratio.

2. Literature Review

2.1.Addressing maternal mortality trends and measurement

Globally, maternal mortality ratio (MMR) decreased from 385 per 100,000 livebirths in 1990 to 216 per 100,000 livebirths at the end of 2015. However, the reduction contributions differ by country developing status: in 2015, MMR of low, middle and high-income level regions were 485, 185 and 17 per 100,000 livebirths respectively. The burden and risk of maternal death remains the highest in Sub-Sahara Africa region, which accounts 547 per 100,000 livebirths. Nigeria from Sub-Sahara Africa and India from South Asia had high number of maternal death which comprised one third of global maternal death even though their respective MMR decreasing at the end of MDGs era. (2, 4)

Accessing of accurate data at all levels and identifying most known and frequent causes of maternal death can be used for planning, monitoring, making the decision and evaluating the systems. Based on relevant data, maternal mortality ratio can also be estimated and it helps to conclude that whether the country has been on real intervention of MMR reduction track or not (4). Lack of active case search, under-reporting and misclassification of maternal death of Ireland led to wrong conclusion of national MMR to 4 per 100,000 livebirths for a long time; but the problem was solved after the introduction of maternal death enquiry system in their health facility level (13).

2.2.Magnitude and Related risk factors of maternal death

About 800 women die due to complications of pregnancy and childbirth in the World every day (3, 10). As MDGs report, estimated lifetime risk of maternal mortality in developing countries up to 1 in every 17 livebirths whereas 1 in 3300 estimated lifetime of maternal mortality in developed areas (4)

In addition to high MMR, developing countries maternal death mostly caused by direct obstetric causes unlike developed ones where indirect causes outweigh higher proportion for their maternal death. The study conducted in Dire Dawa, Ethiopia, revealed that above 90% of maternal death was due to direct obstetric causes; of them about 80% can be avoidable (11). Another study conducted in Ireland showed that 70% of maternal death was due to direct obstetric causes during 2010 – 2013 (14).

Pregnancy induced hypertension, hemorrhage and sepsis are the most frequent direct causes of maternal death whereas anaemia, heart diseases and HIV/AIDS are prominent indirect causes of maternal death worldwide (15). Quarterly report of MDSR scorecard compiled from Ondo State, Nigeria, indicated that sepsis had most known causes of maternal death (16). This direct obstetric causes of maternal deaths can be reduced significantly when relevant actions has been taken at health facility level as hospital based maternal death data analysis study conducted in Morocco. Effective gynaecological interventions, well trained and competent health workers, increasing skilled birth attendance coverage and motivation of health staffs at hospital level need improvement highly as the study conducted in Ghana for effective MDSR implementation (17).

2.3.Maternal Death Surveillance and Response (MDSR)

Elimination of preventable maternal death by using information to take relevant and effective public health action is the main and prominent goal of MDSR (18).

During the discussion on the 2015 MDGs report, there was conclusion that MMR has to be decreased to 70 per 100,000 livebirths at the end of 2030 globally. This new target will be reached by effective MDSR system implementation with high governmental full willingness and incredible stakeholders' partnership (19)

Maternal death surveillance and response (MDSR) is defined as the identification, notification, quantification, determination of causes and avoidability and response to provide essential information for decision making to provoke action for prevention of future maternal deaths and it also help to improve the measurement of maternal mortality (18, 20)

Maternal death surveillance and response (MDSR) system is designed and established in most developing regions as routine surveillance system for maternal death data collection and review at health sector level. The system provides reliable information on how many, where and why mothers died; the information helps to avoid maternal mortality estimates based on statistical models. (18)

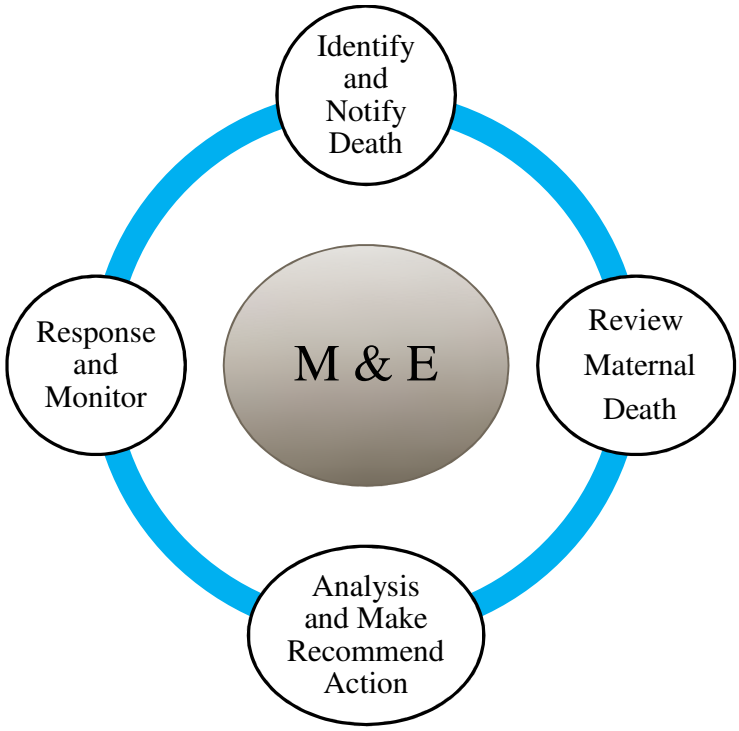

Figure 22 MDSR System: Continuous actions of the system (Source: *Beyond Numbers*)

The MDSR Action Network reported that feasibility study conducted in Tigray, Ethiopia, highlighted effective utilization of existing community and health structures as incredible framework for effective implementation of MDSR. The study recommended that MDSR should be done as teamwork of different disciples which comprises both clinical and non-

clinical actors' involvement at health structures including health facilities like hospitals when implementing in MDSR system. The participation of different specialists and mid-wives in MDSR system at health facility level makes the system more effective to decrease maternal mortality as the study revealed (21).

The MDSR system in Malaysia is taken as model for other resource limited countries for significant reduction of MMR. Scaling up of MDSR across the health system of Ethiopia has been implemented in Oromia, Amhara and Southern Nations, Nationalities and People's regions for the last five years. Eleven zones of Oromia, all zones of Amhara and SNNPR regions were trained on integrated MDSR on health system since February 2015

(22).

2.4.Challenges of MDSR implementation

The most known challenge for effective MDSR is legal framework for development of 'No blame' culture. Challenge may encounter from different levels including for the patient, family, health professional and health facility (23).

Miscommunication between team workers, unequal power relations and ownership within clinical and non-clinical health personnel, loose co-ordination and lack of mid-wives and other specialists as well as lack/shortage and/or turnover of trained manpower for teamwork of MDSR as great challenge during implementation that need to solve as the study verified in different areas (22).

In Ethiopia, there were no more studies conducted on MDSR system evaluation. As public health surveillance, MDSR should be done as ongoing data collection, analysis, and interpretation of maternal death with timely dissemination of resulting information for appropriate decision-making. So that, lack of sufficient studies which regarding MDSR is a great challenge in the country as well as study areas. The country MDSR guideline considered local capabilities, limitations, logistical issues, budgetary realities and legal requirements as prerequisites for MDSR implementation. These prerequisites were not fulfilled in most of health facilities like Wolaita zone, Southern Nation Nationalities and Peoples' Region (SNNPR) except legal requirements.

Justification of the Problem

Maternal death is not only the problem of reduction of MMR but also it raises the problem of economic, political and social problems of country and community as well as family that should be alleviated by public health intervention through improving quality life for pregnant mothers. MDSR is also one of the great strategies that are designed to prevent future maternal death by using information for action. Despite integrated MDSR system in public health system, few maternal deaths reported from health facilities of Wolaita zone in formal way. This shows that the system is not effectively implemented as expected and as its incredible economic, political, health and social impacts.

The data regarding maternal death is too late to report to the next level due to late maternal death review (MDR) at hospital level that gives more chance for the next maternal death by the same cause/s. It needs a great deal of commitments of administrators, politicians, health professionals, stakeholders and general public influential individuals in whole. Besides this, there are no more studies related to MDSR system conducted in the region to alleviate the problem on time and to indicate areas of the gaps by providing analyzed dissemination of information.

3. Objectives of the study

3.1.Main Objective

To evaluate surveillance system of Wolaita Zone in Southern Nations, Nationalities and people's region from January 24 to February 16, 2017.

3.2.Specific Objectives

- ✓ To describe surveillance system for maternal death, Measles and AFP in Wolaita zone
- ✓ To assess core and support functions of the surveillance system
- ✓ To assess surveillance system attributes simplicity, flexibility, data quality, acceptability, sensitivity, predictive value positive, representativeness, timeliness, and stability for MDSR.

4. Methods

4.1.Study Area and Period

The study was conducted in Wolaita Zone from January 24 to February 16, 2017. Wolaita zone is one of 15 zones in Southern Nations, Nationalities and People's Region Ethiopia. The zone encompasses 12 rural woredas and 3 town administrations with 1,928,196 populations as 2009 CSA projection. Wolaita zone located southern part of the Ethiopia 390 kilometers away from Addis Ababa and 157 kilometers away from capital city of the region, Hawassa. The zone bordered with Kembata Tembaro zone at North, Hadiya zone and Oromia region at East, Dawuro zone at West and Gamo Goffa zone at South (see figure 3 below). It covers 4471.3 sq.km areas, which covers 3.8% of the regional land with an estimated density of 431 people per sq.km. The average annual population growth rate of the zone is 2.41%.

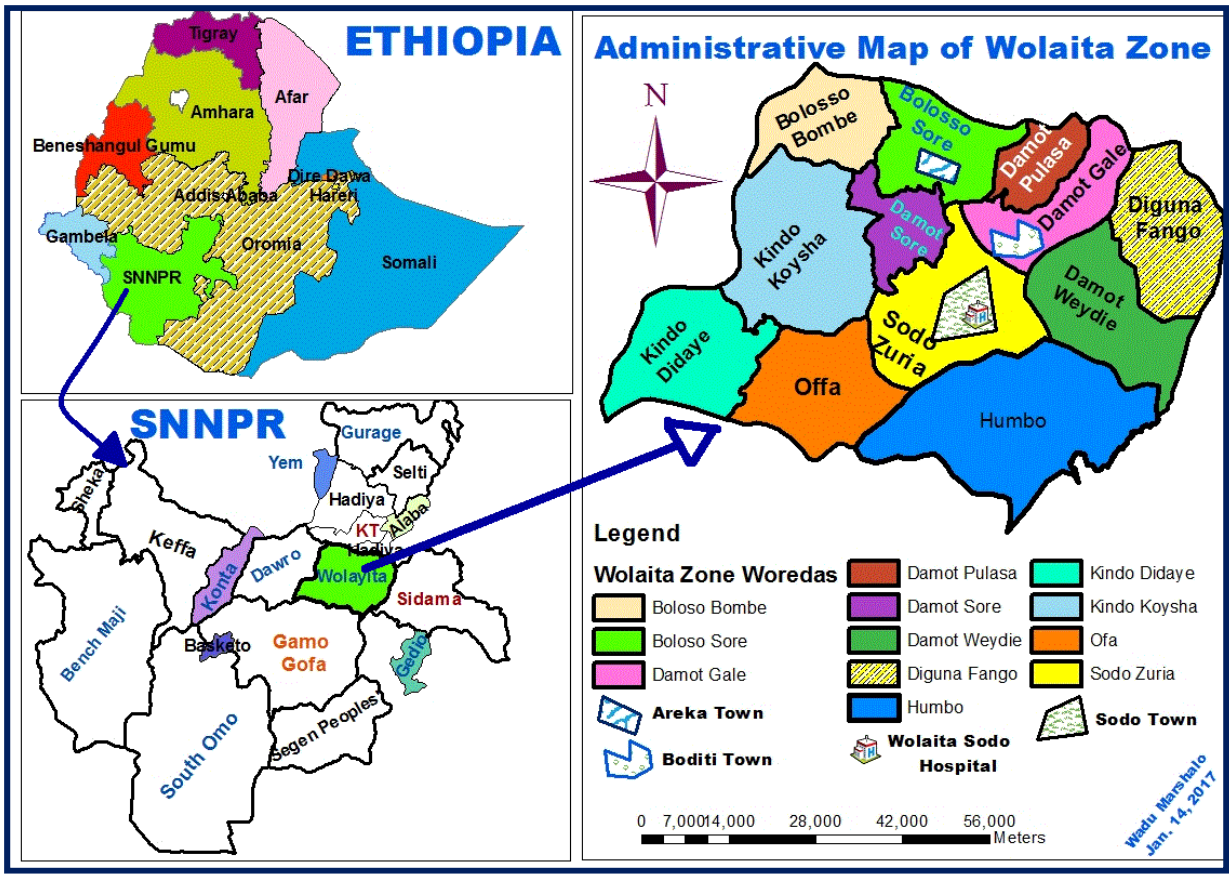

Figure 23 Administrative Map of Wolaita Zone in SNNPR State, Ethiopia

Health coverage of Wolaita zone is about 95.4% with primary health care unit (PHCU). Health utilization rate of the zone is 64.8%. The zone has totally 7 hospitals: 4 district, 1

teaching, 1 NGO and 1 private hospitals. The zone comprises 67 health centers, 343 health posts, 6 NGOs and 210 private health facilities. According to zonal health department annual report, antenatal care (ANC_4) at least fourth times and skilled birth attendance (SBA) at health facility increases through year to year. For the last five consecutive years, in 2011/12, 2012/2013, 2013/14, 2014/15 and 2015/16, ANC_4 coverage of the zone are 30%, 65%, 68.9%, 85.9% and 83.8% whereas that of SBA coverage are 11.7%, 32.8%, 42.2%, 66.2% and 84.2% respectively. An exact maternal mortality rate of the zone is not clear (3).

4.2.Study design

A descriptive cross-sectional study design was conducted by using the CDC Updated Guidelines for Evaluating Public Health Surveillance Systems as a framework to achieve the stated objective of the study.

Sampling Techniques

The Zonal surveillance unit and Wolaita Soddo University teaching hospital surveillance unit were included purposively in the study. One best, one medium and one least performer woredas were selected purposively based on their 2016 annual performance after discussion with zonal public health emergency management core process that runs zonal surveillance system. Then, we selected one health center from each woredas and one health post from each selected health centers' catchments randomly.

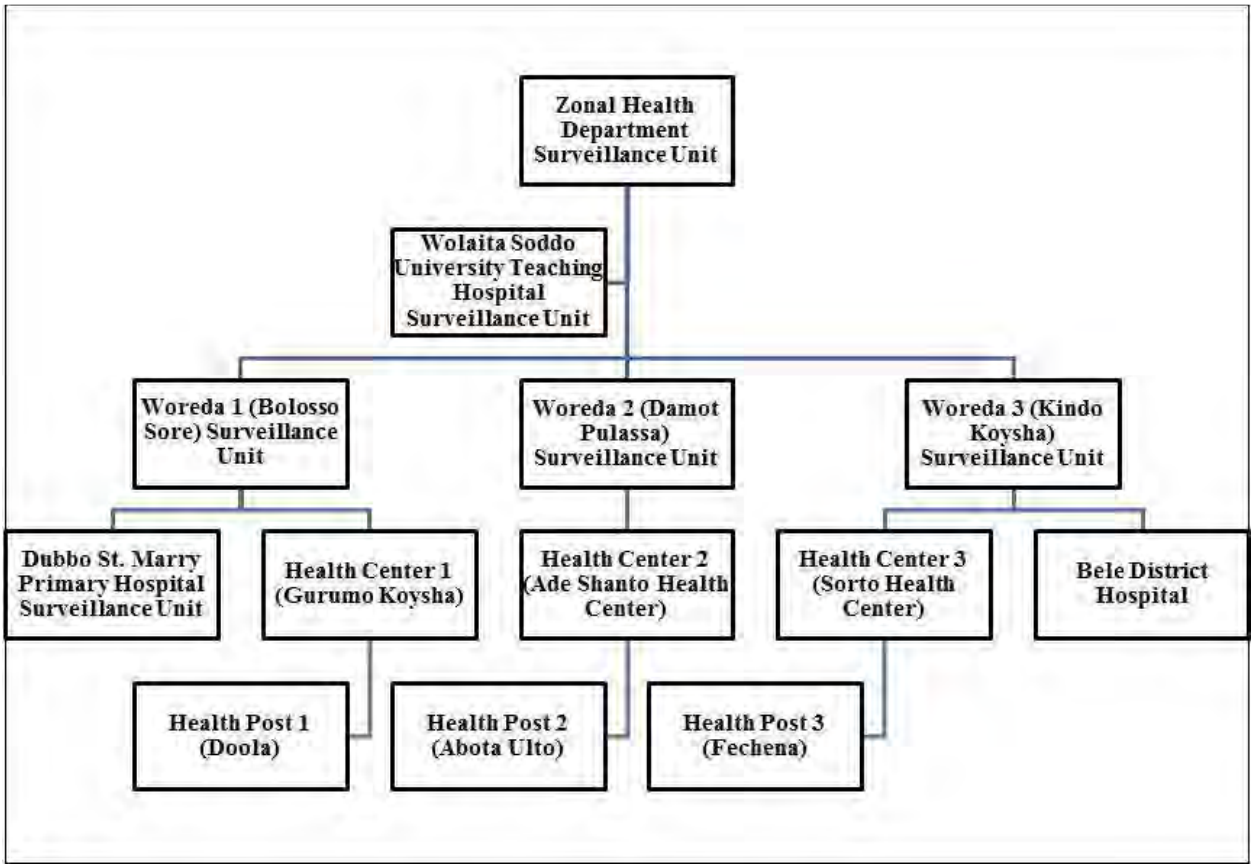

Figure 24 Diagram showed surveillance units that system evaluation study conducted

Data Collection

Data was collected by interviewing surveillance officers and/or focal person using opened and semi-structured questionnaire by principal investigators. Observation and records review was done to confirm data quality of existing surveillance data and weekly IDSR completeness was checked by crossing with eIDSR data and case-based reports.

Data Analysis and Presentation

Data was analyzed using Microsoft Excel 2010 and ArcMap 10.2.2. The result was presented by using proportions, and organizes tables and figures.

Operational definitions

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

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

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

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

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

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

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

Usefulness: Refers to the relevance of the system in terms of feeding information for action.

Positive predictive value: Is the proportion of reported cases that actually have the health-related event under surveillance.

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

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

Ethical issues: Official letter was written to zonal health department from RHB and zonal health department wrote the letter to districts, then selected districts wrote official letter to selected health facilities.

5. Result

Totally 13 surveillance units were evaluated: one zonal, three districts, one teaching hospital, two district/primary hospitals, three heath centers and three health posts. Wolaita zone has being received weekly and immediately surveillance data from 7 hospitals, 67 health centers and 342 health posts.

Table 21 Wolaita Zone Surveillance data Reporting Health Facilities, SNNPR, Ethiopia - 2016

Woreda/Town	Health posts	Health Centers	Hospital	Total
Bolosso Bombe	21	3	1	25
Bolosso Sore	34	8	0	42
Damot Gale	27	7	0	34
Damot Pulassa	23	5	0	28
Damot Sore	20	5	0	25
Damot Woydie	28	4	0	32
Duguna Fango	34	5	1	40
Humbo	31	6	0	37
Kindo Didaye	23	3	1	27
Kindo Koysha	33	4	1	38
Offa	26	4	0	30
Soddo Zuria	31	8	0	39
Areka Town	3	1	0	4
Boditi Town	5	1	0	6
Soddo Town	3	3	0	6
Dubbo Hospital	0	0	1	1
Soddo Christian Hospital	0	0	1	1
Wolaita Soddo Teaching Hosp	0	0	1	1
Total	**342**	**67**	**7**	**416**

At the end of 2016, zonal health department has totally 31 health professionals and 25 supportive staffs. A total of 2769 health professionals and 1456 supportive staffs were serving all zonal populations in the 12 districts and 3 town administrations. The human resource data was not included human resources of Wolaita Soddo University teaching and referral, Soddo Christian and Dubbo St. Marry hospitals, and Bukama and Damot Mokonissa Catholic health centers. In addition to, 124 urban and 754 rural health extension workers were deployed to serve 336,765 urban and 1,449,031 rural populations respectively who lived in 54 urban and 301 rural kebeles.

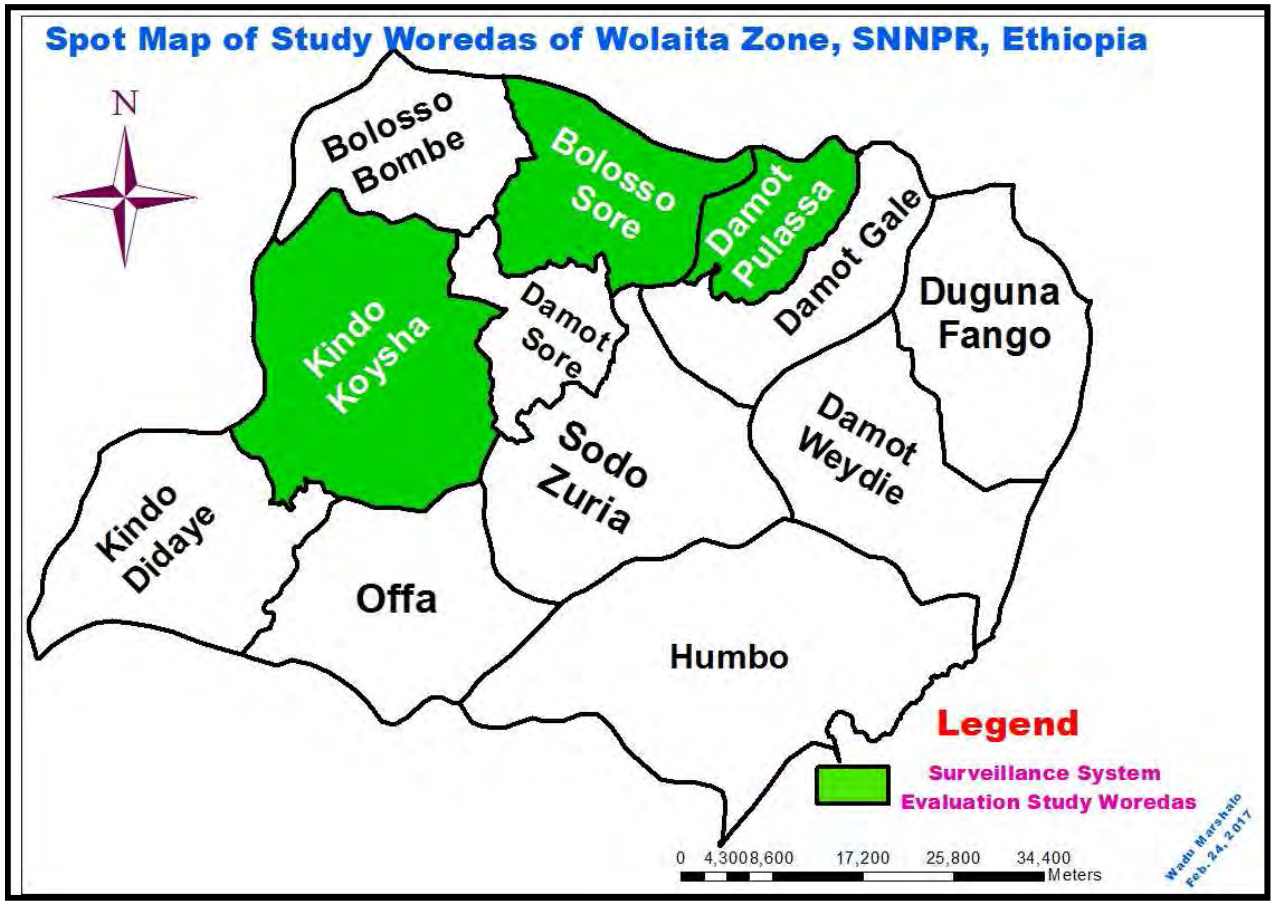

Figure 25 Spot Map of district where surveillance system evaluation was conducted in Wolaita Zone, SNNPR, Ethiopia 2017

5.1.Availability of a National Surveillance Manual

All the 13 health facilities do have current PHEM guideline of Ethiopia version 2013 version, Measles and MDSR guidelines. Except the three health posts, all other surveillance units have objectives of surveillance system. The objectives of their surveillance system are:

- To detect epidemics/outbreaks for early control and prevention,
- To predict epidemics for response plan and resource mobilization,
- To monitor trends of priority diseases in order to inform decision makers for evidence-based intervention,
- To evaluate intervention actions to control and prevent outbreak effectively and efficiently

But they complained of their surveillance system has weakness; active surveillance is not effective, the system is not automated at lower level, community based surveillance system is not effective and the system was not active at urban areas in the zone. The other weakness of the system is emergency preparedness and response plan not budgeted at all levels. The shortage of logistics, transport and financial problems prevents the effectiveness of the system as surveillance unit respondents replied.

Except for maternal death and Anthrax, standard and suspected case definitions for measles, AFP, NNT, guinea worms and other national priority diseases posted at the surveillance unit offices but not posted at all wards in evaluated health facilities. All health facility diagnoses cases based on HMIS disease classification supported by chart booklets except for AFP, measles and NNT.

5.2.Case detection and Registration

All surveillance units, except districts and Health Posts, have diseases registration books for maternal death, measles and AFP. Health posts have malaria morbidity and mortality registration book in addition to family health cards. For less than two months and under five children, the HPs have diseases registration books. All the respondents have knowledge about standard and suspected case definitions for maternal death.

5.3.Data Reporting

There was no shortage of surveillance data reporting formats for all health facilities in 2016. They used standard surveillance data reporting formats but health centers received weekly report by phone from HPs and wrote by ordinary papers. Totally 416 health facilities reported weekly IDSR report: 412 public (342 HPs, 65 HCs and 5 Hospitals) and 4 other (3 NGOs, one private) health facilities. However, there was no means to take daily and/or weekly surveillance data report from 210 different level private clinics, 14 other private and 6 NGOs health facilities.

All districts reported surveillance data via telephone to the next level. The zone received immediately reportable events 1 -2 days after disease detection from lower level. The ZHD, districts and health facilities have been reporting weekly and/or immediately reportable diseases as per agreed time and day as national schedule as respondents answered. For weekly reportable diseases, HPs reported every Monday to HCs and HCs and hospitals reported every Monday to Tuesday until mid-day to districts that answered by all respondents. Nevertheless, there was no evidence for reporting schedule when districts received reports from HCs and HCs from HPs. The districts and town administrations and WSUTRH, Soddo Christian and Dubbo St. Marry Hospitals reported every Tuesday afternoon to Wednesday mid-day to zonal surveillance unit. Weekly surveillance data has been sending on every Wednesday to the regional PHEM via upload.

There was no evidence for maternal death notification from all evaluated surveillance units. All the three districts, Wolaita Soddo University Teaching Referral hospital (WSUTRH) and Zonal Surveillance units have trends to send summary report to decision makers for planning, prevention and control activities for malaria and malnutrition. Health centers, district hospitals and health posts did not know about the summary report to whom they submit rather only they send surveillance data to the next level. All surveillance units do have address of their next level PHEM officers.

Table 22 Number of reported maternal death, Measles and AFP by Woredas, Towns / Hospitals in 2016, Wolaita Zone, SNNPR – Ethiopia

Woreda/Town	Maternal Death	Measles	AFP	Remarks
Bolosso Bombe	1	0	2	
Bolosso Sore	2	1	1	
Damot Gale	1	5	2	
Damot Pulassa	2	2	1	
Damot Sore	3	0	1	
Damot Woydie	2	0	0	
Duguna Fango	4	1	1	
Humbo	2	1	1	
Kindo Didaye	1	1	1	
Kindo Koysha	2	0	2	
Offa	1	0	1	
Soddo Zuria	2	1	1	
Areka Town	1	4	1	
Boditi Town	2	0	0	
Soddo Town	5	0	2	
Dubbo Hospital	0	NA	1	
Soddo Christian Hospital	0	NA	3	
Wolaita Soddo Teaching Hospital	11	NA	4	
Total	**42 (17.6%)**	**17 (42.5%)**	**25 (100%)**	

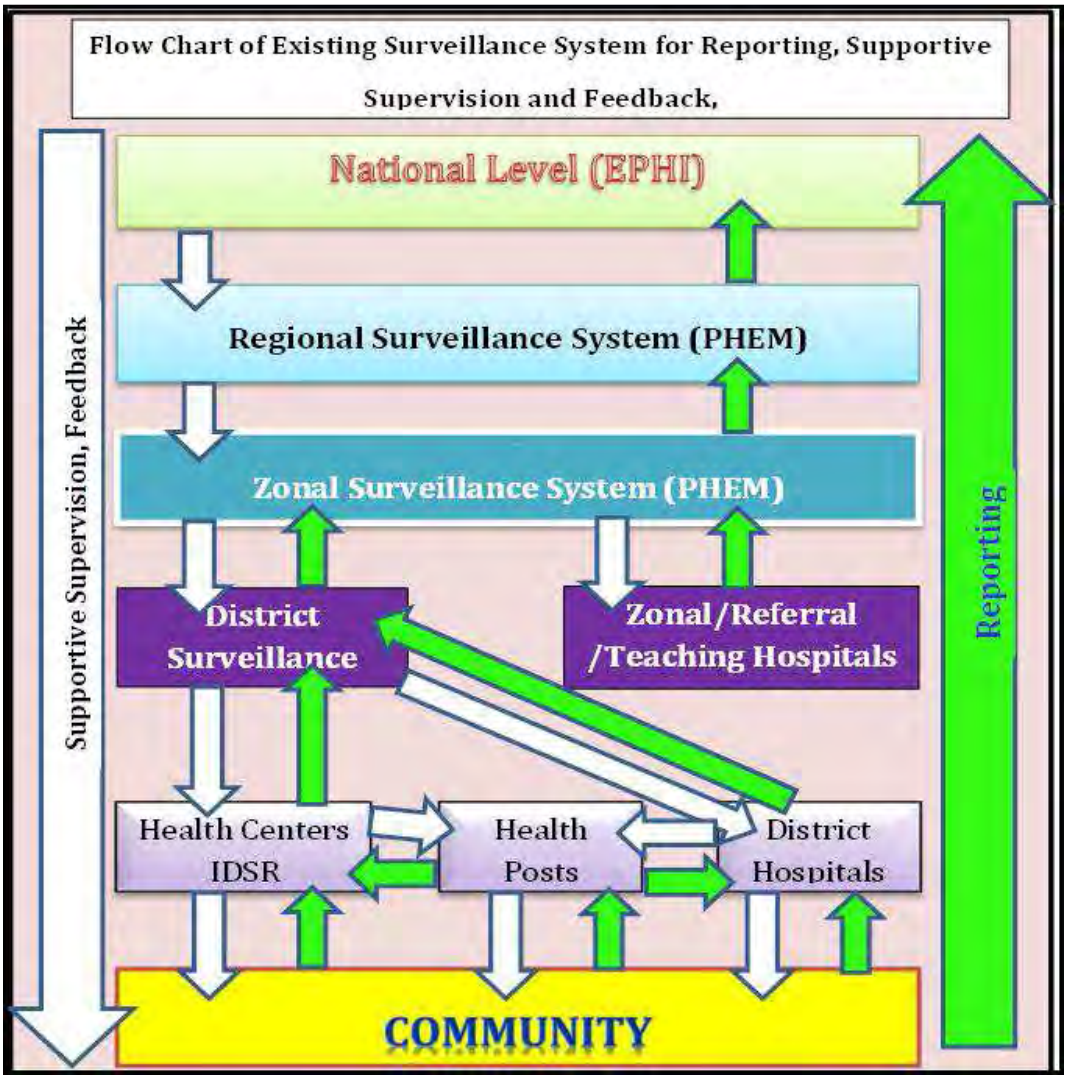

Figure 26 Diagram illustrating the flow of surveillance data and information throughout a health system

All the surveillance units faced challenges during communication like internet inaccessibility, network connection problem, trained health professions high turn-over, manual feeding of surveillance data, power supply shortage and transport access shortage. Telephone is the only communication means for HPs with HCs and HCs with districts then followed by hard copy report.

In 2015/16, there was 24 (0.68%) maternal deaths in WSUTRH out of 3511 total deliveries and in 2016/17 up to 2nd quarter, there were 12 (0.62%) maternal deaths out of 1938 deliveries.

5.4.Data Analysis

All 13 surveillance units' respondents trained at least 4 -10 days for topic of PHEM overview, disease specific surveillance, PHEM basic level phase one and integrated refreshment training (only rural HEWs) with in the last three years. However, Ade Shanto HC and WSUTRH surveillance unit focal persons were not trained on MDSR. Only 34 (50.7%) of HCs IDSR focal persons trained on surveillance system in the zone. There was no onsite training for surveillance system in all health facilities of the zone.

Surveillance /PHEM officers have permanently assigned in 9/12 rural districts. There was no legal PHEM structure for three town administrations in the zone; namely Soddo, Areka and Boditi towns. So that the rest 3 rural districts and 3 town administrations used delegated PHEM officers.

All three HCs, three HPs and Bele district hospital reported surveillance data to next level by using hard copy and calling because of lack of computer. Surveillance data analysis was not done from zonal level to districts even though they have denominators and computer for data analysis due to lack of knowledge and less attention to data analysis. However, zonal, Damot Pulassa and Bolosso Sore districts surveillance units performed trend analysis for malaria only.

5.5.Outbreak Investigation

In 2016, there was one suspected outbreak (Scabies) in all evaluated surveillance units (n=13). Totally 324 rural and 3 urban kebeles were affected by scabies outbreak starting from October 10, 2016. There was incomplete line list for all cases in evaluated districts (N=3) and no line lists in HCs (N=3), HPs (N=3) and Bele district hospital. Bolosso Sore and Damot Pulassa districts have high attack rates among evaluated districts (N=3) with AR of 27 and 15 per 1,000 populations respectively.

Table 23 Scabies outbreak cases by districts and zonal level, Wolaita zone, SNNPR, Ethiopia 2017

Name of districts	Number of Affected Kebeles	Number of Cases				AR from 1,000 populations
		Male	Female	<5 years	Total	
Bolosso Sore	32	2109	3166	315	5275	27
Damot Pulassa	23	1024	909	147	1933	15
Kindo Koysha	4	57	75	6	132	1
Other district (N=12)	265	3929	3501	2438	7430	5
Total	**324**	**7119**	**7651**	**2906**	**14770**	**8**

Mass treatment was done for specific kebeles of Damot Pulassa and Bolosso Sore districts where their AR was above 15% and the treatment with Ivermectin ointment was done for all cases and contacts for kebeles below 15% AR. The outbreak was not getting attention in the decision makers at all levels. The outbreak was not investigated to identify risk factors for disease at all evaluated units (N=13).

5.6.Laboratory Case Confirmatory Test

There was no regional public health laboratory but they used WSUTRH central laboratory, Soddo Christian hospital, Dubbo St. Marry primary and district hospitals (N=4) and HCs for specimen collection for Measles, AFP and Meningitis confirmation test. Except WSUTRH central laboratory, all hospitals (n=6), and health centers' (n=67) laboratories performed mostly routine medical laboratory activities in the zone.

All evaluated HCs (N=3) and hospitals (N=3) do have ability to collect specimen for sputum, stool, blood and serum for investigation. WSUTRH can perform CSF specimen collection and gram-stain lab confirmation. Except Gurumo Koysha HC, three HPs and WSUTRH, all evaluated surveillance units used standard specimen collection material for stool and blood. During at the time of evaluation, for all three HPs there was no cold chain management system. We observed that all surveillance units used vaccine carriers for shipments of specimens.

5.7.Epidemic Preparedness and Response

Except zonal and Damot Pulassa district, EPRP was not prepared at evaluated districts and health facilities. Zonal EPRP was budgeted whereas that of Damot Pulassa was not budgeted. Despite no EPRP, all surveillance units secured emergency drugs and supplies.

Epidemic management committee and RRT were established for all (N=13) units but they have no regular meeting; there was no meeting when there was no epidemic and maternal death. Zonal and districts' surveillance units have case management protocols for some of epidemic prone diseases like measles, malaria, AWD/Cholera, scabies, meningitis whereas there was no this protocols for health facilities except for malaria.

Zonal epidemic preparedness and emergency task force held meeting in every quarter; when there was epidemic, they met every 15 days. The scabies outbreak did not get any attention at zonal level that much except Damot Pulassa district in which epidemic management and RRT committee held their meeting at district level every 15 days and every week respectively.

5.8.Supervision, Feedback and Training

Except Bolosso Sore district, no evaluated units have PHEM specific supervision schedule/plan to the lower units. However, they performed by integration with other health service activities due to lack of resources, transportation, human resources and financial problem as they responded. Any of the evaluated units (N=13), except zonal and WSUTRH surveillance units, not supported by PHEM specific supportive supervision from higher levels. In 2016, there was no PHEM specific supportive supervision system for all evaluated surveillance units (N=13). Regional Health Bureau conducted Malaria related for zonal and MDSR related for WSUTRH supportive supervision once in the year, but no officially written feedback for supervision. They have no PHEM specific and standard supportive supervision checklists. There was no active case search at all levels in the zone.

Only 5(15.15%) of zonal, 35(22.4%) of Bolosso Sore, 56(33.7%) of Damot Pulassa and 63(37.5%) of Kindo Koysha districts' health professionals trained on surveillance system.

Ade Shanto HC and WSUTRH surveillance unit officers were not trained on MDSR. Only zonal PHEM officers were trained PHEM basic level training first phase.

5.9.Resources, Logistics and Communications

Electronic IDSR system was installed for zonal, districts and hospitals except Bele district hospital that helped to computerize the surveillance data documentation. Only

20% of the Kindo Koysha district' health facilities have fixed telephone, electric power supply, motor bikes and computer with printer. Only ZHD have photocopy machine and broadband internet access for communications. Among 13 respondents, 8 (61.5%) were not satisfied with existing surveillance system regarding resource limitation and structural lack of attention by decision makers. They suggested that the surveillance system should consider resource mobilization and human resources with relevant incentives as the structure required and as per guidelines to prevent public health problem.

Only zonal surveillance unit (PHEM) equipped with enough stationery, computer, printer with cartilage, software and statistical packages for data management and communication facilities. Health extension workers expected to conduct community IDSR but there was no communication tool at HP level. They use their own mobile phone to communicate emergency and other health related activities. Zonal PHEM only has computerized surveillance network with regional PHEM.

5.10. Surveillance System Attributes and Level of Usefulness

In 2016, Zonal PHEM officially reported 24 maternal deaths, which reported from WSUTRH, 24 suspected measles cases and 25 non-polio AFP cases by using national standard case-based reporting format. Out of 24 maternal death, 12 deaths were resident of Wolaita zone, 10 deaths from Gamo Goffa and two from Dawro zones (***Source:*** *Wolaita Zone PHEM Annual Report*). There was no report on measles and NP-AFP related deaths.

5.10.1. Level of Usefulness

Zonal surveillance system has been serving above 1.9 million populations. They used the system to detect outbreaks of priority diseases (Malaria, measles, meningitis, AWD/Cholera, malnutrition) early. They used it to permit accurate diagnosis, to estimate the magnitude of morbidity and mortality related to these diseases, including identification of factors associated with these diseases and to permit assessment of the effect of prevention and control programs. Despite this usefulness, there was no evidence for intervention and diseases trends analysis at all levels. Districts and health facilities used the system only for weekly IDSR report.

Table 24 Maternal death data reported, on hand data and their difference of Wolaita zone, SNNPR, Ethiopia 2017

Woreda/Hospital	Data on hand	Officially Reported	Difference	Comment
Bolosso Sore	2	0	2	
Damot Pulassa	3	0	3	
Kindo Koysha	1	0	1	
WSUTRH*	36	24	12	Deaths by direct causes only
Zonal Data	42	24	18	23 to RPHM**

* Wolaita Soddo University Teaching & Referral Hospital reports 24 deaths in 2015/16,
**Regional PHEM received 23 deaths (18 in 2015/16 and 5 biannual of 2016/17)
***Sources**: Wolaita Zone PHEM Annual Report, WSUTRH HMIS, Districts Surveillance units and Regional PHEM 2015/16 Annual and 2016/17 Biannual Reports*

5.10.2. Simplicity

The case definitions of maternal death, measles and AFP are easy to understand for all levels of health professionals. Filling of their formats will take maximum of 10-15 minutes. Facility based abstraction form for maternal death takes more than one hour to fill all variables. The surveillance system helps to record and report data on time except for maternal death. All respondents (N=13) argued that the surveillance system for maternal death was challenged to fill data by most health professionals rather than it left over to surveillance officers in the unit due to high degree of blame from decision makers. Moreover, death confirmation will take more than a month to conduct verbal autopsy for maternal deaths.

5.10.3. Flexibility

Current MDSR reporting formats (notification, facility-based abstraction, reporting formats) are specific for maternal death only that made difficult to use formats for other newly occurring health events. All respondents complained that weekly IDSR reporting format is also difficult to add newly emerging diseases and it missed important variables like age, sex, address and sign and symptoms for all national priority disease.

Electronic IDSR software allowed entering case number for already prepared variables/events only. Respondents agreed with surveillance system can be integrated with other health service systems like diseases prevention and health promotion (DPHP), maternal and child health and nutrition (MCHN) and disaster prevention and food security of Agricultural and natural Resource Department. .

5.10.4. Acceptability

All respondents (N=13) accepted and engaged to surveillance activities irrespective of the challenges of the system. Private health facilities (N=234) were not involved to report surveillance data except Soddo Christian hospital due to lack of awareness, no recognition given by the higher officials and lack of understanding of the relevance of surveillance data. Only 416 (64%) health facilities were participated actively on surveillance system in which 413 public, 2 NGOs and one private health facilities.

Case-based reports and disease registration books revealed that evaluated health centers (N=3) and hospitals (N=3) used standard case definition to identify cases. For MDSR, Bolosso Sore, Damot Pulassa districts, Dubbo St. Marry primary and WSUTRH hospitals were confirmed for their utilization of standard case definition to identify maternal death. However, it is difficult to say all health posts and Kindo Koysha districts used standard case definition since there was no evidence about MDSR. Respondents suggested that only PHEM officers were responsible for about surveillance system due to lack of awareness for other health professionals.

5.10.5. Data Quality: Completeness of reporting forms and validity of the recorded data

Zonal PHEM and Damot Pulassa district tried to check data quality. About 3 (17%) MDSR, 7 (29%) Measles and 11 (44%) AFP of zonal data records with missed items of adimission dates, extremity paralysed (Left or Right or Both), vaccination status, status of patient (alive or dead) for measles and AFP and unfilled items of gravida/parity of mother, ANC service, type of delivery not completed for maternal death. So that completeness of recorded data was 56%, 71% and 83% for AFP, Measles and MDSR respectively.

In 2015/16, average weekly IDSR completeness of zonal PHEM was 97.7%; that of Bolosso Sore, Damot Pulassa and Kindo Koysha was about 99.3%, 98.1% and 97.5% respectively.

5.10.6. Representativeness

Wolaita zone reached 95.4% health service coverage but its utilization rate is about 64.8%. Health service coverage of Damot Pulassa district is about 93.5% and that of Bolosso Sore and Kindo Koysha districts is above 100% for PHCU to total population as national standard. However, utilization rate of health service for Damot Pulassa, Bolosso Sore and Kindo Koysha districts are 35.2%, 48% and 76.2% respectively.

Zonal PHEM complained that rural community well benefited from surveillance system more than urban areas due to lack of surveillance system at urban level. Maternal death surveillance of zonal level did not show true occurrence and patterns of maternal death in the community. Nevertheless, structurally, surveillance system is representative since each kebeles have HPs and HEWs for surveillance. All socio demographic variables, like age, marital status, ethnic groups and religion were included in MDSR reporting formats.

5.10.7. Stability

Zonal and districts' surveillance units agreed that stability of surveillance system mainly based on internet access and constant power supply. Trained surveillance officers' turnover and lack of sufficient communication means are responded as challenge for surveillance system stability.

5.10.8. Timeliness

In 2015/16, zonal PHEM eIDSR showed weekly surveillance report timeliness was 100% in which all public (N=412), NGOs (N=3) and private (N=1) health facilities seemed that they reported timely to their next level surveillance unit but no weekly and/or immediately reported cases formats in the health posts. There was no evidence to determine timeliness for MDSR while early notification of maternal death as per guideline was not familiar at all level before verbal autopsy. Surveillance units replied that verbal autopsy/maternal death review for maternal death will take above 1 month without any notification.

5.10.9. Sensitivity and Positive Predictive Value (PPV)

Maternal death data on hand aggregated from deaths due to direct obstetric causes at the time of delivery and deaths in the health facility only. They insisted on that maternal death itself is sensitive issue for decision makers to blame service providers rather than taking relevant intervention to prevent next maternal death by the same causes. Therefore, those surveillance officers hesitated to notify any maternal death before verbal autopsy irrespective of cause of death.

It is also challenge to assess PVP for MDSR system in Wolaita zone. In simple word, sensitivity can be calculated using reported maternal deaths (n=23) over total maternal deaths' data on hand (N=42) which accounts 54.76% of MDSR PPV at zonal level. Moreover, sensitivity for MDSR seems 100% since there was no falsely reported maternal deaths.

6. Discussion

Public health surveillance is the systematic, ongoing collection, management, analysis, and interpretation of data followed by the dissemination of these data to public health programs to stimulate public health action (1, 2, 28). Maternal death surveillance system was designed to gather relevant information for action in which it help to prevent further maternal death by the same causes (7, 11). Surveillance system needs active participation of every structure from community to higher-level officials to alleviate public health problems early as its objectives. More than 200 private health facilities are not involved in surveillance system participation in Wolaita zone so that some sort of surveillance data for national priority diseases missed. The study result revealed that lack of intensive and timely refreshment trainings, budget and transportation shortage, high turnover of trained surveillance officers and lack of PHEM structure at urban level hindered zonal surveillance system. Moreover, zonal and districts PHEM structures comprised 1 -2 surveillance officers who tried to cover all surveillance system activities.

Most of health professionals, who have not trained surveillance activities, were not familiar with case definitions of national priority diseases. Moreover, weekly IDSR data could not be analyzed in terms of person since the format lacks this variable. Zonal PHEM has been collecting weekly IDSR data from districts, town administration and

hospitals by using phone calling then feed to eIDSR manually and then uploaded to the regional eIDSR server when there was internet connection only. This software is restricted for inserting case numbers of selected 21 diseases/events whereas there was no chance to add new diseases if any. This indicated that surveillance system format at zonal and district level is not flexible for new disease to add-on. The study was confirmed by the same surveillance system evaluation conducted in Dawro zone in 2014 and that of Oromo nationalities in Amhara region (29, 30).

The result showed that Surveillance data analysis was not practiced at all level; but zonal PHEM, WSUTRH, Bolosso Sore and Damot Pulassa districts tried to conduct trend analysis of malaria surveillance data by time and place only.

Even though MDSR data analysis (tabulated) was started at zonal level, analysed information was not utilized for prevention and intervention activities. Any of the evaluated districts (N=3) and hospitals did not conduct surveillance data analysis for MDSR, Measles and AFP due to lack of knowledge and analysis was not familiar that needs surveillance system training on data management and analysis. Scabies is one of public health problem that occurred as outbreak in the zone, but it has not been investigated yet due to lack knowledge, checklist as well as lack of attention for the disease.

Epidemic preparedness and response is active when regular evaluation and monitoring of surveillance system ongoing activities with relevant plan. Despite RRT and epidemic management committee established at all levels, there was no evidence for their regular meeting after and before scabies outbreak. This indicates that outbreak occurrence is the only means to provoke these committees for regular meeting.

Due to lack of PHEM specific supervision and monitoring, surveillance system stayed with their challenges as the result indicated. Moreover, lack of stable communication system, especially for HEWs and Health facility focal persons, some of surveillance system attributes could not be assessed.

The result revealed that MDSR system bottlenecked by unspecified factors that prevent implementation of this surveillance system in the zone as per national guideline. The

surveillance system of Wolaita zone was not met with WHO criteria for some priority surveillance (13, 31).

Utilization of surveillance system outweighed to rural communities as the PHEM structure of urban area was not set legally although health service coverage is above 100% in urban areas. In 2015/16, health service utilization of Bolosso Sore and Damot Pulassa was below zonal achievement. As the respondents replied that community-based health insurance helped health service utilization rate increased where it fully applied.

Except zonal PHEM, the date of report receiving was not labelled at all evaluated surveillance units that challenged to assess timeliness of the system. Ideally, all respondents agreed with the importance and/or usefulness of maternal death surveillance system as we observed during study.

Surveillance data quality is vital for specific control and prevention intervention for decision makers (32) and 44% of case-based reports were not completed from all evaluated units for AFP, 29% for measles and 17% for maternal death. Some variables missed on formats were not filling whether the case is true or not (N=10), admission date (N=7), who notify the case (N=2) and duration of stay at health facility before death (N=9) and types of treatment/intervention taken (N=24).

7. Limitations

Community based surveillance was not evaluated for MDSR whether community maternal death present or not. Medical records for maternal death was not reviewed; results based mainly on surveillance data, HMIS, case-based reporting formats and interview of surveillance officers of zonal & districts' PHEM, HCs and hospitals focal persons and HEWs only.

8. Conclusion

In 2015/16, Wolaita zone maintained completeness of surveillance data reporting facilities above national and regional expected range. Despite its usefulness, surveillance data was not analysed regularly to elicit evidence-based decision taking. Maternal death surveillance system has been compromised in the zone unless factors affecting MDSR implementation identified and solved based on its finding. Surveillance system attributes

could not be assessed for maternal death since surveillance activities were not implemented as per national guideline. Lack of relevant communication materials, lack of PHEM specific supervision, budget line shortage, trained work force shortage and turnover, lack of refreshment training and low attention from higher officials as well as lack of surveillance unit structure at urban areas are the main bottlenecks of surveillance system for the zone.

9. Recommendation

Based on the findings of the study, we recommended that all health professionals should have surveillance activity training to be able to fill surveillance activity reporting formats easily.

Surveillance units should aware and recognize private health facilities to increase the participation in surveillance activities for relevance of the data to be collected.

Budget line and logistics for surveillance system should be secured to undergo PHEM specific supervision.

Weekly IDSR reporting format should be updated to hold socio demographic variable like sex, age groups to analyze surveillance data by time, place and person. Surveillance data quality should be improved by increasing report completeness and fill all required variables.

Maternal death surveillance system should be strengthen by following national guidelines to prevent further maternal death and MDSR should include not only deaths due to direct obstetric cause at health facilities but also indirect cause and all pregnancy related community deaths.

Android mobile application is recommended to stable surveillance system at HPs and HCs level that will increase surveillance data management, helps to assess the system attributes and fastens early communication between surveillance units. Finally, we recommended further assessment to find out factors affecting implementation of MDSR at all levels.

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Chapter IV-Health Profile Description Report

4.1 Health Profile Description of Kindo Didaye district, Wolaita Zone, SNNPR – Ethiopia 2016

Abstract

Introduction: Health profile description is a system of collecting, organizing and summarizing health and other health related events. The Ethiopia 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. This study was conducted to provide health profile description of Kindo Didaye district that will help for health planning.

Method: The cross-sectional study design was conducted in Kindo Didaye district from January 28 – February 14, 2016. The data was collected through interviewing district head administrator, sectors head, experts; reviewing documents using developed health profile data collection checklists. Data was managed and analyzed by using Microsoft Excel 2010 and ArcMap 10.2.2.

Result: The total population of the district in 2016 is estimated as 122,062 based on a projection of 2007 census with 60726 (49.75%) males and 61336 (50.25%) females. The employment ratio of the district is estimated as 1.44:1. There were a landslide, ice and fire disasters in the district in the past two years ago. The recent landslide disaster affected nine kebeles with 37 deaths, 344 households displaced and more than 275 million birrs estimated property lost. The district has 1 primary hospital, 3 health centers, 24 health posts and 4 private clinics. Malaria and pneumonia were the first top adult and pediatric morbidity and mortality cases respectively. Only 0.79% of the total population selected for a fee waiver in the year. The district has 82% health service coverage, 100% primary school coverage, 100% latrine coverage and 69.64% safe drinking water coverage in 2015. The district sustained 100% coverage for most Expanded Program of Immunization activities. Contraceptive acceptance rate and skill birth attendant was 66.12% and 44.3% respectively in 2014/15. The district has 40.31% and 95.16% TB detection and treatment success rates respectively in the year.

Discussion and conclusion: Health center population (1:30516), physician population (1:122062), health officer population (1:20344) and mid-wife population (1:11097) ratios was below regional and national performance in 2010. As the vaccination indicator, the district has high coverage of $penta_3$, PCV_3, and measles than total zonal, regional and national coverage of 2015. The coverage of LLITNs and IRS in the year was 81.25% and 57% respectively, burden of malaria was taken as leading cause of morbidity and mortality for adult while pneumonia remained as leading cause of pediatirics morbidity and mortality. This might be underutilization of LLITNs and problem in quality of IRS.

1. Introduction

Health profile description is a system of collecting, organizing and summarizing health and other health related events. The Ethiopia 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. The description comprises demographic, socio-economic, vital statistics, political, cultural and others aspect of particular geographic areas of interest. The description gives clues for health structures in prioritizing health and others health related condition occurred within the communities. (1, 2)

The data summarized and public health events that described as health profile description gives the imminence clues for health care providers, official and even policy makers to take relevant and possible actions and solutions for identified gaps.

The main purpose of this cross-sectional study is to assess and describe Kindo Didaye district health profile that will help to point out health and health related problems of the district which need planning and different intervention to alleviate way of taking the solutions for identified public health problems in the existing programs and revision of impact of that programs.

Kindo Didaye district is one of the 12 rural districts in the Wolaita Zone where found South West from Zonal town Soddo with a total population of 122,062. It is 94KM far from Soddo and 289KM far apart from the capital city of SNNPR, Hawassa. Measles, malnutrition, Malaria and other communicable diseases are common public health problems in the district. Landslide is highly threatened public disaster of the district which resulted in 7 – 18 deaths and more than 500 households' displacement in past four years ago. In addition, to those, the district is surrounded by a chain of mountains that make difficult and hard to reach the health services to the communities as expected. This is in short why the district is selected for health profile description study in addition to health profile description has not been conducted in the district yet. The district was more described in the next topics under result part.

2. Rationale of the study

Health profile description of Kindo Didaye district is an important means to point out the actual gaps of health and health related services and activities in the community and it gives an advantage for officials' and stakeholder's priority setting in resource mobilization and gap filling programs. It is important to understand the demographic, socio-economic, vital statistics, endemic disease status and other data of the district. The study was formulated and created data that can be used for the provision of health services at the community level in the district and it was provided evidence to the district and other stakeholders for public health decision-makings.

3. Objectives

3.1.General objective

To assess and describe health and health-related situations and identify problems for priority setting of Kindo Didaye district in Wolaita zone in Southern Nations, Nationalities and people Region, Ethiopia.

3.2.Specific objectives

- To assess health profile status and health indicators of the district
- To describe health service delivery setup and disease burden of the district
- To describe existing health information and indicate actual gaps of health structure
- To assess human resources and health coverage of the district
- To identify priority problem setting in the district.

4. Methods

4.1.Study setting and period

The cross-sectional health profile description study was conducted in Kindo Didaye district from January 28 – February 14, 2016. The district is one of 12 rural districts of Wolaita zone in SNNPR, Ethiopia, with a total population of 122062 in 2016.

4.2.Data source

Data was gained from the district administrative office head, health office, education, water and irrigation office, youth affair office, finance and economy, agriculture and natural resource, municipality heads, culture tourism and government communication offices and elders.

4.3.Data collection

The data was collected through interviewing district head administrator, sectors head, experts; reviewing documents using developed health profile data collection checklists; discussing with office heads, expertise, professionals and conducting personal observation.

4.4.Data analysis, organization, and dissemination

Data was managed and analyzed by using Microsoft Excel 2010 and ArcMap 10.2.2. The findings was disseminated to Kindo Didaye district administration, health office, Wolaita Zone health department and other stakeholders who currently acting in the zone.

4.5.Ethical Issus

Permission letter was obtained from field site, SNNPR PHEM core process, to Wolaita Zone Health Department, the department also sent a letter to the district, and finally the district health office wrote a letter to other concerned sectors.

5. Result

5.1.Description of the district

5.1.1. Historical, Geographic and Demographic Characteristics of Kindo Didaye district

Wolaita Zone is one of 15 zones of Southern Nations, Nationalities and People Region, which far from capital city of the region, Hawassa, 157KM. Kindo Didaye district is one of 12 rural districts of Wolaita Zone in the region that located on the South West edge of Zone that far 94 KM apart from Soddo, the capital city of Wolaita Zone. The district was established on 2006 (1998 E.C.) by taking 10 kebeles from Offa district and 11 kebeles from Kindo Koysha districts to form 21 kebeles (19 rural and 2 urban) of a district based on geographical location and social and cultural assembly of the people. The area is said as the origin of all Wolaita Nations and Wolaita native culture takes place that sustained for long years ago. Three kebeles of the district are covered with natural charcoal and Gelgel Gibe 3 Hydroelectric Power dam is found that will generate 1870 Megawatt power just after 6 – 9 months (August – November 2016).

The name of the district called for the memorial aspect of Kindo Halala who was the rich-man without a child and gifted all his property to the local governing body, and the mountain 'Didaye' where the palace of Wolaita Mala dynasty the third King of Wolaita was found. The main town of the district called Halale was established in 1880's and found at 1842m altitude which is near to Gilgel Gibe 3 Hydroelectric Power dam. Kindo Didaye district bordered by Kindo Koysha district and Dawuro Zone from the North, Gamo Gofa Zone from South, Offa and part of Kindo Koysha districts in the West and Dawuro Zone in the East. The estimated area of the district is about 38,874 hectares or 388.74km^2 which covers 8.73% of Wolaita zone area with a total population of 122,062 in 2007 EFY as the projection from 2007 census of CSA. Its population density is about 62 persons per km^2.

The climatic condition of the district is about 23.65% Kolla (hot zone), 59% Woynadega (temperate) and 17.35% Dega (cold zone) with the highest altitude 2827m at Lasho Mountain to lowest 910m at Shela Sade and around Gibe 3 Hydroelectric Power dam. Its latitude and longitude are about 6^{0}45.322'N and 37^{0}20.704'E respectively at the capital town of the district. The annual rainfall ranges from 700ml to 1290ml with the average of 1100ml. Enset, maize, Teff, Cassava, cereals, fruits and vegetables are the prominent

agro-ecological production of the district. About 89% of the district has land bodies with about 11% water bodies including the man-made lake of Gibe 3 Hydroelectric Power dam which covered some part of three Omo River bordered kebeles.

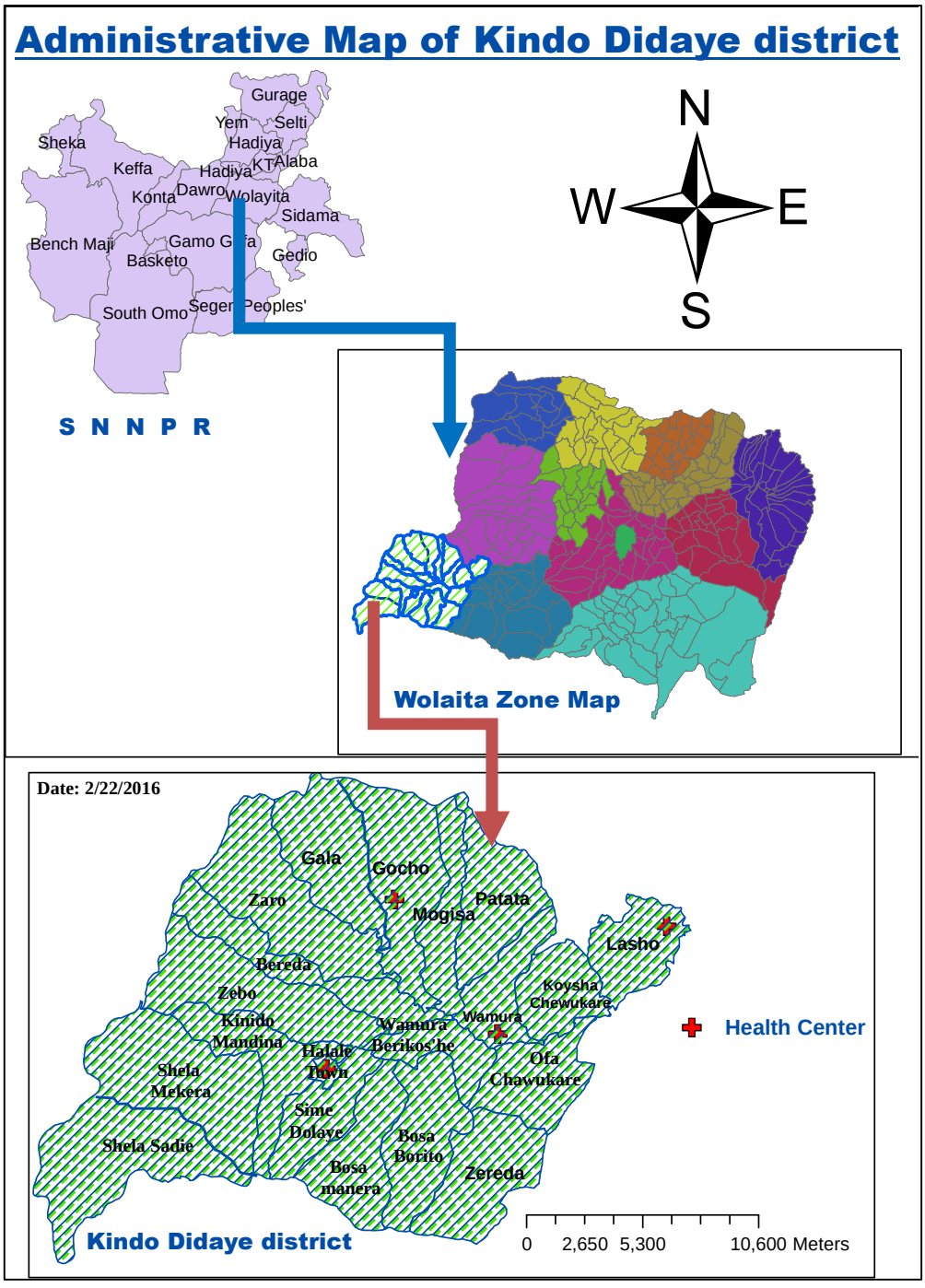

Figure 27 Administrative map of Kindo Didaye district, Wolaita Zone, SNNPR - Ethiopia.

5.1.2. Population and population structures

Table 25 Population Profile of Kindo Didaye district in 2007 EFY, SNNPR, Ethiopia.

S. N	Category	Number	Percent (%)	Remarks
1	Total Population	122062	100	
2	Male	60726	49.72	
3	Female	61336	50.25	
4	Rural	118985	97.48	
5	Urban	3077	2.52	
6	0 – 6 months	2038	1.67	
7	6 – 59 months	17015	13.94	
8	24 – 59 months	12731	10.43	
9	<1 year population	3894	3.19	
10	<3 year population	10143	8.31	
11	<5 year population	19054	15.61	
12	<15 year population	58358	47.81	
13	2 – 29 years population	85443	70	
14	15 – 24 years population	23521	19.27	
15	15 – 59 years population	58919	48.27	
16	Above 60 years	4761	3.90	
17	Women of child bearing	28440	23.30	
18	Pregnant mothers	4223	3.46	
19	Above 65 years old	4394	3.6	

The total population of the district in 2007 EFY is estimated as 122,062 based on a projection of 2007 census. About 60726 (49.75%) are males and 61336 (50.25%) are also

females with the sex ratio of all age groups comprise 0.99 male to female and a dependency ratio of the district is estimated about 79% (54052:67304).

Table 26 Estimated Population size of Kindo Didaye district by Kebeles in 2007 EFY

S. No	Name of kebele	Total population	Female	Male	% Cover	Remark
1	Bereda	5218	2622	2596	4.27%	
2	Bossa Borta	8288	4165	4123	6.79%	
3	Bossa Maniara	5791	2910	2881	4.74%	
4	Gala	5739	2884	2855	4.70%	
5	Gocho	5748	2888	2860	4.71%	
6	Halale 01	1755	882	873	1.44%	
7	Kindo Mandina	6166	3098	3068	5.05%	
8	Koysha Chawukare	7478	3758	3720	6.13%	
9	Koysha Wamura	6701	3367	3334	5.49%	
10	Lasho	8391	4216	4175	6.87%	
11	Mogissa	4997	2511	2486	4.09%	
12	Offa Chawukare	6368	3200	3168	5.22%	
13	Patata	8402	4222	4180	6.88%	
14	Shella Mekera	4615	2319	2296	3.78%	
15	Shella Sadie	4615	2319	2296	3.78%	
16	Sime Dolaye	3681	1850	1831	3.02%	
17	Wamura 01	1333	670	663	1.09%	
18	Wamura Borkoshe	4084	2052	2032	3.35%	
19	Zaro	6897	3466	3431	5.65%	
20	Zebo	8694	4369	4325	7.12%	
21	Zerada	7101	3568	3533	5.82%	
	Total	**122062**	**61336**	**60726**	**100.00%**	

5.1.3. Population size by religion and ethnic composition

About 67.3% of the district population follow protestant region and about 27.2%, 1.2% and 4.3% of the population are following Orthodox, Catholic, and other religions respectively. The ethnic composition of the district dominated by Wolaita ethnicity, about

120109 (98.4%) of the total population, followed by Gofa 732 (0.6%), Dawuro 610 (0.5%), Gamo 366 (0.3%) and other 245 (0.2%) ethnic groups. As the shown table below, Zebo Kebele comprises the highest portion of total district population which accounts 7.12% (8694) and Halale and Wamura towns covered the least number of the population, about 1.44%, and 1.09% respectively. This shows that above 97% of the total population live in rural areas in the district (12, 14).

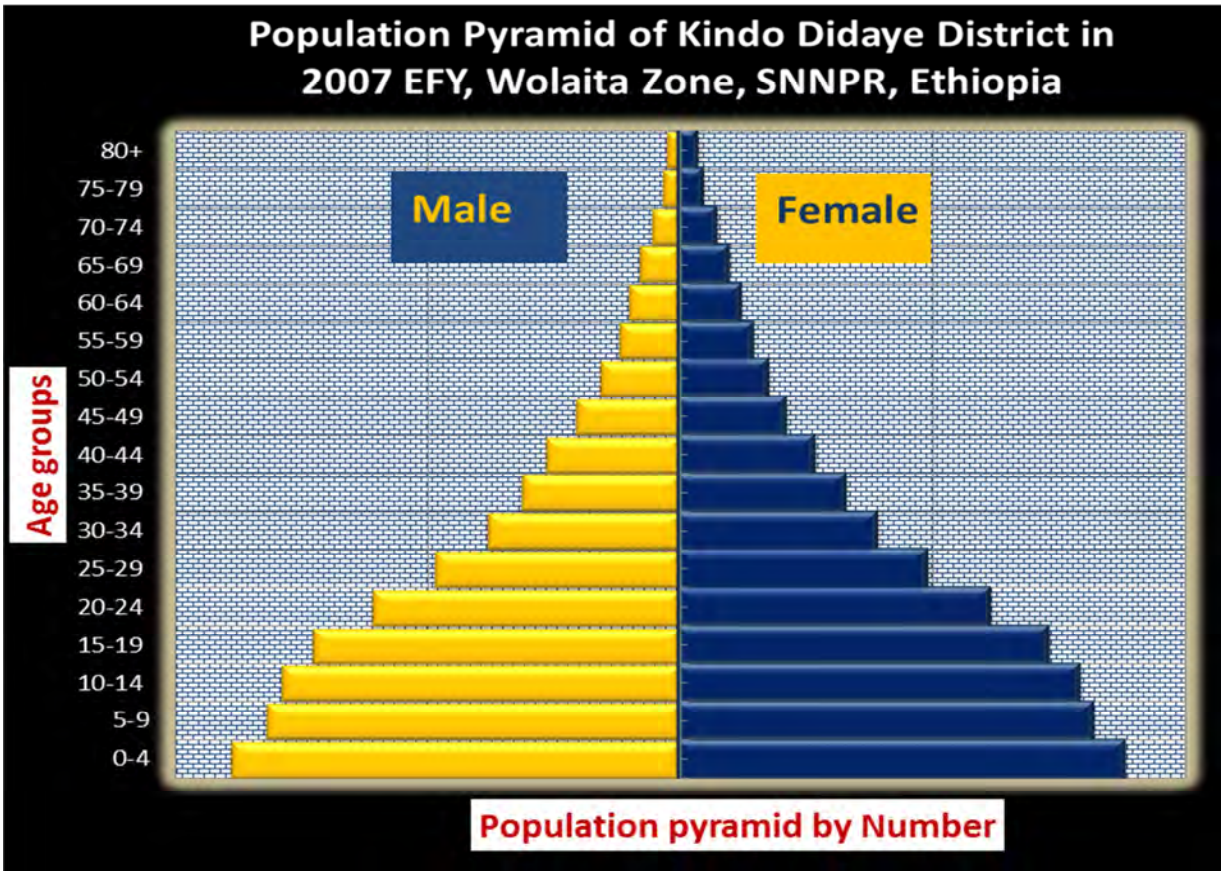

Figure 28 Population Pyramid of Kindo Didaye district in 2007 EFY, Wolaita, SNNPR, Ethiopia.

5.2.Economic Status of the district

5.2.1. Income

The main source of income of the population of the district is composed of agriculture followed by government employee and small-scale trade. About 19214 (77.13%) of total households are committed to agriculture. The others are committed to participation in

Government employment 1657, merchandise 462, hotel & catering only 2 households and other works as the source of income. Average annual household income estimated as 14,300 birr with an average income per capita of 2860 birr.

5.2.2. Employment

The administrative office of the district reported that totally 3406 population employed at small scale enterprise and 1660 are daily and permanent Gibe 3 Hydroelectric Power dam worker with 2354 unemployed population. The employment ratio of the district is estimated as 1.44:1.

5.3.Education and Literacy Status of Kindo Didaye district in 2007 EFY

5.3.1. Education and school Health

All 39 schools have gravity assisted spring water supply from neighboring water point and have functional female-male separated latrines. The schools have different health related clubs like HIV, environmental health, WASHE and others.

Table 27 Number of schools, Teachers, and Students in 2007 EFY in Kindo Didaye district, Wolaita Zone, SNNPR, Ethiopia.

Type of School	Level of grade	Number of Schools	Number of teachers		Number of Students		Student drops out		Remark
			Male	Female	Male	Female	Male	Female	
Primary	1 to 4	2	5	0	10085	9092	20	17	
	5 to 8	33	356	96	4968	4691	23	20	
	Total	**35**	**361**	**96**	**15053**	**13783**	**43**	**37**	
Secondary	9 to 10	3	52	4	1301	1049	16	12	
	11 to 12	1	48	4	285	262	3	7	
	Total	**4**	**100**	**8**	**1586**	**1311**	**19**	**19**	
Grand Total(1 to 12)		**39**	**461**	**104**	**16639**	**15094**	**62**	**56**	

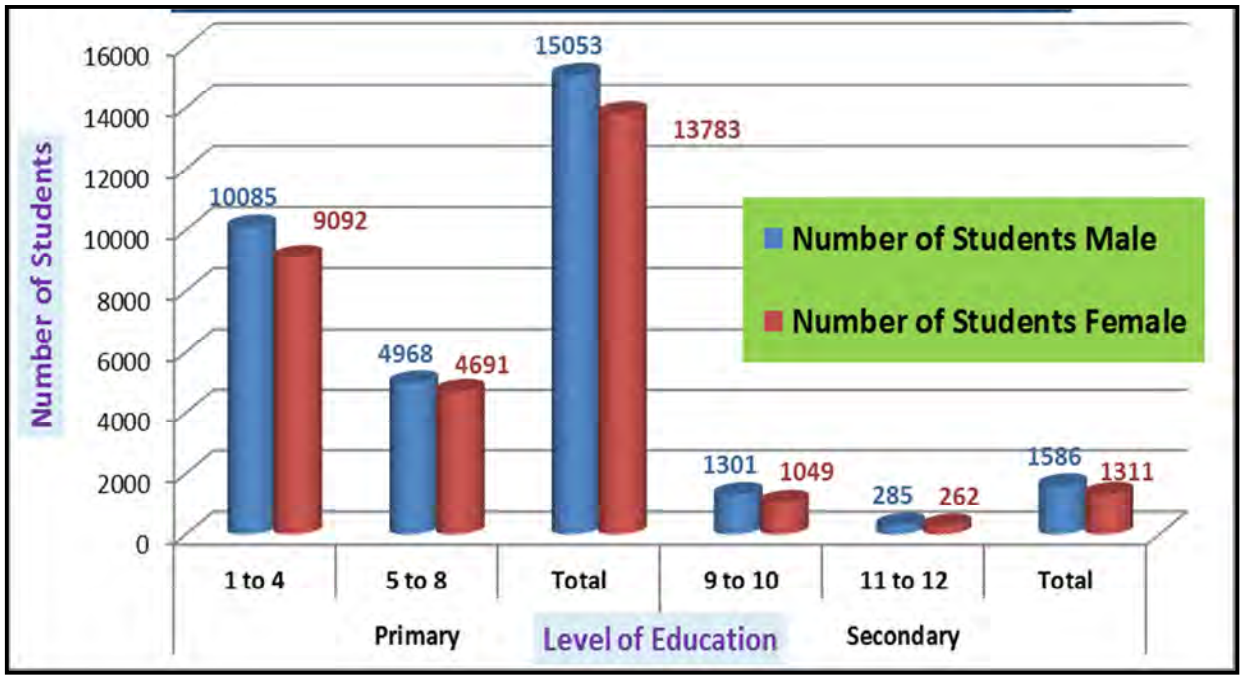

Figure 29 comparison of male and female students enrolled in 2007 EFY at Kindo Didaye district in Wolaita Zone, SNNPR, Ethiopia.

5.4.Facilities

5.4.1. Social aspects

There are different youth clubs in the districts like health and ethics, tomorrow teachers, mini-media, environmental conservation, science and technology, service delivery and women education with 9765 members.

5.4.2. Communication and Utilities

Currently, the district has 2 ambulances for MCH and referral system and 4 motorbikes to reach all the health facilities for supportive supervision and material supply. None of the health centers and health post have car or motorbikes. About 23 (82%) health facilities and 18 (85.7%) kebeles have access to roads of local type. There is only one fixed line phone for district health office level only and 17 (61%) health facilities and 12 (57%) kebeles have access to the mobile network. Only 3 kebeles and 3 health facilities have access to 24 hours electric supple and 7 (25%) HFs has the access of solar energy for electric power supply. Even though 4 HCs and 4 HPs have a refrigerator for vaccine storage, refrigerators in the HPs are not functional.

5.5.Disaster Situation of the district

There were a landslide, ice and fire disasters in the district in the past two years ago which resulted in 8 deaths (including 1 pregnant mother), 29 households displaced and more than 14 million birrs estimated property lost. The kebeles affected by those disasters included Patata, Koysha Wamura, Bossa Borto, Halale o1, Koysha Chawukare, Kindo Mandina, Sime Dolaye, Sheila Mekera and Wamura Borkoshe.

5.6.Vital statistics and Health Indicators in 2007 EFY

The district has no data for Vital statistics and health indicator like Maternal Mortality Rate, Crude death and birth rates, IMR, CMR etc.

5.7.Health Services of the district in 2007 EFY

5.7.1. Number and type of health facilities

The district has one primarily hospital (under construction during data collection), four health centers (one will be missed when primary hospital construction completed), 24 health posts and four different levels of private clinics.

5.7.2. Human resources of health sector in 2007 EFY

Table 28 Type and Number of human resources present in 2007 EFY in Kindo Didaye district, Wolaita Zone, SNNPR, Ethiopia

S. no	Type	Number		
		Male	Female	Total
1	Physicians (all levels)	1	0	1
2	Health officers	6	0	6
3	Laboratory technician/technologist	7	7	14
4	Pharmacy technician/Pharmacist	12	1	13
5	Nurses all type except midwife	46	13	59
6	Midwife	0	11	11
7	X-Ray technician	0	0	0
8	Environmental Health Technician	1	3	4
9	Health Information Technologist	0	2	2
10	HEWs	0	56	56
11	All administrative staffs	76	45	135

5.7.3. Ratio of Health facility and professional to population

Table 29 Health Facility population and Health Workers Population Ratios of Kindo Didaye district in 2007 EFY, SNNPR, Ethiopia.

S. no	Description	Ratio
1	Hospital: population	1:122062
2	Health center: population	1:30516
3	Health post: population	1:5086
4	Physician: Population	1:122062
5	Health officer: population	1:20344
6	Pharmacy professional - population	1:9389
7	Laboratory professional - population	1:8719
8	Nurse: population	1:2069
9	Midwife: population	1:11097
10	HEW: population	1:2180

5.7.4. Top causes of Morbidity, admission, and mortality in 2007 EFY

Table 30 Adult and Pediatrics OPD top ten causes of Morbidity in 2007 EFY of Kindo Didaye district in Wolaita Zone, SNNPR, Ethiopia.

S no	Adult			Pediatrics		
	Cause	**No.**	**%**	**Cause**	**No.**	**%**
1	Malaria all types	1789	30.75	Pneumonia	1322	18.65
2	AFI	926	15.91	Malaria all types	1255	17.71
3	Helminthiasis	902	15.50	AFI & Typhoid fever	993	14.00
4	parasitic diseases	546	9.38	Diarrhea all types	917	12.94
5	Trauma	497	8.54	Helminthiasis	574	8.10
6	Typhoid fever	323	5.55	Malnutrition	506	7.14
7	Infectious of skin and subcutaneous tissue	252	4.33	Unspecified infection and parasitic diseases	463	6.53
8	Eye disease	199	3.42	Skin diseases	414	5.84
9	Pneumonia	193	3.32	Trauma	370	5.22
10	Dyspepsia	192	3.30	All respiratory disease	274	3.87
	Total	**5819**		**Total**	**7088**	**100**

Table 31 Adult and Pediatrics IPD top ten causes of Mortality in 2007 EFY of Kindo Didaye district in Wolaita Zone, SNNPR, Ethiopia

S. no	Adult			Pediatrics		
	Cause	No.	%	Cause	No.	%
1	Malaria all types	2	40	No Data for pediatric		
2	TB	2	40			
3	Pneumonia	1	20			
	Total	**5**	**100**			

Table 32 Adult and Pediatrics IPD top ten causes of Morbidity in 2007 EFY of Kindo Didaye district in Wolaita Zone, SNNPR, Ethiopia

S. no	Adult			Pediatrics		
	Cause	No.	%	Cause	No.	%
1	Malaria all types	29	50.88	Pneumonia	45	42.86
2	Diarrhea with dehydration	5	8.78	Malaria all types	20	19.05
3	Pneumonia	4	7.02	Malnutrition	16	15.24
4	Typhoid fever (AFI)	3	5.26	Diarrhea all types	8	7.62
5	Dyspepsia	3	5.26	Skin related diseases	4	3.81
6	Trauma	3	5.26	Burns and corrosions	3	2.86
7	Burns and corrosions	3	5.26	Birth Asphyxia	3	2.86
8	PUD	3	5.26	Typhoid fever (AFI)	2	1.90
9	Dysentery	2	3.51	Trauma	2	1.90
10	HIV related diseases	2	3.51	Unspecified infection and parasitic diseases	2	1.90
		57	**100**		**105**	**100**

5.7.5. Health Sector Budget, Expenditure and Health Care Financing

Health Sector Budget

Table 33. Health Sector Budget Distribution for last five years of Kindo Didaye district, Wolaita Zone, SNNPR, Ethiopia

S. no	Health institution	2003 EFY		2004 EFY		2005 EFY		2006 EFY		2007 EFY	
		Salary* (birr)	Recurrent (birr)	Salary (birr)	Recurrent (birr)	Salary (birr)	Recurrent (birr)	Salary (birr)	Recurrent (birr)	Salary (birr)	Recurrent (birr)
1	Gocho HC	**Under DHO**		416077	12653	721225	269916	781121	244972	852014	347615
2	Halale HC	**Under DHO**		796489	27124	1037085	324098	1091463	405192	1233035	361173
3	Lasho HC	**Under DHO**		375209	12933	633521	163790	648081	199020	718814	188648
4	Wamura HC	**Under DHO**		443654	12940	653041	212801	732604	272270	686254	265000
5	DHO	2046493	562563	944012	84450	981255	104847	980481	934410	1019257	1488116
	Total	2046493	562563	2975411	150100	4026127	1075452	4233750	2055864	4509374	2650552

Table 34. Health Sector Budget Distribution for last five years of Kindo Didaye district, Wolaita Zone, SNNPR, Ethiopia

	Source	2003	2004	2005	2006	2007
1	Total district budget (Birr)	21359706	21287506	31499931	39147114	46882485
2	Allocated to health sector (Birr)	2609056	3125511	5101579	6289614	7159926
3	Total per capital health expenditure(Birr)	23.85	27.86	44.22	52.93	58.66

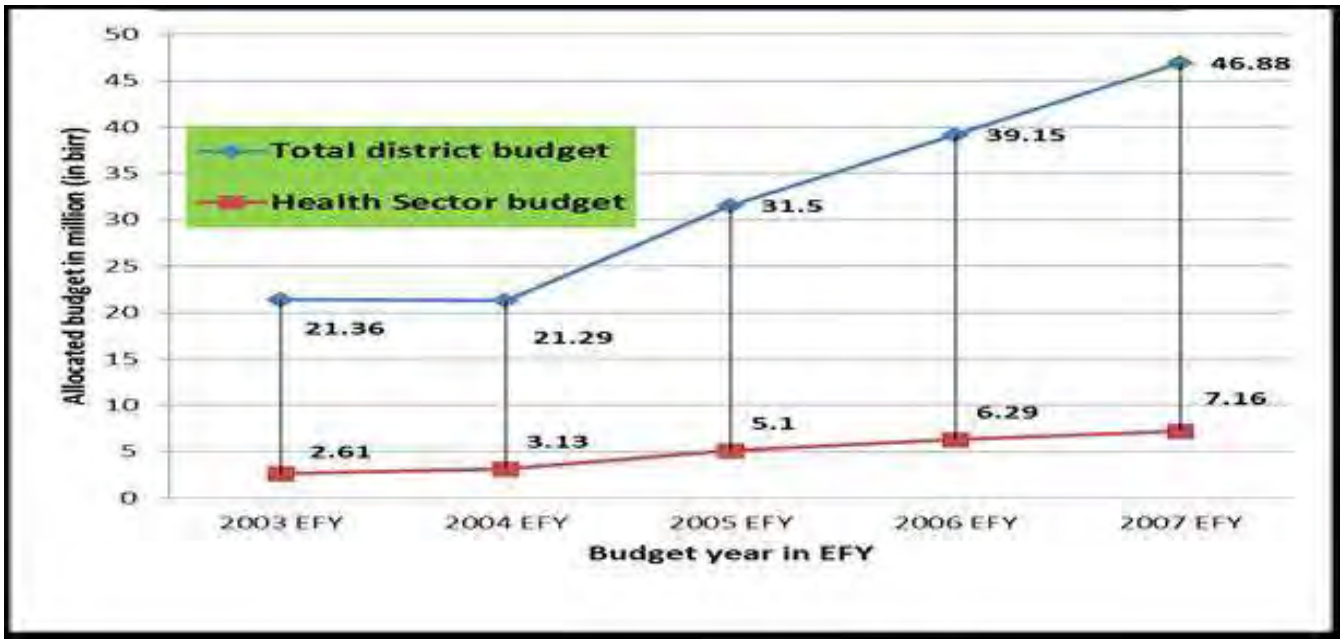

Figure 30 Comparison of total budget increment rate of the district with allocated to health sector budgets of Kindo Didaye, SNNPR, Ethiopia, 2010/11 to 2014/15

5.7.6. Health Care Financing status of the district

Table 35 Health Care Financing status of HCs of Kindo Didaye district for last 3 years, Wolaita Zone, SNNPR, Ethiopia.

S. No	Name of the Health HFs	HCF Started at (EFY)	Budget Allocated (birr)			Budget Utilized (birr)		
			2005	2006	2007	2005	2006	2007
1	Gocho HC	2003	165461	187008	249999	152665	178153	230491
2	Halale HC	1998	195733	215306	270000	148379	196167	203089
3	Lasho HC	2003	112357	123593	155829	86487	79976	103717
4	Wamura HC	2003	126449	139082	190000	99871	108905	130806
	Total		**600000**	**660000**	**865828**	**487404**	**563202**	**668103**

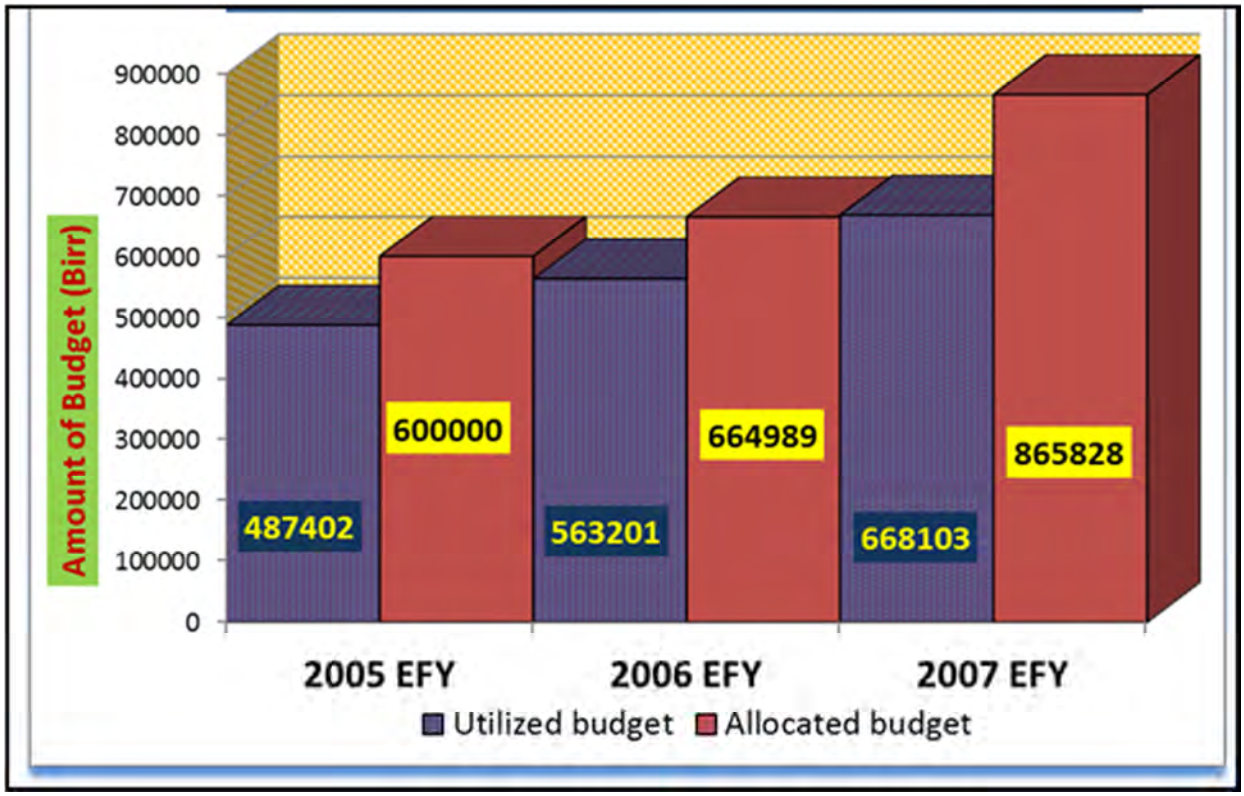

Figure 31 Health Care Financing status of HCs of Kindo Didaye district for last 3 years, Wolaita Zone, SNNPR, Ethiopia.

5.7.7. Fee Waiver distribution by Kebeles in 2007 EFY

The district allocated a total of 100,000 birrs for a fee waiver in 2007 EFY for 923 selected beneficiaries from 21 kebeles. The selection of beneficiaries was not done as the standards and the regulation stated 10% of total population assumed as the candidates for fee waiver from each kebele. Nevertheless, the district selection was done as quota system where the maximum number of beneficiary selected from Kindo Mandina 85, Galla 79, Bereda 55 in which they contributed 1.31%, 1.38%, and 1.05% respectively from the population of respective kebeles. The highest coverage of about 41/1333 = 3.08%. This shows that only 0.79% of the total population selected for a fee waiver and this violates the country rule and regulation of selection criteria for fee waiver.

Table 36 Fee waiver status of Kindo Didaye district in the 2007 EFY, SNNPR, Ethiopia

S. No	Name of kebeles	Total population	Selected beneficiary	Proportion (%)	# people get service	Budget utilized
1	Bereda	5218	55	1.05	3	1147.45
2	Bossa Borta	8288	43	0.52	4	4408.30
3	Bossa Maniara	5791	38	0.66	1	442.00
4	Gala	5739	79	1.38	5	3909.10
5	Gocho	5748	42	0.73	6	8006.40
6	Halale 01	1755	44	2.51	10	17079.25
7	Kindo Mandina	6166	85	1.38	6	990.60
8	Koysha Chawukare	7478	30	0.40	10	8893.90
9	Koysha Wamura	6701	31	0.46	2	2201.50
10	Lasho	8391	43	0.51	4	3839.50
11	Mogissa	4997	52	1.04	7	6917.00
12	Offa Chawukare	6368	39	0.61	4	1927.00
13	Patata	8402	52	0.62	0	0
14	Shella Mekera	4615	38	0.82	4	2493.00
15	Shella Sadie	4615	48	1.04	1	1429.70
16	Sime Dolaye	3681	45	1.22	3	921.00
17	Wamura 01	1333	41	3.08	5	5026.00
18	Wamura Borkoshe	4084	28	0.69	5	3198.65
19	Zaro	6897	30	0.43	2	660.75
20	Zebo	8694	44	0.51	9	13205.20
21	Zerada	7101	16	0.23	2	803.70
	Total	**122062**	**923**	**0.79**	**93**	**91500.00**

5.7.8. Exempted Health services in the district:

a/ Diagnosis and treatment of TB/Leprosy

b/ Most MCH services like any type of delivery, FP, ANC, PNC, PMTCT, VCT and PICT

d/ Vaccination services and Ambulance services

5.7.9. Community Health Services status of the district in 2007 EFY

i. Health Development Army status

Table 37 status of HDA in 2007 of Kindo Didaye district, SNNPR, Ethiopia

S.No.	HDA-type	Expected Number	Actual Number	Percent (%)	Graduated (%)
1	Development team	830	674	81.2	598(88.8%)
2	1 to 5 network	4151	3487	84	3093(88.7%)
3	1 to 5 network members	19930	17435	87.5	13345(76.5%)
	Total HDA	**24911**	**21596**	**87**	**17036(78.9%)**

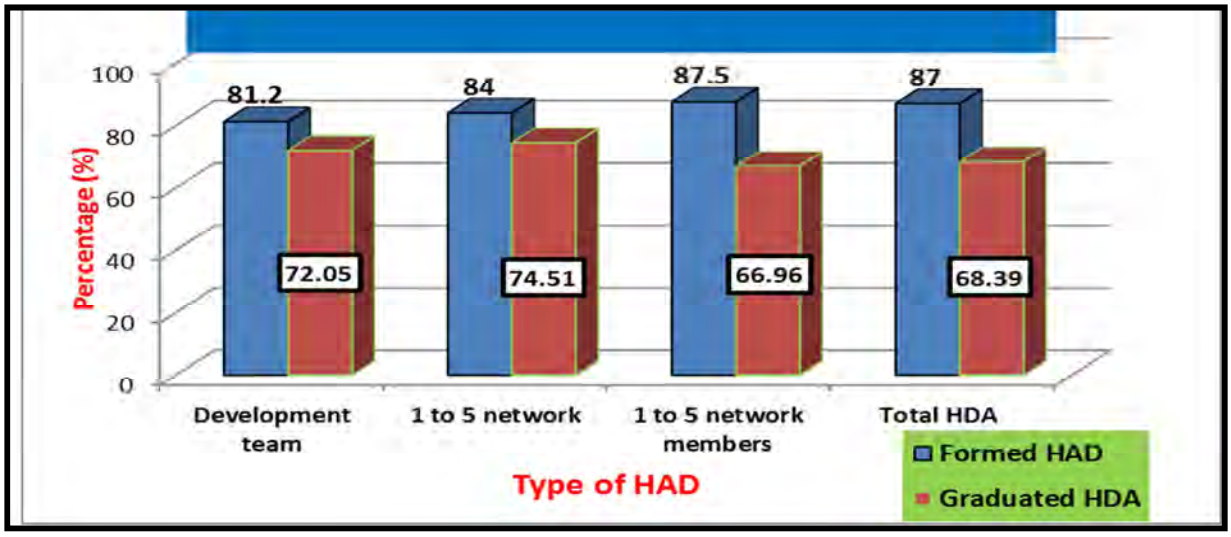

Figure 32 HDA formed versus graduated in 2007 EFY of Kindo Didaye district, SNNPR, Ethiopia

ii. HEWs activities of the district in 2007 EFY (2014/15)

Table 38 some activities were done by HEWs in 2007 EFY of Kindo Didaye, SNNPR, Ethiopia.

S. No.	Activities	Annual Plan	Annual Achievement	Coverage	Remark
1	ICCM	3894	1695	43.53%	
2	CC	21596	19020	88.1%	
3	Community TB	132	70	53.03%	
4	CBNC	6169	5656	91.68%	

5.8.Status of Primary Health Care Components

5.8.1. MCH and EPI coverage of the district in 2007 EFY (2014/2015)

Table 39 Some MCH and EPI activity coverages of Kindo Didaye district, SNNPR, Ethiopia.

S. no	Description	Achievement by Number	Coverage	Remark
1	ANC1 coverage	4119	97.5	
2	ANC4 coverage	3368	79.7	
3	Skilled Birth Attendant Delivery	1872	44.3	
4	Early PNC coverage	2597	61.5	
5	BCG coverage	3995	94.6	
6	Measles vaccine	4028	100	DOR = 0.37%
7	OPV1	4397	100	
8	OPV3	4073	100	
9	Penta1	4077	100	
10	Penta3	4043	100	DOR = 0.83%
11	PCV1	4077	100	
12	PCV3	4035	100	DOR = 1.03%
13	Rota1	3984	100	
14	Rota2	4035	100	DOR = -1.28%
15	CAR	14571	66.12	

5.8.2. Environmental Health, Sanitation and Safe Water Availability

Table 40 Latrine and safe water coverage of Kindo Didaye in 2007 EFY, SNNPR, Ethiopia

S. no	Description		Number	(%)
1	Latrine coverage		24920	100.00
2	Number of household with latrine		24911	100.00
3	Type of drinking water sources	Pipe	0	0
		Gravity assisted Spring	206	100
		Shallow	0	0
		Hand pipe	0	0
		Others	0	0
4	Number of kebeles accessed to safe water supply		21	100

In terms of water access for the population within 1.5km radius, safe drinking water coverage of the district is about 69.64% since in this radius total of 85,000 populations accessed for safe water. Gravity assisted spring is the only source of drinking water for the district.

5.8.3. Health Education conducted in the district in 2007 EFY (2014/15)

Health education at health facilities level was not organized and the data is not available even though HFs' managers told that some topics covered during health education in the HF without records (registered).

5.9.Endemic Diseases status of the district

5.9.1. Malaria

The district was mostly affected by plasmodium vivax (61% from total positive cases) type of malaria in 2007 EFY and above 70% kebeles of the district is vulnerable /Risk/ for malaria. The district has well organized and planned emergency preparedness and response plan /EPRP/ on the shelf but not practically assisted with relevant budget and materials like drugs, supplies, and equipment. There is malaria prevention and control material shortage in the district even though a current situation like weather condition threatens for the occurrence of malaria outbreak in the year.

Table 41 Malaria status and prevention and control activities of Kindo Didaye district in 2007 EFY, Wolaita Zone, SNNPR, Ethiopia

S. no	Description		Number of population (%)	
1	Number of Malarious Kebeles (17 kebeles)		86,127 (70.56%)	
2	ITN coverage (45,450 distributed)		99,174 (81.25%)	
3	Coverage of Indoor Residual spray (IRS)		10,029 (40.26%), from plan 64.6%	
4	Total no. of Malaria cases/year = 3627		Number	%
4.1	Case fatality rate (CFR) of malaria		2	2/1000 cases
4.2	Case treated clinically		245	6.75%
4.3	Cases treated based on lab finding	PF	1058	29.17%
		PV	1761	48.56%
		Mixed	563	15.52%
4.4	Malaria positivity rate	Total examined	11979	
		Total +ve cases	3382	28.23%

Table 42 Malaria prevention and control supplies present currently Kindo Didaye district for 2008 EFY, Wolaita Zone, SNNPR, Ethiopia.

S.No	Available drugs/supplies	Unit	Quantity required	Quantity available	Gap
1	LLITN	Households	1188	0	1188
2	Abet Chemical of 20L	Jar	58	80	0
3	ACT	Dose	12285	190	12095
4	Chloroquine syrup	Bottle	1240	25	1215
5	Chloroquine tablet	Dose	1229	0	1229
6	Quinine injection	Amp	197	0	197
7	Quinine tablet	Dose	226	0	226
8	RDT	Test			
9	IRS chemical	Household	24581	10029	14552

5.9.2. TB/Leprosy

Table 43 TB detection, cure and treatment success rates in 2007 EFY of Kindo Didaye district in Wolaita zone, SNNPR, Ethiopia.

S. No	Description		Population no. (%)
	Prevalence of TB		186 per 100,000 ((228/122062)*100000)
1	Pulmonary TB	Smear positive	84/104 = 80.77%
		Smear negative	6/104 = 5.77%
2	Extra PTB		14/104 = 13.46%
3	TB detection rate		104/258 = 40.31% TB all forms
4	TB Rx complete		17
5	TB cure rate		(42/62)*100% = 67.74%
6	TB Rx success rate		95.16%
7	TB defaulter rate		(1/62)*100% = 1.61%
8	Death on TB Rx		(2/77)*100% = 2.6%
9	Total TB patients screened for HIV		71

5.9.3. HIV/AIDS

Table 44 HIV/AIDS status of Kindo Didaye district in 2007 EFY, SNNPR, Ethiopia

S. No	Activities	Male	Female	Total	Remark
1	Total people screened for HIV	6221	12564	18785	
2	VCT	1901	2472	4373	
3	PICT	4320	4782	9102	
4	PMTCT		4119	4119	
5	HIV Prevalence	0.007	0.025	0.016	
6	Total PLWHIV	4	15	19	
7	On ART	4	12	16	
8	Pre ART	0	3	3	
9	Condom Distribution	313457	0	313457	

5.10. Nutritional Status

All health facilities (24 HPs and 4 HCs) provided nutritional interventions in the district in which CBN and OTP services were done in all health posts and SC programs were done in all HCs full setups in addition to OTP services. The annual performance report of 2007 EFY showed that 506 OTP and 16 SC cases were treated according to the nutritional protocol of the country.

5.11. Major Health Problem of the district

Malaria, HIV, and UVP are frequently suggested problems in addition to malnutrition and other communicable diseases due to manmade Lake of Omo river which covers about 10% of total land of the district, huge project workers of Gibe 3 Hydroelectric Power dam residents live and home delivery in 2007 EFY fears as the risk of the problems. The suggested solutions for mentioned health problems included sentinel surveillance on the prevalence of HIV and expansion of PHCU in addition to incredible prevention and control intervention with close supervision and evaluation of the program. Some sort of studies also raised to conduct on Leishmaniosis, locally called 'Bolbuwa' which affects part of three kebeles; namely Bosa Borto, Wamura Borkoshe and Wamura 01 to undergo an effective measure of prevention.

Anthrax, rabies, black plaque and foot-mouth zoonotic diseases are suspected as the future threat as zoonosis of the district since the humidity and climate condition of the district is fluctuated currently. Animal vaccination is the major activity held in the district to prevent above mentioned zoonotic health problems.

6. Discussion

Health profile description is an essential tool to assess health service status of the area like Kindo Didaye district that helps to point out gaps in health sectors, officials, and stakeholders in detail. Socioeconomic status, access to primary schools and increasing literacy ratio, infrastructure, and resources like human, financial and material, intensive community participation and administrative and political settlement have significant role and impact for health status development of country being good or bad that they can compromise healthcare service delivery. (1, 5, 10, 13).

The level of education and literacy has a direct impact on the health status of the community. Access to quality education for all is one of sustainable development goals (SDGs) to enhance the global literacy ratio in which Ethiopia undergoes on the way to

perform the plan; Kindo Didaye district has 39 schools in which more than half of total kebeles in the district have 2 schools per kebele to increase access to primary education level. The district enrolled 16639 (52.4%) male and 15094 (47.6%) female in 2007 EFY but the participation of female students decreased through primary (47.80%) to secondary (45.25%) level. As the discussion with the district education office head, most schools' latrines are not constructed as standard and safe water supply of the schools not accessed within schools rather than around the campus except 3 secondary schools. School dropout (3-4 per 1000 students) of the district was the same for male and female in general; but that of female (2 – 3 per 100) students at secondary level 2 – 3 times higher than males (< 1 per 100 students) especially for preparatory level (5, 9, 17).

Trained health professionals, sufficient administrative staffs, and enough budget allocation are important elements to enhance the quality and accessibility of healthcare services. Budget allocation should be proportional to the development of health service and level of community demand for the services to hold expected goals. Budget allocation shares of the district for health sector (2.61% to 7.16%) were not proportional with that of total district budget increment (21.36% to 46.88%) from 2010/11 to 2014/15. As shown in fig. 4 the gaps between two rates were widening from year to year. this showed that it was below that of national (11% to 12.8%) and regional (9% to 11%) health sector shares. Health care financing system was applied by all health centers since 2003 EFY in the district. Utilization of HCF of each HC was performed based on plan and revenue of the institution (2, 3, 4, 10, 11, 13).

According to national standards, health facility population and health professional population ratios are an important indicator to assess the access and quality of health services to the community. Health center population (1:30516), physician population (1:122062), health officer population (1:20344) and mid-wife population (1:11097) ratios was beyond regional and national performance. The regional ratio accounted physicians 1:63124 and 1:28847, health officers 1:14159 and 1:17128, mid-wives 1:17623 and 1:21811, nurses 1:2091 and 1:2299, pharmacy 1:15555 and 1:16021 and laboratory 1:16088 and 1:15790 respectively that need special attention to strengthen the quality and access of healthcare services to the community (3, 4, 5, 7, 8, 14).

Family planning, Focused antenatal care, skilled birth attendance and early postnatal care are expected MCH activities to decrease MMR globally. In 2014/15, the district achieved ANC_1 (95.5%), ANC_4 (79.7%), skilled delivery (44.3%) and early PNC (61.5%). These performances showed that the performance was below national performance in the year; and they were lower than zonal achievements in the same year too since national performance of ANC, Skilled delivery and PNC in 2007 EFY was 96.9%, 60.7% and 90.0% respectively, and that of region ANC_4 (90%), Skilled delivery (64%) and PNC (95%). Contraceptive acceptance rate (CAR) of the district in 2007 EFY was 66.12% which was below national performance 69.9% and regional (89.7%) coverage. The health coverage of the district (81.9%) is below Wolaita zone (93.03%) and national expected health coverage (87%) at the same year (2, 3, 8, 14).

Vaccination is also one of the global strategies used to reduce IMR, CMR, and even child morbidity. As the vaccination indicator, the district has high coverage of $penta_3$, PCV_3, and measles than total zonal, regional and national coverage of 2007 EFY. To be 85% of immunity development, 100% of children should be vaccinated measles at the age between 9 and 12 months. Global and national Measles elimination strategy suggested that 95% immunity for measles expected supplementary immunization activity (SIAs) of measles vaccination in addition to routine EPI program. Despite the vaccination coverage was 100%, there was measles outbreak history at the end of 2005 E.C. which resulted in a total of 8 deaths with CFR 1.4%. The vaccination report of Rotavirus 2nd dose was above Rotavirus 1st dose, which resulted in negative DOR. This shows the reliability of the report under question marks that need intensive follow-up and data refine before the report to the next level if the service delivered to the community as planned (3, 6, 14).

About ¾ of the country is endemic for malaria; it has been leading cause of morbidity and mortality of adult and children in Ethiopia (6). This is also true for Kindo Didaye district in which malaria is 1st morbidity and mortality cause to adults in both outpatient (30.75%) and admission (50.88%) cases whereas malaria for pediatrics was 2nd leading morbidity case followed by pneumonia in outpatient (17.71%) and admission (19.05%). Pneumonia was the first leading cause of pediatric morbidity in both outpatient and inpatient cases which accounts 18.65% and 42.86% respectively. Only 5 deaths recorded

in the district officially in which malaria, TB and pneumonia contributed 2, 2 and 1 deaths respectively. Morbidity and mortality cases of malaria all types accounted about 3627 (24.95%) for all age groups from total inpatient and outpatient cases including others whereas in adults' morbidity it accounted above 30% of all adult cases. Malaria AR of the district in 2007 EFY was 42 person per 1000 population in the district. Even though the coverage of LLITNs and IRS in the year was 81.25% and 57% respectively, burden of malaria was taken as leading cause of morbidity and mortality. This might be underutilization of LLITNs and problem in quality of IRS (2, 3, 14, 18).

Infectious diseases were the leading health problems in the district since among all the top ten morbidity and mortality cases of the district in 2007 EFY, infectious diseases led all other cases. The pit latrine coverage of the district in household, community and school level accounted about 100% and safe water supply coverage was estimated as 69.64% within 1.5km radius; but helminthiasis, diarrheal diseases and dysentery cases were part of top ten morbidity cases for all age groups in the year. The findings revealed that quality of community health services and prevention and control intervention of hygiene and environmental sanitation were not attained as the goals. The latrine coverage (100%) of the district was above national coverage in 2011 (62%), but the effectiveness of utilization of latrine, handling of drinking water in the household and water point levels and sustainability of community practice were not clear in the district (2, 4, 14).

In 2014/15, TB detection rate, 104 per 122,062 populations (40.31%), was below regional (76.6%) and national (67.3%). In 2014/15, TB cure rate and treatment success rate of the district accounted 67.74% and 95.16% respectively whereas those of national and regional rates in the same year were 77.9% and 92.1%, and 74.5% and 96.2% respectively. This showed that TB cure and treatment success rates were below the achievement of the region in the same year. TB death rate in the year was 2 (2.6%) and TB patients screened for HIV was 71 (68.27%) of the no HIV positive person detected. But 6 out of 71 have no defined outcome whether their result positive or negative that needs an intensive follow-up since the country found under high burden of TB disease (2, 7, 8, 14, 15).

The status of HIV needs further investigation as the district administrator complained that Gibe 3 Hydroelectric power dam area was more vulnerable and under risk of the disease. Despite high risk of the disease and 19 PLWHAs, who disclosed themselves, there was no ART clinic access in the district. Either they have a long distance to get ART services from Soddo Hospital or Bele Hospital and Gesuba HC somewhere found 94km, 59km and 53km far from the main town of the district, Halale. PMTCT service was done 100% as the report revealed but VCT, PICT, and ART services accounted 4373(17.55%), 9102(36.54%) and total people screened for HIV 18785 (75.41%) which are below national and regional level in the 2007 EFY. As the district health office responded that due to lack ART access in area 3 PLWHAs couldn't start ART but they were taken as pre-ART (2, 7, 8, 14).

The district nutritional program implementation status showed that totally 506 OTP and 16 SC were treated as necessary in 24 HPs and 4 HCs. Malnutrition data was not managed perfectly since its data reported weekly showed 242 OTP and 28 SC whereas monthly reported data through HMIS and DPHP were different for the year. The Age-specific AR of malnutrition of the district in 2007 EFY was 2.74 means that out of 1000 under five children 27 – 28 children was under malnutrition problem. National nutritional programs like vitamin A supplementation and deworming, CMAM (Community-based Management of Acute Malnutrition), EOS and CBN were undergone quarterly and monthly basis to sustain the district nutritional programs in which 5656 (91.68%) of <5 children got CBNC services. According to the annual report of the district curative and rehabilitative core process, there was a critical shortage of most essential drugs in the last 9 – 10 months in the year. Community participation and ownership on prevention and controlling of communicable and non-communicable diseases implementation is playing a vital role in the progression of the development of health care services and guaranteed for the quality of health services in addition to access to HFs, infrastructures, human and material resources adequacy for health. In the 2007 EFY, from total 68.39% of women health development army (HDA) graduated as the standards of national community health extension package that they contributed great effort for HEWs performance in their entire kebeles. Other essential activities like ICCM 1695 (43.53%), CC 19020 (88.1%) and community 70 (53.03%) TB treatments were done in the HP level(2, 3).

7. Conclusion

Health coverage of the district is below 85% in spite of the fact that geographical presentation of the district located with full of area hard to reach and nearly 20% of kebeles have limited access to transportation. Majority of infectious diseases have a high contribution for morbidity causes of all age groups; malaria was the leading cause of top ten diseases and stockpile of antimalarial supplies were not secured even though current climatic situation threaten for malaria outbreak. Pneumonia and malaria were 1st and 2nd leading pediatric morbidity cases of both outpatient and admission cases. Budget allocation for health sector of the district was below national and regional shares, and the proportion of allocation was not sustained from year to year.

8. Recommendation

Health facility expansion should be considered to increase health services coverage. Accuracy, reliability, consistency and reproducibility of data should be maintained with the great agreement within the health sector core processes before reporting to the next level. Some sort of studies and/or investigations/assessments should be undergone on proper utilization of household, community, and school latrines, on the utilization of LLITNs, and on proper handling of drinking water at household and water sources. Establishment of ART clinic needed to minimize defaulters and to increases adherences that will help to decrease antiretroviral drug resistance. Fee waiver beneficiaries should be selected as the rule and regulation and health sector budget allocation should be proportional to the health development. Utilization of HCF should be increased. Additional Health professionals should be employed to maintain national and regional health professional population ratio. Delivery by skilled health workers, TB detection rate, and CAR should be increased. Availability of essential and antimalarial drugs shouldn't be compromised for the prevention and control of infectious and noninfectious diseases.

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Chapter V- Scientific Manuscripts for Peer reviewed Journals

5.1. An epidemic of Leg Swelling of Unknown Etiology in Prison, Southern Ethiopia, 2016

Authors: Wadu Marshalo[1], Adamu Addissie[2], Wondimu Ayele[2], Alemayehu Bekele[3], Endashaw Shibru[4], Abraham Lere[1], Lucy Boulanger[5], John Fogarty[6]

1. Addis Ababa University School of Public Health, EFETP Resident, Cohort VII
2. Addis Ababa University College of Health Science School of Public Health
3. Ethiopian Public Health Association
4. Southern Nations, Nationalities and Peoples' Regional Health Bureau, PHEM
5. CDC – Global Health Security, Ethiopia
6. Suisse Clinic, Addis Ababa – Ethiopia

Address: wadumarshalo@yahoo.com / marshwadu2013@gmail.com
+251911088754 / +251912322860

ABSTRACT

Introduction:

In October 2016, we received reports of five deaths among prisoners with leg swelling of unknown etiology housed in a prison in southwestern Ethiopia. We investigated to describe the outbreak, identify risk factors and propose control measures.

Method: We conducted a descriptive cross-sectional study followed by an unmatched case-control study. A case was defined as a prisoner with onset of leg swelling of unknown etiology that developed between 5/18/2016 to 10/29/2016. A control was a prisoner without leg swelling during the same study period. Data was collected from 103 cases and 206 controls using a structured questionnaire and analyzed using Epi Info. Eight suspect cases were transferred to Addis Ababa for specialized medical evaluations.

Results: We identified 116 suspect cases with leg swelling of unclear etiology. Eight of the suspect cases were examined by senior clinicians and 7 met clinical criteria for scurvy. Three of seven clinical confirmed cases had non-detectable levels of vitamin C. Eleven deaths were identified. The attack rate for the prison was 4.2%, and the case fatality rate was 9.5%. All clinical confirmed cases had severe anemia with hemoglobin < 6.7g/dl.

Regular consumption of vegetables [OR = 0.40,(95% CI;0.23 - 0.69)] and fruits [OR = 0.38(95% CI;0.13 - 0.50)] prior to imprisonment and consumption of fruits or vegetables while in prison were protective of disease [OR = 0.12; (95% CI = 0.02-0.63)]. Prior consumption of alcohol [OR = 2.86,(95%CI: 1.33 – 4.61)]; use of tobacco [OR = 2.47,(95%CI: 1.33 - 4.61)]; and history of a chronic illness [OR: 4.42,(95%CI: 2.02 – 9.66)] were risk factors for developing leg swelling.

The diet provided by the prison consisted entirely of cereals, as fruits and vegetables had been suspended for two months prior to the investigation due to an outbreak of acute watery diarrhea. A clinical diagnosis of scurvy was made, and vitamin C supplementation promptly initiated. All symptomatic prisoners improved and no further cases were identified in a four weeks follow up period of active surveillance.

Conclusion: We identified an outbreak of leg swelling and fatal hemorrhage in a prison. Surveillance systems that can detect diseases associated with micronutrient deficiencies such as vitamin C should be established for high-risk populations. Further study needed.

Key words: Leg swelling, Unknown etiology, vitamin C deficiency, Ethiopia

INTRODUCTION

Leg swelling generally occurs because of an abnormal accumulation of fluid in the tissues of the lower extremity by different causes. Leg swelling can be symptoms of pitting and/or physiological edema (1). Conditions like allergic reaction, obstruction of the flow, nutritional deficiency, pregnancy, and microorganism infection, imbalance of body substances in the blood, trauma, chronic smoking and alcohol drinking are the most common contributing factors of the swelling. For instance smoking impairs the absorption of vitamin C that leads the deficiency (1, 4).

Scurvy is one of the oldest human diseases. Descriptions of scurvy have been found in the Old Testament, the writings of Pliny, and in 3500 years' old Egyptian medical scrolls (1, 2). Evidence of the disease has been found in human skeletons from ancient Native American archeological sites (3). The disease is caused by a deficiency of vitamin C (ascorbic acid). Humans - along with monkeys and guinea pigs - are one of the few species unable to synthesize vitamin C. Stores of vitamin C also are limited in humans, and clinical disease becomes evident within 2-4 months of inadequate intake (4-6). Scurvy characteristically has been associated with extended sailing expeditions, and has previously caused a large burden of disease among sailors and explorers. It is estimated that two million sailors died of scurvy from the 16^{th} – 19^{th} centuries(7). "Land scurvy" also has been known to affect vulnerable populations on land during times of war and famine, such as during the American Civil War and the Irish potato famine (8, 9).

With the finding that citrus fruits could prevent scurvy in 1747 and recommendations by the British Navy to add lemon juice to voyages, the global incidence of scurvy declined through the 19^{th} century(10). After the discovery of vitamin C in 1928(11), scurvy became a relatively rare disease and few practicing physicians today have encountered a case. Nonetheless, given the inability to synthesize vitamin C, humans remain at risk for scurvy when diets are limited. The medical literature is replete with case reports from many continents describing isolated cases of scurvy associated with chronic disease, alcohol dependence, mental illness, or social disruption(12-16). Large outbreaks of scurvy still occur, especially among vulnerable populations such as refugees and prisoners. It is estimated that scurvy affected more than 100,000 refugees in Somali and

Sudanese camps during the 1980s. Outbreaks of scurvy in the camps typically peaked about 4 months after taking a diet of vitamin C deficient food (17).

Because of its rarity and unfamiliarity among clinicians and public health workers, there often can be a delay in diagnosing and treating scurvy(18, 19). In 2002 an epidemic of scurvy in rural Afghanistan was initially misdiagnosed as an outbreak of Crimean-Congo Hemorrhagic Fever. Aid workers were evacuated and intervention delayed until a World Health Organization investigation determined the cause to be scurvy (20, 21).

More recently scurvy was identified in 38 patients from a prison in southern Ethiopia in 2010. All 38 patients had been referred to a local hospital for evaluation of leg swelling and found clinically to have scurvy. Prisoners who had been incarcerated for more than eight months were found to develop symptomatic scurvy. In addition to leg swelling, these patients frequently were noted to have cough, gum hypertrophy, hyperpigmentation, and anemia (22).

On October 24, 2016, we received a report of an outbreak of leg swelling that included five deaths among prisoners at Mizan-Aman prison in southern Ethiopia. We investigated to describe the magnitude of the outbreak, identify risk factors and etiology, and propose control measures.

BACKGROUND AND METHODS

The Mizan-Aman prison is located in southwestern Ethiopia in the Southern Nations, Nationalities and Peoples' Regional state (SNNPR) near the border with South Sudan. The area is considered temperate and tropical and subsistence farming is the main industry. Coffee, spices, and fruits including pineapple, oranges, bananas are principle cash crops.

At the time of investigation, the prison population included 2677 adult males, 88 adult females and 25 children who were with their mothers. The prison clinic was staffed by 4 nurses, one laboratory technician and 1 health officer. The town where the prison is located also has a hospital staffed by general practitioners and an internal medicine specialist.

Descriptive Epidemiology

We defined a suspect case as a prisoner at the Mizan-Aman prison with either unilateral or bilateral leg swelling with unknown etiology, who did not have a known explanation for the swelling. Although there is lack of an international standard for a case definition for leg swelling of unknown etiology, we defined a clinical confirmed case of scurvy as a prisoner with leg swelling plus petechial hemorrhages and/or hyperkeratotic follicular papules. Petechial are known to be an early sign of scurvy, and hyperkeratosis is a specific sign, having been found in all experimentally induced scurvy patients (4). We defined a laboratory confirmed case as a clinical confirmed case who had vitamin C levels below a reference of 0.8mg/l (23) .

From October 25, 2016 – November 20, 2016 we conducted an investigation to identify suspect patients with leg swelling and determine the etiology. We reviewed prison clinic and local hospital medical records during the investigation period and for five months prior to the investigation that include 18 May to 20 November 2016. We also utilized epidemic line lists from Bench Maji zonal health department. We included cases who had reported symptoms of ongoing leg swelling that had started after May 18, 2016, as we noted there had been an increase in leg swelling reported on line lists after that week.

Eight suspect cases with leg swelling were transferred for specialized medical evaluations in Addis Ababa in order to develop a broader differential diagnosis and ascertain a clinical diagnosis if possible. On October 25-26, 2016 eight patients had independent physical examinations performed by four senior clinicians (WA, JF, LB, MND). On-site clinical examination of additional patients at the prison in SNNPR by senior clinicians was not logistically possible. However, 47 patients were examined at Mizan-Tepi University hospital by general practitioners.

Laboratory Investigations

Routine and basic microscopic examination was done for 47 patients in Mizan-Tepi University hospital for routine diagnosis. Blood samples were obtained from three patients with clinical confirmed scurvy who had been examined in Addis Ababa. After consent, 5ml blood samples were taken and added to lithium heparin tubes and

centrifuged. The supernatant heparin plasma was transferred to new tubes and then immediately frozen. The three frozen samples were transferred by air to Bioscientia Institute for Medical Diagnostics, Ingelheim Germany. HPLC analysis for vitamin C levels was performed.

Case Control Study

We conducted a descriptive cross-sectional study followed by an unmatched case-control study. A case was defined as a prisoner with onset of leg swelling from 5/18/2016 to 10/29/2016 that obtained from medical records of Prison clinic and Line lists. A control was a prisoner without leg swelling during the same study period.

We designed a structured questionnaire in Amharic languages, interviewed 103 suspect cases and 206 controls, and translated the questionnaire back to English. We recruited a convenience sample of control subjects from prisoners of the same gender, ethnic group and sleeping room who had not been ill with symptoms of leg swelling. We collected information about demographic characteristics, diet, water use, frequency of bathing, and work duties. We calculated odds ratios using Epi Info version 7.1.4.0. Oral consent was obtained from all participants prior to interviews.

Environmental Investigations

We evaluated living quarters and conditions, and we investigated the diet, water systems and water sources in the prison. We also conducted key informant open- ended interviews with regional, zonal, and Mizan town surveillance officers and prison authorities.

RESULTS

Descriptive Epidemiology

We identified 145 patients who had been diagnosed with leg swelling between February 23, 2016 and October 20, 2016. Twenty-nine of the patients were excluded as suspect cases having previously received a definitive diagnosis such as lymphatic filariasis. We identified 116 as suspect cases. Seven of the suspect cases had clinical confirmed scurvy. Three of the clinical confirmed cases had laboratory testing performed for vitamin C levels and all three had laboratory confirmed scurvy with non-detectable levels of vitamin C in their blood.

Eleven of the suspect cases died, and 8 of the 11 died between October 16-29. The exact cause of death in the 11 fatal cases was not determined by autopsy. All suspect cases were males, and the mean (SD) age was 34 (±12) years whereas that of control was 30 (±11.7). The attack rate for the prison was 4.2%, and the case fatality rate was 9.5%.

Prisoners with leg swelling of unclear etiology were evaluated by the prison health officer and physicians at the Mizan-Tepi university hospital. Suspect cases with leg swelling were assigned diagnoses prior to the definitive diagnosis of scurvy being made in Addis Ababa. The type of diagnoses included: deep venous thrombosis (39.6%), no diagnosis (30.2%), arthritis (8.6%), cellulitis (15.5%), sexually transmitted infection (3.5%), and other (2.6%).

A records review of prison clinic and the Mizan-Tepi teaching hospital revealed an increased number of prisoners with leg swelling dating to the week of May 22, 2016 (see Figure 1). During the week of September 19, 2016 there was another sharp increase in the number of prisoners diagnosed with leg swelling by the prison clinic (see Figure 2.4 and 2.5 below). The Regional Health Department and the Ethiopia Public Health Institute were notified on October 24, 2016, and an investigation was initiated the following day.

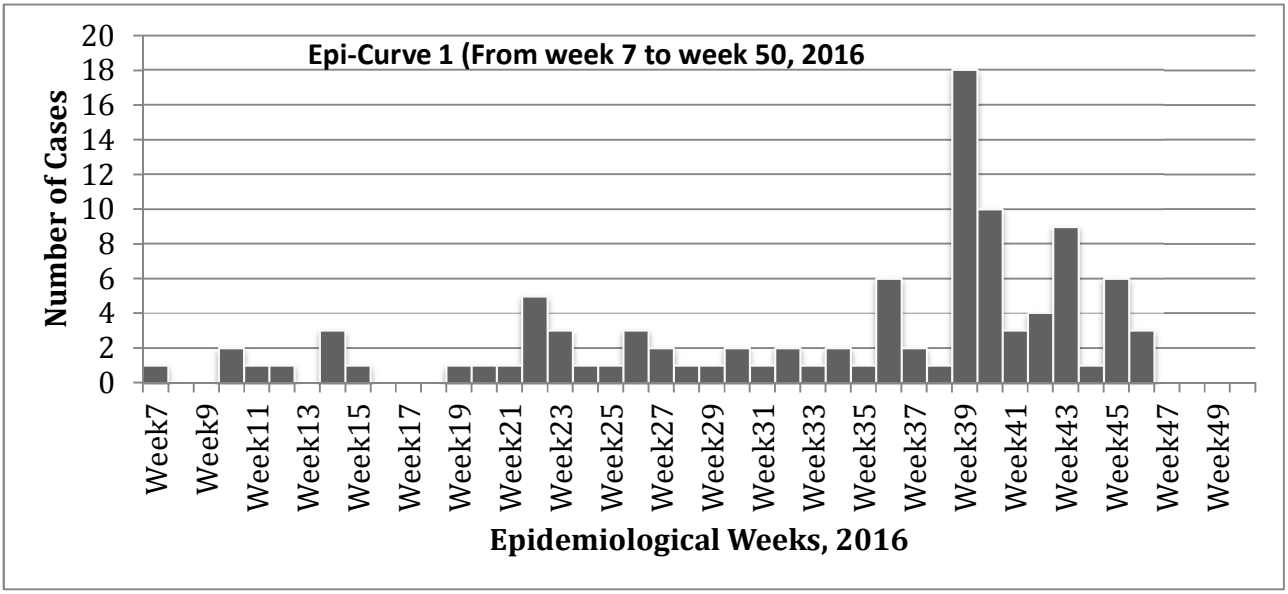

Figure 1: Epidemic Curve for leg swelling diseases by Epidemiological weeks of disease onset, Mizan, SNNPR, Ethiopia, 2016

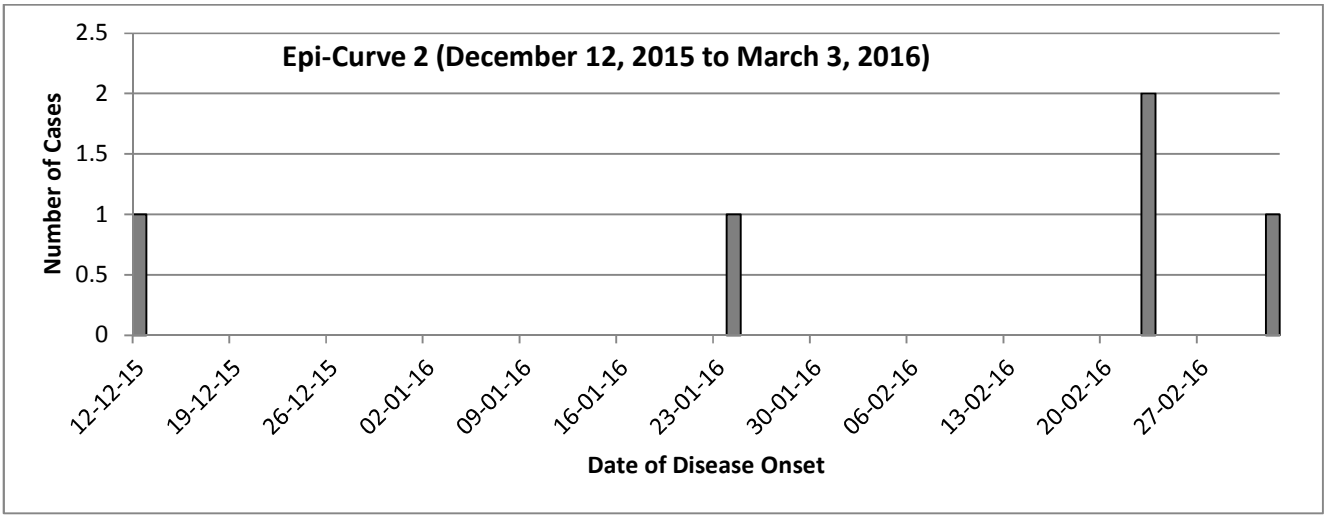

Figure 2.1 Epidemic Curve for leg swelling diseases by date of disease onset, Mizan, SNNPR, Ethiopia, 2016

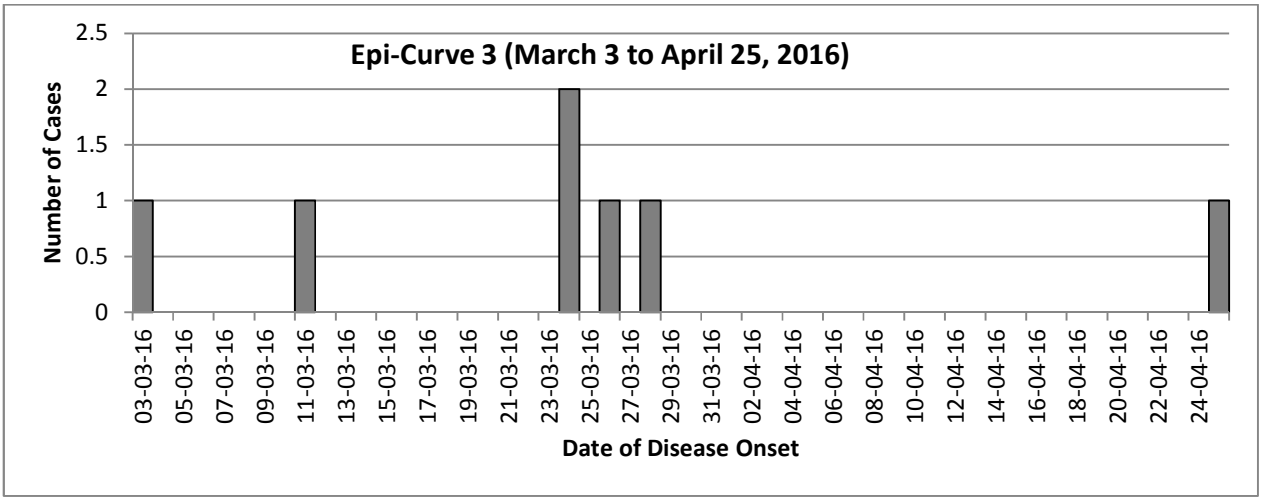

Figure 2.2 Epidemic Curve for leg swelling diseases by date of disease onset, Mizan, SNNPR, Ethiopia, 2016

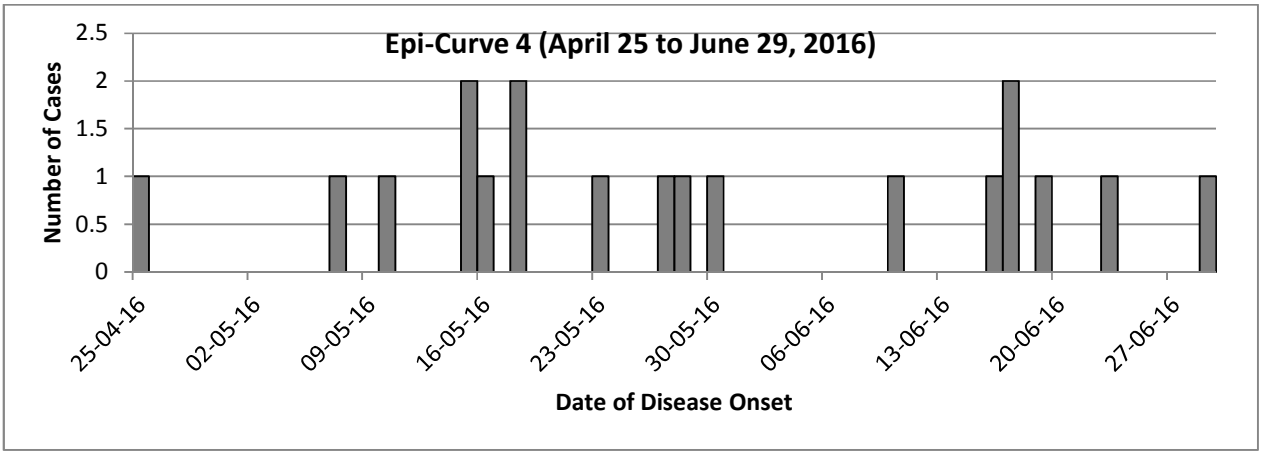

Figure 2.3 Epidemic Curve for scurvy by date of disease onset, SNNPR, Ethiopia, 2016

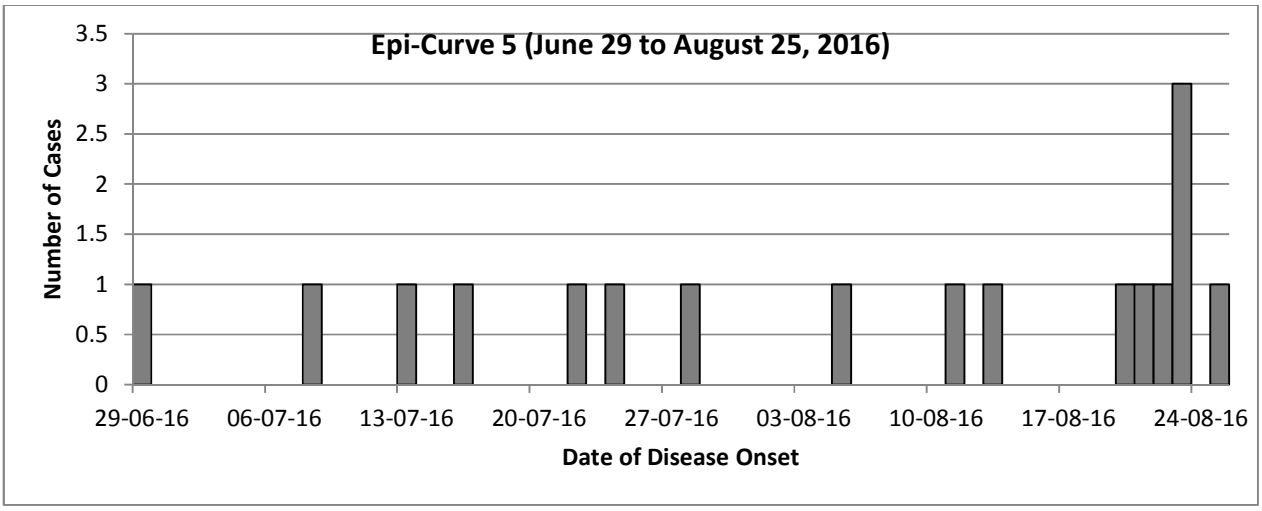

Figure 2.4 Epidemic Curve for leg swelling diseases by date of disease onset, Mizan, SNNPR, Ethiopia, 2016

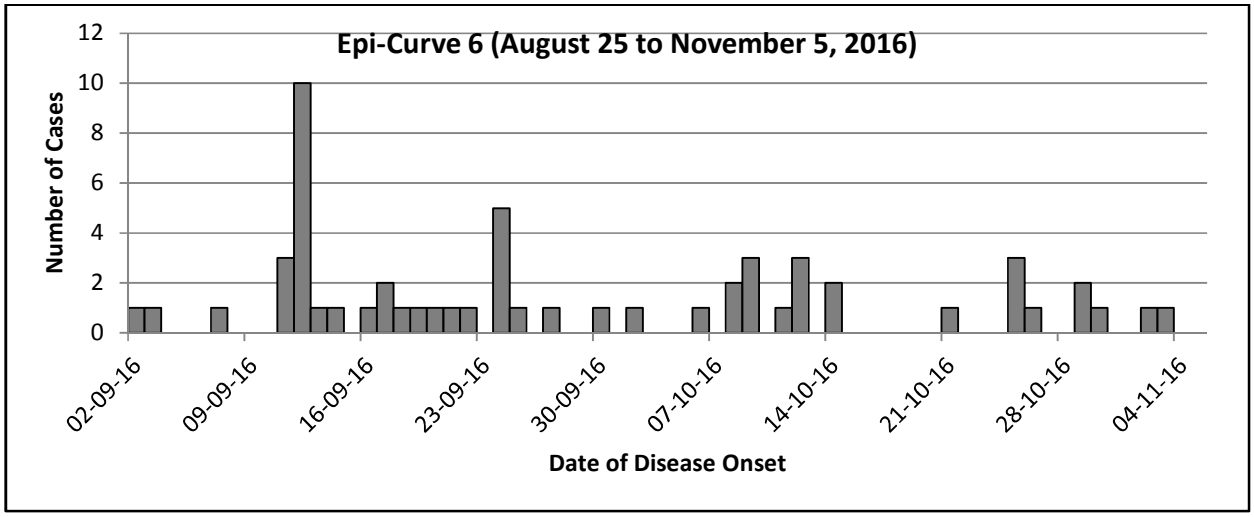

Figure 2.5: Epidemic Curve for leg swelling diseases by date of disease onset, Mizan, SNNPR, Ethiopia, 2016

Clinical findings

Eight suspect cases were transferred from the prison to Addis Ababa for evaluation by senior clinicians. Seven of eight of the suspect cases examined in Addis Ababa met clinical criteria for scurvy, and the clinical findings from these patients are reported. One suspect patient did not meet clinical criteria for scurvy.

Symptoms

All clinical confirmed cases (7/7) had symptoms of myalgias, arthralgias, and fatigue. Five of seven had a history of bloody diarrhea.

Signs

All clinical confirmed cases (7/7) had findings of petechiae of varying sizes mostly over the legs and feet, and 6/7 had hyperkeratotic follicular papules. Five of seven had bleeding gums and/or halitosis. Nine of patients among diagnosed in Mizan-Tepi hospital and four of patient among diagnosed in Addis Ababa had clinical signs of jaundice.

All clinical confirmed case-patients (7/7) had either unilateral or bilateral leg edema. Six of seven were unable to walk without the use of a cane or support, and one was unable to sit upright or rise from the bed without complete assistance.

Laboratory findings

Severe anemia (Hb < 8mg/dl) was found in 7/7 clinical confirmed case-patients. Hypoalbuminemia (albumin < 3.5g/dl), leukopenia (WBC < 4,000 count/μL), and microscopic hematuria were found in 5/7 clinical confirmed case-patients.

Case control study

We interviewed 103 suspect cases (median age = 30 years; interquartile range 15 years) and 206 control subjects (median age = 26 years, interquartile range = 11).

Table 45 Bivariate Analysis and Adjusted Odds Ratio of risk factors in prison, SNNPR, Ethiopia - 2016

Variable		Case (N = 103)	Control (N = 206)	COR (95%CI)	AOR (95%CI)
Age groups	<35 years	62	156	0.48 (0.29, 0.81)	0.59 (0.26, 2.08)
	≥35 years	41	50		
History of chronic illness	Yes	36	21	**4.73 (2.58, 8.68)**	**4.42 (2.02, 9.66)**
	No	67	185		
Tobacco smoking previous history	Yes	61	51	**4.41 (2.66, 7.31)**	**2.47 (1.33, 4.61)**
	No	42	155		
Having history of Alcohol drinking	Yes	94	129	**6.23(2.97, 13.06)**	**2.86 (1.21, 6.78)**
	No	9	77		
Fruit eating access in the prison	Yes	2	27	**0.13 (0.03, 0.56)**	**0.12 (0.02, 0.63)**
	No	101	179		
Fruit eating habit before imprisonment	Yes	23	87	**0.39 (0.23, 0.67)**	**0.39 (0.14, 0.50)**
	No	80	119		
Vegetable eating habit before imprisonment	Yes	32	91	**0.57 (0.35, 0.94)**	**0.40 (0.24, 0.69)**
	No	71	115		
History of Barefoot walking	Yes	38	35	2.86 (1.66, 4.91)	1.98 (0.99, 3.93)
	No	65	171		
Doing physical exercise regular	Yes	4	28	0.26 (0.08, 0.75)	0.69 (0.20, 2.40)
	No	99	178		
Place of sleeping in prison	On floor	46	62	1.87 (1.15, 3.06)	1.46 (0.79, 2.71)
	On bed	57	144		
Formal educational history of HH head	Yes	34	148	**0.19 (0.19, 0.32)**	**0.24 (0.13, 0.44)**
	No	69	58		

Prior consumption of alcohol [Odds ratio (OR) = 2.86,(95%CI: 1.21 – 6.78)]; use of tobacco [OR = 2.471,(95%CI: 1.33 - 4.61)]; and history of a chronic illness [AOR: 4.42,(95%CI: 2.10 – 9.66)] were risk factors for developing scurvy. Regular consumption of fruits prior to imprisonment,(AOR 0.40,(95% CI;0.13 - 0.50)), and consumption of fruits or vegetables while in prison were protective of disease (O.R. = 0.122; 95% CI = 0.024 – 0.628). Only 2/103 control subjects had consumed fruits or vegetables during the 15 days before the interview. There were no statistical differences between the suspect cases and control subjects with regard to length of imprisonment (OR=1.5992, 95% CI = 0.9656 – 2.6484 for length of stay at least 3 years), religion, ethnicity, and type of work in the prison.

Environmental Investigations

At the time of the investigation there were 2,790 prisoners held in 18 rooms. The diet provided by the prison consisted entirely of cereals. Prior to April 2016 fruits and vegetables had been supplied to all prisoners at least twice weekly. However, in March 2016 an outbreak of acute watery diarrhea (AWD) affected many communities in the southern part of Ethiopia. To protect against an AWD outbreak in the prison, the provision of fruits and vegetables by the prison food service was suspended. Some prisoners maintained limited access to fruits and vegetables sporadically when family members delivered them for personal consumption. However, we determined that most prisoners did not have access to fruits or vegetables between June 22, 2016 and October 27, 2106.

Treatment and public health interventions

A clinical diagnosis indicated scurvy as the cause of the leg swelling. Vitamin C supplementation was initiated the following day, and all prisoners began receiving 500mg of vitamin C for one month. Additionally, the diet for prisoners was expanded to include fruits on three days per week basis.

The final suspect case was diagnosed with leg swelling on November 03, 2016. There were no prisoners diagnosed with scurvy and no deaths attributable to leg swelling during a four-week period of active surveillance following the outbreak investigation.

DISCUSSION

We identified an outbreak of leg swelling of unknown etiology in a prison attributed to a change in diet that contained no substantial sources of vitamin C. Fruits and vegetables were removed from the diet at the prison during an outbreak of acute watery diarrhea that was occurring in southern Ethiopia. The diet for prisoners consisted almost entirely of grains lacking vitamin C for four months prior to our investigation.

Given that signs and symptoms of scurvy manifest within 2-4 months of dietary restriction of vitamin C, it is likely that there were more prisoners with scurvy than we identified as suspect cases. Consequently, our reported attack rate of 4.2% is likely an underestimate, and the case fatality rate of 9.5% is an overestimate since there was no autopsy conducted. The number of deaths associated with this outbreak underscores the importance of early diagnosis and treatment of scurvy. As scurvy is rare in modern society, most clinicians and public health workers remain unfamiliar with the signs of symptoms of the disease. However, the medical literature has for decades contained reports describing difficulties in diagnosing scurvy and has offered warnings about delays in diagnosis (18, 19, 24-26).

Patients described in case reports in the literature are frequently misdiagnosed with rheumatologic, autoimmune or bone diseases, deep venous thrombosis, or infectious diseases such as meningococcus or syphilis(14). The patients with scurvy in our report were most commonly misdiagnosed with deep venous thrombosis or arthritis.

Clinical findings of leg swelling of unknown etiology

The clinical findings in our report are consistent with findings in patients with experimentally induced scurvy. In studies of prisoners in an Iowa state penitentiary who were deprived of all vitamin C, the chief symptoms were fatigue, myalgia, arthralgia followed by more specific signs of follicular hyperkeratosis, hemorrhage and peripheral edema. Dermatologic changes occurred 8-13 weeks after vitamin C restriction, and oral lesions began after 11-19 weeks(4, 27). In another study conducted during World War II, volunteers in England were fed a diet with restricted vitamin C content (10-70mg per day). Within 17-21 weeks, subjects developed characteristic hyperkeratotic papules and

after 30-36 weeks they developed purple swollen bleeding gums. In another case study of experimentally induced scurvy, a physician restricted all vitamin C intakes. He developed fatigue at 12 weeks, hyperkeratotic lesions at 19 weeks, petechiae at 23 weeks, and poorly healing wounds at 26 weeks(2).

As can be seen from these reports documenting experimental scurvy, the clinical disease has a typical progression. The initial findings after restriction of vitamin C intake include fatigue and lethargy followed by myalgias and joint pains. These symptoms are followed by clinical signs of edema, arthritis, rash, and oral lesions. The rapidity of onset of symptoms appears dependent upon the degree of restriction of vitamin C.

Perhaps most striking in our examination of clinical confirmed cases was that 13 out of 29 were unable to walk without the use of a cane or support, and one was completely bedridden. It appeared that the edema and hemorrhages into the muscles and joints had created the equivalent of "flexion contractures", and the patients were unable to extend knees and elbows passively or actively fully. Joint and musculoskeletal pains along with leg swelling are known to be common and are accompanied by bleeding into the muscles and soft tissues. (28-30).

Some of the more specific findings of scurvy include dermatologic findings, which include follicular hyperkeratosis, ecchymoses, petechiae and perifollicular hemorrhages(30). All clinical confirmed cases in our report had evidence of these dermatologic changes. Scurvy is known widely among laypersons as being associated with loss of teeth and gum abnormalities. These oral findings can include a purplish discoloration of the gums, hypertrophy, friability, and eventually tooth loss(31). All clinical confirmed cases in our review had halitosis and/or identifiable changes of gums, including the loss of teeth.

The patients identified with clinical confirmed and laboratory confirmed scurvy in our report had classic clinical findings. Their signs and symptoms were nearly identical to an elegant description of scurvy by James Lind from 1753 (32).

LIMITATIONS

The exact number of persons who were affected by vitamin C deficiency in this outbreak is not known, as we relied on a narrow case definition for suspect cases (edema) and utilized primarily prison and local health records to identify suspect cases. Logistically it was not possible to conduct expert clinical examinations on all prisoners. Persons who had only subtle or early findings of scurvy, such as fatigue or dermatologic changes, would not have been included as cases. We also could only infer from the health records that prisoners who died from an unknown cause and had leg swelling documented during the period of the investigation died from scurvy.

CONCLUSION

We identified the existence of outbreak of leg swelling of unknown etiology in a prison that included eleven deaths. The clinical and laboratory findings for confirmed cases indicated the cause of the disease is deficiency of vitamin C, scurvy. Health professionals working with vulnerable populations should maintain an index of suspicion for scurvy and have an awareness of the signs and symptoms of the disease. Surveillance systems that can detect diseases associated with micronutrient deficiencies such as vitamin C should be established for high risk populations (33). The experience described in this report and in previous outbreaks of scurvy among prisoners and refugees in Afghanistan, Somalia, Sudan, and Ethiopia underscore the importance of having such surveillance systems in place(17, 20, 22).

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Chapter VI – Abstracts for Scientific Presentation

6.1. Measles outbreak investigation of Konta special district, Southern Nations, Nationalities and Peoples' Region, Ethiopia - 2016

Authors: Wadu Marshalo Anebo1, Wondimu Ayele2, Alemayehu Bekele3, Endashaw Shibru4

1. Addis Ababa University School of Public Health, FETP Resident, Cohort VII
2. Addis Ababa University College of Health Science School of Public Health
3. Ethiopian Public Health Association
4. Southern Nations, Nationalities and Peoples' Regional Health Bureau

Email: wadumarshalo@yahoo.com, marshwadu2013@gmail.com, wondaay@gmail.com, alemayehubekele2002@gmail.com, endash_s@yahoo.com

Abstract

Introduction: Measles is highly contagious outbreak-prone acute viral human diseases caused by virus called member of Morbillivirus paramyxoviridae. Globally, it accounts for 44% of total deaths due to vaccine preventable diseases among children less than 15 years, the highest mortality occurring in poor communities with malnutrition, overcrowding and low vaccination coverage. Regional health bureau received measles outbreak rumor in Konta special district with some deaths. The aim of study is to investigate the outbreak and find out contributing risk factors.

Methods: An outbreak investigation was conducted in Konta special district, SNNPR from February 22 to March 20, 2016. Both descriptive cross-sectional and unmatched case control studies were conducted with qualitative. Totally six active measles cases were examined by collecting blood samples and 5(83%) cases confirmed as IgM positive for measles. For Case control study, data was collected from 68 cases and 136 controls by using a structured outbreak investigation. Data was analyzed using excel and Epi Info version 7.1.4.0.

Result and Discussion: Totally 1068 (AR = 926 cases per 100,000 population) measles cases were reported from the district with 6 IgM+ measles cases. Case fatality of the outbreak was 10.77%. About 747 (70%) of cases developed complication; Pneumonia 52.6%, Diarrhea 10%, Malnutrition 3% and Otitis media 0.6%. The case-control study finding revealed persons who were vaccinated for measles before were 68.63% less likely

to develop measles disease as compared to non-vaccinated persons (AOR = 0.31; 95% CI = 0.12, 0.84 with p-value = 0.02) even though the coverage was very low. The odds of being a case of measles were 5.53 times more likely among those who were living with cases of measles than those who did not (AOR=5.53; 95% CI = 2.51, 12.13 with p-value 0.000001). Children who were malnourished children had 3.51 times more likely suspected to develop measles (AOR = 3.51, 95% CI = 1.45, 8.441with the p-value of 0.0051) as compared to normal children.

Conclusion and recommendation: There was laboratory confirmed and epidemiological linked measles outbreak in the district. The outbreak was significantly associated with low routine measles vaccination coverage. Magnitude of the outbreak was intensified due to late detection and notification of the outbreak. Moreover, community deaths were increased because of lack of organized response, misunderstanding of measles case definition and misleading of case management. Mass measles vaccination campaign should be done for all under five years populations and SIAs for measles should be continued.

Key words: Measles, outbreak investigation, Ethiopia

6.2. An Epidemic of Leg Swelling of Unknown Etiology in Prison, Southern Nations, Nationalities and Peoples' Region, Ethiopia, October 2016

Authors: A. M. Wadu[1], A. Adamu[2], A. Wondimu[2], B. Alemayehu[3], S. Endashaw[4], B. Lucy[5], F. John[6]

1. Addis Ababa University School of Public Health, EFETP Resident, Cohort VII
2. Addis Ababa University College of Health Science School of Public Health
3. Ethiopian Public Health Association
4. Southern Nations, Nationalities and Peoples' Regional Health Bureau, PHEM
5. CDC – Global Health Security, Ethiopia
6. Suisse Clinic, Addis Ababa – Ethiopia

   Address: wadumarshalo@yahoo.com / marshwadu2013@gmail.com

   +251911088754 / +251912322860

ABSTRACT

Introduction: Leg swelling generally occurs because of an abnormal accumulation of fluid in the tissues of the lower extremity by different causes. In October 2016, we received reports of five deaths among prisoners with leg swelling of unknown etiology housed in a prison in southwestern Ethiopia. We investigated to describe the magnitude of cases, identify risk factors and propose control measures.

Method: We conducted a descriptive cross-sectional study followed by an unmatched case-control study. A case was defined as a prisoner with onset of leg swelling of unknown etiology that developed between 5/18/2016 to 10/29/2016. A control was a prisoner without leg swelling during the same study period. Data was collected from 103 cases and 206 controls using a structured questionnaire and analyzed using Epi Info. Eight suspect cases were transferred to Addis Ababa for specialized medical evaluations. The three frozen samples were transferred by air to Bioscientia Institute for Medical Diagnostics, Ingelheim Germany. HPLC analysis for vitamin C levels was performed.

Results: We identified 116 suspect cases with leg swelling of unclear etiology. Eight of the suspect cases were examined by senior clinicians in Addis Ababa and 7 met clinical criteria for scurvy. Three of 3 clinical confirmed cases had non-detectable levels of vitamin C. Eleven deaths were identified. The attack rate for the prison was 4.2%, and the case fatality rate was 9.5%. All clinical confirmed and eight suspected cases had severe anemia with hemoglobin < 8g/dl.

The diet provided by the prison consisted entirely of cereals, as fruits and vegetables had been suspended for three months prior to the investigation due to an outbreak of acute watery diarrhea. A clinical diagnosis of scurvy was made, and vitamin C supplementation promptly initiated. All symptomatic prisoners improved and no further cases were identified in a four weeks follow up period of active surveillance after vitamin C supplementation.

Regular consumption of fruits prior to imprisonment,(OR = 0.40,(95% CI;0.23 - 0.69)), and consumption of fruits or vegetables while in prison were protective of disease (OR = 0.122; 95% CI = 0.024-0.628). Prior consumption of alcohol (OR = 2.863,(95%CI: 1.21 – 6.78); use of tobacco (OR = 2.47,(95%CI: 1.33 - 4.61)); and history of a chronic illness (AOR: 4.42,(95%CI: 2.02 – 9.66)) were risk factors for developing leg swelling.

Conclusion: We identified an outbreak of leg swelling and fatal hemorrhage in a prison. The study showed an indication of vitamin C deficiency for outbreak. Surveillance systems that can detect diseases associated with micronutrient deficiencies such as vitamin C should be established for high-risk populations. Further clinical case studies should be done to identify other clinically asymptomatic cases and to find out other risk factors.

Keywords: Leg swelling, unknown etiology, Vitamin C deficiency, Prison, Mizan

Chapter VII – Narrative Summary of Disaster Situation Visited

7.1 (Belg) Humanitarian, Health and Nutrition Need Assessment, SNNPR June, 2016

Summary

The government of Ethiopia has been conducting multi agency and multi-sectoral emergency health and nutrition assessment to address the emergency health and nutrition need of the country. The assessment has been conducted twice in a year following post harvesting season Belg and Meher. However, in case of El Nino and La-Nina, the government decided to conduct the assessment quarterly bases since 2015. This Belg 2016 assessment is envisaged to assess the impact of the current weather situation on the food security status of the community and to come up with recommendations both on the food and non-food requirements of communities in SNNPR for the next six months (July – Dec 2016). Accordingly, a multi-agency Emergency need assessment mission comprising six teams was organized and the need assessment was conducted between June 6 and 23, 2016.

The team was composed of FDRMFSS, SNNPR health bureau/ PHEM/, WFP, Ministry of Water and irrigation, Ministry of Education, National Metrology agency, UNICEF, World Vision and SNNPR EWR. The assessment covered four Woredas of Wolaita zone and two Woredas of Dawuro zone. The objectives of this assessment were to identify areas where emergency assistance (WASH, health, nutrition and education) might be needed during the next six months of the year 2016 and to develop necessary plans and complete preparedness actions early in the WASH, Health, Nutrition and Education sectors for adequately addressing the potential emergencies.

Data collection checklists were prepared for each level. The team formed from different sectors (GO and NGOs) composed of different disciplines. Before starting data collection, the team had briefing from representatives of zonal sector offices and made some adjustment on the lists of woredas to be visited by the assessment team. Both secondary and primary non-food related data were collected using checklists. The team had briefing sessions at woreda level which actually followed by data collection from

sector offices. In order to understand the realities on the ground, the team visited selected health facilities and schools. Debriefing was done at the Woreda and zonal level after data collection and site visit by the team.

Both Dawro and Wolaita zones prepared emergency preparedness and response plan and allocated budget to execute the plan. Similarly, the woreda offices also have health EPRP but some have allocated budget and others do not have. Wolaita zone has a very comprehensive emergency preparedness and response plan for the period July 2015 to June 2016 but the plan is not budgeted at zonal level unlike Dawuro zone. Multi-sectoral emergency coordination forum is functional in all visited woredas of two zones and the frequency of meetings in the visited areas of Dawuro zone is not regular activated at time where emergency evolves; the meeting was held at the time of emergency only. Whereas, this Multi-sectoral emergency coordination forum is functional in all woredas of Wolaita zone and the frequency of meetings in most visited areas is once per month.

Anticipated diseases that have potential to cause outbreaks were measles, meningococcal meningitis, AWD and malaria. About 5,318 and 10,390 populations are expected to be affected by AWD and malaria respectively from 106,361 and 519,491 risk populations for AWD and malaria respectively. A total of 1.4 million birr is estimated for the preparedness and response activities in the period July – December 2016 as the finding of assessment revealed.

Among assessed woredas (N=6), Humbo, Duguna Fango and Kindo Didaye (not visited) Woredas of Wolaita zone were highly suspected for AWD emergency following flood and landslides.

In the last three years, there was no disease outbreak report in all visited woredas of Dawuro and Wolaita zones. However, from the field observation and reports of the top 10 morbidities in 2014/15, malaria is ranking first in most malaria endemic woredas of the two zones. The coverage of LLITNs Dawuro and Wolaita Zones is above 95% and 85% in the visited woredas respectively that is contributing a lot in the prevention and control of malaria disease. However, the LLITNs are losing their strength and compared with last year, malaria cases were building up in Loma woreda of Dawuro zone and Kindo Koysha

Woreda of Wolaita Zone from week 2 to week 18, 2016. The malaria case was picked-up in week 12 – 16, 2016 above twice of last year's cases of the same weeks in Wolaita zone.

There was slight increase in admission of SAM from November 2015 to January in 2016 in Wolaita zone as compared to that of 2014/15. However, slight reduction in SAM admission was observed between February and April 2016. Compared with other zones in the region, Wolaita zone had relatively lower admission of SAM cases in the last two years.

All assessed woredas (N=6) have been implementing CHD as their routine HEP. The lowest screening coverage was in April (72%) and the highest in Nov 2015 (96%) in Dawuro zone whereas that of Wolaita zone was above 90% every month in the year.

Safe drinking water coverage in Dawuro and Wolaita zone is at 70% and 56% respectively, and the non-functionality rate stands at 12% and 8.9% in Dawuro and Wolaita zones respectively. However, woredas like Duguna Fango in Wolaita zone and Gena Bossa in Dawuro zone have a very low safe drinking coverage and it is about 38% and 36% respectively.

Though the latrine coverage of Gena Bossa and Loma Woredas of Dawuro is at 87% and 92.7% respectively and that of all woredas of Wolaita zone is 100%, most school and health institutions do not have separate rooms for men and women and the sanitation statuses are poor. In the four woredas; out of 184 primary schools only 65 (35%) have functional drinking water and hand wash facilities and the same is true for secondary schools as out of the 48 schools, 10 (20.8%) have functional drinking water and hand wash facilities.

Recommendations

The zonal health departments should support woredas in getting adequate IRS chemicals and ITNs replacement. Regional and zonal water and irrigation sectors should plan for additional water schemes establishment to address safe drinking water for Duguna Fango of Wolaita zone and Gena Bossa woreda of Dawuro zone in addition to their current

activities on the issue. Additional nutritional based study and assessment is recommended for Dawuro zone since the zonal nutritional data and current situation of visited woredas were not matched. Institutional based WASH program should be strengthen to prevent different environmental and sanitation related communicable disease outbreaks. Feeding program at school level and TSFP should be continued to sustain educational activities and to decrease school dropout rate of the student. Training for RRT should be considered and EPRP should be supported with budget. Response and Mitigation plan should be prepared and intervened for landslide and flood affected areas.

7.2. Rapid Need Assessment and Humanitarian Health Action following Landslide Disaster in SNNPR, May 2016

BACKGROUND

Kindo Didaye is one of 12 rural Woredas found in Wolaita Zone in Southern Nations, Nationalities and Peoples Regional State (SNNPRS). Capital of the woreda is Halale town, which is located at a distance of 93 kilometres south west of capital city of Wolaita Zone called Soddo town. The Woreda capital town located at the altitude of 2285m above sea level with the latitude and longitude of $6^0$45.322'N and $37^0$20.704'E respectively.

The Woreda is bounded Offa Woreda from East, Kindo Koysha Woreda from North, Dawro zone Loma Woreda from West and Kucha Woreda of Gamo Gofa Zone of SNNPR. The estimated area of the district is about 38,874 hectares or 388.74km^2 which covers 8.73% of Wolaita zone area with a total population of 122,062 in 2007 EFY as the projection from 2007 census of CSA. Its population density is about 62 persons per km^2.

The climatic condition of the district is about 23.65% Kolla (hot zone), 59% Woynadega (temperate) and 17.35% Dega (cold zone) with the highest altitude 2827m at Lasho Mountain to lowest 910m at Shela Sade and around Gibe 3 Hydroelectric Power dam. Its latitude and longitude are about $6^0$45.322'N and $37^0$20.704'E respectively at the capital town of the district. The annual rainfall ranges from 700ml to 1290ml with the average of 1100ml. Enset, maize, Teff, Cassava, cereals, fruits and vegetables are the prominent agro-ecological production of the district. About 89% of the district has land bodies with about 11% water bodies including the man-made lake of Gibe 3 Hydroelectric Power dam, which covered some part of three Omo River bordered kebeles.

Landslide is highly threatened public disaster of the district which resulted in 7 – 18 deaths and more than 500 households' displacement in past four years ago in addition to burden of communicable diseases like malaria, measles and non-communicable diseases like malnutrition. Landslide and flood happened on May 9, 2016 mid-night resulted in 37 deaths and 461 households displacement which was very fatal as compared with previous in human life lost, property damaged and home destroyed.

INTRODUCTION

Disaster is a sudden phenomenon that causes damage, ecological disruption, loss of human life, deterioration of health and health services. A natural and man-made event resulted in untold suffering to the millions of people. Natural disasters like Hurricanes and storms, tsunamis, Earthquake, floods, drought, volcanic eruptions, and landslides occurred frequently. Man-made disaster like road traffic accidents, fires, explosions, nuclear blasts, conflicts/war and terrorism have been occurring in high rate. It requires external assistance (1). Disaster hit every part of the globe (developing and developed). In 2015, there were 346 different types of disasters globally. Those disasters resulted in 22,773 people dead, 98.6 million people affected and 66.5 billion USD economic damaged. In every part of the world, the disaster event is on increasing trend due to impact of continuation of El Nino and La-Nino.

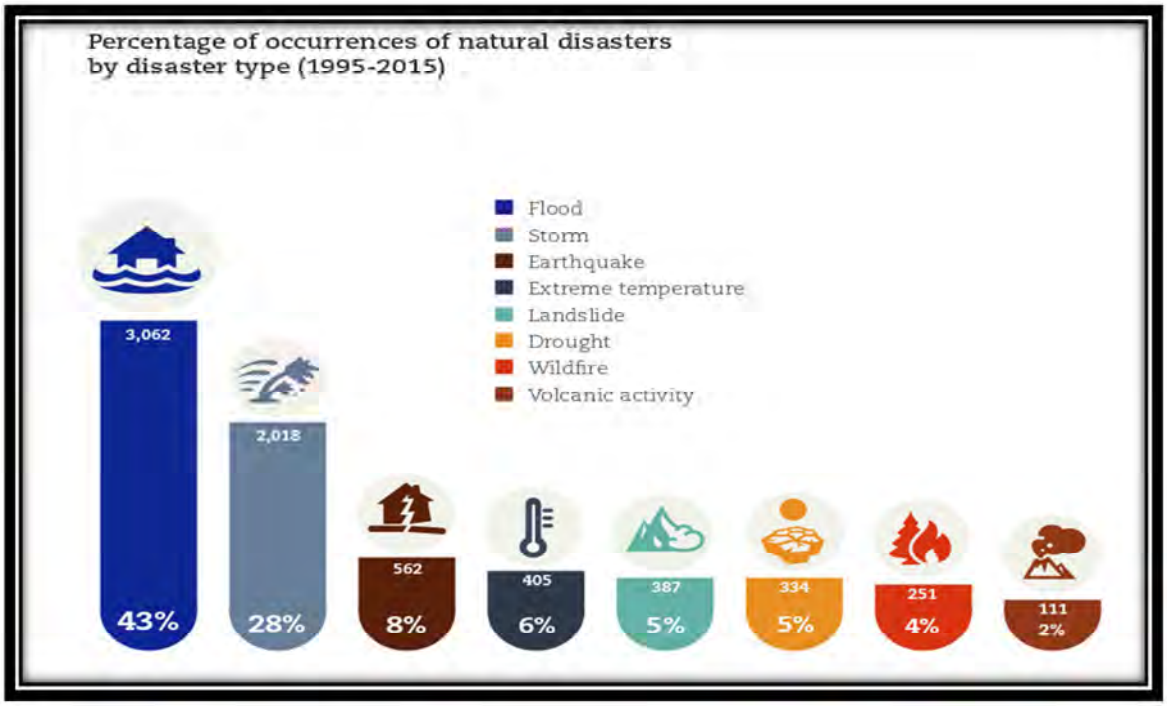
Asia affected highly by natural disaster in 2016 but Oceania and Europe affected least in the year. Number of disaster decreased for Africa, America and Europe whereas increased for Asia in the years

Different types of disasters have different ranks by impact since 2000. Flood affected the highest in the world as compared to other disasters. Drought contributed the least impact since 1970. Despite the degree of impact, occurrence of all types of disaster has been increasing globally that need great public response and integration of multi-sectoral collaboration.

During 1995 to 2015, flood, storm and earthquake contributed the 1st to third highest natural disasters which contributed 43% (3,062), 28% (2,018) and 8% (562) of total natural disasters Worldwide. Landslide was the 5th highest disaster in the period which accounts 387 (5%). The number of totally affected persons increased in 2016 after dramatically lowered from 2002 to 2015 even though the number of natural disaster decreased in the year. Asia only contributed about 97% (343,929) affected persons in 2016 as compared to other continents.

In 2016, as of 17 November 2016 report, above 200 different types of disasters occurred in the world. Despite lower number of disaster as compared to 2015, more than 1634

persons per 1000 population per disaster affected in the year. The effect of the natural disaster in 2016 has not been occurred since 2002 in which more than 1447 persons per 1000 populations per natural disaster affected in 2002. Landslide contributed 5% of total natural disaster in 1995 to 2015 globally (see figure below). Landslide is one of hydrological sub-type of natural disaster that contributed some part of 47.2% of total natural disaster in 2014 globally. In 2015, landslide affected about 50,332 persons that resulted in 1,369 deaths globally (1, 2).



Source: *CRED; 2015; EM-DAT: 2015 Disasters in Number, UNISDR 2016*

Ethiopia placed at the third position from top ten countries in which 10,210,600 persons affected by natural disasters in 2015 next to Democratic Republic Korea and India (2, 3). Southern Nations, Nationalities and Peoples' Region of Ethiopia is located under the basin of Rift Valleys that affected by different types of natural disasters like flood, earthquake, drought, landslide etc.

Landslide is the result of natural and artificial catastrophic natural disaster that results in permanently unstable sites that cannot be repaired or developed. This considers both direct effects include injury or loss of life, damage to infrastructures and property, and the loss of resources and indirect effects include lack of food, outbreaks of communicable diseases where they were endemic. Frustration of effective social service is taken as the socio-economic significance of landslide for the entire community as well as next generation that need effective mitigation to risk management following landslides. Landslide can be different types of movements: falls, slides, topples, lateral spread, and flows. Landslides can be secondary effects of heavy storms, volcanic eruptions and earthquakes (1).

Landslides are one of major natural disasters in Ethiopia that concerned under public health emergency management event in which public health impact following landslides result in irreversible loss of life, home, properties and infrastructures and landslide hazard is one of the crucial environmental constraints for the development of Ethiopia, representing a limiting factor for urbanization and infrastructures. Heavy summer rainfall is the main triggering factor of most landslides in the history of Ethiopia (4).

IMMEDIATE PUBLIC HEALTH RISKS FOLLOWING LANDSLIDE

Direct Impact: Landslides cause high mortality and few injuries: trauma and suffocation by entrapment are common. Short and long-term mental health effects are observed. Debris will result in problem URTI and other health problems

Indirect impact: The impact on lifeline systems (water system, hospital, health center, energy and lines of communication) present in the path of the landslide is massive. They can be severely damaged or destroyed.

The main public health threats of this Landslide are related to direct and indirect health impacts, communicable diseases, related to the risk factors listed below.

1. **Interruption of safe water and sanitation supplies**: The populations displaced by landslide are at immediate and high risk of outbreaks of waterborne and food borne diseases, such as AWD.
2. **Population displacement with overcrowding**: Populations in the affected areas have been displaced into schools, temporary shelters/camps or with host families, and are at immediate and high risk for transmission of measles and meningitis and increased incidence of acute respiratory infections (ARI), especially pneumonia in children under 5 years.
3. **Vector breeding**: Flooding can result in the proliferation of vector breeding sites, increasing the medium-term (weeks to months) risk of malaria.
4. **Poor access to quality health services** is of immediate concern, as the health infrastructure could have been overwhelmed.
5. **Malnutrition and transmission of communicable diseases**: Malnutrition compromises natural immunity, leading to more frequent, severe and prolonged episodes of infections.

Waterborne and food borne diseases

The populations affected by the landslide are at immediate risk from outbreaks of waterborne and food borne diseases, particularly AWD, typhoid, Shigellosis, hepatitis A and E. Population displacement, crowding, poor access to safe water, inadequate hygiene and toilet facilities, and unsafe food preparation and handling practices are associated with transmission. Usual water sources can become unsafe for drinking for several reasons: the incursion of floodwaters; faecal contamination caused by overflow of latrines and inadequate sanitation; contamination by dead animals; and upstream contamination if water sources are interconnected.

Vector-borne diseases

Even though Malaria is not endemic in all landslide affected areas, the place where they displaced need attention for prevention of malaria of the district. Water supply and storage of safe water practices should also be put in place to prevent vector breeding in water storage containers. Discarded tires and other water holding containers could further facilitate vector breeding.

Diseases associated with crowding

Population displacement caused by flooding can result in crowding in resettlement areas, raising the risk of transmission of certain communicable diseases. Measles, ARI and meningococcal disease are transmitted from person to person, and risk is increased in situations of forced relocation to shared areas of high ground, often with inadequate shelter. Crowding can also increase the likelihood of transmission of waterborne and vector-borne diseases.

Other communicable diseases

When an emergency develops, people may be subjected to situations that substantially increase their risk of contracting: Sexually transmitted infection, including HIV and Transmission of tuberculosis (TB) may also increase.

Table1. Summary of risk of communicable diseases in flood-affected populations

Communicable disease	**Immediate likelihood of occurrence following Landslide**	**likelihood of occurrence in weeks to months following Landslide**
AWD/Typhoid/Shigellosis	+++	-
Acute lower respiratory tract infections	+++	-
Hepatitis A & E	++	-
Leptospirosis	++	-
Measles	++	-
Malaria	+	++
Tuberculosis	++	++
Meningitis	++	++
HIV/AIDS	++	++
Key: - = Unknown 0 = No risk + = low risk ++ = moderate risk +++ = high risk		

Other public health risks: includes Injuries and disabilities, Snakebites, mental health disorders and psychosocial problems, malnutrition, maternal and child health care are most known health related problems following landslide. These problems have been resulted in mortality and morbidity of population during and after the landslide.

Malnutrition

If the crisis is prolonged and there is a lack of access to appropriate and adequate food, including complementary foods, risk of malnutrition could increase for vulnerable groups such as young children, pregnant and lactating women and older persons. The risk is also likely to increase if there is a lack of or inadequate support for, mothers or caretakers to exclusively breastfeed for under six months and to continue breastfeeding up to two years, with appropriate and safe complementary feeding.

PRIORITY INTERVENTIONS

I. Health sector priorities

- Multi- Sectorial assessments to identify needs, gaps and priorities
- Restore access to basic and secondary health care services including provision of temporary mobile health services with relevant medicines and supplies to increase access to care.
- Ensure appropriate triage and referral systems for emergency medical, surgical and obstetric care.
- Resume vaccination services as soon as possible and consider mass measles vaccination in crowded settings/camps.
- Prevent disease outbreaks and ensure capacity for early detection and rapid response to public health emergencies by strengthening EWARN and ensuring outbreak preparedness and prepositioning.
- Support adequate maternal and newborn health services, ensuring privacy and cultural sensitivity, with registration in camps, early detection of and referral for complications of pregnancy and childbirth, safe delivery, and provision of relevant commodities.

- Support appropriate infant and young child feeding, supplementation for pregnant and lactating mothers, and management of malnutrition, including capacity building for health workers and supporting referral and hospital care for management of severe malnutrition.
- Intensify community social mobilization including health risk communication to promote safe water, sanitation and hygiene practices in camp and outside.
- Assess the early recovery needs of the affected population and prioritize recovery interventions.
- Psychosocial support to whom they lost their families by landslide

II. Non-health sector priorities influencing health

- Ensure adequately sized and ventilated shelter.
- Provide sufficient and safe water.
- Provide adequate sanitation and hygiene facilities.
- Provide blankets and non-food items in camps

Provide safe food, including complementary food for children less than two years of age.

The Woreda is one of the prone areas for natural disasters of landslide usually lead to lose of life and properties, and to sickness and population displacement.

THE MAGNITUDE OF IMPACT OF LANDSLIDE

Landslide in Kindo Didaye of Wolaita zone occurred on 9 May 2016 at 3:30 – 5:00 night following heavy rain all the night. Totally 13 kebeles were affected by the disaster. The disaster resulted in 37 deaths (Male 18, Female 19) and 461 households' displacement within 8 kebeles. About 2881 populations are under the risk for further flood and landslide that need immediate response from relevant bodies.

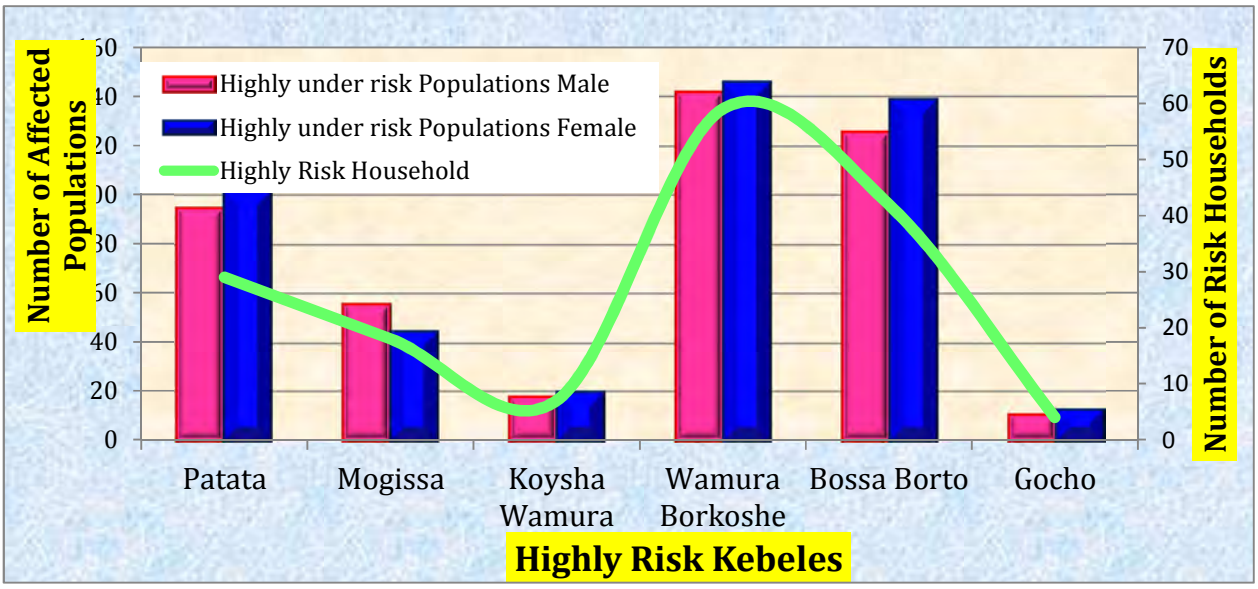


Figure 2: Number of affected populations and under risk households following Landslide in six Kebeles in Kindo Didaye, SNNPR, Ethiopia, May 2016

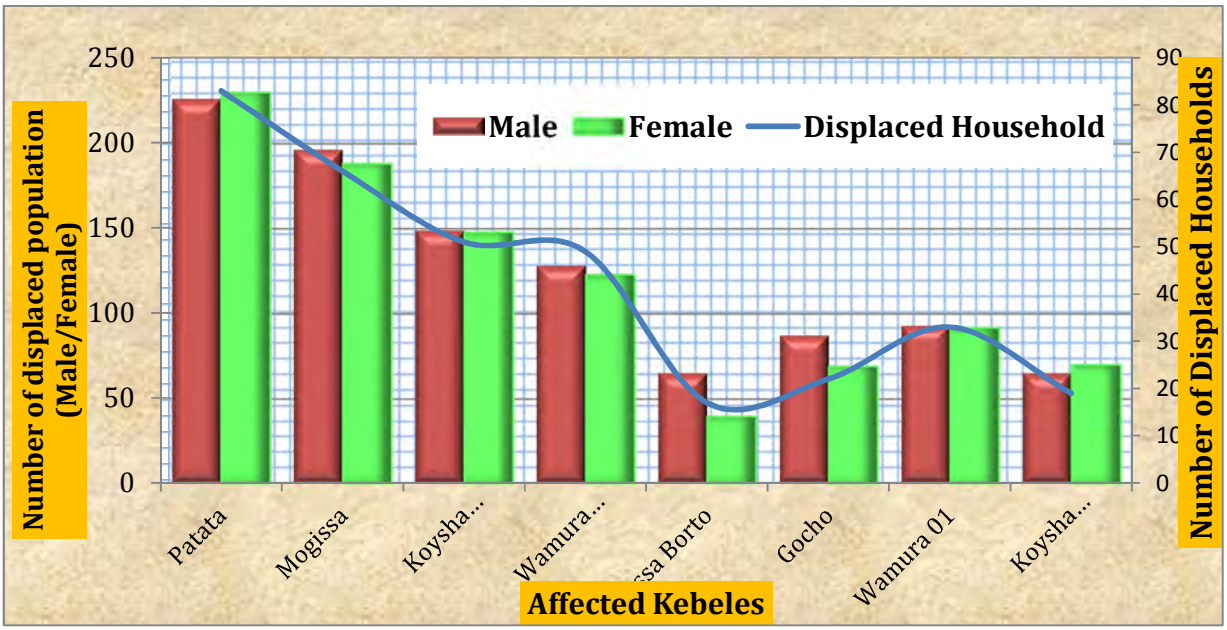


Figure 3: Number of displaced populations and households following Landslide in Kindo Didaye, SNNPR, Ethiopia, May 2016

Figure 4: Spot map of Kebeles with number of deaths by Landslide in Kindo Didaye, SNNPR, Ethiopia, May 2016

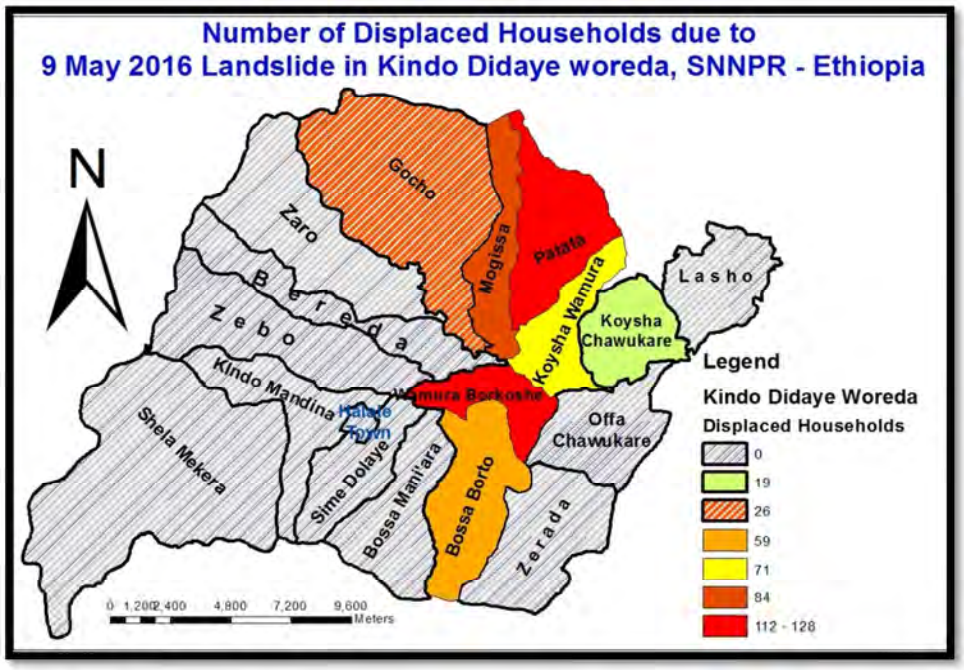


Figure 5: Spot map of Kebeles with number of displaced households by Landslide in Kindo Didaye, SNNPR, Ethiopia, May 2016

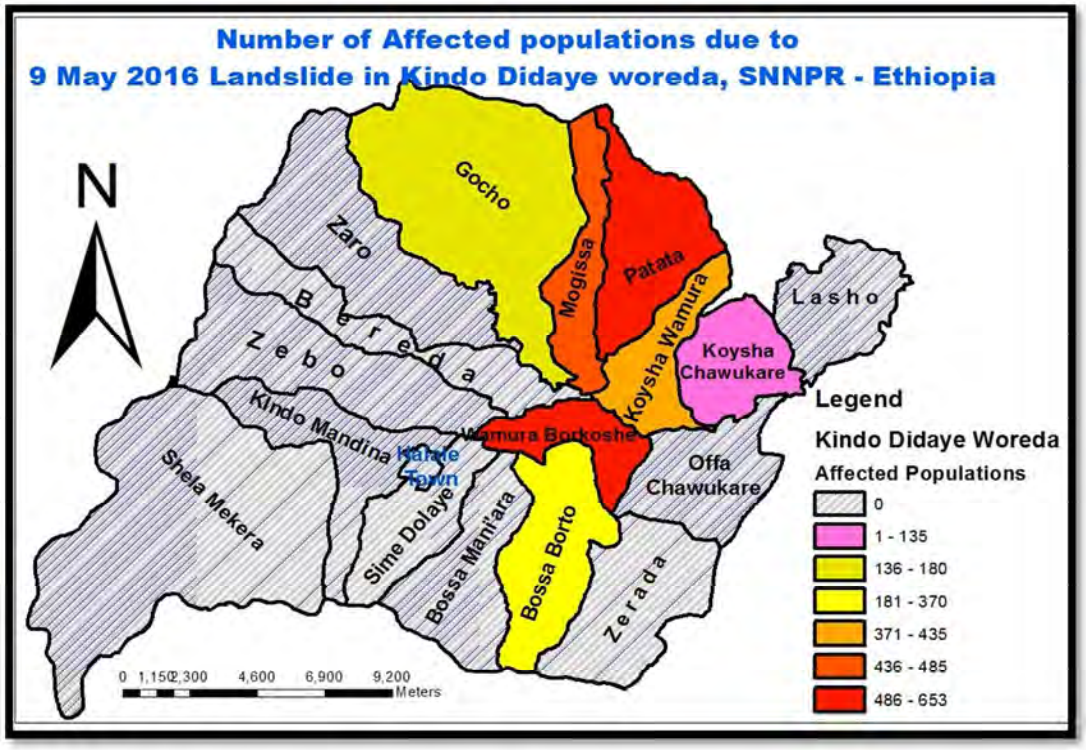


Figure 6: Spot map of Kebeles with number of affected populations by Landslide in Kindo Didaye, SNNPR, Ethiopia, May 2016

RAPID NEED ASSESSMENT

Expected health risks are acute Watery Diarrhea (AWD) and any other intestinal parasitic diseases, malaria, malnutrition, measles, acute Respiratory tract infections (ARTI), meningitis, skin diseases and relapsing fever.

Animal, Resident/Property and Crop Damage Assessment

Totally 172 animals were died namely 22 oxen, 32 cows, 21 calves, 19 goats, 11 sheep, 4 donkeys, 6 horses, 6 mules and 49 hens were dead by the landslide. Following the disaster, about 839.44 hectare farmland was destroyed with different plants, crops, fruits and vegetables. About 17 cottage houses and 18 steel sheet covered houses destroyed irreversibly due to the disaster with their full household properties, furniture and equipment. About 15.5 hectare grass land was damaged in the case of landslide and following flood. Wamura Borkoshe kebele was the most affected one following to Patata

Kebele in which 205.5 and 148.5 hectares were damaged respectively whereas Gocho kebele (65.4 hectares) and Wamura 01(38 hectares) were the least affected kebeles by the landslide.

Assessment of damage of infrastructures

In the case of flood and landslide on 9 May 2016, totally 63 water schemes were damaged in 8 kebeles of the woreda. From Koysha Chawukare to Patata 32, from Koysha Wamura to Wamura 01 five, from Gocho to Wajira village three and from Mogissa to Halale town 23 water schemes were damaged following the disaster. The roads, which connect the district with Kindo Koysha, district and zonal was broken at two main places and other minor roads, which access to reach every kebeles were damaged as the result of flood following landslide.

Humanitarian and Public Health Responses

The zonal and district administration supported 6,000 – 10,000 ETB for funeral services as the number of death per household. Ethiopia Red Cross, Regional disaster prevention and early warning, regional water and irrigation bureau, regional health bureau, Wolaita Soddo University, CONCERN Worldwide Ethiopia and all zonal sectors gave their supports. The affected population were supported food and non-food items such as 124 tents, 500 blankets, 700 bed sheets, 272 buckets, 420 jogs, 700 jerrykans, 420 different household utensils, 620 mattress, different clothes, drugs and medical equipment, 16900 LLITNs, 2800 sachets water purifier, 90 bottles of water guard supports. SALINI project of Gibe III hydroelectric power dam constructor supported 7000 steel sheet for house with 250,000 ETB for permanent residency construction. Federal disaster prevention and food security supplied 142.5-quintal wheat, 9.5-quintal leguminous cereals, 15-quintal nutritional food, 415 liters of cooking oil, 313 plastic sheets, 831 different items of household utensils for disaster-affected populations.

Totally 38 water schemes were repaired by technical and material support of zonal water and irrigation department with Enter-Aid France. The rest 25 water schemes were under construction. The help of SALINI project of Gibe III hydroelectric power dam

constructor reconstructed damaged roads. Tents were stretched at five sites in Patata, Wamura Borkoshe, Mogissa and Koysha Wamura kebeles for temporary shelters.

Four teams of mobile clinics were established. In mobile clinics totally 93 severely and 206 lightly injured peoples were get treatment. Seven persons who lost their families due to the disaster get psychosocial support from Wolaita Soddo University and health staffs.

Two main sites were selected for resettlement of displaced populations. The area located at West south of the place where the disaster occurred far 30 – 35 KM. the area average altitude is 1058m and its average temperature 25^0C and the estimated water sources is 0.5 liter per second in 674.5 hectares. The area selected for settlement was located after the approval of geological survey of the zonal natural and agricultural department.

Recommendations

Emergency preparedness and response plan should be prepared every three months based on the getting expected result of rapid need assessment. Mitigation plan should be considered to settle the victims where areas to selected for settlement. Coordination and collaboration of administration should be strengthening for participation of partners for mitigation purpose.

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Chapter VIII – Protocol/Proposal for Epidemiologic Research Project

8.1 Describing Maternal Death and Exploring Factors Affecting Implementation of Maternal Death Surveillance and Response in Wolaita Zone, Ethiopia 2017

Project Summary

Introduction: Globally, maternal mortality ratio decreased from 385 per 100,000 livebirths in 1990 to 216 per 100,000 livebirths at the end of 2015. Nevertheless, the reduction contributions differ by countries developing status. The burden and risk of maternal death remains the highest in developing ones, which accounts 547 per 100,000 livebirths. Maternal Death Surveillance and Response system is designed to gather information for action that helps to prevent further maternal death from the same cause. Ethiopia launched Maternal Death Surveillance and Response system in 2013 as guideline, but the effectiveness and impact of the system to decrease maternal death has not been implemented as per national guideline yet; especially in Wolaita zone.

Objective: The main aim of study is to describe maternal death, assess data quality and explore risk factors affecting implementation of maternal death surveillance and Response in public health facilities of Wolaita Zone, Southern Ethiopia.

Methods: Descriptive Cross-sectional facility based study design will be conducted in Wolaita zone, Ethiopia from July 15 to December 20, 2017 with both quantitative and qualitative methods. About 25 public health facilities will be selected, including one zonal/referral hospital, four district hospitals purposively. All maternal deaths' data will be collected from those selected health facilities and their records review will be conducted. Quantitative data will be entered and analysed by using Epi Info 7.1.4.0 and SPSS 20. Qualitative data will be analysed by entering, coding and categorization the data using OpenCode software. A copy of final report will be submitted to funding body, School of Public Health of Addis Ababa University, Regional Health Bureau, and Wolaita zone health department and to the participated health facilities. The findings will also be presented in different workshops, conferences and seminars and will be published in peer-reviewed journals.

Anticipated outcome of study: Accountability and responsibility regarding maternal death will be increased at health facility level and this will result in reduction of zonal, regional and national maternal mortality. The finding will be used as reference for researchers and policy makers.

Duration and Estimated budget proposal of study: the study will be completed within 19 weeks. Totally ***91,794.73*** /Ninety one thousand seven hundred ninety four and seventy three cents/ Birr is estimated cost for study.

1. Introduction

1.1.Background

Maternal death is defined by the WHO as ‘’the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.’’(1). Maternal Death Surveillance and Response (MDSR) system is designed to gather information for action that helps to prevent further maternal death from the same cause. The accountability and responsibility of maternal death expected to be increased by inter-facility level (1, 2). It is also a form of continuous way of gathering information for action by means of regular identification, notification, quantification and determination of causes and avoids possible risk factors for cause of all maternal deaths. As public health intelligence, MDSR should be done as ongoing data collection, analysis, and interpretation of maternal death with timely dissemination of resulting information for appropriate decision-making (2).

The immediate benefit of active surveillance of maternal deaths would include timely notification of events, assessment and confirmation of cases, increased awareness and advocacy, and most importantly accountability for health services, policy makers, managers and civil society for monitoring progress. The term ‘surveillance’ is not new and has been used with reference to maternal health to address maternal death reviews, audits, confidential enquiries, or at demographic surveillance sites. However, converting surveillance systems and responses originally developed for communicable and non-communicable diseases for eliminating maternal mortality has only recently been adopted as a framework with guidelines for implementation being developed (2, 3).

Almost all of the maternal deaths result from avoidable causes. Establishing a functional MDSR system enables timely review of maternal death at care delivery point to identify avoidable factors and take proper action to improve care at all levels of the health system. Ethiopia launched MDSR system in 2013 as guideline (3), but the effectiveness and impact of the system to decrease maternal death has not been implemented as per national guideline yet; especially in Wolaita zone. This problem was revealed by the surveillance system evaluation of maternal death in February 2017. Due to this problem, zonal maternal mortality rate cannot be described and some of surveillance system attributes

could not be assessed. The study will give decisive information about maternal death and the zonal MDSR implementation to policy and decision makers for significant decrease of national and zonal MMR by taking action on preventable maternal death (4).

1.2.Statement of the problem

According to WHO and ICD, maternal death is defined as death of women during pregnancy or childbirth or within 42 days of termination of pregnancy, irrespective of duration and site of pregnancy from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental causes (1, 5).

Maternal death in developing countries exceeds as compared to developed one now a days. Sub-Sahara Africa and South and Middle Asia countries account for 286,000 deaths from total of estimated 287,000 global annual maternal death (6, 7).

Majority of maternal death caused by direct and indirect obstetric complication like hemorrhage, infection, pregnancy induced hypertension, unsafe abortion and obstructed labour (8). MDSR was designed to prevent avoidable maternal death by generating information through surveillance system since almost all maternal death resulted by avoidable causes (9). So that establishment of functional MDSR system enables timely review of all maternal death at service delivery point in order to identify avoidable maternal factors and take proper action to improve care at all levels of the health system (9, 10).

Despite the importance, maternal death reported and registered at health facility was not matched as well as reported through monthly HMIS and through surveillance system showed great difference in Wolaita zone. Wolaita zone reported only 23 (17.7%) in 2015/16 and only 5 (4%) maternal death in six months of 2016/17 through surveillance unit. During baseline data collection, out of 42 maternal deaths only 23 were reported through surveillance system and 39 through monthly HMIS in 2016 (11, 12). Out of 23 reported maternal death, only seven was notified prior to reporting through surveillance structure. This showed there are some factors that affect proper implementation of MDSR in the zone. Moreoover, as MDSR implemented in the zone, health professionals and/or surveillance officers argued that high degree of blame as factors in least that showed

during surveillance system evaluation. This study aimed to explore factors which affecting implementation of MDSR at zonal selected health facilities and come up with recommendation for implementation.

1.3.Justification of the study

Maternal death is not only the problem for reduction of MMR but also it raises the problem of economic, political and social problems of country and community as well as family that should be alleviated by public health intervention through improving quality life for pregnant mothers. MDSR is also one of the great strategies that are designed to prevent future maternal death by using information for action (1, 13). Despite integrated MDSR system in public health system, only 141 maternal deaths reported from a few hospitals of the SNNPR in formal way. From 141 maternal deaths, 24 (17%) reported from Wolaita zone (only seven notified immediately, 17 maternal death reviewed) (11, 12). This shows that the system is not effectively implemented as expected and as its incredible economic, political, health and social impacts. Still mothers are dying duet avoidable causes in the facilities and community.

The data regarding maternal death is too late to report to the next level due to late maternal death review (MDR) at health facility level that gives more chance for the next maternal death by the same cause/s. It needs a great deal of commitments of administrators, politicians, health professionals, stakeholders and general public influential individuals in whole (14). However, there are no more studies related to MDSR system conducted in Wolaita zone to indicate areas of the gaps. Moreover, in 2015/16, Wolaita zone reported only 24 (10.08%) maternal deaths. Out of reported maternal deaths, only 7 (29.17%) were notified before report. In the other hand, there were 42 maternal deaths in Wolaita Soddo Teaching Hospital in the year and zonal HMIS showed that there were 52 maternal deaths (11, 12). This shows that there were some factors affecting the implementation of MDSR in the zone.

1.4.Significance of the study

Strengthening MDSR system is the key of information making process that provides action-taking areas to prevent future maternal death at health facility level and community. Preventing avoidable maternal death at facility level needs relevant

information about implication of maternal death. This study will deliver relevant information that will show clear image of MDSR status of Wolaita zone. The study will also describe the magnitude of maternal death and it will point out the main causes of maternal death. The regional health bureau and zonal health department as well as health facilities will be informed on gaps of MDSR implementation that will help them to take relevant actions to prevent avoidable maternal death based on the finding of the risk factors of study that is incredible way of decreasing national, regional and zonal maternal mortality ratio.

This descriptive cross-sectional study that will conducted in Wolaita zone will show the gaps of MDSR implementation and avoidable causes of maternal death to prevent future maternal death by the same cause.

2. Literature Review

2.1. Addressing maternal mortality trends and measurement

Globally, maternal mortality ratio (MMR) decreased from 385 per 100,000 livebirths in 1990 to 216 per 100,000 livebirths at the end of 2015. However, the reduction contributions differ by country's developing status: in 2015, MMR of low, middle and high income level regions were 485, 185 and 17 per 100,000 livebirths respectively. The burden and risk of maternal death remains the highest in Sub-Sahara Africa region, which accounts 547 per 100,000 livebirths. Nigeria from Sub-Sahara Africa and India from South Asia had high number of maternal death, which comprised one third of global maternal death even though their respective MMR decreasing at the end of MDGs era (4).

Accessing of accurate data at all levels and identifying most known and frequent causes of maternal death can be used for planning, monitoring, making the decision and evaluating the systems. Based on relevant data, maternal mortality ratio can also be estimated and it helps to conclude that whether the country has been on real intervention of MMR reduction track or not (5). Lack of active case search, under-reporting and misclassification of maternal death of Ireland led to wrong conclusion of national MMR

to four per 100,000 livebirths for a long time; but the problem was solved after the introduction of maternal death enquiry system in their health facility level (6).

2.2. Magnitude and Related risk factors of maternal death

In 2015, about 830 women die due to complications of pregnancy and childbirth in the World every day, in which 550 deaths contributed from Sub-Sahara Africa and 180 from Southern Asia (7). As MDGs report, estimated lifetime risk of maternal mortality in developing countries up to 1 in every 17 livebirths whereas 1 in 3300 estimated lifetime of maternal mortality in developed areas, this shows that women died in developing country was as high as 33 times than in developed country (4, 8).

In addition to high MMR, developing countries maternal death mostly caused by direct obstetric causes unlike developed ones where indirect causes outweigh higher proportion for their maternal death (9, 10). The study conducted in Dire Dawa, Ethiopia, revealed that above 90% of maternal death was due to direct obstetric causes; of them about 80% can be avoidable (11). Another study conducted in Ireland showed that 70% of maternal death was due to direct obstetric causes during 2010 – 2013 (6).

Pregnancy induced hypertension; hemorrhage and sepsis are the most frequent direct causes of maternal death whereas anaemia, heart diseases and HIV/AIDS are prominent indirect causes of maternal death worldwide (10, 12). The study conducted in Dire Dawa confirmed that direct obstetric causes were the leading for maternal death and above 60% of them were avoidable causes (11). Quarterly report of MDSR scorecard compiled from Ondo State, Nigeria, indicated that sepsis had most known causes of maternal death (13). This direct obstetric causes of maternal deaths can be reduced significantly when relevant actions has been taken at health facility level as hospital based maternal death data analysis study conducted in Morocco . Effective gynecological interventions, well trained and competent health workers, increasing skilled birth attendance coverage and motivation of health staffs at hospital level need improvement highly as the study conducted in Ghana for effective MDSR implementation (17).

2.3. Maternal Death Surveillance and Response (MDSR)

Maternal death surveillance and response system is designed and established in most developing regions as routine surveillance system for maternal death data collection and review at health sector level. The system provides reliable information on how many, where and why mothers died; the information helps to reduce maternal mortality (1, 2).

Maternal death surveillance and response is defined as the identification, notification, quantification, determination of causes and avoid ability and response to provide essential information for decision making to provoke action for prevention of future maternal deaths and it also help to improve the measurement of maternal mortality (1, 3).

During the discussion on the 2015 MDGs report, there was conclusion that MMR has to be decreased to 70 per 100,000 livebirths at the end of 2030 globally. This new target will be reached by effective MDSR system implementation with high governmental full willingness and incredible stakeholders' partnership (4).

Elimination of preventable maternal death by using information to take relevant and effective public health action is the main and prominent goal of MDSR (2).

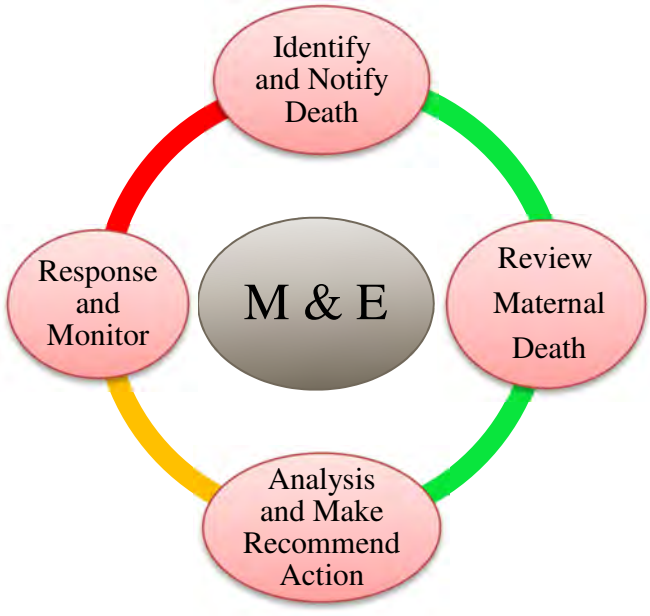

Figure 33 MDSR System: Continuous actions of the system (Source: Beyond Numbers)

The MDSR Action Network reported that feasibility study conducted in Tigray, Ethiopia, highlighted effective utilization of existing community and health structures as incredible framework for effective implementation of MDSR (14). The study recommended that MDSR should be done as teamwork of different disciples that comprises both clinical and non-clinical actors' involvement at health structures including health facilities like hospitals when implementing in MDSR system (14). The participation of different specialists and mid-wives in MDSR system at health facility level makes the system more effective to decrease maternal mortality as the study revealed (21).

Scaling up of MDSR across the health system of Ethiopia has been implemented in Oromia, Amhara and Southern Nations, Nationalities and People's regions for the last five years. Eleven zones of Oromia, all zones of Amhara and SNNPR regions were trained on integrated MDSR on health system since February 2015 (3).

2.5. Challenges of MDSR implementation

The most known challenge for effective MDSR is legal framework for development of 'No blame' culture. Challenge may encounter from different levels including for the patient, family, health professional and health facility (15).

Miscommunication between team workers, unequal power relations and ownership within clinical and non-clinical health personnel, loose co-ordination and lack of mid-wives and other specialists as well as lack/shortage and/or turnover of trained manpower for teamwork of MDSR as great challenge during implementation that need to solve as the study verified in different areas (15).

As public health surveillance, MDSR should be done as ongoing data collection, analysis, and interpretation of maternal death with timely dissemination of resulting information for appropriate decision-making. So that lack of sufficient studies which regarding MDSR is a great challenge in the zone. The country MDSR guideline considered local capabilities, limitations, logistical issues, budgetary realities and legal requirements as prerequisites for MDSR implementation (3). These prerequisites were not fulfilled in most of health facilities like Southern Nation Nationalities and Peoples' Region (SNNPR) except legal requirements.

2.6. Factors affecting implementation of MDSR

The implementation of MDSR depends on the level of maternal death notification and review systems implementation and on the quality of information produced and using the information to ensure actions are taken to implement the recommendations and avoid future deaths. And WHO recommended that implementing MDSR will depend on the degree to which maternal death notification and review systems have already been implemented and the quality of information they are producing (1, 16). The impact of MDSR implementation is not simply counting numbers but taking relevant action based on the finding. Factors affecting MDSR implementation related directly or indirectly with political commitment of local administrators, availability of competent health professions /expertise, accessibility of health facility with full logistics, behavioral change of community and individual acceptance (16).

3. Objectives

3.1. General objective

To describe maternal death, assess data quality and explore factors affecting implementation of maternal death surveillance and Response in public health facilities of Wolaita Zone, Ethiopia – 2017.

3.2. Specific objectives

To describe zonal maternal death by place, person and time

To address data discrepancy between surveillance system and monthly HMIS for maternal death

To explore barriers affecting implementation of MDSR at health facility level

4. Research Questions

How many mothers died in the zone and where is the most contributed area? At what age group mothers died in the zone? At what time maternal death occurred frequently in the health facility? What are the contributing factors for maternal deaths? Is the information flow of maternal death sensitive at every health professionals? Do health professionals in the facility understand maternal death is immediately reportable event? What is/are the known cause(s) of maternal death in the zone? What are identified risk factors for the

maternal death in Wolaita zone? How can MDRs lead to improvements in care/health outcomes? If there was no improvement, what are the barriers preventing MDRs from having an impact? Does implementing maternal death surveillance and response (MDSR) contribute to improved quality of care and better maternal and perinatal health outcomes? If not, what are the factors affecting the implementation of MDSR?

5. Procedures and Methods

5.1. Study Area and Period

The study will be conducted in Wolaita Zone from July 15 to December 20, 2017. Wolaita zone is one of 15 zones in Southern Nations, Nationalities and People's Region Ethiopia. The zone encompasses 12 rural woredas and 3 town administrations with 1,928,196 populations as 2009 CSA projection. Wolaita zone located southern part of the Ethiopia 390 kilometers away from Addis Ababa and 157 kilometers away from capital city of the region, Hawassa. The zone bordered Kembata Tembaro zone at North, Hadiya zone and Oromia region at East, Dawuro zone at West and Gamo Goffa zone at South (see administrative map below). It covers 4208.64 sq.km areas, which covers 3.8% of the regional land with an estimated density of 428.7 people per sq.km (21). The average annual population growth rate of the zone is 2.41% and the zonal total fertility rate (TFR) is estimated 3.16%.

Health coverage of Wolaita zone is about 95.4% with primary health care unit (PHCU). Health utilization rate of the zone is 76.6%. The zone has four district hospitals, one teaching, one NGO and one private hospital. The zone comprises 68 health centers, 342 health posts, 6 NGOs and 234 private health facilities. According to zonal health department annual report, antenatal care (ANC_4) at least fourth times and skilled birth attendance (SBA) at health facility increases through year to year. For the last five consecutive years, in 2011/12, 2012/2013, 2013/14, 2014/15 and 2015/16, ANC_4 coverage of the zone are 30%, 65%, 68.9%, 85.9% and 83.8% whereas that of SBA coverage are 11.7%, 32.8%, 42.2%, 66.2% and 84.2% respectively. The current maternal mortality rate of the zone is about 238 per 100,000 livebirths (18).

5.2. Study design:

Descriptive Cross-sectional facility based study will be conducted with both quantitative and qualitative methods. The quantitative method will conduct retrospectively. Retrospective data will obtain from 2014 to 2017 documents by reviewing their medical records and surveillance data (11). Qualitative method will be conducted to explore factors affecting implementation of MDSR by in-depth interview of informants in selected public health facilities in Wolaita zone. The study will be held by using record review and interview of health service providers from selected health facility quantitatively and in-depth interview for informants from the selected four public health facilities for qualitative method.

5.3. Population Studied

Source populations: All maternal deaths occurred in the public health facility of Wolaita zone and all health workers of Wolaita zone will be the source population.

Study population: the study population will be number of maternal deaths occurred in selected health facilities within specified years (February 2014 to October 2017) for description, and MDSR committees and health workers who are currently providing health care services in the MCH department in selected health facilities will be interviewed for assessment of factors affecting implementation of MDSR. Key informants will be selected purposively from all selected health facilities to explore barriers affecting MDSR implementation.

5.4. Operational definitions:

Maternal death is defined as death of women while pregnant at the age between 15 – 49 years and died in the health facilities who were registered on medical records of the facility whether MDR was done or not and community death whose verbal autopsy was done and confirmed as maternal death.

Maternal Death Review (Facility-based maternal deaths review) is a qualitative, in-depth investigation of the causes of and circumstances surrounding maternal deaths occurring at health facilities that will be confirmed by written information with action taken based on recommendation. It was done if at least 2/3rd of MDR committee presented and signed on the minute book.

Verbal autopsy (VA) is investigation of community maternal death that died out side of health facility but confirmed by MDSR committees as maternal death after collection of information and recorded on their minute book. The information gathered by health professional should include medical and non-medical issues for VA.

MDSR Committee is committee consists of medical and non-medical persons who established in the health facility, assigned formally, and posted in the health facility to take action based on findings of MDR or verbal autopsy.

MDR Committee is committee who are composed of medical persons only and assigned to conduct facility based maternal death review, and accountability and responsibility of maternal death fall.

Key informants are health professionals who trained on MDSR, have at least two years' experience on maternal health issues, and selected from health facilities or woreda health office purposively for in-depth interview.

Basic services: providing maternal health services like HIV testing, PMTCT, Fefol supplementation, laboratory testing, ANC, PNC and normal delivery (SVD) services.

Active materinity services: includes basic services and availability of pregnant mothers waiting rooms with full facilities – beds, cooking materials, food stuffs, washing facilities

Preventable maternal death: death that can be avoided if the action was taken for identified risk factors whether individual, health care provider, structure/institution and/or logistic related problem solved.

Direct cause of death: cause of maternal death directly related with pregnancy and/or complications due to pregnancy.

Formats: standard papers that supplied from, printed by FMOH, and used to report maternal deaths

Records/documents: are any written materials that hold maternal death information and reports such as HMIS, weekly IDSR, delivery registration, discharge registration, IPD and emergency registration, minute books, annual and biannual performance documents.

5.5. Case definitions

Community case definition (probable maternal deaths): Death of a woman of reproductive age (between 15-49 years of age)

Suspected maternal death: Community case definition plus at least one of the following: died while pregnant, died within 42 days of termination of pregnancy or missed her menses before she died.

Standard case definition (confirmed maternal death):"The death of a woman while pregnant or within 42 days of the end of pregnancy (irrespective of duration and site of pregnancy), from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" (22).

5.6. Variables

Dependent variables: percent of reported maternal death and data quality,

Independent variables: Age, availability of basic services, standard formats, trained health workers, professional background of service providers, timeliness and completeness of maternal death report, MDSR committes actions, number of reviewed maternal death, MDR sessions, type of health facility, place of usual residence, conducted ANC visits, state of pregnance at the time of death, HMIS monthly report, facility based abstraction report, registration of maternal death, weekly IDSR report.

5.7. Inclusion and Exclusion Criteria

Inclusion criteria:

i. All maternal deaths occurred and recorded in the selected health facilities and community deaths whose verbal autopsy done by selected MDR/MDSR committees will be included for description of maternal death
ii. All MDR/MDSR committee members and/or IDSR focal persons of all selected facilities and performance review team of district hospitals and health centres can be included.

Exclusion criteria:

i. Maternal deaths occurred on the way from their home to health facility and women who died on their way while referred to next higher level and whose verbal autopsy was not conducted will be excluded.
ii. Health workers who are employed below six months newly, whose work experience below one year and not trained on MDSR will be excluded.

5.8. Sample size and Sampling procedure:

All four district hospitals and one referral hospital will be selected purposively. Top 20 health centers will be selected for study purposively based on their annual high number of skilled delivery performance, active maternity service and MDSR activity (18).

The study sample will be zonal expected number of maternal deaths in 2017/18 up to study period multiplied by current zonall MMR, 238 per 100,000 livebirths (23). Number of deliveries found in the last four years (2014 to 2017 nine months) in the selected 25 health facilities are 41,227. Then the expected number of deaths will be equals to (41,227X238 per 100,000 livebirths = 98). Moreover, five MDR committee members, surveillance unit officers and IDSR focal persons will be included from each selected Health facilities (HF) since they trained on MDSR and/or experienced on issue. Moreover, 22 key informants, who are not included for interview, will be recruited from selected health facility purposively for qualitative method and they will be informed two weeks prior to data collection.

5.9. Data Collection procedures

Quantitative data collection

Medical records and delivery registers will be reviewed for specified periods. For document review, hospitals and health centers monthly HMIS reports, delivery registers, facility-based abstraction, maternal death reporting format, weekly IDSR reports and MDR records will be reviewed. The document review will be done by modified WHO standard maternal death data collection tool. The tool captures key data including socio-demographic and obstetric characteristics of the deceased mother, and causes and avoidable factors of maternal deaths (1, 24).

Health workers will be interviewed by using a semi-structured questionnaire to find out the factors affecting implementation of MDSR. The questionnaire will be prepared by using CDC manual of surveillance system evaluation and MDR guideline and tools for health professionals (24, 25). Questions in the interview questionnaire will be arranged in a way general questions followed by more specific questions and in the end questions will focus on experiences and challenges to implementation of the system (11). The questionnaire will be pre-tested at Hawassa Referral and Teaching hospital and Alamura

health centre, and then it will be updated based on the pretest findings. Totally four data collectors and two supervisors will be recruited and they will be trained two days on the clarity of questionnaire. There are three criteria for selection of data collectors: educational status, profession and work experience. The data collectors should have at least Bachelor degree in the clinical nurse, midwife and public health (HO) with a minimum of two years' work experience at the government health structure. Data collector who recruited from selected study health facility will be deployed away from his/her health facility to minimise data collector related bias. Supervisors will be assigned purposively among graduate of field epidemiology.

Qualitative data collection

Open-ended interview guide will be administered to informants to explore issues and factors affecting implementation of MDSR in the health facilities. Informants will be selected purposefully and will be informed prior that he/she will be not participated during interviewing other health workers for quantitative data collection by using semi-structured questionnaire. Informants will be a member of MDR/MDSR committees with at least one-year work experience on the issue (maternal health services) and trained on MDSR (11). The interview guide will be developed in English and then translated to Amharic; the language that interviewees speak and work in the health facility. The interview guide will hold open-ended questions to reduce predetermined responses and to allow informants to think more and to express their experiences without any limitation. The in-depth interview will be done by the principal investigator and the data will be collected by taking notes and recording voice.

5.10. Data Analysis

Data will be entered and analysed by using Epi Info 7.1.4.0 and SPSS 20 for quantitative data. Mean, median, mode and range will be calculated for age, gestational week, Para gravida of deceased mothers; frequency and percentage of obstetric characteristics, availability services, causes of death (direct or indirect), type of death (preventable or non-preventable), time of death (day or night) and duration of admission before death. Spot map of residence of deceased mothers will be indicated by woreda and/or kebele. Frequency and percentage of MDR session, maternal death report timeliness, completeness of report formats, MDSR trained professionals and work experience of

expertise will be analysed. Data discrepancy of maternal death report between surveillance and HMIS will be tabulated.

For qualitative data, the analysis will be held together with data collection. The data, which obtained an in-depth interview, will be translated into English by the principal investigator and the recorded voice will be transcribed to word statement by using the guiding questionnaire. The notes and the transcription will be read repeatedly until to understand all raised issues of factors affecting implementation of MDSR. The initial step of the analysis was reading and rereading of the notes and transcriptions and hearing of recordings to understand the issues raised by the informants and to get an overall impression of the material. The second step was entering, coding and categorizing the data using OpenCode software. The interview guides were used to make preliminary labeling of the themes. The third step was putting relevant texts under the respective themes. The data then further analyzed by using content analysis approach.

5.11. Study Limitation

Near miss and community death, which are not recorded, verified and reported, can affect the impact of the study by changing the result. Underreporting for early pregnancy deaths and misreporting of indirect maternal deaths may affect the conclusion of the maternal mortality rate of the area.

5.12. Ethical consideration

Ethical clearance will be obtained from Research and Ethical Committee of School of Public Health, Addis Ababa University and Research and Technology Transformation supportive core process of SNNPR Health Bureau. School of Public Health and SNNPR PHEM will write a support letter to Wolaita Zone Health Department. The zonal health department will write a letter to the Wolaita Soddo University Teaching Hospitals and Woredas where four district hospitals and six health centres that the actual study will be done. Woreda health offices will write a letter to selected health facilities. The Chief Clinical directorate of WSUTH, CEOs and medical directors of district hospitals and health centre managers will be informed about the study and will be asked to get permission to conduct the study in each facility. Informed consent will be delivered to each participant of the study. The interviews will be conducted individually and

anonymously to ensure privacy and confidentiality of the participant. The informants' names and other personal identifications will not be noted and recorded during an in-depth interview. The interviews will be conducted entirely based on participants' willingness and no payment will be given to all study participants. All data collection materials will be kept for two months after submission of a copy of the final report under control of principal investigator and co-investigators, and then will be destroyed by fire to keep privacy and confidentiality of participants and health facilities.

5.13. Dissemination of the study result:

A hard and soft copy of the final study report will be submitted to the funding body, School of Public Health College of Health Sciences of AAU, SNNPR Health Bureau, and Wolaita zone health department and to the participated health facilities. The findings will also be presented in different workshops, conferences and seminars and will be published in peer-reviewed journals.

1. Dummy tables

Table 46 Distribution of delivery and maternal death from 2014 to 2017 in the health facilities, Wolaita Zone, SNNPR

S. No	Health Facility Name	Number of delivery	Number of Maternal death	Maternal death ratio	MMR per 100,000 LBs

Table 47 Distribution and type of maternal death and cause of death in the health facilities from 2014 to 2017, Wolaita Zone, SNNPR

S. No	Health Facility Name	Preventable maternal death	Non-preventable maternal death	Direct obstetric cause	Indirect obstetric cause

Table 48 Distribution of age groups of deceased mothers and cause of death in the health facilities from 2014 to 2017, Wolaita Zone, SNNPR

S. No	**Age groups (in years)**	**Maternal death due to**	
		Direct obstetric cause	**Indirect obstetric cause**
	Below 20		
	20 to 29		
	30 to 39		
	40 and above		

Table 49 Frequency and percentage of MDSR trained HWs in the health facilities, Wolaita Zone, SNNPR

S. No	Health Facility Name	Total HWs	MDSR trained HWs	Percentage of MDSR trained HWs

Table 50 Distribution of health professional in the health facilities, Wolaita Zone, SNNPR

HF Name	Gynaecologist /obstetrician	Other specialist	Accelerated surgeon	General Practitioner	Mid-wife	Health Officers	Other Nurses	Others

Table 51 Availability of Maternity services in the health facilities, Wolaita Zone, SNNPR

S. No	Health Facility Name	Basic MCH	BEmONC	CEmONC

Table 52 Risk factors for contributing of maternal death in Wolaita Zone, SNNPR, Ethiopia

S. No	Risk factors	Number of death	Percentage	Remark

Tentative Work Action Plan

Table 53 Tentative schedule and Work Action Plan for study by weeks

Description of Activities	Responsibility	Study Schedule by Months and weeks – Timetable																		
		Month 1				Month 2				Month 3				Month 4				Month 5		
		W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3
Prepare proposal and submit to funding body (FMOH, CDC, EPHA, AAU)	PI																			
Obtain budget and discuss arrangement with RHB and ZHD	PI																			
Preparation and development of data collection tools	PI																			
Prepare for field work	PI																			
Travel to data collection site	PI																			
Recruitment and Training of data collectors (DC) & study supervisors	PI																			

(SS)																				
Pretesting of the study instruments and updating	PI+SS+ DC																			
Medical and other records review	PI+SS+ DC																			
In-depth interview of Key Informants	PI																			
Interview of study participants (HWs)	SS+DC																			
Data entry, cleaning, encoding and Categorization	PI+CI+ SS																			
Data analysis and write up	PI																			
Preparing workshop on findings at zonal level	PI+CI																			
Print report and Submission of copy of final report	PI+CI																			
Hold workshop	PI+CI																			

Estimated budget proposal

Table 54 Estimated Budget Proposal for completion of the study

S. No	Budget Category	Unit Cost (in ETB)	Multiplying factors	Total Cost (in ETB)	Remark
1	**Personnel cost**	**Per diem**	**Number of staffs x Number of working days**		
	Principal investigator (PI)	210.00	1PI x 26 days x 210	5,460.00	
	Co-investigators (CI)	210.00	2CI x 11days x 210	4,620.00	
	Supervisors (SS)	210.00	2SS x 20days x 210	8,400.00	
	Data collectors (DC)	210.00	4DC x 20days x 210	16,840.00	
	Drivers (DR)	210.00	3DR x 20 days x 210	12,600.00	
			Personnel Sub Total	**47,920.00**	
2	**Transport Cost**	**Unit Cost (in ETB)**	**Number of cars x liter of fuel per day x number of days**	**Total cost (in ETB)**	
	Cars	16.72	1 car x 25 liters/day x 20 days x 16.72	8,360.00	
	Traveling to submission	235.00	1 PI x twice x for 2 places x 235	940.00	
			Transport cost Sub Total	**9,300.00**	
3	**Supplies and stationary**	**Cost per item**	**Required Number**		
	Questionnaire duplication	12 ETB/questionnaire	612	7,344.00	
	Clip board	32.00	9	288.00	
	Pencil	2.00	18	36.00	
	pen	7.50	69	517.50	
	Flip chart	37.00	3	111.00	
	Note book	25.00	69	1,725.00	

	Eraser	5.00	9	45.00	
	Sharper	5.00	9	45.00	
	Marker by packet	175.00	3	525.00	
	Printing paper (by rim)	110.00	4	440.00	
	Photocopy cost	1.00	650	650.00	
	Printing and binding	75.00	15	1,125.00	
			Supplies and stationary Total cost	**12,851.50**	
4	**Training**	**Cost per item/participant**	**Number of days (multiplier)**	**Total cost (in ETB)**	
	Hall rent	1,500.00	2 days	3,000.00	
	Refreshment	125.00	27 participants x 2 days x 125	6,750.00	
			Training Total cost	**9,750.00**	
			Total	**79,821.50**	
			Contingency (15%)	**11,973.23**	
			Grand Total	**91,794.73**	

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Chapter IX - Other Additional Output Reports

9.1 Acute Febrile Illness Outbreak Investigation in South Omo Zone, SNNPR, Ethiopia - 2016

INTRODUCTION

From the Latin word febris, meaning fever, an Acute Febrile Illness is a type of illness characterised by a sudden onset of fever, which is an increase in internal body temperature to levels above normal. This is a nonspecific term for any illness of sudden onset accompanied by fever. Acute fever associated with multi-systems illness is a common feature of several infections like malaria, typhoid fever, typhus, leptospirosis, dengue etc. The absence of golden standards for early detection of causing agent was a problem for AFI being undifferentiated illness (1). Acute febrile illness can occur anywhere in the world in terms of emerging or reemerging infections that need sophisticated diagnostic materials to detect easily (2).

Salmonella paratyphoid and salmonella typhoid are the responsible pathogens for most acute febrile illness (3, 4). Salmonella species can be differentiated by using blood, urine and stool sample (5). Typhoid is a foodborne infectious disease that affects a human being and it is the disease of uncivilised nations in Africa and Asia (6).

Initial symptoms may include fever, anorexia, lethargy, malaise, headache, non-productive cough, abdominal pain, and constipation. Diarrhoea may develop, particularly in children less than one-year-old. In endemic areas of the world, mild infections are common. If the illness progresses, there is protracted fever and mental dullness. Many patients develop hepatosplenomegaly. Some cases develop a salmon-colored macular rash (“rose spots”) on the trunk. Intestinal haemorrhage or perforation may occur and can be life-threatening. Without treatment, illness may last for 3 to 4 weeks and death rates range between 12% and 30% (7).

Transmission of typhoid is mainly through fecal-oral contamination and human being is the only host for the pathogen (6). Environmental sanitation and hygiene defects are the

most known risk factors for the dissemination of typhoid fever (8).Typhoid fever is one of national priority diseases/events that has been reporting weekly basis (9).

On April 26, 2016, regional health bureau, PHEM, received AFI outbreak with four deaths from South Omo zone health department. The aim of the study is to detect the existence of AFI outbreak, identify the aetiology and describe the outbreak for control and prevention measures.

BACKGROUND

South Omo is one of 15 zones in Southern Nations, Nationalities and Peoples region. The zone composed of 263 (16 urban and 247 rural) kebeles, eight woredas and one town administration. The capital of the zone, Jinka, located South West part of the region as well as the country and far 778 KMs from Addis Ababa and 545 KMs from Hawassa, the capital city of the region. The zone bordered with Segen Area Peoples zone at the East, Gamo Goffa zone and Basketo special woreda at North, Bench Maji zone at the West, South Sudan at South West and Kenya at the South. The total population of the zone is 714,588 according to CSA projection for 2016.

The area of the zone is 23,535km square and the altitude is 380-3300m above sea level. The average temperature ranges from 14^0c—41^0c and rainfall range from 700 –2500 mm. Regarding to climatic condition, the zone has 0.5% humid (Degga), 5.1% temperate (Woina Degga), 60% hot (Kolla) and 34.4% semi-desert. Population density is 31 persons per square kilometres.

The place has been known by high tourism takes place and Omo Kuraz sugar factories found. In the zone, there are 16 ethnic groups and their main economic status based on both pastoral (six woredas 100%) and agricultural (two woredas 100%). Totally 227 health posts, 32 health centre, two primary and one general hospital have been delivering primary and secondary healthcare services. Sub-regional public health laboratory has been diagnosing some sort of public health infectious and non-infectious examinations.

In the last three years, communicable diseases like malaria, measles, yellow fever, anthrax, AWD and others were caused by an outbreak that resulted in high morbidity and

mortality of the zone. Malaria and AFI were the first top morbidity and mortality of the zone since 2013. Zonal health service utilisation was 0.29% in 2013/14.

Bena Tsemay and Maale are woredas of South Omo zone. They bordered each other at Chali and Beneta kebeles respectively.

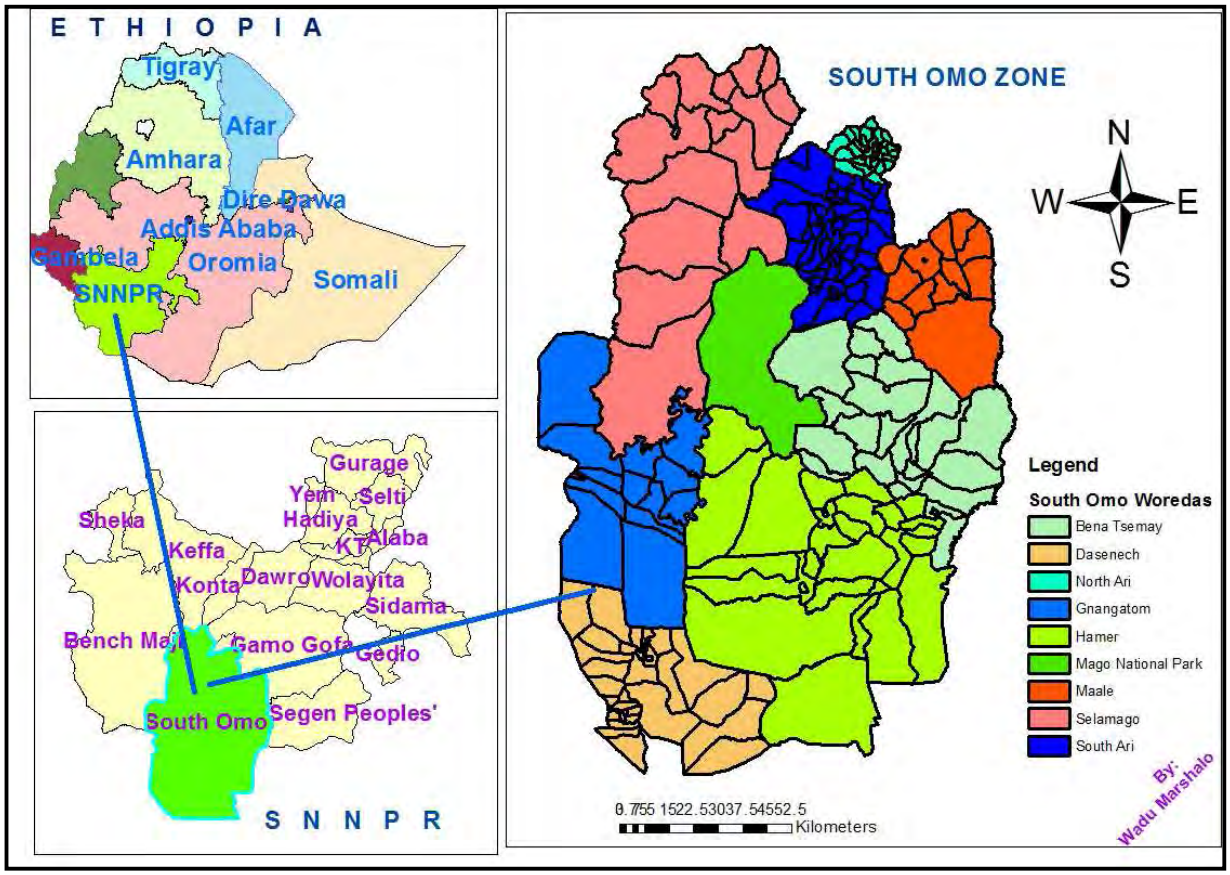

Figure 34: Administrative Map of South Omo Zone, SNNPR, Ethiopia

OBJECTIVES

To verify the existence of AFI outbreak

To describe the magnitude of epidemic in terms of place, person and time

To conduct outbreak control and prevention public health interventions

To evaluate outbreak response and management interventions

To identify others undiagnosed cases and get risk factors to prevent transmission by active surveillance

PROCEDURES AND METHODS

Descriptive epidemiology

We defined suspected cases as any person who has been lived in Bena Tsemay and Male woredas with gradual onset of remittent fever (rising in stepladder fashion) in the 1st week, headache, arthralgia, anorexia, constipation and abdominal pain who did not have a known explanation for the febrile illness.

From May 14 – 27, 2016, we conducted an outbreak investigation to identify suspect patients of febrile illness and determine the aetiology. We reviewed Jinka hospital and Kanko health centre records during the investigation. We also utilised epidemic line lists from South Omo zonal health department. Totally 78 patients from Beneta kebele and 29 from Chali kebele were diagnosed clinically by an internist (Dr Engida) who came from Jinka hospital. We included cases who had reported symptoms of AFI that had started after April 23, 2016, to June 06, 2016, as we noted there had been an increase in febrile illness reported by line lists after that week.
The data was analysed by using Excel 2010 and ArcMap.

Laboratory Investigations

Five water samples were collected from the river where the source of their drinking water takes place for coliform investigation at Jinka sub-regional public health laboratory. Stool samples were collected from 10 patients (five samples from each kebele) for culture and seven blood samples were drowned for the possible parasitic and bacterial investigation after oral consent with patients. The samples were transferred to EPHI and regional public health laboratory. Blood film examination was done for all 494 patients for malaria and for differential diagnosis.

Environmental methods

We assessed the source of drinking water and sanitation status of the most affected areas in two kebeles. We assessed drinking water handling, latrine utilisation, hand washing practices and other food and drinking liquor preparation (locally called “Chaqa”). We

also conducted interviewing key informants with surveillance officers of regional, zonal, woreda and health centre and kebeles' administrators for risk factors.

Public health interventions

We organised teams at five thematic intervention areas by setting activities, responsibilities and expected results. Five thematic areas included case management, surveillance, WASH, supplies and logistics, and coordination teams. We conducted case management, active case search and social mobilisation for preventive interventions in two most affected kebeles. Health education and environmental sanitation campaign were conducted by using one to five health development networks.

RESULTS

Descriptive epidemiology

Totally 839 (501 females and 338 males) AFI cases were line listed between April 23, 2016, to June 06, 2016 from Chali kebele (N=185) of Bena Tsemay with five deaths and Beneta kebele (N=654) from Maale woredas with one death. The attack rate (AR) was 369 and 706 per 10,000 populations for Chali and Beneta kebeles respectively. Case fatality rate was 2.7% and 0.15% for Bena Tsemay and Maale respectively.

The most affected age groups are 15 to 44 years following 5 to 14 years of age. Under five and above 45 years contributed 18% and 7% of total cases.

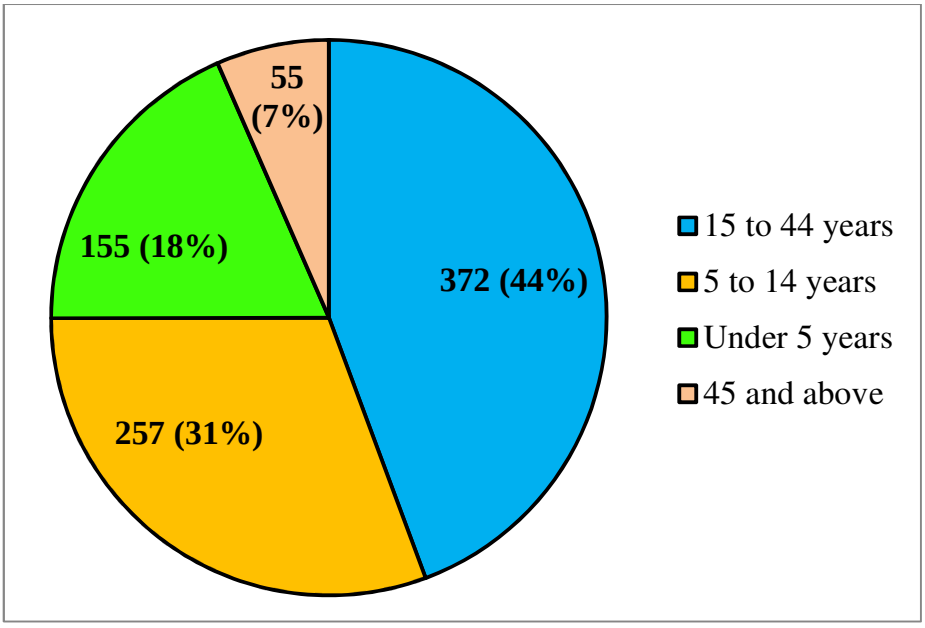

Figure 35: AFI cases (N=839) by age groups, South Omo, SNNPR – Ethiopia, 2016

Table 55: AFI cases (N=839) by age groups for each kebele, South Omo, SNNPR – Ethiopia, 2016

Name of Affected Kebele	Under 5 years		5 to 14 years		15 to 44 years		45 and above	
	Number	%	Number	%	Number	%	Number	%
Chali - Bena Tsemay	20	2%	69	8.2%	87	10%	9	1.1%
Beneta - Maale	135	16%	188	22.4%	285	34%	46	5.5%
Total	**155**	**18%**	**257**	**30.6%**	**372**	**44%**	**55**	**6.6%**

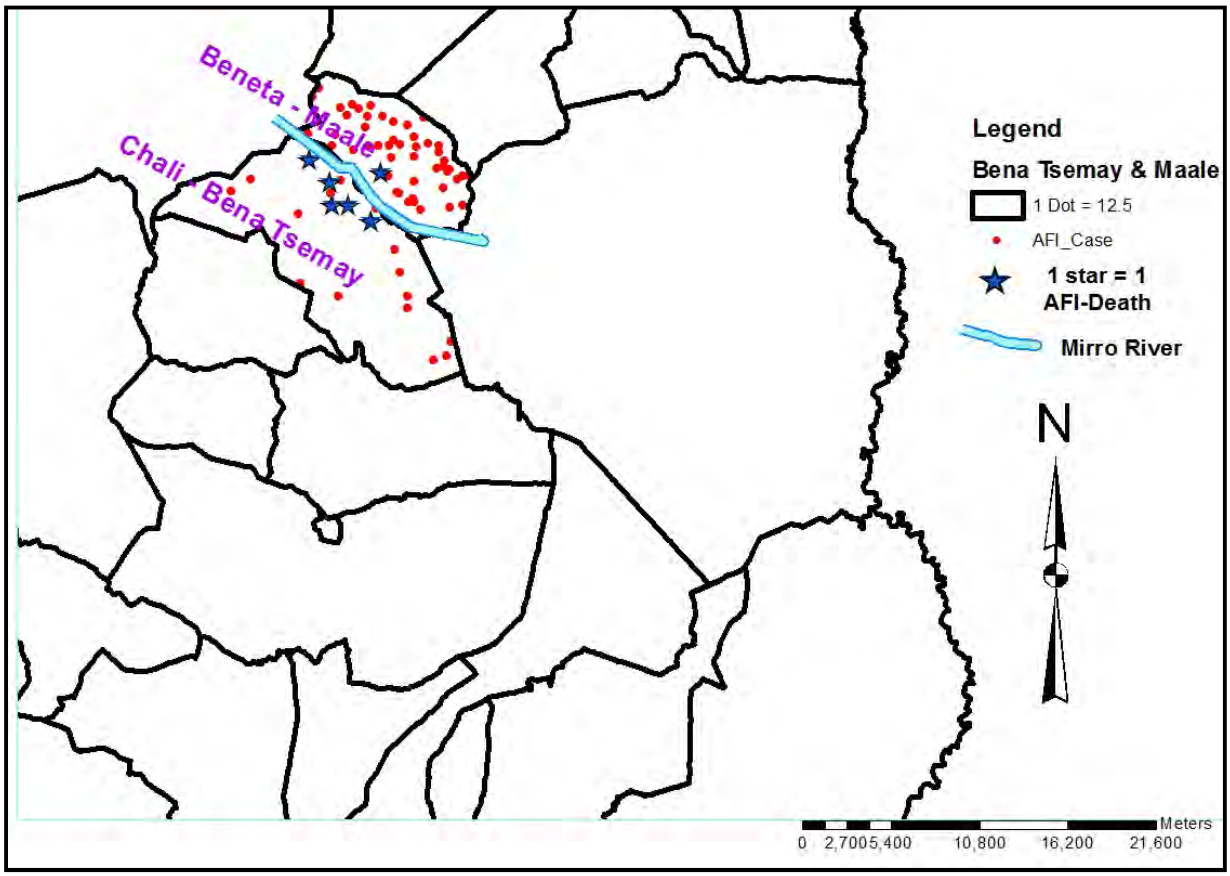

Figure 36 Spot map of undetected AFI cases (N=839) in Bena Tsemay and Maale woredas in South Omo, SNNPR, Ethiopia – 2016

The residence of all cases of Chali (N=185) and Beneta (N=654) was found near to Mirro river, which bordered Chali kebele of Bena Tsemay woreda and Beneta kebele of Maale woreda. Mirro River has been used by the community for multi-purposes including drinking and for the preparation of local liquor ("Chaqa").

The number of cases increased starting from May 05, 2016 in Chali and May 15, 2016, in Beneta kebeles. Chali kebele notified the outbreak on 26th April 2016 whereas Beneta notified 16th May 2016.

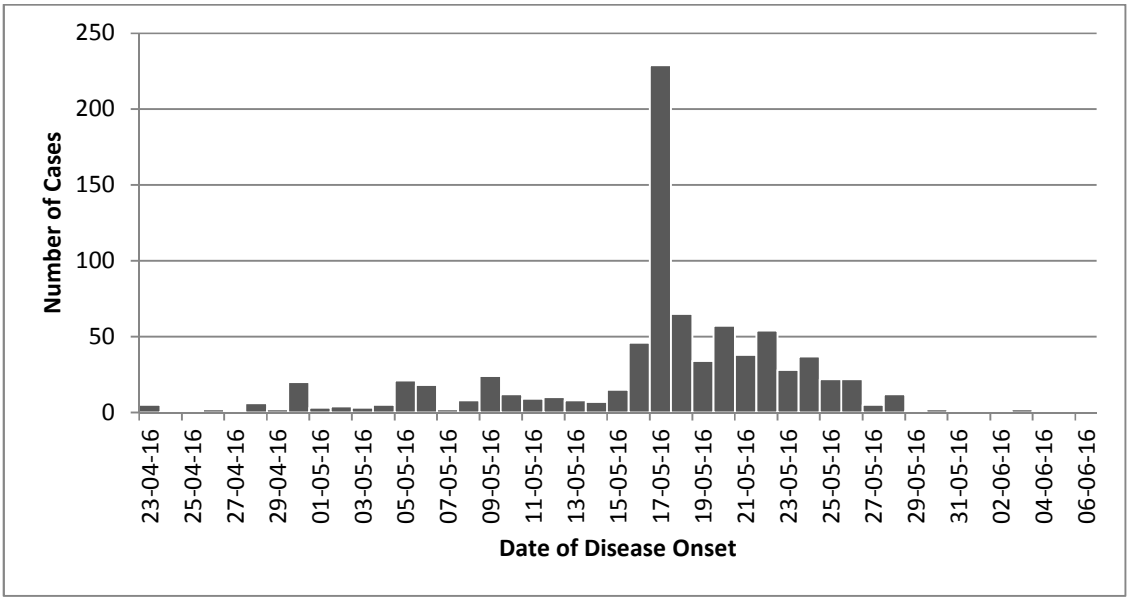

Figure 37: Epidemic curve of AFI cases (N=839) by Date of fever Onset in South Omo, SNNPR, Ethiopia, 2016

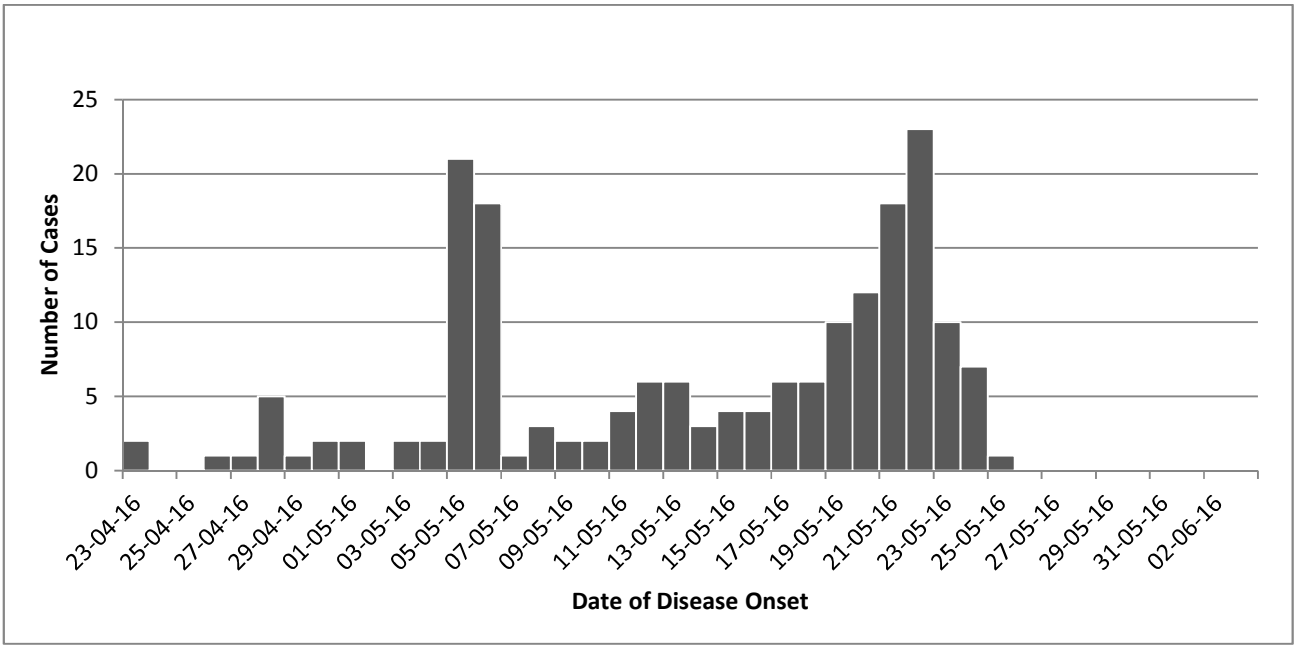

Figure 38: Epidemic curve of Bene Tsemay woreda AFI cases (N=185), SNNPR, Ethiopia, 2016

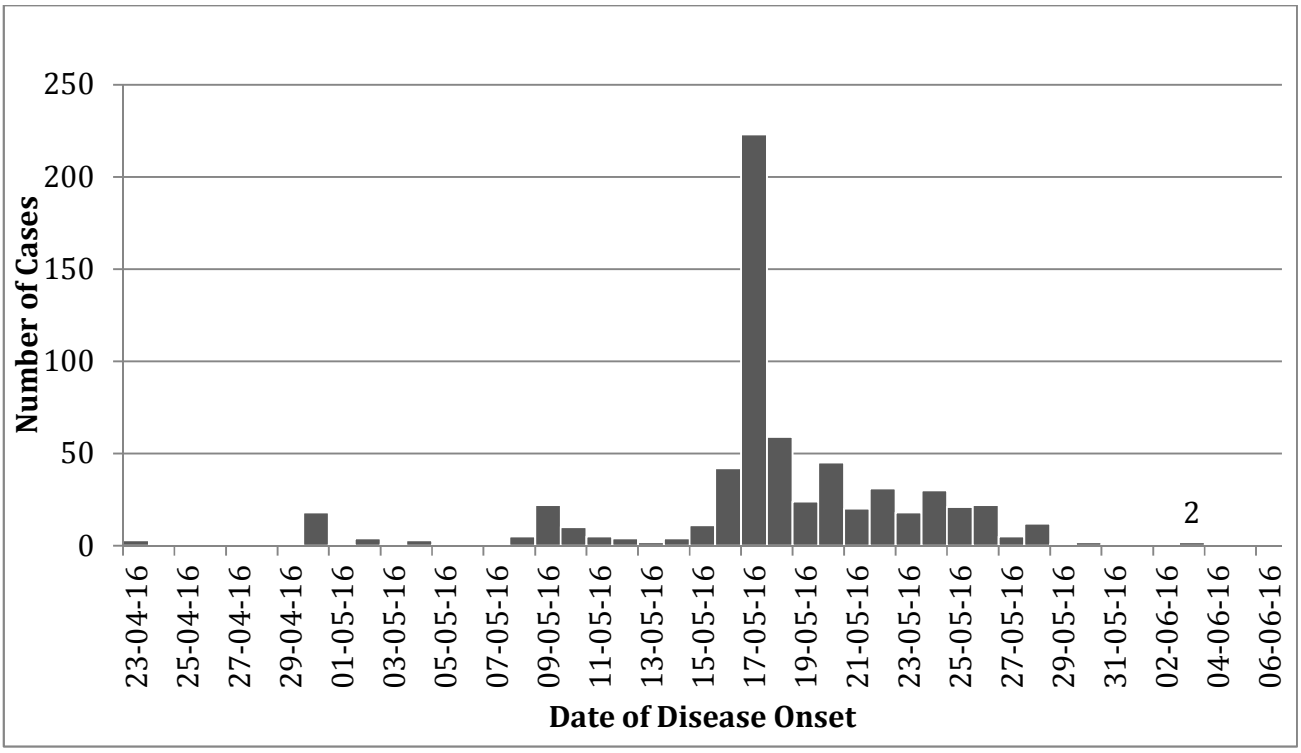

Figure 39: Epidemic curve of Maale woreda AFI cases (N=654) by Date of Disease Onset, SNNPR, Ethiopia, 2016

The outbreak was stopped on May 26, 2016, for Bena Tsemay whereas June 05, 2016 for Maale woreda. The epidemic curve was picked –up four times as shown in first two epidemic curves.

Laboratory Investigations

Faecal Coliform found in water samples which are unaccepted by WHO. No malaria detected from all examined blood films. The stool culture indicated the presence of Salmonella spp. para-typhoid in seven samples out of 10. The Salmonella para typhi species were insensitive to chloramphenicol but more sensitive to Ciprofloxacillin antibiotics. The blood samples' result was on pending until the report.

Clinical findings: Sign and Symptoms

As diagnosed by an internist, 44 cases of Beneta and 23 cases from Chali developed the following sign and symptoms: 92% headache, 42% arthralgia, 29% anorexia, 18%

constipation and 6% abdominal pain. In the line list, the cases showed fever, headache, diarrhoea, cough, back pain, chilling and shivering, abdominal and joint pains, loss of appetite, chest pain and constipation as sign and symptoms (see table below).

Table 56: Types of sign and symptoms for undetected AFI cases (N=839), South Omo in SNNPR, Ethiopia, 2016

S. No	Type of Sign & symptoms	Number of Cases	Percentage	Remark
1	Fever	613	73%	
2	Headache	429	51%	
3	Diarrhea	193	23%	
4	Cough	169	20%	
5	Back pain	146	17%	
6	Chilling	143	17%	
7	Vomiting	69	8%	
8	Shivering	52	6%	
9	Abdominal pain	50	6%	
10	Joint pain	34	4%	
11	Lethargy	31	4%	
12	Loss of appetite	28	3%	
13	Sweating	23	3%	
14	Bloody diarrhea	20	2%	
15	Chest pain	19	2%	
16	Others	18	2%	

Environmental Investigations

The latrine coverage of the two kebeles was about 70% (Chali 82% and Beneta 64%).Totally 1,072 populations from Chali kebele and 4,120 populations participated in three days sanitation campaign. Two communal latrines were built around at most risk areas and household latrine inventory was conducted by HEWs, kebele leaders and HWs. Totally 2,179 new latrines were constructed in two kebeles; 709 in Chali and 1470 in Beneta. Drinking water handling and hand washing practices were poor in the community when observed. Local liquor, Chaqa prepared by Mirro River after the water boiled. The community shared material during Chaqa drinking; 6 – 10 persons used one local cup at a

time by sharing. The community has a habit of eating freshly cooked foods and they eat vegetables and fruits frequently.

Treatment and Public Health Interventions

One hundred ninety-eight (23.6%) cases were treated as an in-patient (47 (25.4%) of Chali cases (N=185) and 151 (23.1% of Beneta cases)) were treated by sensitive antibiotics after the sensitivity tests for bacteria. Above 4,500 populations were participated in social mobilisation and sanitation campaign. Bishan Gari 4,940 sachets, PUR 1,220 sachets and water guard 970 bottles were distributed to treat the water for drinking and household utilisation. Regional health bureau and zonal health department supplied WASH supplies and drugs for epidemic control and prevention interventions. Active case search was strengthened in two kebeles around Mirro River for additional cases. Health education was conducted at six villages (two villages of Chali and four villages of Beneta kebeles) following Mirro River on estimated risk factors, water treatment, latrine utilisation, handwashing practice and transmission of the disease. Water chemical demonstration was conducted at those six villages.

DISCUSSION

We identified large number AFI outbreaks in Bena Tsemay and Maale woredas following Mirro River, which borders Chali kebeles of Bena Tsemay and Beneta kebele of Maale woreda. The laboratory investigation confirmed that Mirro River was contaminated and stool culture confirmed the presence of Salmonella para-typhi, bacteria responsible for the outbreak (5). All the cases of two kebeles have a common source of the epidemic in which the residence of all cases was found around the river. They used the river for different purposes at the household level and they have been drinking the river without chemical treatment. Therefore, Mirro River was the confirmed source of infections and the transmission of the disease was due to the common utilisation of this water by both kebeles.

Productive age groups were most affected populations by the epidemic in both kebeles. Age-specific attack rate was below 25 children per 1,000 under five population. Case fatality rate of the outbreak was below expected amount (7). This may be due to effective

case management and active surveillance activities (8). Drinking of Chaqa was not considered as risk factors because they used well-boiled water for its preparation.

The epidemic curves of both kebeles showed propagated outbreak in which the transmission of disease was from person to person (9). The epidemic curve picked-up on 17 May 2016 due strong active surveillance and sensitivity of community case definition of the disease.

Clinical findings confirmed that the sign and symptoms of most cases matched with that of typhoid fever (7). Environmental sanitation campaign and public health interventions resulted in gradual decreasing of cases and early controlling of the outbreak.

LIMITATIONS

Case-control study was not conducted to identify risk factors due to time constraints and resource limitation. Food samples were not collected for laboratory examinations due to a shortage of laboratory personnel in the area.

CONCLUSION

There was confirmed an outbreak of typhoid fever in two woredas of South Omo zone. The occurrence of the outbreak was related to low coverage of latrine and poor handwashing practice in the community. Lack of safe drinking water was one of estimated risk factor for the outbreak in which the community used Mirro River for drinking which contains faecal coliforms during laboratory investigation.

RECOMMENDATION

Safe drinking water should be considered for areas to prevent waterborne and foodborne diseases in the community. Public and household latrine should be constructed 100% at the areas. Supply of water treatment chemicals should be continued for the next three months for the areas where Mirro River used as drinking water.

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9.2. Summary of training on Public health surveillance and Diseases of Public Health Intelligence – at Tembaro/Mudula primary hospital from December 13 – 17, 2016

Introduction

Public health emergency management is designed to ensure rapid detection, anticipation and gathering information of any public health threats, preparedness related to logistics and fund administration, and prompt response to and recovery from various public man-made and/or natural health emergencies. Public health surveillance need for containment epidemics/outbreaks. Acute watery diarrhea (AWD) and Scabies get high public health importance in the SNNPR region since 2015. Kembata Tembaro is one of areas which affected by these diseases in 2016 in the region.

Integrated disease surveillance, risk assessment, early warning and preparedness, response, and recovery activities are the major tasks of the public health emergency management process of the health sector at all level. Despite these major activities, most PHEM officers and health workers who participated on containment of AWD and scabies outbreak in the zone were not trained when their training status reviewed. So that, the regional PHEM core process decided to give training for the zonal and district PHEM officers, and outbreak case management team members on the PHEM overview and outbreaks management in collaboration with SAVE the CHILDREN Ethiopia.

Objectives of the training

To train the new officers and refresh previously trained officers on PHEM activities

To capacitate health workers on AWD and scabies outbreak prevention and control interventions

Methods of training

Power point presentations, Group work and presentations, Discussion and experience sharing and Pre and post-tests for evaluation are the ways of delivering training.

Result

Totally 37 (95.6%) participants: 19 PHEM officers (2 zonal officers, 14 district officers and 3 town PHEM delegates) and 18 health workers (5 from Mudula primary hospital, 13 from health centers of Tembaro district where ongoing AWD outbreak present at the time of training) were trained on the PHEM overview and outbreak management.

The lowest and highest scorers earned for pre-test 13 (28%) and 37 (80%) whereas that of post-test was 27 (59%) and 45 (98%) respectively.

Statistical Measurements	Pre-test score	Post test score	% Pre test	% Post test	Difference
SUM	894	1338	53%	79%	26%
Mean	24	36	53%	79%	26%
Mode	18	33	39%	72%	33%
Median	23	37	50%	80%	30%
Range	24	18	52%	39%	-13%
Variance	37.4	23.0	81%	50%	-31%
Standard Deviation	6.1	4.8	13%	10%	-3%

Major topics covered during the training and its modulators

1. PHEM Overview - Mr. Yeshitila Mogessie, Regional PHEM Officer and EFETP graduate of Cohort IV
2. Epidemiology, pathogenesis and clinical features of AWD/cholera – Mr. Wadu Marshalo, EFETP Resident, Cohort VII
3. AWD Case management and outbreak control - Mr. Yeshitila Mogessie, Regional PHEM Officer and EFETP graduate of Cohort IV
4. Monitoring and Evaluation of AWD outbreak management – Mrs. Mekdes Demissie, Regional PHEM officer and EFETP graduate of Cohort III
5. Scabies outbreak response was presented by different experts and regional PHEM officers

I took the opportunity to present and facilitate on session of Epidemiology, pathogenesis and clinical features of AWD/cholera. The participants were held group discussion and then presented following each session with experience sharing by each other.

Conclusion

It was an important training for the PHEM officers and outbreak management teams since knowledge gap between trainers was narrowed at the end of training. The health facility workers were capacitated for AWD and scabies case management and outbreak prevention and control interventions after the training.

9.3. Weekly PHEM Bulletin Preparation

9.2.1. Weekly Bulletin for Epidemiological week 40, 2016, SNNPR - Ethiopia

South Nations, Nationalities and People's Regional State Health Bureau

Public Health Emergency Management (PHEM) Core Process

WEEKLY PHEM BULLETIN

Epidemiological Week 40, 2016 (23/01/09 - 29/01/2009 E.C); Hawassa; Tele:0462120281; phemsnnpr@gmail.com By Wadu Marshalo

Highlight of the week

- ✓ Weekly Report 91% completeness and 80% Timeliness
- ✓ AWD outbreak is ongoing actively in Wondo genet and Hawassa City in the region.
- ✓ Malaria outbreak at Salamago and Dasenech Woredas, South Omo zone
- ✓ Disaster management at Gedeo zone due to internal conflict

Weekly PHEM report completeness

All zones and special woredas have delivered weekly PHEM report in the 40th epidemiological week of 2016. Out of expected 4,625 governmental health facilities in the region, 4,208 health facilities submitted PHEM report in the week. Subsequently, 91% of PHEM report completeness has been achieved at the regional level in this week while the regional target is 90% and above.

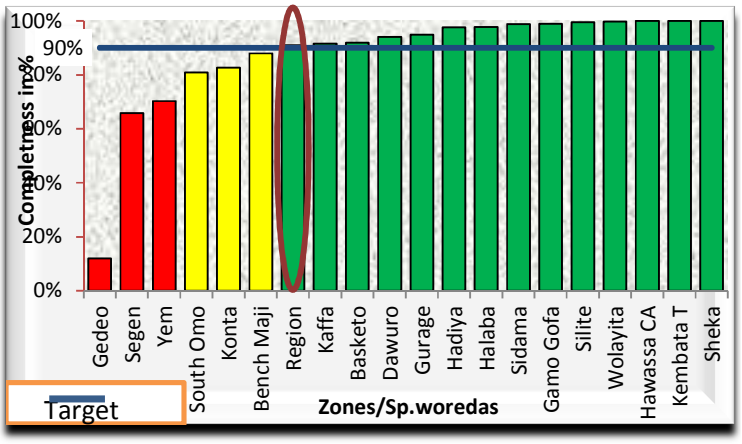


Fig.1: PHEM report completeness by zones/special woredas in SNNPR, Week 40, 2016

As it is presented in figure 1 above, seven zones namely Silite, Sheka, Wolaita, Sidama, Gamo Goffa, Kembata Tembaro and Hawassa town reported 99 - 100% while Gadeo, Segen, South Omo, Benchi Maji zones and Yem, Konta special woredas reported far below (12 – 88%) the target of report completeness in the week. Therefore, Low performing special Woredas and zones need support from the RHB.

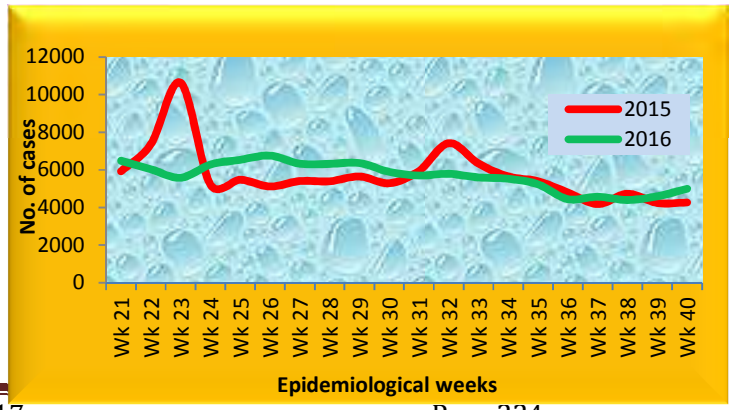
does not submit weekly report due to internal conflict as the zonal PHEM responded.

1. Malaria

In this week, 31,225 suspected malaria cases were examined by RDT/microscopy and 4,892 cases were reported as confirmed malaria. From the total confirmed cases, 2 deaths (CFR = 4 per 10,000 confirmed cases at regional level) reported from Wolaita Soddo hospital. Of which Falciparum cases were 2,962 (59.3 %), P. vivax cases were 1,930 (38.6%) and the rest 103 (2.1%) were treated clinically. In general, 4,995 confirmed and clinical cases of malaria were reported in the region. Of these cases, 4,953 (99 %) were outpatients and 42 (1%) were inpatients.

Table 1: Top 15 Woredas for malaria in week 40, 2016, SNNPR -Ethiopia

S.No.	Woredas	Week 40
1	Dasench	279
2	Salamago	250
3	Uba Debretsahay	129
4	Shone taHO	117
5	Arba Minch taHO	111
6	Gena Bosa WoHO	110
7	kucha	103
8	Zalla WoHO	95
9	Yeki	95
10	Daramalo WoHO	84
11	Burji WoHO	83
12	Hawassa sub city	81
13	Konta	81
14	Abeshge	80
15	Kemba	77



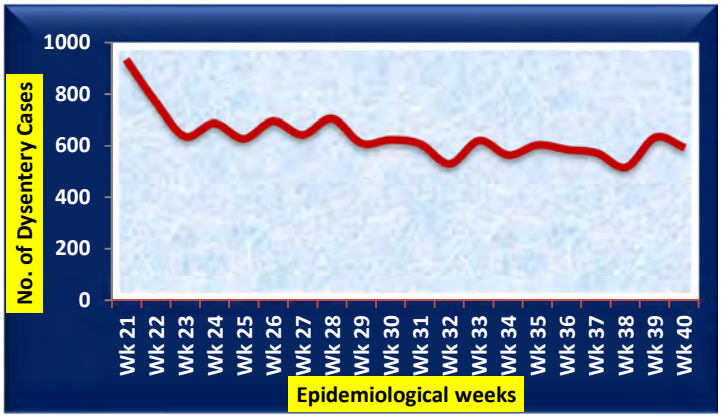


Fig. 6: Trend of dysentery cases for the last 20 weeks, SNNPR, week 40, 2016

During the week, Hawassa Sub city, Basketo, Cheha and Enemor Ener Woredas reported the highest number of 25 - 22 dysentery cases followed by Gedebano Gutazer, Melga and Salamago woredas with 18, 16 and 16 cases respectively in the region.

Table 3: Top Eight woredas/HSPs for Dysentery in week 40, 2016

S. No	Woredas	Week 40
1	Hawassa sub city	25
2	Basketo	24
3	Cheha	23
4	Enemor Ener	22
5	Gedebano Gutazer	18
6	Melga WoHO	16
6	Salamago	16
7	Gumer	13
7	Borricha WoHO	13
8	Bombe HSP	12
8	Bolossa Bonibe WoHO	12
8	Chena WoHO	12

1. Severe Acute Malnutrition

In this week, a total of 686 severe acute malnutrition (SAM) cases were reported in the region. Of these 565 were outpatient and 121 were inpatient cases with two deaths during the week. Each death was reported from Segen town and Butajira hospital.

Generally, the number of SAM cases increased at the regional level by 5 as compared to week thirty-nine (n= 681). As shown in figure 7 below, the inpatient SAM (SC) cases increased in the week by 39 when compared to that of week 39. However, there was slight decrease by outpatient SAM (OTP) by 4 in this week as compared to that of week 39. The SAM case has been increasing since week 36, 2016 in the region.

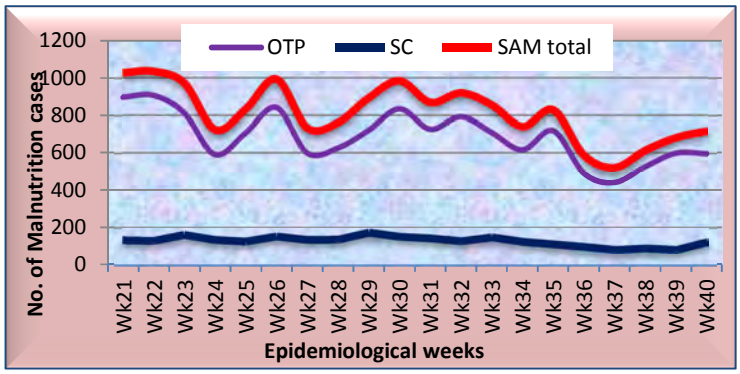


Fig.7: Trend of Severe Acute Malnutrition (SAM) cases in the last 20 weeks in SNNPR, week 40, 2016

As the Figure 8 described, Gamo Goffa zone reported the highest number of SAM cases (n= 112) followed by Sidama, Hadiya and Wolaita zone with 103, 103 and 96 cases in the week. Only Gedeb woreda reported weekly report from Gedeo zone thus SAM decreased due to no report. Kemba, East Badawacho, Silti and Sore woredas are top fours for SAM cases during the week in the region with 31, 27, 20 and 19 cases respectively.

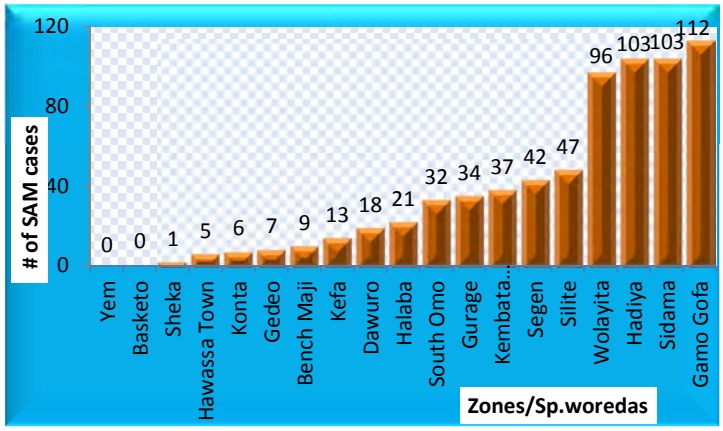


Fig. 8: Number malnutrition cases by zones/ Sp.woredas, SNNPR, week 40, 2016

2. Measles

In this week only 2 suspected measles cases reported in the region. Each case was reported from Kebena Woreda in Guraghe zone and Yirgalem hospital in Sidama Zone. Other zones and special woredas are silent for case based surveillance for none measles febrile rash cases in the week. However, in considering the remaining three months ahead in 2016, improving active case search is necessary for zones/special woredas where the measles surveillance is unsatisfactory in the last 9 months of the year, 2016.

3. AFP

During the week, there was no AFP case report in the region. As the achievement was very low for AFP active case search, zones and/or special woredas who are below the target performance should be considered to report all non-polio acute paralysis cases.

4. AWD

Active AWD outbreak is ongoing in Wondo genet woreda of Sidama zone and Hawssa town in the region during the week.

5. Maternal death

There was no maternal death report in the week. But there should be a great consideration to notify any death of women aged 15 – 49 years.

6. Rabies

The suspected 11 dog bites reported from Tarcha hospital in Dawro zone in this week that needs to confirm whether it is rabies or not.

No case or death of Anthrax, NNT, yellow fever, AHI, SARS, Pandemic influenza, Viral Hemorrhagic Fever, Guinea worm, and Smallpox reported in the region in this reporting period**.**

7. Others

Scabies outbreak has been under investigation at Halaba special woreda and disaster management due to internal conflict at Gedeo zone has been also under response.

8. Preparedness

PHEM officers who trained basic level training are undergoing data collection and analysis based on their respective health facility level.

Contact us:
Email: phemsnnpr@gmail.com
Tele: 0462120281

Your comments will have a significant role in improving our bulletin!

About this newsletter:

The PHEM bulletin is the weekly bulletin of the south Nations nationalities and People's Regional State Health Bureau, Public health emergency management *core process. It is prepared and disseminated on a weekly basis*

. Strengthening PHEM is safeguarding the community from public health threats

South Nations, Nationalities and People's Regional State Health Bureau
Public Health Emergency Management (PHEM) Core Process
WEEKLY PHEM BULLETIN
Epidemiological Week 46, 2016 (12/03/09 - 18/03/2009 E.C); Hawassa; Tele:0462120281;
phemsnnpr@gmail.com By Wadu Marshalo

Highlights of Bulletin

- Malaria cases decreased
- Have ongoing outbreaks of Scabies and AWD
- Have case based report of AFP and Measles

Background: PHEM is the process of anticipating, preventing, preparing for, detecting, responding to, controlling and recovering from consequences of public health threats in order that health and economic impacts are minimised. Analysing weekly surveillance data and sharing to different stakeholders and to those who can support could strengthen PHEM in the region as well in the country.

Weekly surveillance report completeness

All 15 zones and 4 special woredas of the region reported the 46th epidemiological week of 2016 weekly IDSR. Out of expected 4,635 governmental health facilities in the region, 4,410 health facilities submitted IDSR report, representing 95 % of report completeness which meets the regional target, 90%.

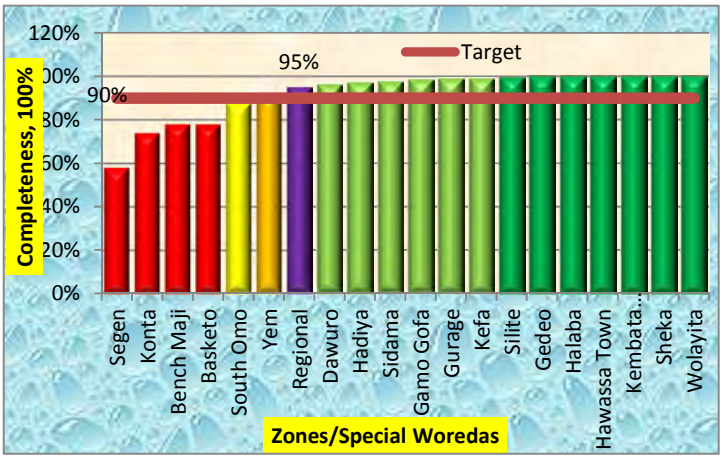


Fig.1: PHEM report completeness by zones/special woredas in SNNPR, Week 46, 2016

As it is presented in figure 1 above, five zones namely Silite, Gedio, Kembata Tembaro, Sheka and Wolaita zones, Hawassa city administration and Halaba special woreda reported 100% whereas Segen Area Peoples, Bench Maji, South Omo zones and Konta, Basketo special woredas reported below the target and regional completeness in the week. Guraferda woreda from Bench Maji one and Segen Town, Konso woreda, Gidole HSP and Karat HSP from Segen Area people zone have not reported in the week. Therefore, Low performing special Woredas and zones need support from the RHB.

Weekly surveillance report Timeliness

Timeliness of the region in the 46th week 2016 is about 70%. Aman hospital from Bench Maji zone, Dawuro, Keffa, Kembata Tembaro, Segen Area people and Wolayita zones have a late report in the week for the region. Every zones and special woredas should give great emphasis for timely reporting in which timely detection of events give chance to save a life.

Malaria

Totally 4, 277 outpatient and 26 inpatient malaria cases were treated in different health facilities in this week. Out of 34,128 suspected malaria case examined by RDT/microscopy, 2,235(6.55%) cases and 1,917 (5.61%) cases were reported as confirmed malaria for P. falciparum and P. vivax respectively. In general, a total of 4,152 (96.49%) confirmed and 151 (3.51%) clinical cases of malaria were reported in the week

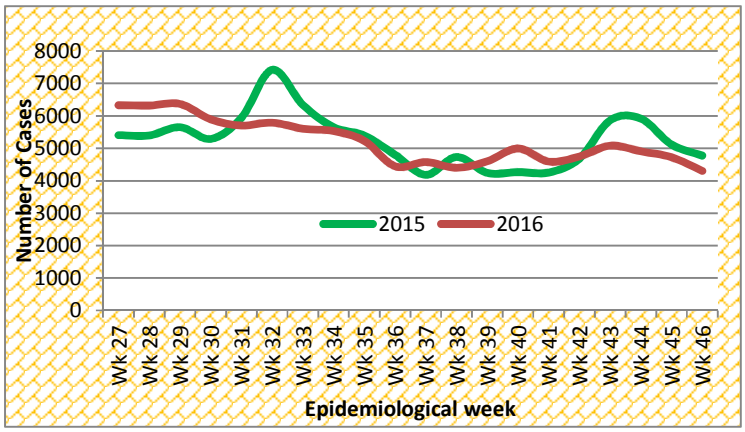


Fig.2: Trend of Malaria cases over the last 20 weeks in SNNPR, week 46, 2016

As compared with the last week (4724 cases), the number of malaria cases decreased in this week by 421 cases. As it is described in figure 2 above, the number of malaria cases remains stable since the last 20 weeks in the region as compared to the last year the same weeks. Malaria cases were slightly increased in Segen Area peoples, South Omo, Kembata Tembaro zones and Basketo special woreda by 44, 23, 6 and 9 cases respectively.

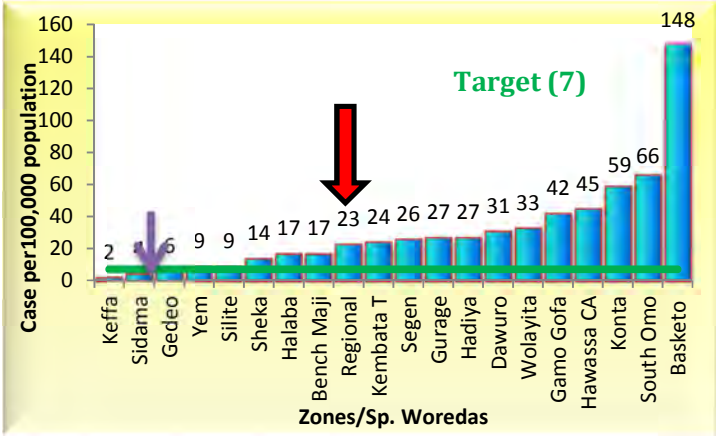


Fig.3: Malaria cases per 100,000 populations by zones/Special woredas in SNNPR, week 46, 2016

As last week, Basketo special woreda reported the highest malaria incidence rate with 148 cases per 100,000 populations in the week. Despite the incidence of malaria decreased for regional level, Basketo special woreda remained the highest incidences for the last 10 weeks. Except Gedeo, Sidama and Keffa zones, other zones and special woredas have a high incidence rate of a regional/national target for malaria (7 malaria cases per 100,000 populations). The incidence rate of Basketo special woreda was 2 – 3 folds higher than that of South Omo, Konta special woreda and Hawassa City administration in which they reported 66, 59 and 45 cases per 100,000 populations in the week 46 respectively. Keffa, Gedeo, Sidama and Yem special woreda reported the least cases with 2 – 9 malaria cases per 100,000 populations in the week.

Despite malaria cases decreased significantly, Salamago woreda from South Omo zone reported the leading malaria case since week 1, 2016 with the report of 221 malaria cases in this week. The woreda also reported 278, 220, 189 and 221 cases in the last four weeks. Hawassa sub city, Uba Debretsehay from Gamo Goffa zone, Shone town administration from Hadiya zone, Basketo special woreda and Shashogo woreda from Hadiya zone are reported 2 to 6 top malaria cases in the week with 117, 117, 115, 104 and 93 cases in the week respectively. (See table 1 below).

These 15 woredas contributed 1503 (35%) of total malaria in the week. prevention and control interventions should be strengthened in these areas before the case building increase.

Salamago woreda from South Omo zone reported the highest malaria cases in the region with a total of 1080 cases within the last five weeks of 2016. Uba Debretsehay, Kucha, Hawassa sub city and Arba Minch town reported the second to fourth highest malaria case with a total of 601, 550, 547 and 524 cases in the past five weeks. Despite different prevention and control measures were done in the area, malaria morbidity is still high that need intensive follow-up of the intervention activities. (See table 2)

Table 1: Number of malaria cases in 15highest reporting woreda in SNNPR, Week 46 in 2016.

S.no.	Woredas	week 46
1	Salamago	221
2	Hawassa sub city	117
3	Uba Debretsahay	117
4	Shone taHO	115
5	Basketo	104
6	Shashago WoHO	93
7	Daramalo WoHO	93
8	Abeshge	91
9	Cheha	87
10	Kemba	85
11	Arba Minch taHO	84
12	kucha	84
13	Zalla WoHO	75
14	Amaro WoHO	69
15	Loma Bosa WoHO	68

Table 2: Top 20 woredas with highest malaria case in last five weeks, SNNPR, week 46,2016

Woreda/Town	wk42	wk43	wk44	wk45	wk46	Total
Salamago	172	220	278	189	221	**1080**
Uba Debretsahay	101	150	146	87	117	**601**
kucha	116	125	127	98	84	**550**
Hawassa sub city	98	97	108	127	117	**547**
Arba Minch taHO	85	102	143	110	84	**524**
Shone taHO	98	90	123	96	115	**522**
Abeshge	97	100	125	81	91	**494**
Cheha	96	86	107	98	87	**474**
Daramalo WoHO	90	92	120	66	93	**461**
Gena Bosa WoHO	95	58	129	107	50	**439**
Zalla WoHO	84	86	92	86	75	**423**
Basketo	62	74	83	95	104	**418**
Shashago WoHO	76	75	78	84	93	**406**
Malie	52	191	67	45	40	**395**
Konta	78	80	58	84	67	**367**
Welkite Town Ad.	80	84	96	65	42	**367**
Arba Minch Zuria	77	56	71	90	57	**351**
Kebena	65	51	79	84	63	342
Amaro WoHO	62	81	58	69	69	**339**
Kemba	80	74	0	83	85	**322**

Meningitis

In this week, 3 suspected outpatient and 17 suspected inpatient meningitis cases with one death were reported in the region. Outpatient cases were reported from Humbo (2 cases) woreda in Wolayita zone and Bona hospital in Sidama zone while 17 inpatient cases were reported from Hawassa referral Hospital (6 cases with 1 death), Dilla Hospital (4 cases), Sodo Hospital (2), Bonga Hospital (1), Durame Hospital (1), Adare Hospital (1) and Jinka Hospital(1). The number of meningitis cases remains the same as the last week but increased by 7 cases as compared with week 43 and 44, 2016.

However, the cases were slightly increased since week 38, 2016 in the year, and the number of case crosses the line of 2015 on week 44. (See figure 4) Active case search and surveillance should be taken into consideration in Gedeo, Sidama, Wolayita zones and Halaba special woreda as they reported a significant number of meningitis cases since week 26, 2016.

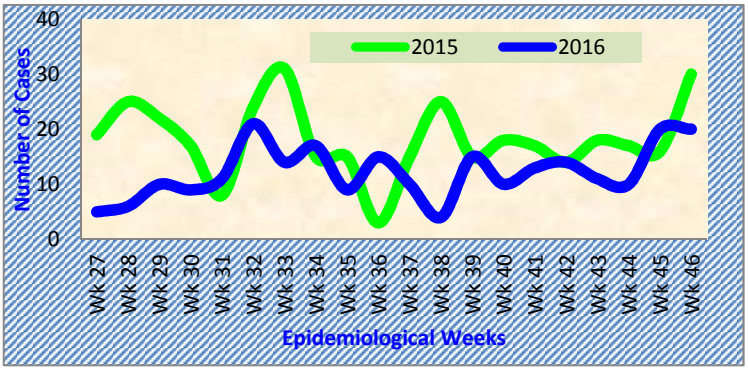


Fig.4: Trend of suspected meningitis cases over the last 20 weeks in SNNPR, week 46, 2016

Dysentery

About 548 dysentery cases (546 OPD and 2 IPD) with zero death were reported from governmental and non-governmental health facilities in the 46th week 2016. The number of dysentery cases increased by 11 as compared to the last 45th week (537 cases were reported in week 45). As it is depicted in fig. 5 below the dysentery cases were stable for the last 20 weeks with slight decrease since 39th week 2016.

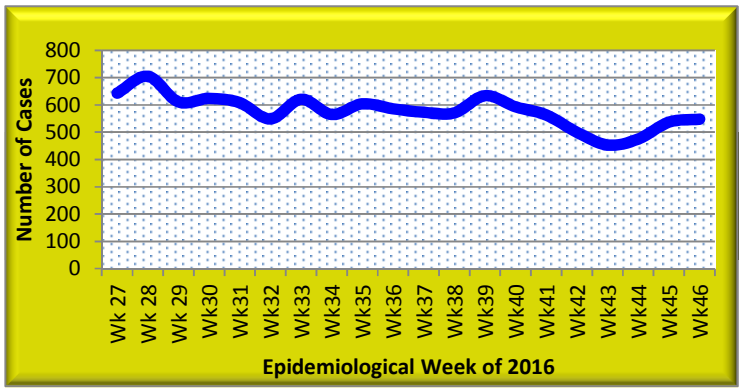


Fig. 5: Trend of dysentery cases for the last 20 weeks, SNNPR, week 46, 2016

As described in fig. 6, Basketo special woreda was reported the highest number of dysentery cases following Hawassa sub city, Wonsho and Enemor Ener woredas. Out of top fifteen, 7 woredas were reported from Sidama zone. (See figure 6)

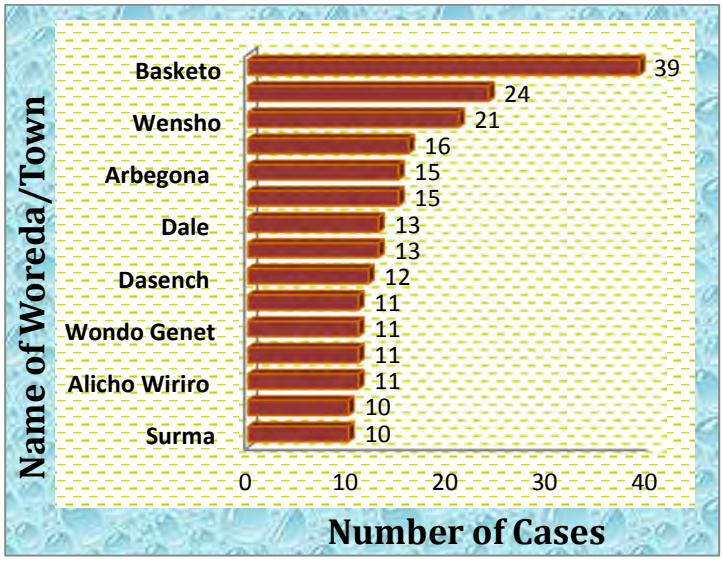


Fig. 6: Top Fifteen woredas/town of dysentery cases, SNNPR, week 46, 2016.

Severe Acute Malnutrition

In this week, 606 severe acute malnutrition (SAM) cases were reported in the region. Of these 488 were outpatient and 118 were inpatient cases with only one death during the week. The death was reported from Dilla Hospital. The number of SAM cases and death were decreased at regional level by 82 cases and 1 death respectively in the week as compared with 45th week (688 SAM cases), but SC cases increased by 28 cases in the 46th week (90 SC cases) as compared to 45th week, 2016 (90 SC case). This indicates that OTP service at health post level was not strong as a previous week to decrease SC cases. So that early detection of SAM cases at health post level should be strengthened by intensive supervision.

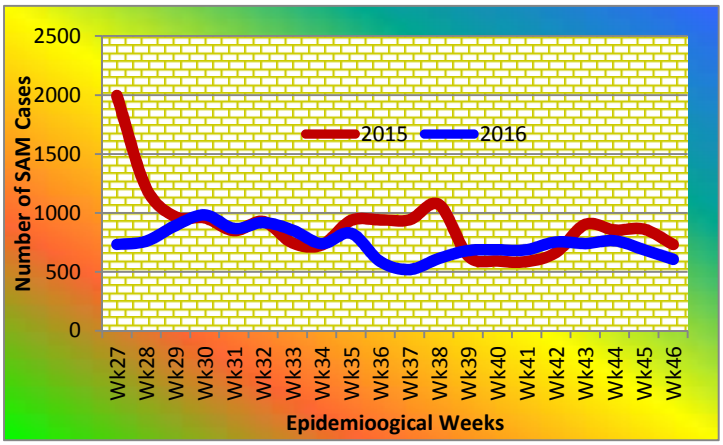


Fig.7: Trend of Severe Acute Malnutrition (SAM) cases over the last 20 weeks in SNNPR week 46, 2016

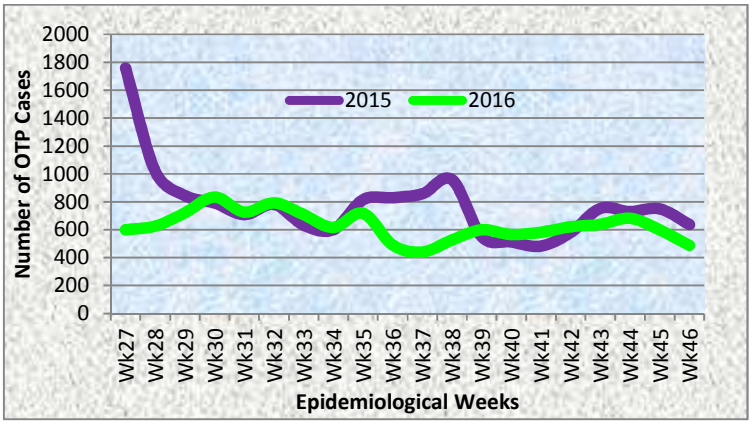


Fig. 8: Trend of OTP cases over the last 20 weeks in SNNPR week 46, 2016

Figure 8 depicts that OTP cases decrease in the week as compared with the same week of last year. Despite OTP cases were stable at the regional level; SC cases were increased since a 43th week in the year.

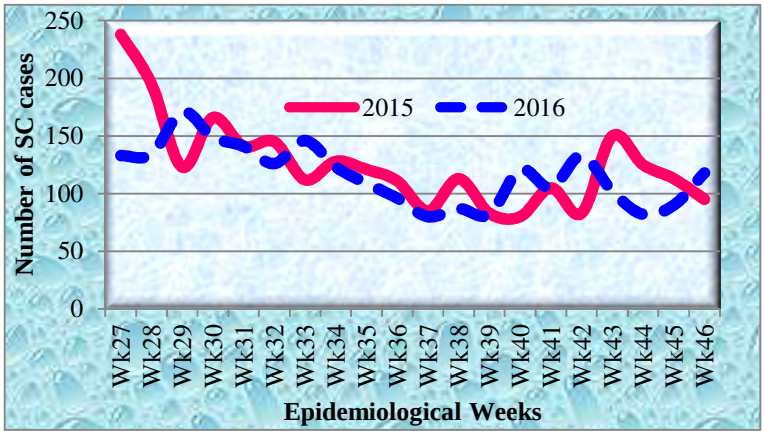


Fig. 8: Trend of SC cases over the last 20 weeks in SNNPR week 46, 2016

Table 3: Top fifteen highest malnutrition cases by zones/ Sp.woredas, SNNPR, week 46, 2016

Woreda/Town	OTP	SC	Total SAM
Halaba Town Ad.	13	10	23
Dara WoHO	21	0	21
Soro WoHO	20	0	20
East Badwacho WoHO	19	0	19
Dale WoHO	18	1	19
Aleta Chuko WoHO	16	1	17
Hadero Tunto Zuria WoHO	16	0	16
Dilla Zuria WoHO	9	5	14
Gibe WoHO	13	0	13
Kemba	12	1	13
Bensa WoHO	12	0	12
Sankura WoHO	11	1	12
Duna WoHO	11	0	11
Misha WoHO	11	0	11
Daramalo WoHO	7	4	11

Halaba sp. woreda, Dara. Soro, East Badawacho and Dale woredas reported 1st to 5th highest SAM cases in the week 46th 2016. (See table 3).

Table 4:* Week 46, 2016 Total SAM cases by Zones/Sp. Woredas, *SNNPR, week 46, 2016

Zone/Sp. Woredas	OTP	SC	Total SAM
Sidama	117	12	129
Hadiya	95	0	95
Gamo Gofa	67	15	82
Gedeo	38	14	52
Wolayita	33	7	40
Kembata Tembaro	32	6	38
Halaba	14	19	33
Silite	21	7	28
Gurage	13	9	22
Segen	16	5	21
South Omo	16	1	17
Dawuro	7	5	12
Hawassa Town	3	7	10
Bench Maji	7	2	9
Kefa	5	3	8
Konta	3	4	7
Basketo	0	2	2
Yem	1	0	1
Total	**488**	**118**	**606**

Sidama zone reported the highest SAM cases, 129 (117 OTP and 12 SC) cases in the week.Hadiya, Gamo Goffa and Gedeo zones reported the next second to fourth highest SAM cases in the week

Scabies

Table 5; Number of Scabies cases as of November 24, 2016, in Zone/Sp. Woredas, SNNPR

Zone/Sp. Woreda	Total Population	Scabies cases	AR/10,000 pop.	Remark
BASKETO	70,299	217	31	
KONTA	113,792	5114	449	
GAMO GOFA	1,992,955	125	1	
WOLAITA	1,882,833	7778	41	
DAWRO	609,719	10072	165	
GURAGE	1,609,908	521	3	
HADIYA	1,573,841	11025	70	
KEMBATA TEMBARO	857,375	1023	12	
HALABA SP.	310,690	34271	1,103	
SILITE	937,007	170	2	
SIDAMA	3,628,716	3785	10	
Total	**13,587,135**	**74101**	**55**	

As of 24 November 2016, totally 74,101 scabies cases were reported in the region. Halaba sp. Woreda was highly affected next to Hadiya, Dawuro, Wolaita and Konta special woredas. The attack rate of Halaba sp. Woreda has 1,103 persons per 10,000 populations and that of Konta, Dawuro, Hadiya and Wolaita was 449, 165, 70 and 41 persons per 10,000 populations respectively. Totally 11 zones, 44 Woredas and 294 Kebeles were affected by scabies in the region as

Dubbo hospital from Wolayita zone and Yirgalem hospital from Sidama zone

9. Measles cases

Totally 12 suspected measles cases were reported in this week. Arbaminch zuria (4 cases), Chencha woreda (2 cases), Chencha hospital (2 cases) and Konta sp. Woreda (2 cases) were reported 10 suspected measles cases in the week. The rest 2 cases were reported from Wonago and Hulbareg woredas.

1. Epidemic Typhus

In the 46th week, totally 2,018 outpatient epidemic typhus cases reported in the region. The number of cases decreased by 23 as compared to week 45 (2,041). Hawassa sub city, Yirgalem town, Ezha, and Sodo woredas reported 367, 112, 95 and 91 cases respectively.

2. Typhoid Fever

There was a total of 8,046 suspected typhoid fever cases (8,039 OPD and 7 IPD) were reported in this week with zero death report. The number of cases increased by 278 cases as compared to week 44, 2016 (8,324). Hawassa sub city (398), Sodo woreda (340), Enemor Ener woreda (259), Dilla hospital (191) and Hossana town (183) were reported five highest typhoid fever reported areas.

reported on 24 November 2016.

8. AFP

In the 46th week, six suspected AFP cases were reported in the region. The cases were reported from Boreda, Kucha, Kamba woredas and Arbaminch hospital from Gamo Goffa zone each AFP case. The rest two cases were reported from

AWD

Three AWD cases are reported from Hawassa city administration in the region during the week. There has active ongoing AWD outbreak in Kembata Tembaro zone, in Tembaro woreda totally 18 cases as of November 25, 2016, report. The outbreak response team was sent to the area on 26 November 2016 from the region.

Relapsing fever and Maternal Death

Zero maternal death was reported in the region in the week. Only one OPD & one IPD relapsing fever cases reported in this week.

No case or death of NNT, yellow fever, Anthrax, AHI, SARS, Pandemic influenza, Viral Hemorrhagic Fever, Guinea worm, Smallpox, and Rabis reported in the region in this reporting period**.**

Contact us:
Email: phemsnnpr@gmail.com
Tele: 0462120281

Your comments will have a significant role in improving our bulletin!

About this newsletter:

The PHEM bulletin is the weekly bulletin of the south Nations nationalities and People's Regional State Health Bureau, Public health emergency management core process. It is prepared and disseminated on a weekly basis.

Strengthening PHEM is safeguarding the community from public health threats

South Nations, Nationalities and People's Regional State Health Bureau
Public Health Emergency Management (PHEM) Core Process

WEEKLY PHEM BULLETIN

Epidemiological Week 10, 2017 (27/06/09 - 03/07/2009 E.C); Hawassa;
Tele:0462120281;

phemsnnpr@gmail.com By Wadu Marshalo

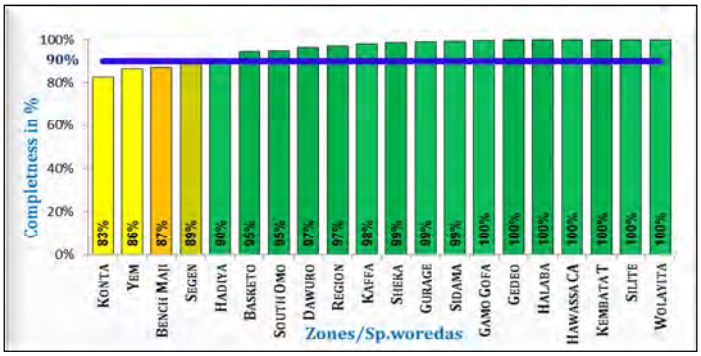
Highlight of the week

- ✓ Weekly Report 97% completeness and 93% Timeliness
- ✓ AWD outbreak is ongoing actively in Duguna Fango and East Badawacho in the region.
- ✓ Malaria outbreak at Arbaminch Town and Guraferda Woreda in Bench Maji zone; weekly malaria and SAM cases increased
- ✓ Scabies affected 16 zones, 101 Woredas and 1,316 Kebeles in the region

Background: PHEM is the process of anticipating, preventing, preparing for, detecting, responding to, controlling and recovering from consequences of public health threats in order that health and economic impacts are minimised. Analysing weekly surveillance data and sharing to different stakeholders and to those who can support could strengthen PHEM in the region as well in the country.

Weekly PHEM report completeness

All zones and special woredas reported weekly PHEM report in the 10th epidemiological week of 2017. Out of expected 4,635 governmental health facilities in the region, 4,470 health facilities submitted PHEM report in the week. Subsequently, 97% of PHEM report completeness has been achieved at the regional level in this week while the regional target is 90% and above. Menit Shasha, Shebench and Maji woredas of Bench Maji zone achieved 46%, 68% and 71% completeness respectively. Similarly, Derashe and Konso Woredas of Segen Area Peoples' zone reported 52% and 76% completeness respectively in this week. There was no report from Shone town administration of Hadiya zone.



As it is presented in figure 1 above, only two zones, namely Segen Area Peoples and Bench Maji zones reported below 90%. And Yem and Konta special woredas reported below 90%, the target of report completeness in the week. Therefore, Low performing special Woredas and zones need support from the RHB.

Malaria

In this week, 33,547 suspected malaria cases were examined by RDT/microscopy and 4,289 cases were reported as confirmed malaria. From the total confirmed cases with no death. Of which P.falciparum cases were 2,651 (62%), P.vivax cases were 1,638 (38%) and only 62 (1.4%) were treated clinically in the week. In general, a total of 4,351 confirmed and clinical cases of malaria were reported in the region. Of these cases, 4,293 (98.7 %) were outpatients and 58 (1.3%) were inpatients.

Table 1: Top 15 for malaria in week 10, 2017

s.no.	Woredas	total case	Incidence per 100,000pop
1	Arba Minch taHO	353	427
2	Guraferda WoHO	332	730
3	Salamago	169	478
4	kucha	129	68
5	Arba Minch HSP	117	Arbaminch Town
6	Gena Bosa WoHO	98	90
7	Konta	96	82
8	Basketo	94	131
9	Amaro WoHO	91	49
10	Offa WoHO	82	62
11	Arba Minch Zuria	75	36
12	Daramalo WoHO	72	70
13	Burji WoHO	67	93
14	Surma WoHO	66	212
15	Zalla WoHO	64	68

The number of malaria cases during the week increased by 606 (14%) as compared to the las week (3,745 total malaria cases were reported in week 9, 2017). As it is described in figure 2 above, the number of malaria cases remains stable since week 1, 2017. However, the number of cases decreased since week 42, 2016 as compared to the same weeks of last year.

Arbaminch town reported the highest (353 cases) next to that of Guraferda woreda (332 cases) of Bench Maji zone. Gamo Goffa and Bench Maji zonal health departments declared malaria outbreak in these areas. A total case of

Fig.1: PHEM report completeness by zones/special woredas in SNNPR, Week 10, 2017

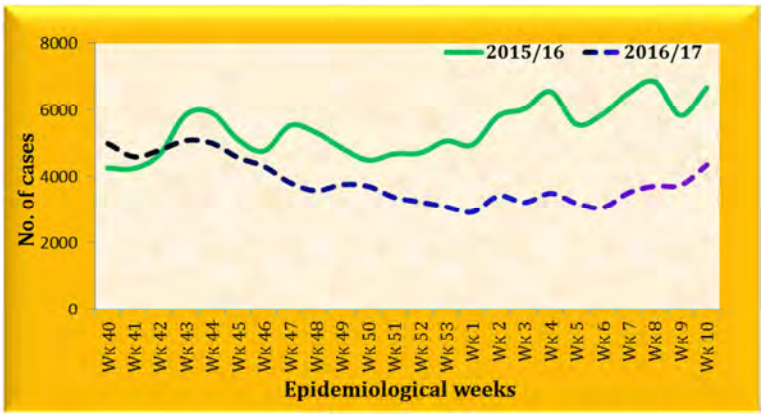


Fig.2: Trend of Malaria cases over the last 21 weeks in SNNPR, week 10, 2017

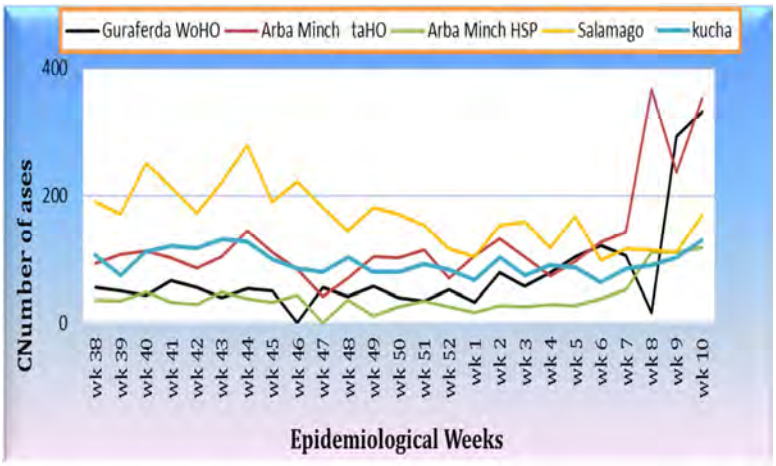


Fig.3: Top 5 Woredas' Trend of Malaria cases over the last 25 weeks in SNNPR, week 10, 2017

As figure 3 elicited, Guraferda woreda from Bench Maji zone and Arbamich town, Arbamich hospital and Kucha Woreda from Gamo Goffa zone reported the highest number of Malaria cases in the week. Salamago woreda malaria cases came to decreased since week 1, 2017 as compared to Guraferda and Arbaminch town cases.

The incidence rate of malaria was highest in Basketo special woreda with the rate of 131 cases per 100,000 populations in this week. It has increased by 30 cases per 100,000 populations in the woreda as compared to last week, 101 cases per 100,000 populations. Konta special woreda, Bench Maji, South Omo and Gamo Goffa Zones reported the second to fifth highest cases with a rate of 82, 64, 60 and 57malaria cases per 100,000 populations in the week respectively: increased in the week.

In the last one month, Arba Minch town reported the highest malaria case in the region with 1098 cases. Guraferda woreda and Salamago reported the second and third highest malaria case with 746 and 506 cases.

Arbaminch town was 470 that included Arbaminch hospital cases.

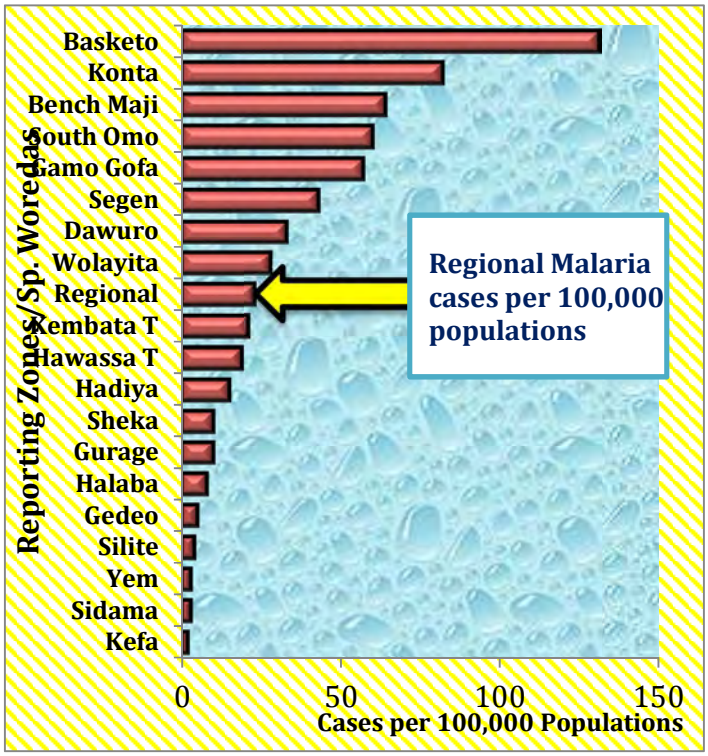


Fig.4: Malaria cases per 100,000 populations by zones/Sp.woredas in SNNPR, week 10, 2017

Table 2: Top 20 Woredas with highest malaria case in last one month, SNNPR, week 10,2017

s.no.	Woredas	wk7	wk8	wk9	wk10	Total
1	Arbaminch town	142	367	236	353	1098
2	Guraferda	105	16	293	332	746
3	Salamago	115	113	109	169	506
4	kucha WoHO	84	89	101	129	403
5	Gena Bosa	114	106	70	98	388
6	Arba Minch HSP	51	109	110	117	387
7	Uba Debretsahay	118	106	84	58	366
8	Amaro	102	94	66	91	353
9	Kemba	52	144	91	61	348
10	Basketo	79	69	79	94	321
11	Daramalo	74	77	87	72	310
12	Shashogo	76	99	51	58	284
13	Zalla WoHO	60	84	69	64	277
14	Burji WoHO	93	62	50	67	272
15	Arbaminch Zuria	58	52	76	75	261
16	Bonke WoHO	89	51	34	42	216
17	Damot Gale	47	43	52	57	199
18	Boreda WoHO	50	45	42	56	193
19	Hamer WoHO	57	51	25	56	189
20	Damot Woyde	53	44	58	27	182

Meningitis

In this week, 17 suspected meningitis cases with zero death were reported in

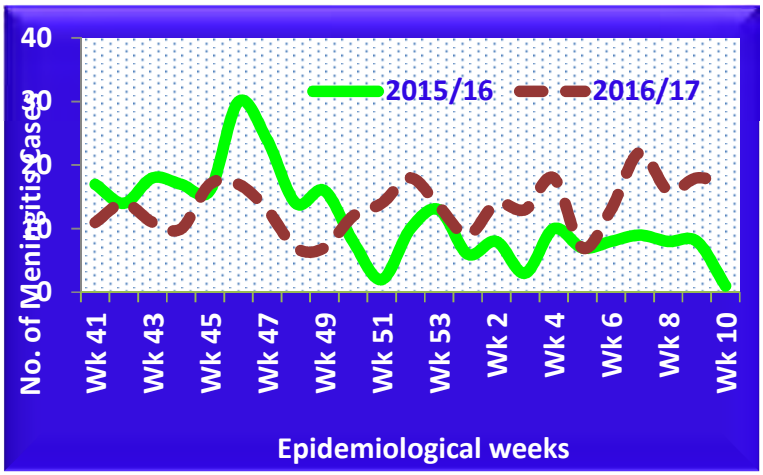


Fig.5: Trend of suspected meningitis cases over the last 20 weeks in SNNPR, week 10, 2017

Dysentery

A total of 873dysentery cases were reported in the week with zero death. All cases were treated as outpatient cases. The number of dysentery cases increased by 39 cases as compared to the last week (834 cases were reported in week 9, 2017).

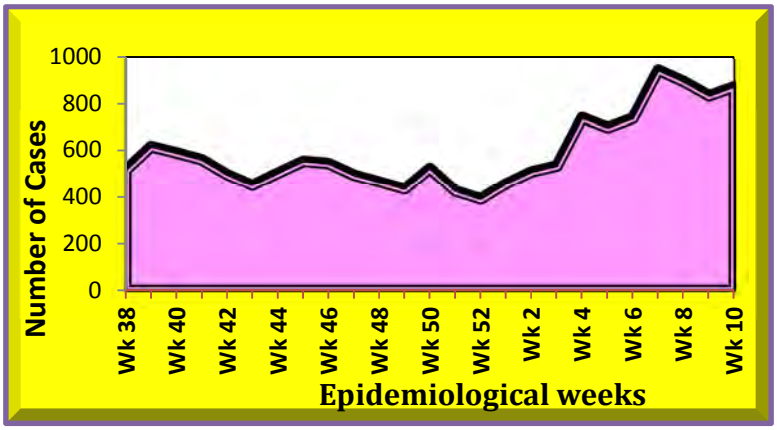


Fig. 6: Trend of dysentery cases for the last 25 weeks, SNNPR, week 10, 2017

In week 10, 2017, Borricha, Meskan woredas, Basketo special woreda, Hawassa sub-city and Hulbareg Woreda reported highest dysentery cases. As indicated in table 3, five woredas from Sidama zone, four woredas from Guraghe zone and three woredas from South Omo in which the condition anticipated as linked with the shortage of safe water in the areas.

the region. The cases are reported from Dila Hospital (8), Kele Hospital (3), Durame Hospital (1), Aman HSP (1), Bona HSP (1), Doyo Gena WoHO (1), Kacha Bira WoHO (1) and Yirgalem HSP (1).

The number of meningitis cases decreased by one case as compared to the last week (18 cases were reported in last week). Meningitis cases have been increased since week 5.

Table 3: Top 15 Woredas for Dysentery in week 10, 2017

s.no.	Woredas	Total Cases
1	Borricha WoHO	59
2	Meskan	44
3	Basketo	30
4	Hawassa sub city	28
5	Hulbareg WoHO	24
6	Dale WoHO	23
7	Loka Abaya WoHO	21
8	Gedebano Gutazer	19
9	Abeshge	18
10	Aleta Chuko WoHO	18
11	Hamer	18
12	Konso WoHO	18
13	Malie	18
14	Yirgalem taHO	17
15	Bena Tsemay	16

Severe Acute Malnutrition /SAM/

In this week, 998 severe acute malnutrition (SAM) cases were reported in the region. Of these 857 were outpatient (OTP) and 141 were inpatient cases (SC) with one death from Kefa zone Decha woreda during the week.

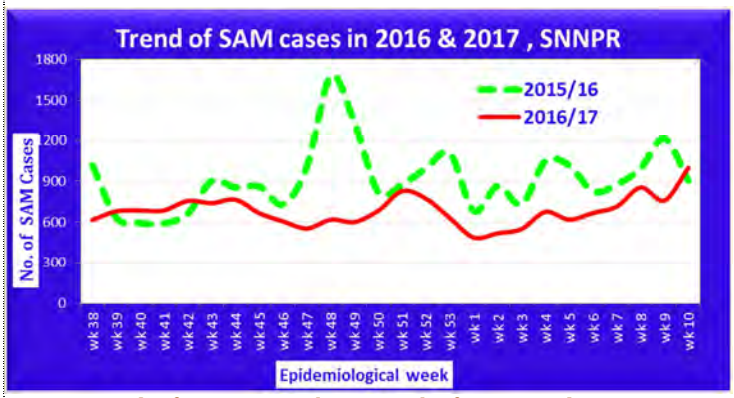


Fig. 7: Trends of SAM cases in last 25 weeks, for 2016 and 2017, SNNPR,

Generally, the number of SAM cases increased at the regional level by 238 (24%) as compared to week 9 (n= 760). As shown in figure 8 below, both OTP and SC cases have been increased since week 1, 2017.

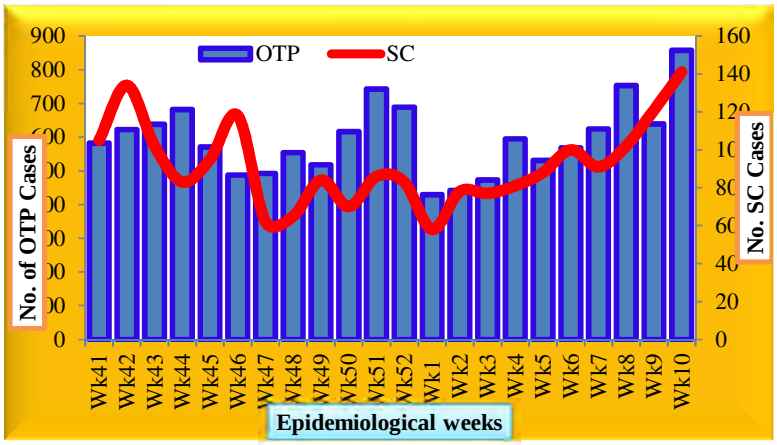


Fig.8: Trend of SC and OTP in the last 20 weeks in SNNPR, week 10, 2017

As data described on the spot map below, Sheka is the only zone not reported any SAM case while Sidama, Gedeo, Hadiya, Gamo Goffa, Wolaita, South Omo zones and Halaba special woreda reported above 65 SAM cases in the week.

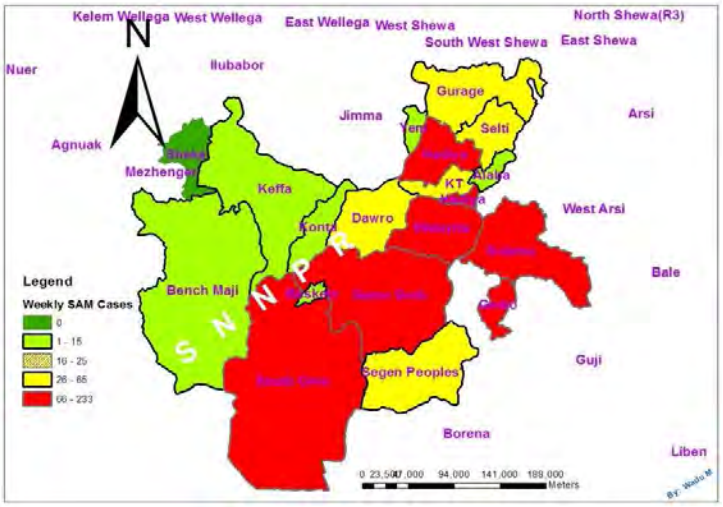


Fig. 10: Spot Map of SAM cases by zones/ Sp. woredas, SNNPR, week 10, 2017

In this week, Wenago (OTP=30, SC=10), Kochere (OTP=33, SC=5) and Yirgachefe town (OTP=30, No SC) from Gedeo zone reported highest SAM cases (see table 4 below). Gibe and Soro woredas from Hadiya zone, Borricha, Bursa, Dara, Aleta Chuko and Bensa woredas from Sidama zone were included in top 15 woredas reporting high SAM cases in the week.

Based on this evidence, regional PHEM wrote early warning letter for all structures and planned to conduct program specific supportive supervision and assessment on malaria and malnutrition status in the most affected areas in the next two weeks.

As the Figure 9 described, Sidama zone reported the highest number of SAM cases (n= 233 (24%)) followed by Gedeo (n= 160 (16%)), Hadiya (n=120 (12%)), Gamo Goffa (n=99 (10%)) and Wolaita (n=84 (8%)) zone in the week. They contributed 696 (70%) of total regional SAM in this week.

Table 4: Top 15 woredas/ town for SAM (OTP+SC) cases in Week 10, 2017

S.No	Woreda/Town	Total SAM (OTP+SC)
1	Wenago	40
2	kochere	38
3	Yrgachefe Town	30
4	Gibe WoHO	27
5	Borricha WoHO	26
6	Dilla Zuria WoHO	24
7	Silti WoHO	23
8	Bursa WoHO	22
9	Kemba	22
10	Dara WoHO	21
11	Soro WoHO	21
12	Mareko	20
13	Aleta Chuko WoHO	19
14	Bensa WoHO	18
15	South Ari	17

Measles

In this week, 13 suspected measles cases reported in the region. Shebedino and Arbegona woredas from Sidama zone reported 5 and 4 suspected measles cases respectively. All five suspected measles cases sample of Shebedino woreda confirmed +ve IgM for measles. This indicated that there was a measles outbreak in Shebedino woreda of Sidama zone. Worabe hospital from Silte and Gedebano Gutazer from Guraghe zone reported 3 and 1 suspected measles cases respectively. For the most case-based report, measles vaccination status was not filled clearly; whether it was written as 'unknown' that suspects the routine and NID/SIAs vaccination performance of the woredas under a question mark.

AFP

During the week, there was four (4) AFP cases reported in the region. Gamo Goffa, Keffa, Guraghe and Silite reported one AFP case from each. As the achievement was very low for AFP active case search, zones and/or special woredas who are below the target performance should be considered to report all non-polio acute paralysis cases.

AWD

There was no new AWD case report in this week. Active AWD outbreak is ongoing in Duguna Fango woreda of Sidama zone and East Badawacho Woreda of Hadiya zone in the region during the week with 197 and 21 total AWD cases respectively.

7.Rabies/Dog bite

There were two suspected dog bites reported from Dawro zone and Keffa zone in this week that need to confirm whether it is rabies or not.

8. NNT

In this week, three NNT cases with one death reported from Guraghe (1 death), Keffa (1 case) zones and Konta (1case) special woreda.

Maternal death

In this week, four maternal deaths were reported from Isara woreda (1) of Dawuro, Melokoza (1) woreda from Gamo Goffa, Lanfuro woreda (1) from Silte zone and Halaba special woreda (1).

others

Scabies affected 16 zones, 101 woredas and 1316 Kebeles with a total of 281, 448 cases as of week 10, 2017. In this week, 32,728 scabies cases reported with no death. Gedeo (236), Bench Maji (14) and Konta (27) were scabies reported areas in this week through weekly IDSR.

No case and/or death of Anthrax, yellow fever, AHI, SARS, Pandemic influenza, Viral Hemorrhagic Fever, Guinea worm, and Smallpox reported in the region in this reporting period.

Contact us:
Email: phemsnnpr@gmail.com
Tele: 0462120281

Your comments will have a significant role in improving our bulletin!

About this newsletter:

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Annexes

Annexe 1: Questionnaire for Leg swelling of Unknown etiology epidemic investigation among prisoners at Mizan-Aman town, SNNPR Ethiopia, 2016

CASE: 1. Yes, 2. No (control)

NO.	Question	Possible Response	Skipping pattern
I. Socio-demographic characteristics			
101	Sex	1. Male 2. Female	
102	Age	_____Years	
103	Educational level	1.un able to read and write 2.Can read and write 3.Primary school (1-8) 4. Secondary school (9-12) 5. Technical School (TVET) 6. Degree and above	
104	What is your Marital Status?	1.Single 2.Married 3.Divorced 4.Widowed	
105	What is your religion?	1. Orthodox 2. Catholic 3. Protestant 4. Muslim 5. If other (specify) _____	
106	Previous occupation	1. Farmer 2. Pastoralist 3. Mining 4. Employee 5.Merchant 6.Other (specify)_____	
107	Previous residential Area	1.Woreda_____ 2.Kebele_____ 3.Village_____	
108	Length in time after entry to prison	1._____year 2._____month 3. _____days	
109	Duration of stay at police station before entry to prison	_____ Months _____days	
II. Personal hygiene			
201	Do you Wash your limb every day?	1.Yes 2.No	If no skip to 203
202	If Yes observe the dust of lower leg to thigh and rank it	1.Clean leg limb 2.Temporary dusted limb 3. Discoloured lower leg due to dust on limb 4.Discoloured thigh due to dust on limb 5.Other, Specify it_____	
203	History of barefoot walking	1. Yes, 2. No	If no skip to 206
204	What type of shoe put on foot in the prison?	1.Siliper or Ergendo or Shebete 2.Shera shoe 3.Leather shoe 4.Other_____	
205	Do the shoe covered at least foot to Ankle?	1.Yes 2.No	
NO.	**Question**	**Possible Response**	**Skipping pattern**
206	Do your clothes commonly wear discoloured	1.Yes	

	with dust?	2.No	
207	Do you have attacked history with insect since in the prison?	1.Yes 2.No	If no skip to 301
208	What kind of insect did you attack?	1. Lice 2.Fleas 3.Bud bug 4. Spider 5.Other Specify it_____	
III. Working Environment			
301	Do you have a habit of doing physical exercises?	1. None 2. Once per week 3. Twice per week 4. ≥Three times per week	
302	Do you have a job in this compound?	1.Yes 2.No	If no skip to 305
303	What types of works commonly do in this compound?	_____ _____	
304	How much time commonly do spend on working in hours per day	_____	
305	Have you done too much work every day based?	1. Never 2. Sometimes 3. Often 4. Always	
305	How you pass your recreation time?	1.Watching movies and TVs 2. Other Specify it_____	
306	How much time commonly do spent on recreation in hours per day?	_____	
IV. Prison situation Assessment			
401	Is the room ventilated?	1. Yes, 2. No	
402	Has the room been cleaned every day	1. Yes, 2. No	
403	Number of prisoners per room	_____	
404	Volume of the room	H_____m L_____m W_____ ___m V=_____m^3	
405	Where do you have slept?	1.Bed 2.Floor	If 2 skip to 410
406	If do have slept on the bed, on what compartment?	1.Top 2.Middle 3.Bottom	
407	What size of the Sleeping area (Bed) do you have?	_____M X _____M=_____M^2	
408	Where do you have slept?	1.Bed with mattress 2. Bed with Matt (ሰሌን) Carpet 3.Floor with mattress 4. Floor with Matt (ሰሌን) Carpet 5.Other Specify it_____	
410	Do you have slept within discomfort situation due to lack of space at night?	1.Yes 2.No	
411	Do you have slept within any side of body situation at night?	1.Yes 2.No	If Yes skip to 413
412	If no which part of the body side commonly slept at night?	1.Right side 2.Left side 3.Both side 4.Back 5.Other Specify_____	
NO.	**Question**	**Possible Response**	**Skipping pattern**
413	Do you have Mosquito infestation at night?	1.Yes 2.No	
414	Do you use mosquito bed net at night?	1.Yes 2.No	
V. **Nutritional and knowledge Assessment**			

501	What types of food items do you commonly eat before imprisonment?	1. Enjera and Bread 2. Boiled Vegetables 3.Unboiled vegetable 3. Fruits 4. Animal products 5.Kolo and Nifrue of Legume 5. Others Specify it_____	
502	Do you have eaten family served food?	1. Yes, 2. No	
503	Do you have a habit of fruit/vegetables eating in the prison within 15 days?	1. Yes, 2. No	
504	What types of food items do you commonly eat in the prison? *NB. Please don`t read but circle what the respondent say.*	1. Enjera and Bread 2. Boiled Vegetables 3.Unboiled vegetable 3. Fruits 4. Animal products 5.Kolo or Nifrue of Legume 5. Others Specify it_____	
505	If you have a Fruit eating habit, Which kind fruit do you commonly consume? *NB. Please don`t read but circle what the respondent say*	1.Orange or Lemon 2.Banana 3.Avocado 4.Mango 5.Green paper 6.Other Specify it_____	If no skip to 507
506	If you have a Fruit eating habit, how often?	1.Every day 2._____day per week 3.Others Specify it_____	
507	Do you think food items preparation changed in the prison recently?	1. Yes, 2. No	If no skip to 509
508	If yes, describe the time and type of Item changed	_____ _____	
509	Have you heard this like disease before?	1. Yes, 2. No	
	What do you think the possible cause of the disease?	1. Lack of personal hygiene 2. Walking on barefoot 3. Due to change of eating habit in the prison 4. Here dietary problem 5. Cultural believe 6. Lack of balanced diet 7. Others (specify)_____	
510	Do you think the disease is preventable?	1. Yes, 2. No 3. I don't know	
511	If yes, how it can be prevented?	_____	
512	Do you have any contact history with leg swelling diseased person?	1. Yes 2. No If yes, how long _____ where _____	
513	Do you have a history of leg swelling disease before?	1. Yes, 2. No	If no skip to 515
514	If yes how much duration of your illness?	1._____year 2._____month 3. _____days	
NO.	**Question**	**Possible Response**	**Skipping pattern**
515	If do you have cured history, how did you get relief from disease?	_____	
516	Do you have a family history of similar disease?	1. Yes, 2. No	If no skip to 519
517	Do you have a history of dermatitis on your leg?	1.Yes 2.No	

518	If Yes describe time of duration	_____ Months _____days	
519	Do you have a history of systemic disease?	1. Yes, 2. No	If no skip to 522
520	If yes, which disease?	1. Heart 2. Kidneys 3. Liver 4. Lung 5. Other, specify_____	
521	If yes how much duration of your illness?	1._____year 2._____month 3. _____days	
522	Did you have any habit of drug user/addiction?	1. Yes, 2. No	
523	If yes, describe of used?	1.Name _____ 2.Time____year____ Months _____days 3.Frequency___per day _____per week 4.Other, specify_____	
524	Do you have a history of trauma on leg / physical torture of leg?	1. Yes, 2. No	
VI. History of illness (for cases only)			
601	Date/Month/year of Disease onset	_____ _____	
602	Did you get treatment?	1. Yes, 2. No	If no skip to 605
603	If yes, write date and place of treatment.	_____ _____	
604	Progress after treatment	1. Improved 2. No, improve 3.Aggravated	
605	Distribution of leg swelling	1. Unilateral 2. Bilateral 3. Generalized	
606	Main sign and symptoms of the disease	1. Pain 2. Chest pain 3. A cough 4. Fever 5. Bleeding 6. Other, specify_____	
607	Where the illness occurred?	1. In the prison 2. Before imprisonment	
608	What was eaten before a day on of disease onset?	_____	
609	What was drunk before a day on of disease onset?	_____	

Annex 2: Questionnaires for Case- control study on Outbreaks of Measles in Konta special district, SNNPR, 2016

Status of Respondent: CASE 1.Yes 2. No (Control)

Patient/Respondent Name_____ Date of Data collection_____

Region_____ Zone_____ Woreda_____ Kebele _____
Got _____ Phone_____

Respondent Type: Case_____ Mother _____ Father_____ Other_____
Location: Longitude: _____Latitude: _____ Altitude _____

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/respondent	1. Farmer 2. Housewife 3. Student 4. Unemployed 5. Daily labourer 6. Merchant 7. Gov't 8. NA (for under 5 children) 9. Other (specify)_____
1.4	Family Occupation(HH head)	1. Farmer 2. Housewife 3. Student 4. Unemployed 5. Daily labourer 6. Merchant 7. Gov't employee 8. Other (specify)_____
1.5	Religion	1. Orthodox 2. Protestant 3. Muslim 4. Catholic 5. Other (specify)_____
1.6	Ethnic group	1. Kafa 8. Kembata 2. Konta 9. Sidama 3. Chara 10. Others (specify) 4. Na'o _____. 5. Sheka _____. 6. Minit 7. Amhara
1.7	Educational level of the patient /respondent	1. Illiterate 2. Read and write 3. Elementary 4. Secondary 5.Above secondary 6. N/A
1.8	Educational level of the family	1. Illiterate 2. Read and write 3.Elementary 4. Secondary 5. Above secondary
1.9	Marital status of parent	1. Single 2. Married 3. Divorced 4. Widowed 5. Separated, 6. others
1.10	Family size	_____
1.11	Is there any sick person with rash, fever, running nose/conductivities (illness) in the family?	1. Yes 2. No
1.12	If yes, number of sick person	_____

1.13	Age(s) of sick person(s)	_____

II. Clinical History of Diseases:* for the case only

2.1	What was the symptom?	1.fever 2.Rash 3.cough, 4.coryza (runny nose), 5. Conjunctivitis (red eyes) 6. Ear discharge 7. Pneumonia 8. Vomiting 9. Others_____
2.2	**Ask ONLY if complication**	Pneumonia: 1.yes 2. no Corneal ulceration: 1. yes 2. no Blindness: 1. yes 2. no Convolution 1. Yes, 2. No Otitis media (ear discharge): 1. Yes, 2. No diarrhoea : 1. yes 2. no Feeding problem 1. Yes, 2. No Encephalitis 1. Yes, 2. No
2.3	Date of rash onset	___/ /_____Duration of rash_____
2.4	Where the rash was started (location)?	District_____Kebele_____ Got _____HDA leader _____
2.5	Have you (has she/he) Visited health facilities?	1. yes 2. no,
2.6	If yes, who told to go health facility?	1. Neighbors 2. HDA leader 3. HCW 4. HEW 5. Kebele leaders 6. FBOs 7. Others (specify) _____
2.7	Type of Health Facility visited	1. Hospital 2. Health center 3. Health post 4.private clinic 5.local drug holder 6. Drug retailer 7.others_____
2.8	Date saw at health facility	___/ /_____
2.9	Illness duration before visiting the health facility	_____ in days/hours
2.10	Did you (he/she) take treatment?	1.Yes 2.No
2.11	If yes, treatment was taken	1.ORS 2.Antibiotics 3.Vitamin A 4.Supplementary food 5. TTC ointment 6.Antipyretics 7.Others given_____
2.12	Did you (she/he) recover after the treatment?	1.recovered / cure 2. partially improved 3. referred to next level HF 3. disabled after illness 4.death

III. Questions related to Risk factors for measles illness

3.1	Did you have (she/he has) been vaccinated for measles?	1.Yes, 2.No …… skip to Q3.5 3.Unknow 4.Not applicable
3.2	If yes, last vaccination date	1.parent recall_____

		2. vaccination card_____ ___/____/_____ d
3.3	Number of vaccine doses received	1.one dose 2. two doses 3.three and above 4. Not know
3.4	At what age you (she/he) vaccinated first dose of measles vaccination?	_____
3.5	If not vaccinated, why?	1.Health facility far apart 2.lack of knowledge about vaccination campaign, 3.absence during vaccination campaign, 4. The site of vaccination unknown 5. Fear of Pain of vaccination 6. No need for measles vaccination for child 7. She/he took other vaccines differ from measles 8. other, specify.
3.6	Did you have any travel history 7-18 days to areas with active measles cases before the onset of symptoms?	1.Yes 2.No If Yes where _____
3.7	Did you contact with a person with measles symptoms within the last 2-3 weeks?	1. yes, 2. No If yes, where_____
3.8	Do you have any travel history four days before and after rash onset	1.Yes, 2. No If yes where _____
3.9	Do you have any contact history with someone else four days before and after rash onset	1.yes 2.No If yes with whom_____
3.10	If Yes to question 3.5 place of travel	1.School 2.Neighbor 3.Market 4.Other_____
3.11	Do you know modes of transmission for measles?	1.Yes 2.No If yes specify_____
3.12	Did you ever have measles infection?	1.Yes, 2. No 3. Don't know
3.13	Is the nutritional status of the cases (use MUAC and weight for <5 children)	1.Normal 2.Moderate 3.Severely malnourished
3.14	MUAC for <5 years	1. Less than 11cm 2. between 11 - 12cm 3. Greater or equal to 12cm 4. Oedema 5. Not applicable
3.15	MUAC for pregnant/lactating mothers	1. <17cm 2. Between 17and 19 cm 3. Between 19 - 21cm 4. Above 21cm
3.16	Physical assessment of <6 months infants	1. Severe wasting 2. No Severe wasting
3.17	Weight for height of >5 years old	1. <70% 2. 70 – 80% 3. Above 80%
3.18	Had she/he received vitamin A supplementation within 6 months?	1.Yes, 2.No 3. Not know

3.19	Had she/he received deworming supplementation after 6 months age of childhood?	1.Yes, 2.No 3. Not know
3.20	How many months did you feed the only breast for your child?	1 two months 2 three month 3 four months 4 six months 5 less than 1 month
3.21	What is the estimated area of the house in sq. m?	_____
3.22	Is the house well ventilated?	1. Yes, 2. No
3.23	Distance from house to HC?	1. <1km 2. Between 1 – 5km 3. >5km
3.24	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)_____
3.25	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. Bad weather condition 5. Other(Specify)
3.26	How could you (she/he) suffer from Measles?	1. Contact with a virus from ill person 2. From God 3. Bad attitude of other people 4. The result of ones/families sins 5. Other(Specify)
3.27	Do you know how could spread/infection of measles be stopped?	1.by vaccination 2. By modern treatment 3. By isolation of infected ones /minimising contact with infected person 4. By doing traditional practice 5. By pray /spraying holy water/ 6. by keeping infected one in dark place in the house 7. Others specify.
3.28	Do you Know measles is vaccine preventable?	1. Yes, 2. No 3. I don't Know
3.29	Who do you think can be affected by measles?	4. Children of aged less than 5 years 5. Children of aged less than 18 years 6. Women of any ages 7. Any age groups of both male and women 8. Other (specify):_____
3.30	How do you think measles can be cured?	1. Using modern medicine 2. Using traditional Medicine 3. Holly water 4. By feeding nutritious foods 5. Keeping the sick person indoor 6. Other(Specify)_____
3.31	Have you any comment on rising?	

IV. Cold chain status including vaccine handling (only for facility and health workers assessment)

	Number of HEWs /HWs in the facility	
	Number of vaccination outreach sites in the Kebele /No. of catchment kebeles	
	Is there static vaccination program in HF	1. Yes 2. No
	If no, why?	1. Shortage of fridge 2. Shortage of vaccine 3. Shortage of kerosene 4. Others
4.1	Does the facility have separate and adequate cold chain room? (observe)	1.Yes, 2.No 3. Not adequate
4.2	How many refrigerators are functional? Write number	1. By Electric. 2. By Solar. 3. By kerosene_____.
4.3	Is the temperature of cold chain monitored twice a day?	1. Yes, 2. No
4.4	Is there a non-functional fridge in the room? Observe	1. Yes, 2. No
4.5	If yes for 4.3, causes of the non-functional fridge.	1. Lack of kerosene 2. Lack of wick 3. Lack of maintenance 4. Unknown causes
4.6	Vaccine arrangement for measles in the fridge (storage condition of measles vaccine) observe	1. Upper compartment 2. Middle compartment 3. Lower compartment
4.7	Temperature of cold chain (Observe)	1. Below 2^o 2. Between 8 – 15^o 3. Between 2 – 8^o 4. Above 15^o
4.8	For how long the temperature of fridge above 8^o for last 2 months?	1. <10 hours _____.(write duration/day) 2. 10 – 24 hours _____. .(write duration/day) 3. >24 hours _____. .(write duration/day)
4.9	Status of measles vaccine in the fridge (Observe)	1. First level VVM 2. 2nd level VVM 3. 3rd level VVM 4. Expired on _____.(write expiry date) 5. The level scratched (cannot identify)
4.10	From where you get measles vaccine for routine vaccination work?	1. HP 2. HC 4. WorHO 4. ZHD
4.11	For how long you travel carrying vaccine carrier with a vaccine?	1. <6 hours 2. 6 - 10 hours 3. Above 10 hours
4.12	Where you return leftover unopened measles vaccine after work?	1. Stay in vaccine carrier 2. Return to fridge 3. Return to cold box 4. Destroyed manually

4.13	For how long you use opened measles vaccine?	1. Below 6 hours 2. Above 6 hours 3. Not know
4.14	How many ice packs per vaccine carrier did you use?	1. Two 3. Three 3. Four
4.15	The distance between vaccination site and vaccine storage	1. < 5 km 2. Between 5 to 10km 3. Between 10 to 15 km 4. Above 15km
4.16	Five years EPI coverage(take the document)	
4.17	Measles vaccine received from RHB/ZHD/HC in vial for 2007 EFY	
4.18	Present stock of Measles at the beginning of 2007 EFY	
4.19	Wastage rate of measles vaccine at the 2007 EFY	
4.20	Ending balance of measles vaccine at the end of 2007 EFY	

Annex 3: Data Abstraction tools for Maternal Death description

SECTION 1: HEALTH FACILITY CHARACTERISTICS:

1.1 Facility name.....

1.2 Type of facility (□): 1. Referral hospital 2. General hospital 3. Health Centre

1.3 No. of personnel covered maternity ward (write number)

1. Doctors covering maternity _____2. Midwives _____ 3. Other Nurses _____ _____ Others _____

1.4 Availability of services 1. Basic services 2. BEMONC/ CEMONC 3. CS 4. Blood transfusion

1.5 Total deliveries and maternal deaths (write number) 1.Number of deliveries _____ 2.Total maternal death_____ 3. Maternal death ratio _____4. Maternal mortality rate _____

SECTION 2: DECEASED WOMEN CHARACTERISTICS

2.1. Socio demographic Characteristics of deceased women:

S. No	Questions	Response
2.1.1	Ethnicity	
2.1.2	Address where death occurred	Woreda/subcity_____ Kebele_____ Got_____ House number_____
2.1.3	Place of usual residence	Woreda/subcity_____ Kebele_____ Got_____ House number_____
2.1.4	Religion	1. Orthodox 2. Muslim 3 Protestant 4. Others (specify)_____
2.1.5	Educational status of the deceased	1. Illiterate 2. Can read and write 3. Primary school 4. Secondary school 5. Beyond
2.1.6	Marital status of the deceased	1. Single 2.Married 3. Divorced 4. Widowed 5. Others (specify)
2.1.7	Occupation of the deceased	1. House wife 2 employed 3. Unemployed 4. Others (specify)
2.1.8	Occupation of the husband	1. Farmer 2. Merchant

		3. Public employee 4. Unemployed 5. Daily labourer 6. Others (specify)
2.1.9	Level of education of the husband	1. Illiterate 2. Can read and write 3. Primary school 4.Secondary school 4. Beyond
2.1.9	Monthly income if possible	_____birr

2.2. Obstetric Conditions and Intervention of the Deceased Women

S. No	Question	Response
2.2.1	Number of Gravidity	_____
2.2.2	Number of Parity	_____
2.2.3	Number of living children	_____
2.2.4	Was she attended ANC?	1. Yes 2. No
2.2.5	If yes, where is the ANC?	1. Health post 2. Health center 3. Hospital 4. Other (specify)
2.2.6	If yes, number of visits	_____
2.2.7	Basic package of services provided o Investigations done (RPR, Hgb, Blood group, HIV status, U/A) separate o BP measurement during the follow up o Fefol supplementation o TT immunization o Other (Specify)	Yes No
2.2.8	Problems or risk factors in the current pregnancy: **I. Preexisting problems** o Hypertension 1. Yes 2. No o Anemia 1. Yes 2. No o Diabetes 1. Yes 2. No o HIV positive 1. Yes 2. No o Cardiac problem 1. Yes 2. No o Malaria 1. Yes 2. No o Tuberculosis 1. Yes 2. No o Hepatitis 1. Yes 2. No o Other (Specify) _____ **Antenatal/ intra-natal problems/risks** o Pre-eclampsia/eclampsia 1. Yes 2. No o Placenta Previa 1. Yes 2. No	

	o Previous C/D 1. Yes 2. No o Multiple gestation 1. Yes 2. No o Abnormal lie/presentation 1. Yes 2. No o Anemia 1. Yes 2. No o Malaria 1. Yes 2. No o UTI/pyelonephritis 1. Yes 2. No o Unintended pregnancy 1. Yes 2. No o Other (specify) _____	
2.2.9	State of pregnancy at the time of death	1. Antepartum 2. Intrapartum 3. Post-partum 4. Post-abortion 5. Ectopic
2.2.10	If delivered, what is the outcome?	1. Live birth 2. Stillbirth
2.2.11	Date and place of delivery	Date: _____ Place of delivery:_____
2.2.12	GA at the time of death in antepartum and /or intrapartum events	_____wks/months
2.2.13	If the event was postpartum or post abortion, after how many days has the event occurred?	_____days
2.2.14	Direct causes of death	A. Hemorrhage B. Preeclampsia/ eclampsia C. Obstructed labor D. Infection E. Unsafe abortion
2.2.15	Indirect causes of death	A. Hypertension B. Cardiac problem C. Anemia D. Malaria E. HIV/AIDS F. Other (Specify)_____
2.2.16	Was verbal Autopsy done for death?	1. Yes 2. No

SECTION 3: FACILITY EPISODE AND SERVICE DELIVERY RELATED CHARACTERISTICS

S. No	Question	Response
3.1.1	Date of admission	_____
3.1.2	Day of admission	1. Working days 2. Weekends 3. Holidays
3.1.3	Time of admission	1. Working hours 2. Nonworking hours
3.1.4	Main reason/symptom for admission	
3.1.5	Is it a referred case?	1. Yes 2. No
3.1.6	Referred from (Name of health facility)	_____
3.1.7	Reason for referral	
3.1.8	Duration of labour	A. < 12 Hrs. B. 12-24 Hrs. C. >24 Hrs. D. Not known

3.1.9	Mode of delivery		A. SVD B. Instrumental C.C/S D. Destructive operations E. Not delivered
3.1.10	Qualification of the most senior attending health professional(s)		
3.1.11	Date of death		
3.1.12	Time of death		
3.1.13	Primary cause of death		1. Direct cause 2. Indirect Cause
3.1.14	Time interval between admission and death		
3.1.15	Is this preventable death?		
3.1.16	If preventable maternal death, specify factors according to the three delay model	Delay in seeking care	1. Yes 2. No
		Delay in reaching at right facility	1. Yes 2. No
		Delay within the facility (diagnostic and therapeutic)	1. Yes 2. No

3.2. Avoidable factors/ Missed opportunities/ Substandard Care

S. No	**Contributory factors to death**	**Questions**	**Response**
3.2.1	Personal/Family /Woman factors	Delay of the woman seeking help	1. Yes 2. No 3. Unknown
		Family poverty	1. Yes 2. No 3. Unknown
		Lack of partner support	1. Yes 2. No 3. Unknown
		Lack of decision to go to health facility	1. Yes 2. No 3. Unknown
		Delayed referral from home	1. Yes 2. No 3. Unknown
		Refusal of treatment or admission	1. Yes 2. No 3. Unknown
		Herbal medication	1. Yes 2. No 3. Unknown
		Refused transfer to higher facility	1. Yes 2. No 3. Unknown
3.2.2	Logistic system related delays	Delayed arrival to referred facility	1. Yes 2. No 3. Unknown
		Lack of transport from home to health facilities	1. Yes 2. No 3. Unknown
		Lack of transport between health facilities	1. Yes 2. No 3. Unknown
		No facility within reasonable distance	1. Yes 2. No 3. Unknown
3.2.3	Health Service	Health service communication	1. Yes 2. No 3. Unknown

	Factors	breakdown	
		Delayed management after admission	1. Yes 2. No 3. Unknown
		Delayed or lacking supplies and equipment(specify)	1. Yes 2. No 3. Unknown _____
3.2.4	Health Personnel Related Factors	Absence of critical human resource	1. Yes 2. No 3. Unknown
		Inadequate numbers of staff	1. Yes 2. No 3. Unknown
		Human error or mismanagement	1. Yes 2. No 3. Unknown
		Staff lack of expertise, training or education	1. Yes 2. No 3. Unknown
		Staff non-action	1. Yes 2. No 3. Unknown

Annex 4: Information Sheet and Consent Forms for the In-depth Interview

My name is Wadu Marshalo Anebo an Ethiopian Field Epidemiology Training Program Resident from Addis Ababa University School of Public Health. I am doing a research on describing maternal death and assessing factors affecting maternal death surveillance and response system implementation and I am interested to hear your experience and opinion about the program.

The purpose of the study is to assess maternal death surveillance and response program, the challenges and factors encountered as well as your perception about its implementation so as to contribute to generate information necessary for the planning to strengthen, improve, redesign and scale up the programs. You are selected to participate in this study because you are directly related to the program implementation and I thought you are the best person in the issues for generating productive ideas.

There is no risk in participating in this study, the interview will be conducted in private, and it will take about 30 minutes. The result of the study will benefit the society, programme planers and decision makers as well as your facility by providing a comprehensive understanding of the issues surrounding implementation of the initiative and by improving maternal health.

I want to emphasize that your participation in the study is upon voluntary basis. There will not be a payment for participating in this study. If you feel uncomfortable with some of the questions, you have the right not to answer. During the interview period, if you feel inconvenient, you can interrupt and clarify inconvenience, appoint to other time or even you can decide not to continue the interview at some point.

If you are agreeing to participate in the interview, you will be asked some short questions about the program and your answers will be recorded. I will not record your name and any other personal identifications. All the data obtained will be kept strictly confidential by using only code numbers assigned to it and will be stored in locked file cabinets, to be accessed only by the principal investigator and my research advisors, and after the study is finalized all the information will be destroyed.

You have full right to refuse to participate and/or withdraw from the study at any time. However, because the information you will be providing us is very useful for the study we encourage of you to participate and provide us with the information we need.

Person to contact: If you want to know more about the study, you can contact the principal investigator, Wadu Marshalo Anebo +251-911-088754, School of Public Health, EFETP Coordinator of AAU by Tel: +251-115547319

Do you have any question that you want to ask us about the study?

Consent Form

Interviewer: Please provide a paper copy of the Consent Form to the respondent and explain it. With due understanding of the aforementioned information, I am willing to participate in the study? (Yes) Check box: ☐ => Proceed (No) Check box: ☐=> Stop

Name of the *interviewer*: _____ Signature _____ Date __/__/_____
Name of the *supervisors*: _____ Signature _____ Date __/__/_____

Identifiers

Q1. Facility name _____ Q2. Facility code [___|____] Q3. Observer name _____
Q4: Today's date (day/month/year) _____Q5. Respondent Code[___|____|___] Time started: HH/Min [___|____] Time completed: HH/Min [___|____]

Annex 5: Interview guide for In-depth interview

With health care providers and heads from maternity unit

I. Background Information

Code ---------- Sex ---------- Professional background ----------

Year of experience ---------- Trainings on MDSR ----------

II. Questions about MDSR implementation

Topics	Main Questions	Probe questions
1. Knowledge	Have you ever heard about MDSR? Is maternal death reportable event in your facility?	What have you heard from others? Can you tell me what you know about MDSR?
2. Source of information	Where did you hear about MDSR?	How did you happen to be discussing it? Who else is talking about MDSR today? Are these things are true?
3. Experience	Do you know anyone who participates in the process of MDSR? And are you?	-Why did you decide to participate?
4. Opinion	What do you think are the advantage and disadvantage of MDSR?	How could MDSR help or harm the health care system, an individual/ health care provider and the community? Would you think MDSR program should be continued and implemented in other areas? Why or why not? Do you think other colleague of yours want the program to continue? What things are improved after the implementation of MDSR?

With MDSR committee members

I. Background Information

Code _____ Sex _____ Professional background _____

Year of experience _____ Trainings on MDSR _____

II. Questions about MDSR implementation

Topics	**Main Questions**	**Probe questions**
1. MDSR Implementation Process	Is the committee organized according to the guideline?	Who are the members of the committee? What will happen if the responsible person for the MDSR process leaves? What framework do you have to evaluate the effectiveness of the program?
2. Factors affecting the implementation of MDSR	Facilitating Factors	What factors influence during identification of maternal death? During the data collection What were Challenges faced during MDSR meeting? What were challenges faced During the application of recommendations
3. Opinion	What do you think about the advantages and disadvantages of MDSR?	- How could MDSR help or harm the health care system, an individual/ health care provider and the community? - Would you think MDSR program should be implemented in the other areas? Why? Or why not? - Do you think other colleague of yours want the program to continue? - What things are improved after the implementation of MDSR? - What should be done to improve the program?

Annex 6: 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: Wadu Marshalo Anebo

Signature: _____

Place: _____

Date of Submission: _____

The thesis has been submitted for examination with my approval as a university advisor.

Name of advisor:

Signature: _____

Date: _____