

ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCE,
SCHOOL OF PUBLIC HEALTH



Ethiopian Field Epidemiology Training Program (EFELTP)

Compiled Body of Work in Field Epidemiology

By: - Dilnesaw Teshome Gete (BSc Nurse)

Submitted to the School of Graduate Studies of Addis Ababa University in
Partial Fulfilment for the Degree of Master of Public Health in Field
Epidemiology

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Table of content

Contents

Table of content	IV
List of Tables	VI
Lists of Annexes	XII
Lists of Acronyms and Abbreviation.....	XIII
Executive summary.....	XV
Chapter One- Outbreak Investigation	1
1.1 Outbreak One: - Investigation of Malaria Outbreak in Elu Gelan Woreda West Shoa Zone, Oromia Regional State 2019	1
1.2. Investigation of Measles Outbreak in Caliya Woreda, West Shoa Zone, Oromia Regional State, Ethiopia, 2020	21
Chapter Two- Surveillance Data Analysis Report	54
2.1. Surveillance data analysis on Meningitis in SNNP-RHB PHEM from 2012-2018.....	54
Chapter Three- Evaluation of Surveillance System	76
3.1. Evaluation of surveillance system for malaria in Elu Gelan Woreda West Shewa Zone, Oromia Regional State, Ethiopia, 2019.....	76
Chapter Four- Health Profile Description Report.	104
4.1. Bona Zuria health profile Sidama Zone, SNNPR, Ethiopia, March, 2019	104
Chapter five; Scientific Manuscript	145
6.1. Surveillance data analysis of Meningococcal meningitis in SNNP Region from 2012-2018. Ethiopia, 2019	158
6.2. Surveillance Evaluation of Malaria in Elu Gelan, west shoa zone, Oromia, Ethiopia, 2019.....	160
6.3. Investigation of Malaria outbreak in Elu Gelan woreda, west shoa zone, Oromia, Ethiopia. 2019.....	162
Chapter Seven: - Summary of disaster situation visited	164
7.1. Humanitarian, health and nutritional assessment in Gedeb District of Gedeo zone SNNPR 2019.....	164
Chapter Eight- Proposal for Scientific Research	174
8.1. Assessment Of Long-Lasting Insecticide Net Utilization And Associated Factors Among Under 5 Children In Ilu Gelan District, West Shoa Zone, Oromia Region, Ethiopia, 2020.....	174

Chapter Nine: other additional output reports	193
9.1. Bulletin of weekly surveillance report at Sidama Zone Health Department, Public health emergency management, 2019.....	193
9.2. Cholera outbreak surveillance in N/lafto S/city of Addis Ababa, Ethiopia, 2019	203

List of Tables

Table 1;- Distribution of malaria cases by sex and Plasmodium species tested in Elu Gelan district, Oromia,- Ethiopia, and August 5- December, 2019.....	10
Table 2;- Distribution of cases by age and Plasmodium species tested in Elu Gelan district, Oromia-Ethiopia, August 5-December, 2019.....	11
Table 3. Distribution of cases by age in Elu Gelan district, Oromia-Ethiopia, August 5-December, 2019.	11
Table 4. Clinical manifestations among malaria cases in Elu Gelan district, Oromia-Ethiopia, August 5-.....	11
Table 5. Distribution of cases by Villages and Plasmodium species tested in Elu Gelan district, Oromia- Ethiopia, August 5-December, 2019.....	12
Table 6. Trends of malaria across years in Elu Gelan district, Oromia, Ethiopia, 2019	13
Table 7: Factors associated with malaria outbreak in Elu Gelan district, West shoa, Ethiopia 2019.....	15
Table 8; Distribution of Laboratory tested by kebeles in Elu Gelan woreda of west shoa zone, Oromia, Ethiopia, 2019	16
Table 9. Summary of the Personal characteristics of cases, Caliya woreda, West shoa zone, Oromia, Ethiopia, 2019	34
Table 10. Common sign & symptoms and complications of cases with measles, Caliya woreda of west shoa zone, oromia region, Ethiopia, 2019. (N=16 enrolled cases).....	35
Table 11.Type of treatment taken, Caliya woreda of West shoa zone, oromia region, Ethiopia, 2019.	35
Table 12. Knowledge and attitude towards measles, Tulu Mara kebele of Caliya woreda west shoa zone, Oromia region, Ethiopia, 2019.	36
Table 13.Distribution of measles cases by age and sex in Tulu Mara kebele, Caliya Woreda, West shoa Zone, Oromia Region, Ethiopia, 2019.....	37
Table 14.Vaccination status of Measles cases of Tulu Mara kebele of Caliya Woreda west shoa Zone, Oromia Region, Ethiopia, 2020.....	38
Table 15.Measles Attack rate (AR) and case fatality rate (CFR) of Caliya woreda, west shoa zone, Oromia Region, Ethiopia, 2019.....	40
Table 16.Routine immunization coverage of kebeles in Caliya woreda of west shoa zone, Oromia, Ethiopia, 2019.	40
Table 17.Bivariate Vs. Multivariate analysis of risk factors for a Measles outbreak in Tulu Mara kebele of Caliya Woreda, west shoa zone Oromia, Ethiopia, December- 2019	42
Table 18. Proportion Measles unvaccinated children in Caliya woreda, west shoa zone, Oromia, Ethiopia, 2019	43
Table 19: Description of M. Meningitis Case and Death in SNNP Regional State from 2012-2018	63
Table 20: Reported M. Meningitis cases by month from 2012-2018, SNNPR	65
Table 21: Reported M. Meningitis cases by Zones from 2012-2018, SNNPR	65

Table 22: Reported Meningitis Death from 2012-2018, SNNPR.....	68
Table 23 : Reported suspected M. Meningitis outbreak cases by Age group in 2013, SNNPR.....	71
Table 24Health facilities selected for surveillance system evaluation in Elu Gelan District, Oromia, Ethiopia, 2019	86
Table 25. Prevalence of malaria across years in Elu Gelan district, 2019.....	91
Table 26 Reporting rate of Visited Site in Elu Gelan District, Oromia, Ethiopia, 2019	94
Table 27 Availability of resources for surveillance activities at all assessed levels, Elu Gelan District, Oromia, Ethiopia, 2019	96
Table 28.Sensitivity and PPV of surveillance system in Elu Gelan District, Oromia, Ethiopia. 2019	98
Table 29. Health coverage of Elu Gelan district, Oromia, Ethiopia, 2019.....	98
Table 30:-Demographic Indicator Estimates of Bona Zuria woreda, Sidama Zone, 2010EFY	114
Table 31: Sources of Income of Bona Zuria Woreda, Sidama Zone in 2010EFY	116
Table 32: Distribution of students enrolled by type of educational institution in Bona Zuria District, Sidama zone, 2010EFY	117
Table 33: Type of health facilities in Bona Zuria district, Sidama zone, 2010EFY	118
Table 34: Human resource to population ratio of Bona Zuria District health office, Sidama zone, 2010EFY	119
Table 35: Vital statistics data in Bona Zuria district health office, Sidama zone, of 2010EFY	121
Table 36: Selected maternal health indicators in Bona Zuria district, Sidama zone, 2010EFY	123
Table 37: Distribution of immunization coverage for children under 1 year and vaccine wastage rate in Bona Zuria district, Sidama zone, 2010EFY	124
Table 38: Distribution of safe drinking water of Bona Zuria Woreda by kebeles, 2010EFY	126
Table 39: Hygiene and Sanitation Activities in Bona Zuria Woreda, Sidama Zone, 2010EFY.....	127
Table 40: Sex and age distribution among OPD attendants in Bona Zuria District, Sidama zone, 2010EFY	128
Table 41: Top ten causes of morbidity in adult OPD at Bona Zuria district, Sidama zone, 2010EFY	128
Table 42: Top Five causes of morbidity for under 5 years children in Bona Zuria district, Sidama zone, 2010EFY	129
Table 43: TB and Leprosy Activities in Bona Zaria District, Sidama Zone, 2010 EFY	130
Table 44: HIV/AIDS Activities in Bona Zuria Woreda, Sidama Zone, 2010EFY	131
Table 45: Selected nutritional indicators in Bona Zuria district, Sidama zone, 2010EFY	132
Table 46: Availability of essential drugs in Bona Zuria district, Sidama zone, 2010EFY	133
Table 47: Problems identified based on priority setting criteria's Bona Zuria district, Sidama zone, 2010EFY..	134

Table 48; - Distribution of malaria cases by sex, age and Plasmodium species in Elu Gelan district, Oromia,- Ethiopia, 2019.....	151
Table 49;Distribution of internally displaced population by woreda in Gedeo zone of SNNPR, and west Guji zone of Oromia, Ethiopia, 2019	168
Table 50; Ten top cause of morbidity and mortality in Gedeb woreda from 5/25/2019-6/29/2019 Gedeo zone, SNNPR, Ethiopia 2019.....	170
Table 51; Five Top causes of under-five morbidity and mortality in Gedeb woreda from 5/25/2019-6/29/2019 Gedeo zone, SNNPR, Ethiopia 2019.....	170
Table 52: Gantt chart showing the work plan of the study on assessment of LLITN Utilization among under five children in Elu Gelan district in 2020.....	190
Table 53: Budget break down and human capital needed for data collection	191
Table 54: Cost of supplies for assessment of LLITN utilization among under five children and associated factors in Elu Gelan district in 2020.....	191
Table 55; summary of budget breakdown.	192
Table 56; Key indicators/ diseases/ conditions reported in week 11, March, 2019	194

List of Figures

Figure 1:-Maps of Elu Gelan District, West Shoa, Oromia, Ethiopia 2019	6
Figure 2:-Maps of Malarias and non-malarias kebeles in Elu Gelan District, West Shoa, Oromia, Ethiopia 2019.	12
Figure 3. Trends of malaria cases of the last twelve years and 3 rd & 4 th quarter of 2019 G.C in Elu Gelan woreda, December, 2019.....	13
Figure 4. Malaria Epidemic Monitoring Chart, Elu Gelan district, Oromia, Ethiopia, 2019.	14
Figure 5. Malaria outbreak Epi Curve in Elu Gelan District, Oromia, Ethiopia 2019.	14
Figure 6:-Map of measles affected kebele in Caliya woreda of west shoa zone, Oromia, Ethiopia, 2019	30
Figure 7.Distribution of measles cases and death by age group and sex in Caliya woreda, West Shoa Zone, Oromia, Ethiopia, 2019.	38
Figure 8. Age specific case fatality rate of measles in Tulu Mara kebele of Caliya woreda, west shoa zone Oromia, Ethiopia, 2019.	39
Figure 9.Age specific attack rate of measles case in Tulu Mara kebele of Caliya woreda, west shoa zone, Oromia, Ethiopia, 2019.	39
Figure 10.Measles outbreak Epi curve by date of onset in Tulu Mara kebele of Caliya woreda, West Shoa Zone, Oromia Region, Ethiopia, 2019.....	41
Figure 11.Measles vaccination coverage from, 2015-2019, Caliya woreda, west shoa zone, Oromia, Ethiopia 2019	41
Figure 12.Nutritional and vaccination status in Tulu Mara kebele of Caliya woreda, west shoa zone, Oromia, Ethiopia 2019	44
Figure 13:-Map of SNNP Regional State, 2018	59
Figure 14: Annual Incidence of Meningococcal Meningitis by Year SNNPR, 2012 to 2018.....	63
Figure 15: Annual Incidence of Meningococcal Meningitis by Zones, SNNPR, 2012 to 2018.....	64
Figure 16: Distribution of Meningitis cases by Zones in SNNPR State from 2012-2018.....	66
Figure 17: Trends of Meningococcal Meningitis Cases by Month from 2012-2018, SNNPR.....	67
Figure 18: Trends of Meningococcal Meningitis Cases by Month from, SNNPR 2012-2018	67
Figure 19: Trend of Meningococcal Meningitis Case and death by year from 2012-2018, SNNPR	68
Figure 20: Meningococcal Meningitis Case Load and Case fatality rate by Zone and Sp. Woredas From 2012-2018, SNNPR, 2019	68
Figure 21: Meningococcal Meningitis Case and death by Woredas of Sidama Zone from 2012-2018, SNNPR, 2019	68
Figure 22: Distribution of M. Meningitis deaths by months in SNNPR State from 2012-2018	69
Figure 23: Distribution of M. Meningitis deaths by months in SNNPR State from 2012-2018	70

Figure 24: Distribution of M. Meningitis cases by Zones and years in SNNPR State from 2012-2018.....	70
Figure 25: Suspected # of Meningococcal Meningitis Outbreak Cases by Sex in SNNPR, 2013	71
Figure 26: Number of Meningococcal Meningitis Outbreak Cases by Age Group in SNNPR, 2013	71
Figure 27: Epidemic Curve of Meningococcal Meningitis Outbreak Cases SNNPR, 2012/2013	72
Figure 28: Epidemic Curve of Meningococcal Meningitis Outbreak Cases SNNPR, 2012/2013	72
Figure 29 Components of surveillance and response systems for monitoring and evaluation.....	79
Figure 30:-Elu Gelan District map (Elu Gelan District health department).....	84
Figure 31 Diagram illustrating the formal and informal flow of surveillance data and information throughout a system [15]	91
Figure 32 Trend of confirmed malaria prevalence by year in Elu Gelan district, from 2015-2019	92
Figure 33 Trends of Confirmed malaria cases by species type and month in Elu Gelan District, Oromia, Ethiopia, 2019.....	92
Figure 34:-Administrative Map of Bona Zuria Woreda.....	109
Figure 35: Organogram of Bona Zuria Woreda Administration in 2010EFY.....	113
Figure 36: Population pyramid of Bona Zuria District, Sidama zone, SNNPR region of 2019.....	114
Figure 37 : Percentage of Income of Bona Zuria woreda, Sidama Zone in 2010EFY	116
Figure 38 : Organizational hierarchy of Bona Zuria district health office, Sidama Zone, 2010EFY.....	120
Figure 39: Health tier system of Bona Zuria district health office, Sidama zone of 2010EFY.....	121
Figure 40: Pregnancy and Pregnancy related activities in Bona Zuria Woreda, Sidama Zone 2008-2010EFY ...	124
Figure 41: Immunization coverage of Bona Zuria District by year.....	125
Figure 42: Malaria case distribution by months in Bona Zuria district, Sidama zone, 2010EFY	130
Figure 43: Distribution of SAM cases by Age and year in Bona Zuria district, Sidama Zone, 2010EFY	133
Figure 44; Map of Gedeb woreda.....	168
Figure 45; Map of Sidama Zone in SNNPR, Ethiopia, 2019	193
Figure 46; Week 11 PHEM report completeness and timeliness by district in Sidama zone of SNNPR, 2019 ...	195
Figure 47; Trends of Zonal surveillance report completeness and Timeliness of 11 Consecutive weeks (WHO week 1-11) 2019.....	195
Figure 48; week 11 malaria cases report by district, in Sidama zone, SNNPR Ethiopia, 2019	196
Figure 49; Week 11 malaria case report by species in Sidama zone, SNNPR Ethiopia, 2019	196
Figure 50; Trend of Malaria cases over the last 11 weeks (1-11 week) in Sidama zone of SNNPR, 2019	197
Figure 51; Trend of Malaria cases by epidemiologic week in Sidama zone of SNNPR, 2019.....	197

Figure 52; Week 11 Dysentery case by reporting sites in Sidama zone of SNNPR, 2019.....	198
Figure 53; Trends of Dysentery cases over the last 11 weeks in Sidama zone of SNNPR, 2019.	198
Figure 54; Week 11 Typhoid Fever cases by reporting sites in Sidama zone of SNNPR, 2019.	199
Figure 55; Trend of Typhoid Fever cases over 11 weeks in Sidama zone of SNNPR, 2019.	199
Figure 56; Week 11 Epidemic Typhus cases by reporting sites in Sidama zone of SNNPR,2019.	200
Figure 57; Trend of Epidemic Typhus over 11 weeks in Sidama zone of SNNPR, 2019.....	200
Figure 58; Trend of SAM cases over 11 weeks by type of service in Sidama zone of SNNPR, 2019	201
Figure 59; Week 11 SAM cases by reporting sites in Sidama zone of SNNPR, 2019.....	202
Figure 60; Trend of SAM cases over 11 weeks in 2018 and 2019 in Sidama zone of SNNPR, 2019	202

Lists of Annexes

Annex 1: Questionnaire for Malaria Outbreak Investigation in Elu Gelan Woreda, West Shoa Zone Oromia Ethiopia, 2019	210
Annex 2: Malaria case control study Questionnaire.....	213
Annex 3:- CHECKLIST for measles outbreak investigation in Caliya woreda of west shoa zone, Oromia, Ethiopia January 2020.....	216
Annex 4:- Questionnaire for Evaluation of Malaria Surveillance System in Elu Gelan Woreda, west shoa zone, Oromia, Ethiopia 2019	221
Annex 5:-Checklist for Health Profile Description at Bona Zuria District in Sidama Zone SNNP region, 2019.	232
Annex 6:-Epi Project Consent Form	241
Annex 7:-Epi project Structured and Semi-structured questionnaire	242

Lists of Acronyms and Abbreviation

AAU.....	Addis Ababa University
AFI	Acute Febrile Illness
ANC.....	Antenatal Care
AOR.....	Adjusted Odds Ratio
AR	Attack Rate
ASAR.....	Age Specific Attack Rate
ASL.....	Above Sea Level
BCC.....	Behavioural Change Communication
BCG	Bacilli Calmette Guerin
CAC.....	Comprehensive Abortion Care
CBR.....	Crude Birth Rate
CC	Community Conversion
CDC.....	Centre for Disease Control
CDR.....	Crude Death Rate
CFR.....	Case Fatality Rate
CI	Confidence Interval
COR.....	Crude Odds Ratio
DPHPCP.....	Disease Prevention and Health Promotion Core Process
EDHS.....	Ethiopian Demographic Health Survey
EFY	Ethiopian fiscal Year
EPHI	Ethiopian Public Health Institute
FMoH	Federal Minister of Health
FV.....	Fully Vaccinated
GTS.....	Global Technical Strategy
HAD.....	Health Development Army
HAPCO.....	HIV/AIDS Prevention and Control Organization
HMIS	Health Management Information System
HMT.....	Health Management Team
HSDP	Health Sector Development Program
IDSR	Integrated Disease Surveillance Response
IEC.....	Information Education and Communication
IHR	International Health Regulation
IMR.....	Infant Mortality Rate
IPV.....	Inactivated Polio Vaccine
IQR.....	Inter Quartile Range
IRS	Indoor Residual Spray
ITNs	Insecticide Treated Nests.
IUD.....	Intra Uterine Device
LAFP.....	Long Acting Family Planning

LLITNs.....	Long Lasting Insecticide Treated Nets.
MARPs.....	Most at Risk Populations
MCH.....	Maternal and Child Health
MCV1.....	Measles Containing Vaccine One
MCV2.....	Measles Containing Vaccine Two
MIS.....	Malaria Indicator Survey
MMR	Maternal Mortality Rate
MUAC.....	Mid-Upper Arm Circumference
NGO	Non-Government Organization
OC.....	Oral Contraceptive
OPD	Outpatient Department.
OR	Odds Ratio
ORHB.....	Oromia Regional Health bureau
ORs	Oral Rehydration
OTP.....	Outpatient Program
PAC.....	Post Abortion care
PCR	Polymers Chain Reaction
PF	Plasmodium Falciparum
PHEM	Public Health Emergency Management
PICT.....	Provider Initiated Counseling Testing
PLWHA.....	People Living With HIV/AIDS
PMTCT.....	Prevention Mother to Child Transmission
PNC.....	Postnatal Care
PV.....	Plasmodium Vivax
RBM.....	Roll Back Malaria
RHB.....	Regional health bureau
RRT	Rapid Response Team
SAC.....	Safe Abortion care
SAFP.....	Short Acting Family Planning
SBA.....	Skill Birth Attendant
SC.....	Stabilization Center
SNNPR.....	Southern Nation's, Nationalities and Peoples of the Region
TCC	The Carter Centre
TTC.....	Tetracycline
UNICEF.....	United Nation International Children Emergency Fund
VCT.....	Voluntary Counseling and Testing
VCWG.....	Vector Control Working Group
WASH.....	Water Sanitation and Hygiene
WHO	World Health Organization
WHOPES.....	World Health Organization Pesticide Evaluation Scheme

Executive summary

This compiled body of work consists a two year Field Epidemiology Training Program Outputs, which were done during the residency time. All these outputs are expected in the residency time which is submitted to graduate school of public health for partial fulfilment of master degree in Field Epidemiology. These are; diseases outbreak investigation, public health surveillance data analysis, surveillance system evaluation, Health profile description, manuscript, abstracts, and protocol/ proposal for epidemiologic research project and additional work like weekly bulletin. The document is organized in eight chapters.

Chapter One: - The first chapter contains two outbreak investigation. The first was malaria outbreak investigation conducted in Elu Gelan woreda of west shoa zone Oromia, Ethiopia from 24/2019 – 16/2020 WHO week in which 2099 malaria cases and no deaths were identified and the second was measles outbreak investigation occurred in Caliya woreda of west shoa zone Oromia, Ethiopia from 50 -1/2019 WHO weeks in which 16 cases and 2 deaths were identified. The second outbreak was confirmed at EPHI national reference laboratory. For both outbreaks. Case control study design was conducted to identify associated the risk factor. Recommendation was given for outbreaks based on the findings.

Chapter Two: - this chapter contains meningococcal meningitis surveillance data analysis which is one of the core competency for field epidemiology training program and conducted in southern nation and nationalities and peoples region from 2012-2018. Seven years meningococcal meningitis data was analyzed retrospectively to describe epidemiology of the disease.

Chapter Three: - malaria surveillance system evaluation conducted in Elu Gelan woreda west shoa zone, Oromia, Ethiopia in 2019 is presented in this chapter. The purpose and objective of malaria disease surveillance was clearly presented and we used descriptive cross sectional study design. It also addressed Public health emergency management surveillance system attributes like simplicity, flexibility, acceptability, representativeness, sensitivity and positive predictive value, timeliness and quality.

Chapter Four: - contains health profile description conducted in Bona Zuria of Sidama zone, SNNPR, Ethiopia in 2019. Health and health related data of the woreda were presented in this chapter.

Chapter Five: - Included scientific manuscript for peer reviewed journal on malaria outbreak investigation conducted in Elu Gelan woreda.

Chapter Six: - Three abstracts were presented in this chapter. These are Abstracts of malaria outbreak investigation conducted in Elu Gelan woreda, meningitis surveillance data analysis conducted in SNNPR, and malaria surveillance system evaluation conducted in Elu Gelan woreda.

Chapter Seven:- contains protocol/ proposal for epidemiologic research project namely assessment of long lasting insecticide net utilization and associated risk factors in under five children in Elu Gelan woreda of West shoa zone, Oromia, which is developed as one of the outputs. Assessment was not widely done in the district on the utilization of long lasting ITN especially for under five children. So the main purpose of this study is to assess ITN utilization and associated risk factors

Chapter One- Outbreak Investigation

1.1 Outbreak One: - Investigation of Malaria Outbreak in Elu Gelan Woreda West Shoa Zone, Oromia Regional State 2019.

Abstract

Background; - Over 68% (74 million) of Ethiopian populations live in areas at risk for malaria. On August 5/2019, surveillance data from Elu Gelan district showed that the district was experiencing an unusual high number of malaria cases in five kebeles (lowest administrative unit). An investigation was conducted to verify the existence of the outbreak, to identify the risk factors for transmission of malaria and to undertake appropriate prevention and control interventions.

Method: - In the last five years' malaria data were reviewed from 2007-2011 at the district level. Cases were identified by using line list and house to house active case search was done on a daily basis. Unmatched case control study was conducted in 1:1 ratio randomly selected case (175) and community control (175). Control was the neighbor of cases and those who have not developed symptoms of malaria in the last three weeks. Data were collected through a semi-structured interview administered questionnaire, entered into Epi-info version 7.2.2.6 and analysed using Epi Info V 7.2.2.6 and SPSS 20.

Result; - There were 2099 confirmed malaria cases (55.1%-males) from five kebeles with no deaths recorded. The overall attack rate (AR) was 115/1000 populations (2099/18,315*1000) and it was highest in Meta Kidanemiret (200/1000 populations) and among 5-14 years old (136.9/1000 populations). Staying out side overnight (OR=2.133; 95%CI: 1.044-4.360), living near mosquito breeding sites (OR of 11.452; 95%CI; 3.879-33.810), irregular use of ITNs (OR=9.437; 95%CI: 3.950-22.545), and inadequate ITNs per family size (OR=2.064; 95%CI: 1.176-3.622) were directly associated with malaria outbreak. Wearing long sleeved clothes was a protective factor (OR=0.159; 95% C.I: 0.115-0.223).

Conclusion; - Several unmanaged stagnated water sources with Anopheles mosquito larvae, and the use of ITNs for other purposes were observed. The outbreak was associated with presence of nearby vector-breeding sites, and poor access and utilization of ITNs and staying out side overnight. Adequate information should be given along ITNs for the community in addition to early management of nearby vector breeding sites to prevent similar outbreak in future.

Keywords: Elu Gelan, malaria, outbreak, plasmodium falciparum

1.1.1. Introduction

Malaria is a febrile illness caused by protozoan parasite of genus plasmodium throughout tropical and sub-tropical regions of the world with huge socio-economic and medical impacts.[1] It causes 206 to 258 million cases and 384,000 to 452,000 deaths in 2018 globally and 213 million of cases and 380,000 deaths were reported from WHO African Region. Sub-Saharan Africa carries the bulk of the global malaria burden, with 93% of cases and 94% of global deaths. Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide. In Ethiopia 474,000 to 5.5 million cases and 74 to 14,700 deaths were reported in the same year [2]. Malaria transmission exhibits a seasonal and unstable pattern in Ethiopia, with transmission varying with altitude and rainfall. The peak malaria transmission season in the country is from September to December, following the main rainy season from June/July to September. In general, 75% of the landmass and around 68% population of Ethiopia considered at risk of malaria, which corresponds to areas below 2,000m altitude. Plasmodium falciparum and Plasmodium vivax are the most dominant malaria parasites in Ethiopia [3].

Ethiopia guided its malaria prevention and control activities using the national strategic plan to reduce the burden of malaria significantly. Early diagnosis and prompt treatment, selective vector control that involves use of indoor residual spraying (IRS), insecticide-treated mosquito nets (ITNs) and environmental management are the four major intervention strategies that are being applied in Ethiopia [4]. Malaria burden is higher in populations that are poor and malnourished. Migrant labourers travelling to endemic areas, children <5 years old, and pregnant women are high-risk groups that are affected by the high burden of malaria [1]. Even though household ownership of at least one ITN was increased from 50% to 80% in sub Saharan African countries, the proportion of households with sufficient nets (i.e. one net for every two people) remained inadequate (43%) [5].

Focal outbreaks are common and the distribution varies from place to place depending on climate and altitude. Malaria is a major concern in the country since it is one of the leading causes of morbidity and mortality. Despite the current efforts to control malaria in Ethiopia, the situation has not improved mainly due to the increasing problems of parasite resistance to the relatively cheaper anti-malarial drugs, vector resistance to insecticides, low coverage of malaria preventive services, poor access to health care, rudimentary health service infrastructure, large population movements and limited financial and human resources [6]. Malaria transmission peaks bi-annually from September to December and April to May,

coinciding with the major harvesting seasons. This seasonality has serious consequences for the subsistence economy of Ethiopia's countryside and for the nation in general FMOH [7].

Ethiopia applied interventions like early diagnosis and treatment, and use of vector control methods (indoor residual spray with insecticide and ITNs) to control malaria in the last 25 years. These interventions are highly effective in reducing both the transmission and exposure to infectious mosquito bites and also the concomitant burden of malaria disease. However, ITN ownership and usage levels are still both below target levels. According to 2015 malaria indicator survey, about 64% of households in malaria-endemic areas owned at least one LLIN with regions ranging in coverage from 34 percent and 73 percent [8].

Elu Gelan district received report of unexpectedly high number of malaria cases occurring since July 5th, 2019. This was unusual, as no malaria outbreak had happened in the last 5 years in the district. Therefore we conducted a study. Understanding the reasons for outbreak occurrence in low transmission areas enable to provide early case management, identify factors that maintain the disease, and design more effective prevention and control measures to facilitate malaria elimination strategy by 2030. Therefore, the objective of this study was to investigate, describe and identify risk factors associated with malaria outbreak in district.

1.1.2. Malaria Epidemiology in Ethiopia: The epidemiology of malaria in Ethiopia is well described in national documents demonstrating the threat to larger number of the population from both *Plasmodium falciparum* and *p. vivax*; the major *Anopheles arabinos* vector and the high variability across different transmission strata. This variability is produced in part by geography and climate and in part by recent scale up of control measures. This variability requires that the country address very different situations with prevention and control tools, but it also provides the opportunity to actively create and extend malaria free areas [6]

Malaria is pervasive to Ethiopia; 75% of the landscape areas below 2000 m above sea level is malarias which is fertile low land areas and suitable for agriculture. More than 60 million populations live in these areas and are at risk of malaria. The transmission is unstable and seasonal from September to December and April to May which is coincide with major planting and harvesting experience seasonal transmission of malaria with sporadic season for farmers - aggravate economic loss [6].

In Ethiopia major epidemics occur every 5 - 8 years, but focal epidemics were occurring every year. *Plasmodium falciparum* and *P. vivax* are the two species commonly known to cause malaria in Ethiopia

accounting for 60% and 40% proportion, respectively. The exact number of people getting sick and dying of malaria every year in Ethiopia is not known. However, it is known that millions of people get sick and tens of thousands of people die due to malaria every year and that rates of mortality and morbidity dramatically increase during epidemics. The distribution of malaria in Ethiopia is not uniform. There are areas where the risk of malaria is high and there are areas where the risk is low. There are even areas, 25% of the country, that are malaria free. Malaria is endemic throughout the tropical areas of the world with the highest prevalence found in sub-Saharan Africa, India, and South-east Asia [6].

Low land areas (below 2000 meters of altitude) in Ethiopia are a place where more people are affected by malaria than high landers (above 2000 meters of altitude) [6]. The major malaria vector in Ethiopia is *Anopheles arabinos* and the most dominant malaria parasites are *Plasmodium falciparum* (PF) and *Plasmodium vivax* (PV) [7]. In Ethiopia controlling malaria vector has a long history of more than 50 years, but malaria remains a major cause of morbidity and mortality in Ethiopia. Currently the main goal of vector control in Ethiopia is to reduce the level of malaria transmission. The main focus is: Improved targeting of localities for coverage and quality of indoor residual spraying, introduction, expansion and scaling up the use of ITNs and Application of environmental management and chemical larval control in areas where it could be cost effective [6].

According to the Ethiopian national malaria indicator survey result 64% of households have at least one mosquito net and 44% of pregnant women and 45% of under five children in malaria area had utilized ITNs. [8]. In Elu Gelan district more than 87% of households owned at least one LLIN Among those who had LLIN, only 61% were slept under LLIN or utilized it properly. From those who properly used LLIN, about 49% were under five children and pregnant women [9]. The challenge now is maintaining the existing high LLIN coverage and increasing utilization rates. Further, targeting IRS based on an epidemiologically sound, affordable and sustainable approach continues to be a challenge. While Ethiopia aims to maintain near zero malaria deaths (no more than 1 confirmed malaria death per 100,000 population at risk) in Ethiopia and by 2020, reduce malaria cases by 40 percent from baseline of 2016 and eliminate malaria from Ethiopia by 2030[10]. Now a day's outbreaks occurred in some areas of the country. One of the affected Ethiopia's region is Oromia. West Shoa zone reported malaria case build up from Elu Gelan district on August 5/2019 G.C. Based on the report from West Shoa zonal health department investigation was conducted in the affected District and kebeles special name 'Meta Kidanemiret, Wedeyi Girance, Werji, Tulu Adiyu, and Tita Maru kebeles.

1.1.3. Objective

1.1.3.1. General Objective:

To investigate, describe and identify risk factors associated with malaria out-break in Elu Gelan district.

1.1.3.2. Specific objectives:

1. To verify the existence of the outbreak
2. To describe the magnitude and distribution of the outbreak by place, person and time in Elu Gelan woreda
3. To conduct environmental assessment
4. To identify the risk factor and propose control measures for the outbreak in Elu Gelan woreda

1.1.4. Materials and Methods

1.1.4.1. Study design:

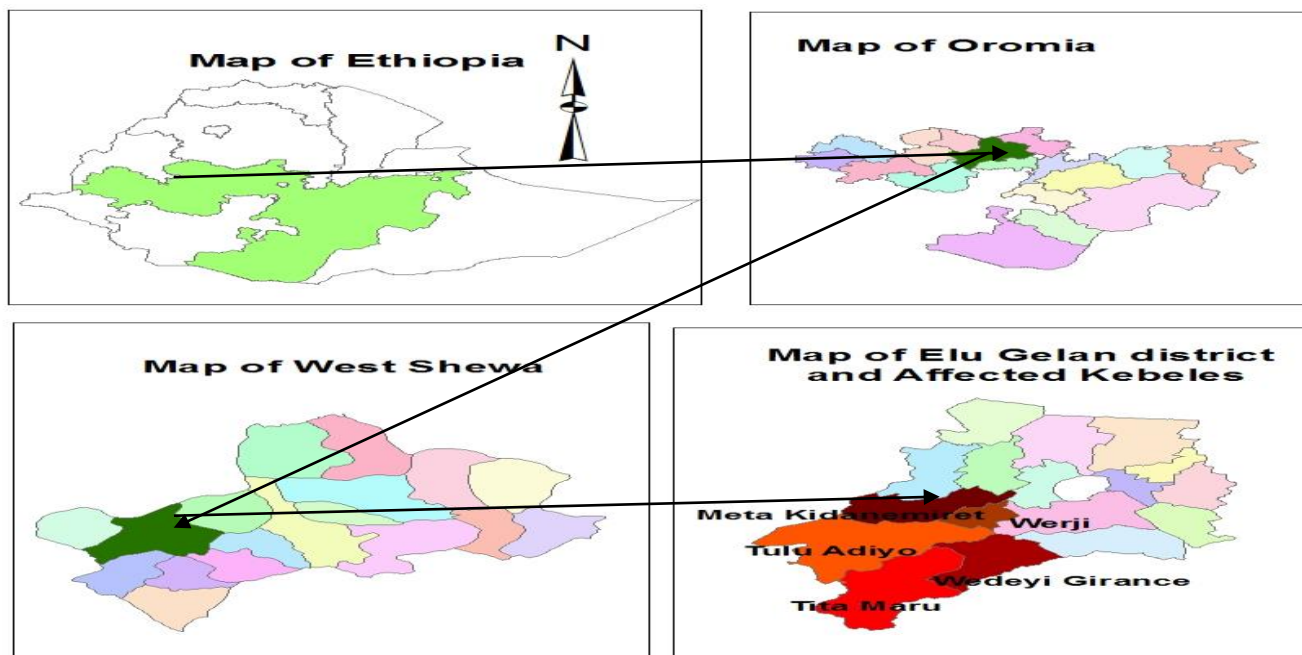
Descriptive Epidemiology; during this outbreak, confirmed malaria case was an acute febrile illness with blood smear positive for malaria. The second largest number from Five year's data (2014-2018) was taken as a threshold and compared with current data (2019). Cases and deaths were obtained from health centers and health posts in the district. This outbreak was described by age, sex, kebele, week, month and year. Attack rate, case fatality rate and slide positivity rate was also calculated.

Analytic epidemiology; unmatched case control study in 1:1 ratio basis to identify the risk factor associated with the outbreak was conducted. Controls were selected from the community and defined as having no malaria sign and symptom for the last 3 months and who did not have malaria by RDT during the outbreak period. The significance of risk factors for the outbreak was determined by calculating Odds Ratio (OR) and 95% Confidence Interval (CI). We used line list for describing malaria cases in terms of time, place and person.

1.1.4.2. Study Area and period: The study was conducted in Elu Gelan District from August 5 to December 2019. Elu Gelan district established as an independent district in 2006 G.C and it is one of the 22 districts found in West shoa Zone. It is 90 KM away from Ambo, the capital of West shoa zone, and 205 KM from Addis Ababa, the capital city of Ethiopia. It is located east of caliya district, west of Bako Tibe, and south of Danno district. The woreda has a total population of 86,006 of and. (43,863 are male and 42,143 female) and 14,131 and 71,875 accounts for under 5 and above 5 age group respectively. The

affected kebeles (i.e. 'Meta Kidanemiret, Wedeyi Girance, Werji, Tulu Adiyo, and Tita Maru) takes 18,315 population. The majority of the inhabitants were Christians, with 96.76% while 3.14% of the population said they professed Muslim. The altitude of this woreda ranges from 1500 meters above sea level in the lowlands to 2200 meters; the climate of the district varies from Kola to Wayina dega. Annual rain fall ranges from 970ml to 1400ml and annual Average temperature 27.5 c°

Figure 1:-Maps of Elu Gelan District, West Shoa, Oromia, Ethiopia 2019



Malaria outbreak kebele in Elu Gelan District, 2019

1.1.4.3. Sample size and Sampling method ; We calculated the sample size using the statistical software calculation of Epi-info taking the power of 80%, odds ratio of 2.25 for ‘presence of mosquito breeding site, percentage of exposed controls of 70.9%, and case to control ratio of 1:1. The total sample size yields 318. With a 10% of non-response rate, our sample size was 350, with 175 cases and 175 controls[11] . We conducted community based case control study. We prepared sampling frame from the line list, selected cases randomly from the line list, and identified one neighborhood controls per each case.

1.1.4.4. Data collection; Data were collected using interviewer administered a structured questionnaire to assess the risk factor for this outbreak. The data collection tools consist of socio-demographic characteristics, clinical information, and exposures information.

1.1.4.5. Laboratory methods: - Laboratory technologists and technicians used a 100x oil immersion microscope to detect malaria parasites and Health Extension Workers confirm malaria species using Rapid Diagnostic Test.

1.1.4.6. Environmental assessment: - Selected cases and controls were asked about presence of mosquito breeding sites in their compound or near their home within 1000 meters' radius. In addition, availability of any uncovered water were observed inside or outside the home of each respondent

1.1.4.7. Data processing and analysis; Data were entered and analyzed using Epi info version 7.2.2.6 and SPSS software version 20. Results were presented using Graphs and tables. Attack rate was also calculated

1.1.4.8. Data quality control; one day training was given to data collectors on the data collection questionnaire. We used line list for describing malaria cases in terms of time, place and person. Data completeness was checked before analysis

1.1.4.9. Operational definition;

Malaria outbreak: increment of malaria cases in a specific week comparing to the second largest number of five year of the same weeks.

Wearing Protective cloth: people those who wore a long cloth that can protect people's leg and hand during night.

Inadequate ITN per family size: peoples who have less ITN number compered to family size (1 ITN for 2 person only) Mosquito breeding site: peoples who have stagnant water, availability of mosquito breeding material, and availability of dungs and tick grass in their dwelling house.

Outdoor overnight: peoples who stay outdoor more than 6 h during the night time.

1.1.4.10. Case definition

1.1.4.10.1. Community case definition: Any person with fever OR fever with headache, back pain, chills, rigor, sweating, muscle pain, nausea and vomiting OR suspected case confirmed by RDT. (Revised PHEM guideline)

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

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

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

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

1.1.4.11. Eligibility criteria

1.1.4.11.1. Inclusion criteria

Cases: Any residents of Elu Gelan district, who had confirmed malaria cases attending health centers and health posts and who agreed to participate

Controls: Any residents of Elu Gelan district during the study who was a neighbor to a case and who had no signs and symptoms of malaria and didn't have confirmed malaria by RDT and agreed to participate.

1.1.4.11.2. Exclusion criteria

Cases: Those who severely ill and who were unconscious during the study period and those who refused to participate.

Control: Those who refused to participate and did not fulfil inclusion criteria

1.1.4.12. Ethical consideration

Official letter from Addis Ababa University, college of health science, school of public health was delivered to ORHB and from Oromia region Health Bureau to West shoa Zone then to Elu Gelan District to assure the legality of this study through field base investigators to practice the ongoing outputs. The purpose and objective of the study was briefly explained and informed consent was signed for study participants and care givers for study subjects with age of less than 18 years old.

1.1.4.13. Descriptive epidemiology: - a case of malaria was defined as an acute febrile illness with a peripheral blood smear positive for malaria parasite or a positive rapid antigen test in a residents of Meta Kidanemiret, Wedeyi Girance, Werji, Tita Maru and Tulu Adiyo kebeles, of Elu Gelan district from August to November, 2019. Weekly malaria surveillance reports were reviewed for 2018/19 and data was compared with the threshold which is determined by the second largest number from five year weekly malaria data to determine whether the epidemic threshold had been crossed. Weekly Surveillance reports

and facility patient registration book were reviewed. House to house active case search was conducted to address all febrile cases. An epidemic curve was constructed.

1.1.4.14. Analytical epidemiology A 1:1 case-control study was conducted to identify the risk factors. Cases were selected based on the case definition mentioned above and those peoples with no fever for the recent months were selected as controls. Semi-structured questionnaire was used to collect information about selected practices, including indoor residual spraying (IRS), utilization of insecticide treated nets, knowledge, attitude and practice of the informants on malaria prevention and controls and transmission, and suspected risk factors near to their house like: - Water resource development programs, artificial water holding containers (i.e. gutter to collect rain water) and stagnant waters. Bivariate analyses were conducted and association between the risk factor and exposure outcome were measured and tested using OR and confidence interval. Data entered and analyzed using Epi-info version 7.2.2.6 and SPSS 20.

1.1.5. Results

1.1.5.1. Descriptive epidemiology by person

This study revealed that, among a total of 2395 suspected malaria cases, 1318 (55%) were males. (Table 1). The median age of suspected malaria cases were 15. The proportion of malaria cases was higher in male than female. The overall positivity rate of this outbreak was 87.6% (2,099). Females had malaria positivity rate of 944 (87.7%). The age group of 5-14 had highest positivity rate 782 (90.7%) followed by above 15 years of age 1119 (87.6%) (Table 1).

A total of 2099 confirmed cases of malaria were identified over the outbreak period from five kebeles. The overall attack rate (AR) was 11.5% (115/1000 populations), and it was highest in Meta Kidanemiret (200/1000 populations) and 5-14 years old (136.6.7/1000 populations) and no death was recorded during the epidemic period.

Among the total of 2099 malaria cases 944 (44.9%) were Female and 1155 (55.1%) were male. Sex specific attack rate was 125/1000 (male) and 104/1000 (female) population. Fever, headache, anorexia, sweating and weakness were predominant clinical manifestation. Diarrhea, vomiting and cough were less frequent, being present in approximately one quarter of cases. (Table 1 and 5). All confirmed malaria cases 2,099(100%) were examined by RDT/Microscopy and from the screened 2395 febrile cases, RDT/microscopy result comes out with 87.6% positivity rate. As the national guideline the outbreak threshold is greater than 50% positive; these results confirmed the outbreak (Table 1). The overall attack rate was 115 per 1000 population with a case fatality ratio of zero. Age group 5-14 years were the most affected with an AR of 136.9 per 1000 population followed by age group >15 years which accounts for 116.6 per 1000 population (Table 3). The highest and the lowest positivity rate was reported in the age group 5-14 (90.7) and less than 4 (77.3) years respectively. (Table 2)

Table 1;- Distribution of malaria cases by sex and Plasmodium species tested in Elu Gelan district, Oromia,-Ethiopia, and August 5- December, 2019.

Gender	Total tested by RDT and Micro	Total positive	Positivity rate (%)	Plasmodium species		
				P. Falciparum; N (%)	P. Vivax; N (%)	Mixed: N (%)
Male	1318	1155	87.6	1067 (92.4)	72 (6.2)	16 (1.4)
Female	1077	944	87.7	886 (93.9)	43 (4.6)	15 (1.5)
Total	2395	2099	87.6	1953 (93.1)	115 (5.5)	31 (1.4)

Table 2;- Distribution of cases by age and Plasmodium species tested in Elu Gelan district, Oromia-Ethiopia, August 5-December, 2019

Age group (years)	Total tested by RDT and Micro	Total positive	Positivity rate (%)	Plasmodium species		
				P. Falciparum; N (%)	P. Vivax; N (%)	Mixed: N (%)
≤ 4	256	198	77.3	177 (89.4)	21 (10.6)	0
5-14	862	782	90.7	719 (91.9)	47 (6)	16 (2.1)
≥15	1277	1119	87.6	1057 (94.5)	47 (4.2)	15 (1.3)
Total	2395	2099	87.6	1953 (93)	115 (5.5)	31 (1.5)

Table 3. Distribution of cases by age in Elu Gelan district, Oromia-Ethiopia, August 5-December, 2019.

Age Group (years)	Frequency	Percent	Population at risk	Age specific AR/1000 Pop
< 4	198	9.4	3009	65.8
5-14	782	37.3	5711	136.9
>15	1119	53.3	9595	116.6
Total	2099	100	18,315	114.6

Table 4. Clinical manifestations among malaria cases in Elu Gelan district, Oromia-Ethiopia, August 5-November, 2019

Symptom	Frequency; (N)	Percent (%)	Symptom	Frequency; (N)	Percent (%)
Sweating	175	100	Rigor	149	85
Diarrhea	2	1.3	Fever	175	100
Headache	175	100	Cough	42	24
Weakness	175	100	Vomiting	22	12.5
Back Pain	162	92.5	anorexia	175	100
Muscle Pain	166	95			

1.1.5.2. Descriptive epidemiology by Place

Among the total of 2395 malaria suspected cases, 903 (37.7%) were from Meta Kidanemiret kebele followed by Wedeyi Girance 423 (17.7%). The most dominant species responsible for this outbreak were P. Falciparum followed by Plasmodium Vivax. The proportion of slides that were positive (slide positivity rate in Meta Kidanemiret kebele 93.5% Wedeyi Girance 87.7%, Tita Maru 87.6%, Tulu Adiyu 87.6%,

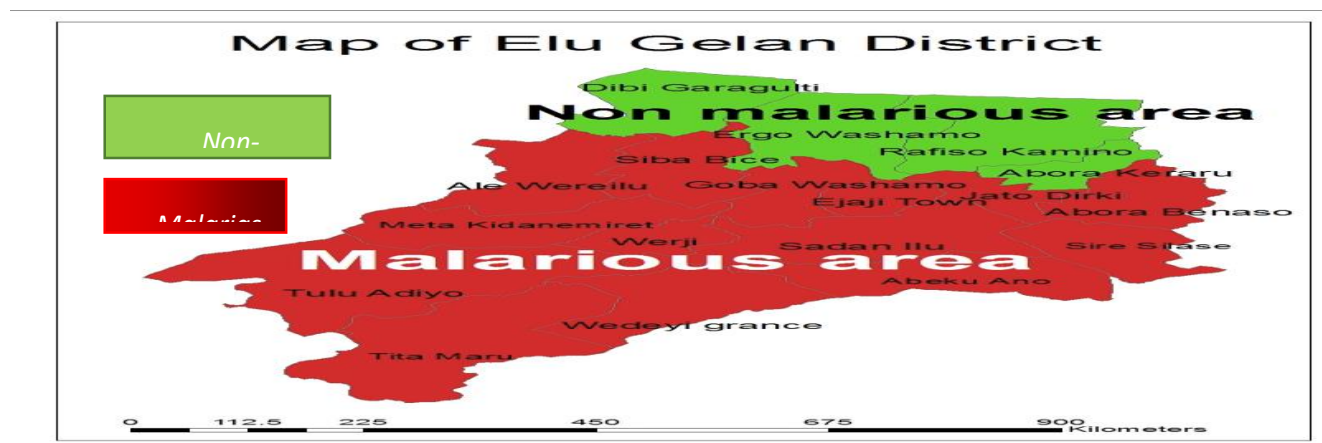
and Werji 69.9% and total 87.6%. On this basis, the event was determined to be an outbreak and not a seasonal increase in the number of cases. (Table 6)

The populations of Meta Kidanemiret kebele were more affected by malaria outbreak followed by Tulu Adiyo Kebele with an attack rate of 201 and 137 per 1000 population, respectively (Table 6).

Table 5. Distribution of cases by Villages and Plasmodium species tested in Elu Gelan district, Oromia-Ethiopia, August 5-December, 2019.

Affected Villages	Total population	Total tested by RDT and Microscope	Total positive	Positivity rate (%)	AR/1000 population
Meta Kidanemiret	4,206	903	844	93.5	201/1000
Tita Maru	4,094	363	318	87.6	78/1000
Tulu Adiyo	2,721	410	359	87.6	132/1000
Werji	1,820	296	207	69.9	114/1000
Wedeyi Girance	5,474	423	371	87.7	68/1000
Total	18,315	2395	2099	87.6	115/1000

Figure 2:-Maps of Malarias and non-malarias kebeles in Elu Gelan District, West Shoa, Oromia, Ethiopia 2019.



1.1.5.3. Descriptive Epidemiology by Time

The alert threshold (second largest number from five year weekly data (2014-2018) had been crossed in WHO week 24 August 2019. It shown that the current trend line of the case was crossed the threshold levels and peaked in week 41 and start to decline in week 47 of October 2019. The Epi curve showed that the district health office intervene lately (several weeks after an outbreak occurred) .The baseline

incidence rate for malaria prior to the outbreak was 2/1000 population to 3/1000 starting week 24. The peak of the outbreak was 29/1000 at week 41 and decreased to 0.4/1000 population in the last week of the outbreak. In 2017, PMI graduated and withdraw the district from IRS program because the burden of malaria was significantly lowered.

Table 6. Trends of malaria across years in Elu Gelan district, Oromia, Ethiopia, 2019

Years	Total Patient at OPD	Total Malaria Cases	% of malaria among all cases	<5 years Morbidity	Pregnant Morbidity	Institutional Mortality
2007	56,743	4,218	7.4	192	21	0
2008	54,312	17,515	32.3	799	88	0
2009	56,231	30,057	53.5	1,371	150	0
2010	54,312	13,599	25	620	68	0
2011	59,564	9,793	16.4	447	49	0
2012	59,876	19,543	32.6	891	98	0
2013	47,654	2,022	4.2	92	10	0
2014	38,765	866	2.2	39	4	0
2015	35,312	491	1.4	22	2	0
2016	36,312	281	0.7	13	1	0
2017	36,668	92	0.3	12	0	0
2018	74,531	363	0.5	25	3	0
2019 (6 M) (July-Dec.)	40,522	8760	21.6	273	13	0

Figure 3. Trends of malaria cases of the last twelve years and 3rd& 4th quarter of 2019 G.C in Elu Gelan woreda, December, 2019

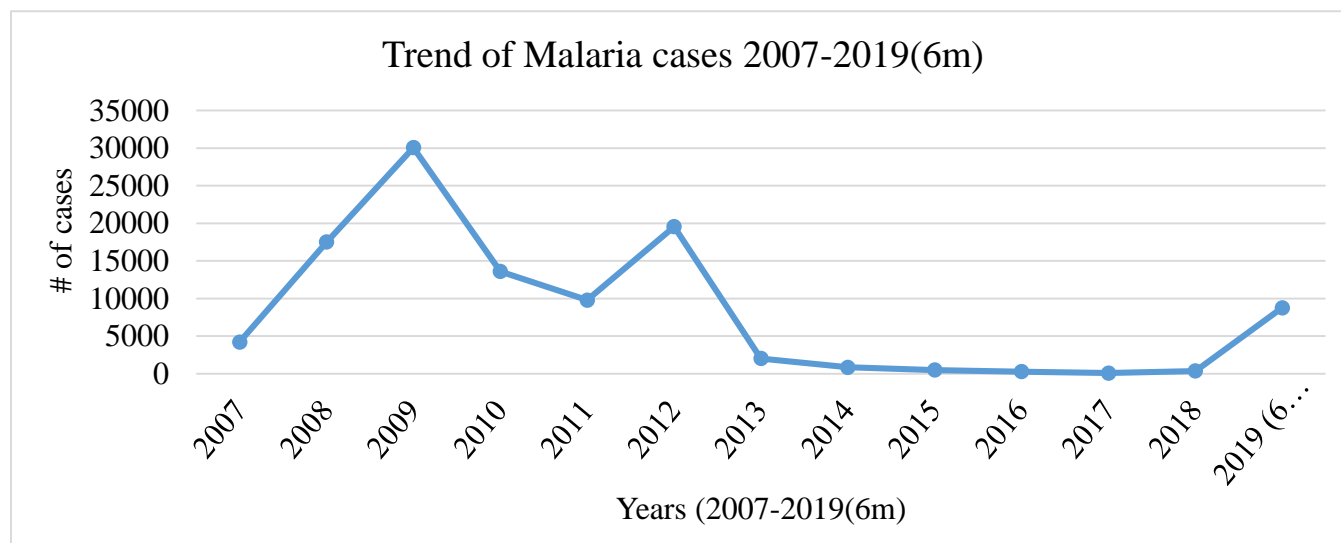


Figure 4. Malaria Epidemic Monitoring Chart, Elu Gelan district, Oromia, Ethiopia, 2019.

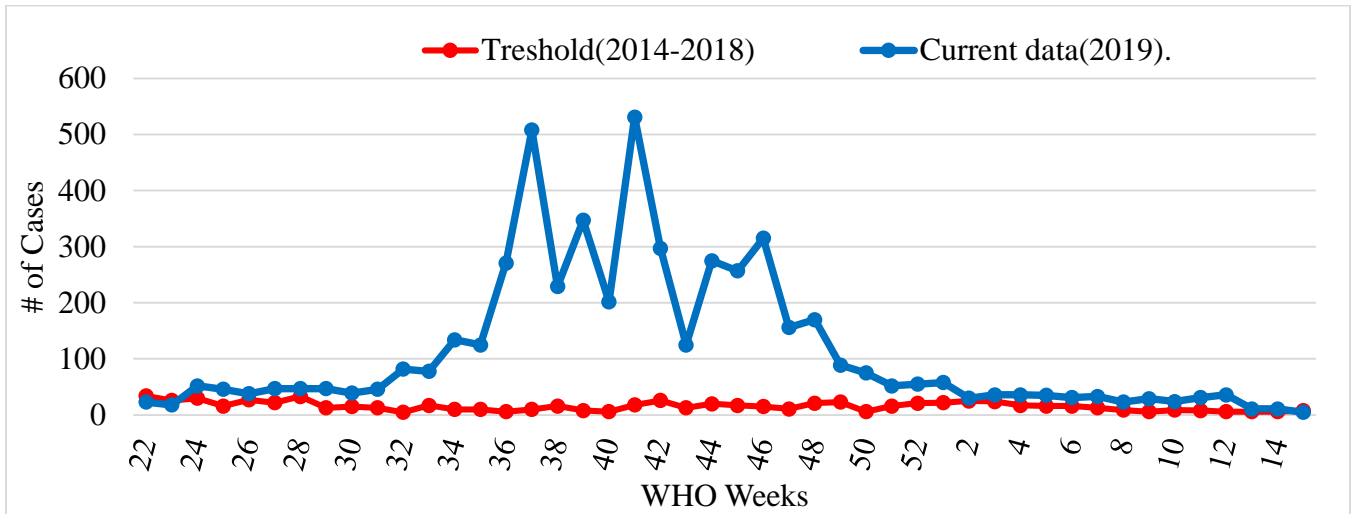
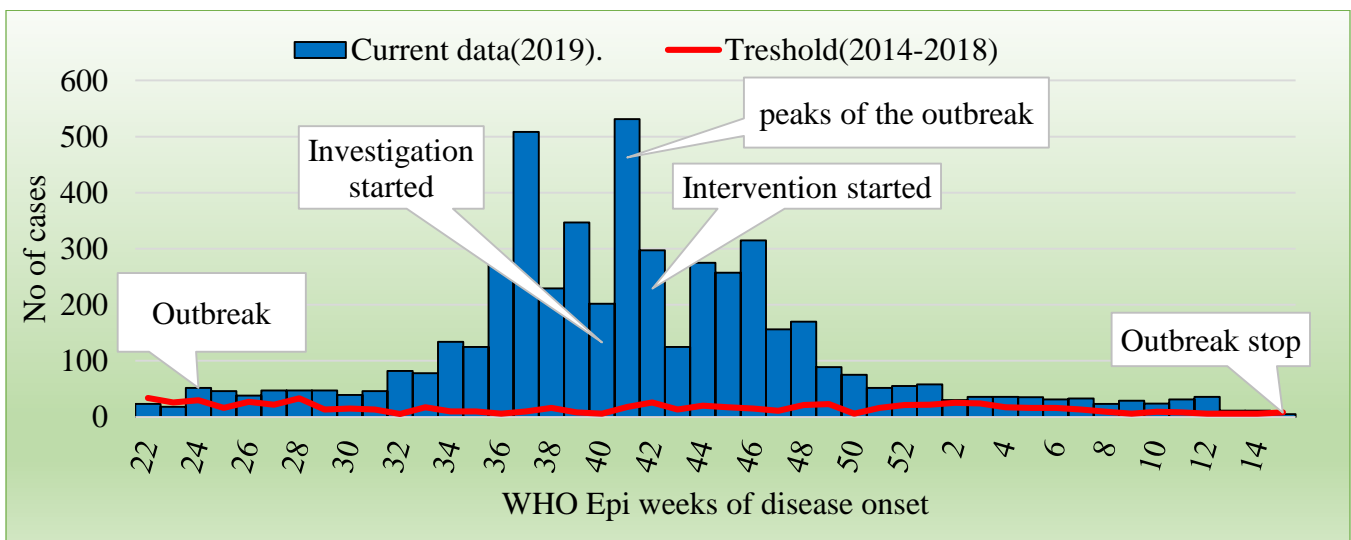


Figure 5. Malaria outbreak Epi Curve in Elu Gelan District, Oromia, Ethiopia 2019.



1.1.5.4. Epidemic preparedness and response

None of the district’s health facility that we visited had an epidemic preparedness plan or rapid response team (RRT) in place prior to and after the outbreak. There were no funds available in the district prior to the occurrence of the epidemic to manage. No chemical was available in all the health facilities in the districts that we visited. There were shortage of kits (RDT and Primaquine). The public health surveillance system was not evaluated prior to the occurrence of the epidemic.

4.5. Analytical epidemiology: - In order to asses associated risk factors, 175 malaria case patients and 175 community control were selected randomly and interviewed. The median age for cases and controls were

34 and 37 respectively. Using multivariate analysis, both cases and controls have bed nets but there was inadequate bed net per family size and irregular utilization of ITNs which has valid association with malaria. 62.89% of cases and 61.43% of controls live near stagnant water and where there was larvae breeding sites around their home which was highly associated with malaria cases.

1.1.5.5. Risk factor Analysis

Of 175 case-patients 104 (59%) and 98 (56%) of 175 controls were male with 100% response rate. In multivariate analysis the risk factors of stayed outside overnight [AOR=2.133(CI 1.044-4.360) P-value of 0.038], presence of mosquito breeding sites around their home,[AOR=11.452(CI 3.879-33.810)P value of <0.001], having inadequate bed net per family size [AOR= 2.064 (CI 1.176-3.622) P value of 0.012], and Use bed net irregularly [AOR=9.437 (CI 3.950-22.545) P value of <0.001] were associated with malaria outbreak.

Table 7: Factors associated with malaria outbreak in Elu Gelan district, West shoa, Ethiopia 2019

Factors	Category	Cases n=175 No (%)	Controls n=175 No (%)	COR (95% CI)	AOR (95% CI)
Staying outside over night	Yes	115 (65.7%)	49 (28%)	4.93 (3.58-6.79)*	2.13 (1.04-4.36)** P.value= 0.038
	No	60 (34.3%)	126 (72%)		
Protective cloth	Yes	62 (34.3%)	135 (77.1%)	0.16 (0.12-0.22)	0.55 (0.29-1.04) P.value=<0.066
	No	115 (65.7%)	40 (22.9%)		
Intermittent rive	Yes	152 (86.9%)	116 (66.3%)	3.36 (2.29-4.92)*	0.16 (0.06-0.42) P.value= <0.001**
	No	23 (13.1%)	59 (33.7%)		
Mosquito breeding site	Yes	110 (62.9%)	105 (61.4%)	1.13 (0.83-1.53)*	11.45(3.88-33.81)** P.value=<0.001
	No	65 (37.1%)	70 (38.6%)		
Irregular use of ITN	Yes	111 (63.4%)	51 (29.1%)	4.22 (3.07-5.79)*	9.44 (3.95-22.55)** P.value=<0.001
	No	64 (36.6%)	124 (70.9%)		
Inadequate ITN per family size	Yes	112(64%)	55 (31.4%)	3.88 (2.83-5.31)*	2.06 (1.18-3.62)** P.value=0.012
	No	63(36%)	120(68.6%)		
Travel History	Yes	22(11.4%)	2(6.3%)	11.16(3.95-31.55)*	0.18 (0.04-0.96) P.value=0.011**
	No	155(88.6%)	173(93.7%)		
	Yes	108(61.7%)	64(36.6%)		0.46 (0.21-1.01)

Presence of artificial water holding bodies	No	67(38.3%)	111(63.4%)	2.79 (2.03-3.84)*	P.value=0.054
Knowledge on transmission	Good	56(32%)	98(56%)	0.37 (0.27-0.50)	0.37 (0.17-0.79) P.value=0.011**
	poor	119(68%)	77(44%)		

* Significant variables in bivariate analysis ** significant variables in multi variate analysis

1.1.5.6. Laboratory:- Between week 24 and week 2, 2019 a total of 2395 malaria blood tests were conducted and 2099 of them were tested positive for malaria species of which 1953 (93%) were *P. falciparum* while the remaining 115 (5.5%) were *P.vivax* and 31(1.5) were mixed.

Table 8; Distribution of Laboratory tested by kebeles in Elu Gelan woreda of west shoa zone, Oromia, Ethiopia, 2019

Affected Villages	Total population	Total Laboratory tested	Total positive
Meta Kidanemiret	4,206	903	844
Tita Maru	4,094	363	318
Tulu Adiyu	2,721	410	359
Werji	1,820	296	207
Wedeyi Girance	5,474	423	371
Total	18,315	2395	2099

1.1.5.7. Environmental assessment: - We identified 25 stagnant water and larvae breeding sites in the range of 1 KM and estimated to 250m². Larvae of anopheles' mosquito were found inside the stagnant water and sample collected by experts from regional health bureau.

1.1.5.8. Intervention: - intervention was not taken early. Both ITN distribution and Indoor residual spray (IRS) were undertaken during and after outbreak investigation respectively. In spite of the fact that larvae breeding site identification, there was no larvicide chemicals (Temphos) for affected kebeles. Health education was given after the occurrence of outbreak about the cause, transmission and prevention of the disease using government structure, schools, mosques and churches. We organized community awareness sessions and training on surveillance and malaria cases management for health care workers.

1.1.6. Discussion

Based on 5 years' epidemiological records of malaria cases, the investigation confirmed the existence of malaria outbreak in five kebeles. Factors like living near mosquito breeding sites, inadequate ITNs per family size, and irregular ITN utilization contributed for the existence of the epidemic. About 1953 (93%) of the confirmed malaria cases were due to plasmodium falciparum (*p. falciparum*) species. This finding is higher than the usual proportion of malaria species in Ethiopia whereas about 60% of the species is *P.f* [12]. This finding also disagrees with previous studies conducted in Butajira Area, south-central Ethiopia, east shoa zone, East Wollega Haro Limu district, Oromia Region where proportion of *p. falciparum* accounted 12.4%, 45% and 22.5% *p.vivax* accounts 86.5%, 54% and 59.2% respectively [13][14][15]. During malaria epidemics, the dominance of *p. falciparum* over the other species is common in Ethiopia [7]. The overall AR is nine point five (9.5) times higher than a study conducted in Laelay Adyabo district Northern Ethiopia (2017) and three (3) times higher than study conducted in Afar (2016) and 3.5 times higher than study conducted in Tanquae Abergelle district, Tigray [16][11][17]. Higher AR might be due to difference in the study populations and area. The AR was highest in Meta Kidanemiret kebele (201 per 1000 populations) and this might be due to presence of multiple mosquito breeding sites nearby residents of Meta Kidanemiret Kebele compared to the other four kebeles. 11 (44%) of 25 mosquito breeding sites were in this kebele. Age specific AR was highest among population 5-14 years and this finding is in line with study from Simada district, northwest Ethiopia, and Laelay Adyabo, north Ethiopia [18] [16]. Males are highly affected than females in the district this may be because males spent most of their time out side home at night keeping cattle's from robberies. Another study also proved that [13, 16], males are affected by malaria than females, which is perceived to be the fact that males are usually engaged in outdoor activities. This could be related to nature of the community: women are less likely involved in outdoor activities between dusk and dawn. Those people living at about 1km radius of mosquito breeding site were 11.5 times to develop malaria compared to those living mosquito free breeding site. This finding is in line with study conducted in Simada District, Northwest Ethiopia: a case-control study [18] and Laelay Adyabo district north Ethiopia [16]. The odds of developing malaria among people who used ITN occasionally was nearly nine times compared to those who use ITNs frequently. Similar finding was also reported from study in Afar region [11] and Simada district, northwest Ethiopia [18]. Respondents who lived in households with inadequate number of ITNs were two times more likely to develop malaria disease. this finding is similar with the study conducted in Afar [5]. Inadequate ITN in households enforce the community to utilize the ITNs infrequently. The odds of developing malaria

among people who stayed outside at night were two times compared to those who stayed inside during night time.[16][17][18] The participants who wore long sleeved clothes were about 85% less likely to develop malaria disease than their counterparts. Clothing can offer protection from biting insects when it is of a thickness and texture through which insects cannot easily bite.[19][20] Our finding unable to reveal any supporting evidence that sleeping area and housing status to show a statistically significant difference between cases and controls. These findings could be related to different social and demographic factors that might not be accounted in. i.e., most of the housing nature found in this community is not screened so that sleeping in or out of the house has no protective value from mosquito biting. The national malaria prevention and control strategy recommends application of IRS at least once in a year with 100% coverage, and at least one ITN per two people in malaria high-risk areas [12]. Despite this fact, IRS was not applied prior to the outbreak and early replacement of ITNs was not done. This might be related to poor planning and /or implementation of malaria prevention and control strategies. Households who had been using the ITNs other than its intended purpose were also observed. This could be due to poor monitoring of the communities after distributing the ITNs given to the communities to enhance their awareness on the cause, transmission, and prevention of the disease.

1.1.7. Conclusion

Generally, the outbreak is related to Interruption of malaria prevention and control activities in the district. Living near mosquito breeding sites, inadequate ITN per family size and irregular utilization of ITNs were significantly associated risk factors for the occurrence of the outbreak.

1.1.8. Recommendation

We recommend, local health officials should apply all malaria prevention and control strategies early and improve awareness of LLIN utilization and environmental management through optimized community participation to prevent subsequent similar malaria outbreaks in the district, and the communities should refrain from using the ITNs for other purpose.

1.1.9. Reference

- [1] World malaria report 2019.
- [2] K. T. Id, M. Yohannes, F. Mardu, and B. Berhe, “Assessment of community knowledge , practice , and determinants of malaria case households in the rural area of Raya Azebo,” pp. 1–14, 2019.
- [3] D. G. Feleke, D. Gebretsadik, and A. Gebreweld, “Analysis of the trend of malaria prevalence in Ataye , North Shoa , Ethiopia between 2013 and 2017,” *Malar. J.*, pp. 1–6, 2018, doi: 10.1186/s12936-018-2474-3.
- [4] A. Talie, “Prevalence of malaria and associated risk factors among asymptomatic migrant laborers in West Armachiho District , Northwest Ethiopia,” pp. 95–101, 2018.
- [5] W. Abay, A. Woday, A. Mohammed, A. Gebre, and K. Urmale, “Prevalence and Associated Factors of Malaria among Febrile Children in Afar Region , Ethiopia : A Health Facility Based Study,” pp. 613–622, 2019.
- [6] P. O. Box, “Current Status of Malaria in Ethiopia : Evaluation of the Burden , Factors for Transmission and Prevention Methods,” vol. 7, no. 1, pp. 1–6, 2018, doi: 10.5829/idosi.apg.2016.7.1.10273.
- [7] R. Areas, G. Zone, E. Molla, and B. Ayele, “Journal of Bacteriology and Parasitology Prevalence of Malaria and Associated Factors in Dilla Town and the Surrounding,” vol. 6, no. 5, 2015, doi: 10.4172/2155-9597.1000242.
- [8] “EPHI,AA,Ethiopia" ethiopia national malaria Indicator survey 2015 technical summary.”
- [9] Elu Gelan health office malaria report “Kebeles reported as malaria epidemic.” .
- [10] U. S. President and M. Initiative, “PRESIDENT ’ S MALARIA INITIATIVE ETHIOPIA,” 2019.
- [11] T. Edition and A. Ababa, “Third Edition,” no. January, 2012.
- [12] A. Woyessa, W. Deressa, A. Ali, and B. Lindtjörn, “Prevalence of malaria infection in Butajira area , south-central Ethiopia,” *Malar. J.*, vol. 11, no. 1, p. 84, 2012, doi: 10.1186/1475-2875-11-84.
- [13] F. Tadesse, A. W. Fogarty, and W. Deressa, “Prevalence and associated risk factors of malaria among adults in East Shewa Zone of Oromia Regional State , Ethiopia : a cross-sectional study,” pp. 1–8, 2018, doi: 10.1186/s12889-017-4577-0.
- [14] E. Wollega, “Prevalence of Malaria and Associated Factors among Febrile Patients Visiting Kalala Health Center in Haro Limmu Woreda , East Wollega Zone , *Epidemiology : Open Access*,” no. February, 2019, doi: 10.4172/2161-1165.1000365.
- [15] A. Tesfahunegn, G. Berhe, and E. Gebregziabher, “Risk factors associated with malaria outbreak

- in Laelay Adyabo district northern Ethiopia , 2017 : case-control study design,” pp. 1–7, 2019.
- [16] M. B. Debela, A. B. Kahsay, and T. M. Mokonnen, “Malaria outbreak and contracting factors in Afar,” vol. 10, no. July, pp. 233–240, 2018, doi: 10.5897/JPHE2018.1000.
- [17] K. Tesfay, B. Assefa, and A. Addisu, “Malaria outbreak investigation in Tanquae Abergelle district , Tigray region of Ethiopia : a case – control study,” BMC Res. Notes, pp. 1–5, 2019, doi: 10.1186/s13104-019-4680-7.
- [18] B. Workineh, F. A. Mekonnen, M. Sisay, and K. A. Gonete, “Malaria outbreak investigation and contracting factors in Simada District , Northwest Ethiopia : a case – control study,” BMC Res. Notes, pp. 1–6, 2019, doi: 10.1186/s13104-019-4315-z.
- [19] Control Measures, “Protective clothing,” pp. 59–87.
- [20] B. Guard, P. Expedition, S. So, and S. Bug, “Insect Repellents Help Prevent Malaria and Other Diseases Spread by Mosquitoes.”

1.2. Investigation of Measles Outbreak in Caliya Woreda, West Shoa Zone, Oromia Regional State, Ethiopia, 2020

Abstract

Background: Measles is an extremely contagious vaccine preventable disease that infects approximately 40 million people resulting in nearly 1 million deaths annually in developing countries. According to official report, an outbreak of measles is occurring throughout the regions of Ethiopia. Caliya was one of the measles outbreak affected woreda in Oromia region in 2019. An investigation was conducted to describe the magnitude of measles, to identify the risk factor and to undertake appropriate prevention and control measures.

Method: We used descriptive cross-sectional followed by unmatched Case control study, 18 cases with 48 controls. We collected data using measles line list, observation of cold chain, key informant interviews using structured questionnaire. Data Analysis was conducted using Epi Info version 7.2.6.6, SPSS V.20 and Microsoft Excel.

Result: A total of 18 measles cases with 2 deaths were reported during the outbreak. The outbreak was confirmed for measles IgM antibody. The index case was from Elfata woreda. Age specific attack rate was higher in age groups of 1-4 year (12.3/1000) followed by Infants aged less than 1 year (AR 4.2/100,000). Overall attack rate of the kebele and woreda was 2.4/1000 and 1.6/1000, populations respectively. Sample was taken for the first five cases and all of them found to be positive for measles IGM. 77.8 % of affected cases were unvaccinated. Exposure to a measles cases was significantly associated with Unvaccinated, contact history and travel history which was (AOR= 9.990, 95% CI (1.614-61.839) with p-value <0.013), (AOR=9.899, 95%CI (1.571-62.370) with p-value 0.015, (AOR=12.061, 95% CI (1.311-110.966) with p-value 0.028 respectively.

Conclusion and recommendation: measles infection was more commonly confirmed among those with none recorded dose (Unvaccinated) children less than 5 years of age compared to suspected cases with one or two recorded doses and they were primarily affected by the outbreak. Contact history, travel history, low vaccination coverage, and poor cold chain management and low level of awareness were most likely contributed to the outbreak. So undertaking supplementary immunization for children 6 months to 15 years of age, enhancing routine vaccination coverage, strengthening cold chain management, and increase community awareness to prevent similar outbreak.

Key words; Measles, Caliya woreda, routine vaccination.

1.2.1. Introduction

Measles is an airborne communicable disease that spreads rapidly through aerosolized respiratory droplets. It is caused by the measles virus; a spherical, non-segmented, enveloped, negative-sense single-stranded RNA virus who is a member of the genus Morbillivirus within the family Paramyxovirus[1].It is a major childhood problem which causes significant illness, death and disability.[2]

Measles is a highly contagious viral disease which affects susceptible individuals of all ages and remains one of the leading causes of death among young children globally, despite the availability of safe and effective measles-containing vaccines.[3] After an incubation period of 10–14 days, measles is characterized by respiratory infection symptoms such as fever (38°C), cough, coryza, and conjunctivitis, followed by a maculopapular rash and high fever (39–40°C).[4]. Measles is one of the world's most contagious diseases which is spread by coughing and sneezing, close personal contact or direct contact with infected nasal or throat secretions. The virus remains active and contagious in the air or on infected surfaces for up to 2 hours. It can be transmitted by an infected person from 4 days prior to the onset of the rash to 4 days after the rash erupts[5]

Measles infects approximately 40 million people resulting in nearly 1 million deaths annually in developing countries. Measles virus accounts for 44% of total deaths among children that are less than 15 years of age. Highest mortality occurs among children living in poor communities especially in areas that are overcrowded, and where there is malnutrition and vaccination coverage is low[2]. According to the World Health Organization (WHO), more measles cases were reported worldwide during the first half of 2019 than in any year since 2006 and The WHO regions with the highest increases in reported cases included Africa (900% increase), the Western Pacific (230% increase) and Europe (150%).[6]

The re-establishment of measles transmission in several countries where it was previously eliminated, including four in Europe (Albania, Czech Greece and the UK), comes as a wake-up call to countries such as Australia.. The UK lost their measles elimination status in August 2019 following a marked increase in cases across England and Wales during 2018 and sustained local transmission. In 2016, the WHO region of the Americas was the first region (as a whole) declared to have eliminated measles. Re-establishment of the disease in Venezuela and Brazil, following ongoing transmission for more than 12 months, has resulted in the region's loss of this status. In 2019, the USA narrowly missed losing its elimination status,

following its largest measles outbreak since it achieved elimination in 2000. This underscores that while measles elimination is hard won, it can be easily lost.[6]

In Africa, about 13 million cases and 650,000 deaths occur annually, with sub-Saharan Africa having the highest morbidity and mortality. In 2018, many developing countries reportedly confirmed measles through laboratory testing with high incidence rates[7]. Measles has been one of the major causes of death and sickness of children in Ethiopia. The disease is known by different names in different localities and languages or Ethnic groups in ancient Ethiopia (such as Kufign, wotetie, ankelis in Amharic, Nifiye in Tigrigna, Shifito, Gifira in Oromifa, Himaki in Afarigna)[8]

In recent years, recurrent measles outbreaks, primarily affecting children below 5 years of age have been reported in several areas of Ethiopia including the Oromia Region.[9] A total of more than 12 thousand cases of measles were reported in 36 zones of 5 regions of Ethiopia in the past 13 months beginning January 2019, according to the UN. “Oromia region bore the brunt of the outbreaks, with 67 per cent of cases, followed by Somali with 21 per cent. Most recently in December 2019 and January 2020, about 1400 cases were reported in East Wollega, East Hararge, West Hararge, Arsi, West Arsi, Shashemene town, West Shewa, Wolayita, Bale, Jima, Gamo, Siti, Kolaher, and Afder zones.[10]

In South West Ethiopia, recurrent outbreak of measles is still habitual despite an expanded vaccination routine and campaign approach as well as implementation of the health extension program is being implemented throughout the country. It believed that there are Different factors that operate at different level determining the measles outbreak recurrence.[11]

Measles is a highly infectious disease that will infect about 90% of unvaccinated individuals exposed before the age of 10 [12]. Measles can infect anyone of any age, but most of the burden of disease globally is still among children < 5 years of age.[13] Case fatality rates from measles vary from 0.1% in the developed world to 15% in the less developed world, with death usually caused by pneumonia or diarrhea. Population immunity of 92% – 95% is considered necessary to stop measles transmission.[14]

According to WHO and UNICEF national immunization coverage estimate, Ethiopia is the fifth country in the world with large number of unimmunized children. In 2018, 872,828 children were not immunized for the third dose of pentavalent vaccine and 1,215,724 children were not immunized with first dose of measles vaccines. [15] Though vaccination coverage’s for the first and third dose of DTP containing vaccine (pentavalent) in Ethiopia has increased from 77 per cent in 2010 to 85 per cent in 2018, measles

vaccination coverage has shown a negligible decrease, from 64 per cent in 2010 to 61 percent in 2018. And 467,586 children have never been vaccinated at all.[15]

According to the 2016 Ethiopia Demographic and Health Survey report, the three biggest and populous regions of Ethiopia (Amara, Oromia and SNNPR) constitute 85.5 per cent of unimmunized children. Incidence of unimmunized children (for all basic vaccines that are given in the country), per 100 children, is highest in Afar (80%) followed by Somali (64%) and Oromia (60%).[15]

Measles remains one of the leading causes of death among young children globally, despite the availability of a safe and effective vaccine. In populations with high levels of malnutrition, particularly vitamin A deficiency, and a lack of adequate health care, about 3–6%, of measles cases result in death, and in displaced groups, up to 30% of cases result in death. Women infected while pregnant are also at risk of severe complications and the pregnancy may end in miscarriage or preterm delivery. People who recover from measles are immune for the rest of their lives[16]

Measles accounts for 5% of child hood mortality. Continuing measles outbreaks, despite efforts to implement planned strategies are documented especially in SNNPR, Amara, and Oromia regions. Beginning 2010, outbreaks became more frequent with visible age shift affecting infants and children and or youngsters above the age of 5 to 20 years[8]. The outbreak response was resource intensive and caused serious illness, particularly among unvaccinated children[17]

Expanded access to measles vaccination was among the most successful public health interventions of recent decades. All WHO regions currently target measles elimination by 2020, yet continued measles circulation in many countries makes that goal seem elusive and remain one of the leading killers of children globally.[18] In 2001 countries in the African region adopted the measles mortality reduction strategy. The recommended strategies for measles mortality reduction include providing the first dose of measles vaccination (MCV1) at or shortly after 9 months of age through routine services and a second dose of measles vaccine through either routine service (MCV2) or through supplemental immunization activities (SIAs).[19]

In response to higher vaccination coverage, reported cases of measles declined > 90% from more than half a million annually in 2000 to fewer than 50,000 in 2008. Despite this progress, 2010 and 2011 saw sharp increases in reported cases due to outbreaks. The average incidence for the period 2012-2014 of reported cases was less than 1 per million population in 11 countries, between 1 and 5 per million in

another 11, between 5 and 9 in 6 countries, and between 10 and 49 in 12 countries. Four countries (Ethiopia, Nigeria, Angola, and Namibia) had an average annual incidence above 50 per million.[14]

Despite great progress in vaccination coverage and surveillance since 2000, substantial challenges to reaching elimination remain. The major challenges are gaps in population immunity at subnational levels, immunity gaps among older children, lack of resources to fully implement recommended strategies, suboptimal performance during SIAs and lack of political commitment and competing priorities at national level.[14]

Outbreak of measles were reported by the woreda health office PHEM officer from one kebele, West shoa Zone on December 20/2019, one case of measles was recorded in unvaccinated child from caliya woreda. Lately on WHO week 51 of 2019, Caliya woreda health office detected increasing number of cases of suspected measles which later confirmed by lab test for measles IgM. All cases were occurred in Tulu Mara Kebele of the Woreda. Investigation team travelled to the woreda and collected information about the outbreak from woreda health office, Tulu Kosoru health center and health extension workers. The woreda informed us there was a new outbreak in Tulu Mara kebeles. On the next day, the investigator of the outbreak and the woreda health office PHEM officer travelled to the Epidemic site (Tulu Mara kebeles) for investigation. On December 27, 2020 investigation and response initiated.

1.2.1.1. Statement of the problem

Measles is a highly contagious viral disease which affects susceptible individuals of all ages and remains one of the leading causes of death among young children globally, despite the availability of safe and effective measles-containing vaccines[3] Measles is more contagious than Ebola, and lingers in the air and on surfaces for long periods of time. You can catch measles simply by being in the same room as someone infected with measles, even two hours after the person left.[20] .Many countries around the world are experiencing measles outbreaks. As of 5 November 2019, there have been 440,263 confirmed cases reported to WHO through official monthly reporting by 187 Member States in 2019.[3] Even with implementation of routine immunization, measles continues to circulate globally due to suboptimal vaccination coverage and population immunity gaps. Any community with less than 95% population immunity is at risk for an outbreak[3]. As of 2018, measles remains a leading cause of vaccine-preventable deaths in the world.[21] In developed countries the mortality rate is lower, for example in England and Wales from 2007-2017 death occurred between two and three cases out of 10,000. In children one to three cases out of every 1,000 die in the United States (0.1–0.2%). In populations with high levels of malnutrition and a lack of adequate healthcare, mortality can be as high as 10%. In cases with complications, the rate may rise to 20–30%.[22] Globally, around 142,000 people died from measles in 2018 – mostly children under the age of 5 years, despite the availability of a safe and effective vaccine.[5] Measles is one of the vaccine-preventable viral diseases and represents an important cause of child mortality in sub-Saharan Africa.[9] As of 22 March 2020, In DR of Congo, there has been a total of 353,551 cases and 6,558 deaths (case fatality ratio 1.9%) since the 31 December 2018. The under-five age group remains the most affected across the country from week 1 to 12 of 2020, with 62.3% of cases.[23] Measles has been one of the major causes of death and sickness of children in Ethiopia[8] According to WHO and UNICEF national immunization coverage estimate, Ethiopia is the fifth country in the world with large number of unimmunized children. In 2018, 1,215,724 children were not immunized with first dose of measles vaccines. Measles vaccination coverage has shown a negligible decrease, from 64 per cent in 2010 to 61 percent in 2018. And 467,586 children have never been vaccinated at all.[15]

According to the 2016 Ethiopia Demographic and Health Survey report, the three biggest and populous regions of Ethiopia (Amhara, Oromia and SNNPR) constitute 85.5 per cent of unimmunized children. Incidence of unimmunized children (for all basic vaccines that are given in the country), per 100 children, is highest in Afar (80%) followed by Somali (64%) and Oromia (60%). Based on the epidemiology of

measles in Ethiopia and burden of disease modeling, it is estimated that more than 1.5 million cases of measles (all age) and 70,000 deaths (assuming 4% case fatality ratio) would occur in Ethiopia annually[8]

1.2.1.2. Rationale of the study

Measles is a notifiable disease condition that needs immediate verbal reporting on clinical Suspicion. According to the PHEM guideline the health facility should notify the woreda within 30 minutes. The woreda should notify the zone within another 30 minutes. The zone should notify the region within another 30 minutes. And the region should notify the Federal PHEM level within another 30 minutes. The total time to report to the federal level should be within 2 hours. Three confirmed or five suspected cases are considered as an outbreak. Investigation of suspected or confirmed measles outbreak and responding to this outbreak is important in order to contain the outbreak locally before spreading. Investigating and responding to any outbreak reduces morbidity and mortality that would happen from the outbreak.

Local capacity to detect (diagnose) and monitor (collect, compile, and analyze data) measles occurrence, is central to an effective surveillance system and to planning control measures. Countries affected by measles are encouraged to strengthen routine immunization, disease surveillance and national preparedness to rapidly detect and respond to outbreaks. So during outbreak investigation local disease surveillance will increase. Furthermore, the study also helps to identify risk factors associated with the outbreak, implement appropriate prevention and control measures.

1.2.1.3. Transmission

Measles virus is contagious and is spread by coughing and sneezing via close personal contact or direct contact with secretions. Measles is the most contagious transmissible virus known. It remains infective for up to two hours in that airspace or nearby surfaces. Measles is so contagious that if one person has it, 90% of nearby non-immune people will also become infected. Humans are the only natural hosts of the virus, and no other animal reservoirs are known to exist. The contagious period begins three to four days prior to and after onset of rash. Transmission is primarily person-to-person via droplet spread; direct contact with nasal or throat secretions of infected persons, and less commonly by articles freshly soiled with nose or throat secretions. Measles is highly contagious, with one case often infecting twenty other individuals.[24], [13], [1],[22] [3]

1.2.1.4. Laboratory testing and notification

Confirming clinically suspected cases of measles with laboratory testing is recommended. The virus is more likely to be present within the first week of onset of rash, so ideally sampling should occur within this time period.[24] Measles is a notifiable disease and the Medical Officer of Health should be notified as soon as measles is suspected and prior to laboratory confirmation. So Serum specimens were collected from five suspected cases and sent to the national measles laboratory for detection of measles-specific IgM anti-bodies test and a test done as per the global and national guidelines.

1.2.2. Objectives

1.2.2.1. General Objective:

To describe measles magnitude and identify risk factors associated with measles outbreak and undertake appropriate public health control measures in Caliya Woreda, west shoa zone of Oromia region, Ethiopia January 2020

1.2.2.2. Specific objectives

To verify the reported measles outbreak in caliya woreda.

To describe the occurrence of the outbreak by time, place and person in the woreda.

To identify the risk factors associated with measles outbreaks

To implement appropriate prevention and control measures.

1.2.3. Methods and materials

1.2.3.1. Study area

Caliya is one of the woreda in west shoa zone, Oromia regional states. It is located at a distance of 176 KMs from Addis Ababa (Capital city of Ethiopia) and 65 KMs from Ambo main city of west shoa zone. It is bordered on the south by Nono woreda, on the west by Ilu Gelan woreda, on the North by Ginde beret woreda and on the East by Ejersa Lafo woreda. The admin center of this woreda is Gedo. The catchment population of the woreda is 109,979 {58,674 (53.4%) male and 51,306 (46.7%) female}. 25,322 (15.27%) of its population were urban dwellers. The ethnic composition of the woreda is 96.19% were Oromo and Amara (3.14%). Majority of the inhabitants said they practiced Ethiopian orthodox Christianity With 68.2% while 15.8% of the population said they were protestant. 11.67% practiced traditional beliefs and 3.99% were Muslim. The woreda has 19 kebeles (18 rural and 1 urban), the physical health coverage of the woreda is 100 %. Currently one General Hospital, 18 health posts and 4 health centers were serving the community. Tulu Mara kebele is the affected kebele and one of 19 kebeles in Caliya woreda with total population of 7,391 with male 49.6% (3,666) and female 50.4% (3,725).

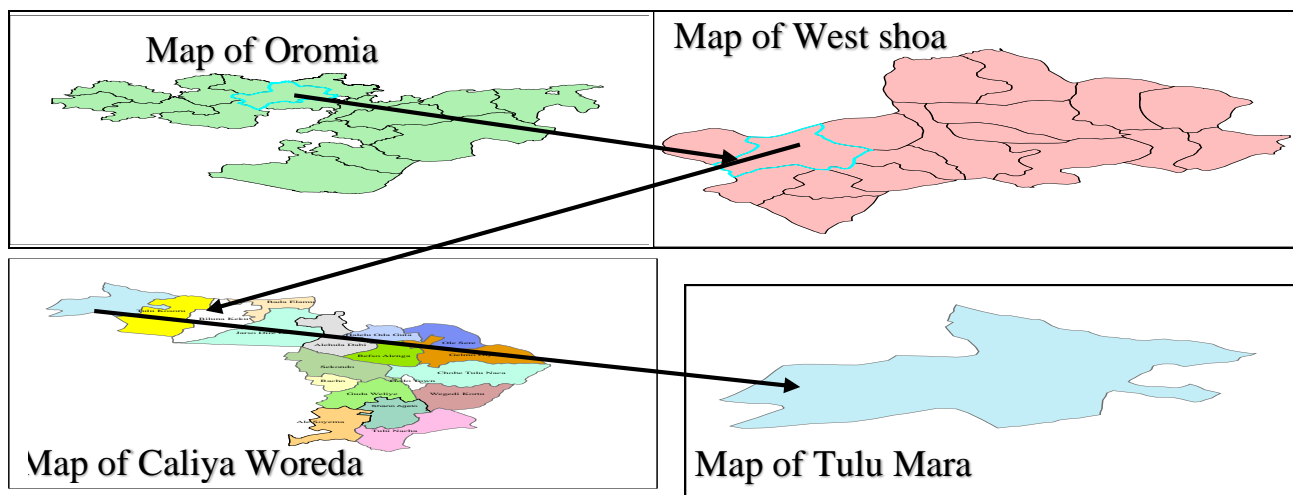


Figure 6:-Map of measles affected kebele in Caliya woreda of west shoa zone, Oromia, Ethiopia, 2019

1.2.3.2. Study period

The study was conducted from December 11/2019 to 26/2019.

1.2.3.3. Study Design

We applied a descriptive analysis of the collected line list of cases followed by Unmatched Case control study design with a case to control ratio of 1:3 in order to investigate the outbreak and identify potential risk factors for the occurrences of the outbreak.

1.2.3.4. Source /Target population

All population living in Tulu Mara kebele of Caliya woreda were the source population

1.2.3.5. Study population

All Children affected by measles were subject of the study.

1.2.3.6. Sample size determination and procedure

Due to rare cases we included all cases for case control study.

1.2.3.7. Sampling Method

We included all 16 reported suspected and confirmed cases and 48 controls randomly from the same village where cases were identified.

1.2.3.8. Case Definition and Selection of Cases and Controls

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

Measles suspected cases at community level: A community member should report any person with rash and fever to a health worker and also advise the person to go to a health facility.

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

Confirmed measles case: A suspected case with laboratory confirmation (positive IgM antibody) or epidemiologically linked to confirmed cases in an outbreak.

Measles death: For surveillance purposes, a measles death is defined as any death from an illness that occurs in a confirmed case or epidemiologically linked case of measles within one month of the onset of rash.

1.2.3.9. Eligibility criteria

1.2.3.9.1. Inclusion criteria

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

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

1.2.3.9.2. Exclusion criteria

Cases: - Those who refused to participate.

Controls: - Those who refused to participate and did not fulfill the inclusion criteria.

1.2.3.10. Data collection tools and procedures

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

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

Interviewing Cases and Controls- Exposure and risk factor information was collected by face to face interview of cases and controls by using structured and semi-structured questionnaire. Additional data

was collected using the line list for measles and WHO case definition was used to classify study participants as case or control.

1.2.3.11. Operational definition

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

Laboratory confirmed case: - is a suspected case which has laboratory results indicating infection (measles IgM positive or isolation of a measles virus).

Epidemiologically linked case: - A suspected measles case that has not had a specimen taken for serologic confirmation and is linked (in place, person and time) to a laboratory confirmed case; i.e., living in the same or in an adjacent district with a laboratory confirmed case where there is a likelihood of transmission; onset of rash of the two cases being within 30 days of each other.

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

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

Vaccinated and unvaccinated measles cases:- Measles cases who have received one or more measles vaccine doses were classified as “vaccinated cases” and those with zero doses and unknown status were classified as “unvaccinated”

1.2.3.12. Data entry and Analysis

All collected data were entered and analyzed using epiinfo version-7.2.2.6, SPSS V.20 and Microsoft Excel.

1.2.3.13. Data Quality control

Before data collection, orientation was given for data collectors. Each completed questionnaire was reviewed by the principal investigator to monitor the data quality. Data was also cleaned for any missing and logically inconsistent values before analysis. We also used line listing for describing measles cases in terms of time, place and person.

1.2.3.14. Ethical Consideration

Official letter from Addis Ababa University, college of health science, school of public health was delivered to ORHB and from Oromia regional Health Bureau to West shoa Zone then to Caliya District to assure the legality of this study through field base investigators to practice the ongoing outputs. The purpose and objective of the study was briefly explained and informed consent was signed for study participants and care givers for study subjects with age of less than 18 years old.

1.2.3.15. Dissemination Plan

This study report was submitted to Addis Ababa University, School of Public Health, Ethiopian field epidemiology program, Oromia Region, West shoa zone and Caliya woreda. The manuscript of the report would be published in peer-reviewed journals to reach the scientific community.

1.2.4. Result

1.2.4.1. Outbreak confirmation

In Ethiopia, a measles outbreak is declared when there are three confirmed or five suspected cases within four consecutive weeks occur in cluster and epidemiologically linked to confirmed cases. Among Five samples from the first five suspected cases, all were positive for measles specific IgM antibodies and therefore measles outbreak was confirmed. The investigation revealed that the first measles case was reported on December 11/2019. The index case was a 2 years old female child who might get infected when travelling early of December to Elfata woreda, one of the woredas in west shoa zone Oromia, in which measles outbreak also occurred from late of November(24/2019) to early of February(12/2020).[25]. The outbreak lasted for almost two weeks, peaks on December 24, 2019 and the last case was identified on 24 December 2019.

1.2.4.2. Demographic characteristics

A total of 18 suspected cases including 2 deaths (CFR=11.1%) were verified as having measles from December 11/2019 to 26/2019 from which the first five cases were laboratory confirmed using the conventional PCR. All reported cases and deaths were from Tulu Mara Kebele of Caliya Woreda. About 55.6% (n=10) were female and 44.4% (n=8) were male. The maximum and the minimum age the case was 9 Month and 20year respectively with a mean and median age of 3.8 and 2 year respectively. The responders (mothers or caregivers) religion were Orthodox Christian 62.5%, protestant 31.25% and Muslim 6.25%. All of them (100%) were married and 87.5% of them were illiterate and 12.5% of them can read and write. concerning their occupational status, all of them were housewife with an average house hold size of 6 person per household.

Table 9. Summary of the Personal characteristics of cases, Caliya woreda, West shoa zone, Oromia, Ethiopia, 2019

Personal Characteristics	Number	%	Personal Characteristics	Number	%
Sex			Occupation		
Male	8	44.4 %	House Wife	16	100%
Female	10	55.5%	Educational Status		
Religion			Illiterate	14	87.5%
Orthodox	10	62.5%	Read and Write	2	12.5%
Protestant	5	31.25%	Marital Status		
Muslim	1	6.25%	Married	16	100%

The main symptoms of the cases were fever, Rash, Cough and Coryza/runny nose 100% followed by conjunctivitis (81.25%), diarrhea (56.25%) loss of appetite (43.75%) and vomiting (37.5%). Concerning complication 11.1 % of the cases have pneumonia (table 2)

Table 10. Common sign & symptoms and complications of cases with measles, Caliya woreda of west shoa zone, oromia region, Ethiopia, 2019. (N=16 enrolled cases)

Sign and Symptoms	Frequency of cases	Percentage	Sign and Symptoms	Frequency of cases	Percentage
Fever	16	100%	Vomiting	6	39%
Rash	16	100%	Complication		
Cough	16	100%	Pneumonia	2	11.1%
Conjunctivitis	13	81.25%	Otitis media	0	0%
Coryza /runny nose	16	100%	2/Convolution	0	0%
diarrhea	9	56%	Blindness	0	0%
Loss of appetite	7	44%	Corneal ulceration	0	0%

All cases 16 (100%) took treatment. All treated cases took antibiotics and none of them took supplementary feeding. 69% of treated cases were completely cured.

Table 11.Type of treatment taken, Caliya woreda of West shoa zone, oromia region, Ethiopia, 2019.

	category	number	%
Treated at Health Facility	Yes	16	89%
	No	2	11%
Type of treatment taken		Number	percentage
ORS	Yes	9	56.25%
	No	7	43.75%
Antibiotics	Yes	16	100%
	No	0	0%
Vitamin .A	Yes	12	75%
	No	4	25%
Antipyretics	Yes	5	31.25%
	No	11	68.75%
TTC eye ointment	Yes	13	81.25%
	No	3	18.75%
Supplementary feeding	Yes	0	0%

	No	17	100%
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Fifty percent (50%) of the interviewee believe that measles is from God and thirty percent (30%) by contact with ill person. Lack of knowledge is the main reason for not vaccinated (68.2%). Forty two percent (42.2%) replied that they prefer traditional medicine for treatment and 67.2 percent believed that measles disease is not vaccine preventable. More than sixty percent (60%) of respondents didn't know the cause and mode of transmission of measles disease. Fifty nine percent prefer traditional healer when they get sick. (Table 4).

Table 12. Knowledge and attitude towards measles, Tulu Mara kebele of Caliya woreda west shoa zone, Oromia region, Ethiopia, 2019.

Variables	Category	# of cases (N=16)	%	# of controls (N=48)	%
Do you Know Mode of transmission	Yes	3	19%	26	52%
	No	13	81%	22	48%
Preferred Treatment Mechanism	Modern Medicine	4	56%	13	27.1%
	Traditional Medicine	6	31%	21	43.7%
	Keeping sick person in door	5	13%	14	29.2%
Knowledge about the Cause of Measles	Know	3	19%	16	33.3%
	Don't Know	13	81%	32	66.7%
Is Measles Vaccine Preventable?	Yes	3	19%	23	47.9%
	No	13	81%	25	52.1%
Where do you go first when you get sick?	Health Facility	5	31%	8	16.7%
	Traditional healer	9	56%	29	60.4%
	Stayed at home	2	13%	11	22.9%
	Others	0	0%	0	0%
How people get measles	Contact with ill person	2	12%	17	35.4%
	From God	11	69%	21	43.7%
	Bad weather	3	19%	10	20.8%
	Others	0	0%	0	0%
Reasons for not vaccinated	Lack of knowledge	9	77.8%	6	60%
	Absent during vaccination	2	11.1%	2	20%
	NA	1	11.1%	2	20%

1.2.4.2.1. Cold chain management

The woreda has 18 health posts and 4 health centers. These functional health posts have no functional refrigerator due to different reasons like lack of power source, shortage of fuel cost, shortage of spare part for the fridge and lack of technical skill to repair. There is functional fridge at all health center.

1.2.4.3. Descriptive Epidemiology

1.2.4.3.1. Descriptive Epidemiology by person

A total of 18 suspected measles cases epidemiologically linked to confirm cases with 2 deaths (both community deaths) were recorded on line list throughout Tulu Mara kebele of Caliya woreda with case fatality rate of 11.1%. Sample was taken from the first five cases to identify the etiologic agent and confirm the outbreak. Accordingly, all (5/5) of them found to be positive for measles IgM using PCR at national reference laboratory. More than half of measles case 10 (55.5%) occurred in females and 13(72.2%) of cases occurred in children below five years of age. The mean and median (IQR) age of the cases was 3.8 and 2 year respectively with a range of 9 months to 20 years.

Table 13. Distribution of measles cases by age and sex in Tulu Mara kebele, Caliya Woreda, West shoa Zone, Oromia Region, Ethiopia, 2019

Age Group	Population	Measles cases and death frequency			In %	AR/100,000	Measles death		CFR (%)
		Male	Female	Total			Male	Female	
<1	238	1	0	1	5.55%	420	1	0	100%
1-4	976	6	6	12	77.8%	1,230	1	0	7.14%
5-14	2304	1	3	4	11.1%	174	0	0	0
+15	3,872	0	1	1	5.55%	26	0	0	0
Tulu Mara	7391	8	10	18	100%	244	2	0	11.1%
Woreda	109,979	8	10	18	100%	16.4%	2	0	11.1%

The overall attack rate (AR) of the case in Tulu Mara kebele was 244 cases per 100,000 populations with case fatality rate of 11.1% (2 deaths/18). The attack rate is high in females (135 cases per 100,000 populations) than males (81 cases per 100,000 populations). Age specific attack rate was vary and Children

1-4 years of age were more affected than any other (AR 1,230 cases per 100,000 population), followed by under 1 years of age (AR 420 cases per 100,000 population), 5-14 years of age AR was 174 cases per 100,000 population. The overall AR for less than 15 years of age was 483 cases per 100,000 population. And for greater than 15 years of age was 26 cases per 100,000 population. (Table 5) Age specific fatality rate was higher in < 1 year 100 % (1/1) followed by 1-4 years of age which was 8.3 % (1/12). (Fig.3)

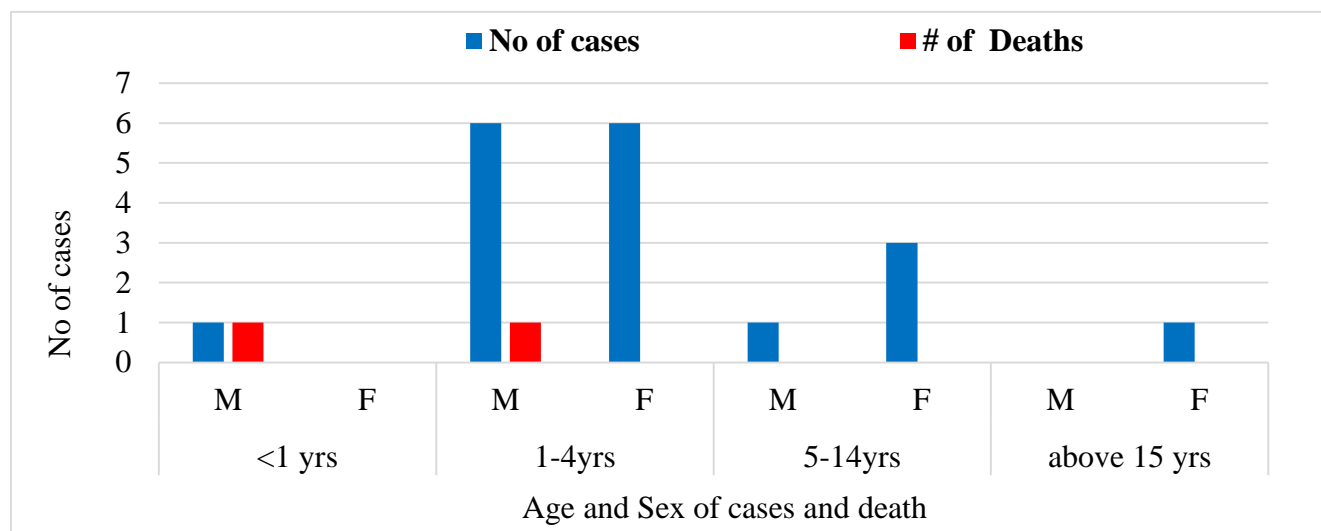


Figure 7. Distribution of measles cases and death by age group and sex in Caliya woreda, West Shoa Zone, Oromia, Ethiopia, 2019.

S.No.	Kebele	Vaccine dose			# cases	% of Unvaccinated cases from kebele total cases
		0	1	2		
1	Tulu Mara	14	4	0	18	77.8%
2	Caliya woreda total	14	4	0	18	77.8%

Table 14. Vaccination status of Measles cases of Tulu Mara kebele of Caliya Woreda west shoa Zone, Oromia Region, Ethiopia, 2020.

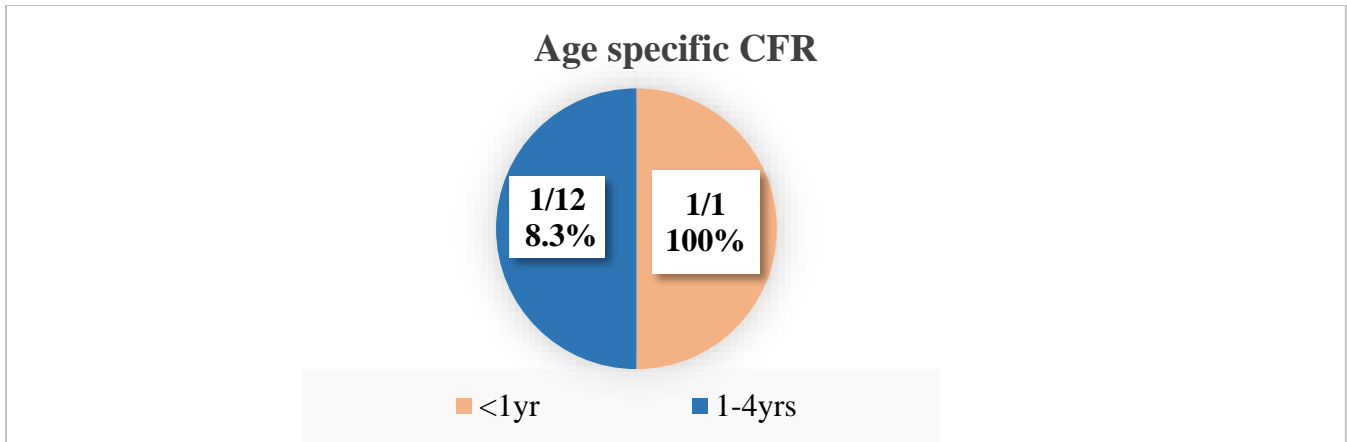


Figure 8. Age specific case fatality rate of measles in Tulu Mara kebele of Caliya woreda, west shoa zone Oromia, Ethiopia, 2019.

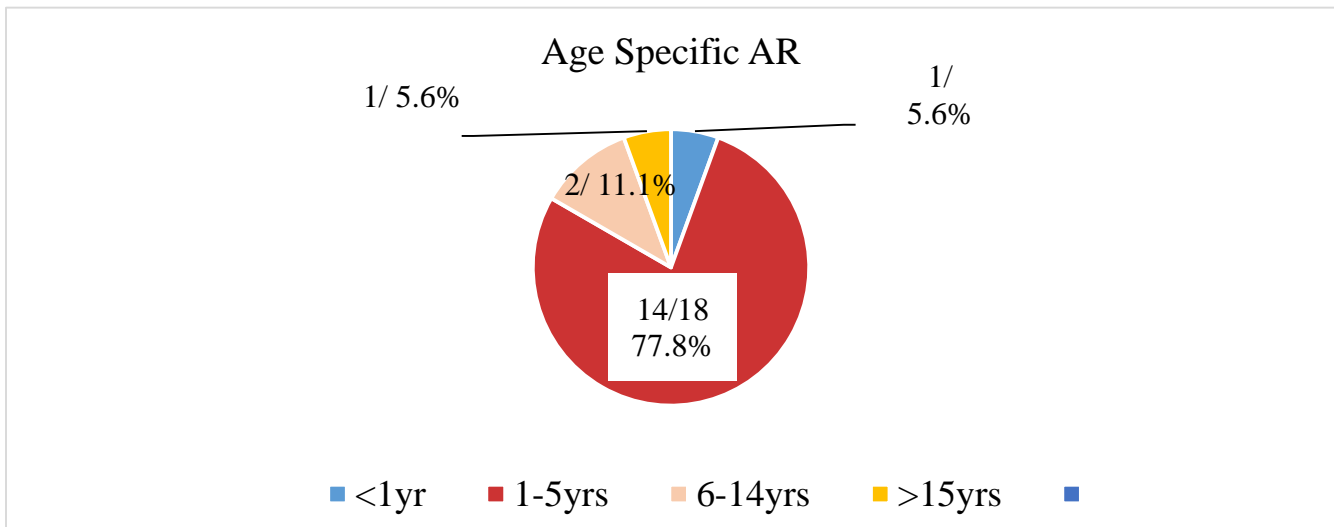


Figure 9. Age specific attack rate of measles case in Tulu Mara kebele of Caliya woreda, west shoa zone, Oromia, Ethiopia, 2019.

1.2.4.3.2. Descriptive epidemiology by Place

One kebele of Caliya woreda was affected by this outbreak. It was occurred within Tulu Mara kebele of Caliya woreda which is hard to reach kebele in the district to even provide routine immunization service and conduct supportive supervision during rainy season due to inaccessible road. The overall attack rate of Tulu Mara kebele was 244 cases per 100,000 population. Two deaths were reported with overall case fatality rate (CFR) of 11.1%. The administrative coverage of measles vaccination in the district and Tulu Mara kebele of 2019 was 71% and 59% respectively. The routine immunization coverage of all kebeles in caliya woreda in 2019 ranges from 59% (in Tulu Mara to 92% (in Gedo town). (Table 8)

Table 15. Measles Attack rate (AR) and case fatality rate (CFR) of Caliya woreda, west shoa zone, Oromia Region, Ethiopia, 2019.

S/N	Kebele	Total population	# of Cases	#of Deaths	Attack rate (AR/100,000 population)	Case fatality rate (CFR)
1	Tulu Mara	7391	16	2	244/100,000 pop.	11.1%
2	Total Woreda	109,979	16	2	14.5/100,000 pop.	11.1%

Table 16. Routine immunization coverage of kebeles in Caliya woreda of west shoa zone, Oromia, Ethiopia, 2019.

S/N	Name of Kebeles	Total Population	Under 1yr population	Vaccination coverage (%)
1	Tulu Mara	7,391	238	59%
2	Biluna Keku	7,170	231	68%
3	Tulu Nacha	5,589	180	75%
4	Tulu Kosoru	6,996	225	72%
5	Halelu Oda Guta	3,373	109	68%
6	Jarso Dire Gada	9,385	302	59%
7	Bada Elamu	3,388	109	62%
8	Rafiso Alenga4	3,700	119	71%
9	Sekondo	3,087	99	79%
10	Racho	1,902	61	76%
11	Guda Waliye	4,359	140	74%
12	Wegedi Kortu	4,056	131	76%
13	Gelma Giyorgis	3,784	122	71%
14	Hole Sire	3,670	118	68%
15	Shano Agelo	4,190	135	65%
16	Ale Soyoma	4,975	160	61%
17	Chobe Tulu Choria	5,330	172	74%
18	Ale Hula Dabi	7,619	245	66%
19	Gedo Town	20,016	645	92%
	Caliya woreda	109,982	3,541	71%

Measles immunization coverage of kebeles in Caliya woreda west shoa zone, Oromia, Ethiopia, 2019.

1.2.4.3.3. Descriptive epidemiology By Time

On 11 December 2019, one measles case was recorded in unvaccinated child from Tulu Mara kebele of Caliya woreda. Onset of rash occurred between December 11/2019 and 26/2019 (figure). The detection and notification of the outbreak was late by more than a week. The outbreak was lasted almost for 2 weeks. The investigation team were reached the site more than one week later after the occurrence of outbreak. (Figure). Routine immunization coverage of the district across years was not uniform. It shows ups and down from 2015 to 2019. In 2017 it achieved more than the district target set by Ethiopian national EPI and Global vaccine action plan which is >80%.

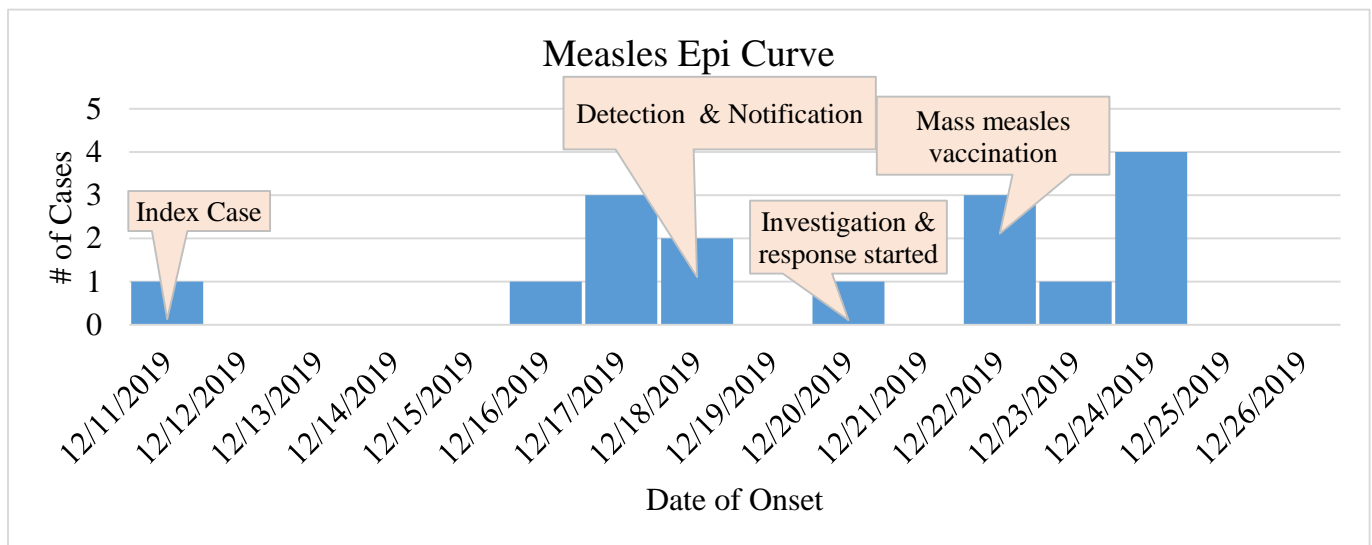


Figure 10. Measles outbreak Epi curve by date of onset in Tulu Mara kebele of Caliya woreda, West Shoa Zone, Oromia Region, Ethiopia, 2019

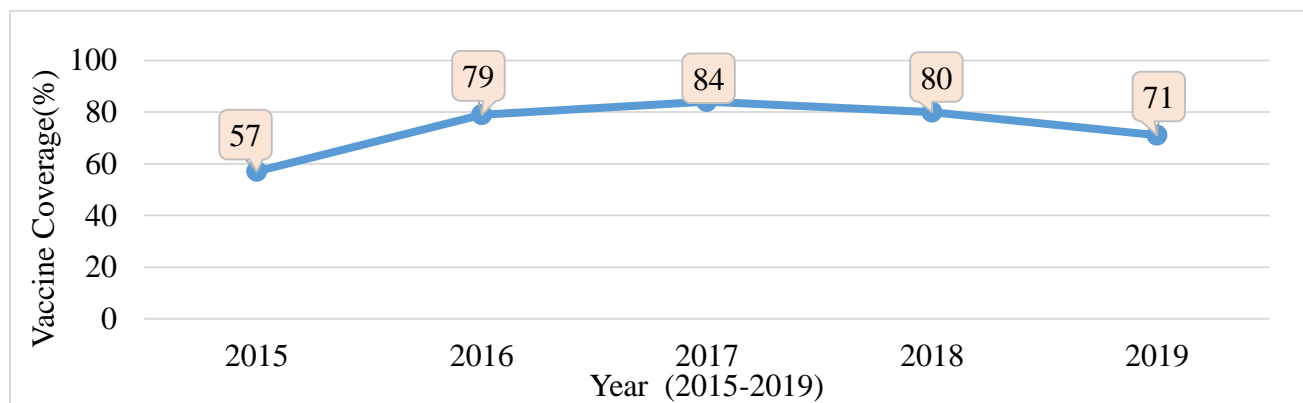


Figure 11. Measles vaccination coverage from, 2015-2019, Caliya woreda, west shoa zone, Oromia, Ethiopia 2019

1.2.4.3.4. Risk factor analysis

In order to assess the possible risk factors of the outbreak, we applied bivariate and multivariate analysis using 95% confidence level and p-value 0.05% and less. On multivariate analysis Unvaccinated case AOR=9.990 (1.614-61.839), travel history of cases AOR= 12.061 (1.311-110.966), and contact history with a rash patient AOR=9.899 (1.571-62.370) were statically associated with probability of acquiring the disease.

Table 17. Bivariate Vs. Multivariate analysis of risk factors for a Measles outbreak in Tulu Mara kebele of Caliya Woreda, west shoa zone Oromia, Ethiopia, December- 2019

Factors	Category	Case No (%)	Controls No (%)	COR (95% CI)	AOR (95% CI)
Nutritional Status	malnutrition	11(69)	16(33)	4.400(1.304-14.838)	0.301(0.049-1.839) P.V=0.194
	Normal	5(31)	32(67)		
Educational Status of Family	Illiterate	14(88)	18(38)	11.277(2.291-55.529)	0.138(0.019-1.013) P.V= 0.052**
	Literate	2(12)	29(62)		
Vaccination status	Unvaccinated	12(75)	10(21)	11.400(3.018-43.053)	9.990(1.614-61.839) P.V= 0.013**
	Vaccinated	4(25)	38(79)		
Travel History	Yes	5(31)	2(4)	10.454(1.786-61.186)	12.061(1.311-110.966) P.V= 0.028**
	No	11(69)	46(96)		
Contact history	Yes	11(69)	14(29)	5.343 (1.566-18.220)	9.899 (1.571-62.370) P.V= 0.015**
	No	5(31)	34(71)		
Knowing mode of transmission of measles disease	Yes	3(19)	26(52)	0.195 (0.049-0.774)	0.042 (0.003-0.534) P.V= 0.015**
	No	13(81)	22(48)		
Housing condition	Not ventilated	15(94)	29(60)	9.827(1.197-80.681)	0.195(0.013-3.003) P.V= 0.241
	Ventilated	1(6)	19(40)		

* Significant variable in Bivariate analysis ** Significant variable in multivariate analysis

1.2.4.3.5. Vaccination Coverage

According to the woreda health office family health report, the measles vaccination coverage of the woreda was 71 %, in 2019. According to this report all kebeles achieved below the district target set by Ethiopian national expanded program for immunization and Global vaccine action plan which is >80%. From the total cases 14 (77.8%) of them had not received any dose of measles containing vaccine (MCV1) and 4 (22.2%) of cases were vaccinated for measles. There was no vaccination card at all. The vaccination

status of those vaccinated cases was identified from vaccination memory (from mothers or care givers response). The average dose taken by the vaccinated cases were one does, and the mean duration of last vaccination was identified as 15 month. Moreover, 11 (68.75%) of the cases aged between 9 month and 5 years (the age range in which a high level of vaccination coverage is to be expected) had not received any dose of measles vaccine. All vaccinated cases had received only one dose of measles containing vaccine (MCV1).

Table 18. Proportion Measles unvaccinated children in Caliya woreda, west shoa zone, Oromia, Ethiopia, 2019

S/ N	Name of Kebeles	Total Population	Under 1yr population	Vaccination coverage (%)	# of Unvaccinated 1<year children	% of Unvaccinated children
1	Tulu Mara	7,391	238	59%	98	41
2	Biluna Keku	7,170	231	68%	74	32
3	Tulu Nacha	5,589	180	75%	45	25
4	Tulu Kosoru	6,996	225	72%	63	28
5	Halelu Oda Guta	3,373	109	68%	35	32
6	Jarso Dire Gada	9,385	302	59%	124	41
7	Bada Elamu	3,388	109	62%	41	38
8	Rafiso Alenga4	3,700	119	71%	35	29
9	Sekondo	3,087	99	79%	21	21
10	Racho	1,902	61	76%	15	24
11	Guda Waliye	4,359	140	74%	36	26
12	Wegedi Kortu	4,056	131	76%	31	24
13	Gelma Giyorgis	3,784	122	71%	35	29
14	Hole Sire	3,670	118	68%	38	32
15	Shano Agelo	4,190	135	65%	47	35
16	Ale Soyoma	4,975	160	61%	62	39
17	Chobe Tulu Choria	5,330	172	74%	45	26
18	Ale Hula Dabi	7,619	245	66%	83	34
19	Gedo Town	20,016	645	92%	52	8
	Caliya woreda	109,982	3,541	71%	1,027	29

Forty two percent of the respondents from both case and control were moderate malnutrition. Among measles cases, 69% were malnourished. To assess the nutritional status of study subjects the middle upper arm circumference was measured and from the total 16 cases, 11 of the cases had moderate mal nutrition. (Fig.7)

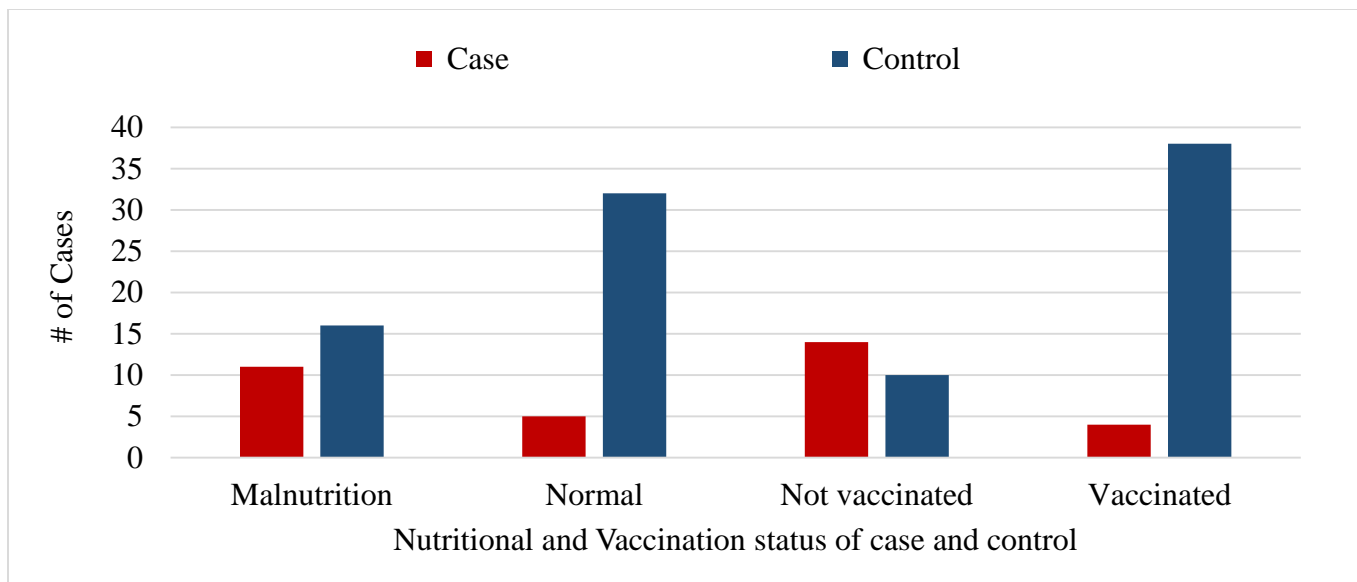


Figure 12. Nutritional and vaccination status in Tulu Mara kebele of Caliya woreda, west shoa zone, Oromia, Ethiopia 2019

We also made a discussion with key informants including the district health officials, Kebele health extension workers and families of the cases. Based on the key informants the outbreak started after the index case (2 years old girl) return to home with her mother after staying in neighboring district for 3 weeks. The mother of the index case reported that, she acquired a fever and rash while she was at the neighboring district. After she come back to home her brother (4 years old) started to show the same symptom. The index case was not vaccinated for measles before and the mother thinks the disease happens because of bad water and she didn't take her children for medical intervention. After few days the disease started to expand in the village and a health extension worker reported the condition to woreda health officials

1.2.4.3.6. Measles outbreak Response

After the team reached at Caliya Woreda, we revitalized a rapid response team to coordinate the outbreak at Woreda level. With Woreda Health Office, we started an active surveillance of Measles. Mass vaccination was conducted by the Oromia regional health bureau. With the local health extension, the team gave a health education on the cause and mode of transmission of measles disease. During our interview with the local community their knowledge and attitude on the usefulness of vaccine to prevent measles was very poor, hence the team gave a feedback to local administration to give a health education

and advocacy activities on the usefulness of vaccine (for vaccine preventable disease especially Measles vaccine to prevent similar incidences.

1.2.4.3.7. Intervention

The investigation team identified and characterized the measles outbreak. Technical assistance was given for health workers on case management, recording and reporting situation. Cases were treated to prevent further spread and reduce morbidity and mortality attributed to measles. Routine surveillance was enhanced and the situation was closely followed at each level on a daily bases, health education given and vaccination campaign was given age 6 month up to 15 years for 3 kebeles bordering the affected kebeles.

1.2.5. Discussion

The majority of the cases (83.3%) were in the age group between 0-5 years old, which is high compared to the outbreaks which occurred in Gabon from April to June 2017 in which 0-5 age group accounted for just 77% of the cases.[4] ,Artuma Fursi woreda, oromia zone which is 31.6%, [16] outbreak occurred in USA New York city which is 58.4%, [17] , outbreak happened in United states in 2019 which is 44.1%[26], and outbreak occurred in north Sumatera, Indonesia which is 46.4%[27].But in Canada the most commonly reported age group is 10-14 years.[1], and in Israel measles outbreak occurred in an adult population with high 2-dose measles vaccination coverage.[28].

An outbreak occurred in Tulu Mara kebele of Caliya Woreda, west shoa zone, Oromia region starting from December 11, 2019 to 24 December 2019. The crude attack rate was higher (244 cases per 100,000 population) compared with the attack rate of measles outbreak recorded nationally, 1.7 per 100,000 population, in 2018 [29]. In addition, this finding was also higher compared with outbreak investigations conducted in Artuma Fursi woreda Oromia zone Amhara region, Guji zone of Oromia, north Sumatera Indonesia, district of Baluchistan province Pakistan, Osun State Nigeria, Bulgaria and France which were 11.8, 81.2, 14, 11.27, 28.8, 17 and 4 cases per 100,000 population respectively [30], [31], [27], [32], [12] and [33]. But lower than other outbreak investigation done in Beijing, China in 2018, Jarar zone of Somali region and outbreak investigation among Thai and Migrant workers in two factories in Nakhon Pathom Thailand in 2019, in Ginnir district of Bale zone Oromia and in Lithuania which was 431, 282, 1003,630 and 304 cases per 100,000 population respectively.[34], [35], [36], [37] and [33].

This may be due to delayed detection and confirmation of the epidemic, which leads to a delayed response to the epidemic. On the other hand, the higher attack rate may be due to the build-up of the susceptible population which may have contributed the spread of the disease faster than expected.

Under five year of age was a highly affected group (AR 1,153/ 100,000) which is the reflection of weak routine immunization coverage in the affected kebele as well as woreda and it is higher than outbreak investigation conducted in Guji zone of Oromia, Artuma Fursi woreda of Oromia, and Jarar zone of Somali Region, which was 36, <29, and 535 cases per 100,000 population [31],[30],[35]. And it is in line with outbreak investigation conducted in Pakistan.[32] But it is lower than the finding of measles investigation conducted in north Sumatera, Indonesia (50,000/ 100,000) [27].and it contradicts with the study conducted in Artuma Fursi woreda of Oromia zone, Amara region and Netherlands that showed the more affected age group were 5-14 and 4-12 respectively [30],[38].The AR for <1 years of age was 420 cases per

100,000.though it was less affected than 1-5 years of age, it is higher than studies conducted in South Africa, Guji zone of Oromia region, north Sumatera of Indonesia, which was 284, 17, 0.0 cases per 100,000 population[39].

Vaccination is the key preventive intervention for measles control[40] Vaccines are considered one of the most safe and cost-effective interventions to reduce childhood morbidity and mortality. Globally, 2-3 million deaths are currently prevented by vaccination every year [41] Despite these acknowledged sign of progress in morbidity reduction, measles is still not controlled in many parts of the world; particularly in Africa and Asia.[42] Wars and famines or other natural disasters increase mortality due to measles. In 2000, measles was responsible for 22% of deaths in children less than 5 years of age and 17% of deaths in children aged 5–14 years in Ethiopia.[2] In developing countries, case-fatality rates average is between 3% -5%; but can be as high as 10%-30%.[43],[37] and[16]

The overall Case fatality rate (CFR) of this outbreak was 11.1% which is higher than the case fatality of measles expected in Ethiopia(3-6%) and expected from developing countries(3-5%)and it may goes up to 10% in an outbreak setting.[44],[8]. This finding is also higher compared to similar studies conducted in Jarar zone of Somali region, Ginnir district of Bale zone Oromia region, Samoa Island, Pakistan, Artuma Fursi woreda of Oromia zone Amara region, Guji zone of Oromia region, Democratic Republic of Congo, Guinea, Kenya, and south Sudan which was 1.2%, 0.5%, 1.32%,7.27%, 2.6%, 0.2%, 1.2% ,0.4%, 0.2% and 0.5% respectively [35], [37] [36], [45] [30], [31],[46]. Age specific fatality rate was reported from children in the age-group of less than five year (13.3%). This high CFR might be due to delayed detection & notification, security problem, unavailability of logistics and supplies and absence of health facilities in recommended distance range which lead to delayed response to the outbreak.

In this outbreak investigation, 5% (1 kebele) was affected with measles outbreak. An active case search and contact tracing was conducted to identify the source of infection and determine whether other areas have been exposed or not. The index case, a Two year's old unvaccinated female case was seen in Tulu Mara kebele on December 11, 2019. The index case showed sign and symptom on 22/12/2019.the index case had travel history to Elfata woreda (one of the woreda in west shoa zone and declared measles outbreak in November 25, 2019) and had history of contact with confirmed case.

Measles vaccination increases the immunity against measles and high vaccination coverage reduces the risk of measles infection in the community [27],[18]. The virus can remain viable in the air for approximately 2 hours and unvaccinated individuals have an approximately 90% chance of contracting

the disease with the potential of affecting 9 to 18 other people.[1] evidence indicates that a single dose of correctly administered measles vaccine which results in sero-conversion will afford lifelong protection for mostly healthy individuals.[47]. Seventy five (75%) percent of measles affected cases had not received any measles vaccination. which is below District and national target set by Ethiopian national EPI and the Global vaccine Action plan which was (80% and 90%) by 2020 respectively. But higher than national measles coverage which was 58.6% (EDHS, 2019). [41].

This finding was in line with studies done in the Guji zone of Oromia region, Australia, Ethiopia, Ginnir district Bale zone Oromia region, Sekota zuria district northern Ethiopia, north west Tigray region Ethiopia, New York City and Madagascar, also discovered that 75%, 66.7%, 58.6% ,79%, 52% 62%, 73.3% and 67.2%, of affected children by measles outbreak were unvaccinated. [31], [6], [41],[37],[42],[48], [17] and [44]. But it was higher than studies conducted in Haut-Ogooue Gabon which is 34.8%, and lower than studies conducted in Pakistan which was 100% unvaccinated.[32].Sixty nine (69%) percent of unvaccinated cases were children under five years of age.

Vaccination is known to be the main protection against Measles. The recent (2019) measles vaccination coverage of Ethiopia was less than 90% (national and WHO target) [41]. Based on data of Caliya woreda health office, about 95% of kebeles vaccination coverage was less than the district and national target (80% and 90%). The district measles vaccination coverage of 2019 was 71 %.(Table 8). All measles cases was reported from Tulu Mara kebele and the lowest (59%) routine measles vaccination coverage for 2019 was also reported from this kebele. According to this findings, there is a strong association between vaccination and the chance of acquiring measles virus.

There was a relationship between Nutritional status of the cases and the chances of acquiring measles. This study showed that malnourished children were 4.4 time at high risk than Normal children. According to this assessment, the parents' knowledge about measles transmission and prevention was very low; only 18.75% of case respondents and 43.75% of controls knew that measles can be transmitted by inhalation and only 40.6% of case and control respondents knew that the disease could be prevented by vaccination. Among unvaccinated children, 68.2% of them were due to lack of knowledge and 29.7% of them knew that contact with measles cases cause measles infection. Similar study conducted in Bassona Worena woreda, Amhara region. [50]

Our investigation also found that contact history with measles cases was another risk factor for the outbreak. The odd of having measles among individuals who had contact with measles case-patient was

almost five-fold higher when compared to those who had no contact history (AOR= 5.343, 95% CI (1.676-7.168)). This finding is consistent with study conducted in Ginnir woreda of Bale zone Oromia, Sekota Zuria woreda of Amara, north Sumatera Indonesia and Madagascar [37][42] and [44]. Contact history refers to sharing the same air space, usually an enclosed area (for example living in the same house hold or being in the same room, school, health facility waiting room, office or transport) for any length of time with a case during the case's infectious period. In addition, the virus remains contagious in the air or on infected surfaces for up to 2 hours even if the contact was not in the same room at the exact same time as the case.[24],[49].

Immunization may not produce protection if the vaccine has been improperly handled or vaccine potency was not kept. All health posts had no fridge and they take vaccine from the nearest health center on monthly base. More than sixty percent (12/19) of health posts were located in long distance (almost greater than 5 km from the nearest health center) and the topography is challenging. Long distance along with hardship topography need more than 2 hour to take vaccine from health center. Because of this reasons the vaccine potency and the cold chain system be questionable. All this factors might contribute to the outbreak of measles.

1.2.6. Conclusion

The investigation indicates that the risk of this measles infection occurrence correlates highly with an increased risk in unvaccinated children less than 5 years of age contact history and travel history. Of course, further investigation must be conducted to get actual picture of the vaccination's true impact. Measles infection among unvaccinated individuals is associated with the majority of outbreaks occurred in Ethiopia. Unvaccinated children less than 5 years of age were primarily affected by the outbreak. The case fatality was higher than expected in Ethiopia (11.1 %.). CFR and AR was higher in children under five years of age. The woreda routine measles vaccination coverage was much less than the expected national and district target for year 2020. The predominant contributing factors for the occurrence of this outbreak was being unvaccinated and having malnutrition and a close contact history with measles cases. Increasing immunization coverage to district and national target (>80% and >90%) and strengthening supplementary immunization activities to refill the routine immunization schedule might reduce the number of susceptible individuals in the population and risk of an outbreak.

1.2.7. Recommendations

Since there are no specific treatments for measles, getting the measles vaccine is the best way to protect the virus and non-selective mass vaccination campaign should be undertaken. Though the highly affected age group was unvaccinated under five children, we would recommend that all children and susceptible individuals be vaccinated with measles vaccine based on the national and WHO recommended guidelines. Enhance mass vaccination campaign. Woreda health office should monitor and evaluate monthly routine immunization coverage in order to attain the district target and avoid measles and others dropout rate. Awareness creation activities, active case search and case management should be strengthened.

1.2.8. Reference

- [1] A. Sanyaolu et al., “Measles Outbreak in Unvaccinated and Partially Vaccinated Children and Adults in the United States and Canada (2018-2019): A Narrative Review of Cases,” 2019, doi: 10.1177/0046958019894098.
- [2] “measles-in-developing-countries.” .
- [3] A. Region, “Emergencies preparedness, response Measles – Global situation,” no. November, pp. 1–5, 2019.
- [4] S. E. Lekana-douki, P. N. Sir-ondo-enguier, and O. Banga-mve-ella, “Epidemiology and molecular characterization of the re-emerging measles virus among children and adults in,” pp. 1–8, 2019.
- [5] “Measles.” .
- [6] M. Wickens, “Measles elimination in Australia,” vol. 49, no. 3, pp. 2019–2021, 2020.
- [7] O. Access, “We are IntechOpen , the world ’ s leading publisher of Open Access books Built by scientists , for scientists TOP 1 %.”
- [8] H. Belete, “Journal of Tropical Diseases Review on Measles Situation in Ethiopia ; Past and Present,” no. August, 2016, doi: 10.4172/2329-891X.1000193.
- [9] P. Poletti et al., “The hidden burden of measles in Ethiopia : how distance to hospital shapes the disease mortality rate,” pp. 1–12, 2018.
- [10] “News_ Thousands affected by measles outbreak in five regions - Addis Standard.” .
- [11] “EC MICROBIOLOGY Research Article Determinants of Measles Recurrent Outbreak in South West Ethiopia: an Obstacle for Implementation of Infectious Disease Eradication in the Country,” vol. 10, pp. 699–706, 2018.
- [12] F. O. Shorunke, O. Adeola-musa, A. Usman, C. Ameh, E. Waziri, and S. A. Adebawale, “Descriptive epidemiology of measles surveillance data , Osun state , Nigeria , 2016 – 2018,” pp. 1–8, 2019.
- [13] V. Diseases, “Vaccine-Preventable Diseases,” pp. 1–30, 2018.
- [14] “Measles and Rubella Global Strategic Plan 2012-2020 Midterm Review,” 2020.
- [15] “More than 870,000 children in Ethiopia miss out on lifesaving measles, diphtheria and tetanus vaccines in 2018.” .
- [16] M. K. Tariku and S. W. Misikir, “Measles outbreak investigation in Artuma Fursi Woreda , Oromia Zone , Amhara Region , Ethiopia , 2018 : a case control study,” BMC Res. Notes, pp. 1–6, 2019, doi: 10.1186/s13104-019-4806-y.
- [17] N. M. Vora et al., “Consequences of Undervaccination — Measles Outbreak, New York City, 2018–2019,” pp. 1009–1017, 2020, doi: 10.1056/NEJMoa1912514.
- [18] S. Takahashi, C. J. E. Metcalf, M. J. Ferrari, A. J. Tatem, and J. Lessler, “The geography of measles vaccination in the African Great Lakes region,” Nat. Commun., vol. 8, no. May 2017, pp. 1–9, 2020, doi: 10.1038/ncomms15585.
- [19] T. K. Desta, E. T. Lemango, J. D. Wayess, and B. G. Masresha, “Measles Epidemiology in Ethiopia from 2006 - 2016 : Predictors of High Measles Incidence from Surveillance Data Analysis,” no. 2018, pp. 122–129, 2020.
- [20] “Measles explained_ What’s behind the recent outbreaks__ UNICEF.” .
- [21] “Measles Data and Statistics,” 2019.

- [22] C. Pneumonia, “morbilli , rubeola , red measles ,.”
- [23] B. Faso, C. African, and D. Republic, “WEEKLY BULLETIN ON OUTBREAKS,” no. February, pp. 10–16, 2020.
- [24] N. Zealand and M. M. R. I. Schedule, “Measles : what to be aware of during an outbreak,” no. 63, pp. 52–57.
- [25] “Measles epidemic line list west shoa zone 2019 and 2020.” .
- [26] M. Patel, A. D. Lee, N. S. Clemmons, S. B. Redd, S. Poser, and D. Blog, “National Update on Measles Cases and Outbreaks — United States ,” vol. 68, no. 40, pp. 893–896, 2019.
- [27] F. Yosep, E. Depari, M. Mudatsir, and H. Harapan, “Being unvaccinated and contact with measles cases as the risk factors of measles outbreak , North Sumatera , Indonesia,” *Clin. Epidemiol. Glob. Heal.*, vol. 8, no. 1, pp. 239–243, 2020, doi: 10.1016/j.cegh.2019.08.006.
- [28] E. Avramovich et al., “Measles Outbreak in a Highly Vaccinated Population — Israel , July – August 2017,” vol. 67, no. 42, pp. 2017–2019, 2018.
- [29] E. P. I. A. Report, “Expanded Program on Immunization (EPI),” 2019.
- [30] M. K. Tariku, “Measles Outbreak Investigation in Artuma Fursi Woreda , Oromia Zone , Amhara Region , Ethiopia , 2018 : A case control study,” pp. 1–14, 2018, doi: 10.21203/rs.2.12677/v2.
- [31] K. Belda et al., “Supplement article Measles outbreak investigation in Guji zone of Oromia,” vol. 27, no. Supp 2, pp. 1–5, 2017, doi: 10.11604/pamj.supp.2017.27.2.10705.
- [32] A. Saeed, Z. A. Butt, and T. Malik, “ORIGINAL ARTICLE INVESTIGATION OF MEASLES OUTBREAK IN A DISTRICT OF BALOCHISTAN PROVINCE , PAKISTAN,” vol. 27, no. December 2012, pp. 900–903, 2020.
- [33] S. Report, “Monthly measles and rubella monitoring report Measles Measles in November 2019,” no. November 2019, pp. 1–9, 2020.
- [34] J. Fu et al., “International Journal of Infectious Diseases A hospital-associated measles outbreak in health workers in Beijing : Implications for measles elimination in China , 2018,” *Int. J. Infect. Dis.*, vol. 78, pp. 85–92, 2019, doi: 10.1016/j.ijid.2018.10.023.
- [35] Y. Mohammed and A. N. Alemu, “Measles Outbreak Investigation and Response in Jarar Zone of Ethiopian Somali Regional State , Eastern Ethiopia,” no. January, 2017, doi: 10.5829/idosi.ijmr.2017.86.91.
- [36] S. Wongsanuphat et al., “Investigation of Measles Outbreak among Thai and Migrant Workers in Two Factories in Nakhon Pathom ,” no. Ddc, pp. 1–11, 2020.
- [37] “Measles outbreak investigation in Ginnir district of Bale zone, Oromia region, Southeast Ethiopia, May 2019,” vol. 8688, no. May 2019, pp. 1–12, 2020.
- [38] T. Woudenberg, *The 2013-2014 measles outbreak in the Netherlands : New evidence on measles epidemiology and control.* 2014.
- [39] G. M. Ntshoe et al., “Measles Outbreak in South Africa : Epidemiology of Laboratory-Confirmed Measles Cases and Assessment of Intervention , 2009 – 2011,” vol. 8, no. 2, pp. 2009–2011, 2013, doi: 10.1371/journal.pone.0055682.
- [40] A. L. Wagner et al., “Risk factors for measles among adults in Tianjin , China : Who should be controls in a case-control study ?,” vol. 27, pp. 1–11, 2017.

- [41] A. Geweniger and K. M. Abbas, “Childhood vaccination coverage and equity impact in Ethiopia by socioeconomic , geographic , maternal and child characteristics,” pp. 1–34, 2020.
- [42] A. Girmay and A. F. Dadi, “Being unvaccinated and having a contact history increased the risk of measles infection during an outbreak : a finding from measles outbreak investigation in rural district of Ethiopia,” vol. 8, pp. 1–6, 2019.
- [43] U. States and C. Description, “highly contagious disease,” no. July, 2019.
- [44] O. Access, “health implications,” vol. 8688, pp. 1–9, 2019, doi: 10.11604/pamj.2020.35.84.19630.
- [45] A. Situation, “Emergency Plan of Action (EPoA) Samoa : Measles Outbreak A . Situation analysis,” 2020.
- [46] B. Faso and C. African, “WEEKLY BULLETIN ON OUTBREAKS,” no. April, pp. 0–17, 2020.
- [47] “Summary of Key Points WHO Position Paper on Vaccines against measles virus,” no. April 2017, pp. 1–23.
- [48] G. Degefa, K. Gebremeriam, T. Juru, R. Jackson, and E. F. Epidemiology, “Magnitude and Trends of Measles in North West of Tigray Region , Ethiopia - A Four-year Surveillance Data Analysis ,” vol. 2, no. 1, pp. 2012–2015, 2019.
- [49] “Measles_ Epidemiology and transmission - UpToDate.” .
- [50] A.Abebe, T.Mengesha, A.Mekuria " measles case, immunization coverage and its determinant factors among 12-23 months children in Bossona Worena woreda, Amhara region, Ethiopia, 2018.

Chapter Two- Surveillance Data Analysis Report

2.1. Surveillance data analysis on Meningitis in SNNP-RHB PHEM from 2012-2018.

Abstract

Background: - Meningococcal disease remains a major public health challenge in the African meningitis belt including Ethiopia. Meningococcal meningitis is one of the priority diseases under surveillance in Ethiopia. Meningococcal meningitis reported from several regions of Ethiopia especially Southern Nation Nationalities and Peoples Region. This study was designed to analyze meningococcal meningitis surveillance data to describe the burden of the disease by place person and time which will provide information in meningococcal meningitis prevention and control activities.

Methods: - The study was conducted in SNNPR regional health bureau from February to March 2019. We used descriptive cross sectional study to describe the data in terms of place, person and time. The data was obtained from SNNPR PHEM routine surveillance database and epidemic line lists. The data analysis covers the region surveillance data from 2012-2018. We used Microsoft Excel.

Results: - From (2012-2018,) 5,483 meningococcal meningitis cases were detected by SNNPR surveillance system. The CFR was 3.1 % (168/5483). The highest CFR 46(29.3%) was reported from Gurage zone. Cases and deaths were reported from all zones. Highest case load was reported during dry season of the region (January-March). We identified an outbreak in 2012/2013. During an outbreak, out of 913 meningococcal meningitis cases 453 were collected for laboratory confirmation and 57 of them were tested positive for meningococcal meningitis. 70% of outbreak cases were reported from Sidama, Wolayita, Halaba and Bench Maji zones with average CF of 2%.The dominant serogroup in the confirmed cases was type 'A'.

Conclusion: -Meningococcal Meningitis suspected case load becomes increasing in 2017 and 2018 compared to 2016 and affected majority of zones and woredas in the region which need strong follow up and strengthening of prevention and control activities. We recommend strengthening of active surveillance system on early case detection and verification of epidemics and reactive vaccination for repeatedly affected zones and woredas.

2.1.1. Introduction

Meningococcal meningitis is contagious acute bacterial disease caused by the meningococcus (*Neisseria meningitidis*), a Gram-negative bacteria. The disease often characterized by sudden onset of fever, headache and neck stiffness. Transmission is person to person by direct contact with respiratory droplets of infected person. In most cases acquired through exposure to asymptomatic carriers, relatively few through direct contact with patients with meningococcal disease. There are different serogroups responsible to meningococcal meningitis. Currently more than twelve serogroups of *N. meningitidis* have been identified, five of which (A, B, C, W135, and X) can cause epidemics [1-3].

Sero group make a difference on geographic distribution and occurrence of meningococcal meningitis epidemics. Serogroup A *N. meningitidis* causes the highest incidence of disease though in 2002 Burkina Faso experienced the largest ever recorded meningitis epidemic due to serogroup NmW135, which was followed in 2003 by an outbreak with mixed etiology (*Neisseria meningitidis* serogroup A and W135). In 2006 *Neisseria meningitidis* serogroup X was isolated as the cause of the outbreak in the districts of the western part of Niger, bringing in new threats for the meningitis belt countries [4].

Meningococcal disease can vary in incidence from very rare to over 1000 cases per 100,000 population every year. Higher incident of meningococcal disease has been associated factors such as poor living conditions(low socioeconomic status) and overcrowded housing, antecedent upper respiratory tract infection, and both active and passive smoking . Migration and travel are also considered possible facilitative means by which the circulation of pathogenic strains moves inside a country, from country to country. During an outbreak family members of an infected person; bar or nightclub patronage and alcohol use has also been associated with higher risk for disease and observed in a range of situations, from sporadic cases, small clusters, to huge epidemics throughout the world, with seasonal variations. The disease can affect anyone of any age, but mainly affects babies, preschool children and young people. [5, 6, 7].

The geographic distribution and epidemic potential differ according to the serogroup. There are no reliable estimates of global meningococcal disease burden due to inadequate surveillance in several parts of the world. The largest burden of meningococcal disease occurs in an area of sub-Saharan Africa known as the meningitis belt, which stretches from Senegal in the west to Ethiopia in the east (26 countries). During the dry season between December to June, dust winds, cold nights and upper respiratory tract infections combine to damage the nasopharyngeal mucosa, increasing the risk of meningococcal disease. At the

same time, transmission of *N. meningitidis* may be facilitated by overcrowded housing. This combination of factors explains the large epidemics which occur during the dry season in the meningitis belt. [7]

Epidemic meningococcal disease remains a major public health challenge in the African "meningitis belt", an area that extends from Senegal to Ethiopia. An estimated 500 million people are at risk of the disease. The estimated number of cases of meningitis for the last 15 years was more than 700,000 of whom about 10% died and more than 20% with serious sequelae. Between 2003 and 2009 more than 271,275 cases and 24,901 deaths were reported by WHO from 13 African countries [8]. Ethiopia experienced different outbreaks in several years. The largest epidemic ever recorded is the 1981 & 1989. In 1981 50,000 cases and 990 deaths, and in 1989 45,806 cases, and 1686 deaths were recorded. Southern Nations and Peoples Region is one of the regions of Ethiopia found in the "meningitis belt" and have been affected by meningitis epidemics in the last 5 years. In 2008 five zones (Sidama, Bench Maji, Wolayita, Kembata Tembaro and Hadiya) were affected with meningococcal meningitis outbreak. During this outbreak a total of 218 cases and 5 deaths, were reported with Regional level CFR of 2.3% and AR of 14.8%. In 2009/2010, 17 cases of suspected meningococcal meningitis with 2 deaths were reported from Durame Hospital and Kembata Tembaro zone. In 2012 outbreak, almost from all Zones and special woredas 114 meningococcal meningitis cases were reported except from Silte, Sheka, Segen, Yem and Gedeo Zones. Meningococcal meningitis is one of the 21 priority diseases under surveillance in SNNPR. The Region administered with 15 zones, 4 special woredas, and 136 woredas; 21 town administrations; and 3608 rural and 324 urban kebeles. The region covers 10% of the country's land mass. The climatic condition of the region: 6.2% dry (arid), 48% kolla (semi-arid); 36.8% temperate (woynadega); 6.5% Dega and 0.7% Wurich (cold) areas. The region found with the range of 375m-4207m altitude above sea level. The population size of the region is 20,191,189 of which 10,055,212 male and 10,135,977 are females. The annual population growth rate is 2.9%. The population density per square Km is 138 person. In the region there are, 26 Hospitals (18 GO, 3 NGO, 5 private); 563 health centers, and 3635 health posts which provide health service. Other private health facilities 76 diagnostic laboratory centers, 10 special clinics, 15 NGO clinics, 13 higher clinics, 110 medium clinics, 483 lower level clinic, 20 Pharmacies, 9 drug distribution centers, 133 drug stores and 333 drug vendors found in the region which give health service. The regional surveillance data collected mostly from governmental health facilities. Surveillance system should be strong in order to detect changing in epidemiological patterns of epidemics in timely manner and provide evidence to epidemic management and early warning. There is a need for the surveillance systems to be strengthened in order to detect changing epidemiological patterns of meningitis epidemics

in a timely manner and provide evidence to guide case management and epidemic response. To achieve this there should be adequate funding of epidemic preparedness and response plan [8, 9].

2.1.1.1. Statement of the problem

Meningococcal meningitis is a bacterial form of meningitis, a serious infection of the thin lining that surrounds the brain and spinal cord. It is associated with high fatality (up to 50% when untreated) and high frequency (more than 10%) of severe sequelae. Early antibiotic treatment is the most important measure to save lives and reduce complications. It is observed in a range of situations, from sporadic cases, small clusters, to huge epidemics throughout the world, with seasonal variations. The disease can affect anyone of any age, but mainly affects babies, preschool children and young people.

A variety of organisms including different bacteria, fungi or viruses, can cause meningitis. Meningococcal meningitis, a bacterial form of meningitis, is a serious infection of the meninges that affects the brain membrane. It can cause severe brain damage and is fatal in 50% of cases if untreated.

In Ethiopia meningitis epidemics have been described in written reports since 1901. The epidemics affect almost all regions of the country. Outbreaks were reported in 1935, 1940, 1950, 1964, 1981 and 1989. The 1981 and 1989 outbreaks were the largest ever recorded in Ethiopia. In the 1981 outbreak 50,000 cases and 1000 deaths were reported. The affected regions were the northern and western parts of Ethiopia. Since then the disease remain endemic with recurrent outbreaks. In Ethiopia epidemics of meningococcal meningitis have been occurred in about eight year cycles but in the last five years outbreaks reported yearly from different parts of the regional states especially from SNNPR [10].

In SNNPR in the last five years outbreaks of meningococcal meningitis have occurred frequently (in 2006, 844 cases and 27 deaths; in 2007, 647 cases and 10 deaths; in 2008, 218 cases and 5 deaths and in 2012, 88 meningococcal meningitis cases were reported [11].

2.1.1.2. Significance of the study

Surveillance is an on-going systematic collection, analysis, interpretation and dissemination to the users who need it for action and meningococcal meningitis is one of the priority diseases under surveillance which have high epidemic potential. The disease occurred as an epidemic in different zones in SNNPR at different time in the last 10 years. So analysis of meningococcal meningitis surveillance data is very important to see trends of the disease which help to design prevention and control strategies. This study

will be designed to analysis the seven year (2012-2018) regional meningococcal meningitis surveillance data to describe the magnitude and distribution of the disease in the region.

2.1.1.3. Literature review

Study conducted on meningococcal meningitis outbreak in hawassa city, southern nation's nationalities and peoples region in 2013 shows that 87 suspected cases and 4 deaths were identified with case fatality rate of 4.6%. Out of identified cases 45(52%) were males. the overall attack rate was 26/100000 and age specific attack rate was highest among persons age 15-29 years. (ASAR 37.5/100000). As the study indicates isolated serogroups were A, C and W135 and gram negative diplococcus from 8 CSF specimens. [12]

Neisseria meningitidis only infects humans; there is no animal reservoir. The bacteria are transmitted from person-to-person through droplets of respiratory or throat secretions from carriers. Smoking, close and prolonged contact – such as kissing, sneezing or coughing on someone, or living in close quarters with a carrier – facilitates the spread of the disease. Transmission of *N. meningitidis* is facilitated during mass gatherings (recent examples include the Haj pilgrimage, and jamborees). The bacteria can be carried in the throat and sometimes overwhelms the body's defences allowing the bacteria to spread through the bloodstream to the brain. It is believed that 1% to 10% of the population carries *N. meningitidis* in their throat at any given time. However, the carriage rate may be higher (10% to 25%) in epidemic situations. [7]

Meningitis epidemics in the African meningitis belt constitute an enormous public health burden. In December 2010, a new meningococcal A conjugate vaccine was introduced in Africa through mass campaigns targeting persons 1 to 29 years of age. As of November 2017, more than 280 million persons have been vaccinated in 21 African belt countries [7]

2.1.2. Objectives

2.1.2.1. General objective

To analyze meningococcal meningitis surveillance data of SNNPR from 2012- 2018.

2.1.2.2. Specific objectives

To describe meningococcal meningitis surveillance data in terms of time, place & person

To describe major transmission seasons

To determine responsible sero-groups for meningococcal meningitis epidemics

2.1.3. Methods and materials

2.1.3.1. Study area and period

The study was conducted in SNNPR regional health bureau from February to march 2019.

SNNPR is one of the nine regional States in Ethiopia. The region surveillance data was collected from 17 zones, 1 special woredas and 1 city administration



Figure 13:-Map of SNNP Regional State, 2018

2.1.3.2. Study design

Descriptive cross sectional study was used.

2.1.3.3. Data source

The data was obtained from Southern nations, Nationalities and Peoples Region public health emergency management meningococcal meningitis surveillance data from 2012-2018

2.1.3.4. Sample size and sampling procedure

Seven years data of SNNP-RHB PHEM department reports. The data was secondary data which was received from RHB.

2.1.3.5. Data processing and analysis

Microsoft Excel 2007 and arc map was used to obtain frequencies, tables and figures.

2.1.3.6. Dissemination of result

Result was submitted timely to Addis Ababa university Department of Public health, and SNNP-RHB, PHEM Department by hard and soft copy.

2.1.3.7. Eligibility criteria

2.1.3.7.1. Inclusion criteria

Data of Meningitis from 2012-2018.

2.1.3.7.2. Exclusion criteria

Other reportable surveillance data and meningitis case out of the selected period.

2.1.3.8. Case definitions

Suspected case

Clinical purpura fulminant in the absence of a positive blood culture; or Gram-negative diplococci, not yet identified, isolated from a normally sterile body site (e.g., blood or cerebrospinal fluid (CSF) or Any person with sudden onset of fever ($>38.5\text{ C}^\circ$ rectal or 38.0 C° axillary) and one of the following signs: neck stiffness, altered consciousness or other meningeal signs. OR Any toddler with sudden onset of fever ($>38.5\text{ C}$ rectal or 38.0 C_o axillary) and one of the following signs: neck stiffness, or flaccid neck, bulging fontanel, convulsion or other meningeal signs.

Confirmed Case:

Detection of *N. meningitidis*-specific nucleic acid in a specimen obtained from a normally sterile body site (e.g., blood or CSF), using a validated polymerase chain reaction (PCR) assay; or Isolation of *N. meningitidis* from a normally sterile body site or purpuric lesions. [13]

2.1.3.9. Ethical issue

Official letter from Addis Ababa University, college of health science, school of public health was delivered to SNNPR HB through field base investigators to practice the ongoing outputs in SZHB.

2.1.4. Result

The regional meningococcal meningitis database from 2012- 2018 and available outbreak line lists in the specified period were analyzed to describe the burden of meningococcal meningitis in SNNPR. Variables in the line list were not computable with variables in the main database. There for the surveillance data was analyzed in to two categories (Outbreak line list data and the routine surveillance database)

2.1.4.1. Analysis of data from public health emergency management surveillance database of SNNPR

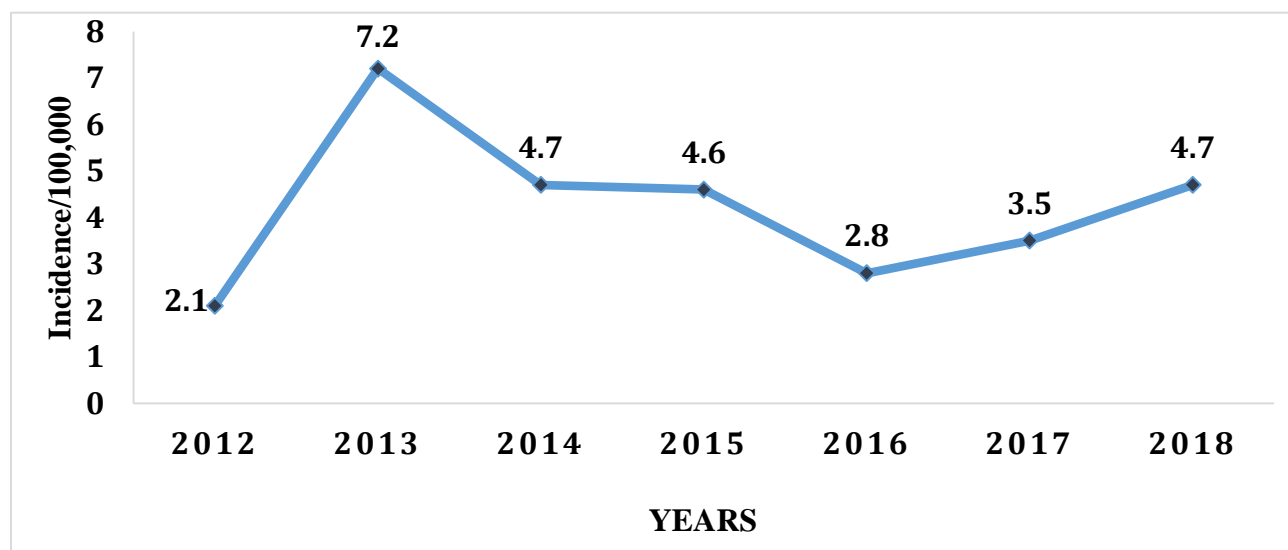
During 7 years (2012-2018) a total of 5483 meningococcal meningitis cases were detected by SNNPR surveillance system. The CFR was 3.1 % (168/5483). The mean annual incidence of meningococcal meningitis, based on 5483 cases documented in SNNPR surveillance database, was 4.8 per 100,000 populations. The highest incidence of meningococcal meningitis was reported in 2013 which was 7.2% (1315/5483) and the least Incidence was reported in 2012 which was 2.1% (376/5483). Cases and deaths were reported from all Zones and Special Woredas of the region except Yem Zone but it was not uniform in all zones and special Woredas of the region. In case of place the highest case load was reported from Sidama =1112(20%), Wolayita, =752 (14%) Gedeo, =638 (12%) Hawassa Town=570 (10.4%) and Halaba Zones=539 (9.8%) and the least case load was reported from Dawuro=24 (0.4%). the highest case fatality rate was reported from; Gurage = 46(29.3), Konta =5(10%), Basketo =3(9%) Segen =9(7%) Gamo Gofa =8(7%) and South Omo =6(6%). In terms of time, Monthly trend of Meningococcal meningitis showed that the highest case load was reported during the dry season of the region. Months in which the highest case load reported throughout 2012-2018 were in March, =755, (14%), January= 616, (11.2%), February=596 (11%) and April=541 (10%) and the place from which the highest incidence of Meningococcal meningitis reported were; from Kembata Tembaro zone (18%) in 2012, from Halaba zone and Hawassa Town (62% and 48%) in 2013 respectively; from Halaba zone (40%) in 2014;from Hawassa Town (28%, 79% and 47%) in 2015,2016 and 2017 respectively for three consecutive year and from Halaba zone (61%) in 2018. The least incidence was reported from Silte zone (0.11%) in 2018. There was an outbreak in 2012/13 in SNNPR. At this time many cases and some deaths were reported almost from all zones and special woredas except Yem Zone. During this outbreak, the highest case load was reported from Sidama zone (399) with incidence of 12% followed by Wolayita Zone (254) with incidence of 15% and Halaba zone (155) with the incidence of 62%. The least case was reported from Dawuro (1) with incidence of 0.18%. In terms of time; the highest case load was reported in the months of March (272

cases) and February (259cases) with CFR of 2.6% and 3.1% respectively. Almost 70% outbreak cases were reported from Sidama, Wolayita, Halaba and Bench Maji Zones with average case fatality of 2%. During the outbreak; high number of cases were reported from week three to week sixteen (3-16 WHO weeks) which falls in dry season (between January to April). Trends in year showed that meningococcal meningitis cases were increased in the last two years after 2013. We identified only one outbreak line list which was reported from all Zones and special woredas of the region except Yem Zone in 2012/2013. Starting from January 2010 meningococcal meningitis cases were reported to the surveillance system in weekly basis.

Table 19: Description of M. Meningitis Case and Death in SNNP Regional State from 2012-2018

Description	Years						
	2012	2013	2014	2015	2016	2017	2018
# of cases	376	1315	857	835	521	664	915
Percent (%)	6.9	24.0	15.6	15.2	9.5	12.1	16.7
IR/100,000	2.1	7.2	4.7	4.6	2.8	3.5	4.7
# of deaths	5	39	59	22	18	6	19
CFR	1.3	3.0	6.9	2.6	3.5	0.9	2.1

Figure 14: Annual Incidence of Meningococcal Meningitis by Year SNNPR, 2012 to 2018



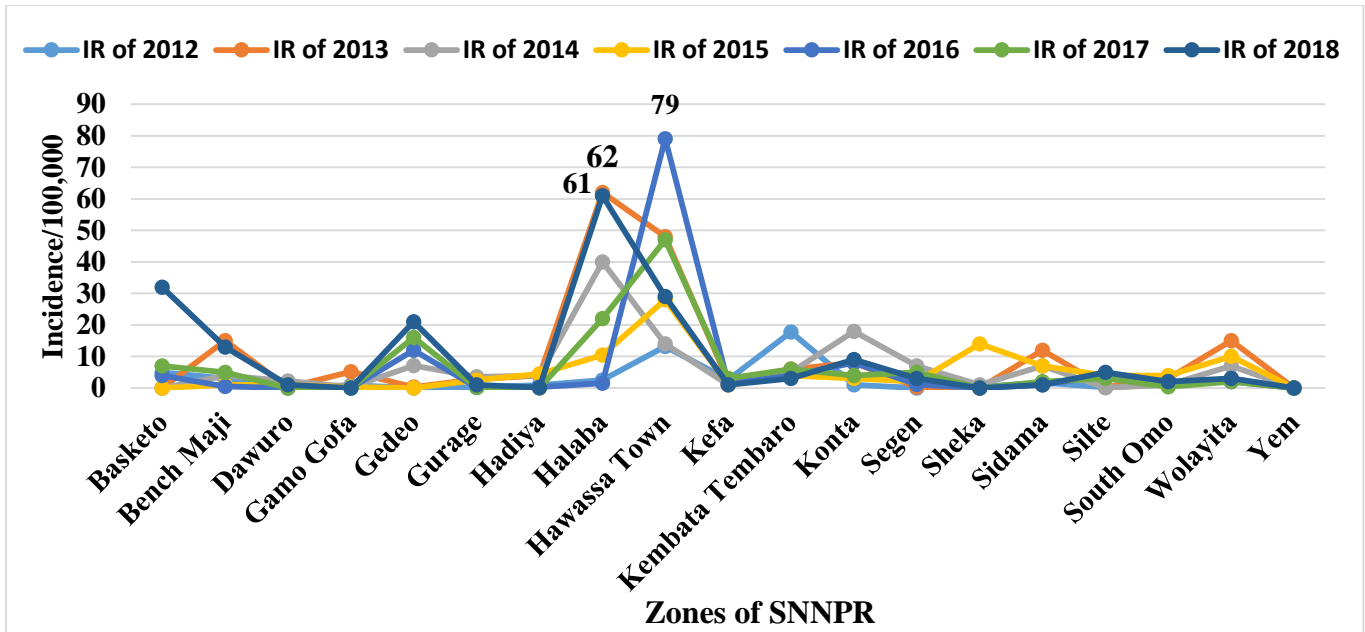


Figure 15: Annual Incidence of Meningococcal Meningitis by Zones, SNNPR, 2012 to 2018

Even though meningococcal meningitis cases were reported every week, the highest cases were reported in specific weeks from Specific Zones. In week Ten (10) and week forty (40), 2014 from Gurage and Konta Zone 9 cases and 9 deaths and 3 cases and 3 death were reported respectively and in week three (3), 2013, 41 cases and 8 deaths from Gamo Gofa Zone; in week thirteen (13), 2015 from Segen Zone 12 cases and 5 deaths, in week thirty (30), 2016; 8 cases and 2 deaths and in week twenty four (24) 2018; 18 cases and 4 deaths from Gedeo Zone were reported to the Region. And also the highest cases were reported in specific months from specific Zones and Special woredas. In March 2013, 139 cases from Wolayita Zone; and 58 cases from Sidama Zone was reported; in February 2013, 103 cases from Sidama Zone; in April 2013, 74 cases from Bench Maji Zone; in January 2013, 75 cases from Sidama Zone; and 59 cases from Gamo Gofa Zone and in March 2018, 54 cases from Gedeo Zone was reported.

Due to an outbreak, cases reported from all zones and special woredas of the region in January to April 2013 were higher than other periods included in the analysis and also in the past seven years (2012-2018) the highest case load was reported from January to March which is mainly part of dry season of the region.

Table 20: Reported M. Meningitis cases by month from 2012-2018, SNNPR

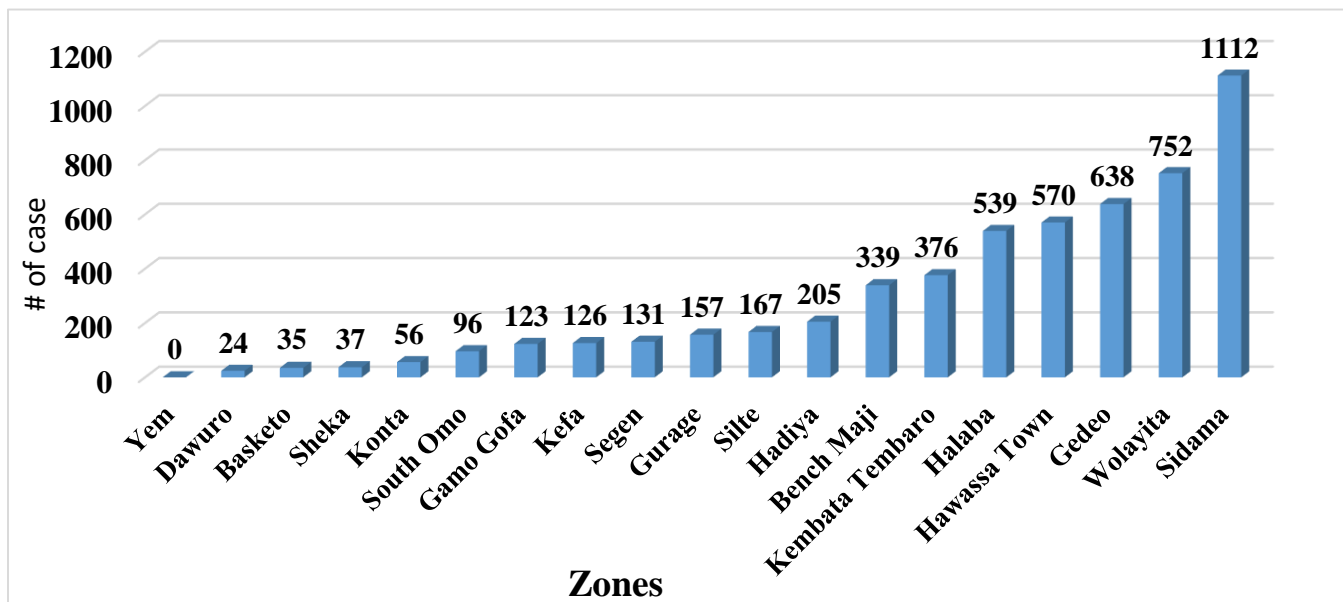
Months	Frequency	Percent (%)	Cumulative %
April	541	9.9	9.9
August	379	6.9	16.8
December	304	5.5	22.4
February	596	10.9	33.2
January	616	11.2	44.5
July	335	6.1	50.6
June	411	7.5	58.1
March	755	13.8	71.8
May	432	7.9	79.7
November	374	6.8	86.5
October	383	7.0	93.5
September	357	6.5	100.0
Grand Total	5483	100.0	

Table 21: Reported M. Meningitis cases by Zones from 2012-2018, SNNPR

Zones	Frequency	Percent (%)	Cumulative (%)
Basketo	35	0.6	0.6
Bench Maji	339	6.2	6.8
Dawuro	24	0.4	7.2
Gamo Gofa	123	2.2	9.5
Gedeo	638	11.6	21.1
Gurage	157	2.9	24.0
Hadiya	205	3.7	27.7
Halaba	539	9.8	37.5
Hawassa Town	570	10.4	47.9
Kefa	126	2.3	50.2
Kembata Tembaro	376	6.9	57.1
Konta	56	1.0	58.1

Segen	131	2.4	60.5
Sheka	37	0.7	61.2
Sidama	1112	20.3	81.4
Silte	167	3.0	84.5
South Omo	96	1.8	86.2
Wolayita	752	13.7	100.0
Yem	0	0.0	100.0
Grand total	5483	100.0	

Figure 16: Distribution of Meningitis cases by Zones in SNNPR State from 2012-2018



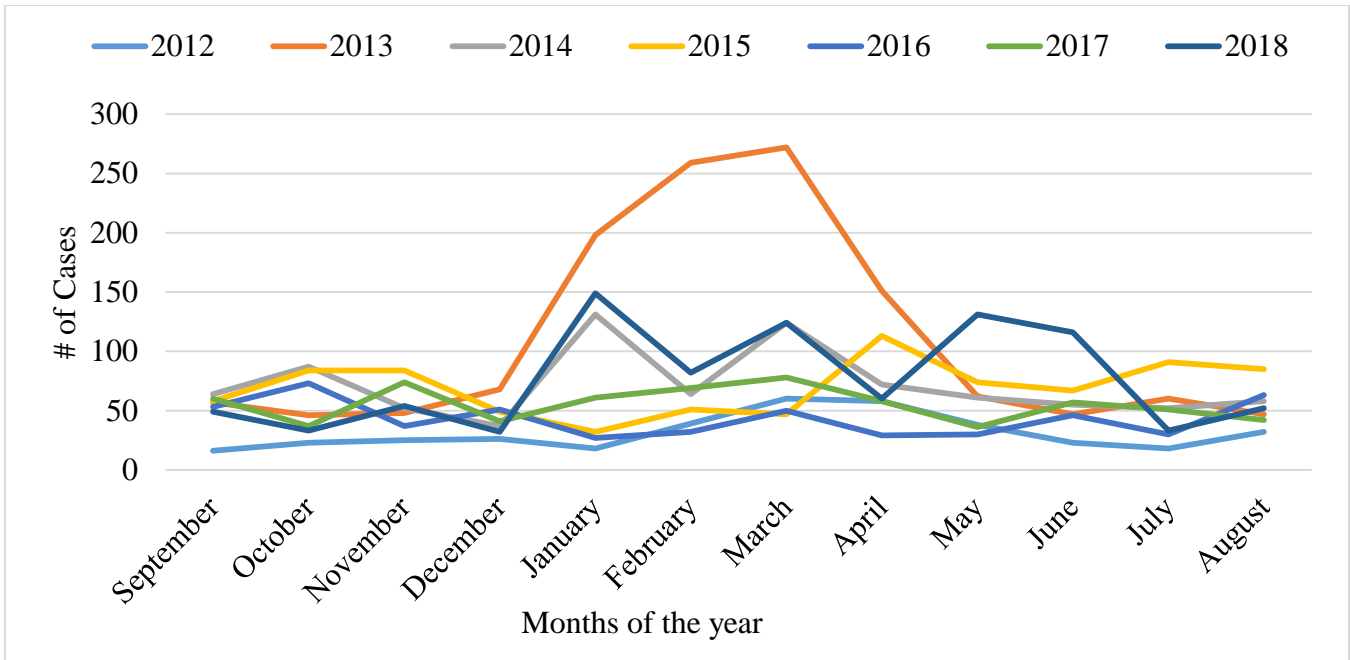


Figure 17: Trends of Meningococcal Meningitis Cases by Month from 2012-2018, SNNPR

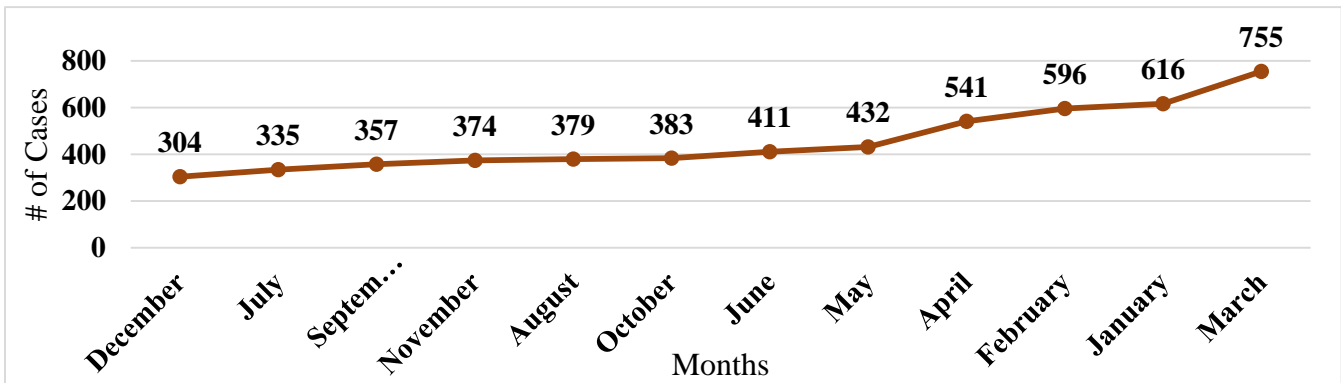


Figure 18: Trends of Meningococcal Meningitis Cases by Month from, SNNPR 2012-2018

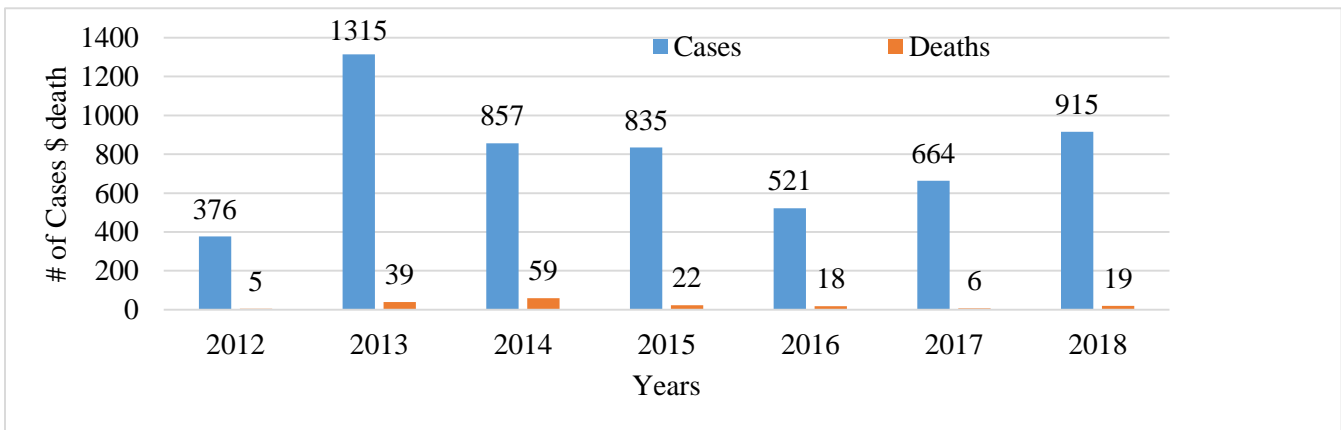


Figure 19: Trend of Meningococcal Meningitis Case and death by year from 2012-2018, SNNPR

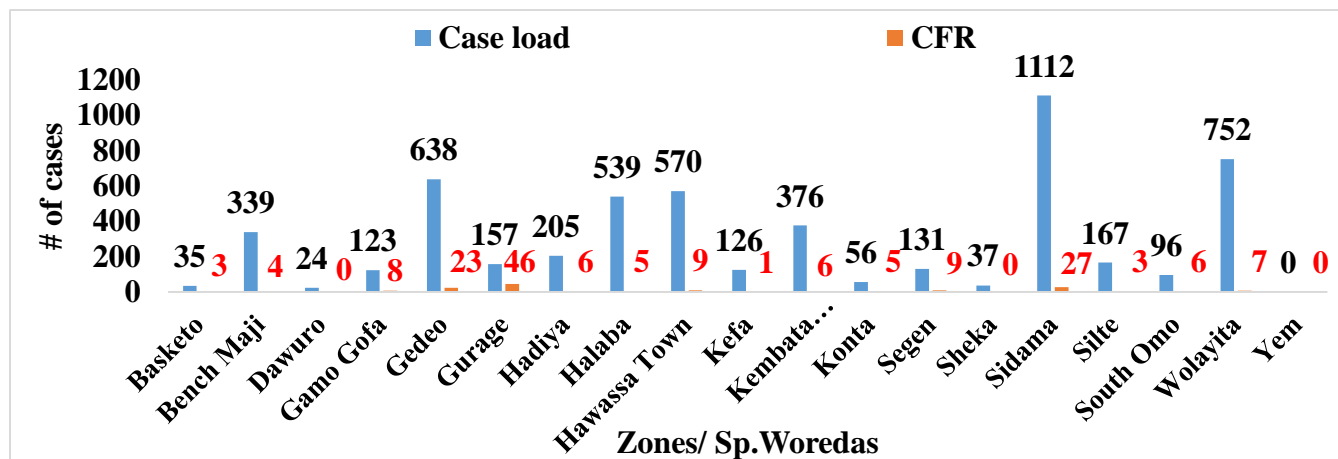


Figure 20: Meningococcal Meningitis Case Load and Case fatality rate by Zone and Sp. Woredas From 2012-2018, SNNPR, 2019

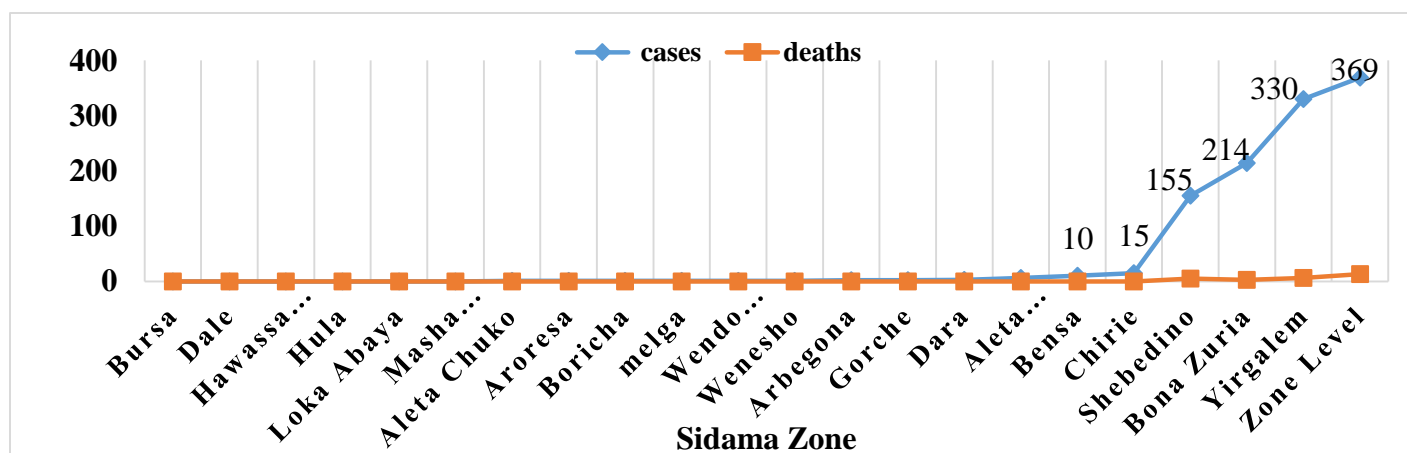


Figure 21:

Meningococcal Meningitis Case and death by Woredas of Sidama Zone from 2012-2018, SNNPR, 2019

Table 22: Reported Meningitis Death from 2012-2018, SNNPR

Zones	Frequency	Percent (%)	Cumulative (%)
Dawuro	0	0.0	0.0
Yem	0	0.0	0.0
Sheka	0	0.0	0.0
Kefa	1	0.6	0.6
Basketo	3	1.8	2.4
Silte	3	1.8	4.2

Bench Maji	4	2.4	6.5
Konta	5	3.0	9.5
Halaba	5	3.0	12.5
Hadiya	6	3.6	16.1
Kembata Tembaro	6	3.6	19.6
South Omo	6	3.6	23.2
Wolayita	7	4.2	27.4
Gamo Gofa	8	4.8	32.1
Hawassa Town	9	5.4	37.5
Segen	9	5.4	42.9
Gedeo	23	13.7	56.5
Sidama	27	16.1	72.6
Gurage	46	27.4	100.0
Total	168	100.0	

Figure 22: Distribution of M. Meningitis deaths by months in SNNPR State from 2012-2018

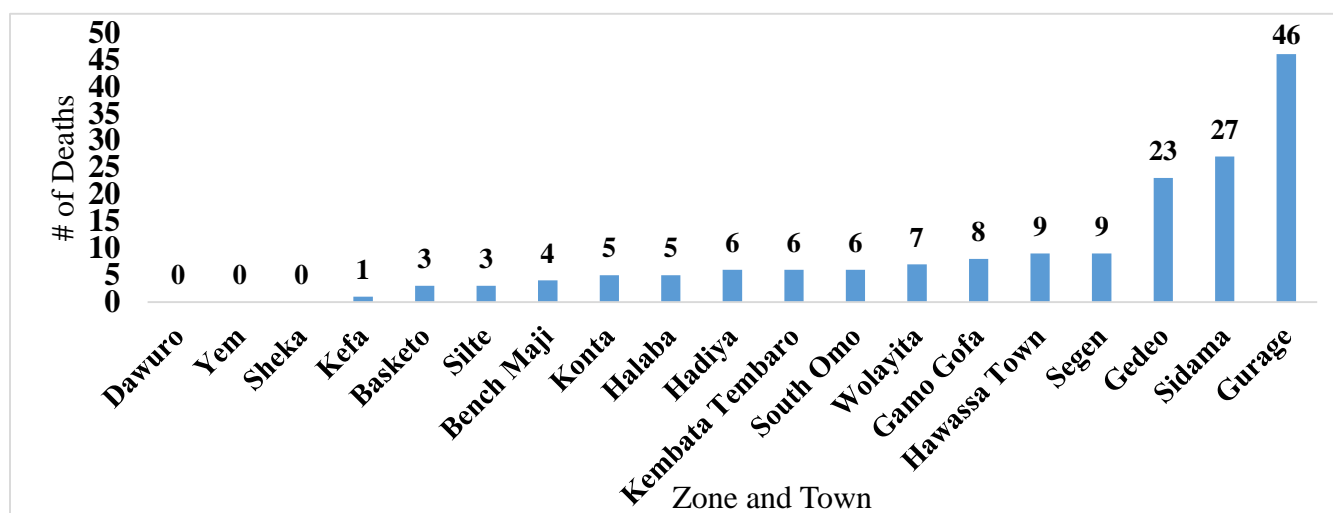
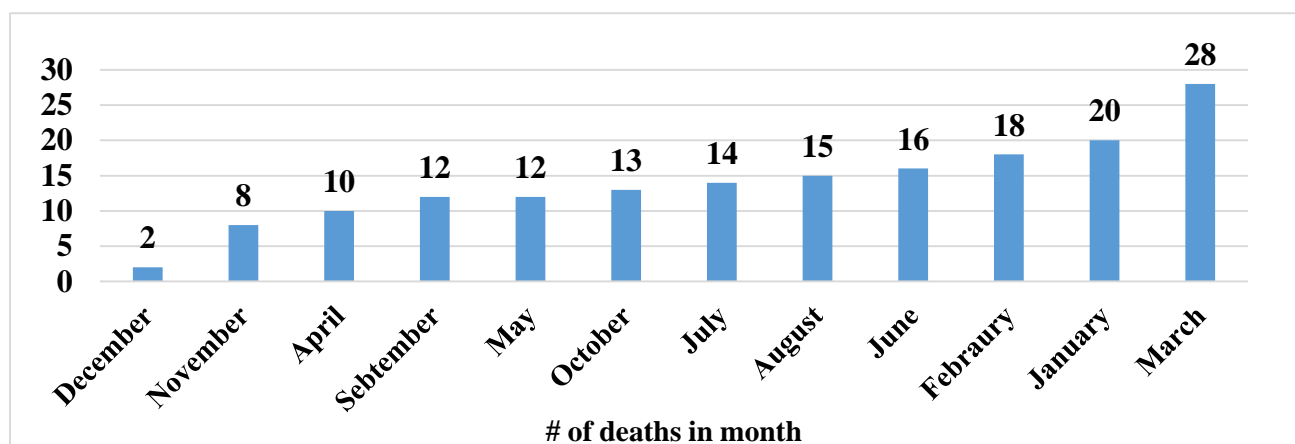


Figure 23: Distribution of M. Meningitis deaths by months in SNNPR State from 2012-2018

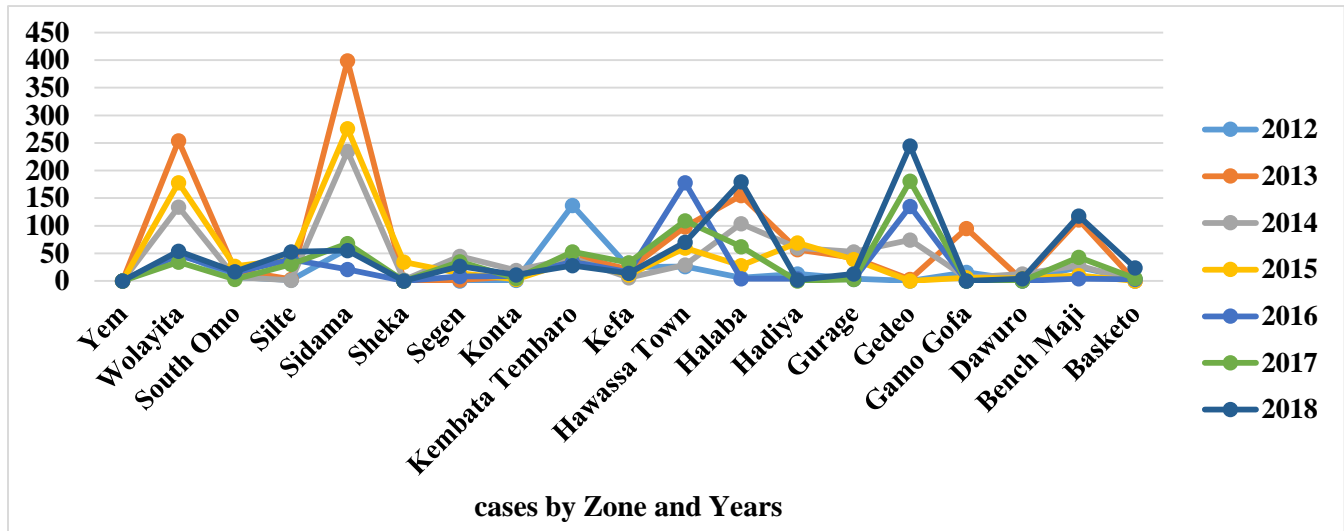


Figure 24: Distribution of M. Meningitis cases by Zones and years in SNNPR State from 2012-2018

2.1.4.2. Description of the outbreak line lists data

Even though there is a surveillance data manager at regional level the surveillance data was not properly organized and documented before. As a result we identified only one outbreak line list which was reported from all Zones and Sp. Woredas of the region except from Yem special Zone in 2013. During this outbreak there were 913 meningococcal meningitis cases reported from all affected zones and special woredas. Among those reported cases specimens of 453 were collected for laboratory confirmation and out of these 57 of them were tested positive for meningococcal meningitis. The responsible serogroups were sero type A=31 cases, sero Group type AC = 1case, Type A&w135 gram-ve diplococcus =2 cases and gram negative diplococcus = 5 cases, +ve (W135/Y) = 5 cases, sero group C= 3 cases, +ve (type B/strept) =10 cases. The outbreak was started on week 33, 2012, and ended through week 32/ 2013. It lasted for more than eleven months and was controlled almost after one year of occurrence. From reported cases 51% were male and 49% were female. Proportionally 82% of the cases were below 30 years of age. Cases were largely reported in the dry season especially in the months of March and February.

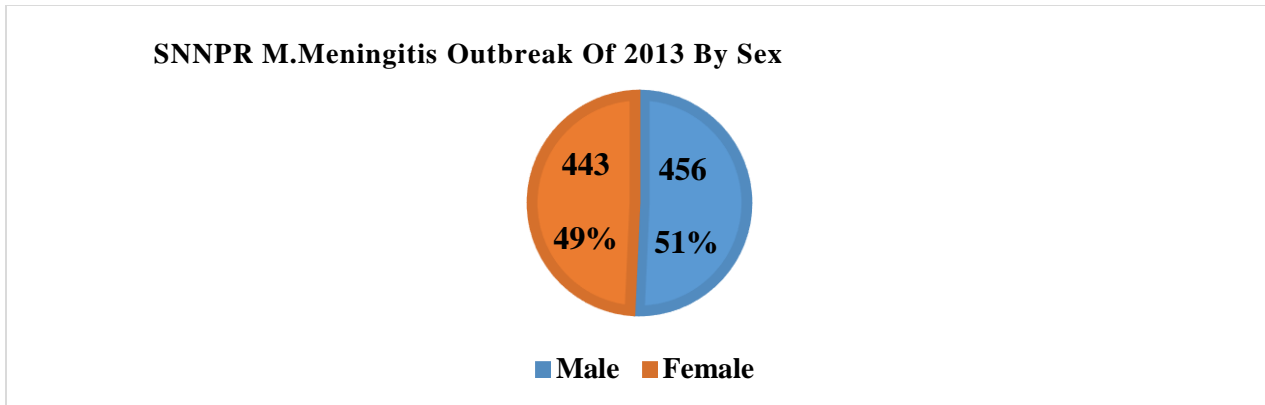


Figure 25: Suspected # of Meningococcal Meningitis Outbreak Cases by Sex in SNNPR, 2013

Age Group	Frequency	Percent (%)	Cumulative (%)
0-4 year	136	14.9	14.9
5-9 year	126	13.8	28.7
10-14 year	163	17.9	46.6
15-29 year	324	35.5	82.1
30-44 year	121	13.3	95.4
† 45 years	42	4.6	100.0
Grand total	912	100.0	

Table 23 : Reported suspected M. Meningitis outbreak cases by Age group in 2013, SNNPR

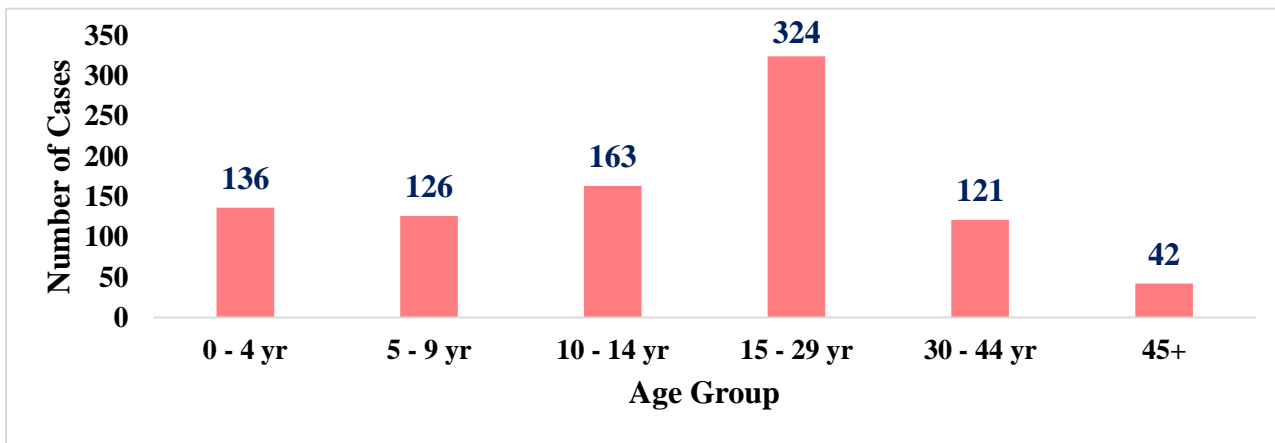


Figure 26: Number of Meningococcal Meningitis Outbreak Cases by Age Group in SNNPR, 2013

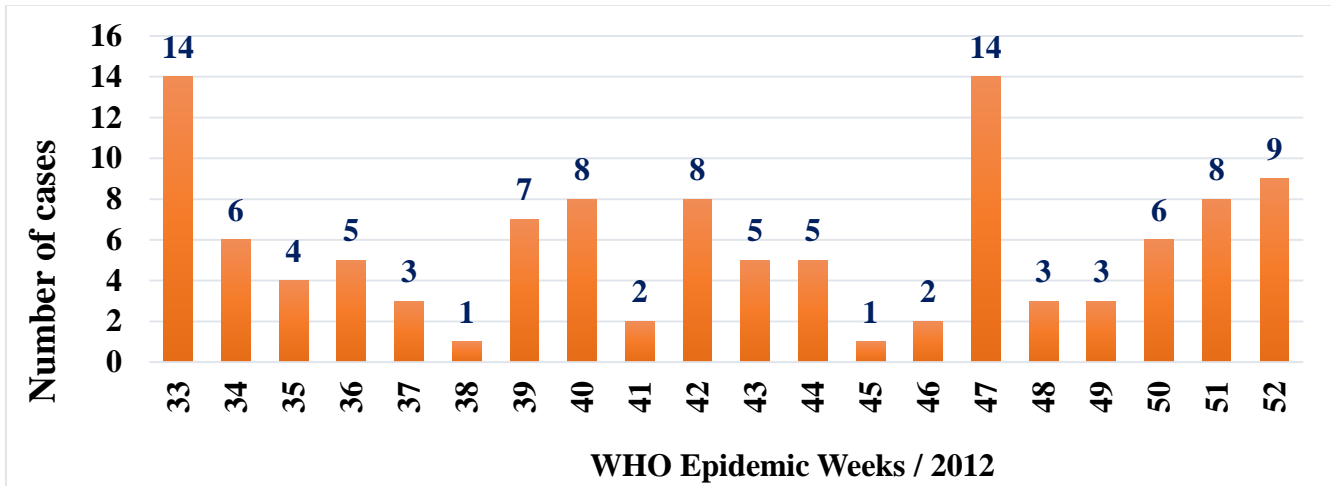


Figure 27: Epidemic Curve of Meningococcal Meningitis Outbreak Cases SNNPR, 2012/2013

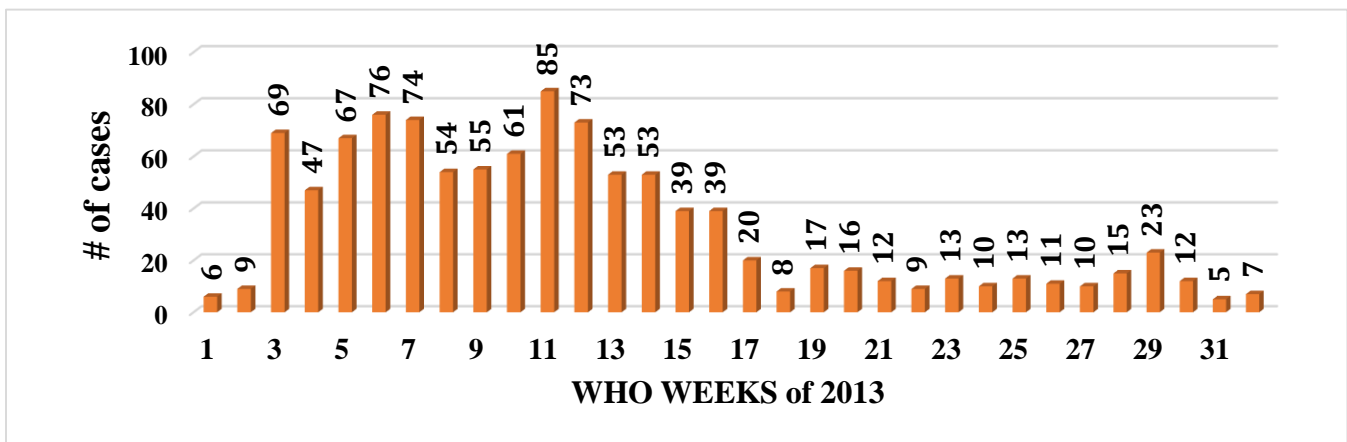


Figure 28: Epidemic Curve of Meningococcal Meningitis Outbreak Cases SNNPR, 2012/2013

2.1.5. Discussion

This Analysis describes the spatial distribution of meningococcal meningitis case load and outbreaks at zonal and Special Woreda level in Southern Nations Nationalities and Peoples Region. The number of cases reported each year showed some increment in the last two years. In different years cases were reported from all zones and special woredas Except Yem zone. Especially Sidama, Wolayita, Halaba, Gedeo, BenchMaji and Kembata Tembaro Zones accounts large number of cases. Even though there is no clear study on risk factors of meningococcal meningitis in SNNPR; studies suggest that the occurrence of epidemics in the localized area linked to population density, socio economic status and humidity of the environment [14-17].

Risk factors for invasive disease and for outbreaks are not completely understood. A combination of conditions (environment, host and organism) are necessary for an epidemic to occur. These include: immunological susceptibility of the population (perhaps due to loss of herd immunity to the prevalent strain), special climatic conditions (dry season, dust storm), low socioeconomic status and transmission of a virulent strain. Acute respiratory tract infections may also contribute to the development of meningococcal disease epidemics. [23]

Climatic factors play an important role in the seasonal upsurge of meningococcal disease. In sub-Saharan Africa the spread of infection may be enhanced mainly by drought and dust storm; meningococcal meningitis epidemics generally stop with the onset of the rains. Low absolute humidity and dust may enhance meningococcal invasion by damaging the mucosal barrier directly or by inhibiting mucosal immune defenses. Unfavorable climatic conditions may lead to the crowding of people in poorly ventilated dwellings, where spread of virulent meningococcus is optimal. [23]

Meningococcal meningitis suspected cases were reported in every week from all affected areas of the region but the highest cases load was reported from week 3 to week 18; about 44% out of total case was reported within these week (2406 cases were reported). These week falls within the month from January to April which is part dry season of the region. It was almost similar with other studies that meningococcal meningitis occurs from December to May in the Sahel" meningitis belt" with large epidemics every 5– 10 years and attack rates rises up to 1000 infections per 100,000 people. Factors associated for seasonal variation was high temperatures coupled with low humidity that may favor the conversion of carriage to disease as the meningococcal bacteria in the nose and throat are better able to cross the mucosal membranes into the blood stream[18,19].

The surveillance data was not properly arranged and fully documented. From 2012-2018 only one outbreak line list was available but every year more than 500 suspected cases and on Average 24 deaths were reported to the regional public health emergence management. In the 2012/2013 meningococcal meningitis outbreak the dominant serogroup in the confirmed cases was type A. The 2013 SNNPR regional public health laboratory activity report supports that among 62 positive specimens, 31 (50%) were N. Meningitides type-A. Similarly study on meningococcal meningitis outbreak investigation in West Arsi Zone confirmed that 59% of patients with Meningitis confirmed as sero type A. The annual incidence of the disease was 6.8 /100,000.populations which is quite large when it compared with 5years hospital based surveillance study conducted in Salvador, Brazil which was **1.7 per 100,000** populations. Meningococcal meningitis affected mostly the young age group in the 2012/2013 outbreak .The M. Meningitis outbreak line list data analysis indicate that 82% of the M. Meningitis suspected cases were below 30 years of age with the highest pick from 15-29 years of age. [20-22].

2.1.6. Limitations

Even though there was some organized and documented data's at the Region level, it was difficult to analyze with important variables like age, sex, occupation, and the lowest administrative structures like Woreda and kebele because the available data was only aggregated report of cases by zone and special woredas.

2.1.7. Conclusion

Meningococcal Meningitis suspected case load becomes increasing from the last two year (2017 and 2018) compared to 2016 and affected majority of zones and woredas in the region which need strong follow up and strengthening of prevention and control activities. The current surveillance system showed progress in detecting cases but it still needs significant improvement in active case search (surveillance) and data quality

2.1.8. Recommendation

There should be well organized database at all level in the surveillance system which makes easy for analysis at the time of required. Active surveillance system should be strengthening on early case detection and verification of epidemics. There should be continues assessment on possible risk factors especially Environmental and climatic factors. We also recommend reactive vaccination for repeatedly affected zones and woredas.

2.1.9. Reference

1. Y. Brihane, D. H/Mariam. H. Kloos: Epidemiology and ecology of health and disease in Ethiopia 1st edition, 2006
2. Bandaru NR, Ibrahim MK, Nuri MS, Suleiman MB .Etiology and occurrence of acute bacterial meningitis in children in Benghazi, Libyan Arab Jamahiriya. East Mediterr Health J 1998; 4:50-7
3. Jason K. Whitson Disease Research Report: Meningococcal Disease (Meningitis) Biology 240 summer 2005
4. Control of epidemic meningococcal disease. WHO practical guidelines.2ndedition
5. You MD. Ampicillin in the treatment of meningitis due to Haemophilus influenza: an appraisal after 6 years of experience. J Pediatr 1969; 74:848-51
6. www.thelancet.com.vol 369 June 30, 2007.
7. <https://www.who.int/news-room/fact-sheets/detail/meningococcal-meningitis#>
8. WHO Standard Operating Procedures for Enhanced Meningitis Surveillance in Africa 2009
9. Unpublished meningococcal meningitis training manuals for SNNPR Health Workers 2012
10. Y. Brihane, D. H/Mariam. H. Kloos: Epidemiology and ecology of health and disease in Ethiopia 1st edition, 2006
11. Unpublished on job Meningitis training manuals for SNNPR
12. Yeshitila M, Meningococcal meningitis Outbreak in Hawassa City, Southern Nation Nationalities and Peoples Region, Ethiopia, 2013
13. Council of State and Territorial Epidemiologists. Revision of the National Surveillance Case Definition for Meningococcal Disease. Available at: http://c.ymcdn.com/sites/www.cste.org/resource/resmgr/2014PS/14_ID_06upd.pdf.
14. WHO. Managing meningitis epidemics in Africa November 2010
15. ELSEVIER. Effect of reactive vaccination on meningitis epidemics in Southern Ethiopia July 2007/www.elsevierhealth.com/journals/jinf/
16. <http://www.cdc.gov/meningitis/index.html>
17. Anna M. Moles worth, Luis E. Cuevas, Stephen J. et al. Environmental Risk and Meningitis Epidemics in Africa, 2003;9(10);1287-1293
18. The Role of Weather in Meningitis Outbreaks in Navrongo, Ghana: A Generalized Additive Modeling Approach September 2012, Volume 17
19. A,Forgor AA, Pflüger V, Dangy JP, et al.(2007) Clonal waves of Neisseria meningitidis colonization and disease in the African meningitis belt: An eight year longitudinal study in northern Ghana. PLoS Med 4(3): e101. Doi: 10.1371/journal.Pmed. 0040101
20. Soraia M. Cordeiroa, Alan B. Nevesa, Cássio T. et al. Hospital-based surveillance of meningococcal meningitis in Salvador, Brazil; Trans R Soc Trop Med Hyg. 2007 November ; 101(11): 1147–1153
21. WHO. Meningococcal disease: 2013 epidemic season in the African Meningitis Belt
22. Gemechu Befa Addressing public health priorities in Africa through FLETPs,2013;AFENET conference Abstracts; page 70
23. <http://www.who.int/emc>
24. <https://www.afro.who.int/health-topics/meningococcal-meningitis>

Chapter Three- Evaluation of Surveillance System.

3.1. Evaluation of surveillance system for malaria in Elu Gelan Woreda West Shewa Zone, Oromia Regional State, Ethiopia, 2019

Abstract

Background: Evaluation refers to ‘the systematic and objective assessment of the relevance, adequacy, progress, efficiency, effectiveness and impact of a course of actions, in relation to objectives and taking into account the resources and facilities that have been deployed’. A functional disease surveillance system is essential for defining problems and taking action. The FMOH/ PHEM of Ethiopia identified 23 top priority diseases which are epidemic prone, of National and international concern and diseases on eradication and elimination programs for surveillance activities. Through program evaluation, we can determine whether activities are implemented as planned and identify program strengths, weaknesses, and areas for improvement. The major health problems of the Sub-Saharan Africa countries are largely preventable communicable diseases. Malaria is among the disease contributing for >90% of child deaths and it’s among priority disease under surveillance in the country. Therefore, this study aimed to evaluate malaria as proxy indicator of surveillance system at public health facilities in selected District.

Methods: institution based descriptive cross-sectional study design supported with qualitative method was conducted from December, 12-26, 2019 in Elu Gelan District, west Shewa zone, Ethiopia. 100% (3) of health centres in the district were selected intentionally, and 60% (10) of health posts were selected randomly. As a result total of 14 (District Health Office, 3 health centers, and 10 health posts) study sites were involved in the study. Data was collected by face to face interview using semi structured questionnaire to collect data on core and supportive activities of surveillance system, review documents to collect data on quantitative attributes and in-depth interview of key informants to collect data on qualitative attributes of surveillance system. Data was entered and analysed using Microsoft Excel 2013. Results was presented by text description, graphs and tables.

Results: PHEM system has not improved and didn’t get attention of even head of health office. The district did not well implemented prevention and control measures based on local data and didn’t gave responses within 48 hours of notification of recently reported outbreak. The district have prepared written epidemic preparedness and response plan (EPRP) but the epidemic management committee didn't evaluated their preparedness and response activities. The case definition of malaria disease for

identification of suspected cases are easy to understand and apply by all levels of health professionals. The malaria confirmatory test takes 10-15 minute at health post level using RDT and near to 1 hour at health center level using microscopy. Recording and reporting surveillance data takes 10-15 minutes. Mostly used telephone to transfer data. The system allowed all the reporting agents accept and well engaged to the surveillance activities. But, all participants are not accept and engaged well.

Completeness and timeliness of the reporting surveillance data of the District was 48.1% and 74.9% respectively. Data analysis and interpretation was done at District level quarterly in irregular manner, all visited health facilities were not analyse surveillance data. District health office was supervised twice a year and all visited health facilities were supervised once by integrated supportive supervision but there was no program specific supportive supervision in the District. Lack of regular written feedback at facility level was clearly revealed in the District. Among surveillance units, only health office and health canters have trained personnel on disease surveillance. There is variations on the length of days and intensity of trainings among health professionals. There is turnover among disease surveillance and malaria trained staffs. There was a plan to supervise once quarterly but not conducted as planned. In 2019 G.C. 8,095 BF was done and 5,315 confirmed cases was identified. Among confirmed cases P.V (5%), PF (94.2%) and Mixed (0.8%) and positivity rate (65.7 %).

Conclusion: Generally, based on evaluation of public health surveillance system core activities, supportive activities and attributes of the surveillance system in the District was not fully implemented to meet its objective. Efforts should be exerted by different stakeholders to improve the surveillance system in the District.

Key words: surveillance, system evaluation, Attributes, Elu Gelan

3.1.1. Introductions

A health information system records and reports information on the health of a population from a variety of demographic, logistical, program management and health-status indicators. Public health surveillance is an essential component of the health information system with objectives and methods that inform action for public health[1]. Public health surveillance is the ongoing, systematic collection, analysis, interpretation, and dissemination of data regarding a health-related event for use in public health action to reduce morbidity and mortality and to improve health[2].

Public health surveillance, and by extension the systems used to enable surveillance, is central to the practice of modern public health. Public health surveillance contributes data and information to assess and characterize the burden and distribution of adverse health events, prioritize public health actions, monitor the impact of control measures, and identify emerging health conditions that may have a significant impact upon population health [3].

Surveillance information has many uses, including monitoring disease trends, describing the natural history of diseases, identifying epidemics or new syndromes, monitoring changes in infectious agents, identifying areas for research, evaluating hypotheses, planning public health policy, and evaluating public health policy and interventions [4]. It is carried out through a system which has legal support and extending from the central health authorities down to the peripheral health facilities and community level through sets of communication channels. These sets include upward and down ward reporting and feedback mechanism. These systems vary from a simple system collecting data from a single source, to electronic systems that receive data from many sources in multiple formats, to complex surveys [5].

Evaluation refers to ‘the systematic and objective assessment of the relevance, adequacy, progress, efficiency, effectiveness and impact of a course of actions, in relation to objectives and taking into account the resources and facilities that have been deployed’[6]. In addition, evaluation encourages us to examine the operations of a program, including which activities take place, who conducts the activities, and who is reached as a result. In addition, evaluation will show how faithfully the program adheres to implementation protocols. Through program evaluation, we can determine whether activities are implemented as planned and identify program strengths, weaknesses, and areas for improvement [7].

The components of surveillance and response systems targeted for monitoring and evaluation comprise: the priority diseases targeted for surveillance, the structure of the system, core functions of the system, support functions of the system and quality of the system [8]

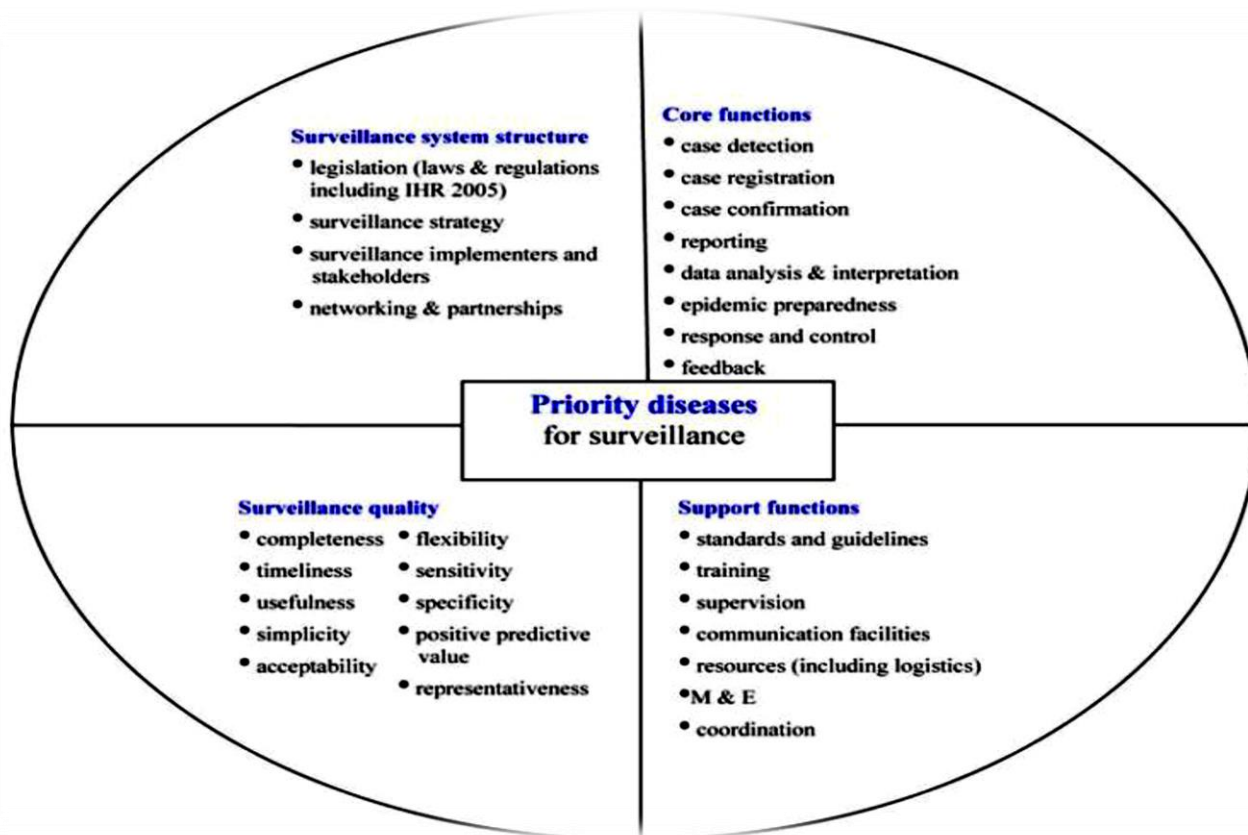


Figure 29 Components of surveillance and response systems for monitoring and evaluation

Surveillance evaluation is periodic assessment of the relevance, effectiveness, and impact of the surveillance system that should be evaluated periodically in order to:

- Assess their performance and determine how well the system operates to meet its stated purpose and objectives.
- Ensure data collected are adequately and effectively guiding their intended public health actions.
- Develop recommendations for improving quality, efficiency, and usefulness, including the optimization of resources.
- Ensure that problems of public health importance are being monitored efficiently and effectively [9].

When surveillance information is used to plan and implement public health practice (policies, programs), the surveillance system should also serve to evaluate the success of the public health practice[10]. Surveillance system evaluation follows the CDC Framework for program evaluation which includes the following steps [7].

- Engage stakeholders.
- Describe the program.
- Focus the evaluation design.
- Gather credible evidence.
- Justify conclusions.
- Ensure use and share lessons learned

The expanding scope of conditions and determinants of conditions amenable to surveillance is, however, a cause for concern. The number of conditions and determinants designated for surveillance must be restricted to the human and financial resources available to adequately sustain the surveillance system, and to conditions in which surveillance can effectively lead to prevention. Therefore, priorities must be set among the long list of diseases and injuries that affect humankind[11]. Priorities should be based on public health importance, including the measure of the disease's seriousness for the individual, its current burden on society, the potential burden on society (which involves the issue of communicability and the potential for epidemic spread), and repeatability. Priorities are also determined by the country's capacity to respond with the necessary public health actions for disease prevention and control[12].

International Health regulation (IHR) 2005 identified health-related events that each country agrees to be bound by the regulations (a "state party") must report to World Health Organization (WHO). In terms of health-related events that occur in its territory, a state party must notify WHO of "all events which may constitute a public health emergency of international concern" (article 6.1). These events include any unexpected or unusual public health event regardless of its origin or source (article 7).The IHR 2005 underscore the commitment to the goal of global security and request all Member States to establish and implement effective surveillance and response systems to detect and contain public health threats of national and international importance [13].

In high-income countries in Europe, North America, Australia, and some parts of Asia, surveillance systems have progressively evolved from monitoring infectious diseases and cataloguing epidemics to examining interactions among biological, social, psychological, and environmental factors in order to support health promotion, inform intervention programs, and guide prevention efforts of non-communicable disease and mental illness. However, despite these impressive advances and the ensuing societal benefits enjoyed by richer nations, surveillance systems in low-income countries remain a neglected and strained public health function and the continuing challenge is to create effective systems that combat communicable diseases[14].

In Ethiopia, there are 23 reportable disease (15 are immediately reportable and 8 weekly reportable) under surveillance which were selected based up on the criteria of the diseases which have high epidemic potential, Required internationally under IHR2005, Diseases targeted for eradication or elimination, Diseases which have a significant public health importance and diseases that have available effective control and prevention measures for addressing the public health problem they pose [15]. Malaria is among priority disease under surveillance in the country.

Malaria is parasitic diseases caused by parasites of the Plasmodium family and transmitted by female Anopheles mosquitoes. There are four common human malaria species (P. falciparum, P. vivax, P. malariae and P. ovale), of which P. falciparum and P.vivax are the most prevalent and P. falciparum is the most dangerous. P.knowlesi, a zoonotic plasmodium, is also known to infect humans [16]. Despite being preventable and treatable, malaria continues to have a devastating impact on people's health and livelihoods around the world [17].

2.2 Statement of the problem

Public health programs operate has become more complex. Programs that work well in some settings fail miserably in others because of the fiscal, socio-economic, demographic, interpersonal, and inter-organizational settings in which they are planted. At the same time that programs have become more complex, the demands for accountability from policy makers and other stakeholders have increased [7]. The capacity of surveillance systems is to accurately describe patterns of diseases of public health importance. Therefore, regular and relevant evaluations of these systems are critical in order to improve their performance and efficiency[12].

Continued howling about the weaknesses of public health surveillance nationally and globally illustrate that achieving useful, sensitive, timely, and stable surveillance through IHR 2005 was a challenge for states and the international community. Several potential obstacles, including technical, resource, governance, legal, and political concerns, will complicate and frustrate efforts to improve national and global surveillance capabilities[18].

A number of limitations have been identified for the current surveillance systems.

- 1) The current surveillance practice is unable to address adequately either current or new potential challenges to public health.
- 2) The current approach to public health surveillance is fragmented, as the various systems are not well coordinated. Ongoing public health information systems are not always integrated with public health

surveillance and prevention activities. Instead, over time, a collection of independent and poorly coordinated surveillance systems has evolved in response to various needs.

- 3) It is difficult to address a new emerging health problem because surveillance for the specific problem usually does not exist. New health problems are not detected through the collection of routine surveillance data.
- 4) Existing surveillance systems may not provide timely data.
- 5) Inadequate funding has been a problem with current systems of surveillance [19].

Evaluation of public health surveillance systems is a critical component of ensuring that conditions of public health importance are appropriately monitored. Enhancing this evaluation is very important to control diseases mainly those has public health importance. The major health problems of the Sub-Saharan Africa countries are largely preventable communicable diseases and nutritional disorders.

Malaria

Malaria remains a global health threat putting an estimated 3.3 billion people at risk of malaria of which 1.2 billion are at high risk. In high risk areas more than one malaria cases occur per 1,000 populations [20]. The latest estimates of World health organization showed that Malaria causes 206 to 258 million cases and 384,000 to 452,000 deaths globally and 213 million of cases and 380,000 deaths were reported from WHO African Region IN 2018. Sub-Saharan Africa carries the bulk of the global malaria burden, with 93% of cases and 94% of global deaths. Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide. In Ethiopia 474,000 to 5.5 million cases and 74 to 14,700 deaths were reported in the same year[21]

Malaria is one of the leading causes of morbidity and mortality in Ethiopia. An estimated 68 million people (68% of the population) are at risk for malaria and approximately 70% districts (565 districts) with malaria risk in Ethiopia (out of 845 total districts). Malaria transmission is generally seasonal and unstable, though patterns and intensity of transmission vary throughout the country due to differences in altitude, rainfall and population movement. Protective immunity in Ethiopian populations is relatively low due to unstable transmission and, unlike large parts of sub-Saharan Africa, all age groups are at risk of infection and disease.[21]

Malaria is pervasive to Ethiopia; 75% of the landscape areas below 2000 m above sea level is malarias which is fertile low land areas and suitable for agriculture. More than 60 million populations live in these areas and are at risk of malaria. The transmission is unstable and seasonal from September to December

and April to May which is coincide with major planting and harvesting experience seasonal transmission of malaria with sporadic season for farmers - aggravate economic loss[22].

Ethiopia applied interventions like early diagnosis and treatment, and use of vector control methods (indoor residual spray with insecticide and ITNs) to control malaria in the last 25 years. These interventions are highly effective in reducing both the transmission and exposure to infectious mosquito bites and also the concomitant burden of malaria disease. However, ITN ownership and usage levels are still both below target levels. According to 2015 malaria indicator survey, about 64% of households in malaria-endemic areas owned at least one LLIN with regions ranging in coverage from 34 percent and 73 percent [23].

2.3 Significance of the study

Generally, in Elu Gelan District, malaria is remaining as a major public health problem of the community and occurred as an outbreak. We believe that those diseases could be used as a proxy indicator of the surveillance system of the district and region in general. As the reports of surveillance system evaluation in other district indicated, use of public health surveillance system for decision-making was not well known and still yet the evaluation was not conducted in the district. Therefore, it provides scientific evidences for public health professionals, managers, concerned bodies and stakeholders that involved ensure the surveillance system is managed effectively and efficiently and to set recommendations for improving the quality and efficiency of the system based on identified gaps.

3. Objectives

3.1 General Objective

- To evaluate the existing surveillance system of malaria in Elu Gelan District .2019

3.2 Specific objectives

- To evaluate the core activities of surveillance system for malaria.
- To evaluate the supportive activities of surveillance system for malaria.
- To evaluate the attributes of the surveillance system for the selected diseases.

4. Methods and Materials

4.1 Study area and period

This study was conducted from December 12-26/2019 G.C in Elu Gelan district, West Shewa, Ethiopia. Elu Gelan district established as an independent district in 1999 E.C and it is one of the 22 districts in West Shoa Zone of Oromia regional state which is separated from Caliya district in 1999 E.C. It is 90 KM away from Ambo, the capital of West shoa zone, and 205 KM from Addis Ababa, the capital city of Ethiopia. It is bordered by Caliya in the East, Bako Tibe in the west and Dano in the south. Its altitude ranges from 1500 meters above sea level to 2200 meters ASL; the climate of the district varies from Kolla to Wayina dega. Annual rain fall ranges from 970ml to 1400ml and annual Average temperature 27.5 c°. Administratively, the woreda is divided in to 3 cluster and 18 Kebeles (17-rural kebele and 1-urban kebele). Regarding to health facility distribution in the District, there are 3-health centres, 17 health posts, 12 primary clinic, 1 Medium clinic and 2 drug store.

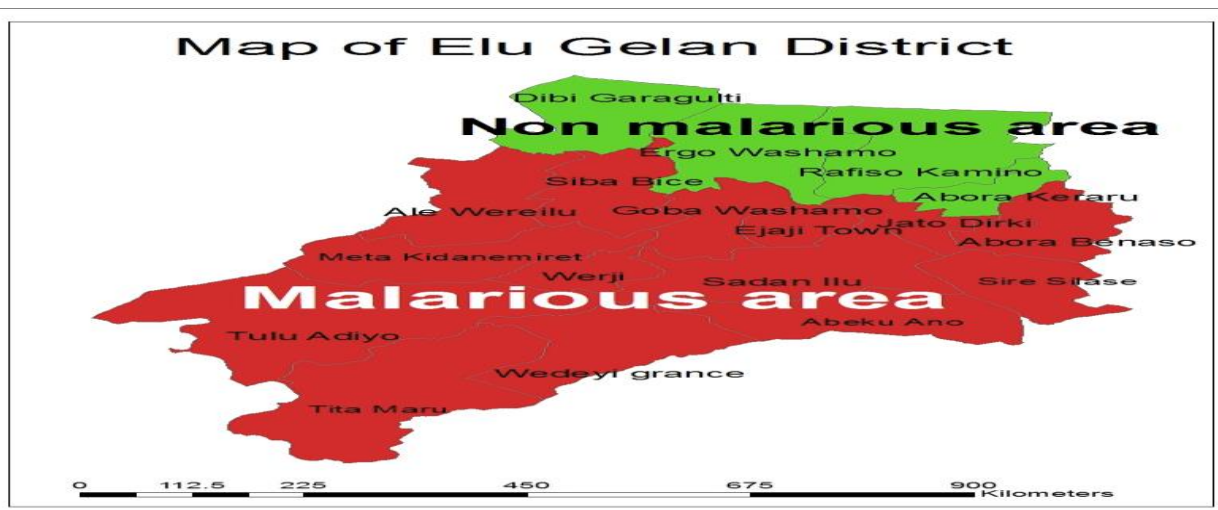


Figure 30:-Elu Gelan District map (Elu Gelan District health department)

3.1.3.2. Study design

Institution based cross-sectional descriptive study design was conducted

4.3 Population

3.1.3.3. Source Population

All Public Health Facilities (Health Centers, and Health Posts) and health office (woreda health office) found in Elu Gelan district in 2019.

3.1.3.4. Study population

Selected public health facilities and office found in Elu Gelan district in 2019.

3.1.3.5. Eligibility criteria

3.1.3.5.1. Inclusion criteria

Functional public health facilities and office that were included in surveillance system at least at the beginning of 2019

3.1.3.5.2. Exclusion criteria

Functional public health facilities and office that were not included in surveillance system at least at the beginning of 2019

3.1.3.6. Sample size and sampling technique

Before selection of a sample we conducted a discussion with woreda health office head and PHEM officer for sampling selection. A total of 14-reporting units were identified for this surveillance system evaluation. Since surveillance system evaluation is one of non-research investigation, 100% of health centres in the district including Health office were selected purposively by considering malaria burden and having settlement area. From each Selected Health centres ten health posts were randomly selected. The sampling technique is described as follows:

1. Woreda health office was not evaluated before therefore it was selected purposively.
2. Three health centre's (100%) in the district were selected purposively.
3. From each Health centres 60% of Health posts were randomly selected.

Finally, 14 study sites were selected and included in the study (Ddistrict Health office, 3 HC, 10 HP).

Table 24 Health facilities selected for surveillance system evaluation in Elu Gelan District, Oromia, Ethiopia, 2019

District Name	Available HCs	Selected HCs	Name of Selected HCs	Available HPs	Selected HPs	Name of Selected HPs
Elu Gelan	3	3	Ejaji HC	7	4	Jato Dirki
						Rafiso Kamino
						Seden Elu
						Goba Washemo
			Elala HC	5	3	Meta Kidanemiret
						Siba Biche
						Ale Wera Elu
			Dano Gabriel HC	5	3	Tita Maru
						Abeku Anno
						Wedeyi Giranche

3.1.3.7. Data collection procedures

The study used semi-structured (Contains both open-ended and closed ended) interviewer-administered questionnaire (The questionnaire was adapted from the generic questionnaire in annex 12 of WHO and CDC guidelines) was administered to collect primary and secondary data; Interviews were conducted with relevant officer and department as per the tool. Different related documents and reports were observed and checked.

3.1.3.8. Data analysis and presentation

We used Micro-soft Excel 2013 to calculate frequency, ratio, rate, and proportion. We also used Microsoft excel to construct tables and figures.

3.1.3.9. Data dissemination

Written report of soft and hard copies prepared and shared to Addis Ababa University/School of Public Health, Oromia Regional Health Bureau PHEM department, West shoa zone health department and Elu Gelan district health office, Ethiopia Field Epidemiology Training Program mentor, resident advisors and coordinators.

3.1.3.10. Study variables

General

- Availability of national manual

Case detection and registration

- Standard case definition

Data reporting

- Provision of surveillance reporting formats to the health facilities
- Reporting health facilities
- Number of reports in the last one year compared to expected number
- Number of reports received on time in the year 2019
- Any report of the immediately reportable diseases in the past one year
- Report to the next high level

Data analysis

- District level description of data by person,place and time
- Performance of trend analysis
- Having an action threshold defined for malaria
- Responsible person for the analysis of the collected data
- Frequency of analysing the collected data
- Availability of an appropriate denominators establish the threshold

Outbreak Investigation

- Occurrence of outbreak in the District.
- List of diseases
- Number of outbreak investigated and risk factors looked for
- Number of outbreak in which findings were used for action
- Number of Health facilities that looked for risk factors
- Number of Health facilities that used the data for action

Epidemic preparedness (relevant for epidemic prone diseases)

- Establishment of epidemic management committee (RRT)
- Availability of plan for epidemic preparedness and response
- Availability of emergency stocks of drugs, vaccines, and supplies at all
- Experience of shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)
- Availability of standard case management protocol for malaria
- Availability of budget line for epidemic response
- Availability of rapid response team for epidemic

Response to epidemics

- Epidemic response within 48 hours of notification from district level

Feedback

- Amount of feedback reports from the district level produced in the last year

Supervision

- Conducted supervision in the last one year

Training

- Received any post-basic training in epidemic management
- Number of staffs trained in surveillance

Resources

- Availability of resource for data management
- Communications availability

Surveillance

- Availability of budget line for surveillance at District
- Opportunities for integration of surveillance activities and functions (Core activities, training, supervision, guidelines, resources etc.)

Qualitative Attributes

- Simplicity
- Flexibility
- Acceptability
- Stability

Quantitative Attributes

- Data quality
- Timeliness
- Representativeness
- Sensitivity
- Positive predictive value

3.1.4. Results

3.1.4.1. Meeting

We conducted a brief meeting with responsible persons (Head of district health office and PHEM focal person) before assessing the objective of the study and its significance, and highlighted information after assessment, at different level. This meeting was also an important first step for assessment and recommendations; which will help for the implementation of recommendations and betterment of the surveillance and response of the major priority diseases of the evaluated district. District health office PHEM focal person described about PHEM system has improved and became focus of even political leaders. But the district has no emergency budget

3.1.4.2. Stakeholders involvement

The surveillance system included all stake holders or entities which were reporting weekly PHEM report starting from Health post to district level, government health facilities, and malaria focal persons for assessment of uses of surveillance data. There was no strong inter and intra-sectorial collaboration of PHEM and other department and offices at district level to provide early warning and response functions.

3.1.4.3. Description of the surveillance system of Elu Gelan District

PHEM is designed to ensure rapid detection of any public health threats, preparedness related to logistic and fund administration, and prompt response to and recovery from various public health emergencies, which range from recurrent epidemics, emerging infections, nutritional emergencies, chemical spills, and biological terrorism [15]. The routine flow of surveillance data is usually from reporting sites to the next level up to the central level as indicated in below. Feedback and information sharing will follow the same route. The surveillance system of the district had one focal person at district level, at all health facilities to facilitate these activities. At health post level health extension workers are dedicated to report weekly PHEM report in addition to routine health services.

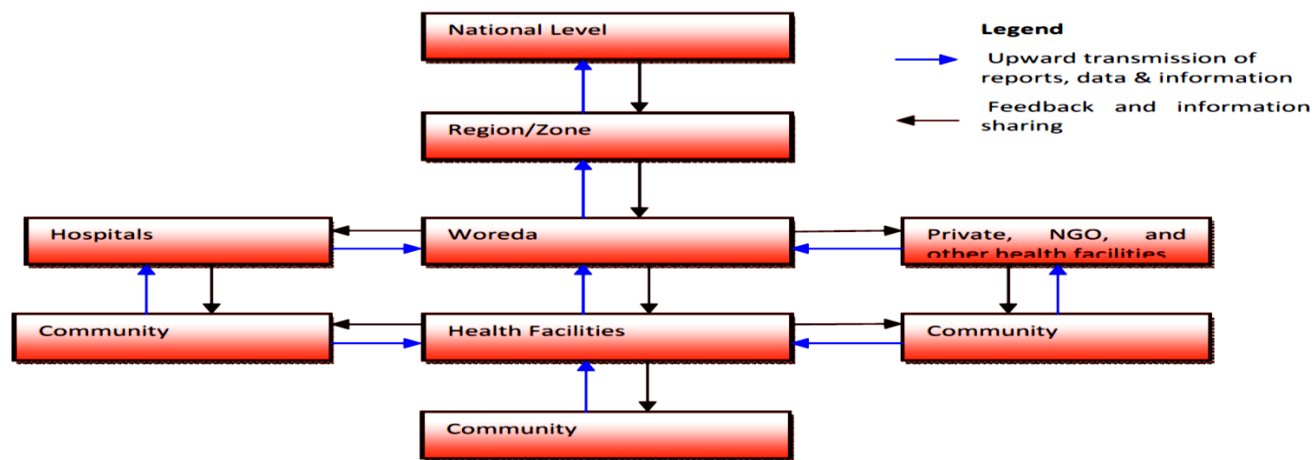


Figure 31 Diagram illustrating the formal and informal flow of surveillance data and information throughout a system [15]

3.1.4.4. Description of malaria in Surveillance System Evaluation

Malaria

A total of 5315 confirmed malaria cases treated by the year 2019 G.C in Elu Gelan district. 5007 (94.2%) were PF, 265 (5%) PV and 43 (0.8%) were Mixed. There was malaria outbreak in the district from WHO week 24-52/2019 with the attack rate of 10.2%. Five consequent years trend analysis of confirmed malaria cases showed that prevalence of malaria was slightly increased from the first years 2015 which was 6/1000 to 2018 which was 11.6/1000 persons then tremendously increase to 2019 which was 61.8/1000 person. The highest prevalence was reported in 2019 which is 61.8/1000 persons. Malaria cases were increased from 2018 to 2019 calendar year with prevalence of 11.6 to 61.8/1000 people. There were no malaria Inpatient case and death reported. Table 2 & Figure 5 below. 92.9% of the woredas population lived in malarious area.

Table 25. Prevalence of malaria across years in Elu Gelan district, 2019.

Year	Total population	Total malaria case	prevalence/1000 Population
2015	81889	491	6.0
2016	83568	568	6.8
2017	84254	745	8.8
2018	85118	986	11.6
2019/20	86006	5315	61.8

Figure 32 Trend of confirmed malaria prevalence by year in Elu Gelan district, from 2015-2019

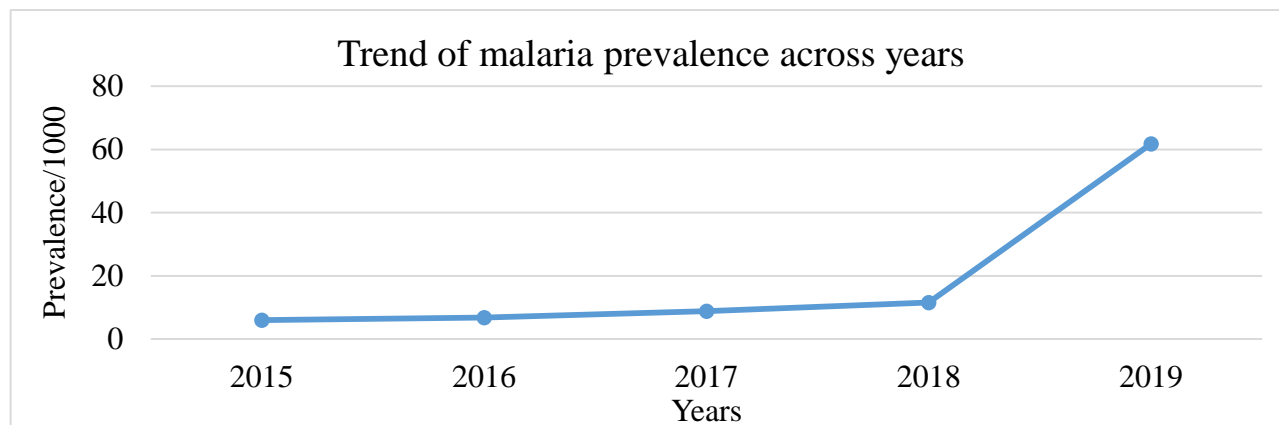
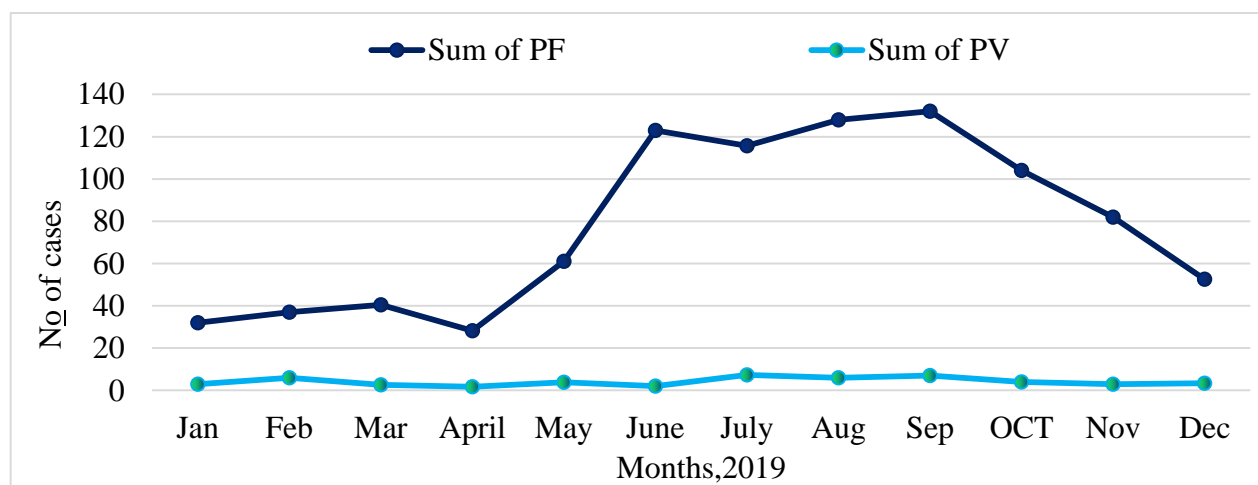


Figure 33 Trends of Confirmed malaria cases by species type and month in Elu Gelan District, Oromia, Ethiopia, 2019



3.1.4.5. Availability of case definition, clinical register and surveillance manuals

According to Ethiopia PHEM guideline [15], there are two types of case definition: standard case and community case definition

3.1.4.5.1 Standard case definition:

Malaria:

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

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

3.1.4.5.2. Community case definition:

Malaria: Any person with fever OR fever with headache, back pain, chills, rigor, sweating, muscle pain, nausea and vomiting OR suspected case confirmed by RDT.

According to the assessment, One health office (100%), 3 health facilities (100%) and 3 HPs (33.3%) had case definition for Malaria. On the other hand, health extension workers who were interviewed during the assessment, 4/10 (40%) of them, were understood the case definition clearly and apply the case definition accordingly as per the national guide line. Clinical register was found in all visited health centers and HP's but the handling of registration book was poor.

3.1.4.6. Availability of surveillance formats

Even though reporting format is prepared and distributed from central level to regional and zonal health offices, there was shortage of reporting format in most of visited health facilities in the past one year. Due to these reasons more than half of the visited health facilities were using copy of reporting formats. On the other hand, reporting formats prepared at central level is stored at Woreda level for long period of time instead of distributing to health facilities on time. But currently they are distributed for certain health facilities. In the district, there was no shortage of reporting format but health centers and HPs faced shortage of surveillance formats like weekly reporting formats, case-based formats for different diseases, epidemic reporting format and line listing formats.

3.1.4.7. Data Reporting

Elu Gelan district PHEM department were expected about 1056 and 1,008 weekly surveillance reports in the past twelve months of 2019 to send for zone and receive from health posts and health centers. However, only 544 (54%) reports were received from 21 health facilities and only 62% of them were sent on time. From visited HC's and HP's, reporting completeness and timeliness were shown in table 3.

Table 26 Reporting rate of Visited Site in Elu Gelan District, Oromia, Ethiopia, 2019

Name Visited Site	Number of health facility	Expected report	Reported	on time	completeness	Timeliness
Elu Gelan WoHO	21	48	23	36	48.1	74.9
Health office	1	48	48	47	87.5	89.6
Ejaji HC Cluster	9	48	22	35	46.8	73
Ejaji HC	1	48	48	47	87.5	95.8
Jato Dirki HP	1	48	20	18	40	90
Sire silase HP	1	48	24	20	58.3	83.3
Hobora Beneso HP	1	48	18	10	33.3	55.6
Hobora Keraru HP	1	48	16	12	37.5	75
Refiso Kamino HP	1	48	16	8	50	50
Goba Washemo HP	1	48	18	12	22.2	66.7
Seden Ilu HP	1	48	20	16	30	80
Ejaji 01 HP	1	48	16	10	62.5	62.5
Elala HC Cluster	6	48	19	45	40.5	93.5
Elala HC	1	48	48	36	46.2	75
Siba Biche HP	1	48	24	18	50	75
Meta K/miret HP	1	48	16	12	37.5	75
Dibi Gara Gulti HP	1	48	12	8	25	66.7
Ale Wara Elu HP	1	48	20	14	42	70
Ergo Washemo HP	1	48	20	10	42	50
Dano Gebriel HC Cluster	6	48	28	40	57.6	83.9
Dano Gebriel HC	1	48	42	38	90.5	90.5
Tita Maru HP	1	48	28	24	58	85.7
Tulu Adiyo HP	1	48	22	18	46	81.8
Abeku Ano HP	1	48	18	14	38	77.8
Werji HP	1	48	28	24	67	85.7
Wedeyi Girance HP	1	48	22	18	46	81.8

3.1.4.8. Data analysis

In the district, surveillance data analysis was not conducted in regular basis but for malaria trend analysis they conducted quarterly. All visited HCs and HPs did not analyze surveillance data.

3.1.4.9. Outbreak investigation

By 2019, Elu Gelan district reported a malaria outbreak from five kebeles. The outbreak was investigated by investigation team from Zone and District to identify the disease risk factor and the finding was used for prevention and control of the disease. However, it was identified that the district and health facilities hadn't the capacity to investigate outbreak by their own staff.

3.1.4.10. Epidemic preparedness and response

The District health office had established team and plan for epidemic preparedness and response. But the team was not functional and didn't know their role and responsibility. Health facilities had not epidemic preparedness and response plan.

3.1.4.11. Feedback

Feedback is a critical activity in strengthening surveillance system. The district didn't receive any written feedback from higher level concerning surveillance and health facilities didn't receive feedback that only concerns surveillance system but receive feedback with integration of other activities that consists few indicators of surveillance activities quarterly. In the district, producing and dissemination of written feedback for health facilities is very poor. In other hand, PHEM focal persons at zonal and district level have been giving feedback for health facilities orally and writing on their registration book during their field visit.

3.1.4.12. Supervision

The District health office and all health centers didn't conducted program based supportive supervision during the past 12 months on surveillance activities. District health office was supervised twice a year and all visited HCs and HPs, were supervised once by integrated supportive supervision conducted with limited number of surveillance indicators. All health facilities were supervised once in integrated supportive supervision.

3.1.4.13. Training

District health office and visited health centres PHEM focal persons had training on basic PHEM training for five days. But visited health posts had no trained personnel on basic PHEM or on different surveillance topics.

3.1.4.14. Resource

Unlike Zonal level, at Woreda and Health facility level budget was not allocated from government source for public health emergency activities. As indicated in the following table essential material resources available to undertake surveillance activities at all levels were as follows

Table 27 Availability of resources for surveillance activities at all assessed levels, Elu Gelan District, Oromia, Ethiopia, 2019

S.No	Resources	Woreda Health Offices	Health Centers	Health Posts
		N (%)	N (%)	N (%)
1	Electricity	1(100%)	3(100%)	0(0%)
2	Computer	1(100%)	3(100%)	0(0%)
3	Printer	1(100%)	3(100%)	0(0%)
4	Stationery	1(100%)	3(100%)	9(100%)
5	Vehicle	1(100%)	0(0%)	0(0%)
6	Motor Cycle	1(100%)	0(0%)	0(0%)
7	Fax	0(0%)	0(0%)	0(0%)
8	Telephone	1 (100%)	1(33.3%)	0(0%)

3.1.4.15. Common attributes of the surveillance system

Simplicity

The simplicity of a public health surveillance system refers to both its structure and ease of operation. Surveillance systems should be as simple as possible while meeting their objectives [24].

All Experts working at visited Woreda, health facilities and HEWs respond as the surveillance format are easy to fill, understand on its important for timely recording and reporting data. Additionally, they respond as the information /indicators developed in the surveillance format are used for investigation of the outbreak / diseases. The malaria confirmatory test takes 10-15 minute at health post level using RDT and near to 1 hour at health centre level using microscopy. The system allows all professionals to fill data easily; and to record and report surveillance data on time and it takes 10-15 minutes. The most common way of transmitting data to the higher level is telephone.

Flexibility

A flexible public health surveillance system can adapt to changing information needs or operating conditions with little additional time, personnel, or allocated funds. Flexible system can accommodate new health related events, changes in case definition or technology and variations in funding or reporting sources [24]. Health office, all visited health facilities and HEW mention that public health surveillance system is flexible because it has a place to accommodate new health related events.

Data Quality

Data quality reflects the completeness and validity of the data recorded in the public health surveillance system[24]. Majority of surveillance forms have 'blank' on facility information and reporter information. Regarding validity of the data recorded on the format, especially in all health centres, and HPs the data on format was not found on disease registration book. Inpatient case and deaths of malaria was not reported for the past three years.

Acceptability

Acceptability reflects the willingness of persons and organizations to participate in the surveillance system[24]. Acceptability is a largely subjective attribute and influenced by different factors such as regular feedback, supervision, Acknowledgment by the system of the person's contribution and others. But the above attributes like reporting rate, data quality and timeliness indicated that the acceptability may be poor. All health facilities in the district accepted and engaged in the system. Cases were identified using standard and community case definition.

Sensitivity

The sensitivity of a surveillance system can be considered on two levels. First, at the level of case reporting, sensitivity refers to the proportion of cases of a disease (or other health-related event) detected

by the surveillance system. Second, sensitivity can refer to the ability to detect outbreaks, including the ability to monitor changes in the number of cases over time[24].

- During the year 2019 Elu Gelan District, sensitivity or proportion of case detected by surveillance was 73.3%.
- Data quality, completeness, lack of data analysis at district and facility level and other related attributes, shows that Sensitivity was not good

Table 28.Sensitivity and PPV of surveillance system in Elu Gelan District, Oromia, Ethiopia. 2019

Detect by Surveillances	Malaria parasite present		
	Yes	No	Total
Yes	3,897	1,953	5,850
No	1,418	827	2,245
	5,315	2,780	8,095

Sensitivity and Predictive Value Positive (PVP)

Sensitivity and PPV of 2019 of Elu Gelan district was $3,897/5,315 \times 100$ (73.3%) and $3,897/5,850 \times 100$ (66.6%). Respectively.

Representativeness

A public health surveillance system that is representative accurately describes the occurrence of a health-related event over time and its distribution in the population by place and person [24]. The health coverage of the District was 100% therefore, public health surveillance system was representative. The health coverage of the district was very good. This might be due to the health coverage was calculated based on the ratio of 1HC for 25,000 Population.

Table 29. Health coverage of Elu Gelan district, Oromia, Ethiopia, 2019

S. N	District	Total population	No of required HC	No of Available HC	No of required HP	No of Available HP	Health coverage (%)
1	Elu Gelan	86,006	3	3	18	18	100

Stability

Stability refers to the reliability (i.e., the ability to collect, manage, and provide data properly without failure) and availability (the ability to be operational when it is needed) of the public health surveillance system [24].

A lack of dedicated resources might affect the stability of a public health surveillance system. All health facilities and Woreda Health Office complain the lack of transportation facility, scarcity of budget, lack of refreshment training, reporting format and shortage of human power as a reason hindering the implementation of surveillance activities as planned.

3.1.5. Discussion

A total of 5315 malaria cases 100(%) were confirmed. This finding may indicate treating malaria by clinical was avoided which is recommended by WHO. (Confirmed +clinical) treated by the year 2019 in Elu Gelan district. Five consequent years trend analysis of confirmed malaria cases showed that prevalence of malaria was slightly increased from the first years 2015 to 2017 then tremendously increase from 2018 to 2019. The increment was might be because of interruption of malaria control measures like Indoor residual spray (chemical) and ITN distribution). Even though there was an outbreak, there were no malaria inpatient case and death reported in the past three years. This may be because of fear of evaluation of case management or negligence of professionals.

The analysis of the PHEM data was done at district level irregularly for action while analysis of data at the local level to detect any irregularity in the reports was non-existent at health facility level. The data analysis description might indicate who analyses the data, how do they analyse, and how often. This description could also address how the system ensures that appropriate scientific methods are used to analyse the data. Surveillance data should be analysed, interpreted and used for decision making starting from local (generators of the data) to the central level in order for the values of the data to be realized.

Reporting rate of the district health office is 51.5% which was below the target of the region (80%), the timeliness also very low. Completeness and timeliness of all health facilities were very low that made inaccurate information about disease occurrence and negative influence on other surveillance system attributes. Shortage of reporting format at health facility level, lack of regular program based supportive supervision, lack of regular written feedback and lack of trained manpower at facility level was clearly revealed in the district.

3.1.6. Conclusions

The analysis of the PHEM data was conducted only at district health office irregularly. Shortage of reporting format at health facility level, lack of regular program based supportive supervision, lack of regular written feedback and lack of trained manpower at facility level was clearly revealed in the district. Poor data quality, low report completeness and timeliness was showed. Generally, based on evaluation of public health surveillance system core activities, supportive activities and attributes, the surveillance system in the district was not fully implemented to meet its objective. Lack of budget for PHEM was there, low case detection and low report completeness and timeliness.

3.1.7. Recommendations

In all level, training on Surveillance indicators, data reporting, analysis and dissemination should be cascaded for their respective reporting sites up to the Health Extension Workers. Health facilities should improve report completeness and timeliness and analyze surveillance data weekly and monthly base. Also enhance case detection capacities.

At all level, regularly supportive supervision and feedback specifically on the surveillance activities (Program based) should be conducted for their respective reporting sites in collaboration with the available stakeholders.

During the follow-up period, the team should integrate on job training for health professionals and Health Extension Workers.

At all level review meeting and best experience sharing program among the health professionals and health facilities should be planned and conducted accordingly.

Regional Health Bureau and ZHD should try to solve the problem in transportation, telephone, electricity and lack of budget for surveillance activates encountered in the Health facilities and Woreda Health Office.

Availability of reporting formats and registration book should be checked at regular basis at all levels.

Budgets should be mobilized by governmental and non-governmental organization and line budget should be there especially at district level

3.1.8. Reference

- [1] A. Bassili, “Components of a good surveillance system and future plans for improvement in the EMR,” *World Heal. Organ.*, no. October, pp. 27–29, 2009.
- [2] Centers for Diseases Control, “Updated Guidelines for Evaluating Public Health Surveillance Systems Recommendationstions,” *Morb. Mortal. Wkly. Rep.*, vol. 50, no. RR-13, 2001.
- [3] S. L. G. and D. L. Buckeridge, “Public Health Surveillance Systems: Recent Advances in Their Use and Evaluation Samuel,” *Annu. Rev. Public Heal.*, vol. 38, pp. 57–79, 2017, doi: 10.1146/annurev-publhealth-031816-044348.
- [4] R. R. German et al., “Updated guidelines for evaluating public health surveillance systems: recommendations from the Guidelines Working Group.,” *MMWR. Recomm. reports Morb. Mortal. Wkly. report. Recomm. reports*, vol. 50, no. RR-13, pp. 1–35; quiz CE1-7, 2001, doi: Robert R. German, M.P.H. Epidemiology Program Office, CDC.
- [5] C. Calba et al., “Surveillance systems evaluation: A systematic review of the existing approaches,” *BMC Public Health*, vol. 15, no. 1, 2015, doi: 10.1186/s12889-015-1791-5.
- [6] A. Burchard, “Evaluation of the South Australian Monitoring and Surveillance System,” 2017.
- [7] O. of S. and I. U.S. Department of Health and Human Services Centers for Disease Control and Prevention. Office of the Director, “Introduction to program evaluation for public health programs: A self-study guide.,” Atlanta, GA Centers Dis. Control Prev., no. October, 2011.
- [8] Geneva: World Health Organization., “Communicable disease surveillance and response systems: Alertresponse, Epidemicpandemic,” pp. 1–90, 2006.
- [9] A. Saunders, P. H. Ontario, M. Helferty, and L. Care, “Evaluating Surveillance Systems – Let’s Get Critical, Critical!,” in *Infectious Disease Workshop: October 8, 2015*, 2015, p. 22.
- [10] D. A. Salmon and N. A. Halsey, “How Vaccine Safety is Monitored,” in *The Vaccine Book: Second Edition*, 2016, pp. 153–165.
- [11] M. Thrusfield, “Toolkit Surveillance Public,” *Vet. Epidemiol. Fourth Ed.*, pp. 457–491, 2017, doi: 10.1002/9781118280249.ch21.
- [12] B. C. K. Choi, “The Past, Present, and Future of Public Health Surveillance,” *Scientifica*, vol. 2012, pp. 1–26, 2012, doi: 10.6064/2012/875253.
- [13] M. G. B. and D. P. Fidler†, “Global Public Health Surveillance under New International Health Regulations,” *Med. J. Aust.*, vol. 12, no. 7, pp. 54–56, 2006.
- [14] N. Erondy, “Evaluating communicable disease surveillance in resource-poor settings:A new

approach applied to meningitis surveillance in Chad Ngozi Adaeze Erongu,” 2016.

- [15] Ethiopian Public Health Institute, “Public Health Emergency Management,” 2012, pp. 1–140, 2012.
- [16] “Global technical strategy for malaria 2016–2030,” 2016.
- [17] B. S. Ibrahim, A. A. Abubakar, U. A. Bajoga, and P. M. Nguku, “Evaluation of the Malaria Surveillance System in Kaduna State , Nigeria 2016,” vol. 9, no. 1, pp. 2016–2017, 2017.
- [18] E. C. D. Todd, “Challenges to global surveillance of disease patterns,” Mar. Pollut. Bull., vol. 53, no. 10–12, pp. 569–578, 2006, doi: 10.1016/j.marpolbul.2006.08.004.
- [19] P. Hitchcock, A. Chamberlain, M. Van Wagoner, T. V Inglesby, and T. O. Toole, “C HALLENGES TO G LOBAL S URVEILLANCE AND,” vol. 5, no. 3, 2007, doi: 10.1089/bsp.2007.0041.
- [20] E. Wollega, “Prevalence of Malaria and Associated Factors among Febrile Patients Visiting Kalala Health Center in Haro Limmu Woreda , East Wollega Zone , Epidemiology : Open Access,” no. February, 2019, doi: 10.4172/2161-1165.1000365.
- [21] World malaria report 2019. 2019.
- [22] P. O. Box, “Current Status of Malaria in Ethiopia : Evaluation of the Burden , Factors for Transmission and Prevention Methods,” vol. 7, no. 1, pp. 1–6, 2018, doi: 10.5829/idosi.apg.2016.7.1.10273.
- [23] M. Indicator, “No Title.”
- [24] D. Westmoreland, E. P. Office, G. Armstrong, G. S. Birkhead, and T. Epidemiologists, “Updated Guidelines for Evaluating Public Health Surveillance Systems,” vol. 50, pp. 1–40, 2001.

Chapter Four- Health Profile Description Report.

4.1. Bona Zuria health profile Sidama Zone, SNNPR, Ethiopia, March, 2019

Abstract

Background: - Health profile is a system of collecting and summarizing health and others health related events, demographic, socio-economic, political and cultural aspect of a given geographical setting. The information obtained from health profile is important for health managers and stakeholders to use for planning, implementation and evaluation of public health intervention.

Objective: - To assess and describe health and health related data so that identify problems for health priority setting of Bona Zuria Woreda, 2019

Methods: - Retrospective descriptive cross-sectional study design was conducted. Health and health related data was collected from different sectors in Bona Zuria district from 21/02 to 20/03/2019 with the objective of describing the health and health related profile of Bona Zuria district. Semi structured questionnaires and open ended questions were used to identify health and health related problems. Priority setting and recommendations were based on the magnitude and severity of the problems, community concern, government concern, and feasibility of intervention. Data was compiled and analyzed using micro soft excel statistical program.

Result: according to the projection of 2015, Population of the Bona Zuria Woreda in 2018/19 was estimated to be 161,715. Of which 146,352(90.5%) were rural residents, and the dependency ratio was 42.6. The Woreda has 24 rural and one urban kebeles. There were 24 health posts and 5 health centers in the woreda. According to data from water resource management office of 2010 E.C; Access to safe drinking water supply and excreta disposal was 30.9 % and 25.2% respectively. More than half (69.1%) of the population use unsafe water for drinking from river, unprotected spring, ponds and shallow well. And no kebeles were graduated as open defecation free kebeles. Aggregated Data from Bona Zuria woreda health office showed that among top ten leading morbidity in adult outpatient department, Pneumonia accounts 3,749 (17%) followed by Acute Febrile Illness 3,467 (16%) while among five top causes of morbidity of under-five, non- bloody diarrhea accounts 2,740 (44.2%) followed by pneumonia 2,032 (32.7%). Same of the notifiable diseases has shown an increase in the last two years such as severe acute malnutrition, Malaria and Dysentery. Measles and third dose of pneumococcal vaccination coverage

was 100%. The health Extension workers density per 1000 population was 0.5 (1.4/3000) population which is acceptable by the national standard of (1 per 2,500- 3,000 population).

Conclusion and recommendation: List of ten top and five top diseases in Bona Zuria district indicates that communicable diseases were the most commonly occurring disease both in adults and under 5 years. And safe water supply was below the national (80%) and regional target (75%). Therefore, the district health office and health facility staffs should strength communicable disease prevention and control measures to reduce the morbidity of priority diseases using the presence of active health development Army, strategic plan, voluntary health workers and others.

Key words-Health profile, health problems, prioritization of problems, health service,

4.1.1. Introduction

Health profile is a holistic approach and a systematic collection, organization and documentation of health and health related data of specific area in the community using epidemiological tools. It is a comprehensive compilation of information about a community which contains information about the history foundation and location of the district, its accessibility, its cultural value, political and administrative setup, demographic characteristics of its population, general health status, health indicator, education and socioeconomic status.

The data in the profile is a mirror of health and wellbeing of a particular community from much different perspective. Health profile has an indispensable role in generating evidence-based information for planning, implementation and evaluation of health program in the district.

Health managers and stake holders of the community will access evidence based information generated from well compiled health profile and it can also be a basis for the further conducting health research for the benefits of community.

Historical development of modern medicine in Ethiopia as organized by government began to be practiced at the beginning of 20th century. However, it was introduced and practiced in a fragmentary situation starting from 16th century by different groups of people ranging from religious and diplomatic missions to travelers, traders, invaders and warriors. The government was not fully responsible for the operating of modern health service system until the beginning of 20th century. Prior this time, even though the services existed they were limited to few private individuals, religious missions, diplomats and member of the royal family. The first government sponsored health facilities were established in Harar and Addis Ababa by Ras Tefer Makonen and Emperor Menelik-II in 1909 respectively [1].

The recently the health sector has introduced a three-tier health care delivery system which is characterized by a first level of a Woreda/District health system comprising a primary hospital (with population coverage of 60,000-100,000 people), health centers (1/15,000-25,000 population) and their satellite Health Posts (1/3,000-5,000 population) that are connected to each other by a referral system. A Primary Hospital, Health center and health posts form a Primary health care unit (PHCU) with each health center having five satellite health posts. The second level in the tier is a General Hospital with population coverage of 1-1.5 million people; and the third a Specialized Hospital that covers population of 3.5-5 million[2,4].

The Ethiopian Health care System is augmented by the rapid expansion of the private for profit and NGOs sector playing significant role in boosting the health service coverage and utilization thus enhancing the public/private/NGOs partnership in the delivery of health care services in the country. Offices at different levels of the health sector from the Federal Ministry of Health to Regional Health Bureaus and Woreda Health Offices share decision making processes, decision powers, duties and responsibilities. The FMOH and the RHBs focus more on policy matters and technical support while Woreda Health Offices have basic roles of managing and coordinating the operation of a district health system under their jurisdiction. Regions and districts have Regional Health Bureaus (RHB) and district health offices, respectively for the management of public health services at their levels. The devolution of power to regional governments has resulted in the shifting of decision making for public service deliveries from the center to largely under the authority of the regions and down to the district level [2].

The 24 rural and 1 urban kebeles of the Woreda contains 3.8 % of the zone's population, with above 160 Thousand population depending on 2018/19 population projection. Bona Zuria is one of the Woredas of the Sidama Zone with different ethnic and language groups, including Gurage, Hadiya, Kembata, Sidama, Oromo, Tigre and Amhara.

Summarizing the public health data of the woreda is important for public health officials and stakeholders to use it for policy development, planning, implementation and evaluation of public health programs. More over Describing health profile of a particular woreda is vital to describe and communicate health status and determine diseases burden in a simple way and can also be used as an entry point for operational research. Hence collecting, compiling and documenting of health profile of a woreda is critically important for countries like Ethiopia where data management and information system is poor, especially at woreda level. Hence this data was a valuable asset for the health offices that found in Bona Zuria woreda.

4.1.1.1. Statement of the problem

Assessing health profile is crucial for prioritizing health and health related problems of the community at any level especially detail assessment of current health status of the priority disease. The planning and management of health services in developing countries often proceeds within an environment of inadequate information about the health status of the population served and the occurrence of important determination of health.

Due to these problems information like socio demographic, education, infrastructure, health system, public health emergency and health & health related issues should be avail in organized and well documented manner for prioritizing the problem & proper planning. Therefore describing the health profile of the woreda is helpful to give evidence based information for prioritizing and instituting appropriate public health interventions in the woreda.

4.1.1.2. Significance of the study

Describing health profile of a particular district is fundamental to describe health status and determine disease burden to communicate health related information in easy way. It depends on different activities like education and school health, health facilities and human resources, health indicators and vital statics, immunization coverage, water supply and sanitation, leading cause of morbidity and mortality, endemic diseases, nutritional status and disaster situation and health budget allocation. Therefore, to continuously monitor and evaluate the health plan according to their situation all levels have to describe, summarize and analyze the health profiles.

This study aims to describe the health profile of Bona Zuria district to identify gaps/problems, to clearly present a community's health needs and issues so that they can be prioritized for action; to form the base line for the community health improvement plan and other community planning documents; to identify health indicators and sources of data that can be used to monitor change and progress in addressing priority health issues, and provides the recommendation for the district and zonal health staffs and managers

4.1.2. Objective

4.1.2.1. General objective

To assess and describe health and health related data and to identify problems for priority setting of Bona Zuria Woreda, 2019

4.1.2.2. Specific objectives

- To assess the health service status of Bona Zuria district of Sidama zone, 2019
- To identify the major public health problems of Bona Zuria district of Sidama zone, 2019
- To recommend on prioritized problems identified in the district of Bona Zuria district of Sidama zone, 2019.
- To describe health and health related data of the woreda

4.1.3. Methods and materials

4.1.3.1. Study area

Health Profile Description was conducted in Bona Zuria Woreda, Sidama zone, SNNPR, Ethiopia, 2019. Bona Zuria is one of the woredas in the Sidama Zone, SNNPR of Ethiopia. It is bordered in the south by the Oromia Region, in the west by Hula, in the northwest by Bursa, in the north by Arbegona, and in the east by Bensa. The major town of Bona Zuria is Bona. Bona Zuria was separated from Hula woreda and established in 1999. It is located approximately 109 km and 384 km far away from hawassa, major city of Sidama Zone and SNNPR state and Addis Ababa, Capital of Ethiopia respectively.

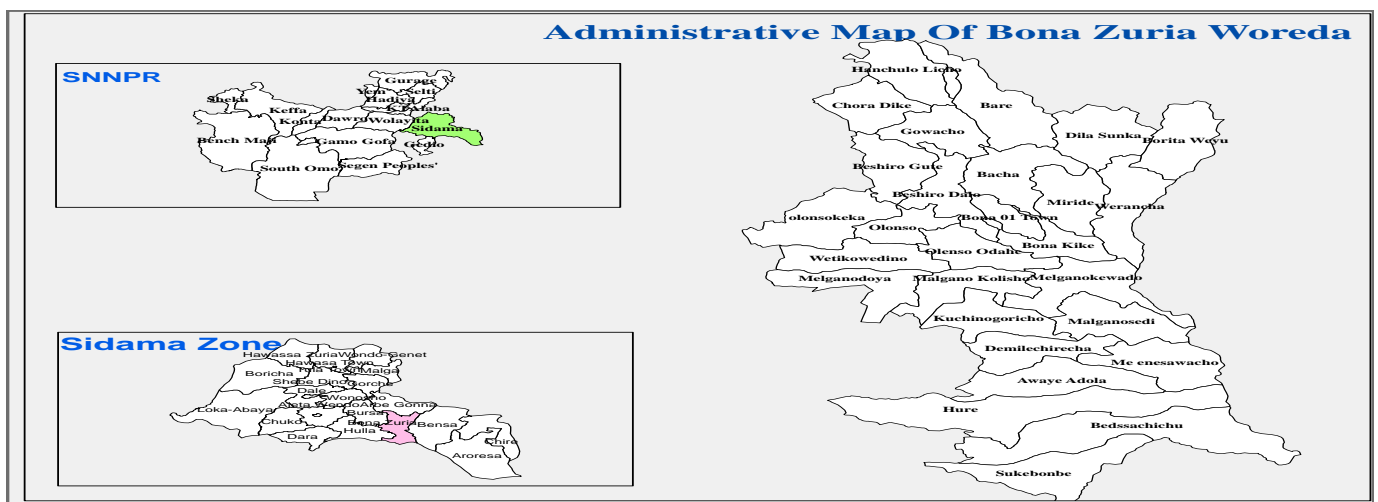


Figure 34:-Administrative Map of Bona Zuria Woreda

4.1.3.2. Study period

Data was collected, analyzed and interpreted From February 21 to March 20/ 2019

4.1.3.3. Study design

Retrospective descriptive cross-sectional study design was used by using structural and semi-structured questionnaire. Any data source (hard and soft copy) was reviewed to generate different data. In addition to these, discussion and interview was conducted with concerned body.

4.1.3.4. Study population & units

All population of Bona Zuria Woreda and Woreda health office, health centers, other health facilities, and related government sectors.

4.1.3.5. Data collection method

Data was collected from district's different sectors (Health, Administration, Agriculture, Finance and economy development, Education, Culture and Tourism offices; and Water, mineral & energy, and Revenue authorities) by interviewing the respective offices using semi structured questionnaires and open ended questions was used to identify community problems. In addition, some data was collected by reviewing free Wikipedia about the area.

4.1.3.5. Data Quality Assurance

The immediate field supervisor and mentor commented on the prepared data collection checklist prior to conduct of the study. The content of monthly HMIS report was reviewed for its variables before the development of questionnaires. The data collected from the district health office was cross checked with the data available at zone data base to assure the credibility of the data. The compiled data checked for completeness and cleaned before data analysis

4.1.3.6. Data analysis

The collected data was checked for completeness and consistency, and entered to a computer. Finally processed and analyzed by using Microsoft excel 2013. Community problems was prioritized.

4.1.3.7. Ethical clearance

Official letter was written from Sidama-RHB public health Emergence management to Bona Zuria health office and to all respected sectors and institutions to assess data of the district to prove legality of the study.

4.1.4. Results

4.1.4.1. Historical background of the woreda

Historically Bona Zuria district was named after the famous person called Bona, one of the Sidama Son who lived and ruled that place with his tribes many years ago. Bona was a warrior and noble person who was considered as sign of courage and strength among the people of the woredas. As the informant says, after Bona passed away the people of that area were agreed to call the area by his name for his remembrance. Bona Zuria was separated from Hula woreda and established as independent woreda in 1999.

4.1.4.2. Geographic and climatic condition

Bona Zuria Woreda is one of the woredas in the Southern Nations, Nationalities and Peoples' Region of Ethiopia. And located 109 km from Sidama zone and regional city, Hawassa and 384 Km away from Addis Ababa capital city of Ethiopia respectively. It is located to the East of Sidama zone major city Hawassa. Bona Zuria is Part of Sidama zone and bordered in the south by the Oromia Region, in the west by Hula woreda, in the northwest by Bursa woreda, in the north by Arbegona woreda, and in the east by Bensa woreda. The main town of Bona Zuria is Bona. It has total area of 400.075 Square kilometer (40,007.5 hectare) which accounts for 4% of the total area of Sidama zone of which 3.27km² is covered by water bodies and 396.8km² is land. Out of 40,007.5 hectare; 43.7 % (17,481 hector) is covered by permanent production (coffee, enset, banana, Avocado, Mango and sugar cane plants and other fruits), 0.8% (327 hect) is covered by water bodies, 3.09% (1235.7 hector) is occupied by village, 0.08% (32 hect) is reserved for future use, 0.07% (28 hect) is out of use because of unsuitable topography, and 2.4% (943.8 hect) is covered by forest; Out of these 0.7% (235 hect) is covered by natural forest, 1.9% (632hect) is covered by private forest and 0.23% (76.8 hect) is covered by government forest and 17.61 % (7045 hect) is covered by coffee and out of these 62.34% is covered with productive coffee and 37.7% (2652.75 hect) is covered with non-productive coffee, 32.3% (12,915 hect) is used for different cereals and vegetables (beans, peas, wheat, maize, barley, teff, potato, carrot, cabbage, radish, onion, and others. Bona Zuria has two types of climatic condition; .these are dega (cool climate) which accounts 11% of the total area with elevation between 2500m – 2750 meters above sea level. This part gets the highest amount of rainfall, ranging from 1600mm-1950mm. it has a mean annual temperature of 11 ° C to 14 ° C and woynadega (temperate climate) accounts 89% which ranges from an elevation of 1500m-2500m above sea level. The mean annual rainfall of the area varies between 1200-1599 mm with 15C° to 19.9 C° average

annual temperature. Highest peak of rain occurs through June to August and the minimum amount of rain fall happens in the district from March to May. Coffee is the major cash crop produced in the district with area of 7045 hectares.

4.1.4.3. Administrative and political organization

Bona Zuria Woreda has 24 rural and 1 urban kebeles whose administrative center is located in Bona town. There are 2 supporting Non-Governmental Organizations (NGOs) working together with the district explicitly challenge TB, and peoples need. NGOs are supporting the woreda with budget during training, supportive supervision, and Review meeting and supply equipment's.

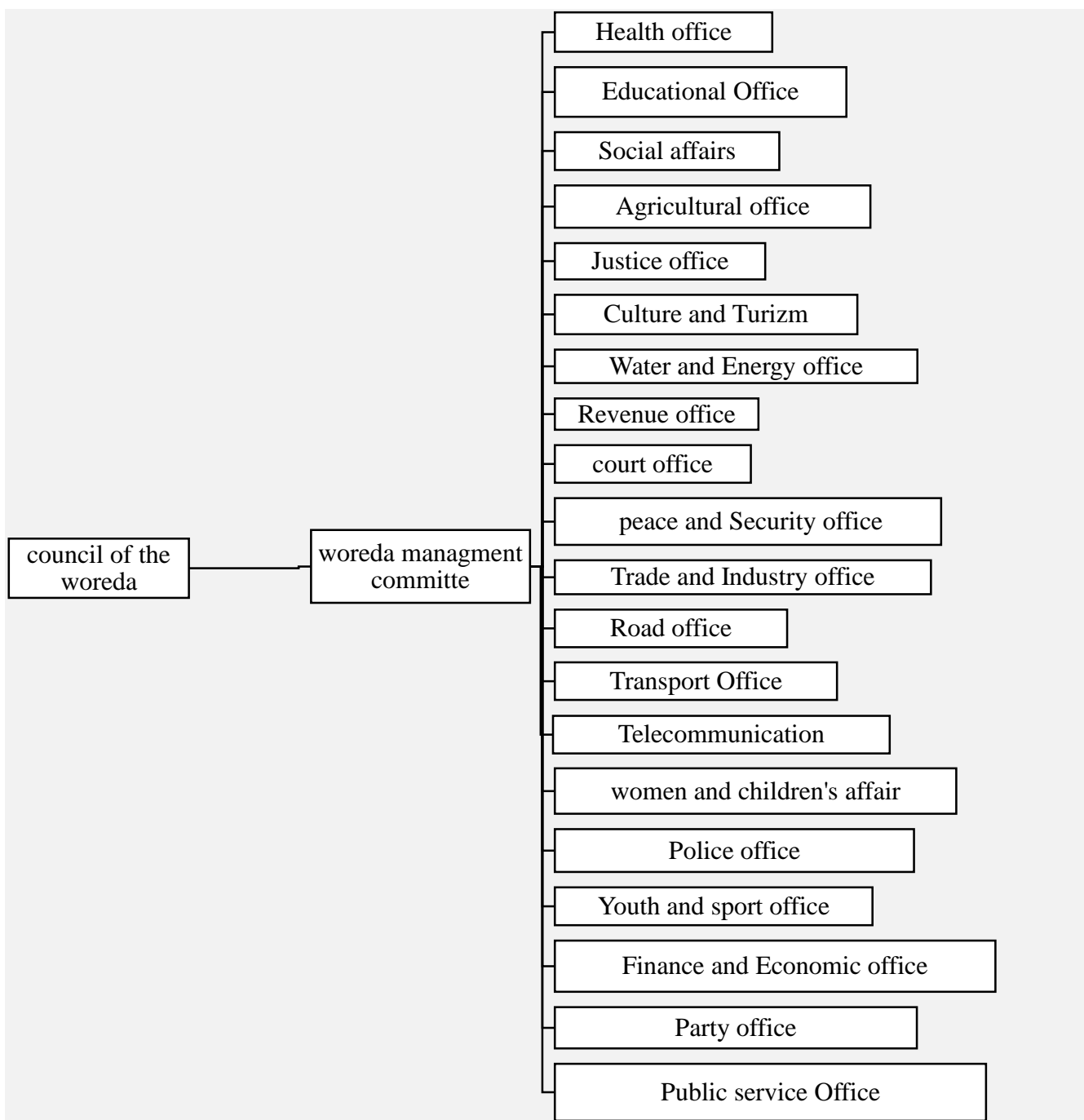


Figure 35: Organogram of Bona Zuria Woreda Administration in 2010EFY

4.1.4.4. Demographic Information

Based on population projection, the district has total population of 163,515 for the year 2018/2019; of whom 49.4% are males and 50.6% are females and male to female ratio is almost 1:1. Among the total population, 9.5% and 90.5% are residing in urban and rural areas respectively. Of the total population,

less than 5 years population constitute 13.72% of whom 3.39% are surviving infants less than 1 year. Women’s of child bearing age group (15-49 years) accounts 24.72% of the total population (Source: Bona Zuria district health office woreda based plan, 2018/19).

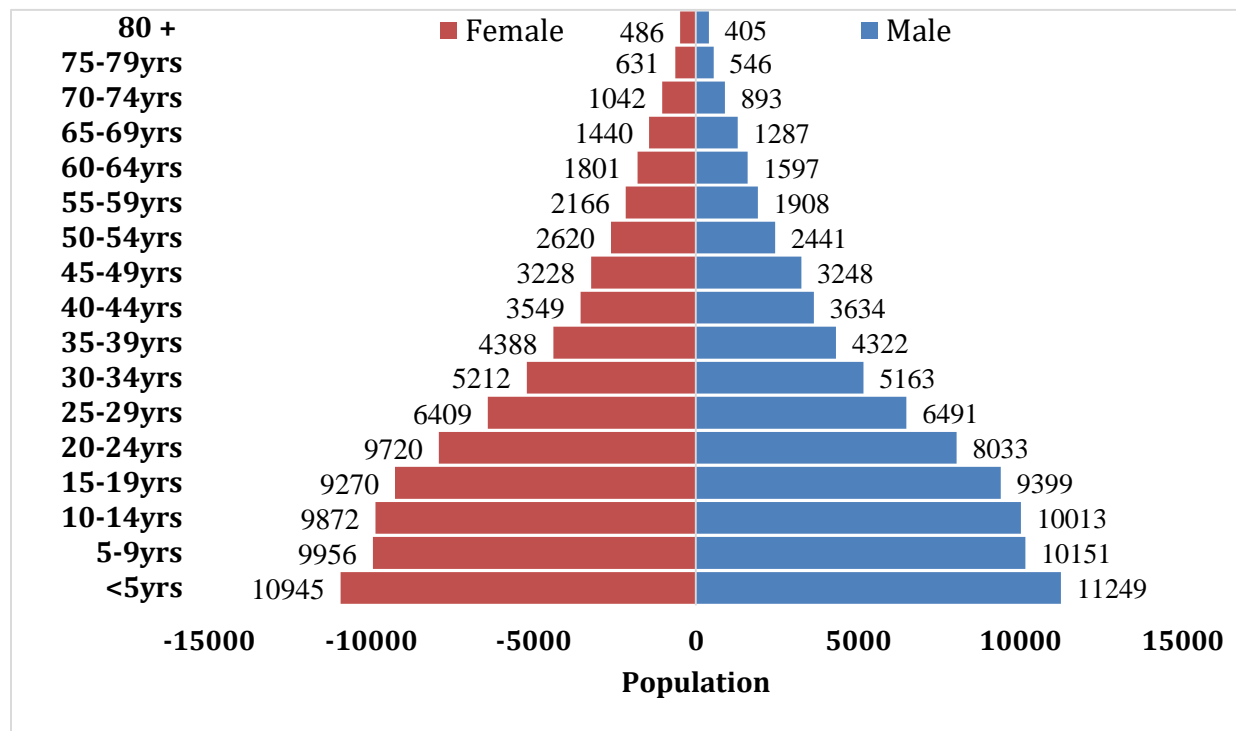


Figure 36: Population pyramid of Bona Zuria District, Sidama zone, SNNPR region of 2019

The majority of the inhabitants were protestant, with 92.44% (149,489), 4.43% (7164) practiced Ethiopian Orthodox Christianity, 1.68% (2717) were Catholic, and 1.45% (2345) were Muslims, The five major ethnic groups in Bona Zuria are Sidama (92%), Oromo (3%), Kembata (1%), Hadiya (1.5%), and Amara (1%); all other ethnic group accounts 1.5% of the population. Majority (96%) of the population speaks Sidamigna and the remaining 4% speak Afan Oromo and Amharic language.

Table 30:-Demographic Indicator Estimates of Bona Zuria woreda, Sidama Zone, 2010EFY

S.N.	Demographic indicators	% from total population	Population
1.	Estimated households size	4.8	33,691
2.	Estimated live births	3.47	5,612
3.	Total number of surviving infants at 1 years	3.39	5,479
4.	Total under 6 month infants	1.7	2,789

5.	Total number of under 2 year	6.03	9,759
6.	Total number of under 3 year	8.6	13,972
7.	Under 5 year child population	13.72	22,195
8.	6 – 59 months age group	12.00	19,406
9.	24 – 59 months age group	8.95	14,473
10.	<15 year age group	38.45	62,187
11.	15-24 age group	21.41	34,622
12.	15-59 age group	55.28	89,400
13.	Women in reproductive age (15 -49 years)	24.72	39,976
14.	Total number of estimated pregnancies / Births	3.47	5,612
15.	Estimated deliveries	3.47	5,612
16.	Non-pregnant women in fertile age	21.25	34,364
17.	Total population > 64 years	4.2	6730
18.	Dependence rate	42.6	68,917

4.1.4.5. Productivity and income

The main source of woredas income in 2010/2017/18 are government employment, 11,235,867.25, Agricultural products, 1,676,047.57, NGO, 521,487.50, Trade, 76,528.63, and from others like road contraction (URAP) and other businesses, 3,748,393.30 based on plan achievement. The district got an annual income of 17,258,324.25 Birr from different main stay of economy and governmental employments in 2018. The major annual crops grown in the district are cereals like barley, beans, peas, wheat Teff and maize. Fruits and coffee are also important cash crops of the district. In the district there are 2732 permanent government employers, 15 private and non-government employers, and 4,268 identified jobless. Children less than 15 years and elders greater than 65 years old age (dependent age group) accounts for 68,917 (42.6%) of the total population. (Source: Bona Zuria district income authority office, Bona Zuria district labor and social affairs office, and agricultural office).

Table 31: Sources of Income of Bona Zuria Woreda, Sidama Zone in 2010EFY

Source of Income	Plan	Achievement	%	From total (%) income
Government employees	11,698,547.60	11,235,867.25	96.04	65.1
Agriculture	2,526,921.25	1,676,047.57	66.33	9.7
NGO	839,752.80	521,487.50	62.10	3.02
Trade	98,235,70	76,528.63	77.88	0.44
Other business (tax etc.)	4,000,000.00	3,748,393.30	93.71	21.7
Total	19,163,457.35	17,258,324.25	90.06	

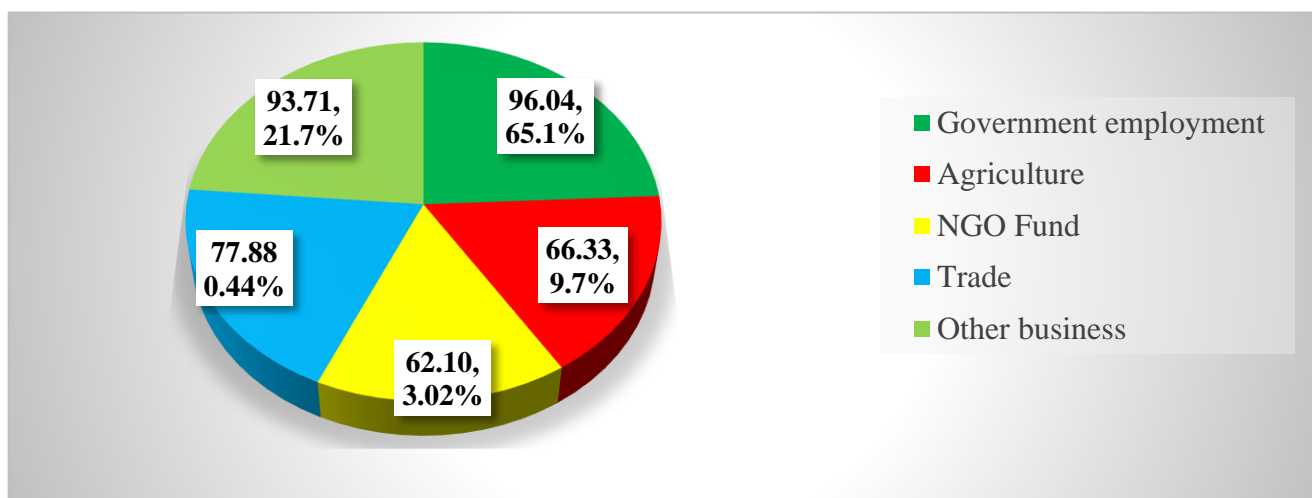


Figure 37 : Percentage of Income of Bona Zuria woreda, Sidama Zone in 2010EFY

4.1.4.6. Education and School Health

Health and Education are the most interrelated area that are based on one another depending on their functional field. Education is a key determinant of individual opportunities, attitudes, and economic and social status. The educational attainment has a strong effect on reproductive behavior, fertility, infant and child mortality and morbidity, attitudes and awareness related to family health, use of family planning, sanitation and early medical seeking and advice .In opposite to these uneducated peoples usually associated with high risk and low health seeking behavior

There are a total of 53 governmental schools in the district. (5 kindergartens, 45 primary, 2 secondary, 1 preparatory) are available. However, there are no governmental or non-governmental colleges. In Bona zuria district there were 61,109 school aged children. But only 52,859(86.5%) children were enrolled in 2018/2019, that means more than 8200 (13.5%) school aged children’s were unenrolled and 1031 students were dropped out after enrollment, of which 89% were male and left the school due to economic problem and displacement. among those who enrolled, 26,710 (50.5%) were males and 26,149 (49.5%) were females. Out of total enrollment, 45,529 (86.13%) male 22,985(50.5%) and 22,544(49.5%) female were attending first cycle (1-8), 1,652 (3.13%) male 854 (51.7%) and female 798 (48.3%) were attending kindergarten (0-KG3) and 4,388 (8.3%) male 2,213(50.4) and female 2,175(49.6%) were attending secondary school (9-10) and 1,290 (2.44%) male 658 (51%) female 632 (49%) were attending preparatory school in 2011/2018/19.there are 1471 teachers in the district of which 1,228 (83.5%) were male and 243 (16.5%) were female.

Table 32: Distribution of students enrolled by type of educational institution in Bona Zuria District, Sidama zone, 2010EFY

Educational Institution category	Educational institution		No. of enrolled students		
	Freq.	%	Male	Female	Total
Kindergartens	5	9.4	854	798	1,652
Primarily School (1-8)	45	84.9	22,985	22,544	45,529
Secondary School (9-10)	2	3.8	2,213	2,175	4,388
Preparatory School (11-12)	1	1.9	658	632	1,290
Total	53	100.0	26,710	26,149	52,859

Concerning school infrastructures, among 53 schools 48(90.5%) have no water supply for drinking and hand washing for students and teachers while they staying in the school. Schools with power supply and water supply are 6(11.1%) and 8 (15.1%) respectively. All schools have latrine, but only 15 (28.3%) schools have separated male and female latrines. Regarding school health related clubs, 48 (90.6%) of schools have HIV/AIDS club, mini media and Environmental Protection club (Source: Bona Zuria district education office, March, 2019).

4.1.4.7. Physical Infrastructures

Bona Zuria has 54 kilometers of dry-weather and 102 km all-weather road, for an average road density of 38.9 kilometers per 100 square kilometers. There is a mobile network working in all kebeles of Bona Zuria District. In this district, more than 50% of rural kebeles have no electric power supply. There is one Postal Office serving the community and there is commercial Bank of Ethiopia in the district concerning telephone and electric power users there is no documented data's in the district and the dominant source of energy in both urban and rural population is still fire wood. Only 10,410 (30.9%) house hold and about 49,970 population have access to safe drinking water in the district. The main source of drinking water are spring (90%)bore hole, shallow well, and dag well together accounts 10% and all are protected. (Source: Bona Zuria district water and administration office, May, 2019).

4.1.4.8. Health Infrastructures

Bona Zuria district has 1 Hospital, five health centers (HCs) and 25 health posts (24 rural and 1 urban HPs). The HCs are Awaye Kararo HC, Bona (Werancho) HC, Gobacho HC, Malgano Kawado HC, and Olonso keka HC. All rural kebeles have HEWs. Besides government health facilities, there are private health facilities these are: - 2 primary clinics, 1 medium clinic, 4 drug stores and 1 Drug vender which give health service to the community.

Table 33: Type of health facilities in Bona Zuria district, Sidama zone, 2010EFY

Type		No. of functional health facility	Health facility to population ratio	Infrastructures		
				Water	Electric Power	Fixed telephone
Hospital		1	1:161,715	1	1	1
Health centers		5	1:32,343	5	4	1
Health posts		25	1:6,469	7	1	0
Private Health Facilities	Medium clinic	1				
	primary Clinic	2		-	-	-
	Drug Store	4		-	-	-
	Drug vender	1				

The health center to population ratio was 1:32,343 and the health post to population ratio was 1:6,469. The primary health care coverage in the district was 79%.

4.1.4.9. Health Sector human resources

The district governmental health sectors had about 266 health professional and 96 supporting staffs. The ratio of Midwife to population ratio is 1:16,171, HO to population ratio is 1:8,511 and HEW to population is 1:2,128.

Table 34: Human resource to population ratio of Bona Zuria District health office, Sidama zone, 2010EFY

Type of profession	Educational level	No. of professionals deployed			Health personnel to population ratio
		Male	Female	Total	
MD	Doctor	8	2	10	1: 16,172
Health Officer	Degree	16	03	19	1:8,511
Nurses	Degree	4	1	5	1:1,273
	Diploma	76	46	122	
Midwife	Degree	1	3	4	1:16,171
	Diploma	2	4	6	
Laboratory	Degree	4	2	6	1:14,701
	Diploma	4	1	5	
Pharmacist	Degree	2	0	2	1:40,429
	Diploma	1	1	2	
Environmental Health	Degree	1	0	1	1:161,715
	Diploma	0	0	0	
HIT	Diploma	0	1	1	1:161,715
Health education	Degree	0	0	0	–
HEWs	Urban	0	4	4	1:2,128
	Rural	0	72	72	
Health Assistant		0	0	0	–
Supportive staffs		64	32	96	
Total		183	172	355	

4.1.4.10. District health system

The district health office facilitates health and health related activities by organizational hierarchy (fig.32).

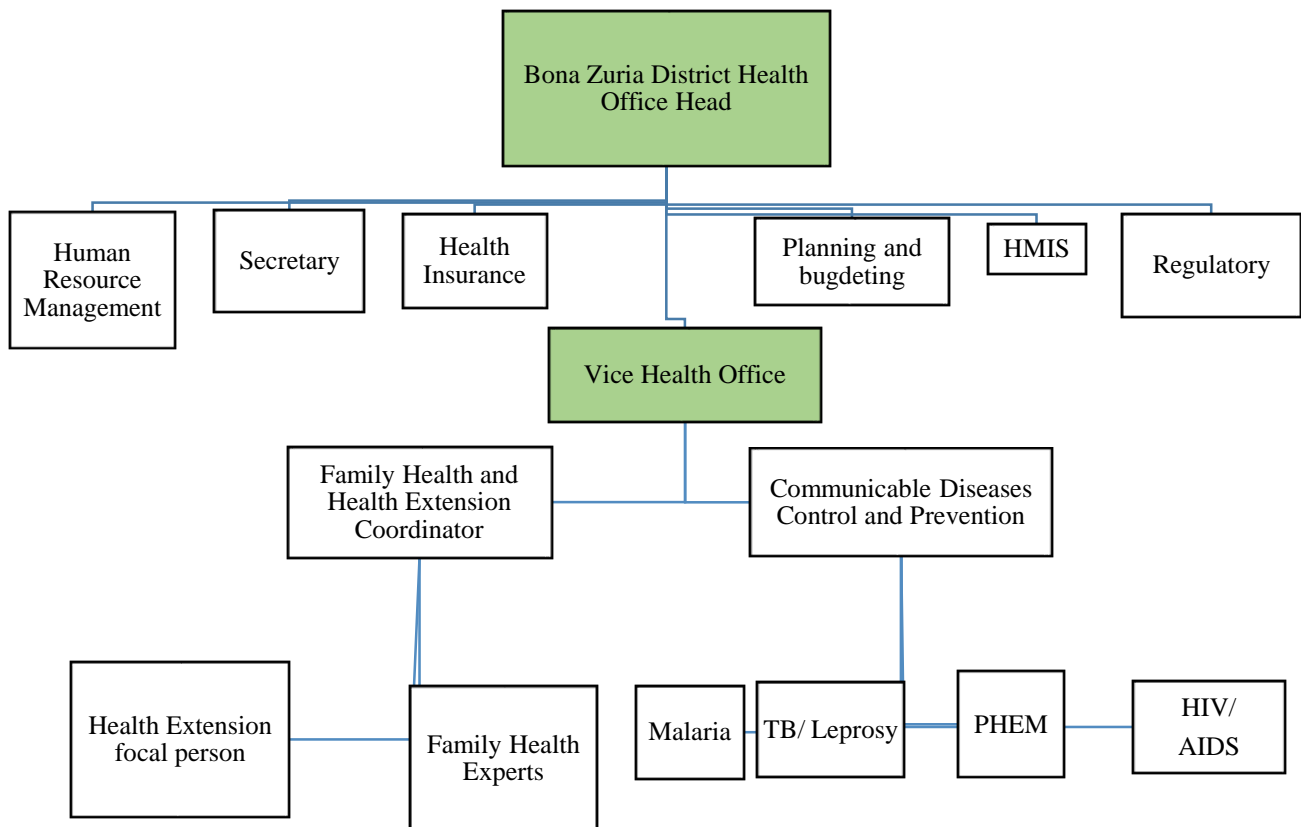


Figure 38 : Organizational hierarchy of Bona Zuria district health office, Sidama Zone, 2010EFY

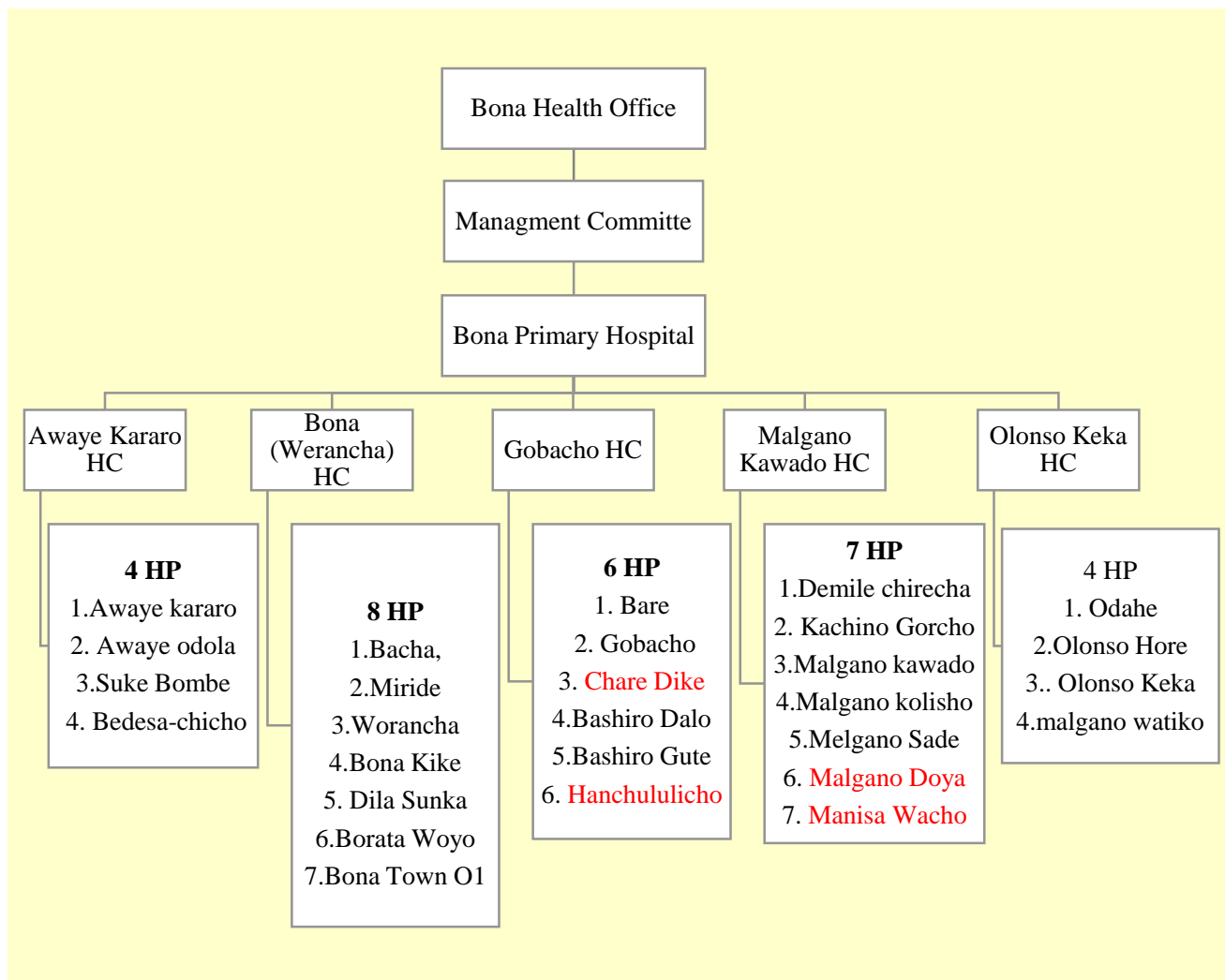


Figure 39: Health tier system of Bona Zuria district health office, Sidama zone of 2010EFY

4.1.4.11. Health indicators and vital statistics

Health indicators and vital statistics are crucial for estimation of the health service and indicate the health status of the community in the District or Kebele. In Bona Zuria district, the available statistics data are listed below (Table 6).

Table 35: Vital statistics data in Bona Zuria district health office, Sidama zone, of 2010EFY

S.No.	Parameter	Number	%
	Total population	161,715	100
	Male	80,049	49.95
	Female	81,666	50.05

	Urban population	15,363	9.5
	Rural population	146,352	90.5
	Under 1 years old	5,479	3.39
	Under 5 years old	22,195	13.72
	Under 15 years old	76,993	47
	Female 15-49 years old	39,976	24.72
	Pregnant women	5611	3.47
	Average house hold size	33,691	4.8
	Old age (≥ 65 years)	6792	4.20
	Dependency ratio	68,917	42.6
	Still birth rate	2	0.06

4.1.4.12. Maternal health activities

94% (27,542) of non-pregnant women were provided with different type of family planning methods in 2010 EFY in Bona Zuria district. Over half of family planning users prefer injectable methods (69%) followed by Implants (21%), IUCD (5%) and oral contraceptives (4%). Out of the 27,542 family planning method users 20,229 (73.4%) used short term family planning methods and 7,313 (26.6%) used long term family planning methods. Among these, 5,901 (21%) used implants and 1,412 (5%) used IUCD. The ANC1 and ANC4 service coverage from the annual plan were 99 % and 89% respectively. However, the percentages of pregnant and lactating women who were tested for HIV and know their results were 3,737 (68.3%). Regarding to delivery service at health facilities, 4,275 (78%) women attended by skilled birth attendants. The first post natal care coverage, within the first 48 hours after delivery, was 95% from the annual eligible plan (Table 7).

Among a total of 5,611 annual expected pregnancies, 3,780 (69.1%) pregnant women were tested for HIV and 598 (11%) tested for syphilis during ANC visit which is below national and regional target 78% and 73% respectively. Among those pregnant women who counseled and tested for HIV, there was no positive for HIV virus. And 2,605 (69.7%) were tested during pregnancy, 1046 (28%) during labor and delivery and the rest during post-partum period. Out of 5,406 pregnant women in the district, comprehensive abortion care was provided for 340 (6.3%) pregnant women and from annual eligible plan it covered 62%.

Among these 340 pregnant women, 288(84.7) were provided safe abortion care and 52(15.3%) provided post abortion care service. There was no reported maternal death in the district.

Table 36: Selected maternal health indicators in Bona Zuria district, Sidama zone, 2010EFY

No	Maternal Health Indicators	2008			2009			2010		
		plan	achievement	%	plan	achievement	%	plan	achievement	%
1.	CAR	27,981	26,140	93	28,681	21,481	75	29,382	27,542	94
2.	Short term FP	13,991	21,969	157	14341	18,568	129	14,691	20,229	100+
3.	LAFP	13,990	4,171	30	14,340	2,913	20	14,691	7,313	50
4.	ANC1	5,212	5,355	103	5,342	5570	104	5,473	5,406	99
5.	ANC4	5,212	4,544	87	5,342	4722	88	5,473	4,750	87
6.	Syphilis screening	5,212	0	0	5,342	335	6	5,473	598	11
7.	skilled Delivery	5,212	4,888	94	5,342	4380	82	5,473	4,275	78
8.	PNC	5,212	4,306	83	5,342	3867	72	5,473	5,183	95
9.	CAC service	521	46	9	534	73	14	547	340	62
10.	SAC service	46	46	100	73	73	100	340	288	84.7
11.	PAC service	46	0	0	73	0	0	340	52	15.3
12.	HDF kebeles	24	0		24	0		24	0	0
13.	PMTCT	5,212	5,415	100+	5,342	5269	98.6	5,473	3,780	69.1
14.	Option B+	10	0		10	0		10	0	0

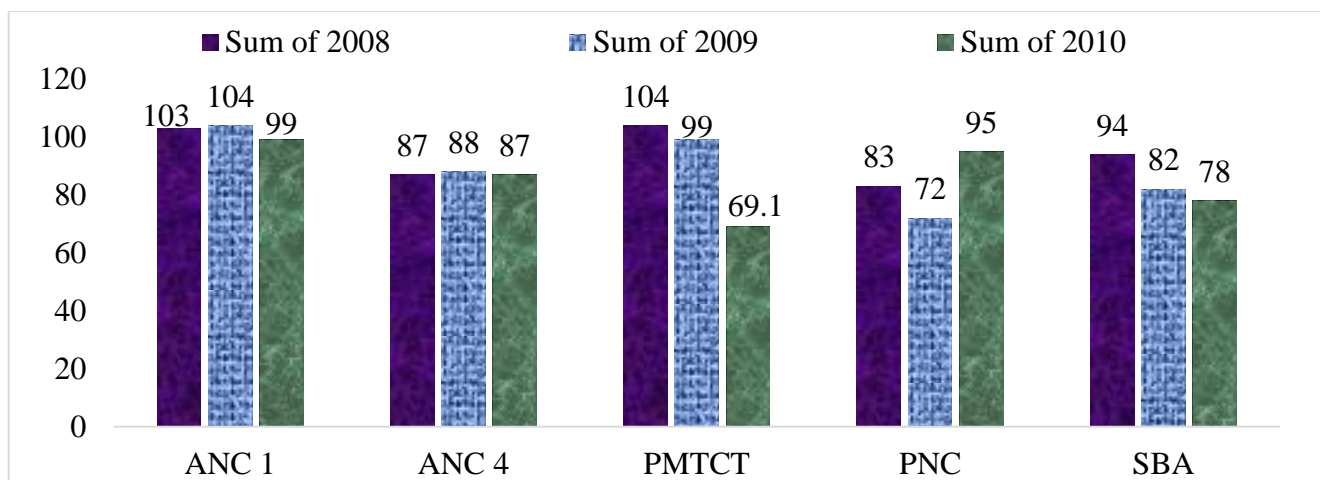


Figure 40: Pregnancy and Pregnancy related activities in Bona Zuria Woreda, Sidama Zone 2008-2010EFY

4.1.4.13. Immunization activities

Concerning Expanded Program of Immunization (EPI), the district has 24 outreach and 29 static sites for routine immunization program of children under 1 year and pregnant women. The 12 months HMIS report of 2010 EFY of the district health office showed that the coverage of all type of vaccination from annual eligible reached 100% except Rota 2, measles and Fully vaccination which were 98%, 99% and 99% respectively. All type of vaccination coverage in 2008 and 2009 were 100% but in 2010 Rota 2, measles and fully vaccination dropped to 98% and 99% respectively.

Table 37: Distribution of immunization coverage for children under 1 year and vaccine wastage rate in Bona Zuria district, Sidama zone, 2010EFY

No.	Types of vaccine	2008 EFY			2009 EFY			2010 EFY			Vaccine Wastage Rate
		Plan	Achiev	%	plan	Achiev	%	plan	Achiev	%	
1	BCG	5212	5235	100	5342	5424	102	5473	5524	101	30.7
2	OPV1	4831	5217	108	4952	5180	105	5073	5310	105	9
4	OPV3	4831	5089	105	4952	5041	102	5073	5098	100	
5	Penta1	4831	5292	110	4952	5529	112	5073	5310	105	9
7	Penta3	4831	5180	107	4952	5325	108	5073	5098	100	

8	PCV1	4831	5275	109	4952	5430	110	5073	5295	104	9
10	PCV3	4831	5166	107	4952	5308	107	5073	5109	101	
11	Rota1	4831	5252	109	4952	5373	109	5073	5223	103	0
12	Rota2	4831	5095	105	4952	5144	104	5073	4996	98	
13	Measles	4831	5143	106	4952	5303	107	5073	5033	99	22.3
14	FV	4831	5119	106	4952	5254	106	5073	5033	99	
16	PAB	4831	5162	107	4952	5497	111	5073	5163	102	

Concerning vaccine dropout rates, Penta1 to Penta3 dropout rate was 212 (4. %), Penta1 to PCV3 was 201 (3.8%), and Penta1 to Measles was 277 (5.2%).

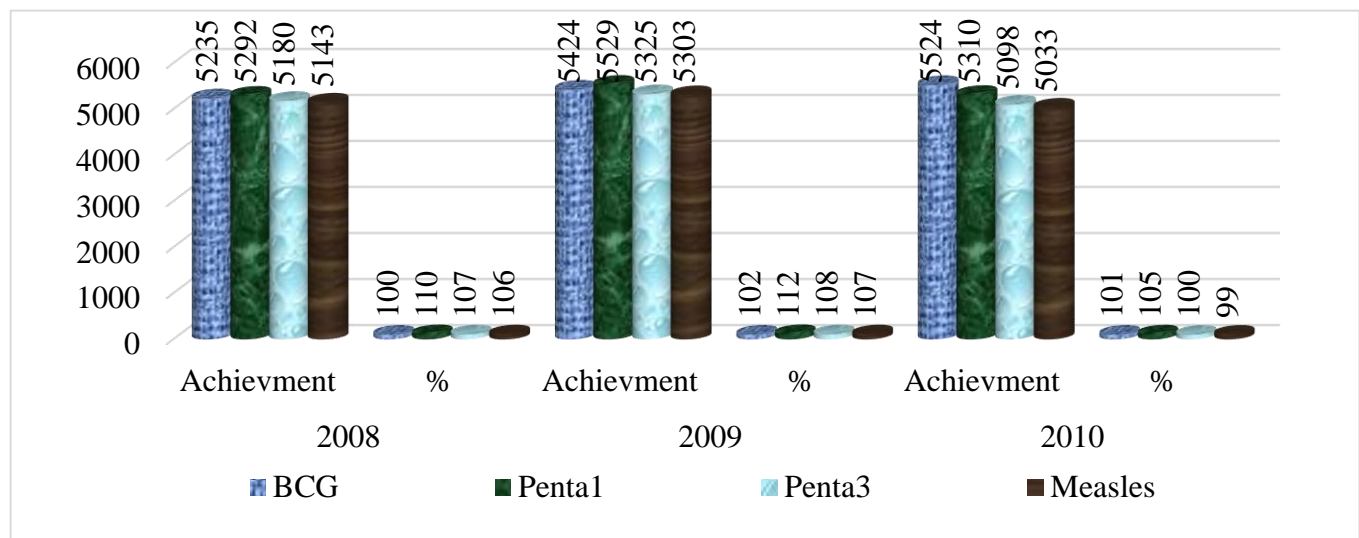


Figure 41: Immunization coverage of Bona Zuria District by year.

4.1.4.14. Health education

The health facilities provided health education to patients and clients on maternal, neonatal and child health (MNCH) services like immunization, family planning, ANC and institutional delivery, communicable disease like TB, HIV and Malaria prevention and control, sanitation, and malnutrition. But there was no recorded data for each specific portion and duration it has been given.

4.1.4.15. Water supply, environmental health and sanitation

In Bona Zuria district from 161,715 total population, 49,970 (30.9%) of the resident have access to safe water supply. 48% of the kebeles in the district have less than 30% access to safe water supply and 52% have 30%-73.92% access to safe drinking water supply. The main source of drinking water for the district was capped spring (90%), Deep Bore hole with piped schemes, shallow borehole with hand pump and dug well with hand pump together accounts 10%. Bona Zuria district has about 33,691 households;

Table 38: Distribution of safe drinking water of Bona Zuria Woreda by kebeles, 2010EFY

S.No	Name the Kebeles	Population of the kebeles	Male	Female	Water coverage in %	Remark
1.	Bachaa	5,114	2,554	2,560	48.20%	
2.	Dila Sunqa	5,223	2,609	2,614	50.00%	
3.	Olonso Keka	6,258	3,126	3,132	35.80%	
4.	Beshiro Gute	5,214	2,604	2,610	40.20%	
5.	Olonso Hore	5,532	2,763	2,769	39.40%	
6.	Worencha	6,532	3,263	3,269	36.70%	
7.	Melgano Wotiko	5,321	2,658	2,663	36.80%	
8.	Bona Kike	5,234	2,614	2,620	31.70%	
9.	Bona 01	16,215	8,099	8,116	32%	
10.	Beshito Dalo	6,521	3,257	3,264	29.80%	
11.	Melgano Kebado	6,925	3,459	3,466	32%	
12.	Suke Bonbe	7,001	3,497	3,504	28.70%	
13.	Mansa Wacho	6,350	3,172	3,178	27.70%	
14.	Odahe	6,523	3,258	3,265	25.90%	
15.	Malgano Sade	6,258	3,126	3,132	25.50%	
16.	Boreta Woyo	5,897	2,946	2,951	35.90%	
17.	Malgano kolisho	6,784	3,389	3,395	24.80%	
18.	Badessa Chicho	6,658	3,326	3,332	26.90%	
19.	Miride	5,178	2,586	2,592	28.80%	
20.	Damile Chiracha	5,346	2,670	2,676	23%	
21.	Barre	6,752	3,373	3,379	37.90%	
22.	Malgano Doya	6,245	3,119	3,126	18.80%	
23.	Awaye Odola	6,952	3,473	3,479	17.90%	
24.	Gobecho	6,584	3,289	3,295	30.70%	
25.	Awaye Kararo	5,098	2,546	2,552	14.99%	

All households have access to latrine and of these 36.2% use standardized type of latrine that have super structure, cover on a hole, and water with soap or locally available detergent. 63.8% have unimproved type of latrine. Among 24 kebeles, 8(33.3%) of them were open defecation free kebeles. The district has no organized data on solid and liquid waste management system. There are 65 food and drinking establishments in the district and they were inspected at least once in the past 12 months.

Table 39: Hygiene and Sanitation Activities in Bona Zuria Woreda, Sidama Zone, 2010EFY

Hygiene & sanitation (Types)	2008			2009			2010		
	Plan	Achiev.	%	Plan	Achiev.	%	Plan	Achiev.	%
Improved latrine	19,736	7,696	24.8	19,628	11,743	35.9	20,215	12,194	36.2
Unimproved latrine	12,694	23,346	75.2	13,086	20,971	64.1	13,476	21,497	63.8
Any type of latrine	31,042	31,042	100	32,714	32,714	100	33,691	33,691	100
Solid waste M	31,042	No data available							
Liquid waste M	31,042								
ODF Coverage	24	13	54.2	24	0	0	24	0	0
Safe Water supply	31,042	No data available					33,691	10,411	30.9

4.1.4.16. Community health services

In the district community health services are provided by Women’s Development Armies (WDA), HEWs and others. There are 1196 Women’s Development Armies and 3,997 one-to-five networks in the district and their responsibility is social mobilization and health promotion in the community for the sake of health and development. There are 72 HEWs in the district and they executed health extension programs. In first quarter of 2018, all households evaluated by health extension package implementation and 45% of the households got “A” (scored $\geq 75\%$). Neither food nor birr was contributed by the community for pregnant women’s who stay in maternal waiting room at health centers starting from 9 months of gestational age until their delivery.

4.1.4.17. OPD per Capita and top ten leading causes OPD visits

4.1.4.17.1. OPD per Capita

There were 32,186 total OPD attendants in the past 12 month among these 46% were males and 54% were females. Of the OPD attendants 40% were children under 5 years and 40% were adults greater than 15 years. The outpatient attendance per capita was 0.2 which is below national and regional target.

Table 40: Sex and age distribution among OPD attendants in Bona Zuria District, Sidama zone, 2010EFY

Outpatient attendance by age	Visit	Male		Female		Total	
		Freq.	%	Freq.	%	Freq.	%
OPD visits < 5	New	2,539	56	2,031	44	4,570	14
	Repeat	4,186	51	4,096	49	8,282	26
OPD visits 5-14	New	1,289	55	1,050	45	2,339	7
	Repeat	1,860	46	2,176	54	4,036	13
OPD visits > = 15:	New	1,795	35	3,372	65	5,167	16
	Repeat	3,081	40	4,711	60	7,792	24
Total OPD visits		14,750	46	17,436	54	32,186	100

4.1.4.17.2. Top ten causes of morbidity for adult

In the list of top ten diseases totally 22,013 patients were recorded. Of these, pneumonia accounted for 17% of patients followed by acute febrile illness (16 %) and non-bloody diarrheal disease (15%) was the third among the top ten causes of morbidity for adults.

Table 41: Top ten causes of morbidity in adult OPD at Bona Zuria district, Sidama zone, 2010EFY

No.	Type of disease	No. of cases	Percent (%)
1	Pneumonia	3,749	17
2	Acute Febrile Illness	3,467	16
3	Diarrhea (Non-bloody)	3,407	15
4	Helmenthiasis	3,400	15
5	Urinary Tract Infections	3,319	15
6	Diarrhea with bloody(dysentery)	2,232	10
7	Typhoid Fever	1,221	6
8	Dyspepsia	825	4
9	Other (unspecified infectious and parasitic disease.	254	1
10	Trauma (injury, fracture...)	139	1
	Total	22,013	100

4.1.4.17.3. Top ten causes of morbidity for under 5 children

Table 42: Top Five causes of morbidity for under 5 years children in Bona Zuria district, Sidama zone, 2010EFY

No.	Type of disease	No. of cases	%
1	Diarrhea (Non-bloody)	2,740	44.2
2	Pneumonia	2,032	32.7
3	SAM	1,167	18.8
4	Diarrhea with dehydration	141	2.3
5	AFI	125	2
		6,205	100

In the list of top five diseases, totally 6,205 patients were recorded. Of these, non-bloody diarrhea accounted for 44.2% of patients followed by pneumonia (32.7 %) and severe malnutrition (18.8%) was the third among the top five causes of morbidity for children.

4.1.4.17.4. Admissions and mortality

Concerning admissions, there were 7 admissions of Adult and 3 under five children; all cases were unspecified endocrine, nutritional, and metabolic diseases. There were no death recorded in IPD but 2 deaths were recorded in 2008/2015/16 in outpatient department from 228 TB cases. (Death rate of 2/228 populations) both attributed to PTB in Adult. However, there were no death records among admitted under 5 Children in the past 12 months in Bona Zuria district.

4.1.4.18. Endemic diseases

4.1.4.18.1. Malaria

Bona Zuria district is not malarious area. However, among 32,186 OPD visited patients, malaria attacked about 0.31% (101) of patients in 2010/2017/18. Among 101 malaria cases, 27.7% (28 cases) are aged < 5 years and 72.3% (73 cases) are adults aged 5 years and above. Of the total 101 malaria cases, 34% cases were confirmed plasmodium falciparum (PF), 66% cases were plasmodium vivax (PV) throughout June, 2017 to May, 2018

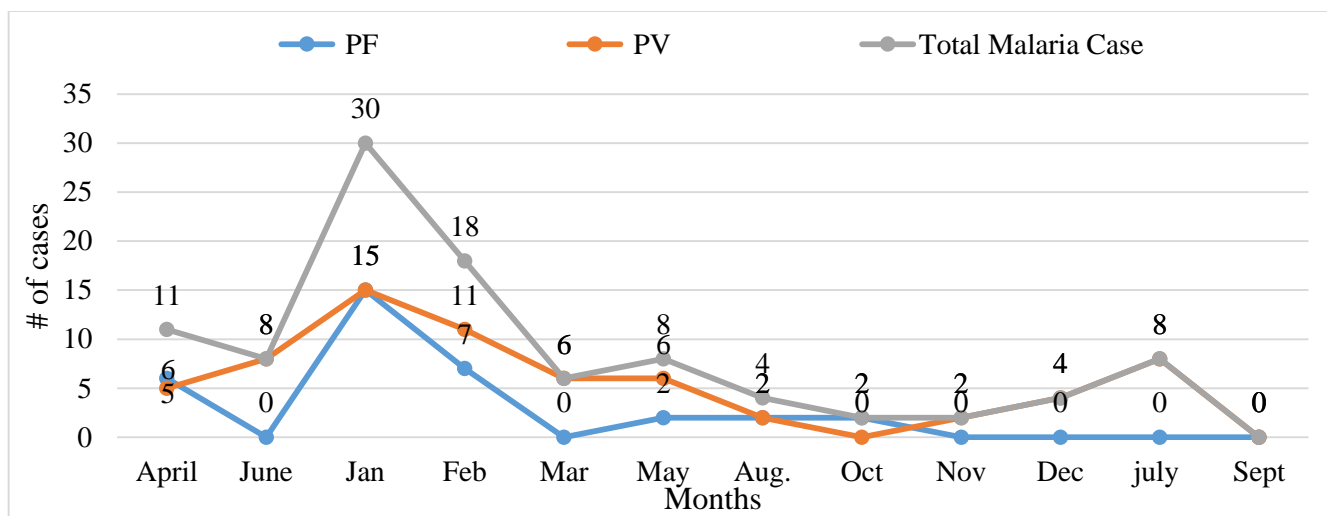


Figure 42: Malaria case distribution by months in Bona Zuria district, Sidama zone, 2010EFY

4.1.4.18.2. TB/Leprosy

Tuberculosis is still among the major communicable diseases with huge public health significance in the district. In 2010/2017/18 a total of 194 new and 3 relapse TB (70.6%) cases were reported in the district and of these, 152 (77.2%) were Pulmonary TB positive, 37(19.2%) were pulmonary TB negative and 8 (4.1%) were extra pulmonary TB cases. TB detection rate among the new smear-positive TB cases estimated in the district was 96.8% and the detection rate of all forms TB was 70.6%. TB treatment completeness was 92.4 % (158/171), TB cure rate was 88.3 % (151/171) and TB treatment success rate was 90.6 % (223/246). There was no death from TB in 2010. All 197 TB patients enrolled in TB treatment were tested for HIV and there was no documented HIV positive TB patient. In Bona Zaria district there was no leprosy case reported through 2008 to 2010 E.C /2015-2018 G.C. In 2008/2015/16 two deaths were reported from TB.

Table 43: TB and Leprosy Activities in Bona Zaria District, Sidama Zone, 2010 EFY

TB/Leprosy	2008			2009			2010		
	plan	Achiev	%	Plan	Achiev	%	Plan	Achi	%
All form of TB	266	230	86.5	272	246	90.4	279	197	70.6
PTB +Ve	150	152	101	153	171	109	157	152	96.8
PTB -Ve		65			67			37	
Extra PTB		13			8			8	
TB Rx completion rate		161		230	128	55.7	246	158	64.2

TB cure rate		56		152	77	50.7	171	151	88.3
TB Defaulter		0			0			0	
TB Rx success rate		161		230	128	55.7	246	223	90.6
Death on TB Rx		2			0			0	
Total TB patients screened for HIV	230	133	57.8	246	171	69.5	197	134	68
Positive for HIV		0			0			0	
Total Leprosy cases detected	8	0	0	9	0	0	10	0	0
Leprosy case treated		0			0			0	

4.1.4.18.3. HIV/AIDS

A total of 8,900 clients were screened for HIV in the last 12 months at VCT, PITC and PMTCT service sites from general population, of these, 2,197 (24.7 %) clients were males and 6,703(75.3%) clients were females. of the total clients screened for HIV, 44.5% were screened at PITC, 42.1% were screened at PMTCT and 13.15% were screened at VCT sites. Among the total screened clients, there was no HIV positive client. The district has one ART site at Bona (werancha) HC and currently 11 people were on ART. In the district there were different activities done regarding to prevention and control of HIV/AIDS through health education, condom distribution, and facilitated income generating activities. There was poor targeted group testing in the district

Table 44: HIV/AIDS Activities in Bona Zuria Woreda, Sidama Zone, 2010EFY

HIV/AIDS	2008			2009			2010		
	plan	Achei	%	Plan	Achei	%	Plan	Achei	%
PICT	15,234	6,377	41.9	15,703	4137	26.34	16,172	3960	24.5
VCT	1,523	6,200	100+	1,570	987	62.9	1,617	1197	74
PMTCT	5,286	5,415	100+	5,449	5269	96.7	5,612	3743	66.7
Total Screened for HIV/AIDS	22,043	17,992	81.6	22,722	10,393	45.7	23,401	8,900	38
Total PLWHA									
Current ON ART		8			9			11	
Pre-ART		1			0			0	

4.1.4.18.4. Nutrition

The district has a total of 24 Outpatient Therapeutic Program (OTP) sites and five functional stabilization centers (SC). There was inconsistency of severe malnutrition data between HMIS (5,657) and CBN (1,167). In 2010/2017/18, 5,657 SAM cases were identified in growth monitoring and screening and reported in HMIS. Of these only 1.7% and 0.23% of SAM cases were admitted to OTP and SC respectively. 98.1% of those admitted to both OTP and SC were recovered and 1.9% of them were with unknown status. There were functional targeted supplementary feeding, community based nutrition program and productive safety net program all working on ensuring community nutrition in the district. In the past 12 months, there were 3,134 total live births and all live births were weighted and 2.9% (92) live-born babies were with birth weight less than 2,500 g. Any disaster situation was not happen in the district in 2017/18

Table 45: Selected nutritional indicators in Bona Zuria district, Sidama zone, 2010EFY

No.	Selected Nutritional Indicators	Number	%
1	Percentage of low birth weight newborns	92	2.9%
2	Percentage of underweight children aged less than 5 years	2,304	10.4%
3	Proportion of children 6 - 59 months with SAM	1,167	29.2%
3.1	OTP	94	1.7%
3.2	SC	13	0.23%
4	Treatment outcome for management of SAM at OTP sites in children 6-59 months		
4.1	Treatment outcome for children recovered	94	100%
5	Treatment outcome for management of SAM at SC sites in children 6-59 months		
5.1	Treatment outcome for children recovered from SC	11	84.6%
5.2	Treatment outcome for children with unknown status	2	15.4%

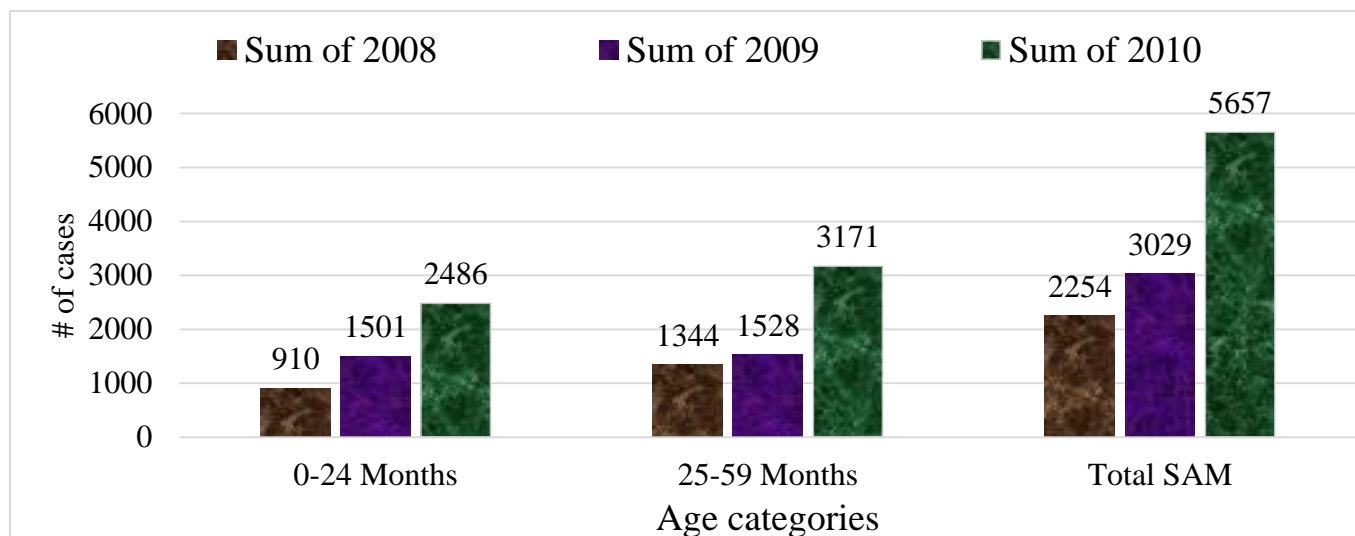


Figure 43: Distribution of SAM cases by Age and year in Bona Zuria district, Sidama Zone, 2010EFY

4.1.4.19. Health budget allocation

Of the total 148,533,966 birr district budget in 2017/18, 17,824,075.92 (12%) birr was allocated for health sector and 2,228,009.49 (1.5%) for contingency plan. From health care finance, the health center allocated more than 50% for drugs.

4.1.4.20. Availability of Essential drugs

The most frequently used and available essential drugs in the health facility of Bona Zuria district are listed below. Artemisin / Lumphantrine and depo injection were the only essential drugs of which shortage encountered at HCs. and at HPs Zinc and Ferrous Sulfate plus Folic Acid were among the essential drugs not commonly available.

Table 46: Availability of essential drugs in Bona Zuria district, Sidama zone, 2010EFY

S/N	List of Essential drugs	% of essential drugs available at HCs within 12 months	% of essential drugs available at HPs within 12 months
1	Amoxicillin	100	91.7
2	Oral Rehydration Salt	100	91.7
3	Arthemisin / Lumphantrine	78	83.3
4	Mebendazole Tablets	100	
5	Tetracycline Eye Ointment	100	91.7
6	Paracetamol	100	91.7

7	Rifampicin/Isoniazid/Pyrazinamide / Ethambutol	100	
8	Medroxyprogesterone Injection	98.3	91.7
9	Ergometrine Maleate Tablets	100	
10	Ferrous Sulfate plus Folic Acid	100	75
11	Pentavalent Vaccine	100	100
12	Zinc	100	75
13	Gentamycin	100	75

4.1.4.21. Problem Identification and Priority Setting

Community problems in the district are prioritized as follows based on criteria like magnitude, severity, community and government concerns, and feasibility to solve the problem. Among the identified problems in the district, poor water supply was the main problem followed by diarrhea and disaster situations. These prioritized problems were recommended accordingly to concerned bodies for the intervention.

Table 47: Problems identified based on priority setting criteria's Bona Zuria district, Sidama zone, 2010EFY

No	Priority problems identified	Criteria of prioritization					Total	Rank	Remark
		Magnitude/size of the problem	Seriousness	Community concern	Gov't concern	Feasibility			
1	Poor water supply	5	4	5	5	4	22	1	
2	Malnutrition	3	4	4	5	5	21	2	
3	Malaria	1	4	2	4	4	15	6	
4	Diarrhea	3	3	3	3	5	17	5	
5	Primary health care coverage	2	4	4	5	4	19	4	
6	HIV target group screening	3	4	3	5	5	20	3	

❖ Estimated magnitude of the problem in % and score: 0-20=1; 21-40=2; 41-60=3; 61-80=4; and 81-100=5.

Action plan for priority community problems in Bona Zuria Woreda, Sidama Zone February 2019

S/N	Prioritized problem	Cause	solution	Responsible body	Time frame
1	Poor water supply	Low concern /attention	Allocate enough budget	woreda water office	From 2020
2	Malnutrition	Economic problem	Support to assure food security		
3	HIV target group screening	Negligence	Motivate providers to enhance screening	WorHO & health facilities	From now on.
4	Primary health care coverage	Lack of Budget	Budget allocation from Gov. & community participation	WorHO	From 2020
5	Diarrhea	<ul style="list-style-type: none"> • Poor hygiene & sanitation • Poor latrine utilization 	Encourage good hygiene practice & latrine utilization	WorHO, and health facilities	From now on
6	Malaria	Climatic change	Apply vector control measures	WorHO	From now on

4.1.5. Discussion

In Bona Zuria district from top 10 causes of morbidity both in adults and children, majority of the disease were communicable diseases which can be prevented through improving hygiene and sanitation. This result agrees with a study that states about 75% of causes of OPD visits in Ethiopia are largely due to the lack of basic sanitation provisions (1). Pneumonia is one of the communicable diseases and it was public health problem in the district accounting 44.2% and 17% of the total top 5 and Top 10 diseases reported at OPD in less than 5 years and adults respectively. The finding is similar with other studies that revealed infectious and communicable diseases account for 60-80% of the health problems in Ethiopia (2). Despite the PCV1 and PCV3 vaccination coverage from annual eligible infants in the district were 100%, pneumonia was among the leading cause of morbidity in children under 5 years of age. This finding is not agrees with a study that states vaccinating against pneumococcal disease prevents substantial mortality and morbidity in Ethiopia. This may be due to poor data quality and efficacy of the vaccines. (3).

In Bona Zuria district Non-bloody diarrhea was among the ten top diseases in both age categories in the district. This study result is similar with another study that revealed many diarrheal diseases vary seasonally, suggesting sensitivity to climate in addition to the results of the poor hygiene and sanitation conditions (1); and both floods and droughts increase the risk of diarrheal diseases (1, 4). But there was no death reported due to diarrhea in the past 12 months. This may be because of expansion of health service to the community levels or the community may have early health seeking behavior.

Acute febrile illness accounts 16% and 2% in adult and under 5 year outpatient ten and five top morbidity respectively. This indicates that there was an increment in AFI cases in the district. AFI is the second leading cause of adult ten top disease in the district.

In Bona Zuria district the contraceptive acceptance rate was 91.3%. This was high compared with the national 71% (5) and SNNP Region 75% in 2017/18 coverage (6). Short term family planning methods (73.4%) were the most commonly used method. This finding was above the national target of decreasing short term users to 50% and shifting to long term users (7).

In the 2010 EFY, ANC1 and ANC4 follow up coverage were 96.3% and 84.7% respectively. EDHS 2017 reported the ANC follow up with at least one visit and four plus visit as 57.2% and 77% respectively (8). So, the achievements in Bona Zuria were above the national figure and it may be as a result of increased awareness of pregnant mothers, commitment of HEWs and health professionals for both ANC1 and ANC4, or may it be double reporting of the same mother by HPs and HCs for ANC1. Among 5406

pregnant women attending ANC clinics, 11 % screened for syphilis. This finding is low as compared to the nationally recommended i.e. every pregnant women should be screened for syphilis (9).

The 12 months report of Bona Zuria district in the 2017/18 showed that the skilled delivery coverage from eligible reached 76.2%. All pregnant women are encouraged to deliver at health facilities with skilled attendants. The target of HSTP for delivery assisted by skilled providers was 78% but the national and the SNNP region skilled delivery coverage of 2017/18 was 71% and 78% respectively (9). Therefore, the 12 month achievement in Bona Zuria was achieved in between the national and the regional coverage. This increment may ascribed to high level political commitment, efforts of WDA, HEWs and health workers with resultant demand for services, and provision of ambulances on top of expansion of health facilities.

The postnatal period is a critical phase in the lives of mothers and newborn babies. Most maternal and infant deaths occur during this time. HSTP target to reach 93% by the year 2017/18 (10) and EDHS 2014 reported coverage of 12% for PNC within the two days period (8). In Bona Zuria district PNC coverage in the first 2 days was 92.4% which was above SNNPR coverage (78%), national coverage (82%) and almost achieved the national target which is 93%. This remarkable improvement shows that the PNC service utilization in the district increased proportionally with skilled deliveries. In case of pregnant mother tested for HIV, from a total of 5,406 pregnant women 3,737 (69.1%) were screened for HIV which was below HSTP target (90%) for 2017/18.

The district achieved HSTP immunization coverage targeted to children less than one year old to prevent them from vaccine preventable diseases. HSTP target for penta 3, 96% for measles 94% and for fully immunization 91%. But bona zuria district perform BCG, 100%, Penta 1, 100%, Penta 3, 100%, measles and fully vaccines 99% which was above the HSTP target. The vaccine dropout rates for Penta1 to Penta3, Penta1 to PCV3 and Penta1 to Measles were 212(4%), 201 (3.8%) and 277 (5.2%) respectively. The vaccine dropout rates in the district were within the acceptable range of WHO recommended level (<5%) except that of measles (5.2) (12). The vaccine wastage rates for the antigens were; 30.7% for BCG, 22.3% for measles, 3% for Pentavalent, 9% for PCV and OPV and 9.5% for TT vaccines and no vaccine wastage rate for Rota vaccine, all of which were within the acceptable range of WHO recommended (i.e. <50% for BCG, <25% for Measles, <10% for PCV, TT & OPV; and <5% for Penta & Rota) (12). This indicates that even though many factors influence vaccine wastage there might be improved vaccine management practices to address it in the district. Those infants considered as fully vaccinated were 5033 which is

above the number of infants who got access to Rota 2 vaccination which is 4996. This may indicate that there is a problem of data consistency.

Severe acute malnutrition was a major public health problem of the district. Most of the kebeles in the district were hot spot areas for malnutrition. In the last 12 months, 5,657 (>29%) children of 6 - 59 months have severe acute malnutrition; of this 1.7% were treated at OTP sites and 100% recovered and 0.23% of them were treated at SC sites, and 84.6% (11) them were recovered and 15.4%(2) were with unknown status. This highlights that 98.1% of those who were screened for severe malnutrition were not enter into OTP or SC. This might be due to reporting error or duplication of data's. The main goal of screening is to provide OTP or admit to SC. there are good OTP and SC centers as well as best case management practices. Among children aged less than 5 years, 5657 (25.5%) were underweight and this indicates that there were no improvement when compared with that of SNNP Regional State (22.2%) underweight (6).

Bona Zuria district is not malarious area. However, among 32,186 OPD visited patients, malaria attacked about 0.31% (101) of patients in 2010/2017/18. Among 101 malaria cases, 27.7% (28 cases) are aged < 5 years and 72.3% (73 cases) are adults aged 5 years and above. Of the total 101 malaria cases, 34% cases were confirmed plasmodium falciparum (PF), 66% cases were plasmodium vivax (PV) throughout June, 2017 to May, 2018. Malaria increases alarmingly from the last two years. In 2008 and 2009 EFY only 2 and 3 cases were reported on HMIS respectively.

Tuberculosis detection rate of all forms of TB was 70.6% which was above national coverage baseline which was 64% and Regional State achievement of 65% in 2017/18 and below the HSTP target of 2017/18, which was 83%. (6). the smear positive pulmonary tuberculosis detection rate was 96.8%, which was high compared to the minimum expected standard of WHO (i.e.70%) and high compared to SNNP regional TB detection performance which was 65% in 2017/18 (6). The TB treatment success rate was 90.6% and it was above the SNNP Regional State achievement of 85% in 2017/18 (6).

A total of 8,900 clients were screened for HIV in the last 12 months at VCT, PITC and PMTCT service sites from general population, of these, 2,197 (24.7 %) clients were males and 6,703(75.3%) clients were females. 44.5% of them were screened at PITC, 42.1% were screened at PMTCT and 13.15% were screened at VCT sites and there was no HIV positive client. The district has one ART site at Bona (werancha) HC_and currently 11 people were on ART. In the district there were different activities done regarding to prevention and control of HIV/AIDS through health education, condom distribution, and

facilitated income generating activities. These all indicates that there was poor targeted group testing in the district.

A total of 32,186 clients registered at OPD, 27.7% of them were screened for HIV which was below the expected 85% with regional plan (11). This may be due to low initiation and commitment of health workers who worked at OPD rooms and/or the refusal of clients for HIV testing due to poor awareness or shortage of HIV test kites at health facility level as expected.

Prevalence and Incidence of HIV among pregnant women attending ANC in the district was 0% which is low as compared to 1.2% of the national prevalence of 2016 ANC HIV sentinel surveillance (15). The 2016 EDHS report showed that the HIV prevalence in urban is 2.4% which is seven times higher than that of the rural (0.4%) (6). The finding of the study may be due to low target group testing, or as a result of 90.5% of population in Bona Zuria district is residing in rural.

According to a progress report to Sustainable Development Goals, 74% of the Ethiopian population had access to improved water sources in 2017; coverage is expected to reach 80% by the year 2011 and 95% in 2012 EFY (98.2 in urban and 70.9% rural) (16). However, in Bona Zuria district all kebeles have access to safe drinking water but their coverage varies from one another (ranges from 14.9% to 73.92). In case of population, 30.9% of them in the district are getting safe water supply which is low as compared to the SDG target coverage of 2017 in Ethiopia.

Bona Zuria district has 8 (33.3%) open defecation free kebeles. There were 33,691 households in the district. All households have an access to latrine and 60.3% of them use standardized type of latrine which was above the national coverage and 100% of latrine utilization (17, 18, and 19).

Concerning health professionals to population ratio one HEW is serving 1:2,128 populations. According to the national guideline every health post is intended to serve about 3000-5000 population and one HEW intended to serve about 2500 populations (20). All primary health facilities including primary hospital were below the national standard. According to national guideline one health center for 15,000-25,000 people, one primary Hospital for 60,000- 100,000 people. But in Bona Zuria district one health post was giving service for 6,449 population, one health center is serving 32,343 people, primary hospital is serving 161,715 people which was below the national standard and an HEW was giving service for 2,128 which was within the range of the national standard. In Bona Zuria district the primary health coverage was 79% which was below the national health coverage of 93% in 2013 (10).

4.1.6. Challenges

Some of the experts from different offices in Bona Zuria district have had little knowledge about jobs done at their respective position due to turn over.

Getting appropriate person during data collection at their position was very difficult. There was poor data quality in terms of number (same times exaggerated number was reported), storage and inconsistency of data in almost all sectors in the District. There was no data from some sectors like Telecom, Electric power, and vital registration office. They didn't have compiled and documented data.

4.1.7. Conclusion

List of ten top and five top diseases indicates that communicable diseases like, pneumonia, acute febrile illness, diarrhea and acute upper respiratory infection were the leading causes of OPD visits both in adult and under five years. Non bloody diarrhea and Pneumonia were the two most leading causes of OPD visits which accounting for 44.2% and 32.7% of the top 5 diseases in under five years children but the 12 month pneumococcal vaccination achievement for PCV1 and PCV3 were 100% from the annual eligible surviving infants which is inconsistent with the pneumonia.

Severe Malnutrition was one of the five top disease of under five children which can be prevented by homemade and provision of therapeutic feeding. There was better health service coverage in ANC, delivery and PNC comparing to the eligible Annual target. Short term family planning methods (73.4%) were the most commonly used method. Among pregnant women attending ANC only 11% were screened for Syphilis.

The vaccine wastage rates for all antigens were within the acceptable ranges (For liquid vaccines supplied in single or two-dose vials (e.g. pentavalent vaccine and PCV10), a wastage rate of 5% is acceptable, For OPV, a wastage rate of 10% is considered acceptable, For liquid vaccines supplied in multi-dose vials of 10 or more doses, a wastage rate of 15% is acceptable, For reconstituted vaccines, wastage rates of 50% for BCG and 25% for measles vaccine are considered acceptable. Vaccine dropout rates of pentavalent 1 to pentavalent 3 (4%) and pental to measles (5.2%) was within the acceptable range (a drop-out rate of 10% or less is considered acceptable). The detection rate for all forms of TB was 70.6% and the smear positive pulmonary tuberculosis detection rate was 96.8%.

Among the district population 30.9% of them were getting safe water supply. The primary health coverage was 78%. The presence of active community participation, improved maternal and child health

services in the community were mainly good opportunities for health service, and health promotion and disease prevention.

4.1.8. Recommendation

The district water, mineral and energy authority, and the district health office should promote hygiene and sanitation for the whole community.

The district health office should:

- Strength communicable disease prevention and control measures to reduce the morbidity attributed to priority diseases.
- Improve data collection, handling and compiling system.
- Purchase and supply the essential drugs continuously for the health posts since pneumonia and diarrheal diseases which could be treated at community level were common in the district.
- Improve access to primary health care services by constructing additional health centers and health posts as per the national standard.
- Continuously evaluate, monitor and check performance of health facilities and consistence of the data.
- Since disaster/outbreak condition was a priority health problem of the community, public health emergency management should be strengthened
- Conduct further study why pneumonia is still the leading cause of OPD visits in under 5 years despite the introduction of pneumococcal vaccine.

The health service provider should:

- Focus on Counseling and testing target groups including pregnant mothers visiting the health facility for HIV.
- Screen all pregnant mothers attending ANC for syphilis.
- Test all pregnant mothers who attended ANC 1 for HIV/AIDS to prevent MTCT of HIV virus.
- Create community awareness to shift short term FP to long term contraceptive methods.
- Promote the treatment of acute febrile illness with specific laboratory diagnosis to rule in/rule out diseases with fever symptoms.
- Provide therapeutic food for all children's screened as severe malnutrition
- Follow up all TB patients on treatment and HIV clients on ART.

- Promote personal hygiene and sanitation of the community through health education.
- Work hard to ensure the food security in the community being with other stakeholders.
- Record and document all data as much as possible by soft copy and hard copy.

The district Water and energy office should:-

- Work hard to provide safe drinking water for all communities and government institutions like School, health facilities and the like since National target of access to safe drinking water in Ethiopia for 2011 is 100%.
- Create opportunity for kebeles to have equal distribution of safe drinking water.

4.1.9. References

1. Ethiopian Journal of health development 2005,19(2):89-103
2. FMOH: National strategic action plan for prevention and control of non-communicable disease in Ethiopia, 2014-2016
3. FMOH and Partners: Introduction of pneumococcal vaccine in Ethiopia, Training manual for health workers, June, 2011
4. Ethiopian Public Health Association: Proceedings of the 21st Annual Conference, Addis Ababa, Ethiopia, March, 2011
5. Central Statistics Agency (CSA).Ethiopian Demography and Health Survey. Addis Ababa, Ethiopia. CSA, 2012
6. FMOH: Health sector transformation plan (HSTP) 2015/16 - 2019/20, May 2015
7. Federal Democratic Republic of Ethiopia Ministry of Health: Basics in Family Planning & Short-Acting Family Planning Methods Participant's Handout, 2013
8. CDC: STI treatment guideline,2015
9. Mini EDHS 2014 report, Central Statistical Agency Addis Ababa, Ethiopia August 2014
10. Federal Democratic Republic of Ethiopia Ministry of Health. Health Sector Development Program IV, 2010/11 – 2014/15
11. National guidelines for comprehensive HIV prevention, care and treatment: Federal Democratic Republic of Ethiopia, MOH, 2014
12. Vaccine management training manual for EPI coordinators and focal persons, FMOH, April 2014 Ethiopia
13. FMOH: Protocol for the management of severe acute malnutrition in Ethiopia, March, 2007
14. Malaria national guideline, January, 2012 Ethiopia
15. CSA. Ethiopia Demographic and Health Survey (EDHS)- 2011 report
16. Epidemiology and Ecology of health and disease in Ethiopia, EPHA, 2006
17. Lectures note on Environmental Health Department of Community Health, Medical Faculty, Addis Ababa University, July 2010
18. Mengistie B, Baraki N. Community based assessment on household management of waste and hygiene practices in Kersa District, Eastern Ethiopia. Ethiop. J. Health Dev. 2010; 24(2):103-109
19. EFMH, Health and health related indicator in 2015

20. FMOH. Health Sector Transformation plan I Program 2015/16 – 2019/20 (2008-2012EFY)Ethiopia, August 2015
21. PHEM. Sidama Zonal health bureau profile.2018/19
22. Dereje Mamo. Addis Ababa University FETP, health profile description.2015
23. Markos Gurmamo. Addis Ababa University FETP,health profile description.2017

Chapter five; Scientific Manuscript

MALARIA OUTBREAK WITH HIGH ATTACK RATE, ELU GELAN WOREDA, OROMIA REGION, ETHIOPIA, 2019: COMMUNITY BASED CASE CONTROL STUDY.

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Background; - Over 68% (74 million) of Ethiopian populations live in areas at risk for malaria. On August 5/2019, surveillance data from Elu Gelan district showed that the district was experiencing an unusual high number of malaria cases in five kebeles (lowest administrative unit). An investigation was conducted to verify the existence of the outbreak, to identify the risk factors for transmission of malaria and to undertake appropriate prevention and control interventions.

Method: - To confirm the outbreak, the last five years' malaria data (2014-2018) were compared with current data (2019) at the district level. Cases were identified by using line list and house to house active case search was done on a daily basis. Unmatched case control study was conducted in 1:1 ratio randomly selected case (175) and community control (175). Control was the neighbor of cases and those who have not developed symptoms of malaria in the last three weeks. Data were collected through a semi-structured interview administered questionnaire, entered into Epi-info version 7.2.2.6 and analysed using Epi Info V 7.2.2.6 and SPSS 20.

Result; - There were 2099 confirmed malaria cases (55.1%-males) from five kebeles with no deaths recorded. The overall attack rate (AR) was 115/1000 populations (2099/18,315*1000) and it was highest in Meta Kidanemiret (200/1000 populations) and among 5-14 years old (373/1000 populations). Staying out side overnight (OR=2.133; 95%CI: 1.044-4.360), irregular use of ITNs (OR=9.437; 95%CI: 3.950-22.545), and inadequate ITNs per family size (OR=2.064; 95%CI: 1.176-3.622) were directly associated with malaria outbreak. Wearing long sleeved clothes was a protective factor (OR=0.159; 95% C.I: 0.115-0.223).

Conclusion; - Several unmanaged stagnated water sources with Anopheles mosquito larvae, and the use of ITNs for other purposes were observed. The outbreak was associated with presence of nearby vector-

breeding sites, and poor access and utilization of ITNs and staying out side overnight. Adequate information should be given along ITNs for the community in addition to early management of nearby vector breeding sites to prevent similar outbreak in future

Key words: Elu Gelan, malaria, outbreak, plasmodium falciparum

Introduction

In 2018, an estimated number of 228 million malaria cases and 405,000 deaths were reported by WHO globally of which, WHO Afro reported 93% of all malaria cases and 94% deaths in 2018 [1]. Children aged under 5 years are the most vulnerable group for malaria infection and during 2018, they accounted for 67% (272 000) of all malaria deaths reported worldwide [1]. Sub-Saharan Africa accounts for the majority of the global malaria burden, with 71% of cases and 86% of global malaria deaths[2]. Malaria burden is higher in populations that are poor and malnourished [3]. Migrant laborers traveling to endemic areas, children <5 years old, and pregnant women are high-risk groups that are affected by the high burden of malaria [3].

In Ethiopia around 75% of the landmass and around 68% (74.2 million) population of Ethiopia considered at risk of malaria, which corresponds to areas below 2,000m altitude [4]. Plasmodium falciparum and Plasmodium vivax are the most dominant malaria parasites in Ethiopia [4]. Malaria transmission exhibits a seasonal and unstable pattern in Ethiopia, with transmission varying with altitude and rainfall. The peak of malaria transmission season in the country is from September to December, following the main rainy season from June/July to September. [5]. In 2018, Ethiopia reported a total of 1,206,891 malaria cases. About 79.7% (926,087) of cases were confirmed by microscopy. Of these 89.4 % (859,675) cases were positive for plasmodium falciparum.[1]

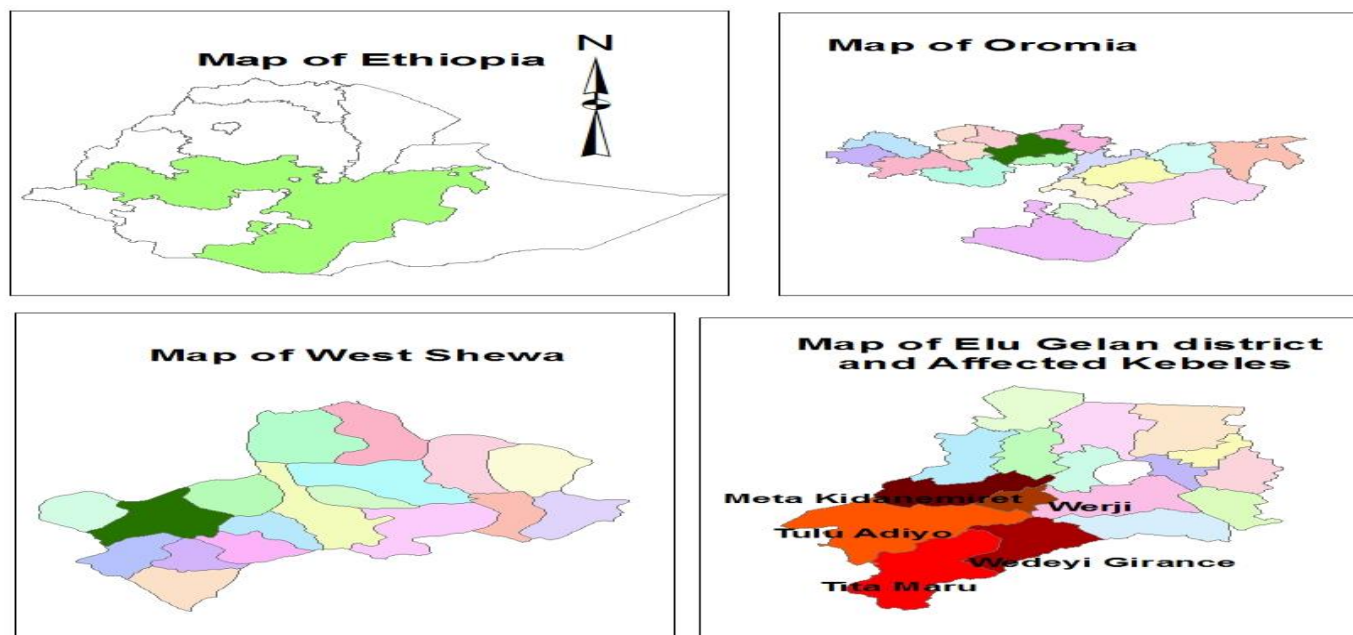
Elu Gelan district is one of a malaria hot spot area in Oromia Region. Every week health posts should report summary patient registry data on the PHEM weekly form. (Health facilities to district health office every Monday until midday, district to zone every Tuesday till midday, zone to region every Wednesday till midday, region to PHEM every Thursday, PHEM to stakeholders every Friday) When the number of cases in a week rises above the threshold (a third quartile/second largest number from five previous years' data) the report must be immediately relayed to all responsible higher levels and continues to report on daily basis till the outbreak stops using the daily epidemic reporting format. Malaria outbreak was reported from Elu Gelan district starting from 5th, July, 2019. Following the report, the regional health bureau deployed a team composed of epidemiologist, clinicians and environmental health officers to support the investigation and response measures. The outbreak investigation was aimed to describe cases by time person and place and determine the risk factors for malaria. We also described control and prevention measures implemented in Elu Gelan district to stop the spread of malaria outbreak. The findings of the

investigation enable effective implementation of prevention measures and contribute towards malaria elimination in the affected area.

Materials and Methods

Location

Map 1: - Map of Elu Gelan District, West Shoa Zone, Oromia, Ethiopia, 2019



We conducted malaria outbreak investigation in Elu Gelan district found in west Shewa zone of Oromia region in Ethiopia. Elu Gelan district was established as an independent district in 1998 and it is one of the 23 districts found in West shoa Zone. It is 205 KM from Addis Ababa, the capital city of Ethiopia. It is located northeast of caliya district, west of Bako Tibe, and south of Danno district. It has a total of 18 kebeles (17 rural and 1 urban) and 89% of them were malarious kebeles. From 16 malarious kebeles, 6 of them (37.5%) were malaria hot spot kebeles (Tita Maru, Tulu Adiyu, Wedeyi Girance, Abeku Ano, Werji and Meta Kidanemiret)

Descriptive Epidemiology

The study was conducted from August 5 – December 28, 2019. We defined malaria outbreak according to the national malaria guideline, as a situation when the number of malaria cases is in excess of the normal number at a specific period of time and place. Therefore, the "normal" expected number has to be

estimated. One way to do this is by using past weekly data of up to five previous years to construct a third quartile (second largest number) threshold line in an epidemic monitoring chart and compared with current data (2019) to confirm the outbreak. Cases and deaths were obtained from health centres and health posts in the district. Cases were identified by laboratory technologists and technicians using a 100x oil immersion microscope to detect malaria parasites. Community health workers also conducted malaria confirmation using malaria Rapid Diagnostic Test. We used line list for describing malaria cases in terms of time, place and person. Cases were described by age, sex, kebele, week, month and year. Attack rate, case fatality rate and slide positivity rate were also calculated.

Case Control Study

Cases were defined as confirmed malaria cases treated in the health center and living in the Elu Gelan district. Controls were defined as residents of Elu Gelan district during the study who were neighbors to a case and who had no signs and symptoms of malaria. Additionally, all controls were tested and did not have confirmed malaria by RDT and agreed to participate in the study. We calculated the sample size using the statistical calculator of Epi-info for sample size taking the power of 80%, odds ratio of 2.25 for 'presence of mosquito breeding site, percentage of exposed controls of 70.9%, and case to control the ratio of 1:1. The result was a total sample size of 318. Factoring in a 10% of non-response rate, our sample size was 350, with 175 cases and 175 controls[7]. Presence of mosquito breeding sites were associated risk factors for almost all malaria outbreak investigated so far in Ethiopia particularly in oromia.

We conducted community-based case control study. We prepared sampling frame from the line list, selected cases randomly from the line list, and identified one neighborhood control per each case.. Data were collected using interviewer administered a structured questionnaire to assess the risk factors. The data collection tools consist of socio-demographic characteristics, clinical information, and exposures information. One-day training was given to data collectors on the data collection questionnaire. Selected cases and controls were asked about presence of mosquito breeding sites in their compound or near their home within 1000 meters' radius. In addition, availability of any uncovered water was observed inside or outside the home of each respondent.

Data completeness was checked before analysis, data were then entered in to Epi info version 7.2.2.6 and Multivariate analysis conducted using SPSS software version 20 and results were presented using Graphs and tables. Attack rate was also calculated. The significance of risk factors for the outbreak was determined by calculating Odds Ratio (OR) and 95% Confidence Interval (CI). All participants were

informed about the objective of the study, confidentiality of the participant was assured, and informed consent was given to the participants, with the knowledge they were free to withdraw at any time.

Results

Descriptive Epidemiology

Description of cases by Person

This study revealed that, among a total of 2395 malaria cases, 1318 (55%) were males and 1077 (45%) were female and the median age of suspected malaria cases was 15 years (Table 1). The proportion of malaria cases was higher in male than female. The overall positivity rate of this outbreak was 2,099 (87.6%). Females had malaria positivity rate of 944 (87.7%). And male had 1155 (87.6%) positivity rate. The age group of 5-14 had highest positivity rate (90.7%) from 782 cases, followed by above 15 years of age (87.6%) from 1119 cases (Table 1). The overall attack rate (AR) was 115 per 1000 populations with a case fatality ratio of zero. Age group 5-14 years were the most affected, with an AR of 136.9 per 1000 population followed by above 15 years old accounting 116.6 per 1000 populations. Male had an attack rate of 127.4 per 1000 population (Table 2). Based on the national guideline the outbreak threshold is $\geq 50\%$ positive; these shows confirmed the malaria outbreak. The highest and the lowest positivity rate was reported in the age group 5-14 (90.7) and less than 4 (77.3) years respectively. (Table 1). Of 175 case-patients 104 (59%) were males and 98 (56%) of 175 controls were male with 100% response rate. (Table 4).

Table 48; - Distribution of malaria cases by sex, age and Plasmodium species in Elu Gelan district, Oromia,-Ethiopia, 2019.

Characteristics	Total tested (RDT \$ Microscopy)	Total positive	Positivity rate (%)	Plasmodium species		
				P.Falciparum; N (%)	P. Vivax; N (%)	Mixed: N (%)
Sex						
Male	1318	1155	87.6	1067 (92.4)	72 (6.2)	16 (1.4)
Female	1077	944	87.7	886 (93.9)	43 (4.6)	15 (1.5)
Age						
≤ 4	256	198	77.3	177 (89.4)	21 (10.6)	0
5-14	862	782	90.7	719 (91.9)	47 (6)	16 (2.1)
≥ 15	1277	1119	87.6	1057 (94.5)	47 (4.2)	15 (1.3)

Table 2 Attack rates and case fatality rates of malaria outbreak in Elu Gelan district, Oromia, Ethiopia, 2019

Variables	Population	no of cases	no of deaths	Attack rate*1000	CFR (%)
Sex					
Male	9,066	1155	0	127.4	0
Female	9,249	944	0	102	0
Age					
< 4	3009	198	0	65.8	0
5-14	5711	782	0	136.9	0
>15	9595	1119	0	116.6	0
Total	18,315	2,099	0	114.6	0

Description of cases by Places

Among the total of 2395 malaria suspected cases, the highest attack rate was recorded in Meta Kidanemiret kebele (201/1000 population) followed by Tulu Adiyu (132/1000 population), Werji (114/1000population), Tita Maru (78/1000 population) and Wedeyi Girance (68/1000 population). The most dominant species responsible for this outbreak were *P. Falciparum* followed by *Plasmodium Vivax*. The proportion of slides that were positive (slide positivity rate in Meta Kidanemiret kebele 93.5% Wedeyi Girance 87.7%, Tita Maru 87.6%, Tulu Adiyu 87.6%, Werji 69.9% and total 87.6%. (Table 3)

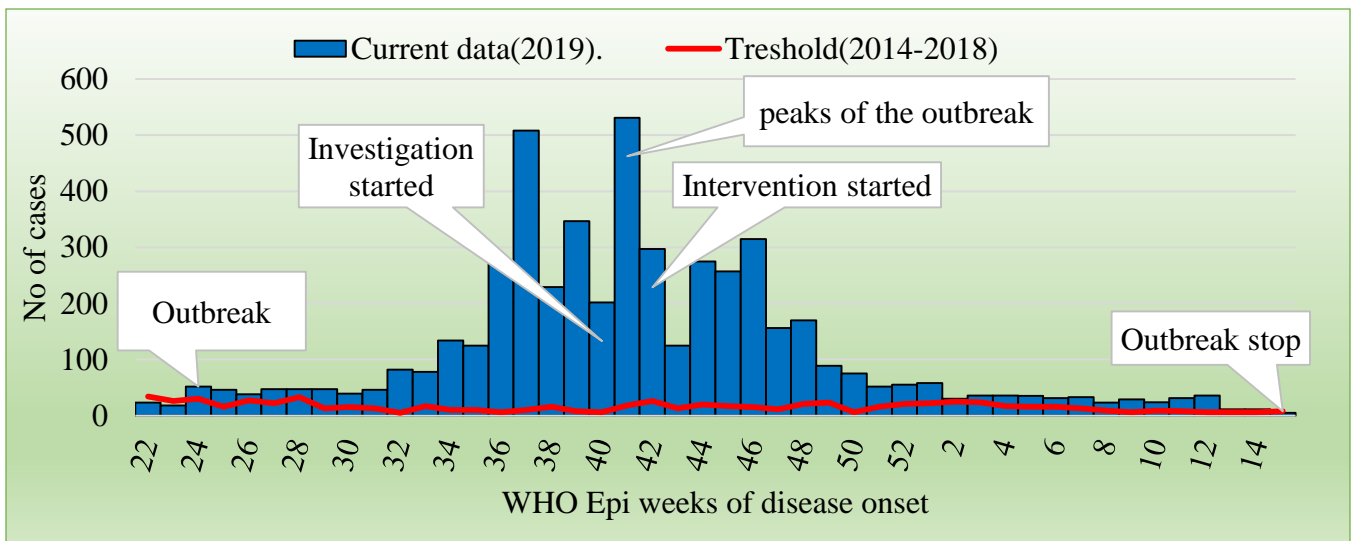
Table 3. Distribution of malaria cases by affected villages and Plasmodium species tested in Elu Gelan district, Oromia- Ethiopia, 2019.

Affected Villages	Total population	Total tested	Total positive	Positivity rate (%)	AR/1000 population
Meta Kidanemiret	4,206	903	844	93.5	201/1000
Tita Maru	4,094	363	318	87.6	78/1000
Tulu Adiyu	2,721	410	359	87.6	132/1000
Werji	1,820	296	207	69.9	114/1000
Wedeyi Girance	5,474	423	371	87.7	68/1000
Total	8,315	2395	2099	87.6	115/1000

Description of cases by Time

The alert threshold (second largest number from five-year weekly data (2014-2018)) had been crossed in WHO week 24, 2019. It was shown that the current trend line of the case was crossed the threshold levels and peaked in week 41 and start to decline in week 47, 2019. It had passed the threshold in all WHO epidemiologic week 24/2019 to 2/2020. The Epi curve showed that the district health office intervenes late (several weeks after an outbreak occurred). In 2017, PMI graduated and withdraw the district from IRS program due to significantly lowered burden of malaria. The investigation team departed to investigate this outbreak on September 14, 2019 and interventions were held starting from the time of investigation

Figure 1. Malaria outbreak Epi Curve in Elu Gelan District, Oromia, Ethiopia 2019.



We conducted environmental observations; Potential mosquitoes breeding sites were assessed and observed for larval density, and identified 25 stagnant water with anopheles larvae and larvae breeding sites in the range of 1 KM and estimated to 250m². Larvae of P.Falciparum of anopheles' mosquito were identified by sight and parallel surface positioning by experts from regional health bureau. In addition, availability of any uncovered water were observed inside and outside the home of each respondent.

We implemented interventions such as, Insecticide treatment net (ITN#) distribution and indoor residual spraying (IRS). We organized community awareness sessions and training on surveillance and malaria cases management for health care workers

Case Control study

Using multivariate analysis, both cases and controls have bed nets but there was inadequate bed net per family size and irregular utilization of ITNs (64% & 63.4%) respectively which has valid association with malaria. 62.89% of cases and 61.43% of controls live within 1KM radius of stagnant water (larvae breeding sites) which was highly associated with malaria cases. In multivariate analysis the risk factors of staying outside overnight [AOR=2.133(CI 1.044-4.360) P-value of 0.038], having inadequate bed net per family size [AOR= 2.064 (CI 1.176-3.622) P value of 0.012], and using bed net irregularly [AOR=9.437 (CI 3.950-22.545) P value of <0.001] were associated with malaria outbreak.

Table 4: Factors associated with malaria outbreak in Elu Gelan district, West shoa, Ethiopia 2019

Factors	Category	Cases n=175 No (%)	Controls n=175 No (%)	COR (95% CI)	AOR (95% CI)
Sex	M	104 (59%)	98 (56%)	1.46 (1.08-1.97)	1.08 (0.52-2.28) P.value=0.830
	F	71 (41%)	77 (44%)		
Staying outside over night	Yes	115 (65.7%)	49 (28%)	4.93 (3.58-6.79)*	2.13 (1.04-4.36) ** P.value= 0.038
	No	60 (34.3%)	126 (72%)		
Protective cloth	Yes	62 (34.3%)	135 (77.1%)	0.16 (0.12-0.22)	0.55 (0.29-1.04) P.value=<0.066
	No	115 (65.7%)	40 (22.9%)		
Mosquito breeding site	Yes	110 (62.9%)	105 (61.4%)	1.13 (0.83-1.53)*	11.45(3.88-33.81) ** P.value=<0.001
	No	65 (37.1%)	70 (38.6%)		
Irregular use of ITN	Yes	111 (63.4%)	51 (29.1%)	4.22 (3.07-5.79)*	9.44 (3.95-22.55) ** P.value=<0.001
	No	64 (36.6%)	124 (70.9%)		
Inadequate ITN per family size	Yes	112(64%)	55 (31.4%)	3.88 (2.83-5.31)*	2.06 (1.18-3.62) ** P.value=0.012
	No	63(36%)	120(68.6%)		
Knowledge on transmission	Good	56(32%)	98(56%)	0.37 (0.27-0.50)	0.37 (0.17-0.79) P.value=0.011
	poor	119(68%)	77(44%)		

* Significant variables in bivariate analysis ** significant variables in multi variate analysis

Discussion

The current outbreak was compared to threshold (the second largest number of the last 5 years' epidemiological records of malaria cases) to confirm the existence of outbreak, based on this, the investigation confirmed the current data (2019) crossed the threshold in WHO week 24/2019 and continued to WHO week 2/2020 which confirms the existence of malaria outbreak in five kebeles. Factors like living near mosquito breeding sites, inadequate ITNs per family size, and irregular ITN utilization contributed for the existence of the epidemic. About 1953 (93%) of the confirmed malaria cases were due to plasmodium falciparum (*p. falciparum*) species. This finding is higher than the usual proportion of malaria species in Ethiopia whereas about 60% of the species is *P.f* [10]. This finding also disagrees with previous studies conducted in Butajira Area, south-central Ethiopia, east shoa zone, East Wollega Haro Limu district, Oromia Region where proportion of *p. falciparum* accounted 12.4%,45% and 22.5% *p.vivax* accounts 86.5%,54% and 59.2% respectively [11][12][13] . During malaria epidemics, the dominance of *p. falciparum* over the other species is common in Ethiopia [5]. But this may be due to interruption of vector control measures (IRS, LLINs and Larval control activities).

The overall AR is nine point five (9.5) times higher than a study conducted in Laelay Adyabo district Northern Ethiopia (2017) and three (3) times higher than study conducted in Afar (2016) and 3.5 times higher than study conducted in Tanquae Abergelle district, Tigray[14][9][15]. Higher AR might be due to difference in the study populations and area. Most of the Study population were using ITNs for other purposes and presence of intermittent rivers and stagnant waters in the area could be suitable for higher attack rate. The AR was highest in Meta Kidanemiret kebele (201 per 1000 populations) and this might be due to presence of multiple mosquito breeding sites nearby residents of Meta Kidanemiret Kebele compared to the other four kebeles. 11 (44%) of 25 mosquito breeding sites were in this kebele. Age specific AR was highest among population >15 years and this finding is in line with study from Amibera District, Afar Region, west Armechiho district, Amara region, Laelay Adyabo, north Ethiopia and Ateya district north shoa ,Oromia region[9][3][14][4]. Males were highly affected than females in the district this may be because males spent most of their time out side home at night keeping cattle's from robberies. Another study also proved that [13, 16], males are affected by malaria than females, which is perceived to be the fact that males are usually engaged in outdoor activities. This could be related to nature of the community: women are less likely involved in outdoor activities between dusk and dawn. Those people living at about 1km radius of mosquito breeding site were 11.5 times to develop malaria compared to those living mosquito free breeding site. This finding is in line with study conducted in Simada District,

Northwest Ethiopia: a case-control study [16] and Laelay Adyabo district north Ethiopia [14]. The national malaria prevention and control strategy recommends application of IRS at least once in a year with 100% coverage, and at least one ITN per two people in malaria high-risk areas [10]. Despite this fact, IRS campaign was not conducted timely prior to the outbreak and early replacement of ITNs was not conducted immediately. Households who had been using the ITNs other than its intended purpose were also observed. This could be due to poor monitoring of the communities after distributing the ITNs given to the communities to enhance their awareness on the cause, transmission, and prevention of the disease

Conclusion and Recommendations

We confirmed malaria outbreak in the district, a late notification delayed investigation and responses to the outbreak. The attack rate was highest among 5-14 years of age groups and males were more affected by malaria. There was a significant association of malaria with stayed outside overnight, presence of mosquito breeding site around home, irregular use of ITN and having inadequate ITN per family size. There was a delay in distribution of ITN and IRS community spray campaigns. To prevent subsequent malaria outbreaks in the district, we would like to recommend the regional health bureau and district health office to distribute and replace the insecticide treated net (ITN), monitor utilization and conduct timely indoor residual spraying operations before rainy seasons. Trends of malaria cases should be monitored on weekly basis at all levels. We recommend to the district health facilities, early detection of malaria outbreak and community mobilization on disruption of potential mosquitoes breeding sites.

Limitations

Controls might be in the incubation period for developing malaria.

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References

- [1] World malaria report 2019..
- [2] K. T. Id, M. Yohannes, F. Mardu, and B. Berhe, “Assessment of community knowledge , practice , and determinants of malaria case households in the rural area of Raya Azebo,” pp. 1–14, 2019.
- [3] A. Talie, “Prevalence of malaria and associated risk factors among asymptomatic migrant laborers in West Armachiho District , Northwest Ethiopia,” pp. 95–101, 2018.
- [4] D. G. Feleke, D. Gebretsadik, and A. Gebreweld, “Analysis of the trend of malaria prevalence in Ataye , North Shoa , Ethiopia between 2013 and 2017,” *Malar. J.*, pp. 1–6, 2018, doi: 10.1186/s12936-018-2474-3.
- [5] R. Areas, G. Zone, E. Molla, and B. Ayele, “Journal of Bacteriology and Parasitology Prevalence of Malaria and Associated Factors in Dilla Town and the Surrounding,” vol. 6, no. 5, 2015, doi: 10.4172/2155-9597.1000242.
- [6] M. B. Debela, A. B. Kahsay, and T. M. Mokonnon, “Malaria outbreak and contracting factors in Afar,” vol. 10, no. July, pp. 233–240, 2018, doi: 10.5897/JPHE2018.1000.
- [7] T. Edition and A. Ababa, “Third Edition,” no. January, 2012.
- [8] A. Woyessa, W. Deressa, A. Ali, and B. Lindtjørn, “Prevalence of malaria infection in Butajira area , south-central Ethiopia,” *Malar. J.*, vol. 11, no. 1, p. 84, 2012, doi: 10.1186/1475-2875-11-84.
- [9] F. Tadesse, A. W. Fogarty, and W. Deressa, “Prevalence and associated risk factors of malaria among adults in East Shewa Zone of Oromia Regional State , Ethiopia : a cross-sectional study,” pp. 1–8, 2018, doi: 10.1186/s12889-017-4577-0.
- [10] E. Wollega, “Prevalence of Malaria and Associated Factors among Febrile Patients Visiting Kalala Health Center in Haro Limmu Woreda , East Wollega Zone , *Epidemiology : Open Access*,” no. February, 2019, doi: 10.4172/2161-1165.1000365.
- [11] A. Tesfahunegn, G. Berhe, and E. Gebregziabher, “Risk factors associated with malaria outbreak in Laelay Adyabo district northern Ethiopia , 2017 : case-control study design,” pp. 1–7, 2019.
- [12] K. Tesfay, B. Assefa, and A. Addisu, “Malaria outbreak investigation in Tanquae Abergelle district , Tigray region of Ethiopia : a case – control study,” *BMC Res. Notes*, pp. 1–5, 2019, doi: 10.1186/s13104-019-4680-7.
- [13] B. Workineh, F. A. Mekonnen, M. Sisay, and K. A. Gonete, “Malaria outbreak investigation and contracting factors in Simada District , Northwest Ethiopia : a case – control study,” *BMC Res. Notes*, pp. 1–6, 2019, doi: 10.1186/s13104-019-4315-z.

Chapter Six- Abstract for Scientific Presentation

6.1. Surveillance data analysis of Meningococcal meningitis in SNNP Region from 2012-2018. Ethiopia, 2019

Abstract

Title: Meningococcal Meningitis surveillance data-in SNNPR from 2012-2018, Ethiopia, 2019.

Author: Dilnesaw T.Gete^{2,3}. Dr Ayele. B³. Dr Zegeye H². Muluken G².

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Background

Meningococcal disease remains a major public health challenge in the African meningitis belt including Ethiopia. Meningococcal meningitis is one of the priority diseases under surveillance in Ethiopia. Meningococcal meningitis reported from several regions of Ethiopia especially Southern Nation Nationalities and Peoples Region. This study was designed to analyze meningococcal meningitis surveillance data to describe the burden of the disease by place person and time which will provide information in meningococcal meningitis prevention and control activities.

Methods

The study was conducted in SNNPR regional health bureau from February to March 2019. We used descriptive cross sectional study to describe the data in terms of place, person and time. The data was obtained from SNNPR PHEM routine surveillance database and epidemic line lists. The data analysis covers the region surveillance data from 2012-2018. We used Microsoft Excel.

Results

From (2012-2018,) 5,483 meningococcal meningitis cases were detected by SNNPR surveillance system. The CFR was 3.1 % (168/5483). The highest CFR 46(29.3%) was reported from Gurage zone. Cases and deaths were reported from all zones. Highest case load was reported during dry season of the region (January-March). We identified an outbreak in 2012/2013. During an outbreak, out of 913 meningococcal meningitis cases 453 were collected for laboratory confirmation and 57 of them were tested positive for meningococcal meningitis. 70% of outbreak cases were reported from Sidama, Wolayita, Halaba and Bench Maji zones with average CF of 2%.The dominant serogroup in the confirmed cases was type 'A'.

Conclusion

Meningococcal Meningitis suspected case load becomes increasing in 2017 and 2018 compared to 2016 and affected majority of zones and woredas in the region which need strong follow up and strengthening of prevention and control activities. We recommend strengthening of active surveillance system on early case detection and verification of epidemics and reactive vaccination for repeatedly affected zones and woredas.

6.2. Surveillance Evaluation of Malaria in Elu Gelan, west shoa zone, Oromia, Ethiopia, 2019.

Abstract

Title: Meningococcal Meningitis surveillance data-in SNNPR from 2012-2018, Ethiopia, 2019.

Author: Dilnesaw T.Gete^{2,3}. Dr Ayele. B³. Dr Zegeye H². Muluken G².

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Background:

Malaria is among the disease contributing for >90% of child deaths and it's among priority disease under surveillance in the country. Therefore, this study aimed to evaluate malaria as proxy indicator of surveillance system at public health facilities in selected District.

Methods:

We conducted descriptive crosssectional study using malaria surveillance data from December 12-26/2019 in Elu Gelan District, Oromia, Ethiopia. 100% (3) of health centres in the district were selected intentionally, and 60% (10) of health posts were selected randomly. Data was collected by face to face interview using semi structured questionnaire to collect data on core and supportive activities of surveillance system, review documents to collect data on quantitative attributes and in-depth interview of key informants to collect data on qualitative attributes of surveillance system. Data was entered and analysed using Microsoft Excel 2013.

Results:

PHEM system has not improved and didn't get attention of even head of health office. The district didn't responded within 48 hours of notification of recently reported outbreak. The district have prepared written epidemic preparedness and response plan (EPRP) but the epidemic management committee didn't evaluated their preparedness and response activities. The case definition of malaria disease is easy to understand and apply by all levels of health professionals. The malaria confirmatory test takes 10-15 minute at health post level using RDT and near to 1 hour at health center level using microscopy. Recording and reporting surveillance data takes 10-15 minutes. Mostly used telephone to transfer data. The system allowed all the reporting agents accept and well engaged to the surveillance activities. Completeness and timeliness of the reported surveillance data of the District was 48.1% and 74.9%

respectively. In 2019 G.C. 8,095 BF was done and 5,315 confirmed cases was identified (P.V (5%), PF (94.2%) and Mixed (0.8%) and positivity rate (65.7 %).

Conclusion:

Generally, based on evaluation of public health surveillance system core activities, supportive activities and attributes of the surveillance system in the District was not fully implemented to meet its objective. Efforts should be exerted by different stakeholders to improve the surveillance system in the District.

6.3. Investigation of Malaria outbreak in Elu Gelan woreda, west shoa zone, Oromia, Ethiopia. 2019

Abstract

Title: Meningococcal Meningitis surveillance data-in SNNPR from 2012-2018, Ethiopia, 2019.

Author: Dilnesaw T. Gete^{2,3}. Dr Ayele. B³. Dr Zegeye H². Muluken G².

Authors Affiliation: ¹Federal Ministry of Health, Field Epidemiology Training Program, ² Addis Ababa University, school of Public Health Field Epidemiology Training Program, ³ Oromia Regional Health Bureau

Background

Malaria causes 206 to 258 million cases and 384,000 to 452,000 deaths in 2018 globally and 474,000 to 5.5 million cases and 74 to 14,700 deaths in Ethiopia. In Ethiopia, it's one of the leading causes of morbidity and mortality and highly seasonal in many communities and unstable in other areas with epidemic-prone transmission pattern. Unusual increment of malaria case was reported from Elu Gelan District surveillance on August 5, 2019. We investigated to verify the existence of outbreak, describe the epidemiology, identify risk factors, and recommend preventive measures.

Methods

We conducted community based unmatched case-control study to identify risk factor and defined suspected malaria patient with fever or history of fever in the last 2 days and who lives in or has travel history to malaria-endemic areas in the last 30 days. We used microscope and RDT to confirm the disease and reviewed previous year's malaria data to establish threshold level and understand trends of the disease. We assessed presence of mosquito breeding site, utilization of ITNs, and larvae of anopheles in affected area of the district using observation.

Results

Among 2395 suspected cases, 2099 (87.6%) were confirmed malaria cases, with *P. Falciparum* 1953 (93%). Age group ≥ 15 years were most affected with an AR of 169.7/1000 population. Male were more affected with AR of 63.1/1000 population. Meta Kidanemiret was most affected kebele with AR of 201/1000 population. Inadequate ITN per family size, presence of mosquito breeding sites, irregular use of ITN and staying outside home at night were identified as risk factor and associated with outbreak with (AOR=2.064; 95% CI: 1.176-3.622), (AOR=11.452; 95% CI: 3.879-33.810), (AOR=9.437; 95% CI: 3.950-22.545) and (AOR=2.133; 95% CI: 1.044-4.360) respectively.

Conclusion

This malaria outbreak investigation in Elu Gelan district was associated with presence of stagnant water, irregular utilization of ITN and having inadequate ITN per family size. We recommended improving awareness of LLITN utilization and environmental management through optimized community participation.

Chapter Seven: - Summary of disaster situation visited

7.1. Humanitarian, health and nutritional assessment in Gedeb District of Gedeo zone SNNPR 2019.

Abstract.

Background: There were about 5.2 million new internal displacements associated with conflict and violence in the first half of 2018 globally. Sub-Saharan Africa was disproportionately affected by displacement associated with conflict and violence, accounting for six of the 10 worst affected countries with the highest figures. Between January and June, More than 1.4 million new displacements associated with conflict and violence was occurred in Ethiopia. Between April and July 2018, nearly 960,000 people were internally displaced from West Guji zone of Oromia and Gedeo zone of Southern Nations, Nationalities and Peoples Region of Ethiopia due to localized conflict and insecurity.

Objective: To conduct rapid need assessment on the existing capacity of the health system and infrastructure in order to locally assess the situation and identify the basic needs that require immediate response in IDPs sites in Gedeb woreda, Gedeo zone of SNNPR, 2019.

Methods:-We conducted a rapid need assessment from June 8-26, 2019 in Gedeb woreda IDP sites. Data was collected primarily by observing, reviewing, and screening, interviewing and assessing all IDP sites. Data was entered cleaned and analysed using MS Excel.

Result: - in all visited IDP sites, peoples were obliged to stay in undignified manner in highly overcrowded place without adequate food, water and Shelter, there was no adequate and standardized sanitation facilities in all sites. Women and girls were put at high of sexual and gender based violence. Due to the use of unsafe water, overcrowded living condition, open defecation and sharing of their cloths, scabies, measles and acute watery diarrhea were potential health risks.

Conclusion and recommendation: - there was inadequate provision of food, drinking water, shelter and sanitation and hygiene materials. These intern may lead to malnutrition, outbreak of water borne diseases (like acute watery diarrhea), scabies, measles and other communicable diseases which are the main public health problems. Women, girls and children were unsecured and lived in crowded places that predispose them for different problems.so we recommended that provision of safe drinking water, food, shelter and sanitation and hygiene materials for these displaced people to protect the predicted health outcomes and save lives.

Key words: IDP, Gedeb woreda, Gedeo zone

1. Introduction

A rapid need assessment is the exercise of collecting information in order to measure the damages and identify the basic needs that require immediate response in the aftermath of disaster.[1] Rapid need assessment is conducted immediately after the occurrence of the disaster in order to assess the need of affected displaced people and the affected areas. Internal displaced peoples are a group of peoples who have been forced to leave their homes or place of habitual residence in particular as a result of conflict or violence and who have not crossed an internationally recognized state border.[2]

There were an estimated 5.2 million new internal displacements associated with conflict and violence in 10 most affected countries in the first half of 2018. Of this Ethiopia accounts for more than 1.4 million IDPs which puts Ethiopia the first from 10 countries most affected. [3]. Conflict related displacement is nothing new in Ethiopia, but since the end of 2017 the number of internally displaced by violence has risen significantly. Inter-communal tensions between Gedeo and west Guji zones escalated and then peaked at the end of 2018 when renewed violence displaced more than 800,000 individuals across the two zones.[4]

Inter-communal conflicts and insecurity between the two zones (west Guji and Gedeo) led to the rapid displacement of nearly 960,000 people between April and July 2018.[5]. in 2018 the humanitarian situation in Ethiopia highly worsened due to disease outbreaks, malnutrition and food insecurity and enormous displacement of population as a result of intensified inter- communal conflict in parts of the country.[6]

Repeated violence between the Gedeo and West Guji zone, compounded by rainy season. The displacement is happening at the peak of the lean season at which time households food resources are most constrained or depleted and malnutrition levels are on the rise especially in the poorest households. The displacement is like to create a life threatening upsurge in malnutrition and childhood illness. [7] The conflict of two zones drove many households in to internally displaced persons' camps at the height of hunger season when people normally have limited access to food. [6]

Most of the newly displaced people in west Guji and Gedeo were living in horrible condition in congested collective shelters. The affected areas was already one of the most tightly populated part of Ethiopia before the current displacement and the inflow of IDPs has doubled the population of the area (woreda).[3]

According to SNNP regional authorities, there were more than 642,152 IDPs in Gedeo zone dispersed across different IDP sites as of 22 June 2018. Out of these More than 300,000 internally displaced people were settled in Gedeb woreda and distributed in different IDP Sites.[8]

Objective

General Objective

To conduct rapid need assessment on the existing capacity of the health system and infrastructure in order to locally assess the situation and identify the basic needs that require immediate response in IDPs sites in Gedeb woreda, Gedeo zone of SNNPR, 2019

Specific Objective

- .To assess the living conditions, sanitation, water supply, food, health and health care services and level of insecurity
- To identify gaps in health system and infrastructures capacity that address anticipated risks and threats in IDPs sites in Gedeb woreda, Gedeo zone of SNNPR.
- To assess the adequacy of the existing response capacity and the immediate additional needs.
- To under taken public health intervention

Methods and materials

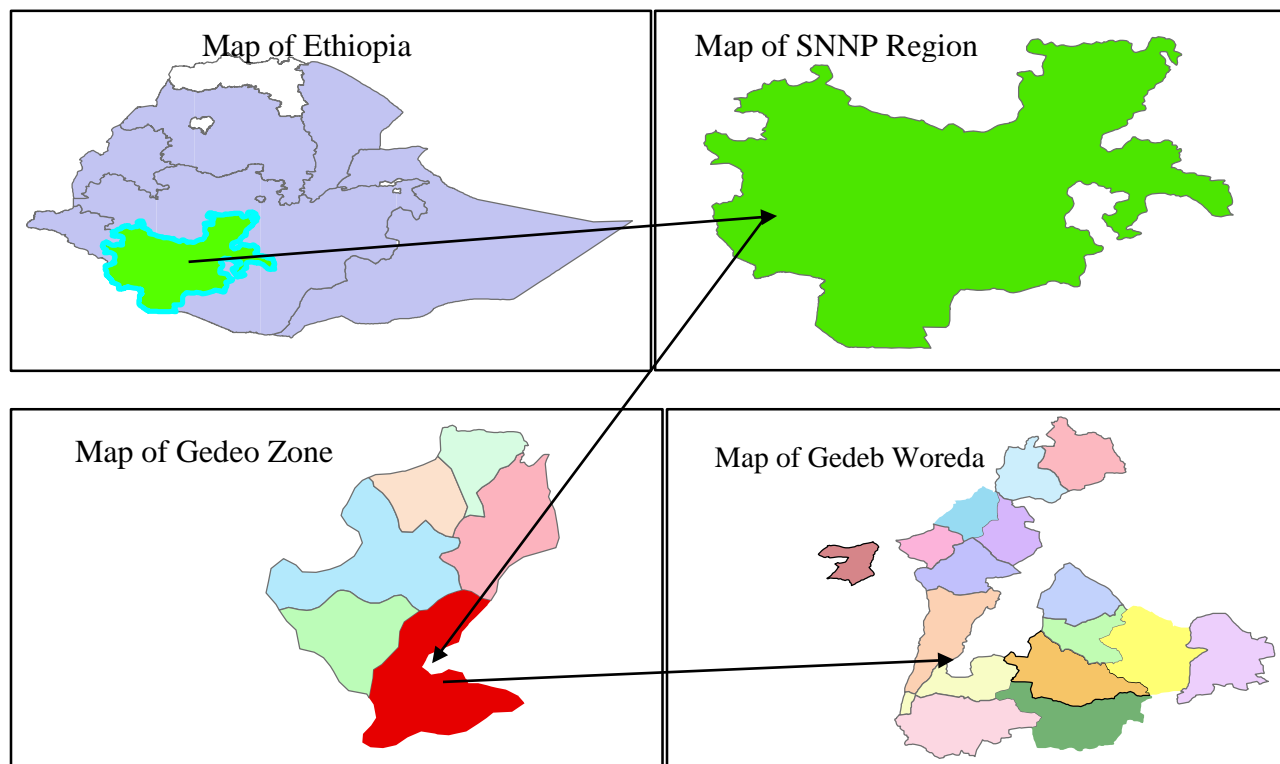
We conducted cross sectional. A rapid need assessment in Gedeb woreda of Gedeo zone IDPs sites from June 8-26/2019. Data was collected by using interviewing, observing/visiting, screening, and reviewing all IDPs sites and study population was all displaced people in Gedeb Woreda.

Gedeb is one of the woredas in southern nations and nationalities and peoples' region of Ethiopia, named after its major town Gedeb. It is part of Gedeo zone and bordered on the east and south by the Oromia region, on the west by Kochere woreda, on the northwest by Yirgachefe and on the north by Bule. Based on the 2007 census conducted by CSA, Gedeb woreda has a total population of 141,990, of whom 71,113 are Male and 70,877 women; 8,931 or 6.29% of its population are urban dwellers.

A total of 24 IDP sites were organized in six clusters in Gedeb woreda. These clusters were Gedeb with 3 IDP sites, Banko Tatatu with 3 IDP sites, Worka with 2 IDP sites, and Banko Gotite with 11 IDP sites, Kedida Gubeta with 2 IDP sites, and Moralayo with 3 IDP sites. 306,572 internal displaced peoples were settled in these 24 IDP sites in Gedeb woreda. Total under 1yrs children was 9,871, <5yrs was 50,273, Pregnant women 4,404 and Lactating women was 6,231.

Gedeb woreda has 16 HPs, 5 health centers and 1 primary hospital. There were also 17 private clinics that provided service for population of the woreda.

Figure 44; Map of Gedeb woreda



Assessment Finding

During the conflict between Gedeo zone of SNNPR and Guji Zone of Oromia, life was lost, public and private assets have damaged. Thousands of people were displaced from their habitual residency and lost their assets. Due to the conflict a total of 818,380 population with 410,008 male and 408,372 Female were displaced from West Guji zone of Oromia and Gedeo zone of SNNPR. From both conflicted Zones, Some of the IDPs were displaced from their residency not due to conflict but due to fear of conflict reside in different woredas of west Guji and Gedeo zones. Distribution of internally displaced population by woreda in Gedeo zone of SNNPR, and west Guji zone of Oromia, Ethiopia, 2019 (29, June 2018 OCHA).

Table 49; Distribution of internally displaced population by woreda in Gedeo zone of SNNPR, and west Guji zone of Oromia, Ethiopia, 2019

Region	Zone	Total IDPs	Woredas	Number of Displaced people		
				Male	Female	Total

SNNPR	Gedeo	642,152	Bule	19,153	19,306	38,459
			Dila Zuria	6,401	6,350	12,751
			Gedeb	154,512	152,060	306,572
			Kochere	41,129	41,294	82,423
			Wonago	16,556	16,228	32,784
			Yirgachefe	53,950	52,882	106,832
			Dila Town	31,568	30,943	62,511
Oromia	Guji	176,098	Abaya	4,735	4,642	9,377
			Birbirsa Kojowa	4,932	4,835	9,767
			Bule Hora	7,742	7,588	15,330
			Gelana	21,828	21,396	43,224
			Hambela Wamena	14,688	14,398	29,086
			Kercha	34,978	34,286	69,264

Case management Activities report

Due to lack of adequate water for both drinking and cooking, inadequate food supply, availabilities of latrine which was not proportional with the size of displaced people which enforced them to defecate in open space and living in overcrowded place, Most of the cases in all IDP sites were similar. Majority of cases were present with Intestinal parasite, AFI, and conjunctivitis in Adults and Intestinal parasite, diarrhea and conjunctivitis in under five children which were ranked 1-3 as cause of morbidity and mortality in 2019.

There was no enough health professionals to provide service for displaced peoples. For some IDP sites health service was not delivered daily due to shortage of health works especially those IDPs who were far from Health facilities. These were another challenge in providing basic health service in Gedeb woreda of Gedeo zone. Children's were died of pneumonia and diarrhea due to lack of treatment. Especially due to Shortage of drugs. Lack integration among professional, there was weak inter sectorial collaboration, no sanitation materials for infants and women (diaper, Modes, & Popo) and shortage of Drug supply.

Table 50; Ten top cause of morbidity and mortality in Gedeb woreda from 5/25/2019-6/29/2019 Gedeo zone, SNNPR, Ethiopia 2019

Type of disease	Male Adult	Female Adult	Total
I/Parasite	5,261	6,872	12,133
AFI	4,521	5,325	9,846
Conjunctivities	4,013	4,256	8,269
Pneumonia	2,634	2,958	5,592
Diarrhea	2,518	2,652	5,170
PUD/ Dyspepsia	1,256	1,326	2,582
Others	1,132	1,254	2,386
Scabies	1,289	1,023	2,312
UTI	1,098	1,125	2,223
URTI	985	1,145	2,130

Table 51; Five Top causes of under-five morbidity and mortality in Gedeb woreda from 5/25/2019-6/29/2019 Gedeo zone, SNNPR, Ethiopia 2019.

Type of disease	Male under 5 yrs.	Female under 5 yrs.	Total under 5 yrs.
Diarrhea	9,284	8,654	17,938
Conjunctivities	7,798	7,851	15,649
I/Parasite	6,589	6,874	13,463
Scabies	5,624	5,231	10,855
Pneumonia	4,623	4,529	9,152

Service delivery assessment

No health post that could provide health service for IDPs alone was established. They were served in health centers established for catchment population. One health center was serving more than fifty thousand population which is beyond standard. A single health center was organized and served more than five IDP sites which contained more than five thousand IDPs each.

Despite of case management, many children and pregnant women were exposed for many preventable diseases like malnutrition, diarrhea, pneumonia, scabies, and intestinal parasite. This is due to shortage of food supply, inadequate number of toilet per population size and shortage of drinking and cooking water

supply in IDP sites especially Banko Gotiti, Banko Tatatu, Moralayo, Worka IDP sites due to unsuitable road during rainy season.

For some IDP sites service delivery was provided by mobile clinic every other day due to lack of manpower. Even though a collection of voluntary health professionals were came together from different regions of Ethiopia and zones of SSNPR to provide basic health service for internally displaced people, it was difficult to provide health service daily for all IDP sites.

There was shortage of essential drugs (Amoxicillin, Paracetamol, Different vaccine for routine immunization in some IDP site for more than a week. Anti-retroviral (for HIV patients) and anti TB drugs were not available for more than two weeks.

Family health services were not properly provided in all IDP sites. Health professionals were provided service only for sick people. There were interruption of routine immunization due to shortage of supply.

Hygiene and Sanitation

Sixty One block of trench latrine containing 12 rooms were constructed in IDP sites of Gedeb woreda. On average one trench latrine room was served more than five thousand (5,000) internally displaced people. It was filled with in a week and this was very challenging, it took more than a week to prepare another after it was filled. The other challenging issues of IDPs especially pregnant and lactating women and children was shortage of water. Water was supplied by world vision once per week due to unsuitable road. When there was rain any means of transportation could not went to or out from some IDP sites especially Banko Gotite, Banko Tatatu Moralayo, and Worka. This made difficult to supply water daily and timely.

Children were died from preventable diseases such as pneumonia, diarrhea and malnutrition. Lack of safe drinking water, open defecation and inadequate food supply were exposed children, pregnant and lactating women and Old age people for different preventable disease conditions in all IDPs. More than 10 children were died from pneumonia and diarrhea Banko Gotiti.

There was no pit in all IDP sites. Garbage was collected in front of each tents in the way in which children were exposed for different disease condition.

Many IDPs needed psychological and social support. In the conflict, many life was lost, properties were damaged, many families were separated which intern resulted in psychological and mental disorder in some IDPs. Support and response from regional and zonal authorities were not only inadequate but also

biased. According to Information from IDPs, many supports especially food were given for relatives of local authorities than those displaced peoples.

Public health intervention.

Sixty one trench latrine containing 12 rooms were constructed by IOM, health education was given for displaced communities about communicable disease, nutrition, chronic disease and hygiene and sanitation practice, orientation for Health extension workers on anticipated diseases outbreaks was given, provision of estimated 650,000 ETB medical supplies by MSF and SNNPR region children pregnant women and lactating women were screened for malnutrition, RRT and task force were established at woreda level, Aba Gada and political leaders were coordinated to solve the conflict peacefully, some critical cases were referred to the hospital

Conclusion

Due to conflict between west Guji of Oromia region and Gedeo of SNNPR Ethiopia, many life was lost families were separated, properties were collapsed and thousands were left their home or displaced. There were lack of drug supply, hygiene kits (Modes & Diaper), and wash materials. Routine immunization was interrupted, there was shortage of safe drinking and cooking water, food supply and inadequate toilet per population in all IDPs. There was no wastage disposal sites in all IDPs. Children were exposed for preventable disease conditions like Malnutrition, diarrhea, pneumonia, scabies and intestinal parasite and others. Women were exposed for sexual abuse. weak multi-sectorial collaboration, lack of integration among professionals, lack of sanitation materials for infants & women, disease like AWD, Measles, scabies, Malnutrition and other diarrheal diseases could occurred as an outbreak

Challenges

- Some host communities were registered as IDPs and shared every support with IDPs.
- Shortage of essential drugs.
- Inaccessibility of some IDP sites due to rain.

Reference

- [1] S. Standards, “Rapid Assessment in Disasters,” vol. 56, no. 1, pp. 19–24, 2013.
- [2] I. D. Persons, “OCHA on Message : Internal Displacement Case study,” pp. 1–2, 2008.
- [3] S. Africa and N. Zealand, “Mid-year figures Internal displacement in 2018 SUMMARY : New displacements,” no. August, 2018.
- [4] M. S. F. June, “Displacement and humanitarian response in Ethiopia : challenges and dilemmas,” no. June, 2019.
- [5] “Ethiopia: gedeo & west guji,” no. 5, pp. 4–6, 2018.
- [6] A. Chuma, “RESIDENT / HUMANITARIAN COORDINATOR REPORT ON THE USE OF CERF FUNDS RAPID RESPONSE,” 2018.
- [7] R. Plan, I. Displacement, and W. Guji, “Ethiopia Response Plan to Internal Displacement around.”
- [8] I. W. Guji, “Ethiopia : West Guji – Gedeo Conflict Displacement,” no. June, pp. 1–4, 2018.

Chapter Eight- Proposal for Scientific Research

8.1. Assessment Of Long-Lasting Insecticide Net Utilization And Associated Factors Among Under 5 Children In Ilu Gelan District, West Shoa Zone, Oromia Region, Ethiopia, 2020

Summary

Background: under five years of age children were one of the most vulnerable risk group for malaria. Consistent use of LLIN can reduce malaria mortality by 20% and morbidity by 50% in children less than 5 years of age. When combined with early diagnosis and treatment, it can reduce malaria mortality by over 50 %. In addition to scaling up of net distribution, periodic assessment of the utilization and associated factors among high risk population is important.

Objective: To assess the level of long lasting insecticide treated nets use and associated factors among under-five children.

Methods: A community-based cross-sectional study will be conducted in Elu Gelan District from April 1/2020 to May 30/2020. Systematic sampling technique will be used to select 408 households. Data will be collected using a semi structured questionnaire and observation checklist. Bivariate and multivariable logistic regressions will be applied for the analysis of the independent variables against long lasting insecticide treated nets use among under five children. The results will be reported using crude and adjusted odds ratio (OR) with their 95% confidence interval.

Key words; Ilu Gelan LLIN, Oromia.

Introduction

Background

Malaria causes an estimated 228 million cases and 405,000 deaths of malaria occurred worldwide in 2018. The WHO African Region still bears the largest burden of malaria morbidity and mortality, with 213 million cases (93%) and 380,000 deaths (94%) in 2018, followed by the WHO South-East Asia Region (3.4%) and the WHO Eastern Mediterranean Region (2.1%). In Ethiopia 474,000 to 5.5 million cases and 74 to 14,700 deaths were reported in the same year. [1]

Even though household ownership of at least one ITN was increased from 50% to 80% in sub-Saharan African countries, the proportion of households with sufficient nets (i.e. one net for every two people) remained inadequate (43%). [23]. Malaria is a major concern in the since it is one of the leading cause of morbidity and mortality. Despite the current efforts to control malaria in Ethiopia the situation has not improved mainly due to the increasing problems of parasite resistance to the relatively cheaper anti-malaria drugs, vector resistance to insecticides, low coverage of malaria preventive services, poor access to health care, rudimentary health service infrastructure, large population movements and limited financial and human resources.[25]

In Ethiopia, malaria is highly seasonal in many communities, but may have nearly constant transmission in some other areas; at the district level, malaria outpatient caseloads may vary several-fold from year to year in an “unstable” epidemic-prone transmission pattern. Peak malaria transmission occurs between September and December in most parts of Ethiopia, after the main rainy season from June to August.[1]

The scale-up of malaria prevention and control intervention was increased in the last decade in Ethiopia. According to the Ethiopian malaria indicator survey of 2015, 71% of households are protected either by owning an insecticide-treated net or having received indoor residual spray (IRS). As a result, the prevalence of malaria parasite was reduced from 1.3% in 2011 to 0.5% in 2015.[2]

The ownership and use of treated mosquito nets is the primary prevention strategy for reducing malaria transmission in Ethiopia, and since 2005 Ethiopia has been using LLINs. Furthermore, Ethiopia has adopted the goal of achieving universal coverage of LLINs, which involves free distribution so that there is one LLIN for every two persons in a household. To increase coverage, timely mass LLIN distribution campaigns are conducted in malarious areas (below 2,000m ASL).[3]

Deployment of insecticide-based interventions has been the principal driver of reductions in the global malaria burden since 2000. The massive scale-up of insecticide treated nets resulted in more than 50% of

people in malaria endemic areas in sub-Saharan Africa sleeping under nets in 2016.1 Of 663 million clinical malaria cases averted in sub-Saharan Africa since 2001, 78% were averted thanks to the use of insecticide-treated nets and indoor residual spraying. Any loss of effectiveness of these interventions could therefore cause a catastrophic rebound in disease incidence and mortality.[4]

Use of insecticide treated nets (ITN) is widely recognized as one of the main interventions to prevent malaria and high use rates are a central goal of malaria programs. The two main indicators to assess outcomes have been household ownership of at least one ITN and population use of ITN the previous night. Consistently, evaluations have found a significant gap between these indicators with ITN use always much lower than ownership of at least one ITN and this has been interpreted as evidence of failure to achieve appropriate net use or as a failure of behavior change communication (BCC) to adequately improve ITN use rate.[5]

ITN use is affected by many factors, including seasonal perception of risk, mosquito biting density, perceived comfort, household composition, physical space constrictions , and in some cases where a variety of nets are available, net preferences .[5]

Several authors have pointed out that the main reason for non-use is lack of access to a net and having enough nets for all within a household is the strongest determinant of net use. Accordingly, adjustments were made for ownership of net within the household by restricting analysis to net-owning households or including the variable of at least one ITN for every two household members .[5]

The 2015 goals of the World Health Organization's (WHO's) Roll Back Malaria Partnership are to reduce global malaria cases by 75% and to reduce malaria deaths to near zero through universal coverage by effective prevention and treatment interventions. Among other preventive interventions, WHO recommends the use of insecticide treated nets (ITNs), particularly Long-Lasting Insecticide Nets, which have been shown to be cost-effective, to reduce malaria episodes among children under 5 years of age by approximately 50% and all-cause mortality by 17% . Universal coverage with ITNs is defined as use by > 80% of individuals in populations at risk.[6]

Consistent and correct use of long-lasting insecticide treated nets (LLITN) does reduce malaria incidence in under-fives by up to 50%, incidence of severe malaria by 45%, and infant mortality by 25% .Universal coverage of LLITNs is defined as the use of a net by more than 80% of the population at risk, counting one net for each two persons. Consensus in the malaria Vector Control Working Group (VCWG) indicates

that universal coverage, reached through mass distribution campaigns, is the main strategy for the rapid attainment of malaria control.[7]

As in most countries in sub-Saharan Africa, LLINs are an important tool for malaria prevention and control in Ethiopia. According to the 2011 MIS, 55% of households reported owning at least one LLIN with varying levels of net ownership across regions in Ethiopia. The level of LLIN utilization also showed variation by region in Ethiopia. According to the World Health Organization Pesticide Evaluation Scheme (WHOPES), LLINs are expected to remain effective for 3 years under field conditions. However, varying levels of durability in the field have been reported with only a few studies confirming their usefulness over the entire 3 years

1.2 Statements of the problem

Consistent use of LLIN can reduce malaria mortality by 20% and morbidity by 50% in children less than 5 years of age. When combined with early diagnosis and treatment, it can reduce malaria mortality by over 50%.[8] Despite ownership of nets in Ethiopia has achieved the Roll back Malaria target of at least 60 percent, utilization has not reached yet the targeted level of 80 percent and the use of ITNs remains low compared to ownership.

The Roll Back Malaria (RBM) has identified under-five children as one of the highest risk groups for malaria (in Africa about one out of every twenty children is likely to die of malaria-related illness before their fifth birthday. [9]

According to MIS 2015, In Ethiopia, only 45.3% of children under 5 of age sleep under an ITN the previous night despite the Abuja target of 80%.moreover 69.5% of under 5 children sleep under an ITN in the household which own an ITN.[1]

The MIS 2015 results highlights the sustained levels of ITN ownership in Ethiopia, but ownership and use levels are still both below target levels. There are likely several factors to account for the findings. According to a PMI-supported study in five districts in Jimma Zone, the barriers for use were the shape of the nets, low risk perception due to seasonality of malaria, saving nets for future use, decreased awareness, negligence, and perceived low efficacy of ITNs. In another cross sectional survey, the two factors strongly associated with use of ITNs were knowledge of malaria transmission by mosquito bites and ITNs being washed at least once by households (Berkessa et al. BMC Public Health (2016) 16:106).

However, the largest barrier to ITN use is the insufficient availability of ITNs at the household level compounded by the lack of an ITN distribution tracking system down to the users.[1]

Different studies have analysed the accessibility, availability, ownership and utilization of ITNs by children less than five years of age (Tassew et al. Malar J (2017) 16:262, Hambisa et al., Alemu et al.) However, utilisation of ITNs in the country still remains low yet ownership has improved over the years. At this level, it will not be possible for the country to achieve the national and international targets of ITN utilization unless factors associated with ITN utilisation are identified and improved. This project tries to assess intra-household factors that may be contributing to low utilisation of ITNs by children under five years. The aim of this study is to bridge gaps.

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1.3 Research Questions

1. What is the awareness level towards malaria, mosquitoes and insecticide treated nets?
2. How to advance the utilization of insecticide treated mosquito nets in the prevention and control of malaria?
3. What are the factors that influence LLIN ownership and use among under 5 children?

1.4 Significance of the study

Ethiopia has made considerable effort in the procurement and distribution of ITNs for malaria control. The distribution of ITNs and LLINs has been strong and consistent but discrepancy still exists between ownership and use of mosquito nets. In Ethiopia, The last ITN distribution campaign was conducted in 2015/16 and over 30 million ITNs were distributed to households in malaria risk areas throughout the country Between FY 2007 and FY 2018, PMI procured a total of 30.8 million ITNs, which were distributed to malaria risk communities. Based on MIS 2015, in Oromia, 58% of households in malarious area (<2,000m ASL) owned at least one LLIN. But only 45% of children under 5 years of age slept under

an ITN the night before the survey. This indicates that a lot of emphasis has been given for ownership but less attention has been given to the factors that affect the utilization of ITNs despite low utilisation. Elu Gelan district is one of malaria hot spot area in west shoa zone of Oromia and malaria is a major public health problem in the district and occurred as an outbreak. ITN distribution is 100% but utilization status of the community is not known in the district. The information generated from this study will help planners to explore ways of increasing utilisation of ITNs among children aged under 5 years. Finally, this study will identifying factors affecting use of ITNs/LLINs by children under-five years of age.

2 Objective of the study.

2.1 General Objectives

- To assess the coverage and effective use of insecticide treated mosquito nets and associated factors among under 5 children in Ilu Gelan district, West Shoa Zone, Oromia region, Ethiopia.

2.2 Specific objectives

- To assess Insecticide treated mosquito net use in the district
- To assess awareness level towards malaria, mosquitoes and insecticide treated nets in the district
- To identify factors that influence insecticide treated mosquito net use in the district
- Assess the current condition of mosquito nets already obtained by the households

Literature review

Malaria remains a major threat to some 3.2 billion persons globally. According to the World Health Organization (WHO), 228 million cases of malaria occurred in 2018, leading to 405,000 deaths. Ninety three percent (93%) of these deaths occurred in the Africa region. In Ethiopia 2.3 million cases and 4757 deaths were reported in the same year. Children aged under 5 years are the most vulnerable group affected by malaria. In 2018, they accounted for 67% (272 000) of all malaria deaths worldwide. In the same year (2018), an estimated 11 million pregnant women in sub-Saharan Africa infected with malaria delivered about 872,000 children with low birth weight due to malaria in pregnancy. About 24 million children in the region were estimated to be infected with the *P. falciparum* parasite in 2018; of these, 12 million had moderate anemia and 1.8 million had severe anemia. An estimated 70% of all malaria deaths globally, most of which were in sub-Saharan Africa, were of children aged under 5 years. [10]

Long-lasting insecticidal nets (LLINs) protect against malaria by acting as a physical barrier between mosquitos and humans, and by the insecticide repelling or killing susceptible mosquitoes. An estimated 663 million cases have been averted worldwide between 2000 and 2015, with 68% of them attributed to insecticide-treated nets [11]

Data from household surveys implemented in 21 moderate to high malaria burden countries between 2015 and 2018 showed that, among children aged under 5 years, the prevalence of any anemia was 61%, mild anemia 25%, moderate anemia 33% and severe anemia 3%. When children were categorized by

malaria rapid diagnostic test (RDT) results, overall anemia was higher in children who were positive for malaria than in those who were negative. When anemia prevalence was further classified, of the children who were positive for malaria, 9% had severe anemia, 54% had moderate anemia, 21% had mild anemia and only 17% had no anemia. In contrast, among those children who had no malaria, 1% had severe anemia, 31% had moderate anemia, 28% had mild anemia and 40% had no anemia. [10]

The highest proportion of deaths was averted in the WHO African Region (94%). Of the estimated 6.8 million fewer malaria deaths between 2001 and 2015, about 6.6 million (97%) were for children aged under 5 years.

Long-lasting insecticidal nets (LLINs) have played an important role in reducing the global malaria burden since 2000. [12]. They are a core prevention tool used widely by people at risk of malaria. Part of pillar 1 of the Global Technical Strategy for Malaria 2016–2030 (GTS) is to ensure universal coverage for all people at risk of malaria using effective vector control with either LLINs or the other core prevention tool, indoor residual spraying (IRS). [13] Universal coverage for malaria vector control is defined as universal access to and use of appropriate interventions by populations at risk of malaria. [14]

ITNs take advantage of the indoor feeding (endophagic) and indoor resting (endophilic) behaviors of some *Anopheles* mosquitoes and work by repelling and killing or decreasing the life span of mosquitoes, as well as providing a physical barrier between mosquitoes and users. In Africa, the primary malaria vectors are from the *Anopheles gambiae* complex and the *Anopheles funestus* group which predominantly bite indoors and when people are sleeping. [15] Absence of separate bedrooms, low perception of ITN as the basic preventive strategy of malaria and lack of sufficient ITNs supply affects ITN utilization. The utilization of ITNs has been found to vary with seasons of the year and the acceptability of the nets in terms of size, color, and shape. Demographic characteristics like age, education, size of household, and ethnicity influenced the use of bed nets. [16]

One of the overriding challenges to the successful implementation of LLINs to protect people from malaria is increasing the consistent use of LLINs. A number of household-based surveys across Africa show that up to 50% of LLINs are not used every night, failing to protect people from getting malaria. The MIS showed lack of knowledge about the causes of malaria and the importance of LLINs as the best way for people to protect themselves from malaria. Knowledge about malaria and the importance of sleeping under LLINs is the basis for bringing about behavior change, the next step in the public process of increasing utilization rates of LLINs. [17]

In Ethiopia, the MIS 2015 found that despite 64% of households in malaria-endemic areas owning at least one LLINs, only 40% of the population had slept under an LLIN the night before, while 45% of children under five age and 44% of pregnant women slept under an LLIN the previous night.[89] However, percent of households with at least one LLIN for every two people is very low (32%).[10]

LLINs are an effective tool to significantly reduce morbidity and mortality due to malaria by protecting people from being bitten by infected mosquitoes. Additionally, when coverage rates are high and if a large proportion of human biting by local vectors takes place after people have gone to sleep, LLINs also can have an impact on vector populations. A LLIN has three main functions:

i)When mosquitoes are in contact with the net, it has a knock-down effect, temporarily incapacitating or even killing mosquitoes; ii) It has a repellent effect; and, iii) It reduces contact between the person sleeping under the net and mosquitoes by acting as a physical barrier. LLINs also have an effect on other insects, such as head lice, sand-flies, ticks and other household pests (e.g. bedbugs and cockroaches) .[17]

Although ITNs are effective, local perceptions, acceptance of and use of ITNs as well as use of other mosquito methods are invaluable in malaria control programmes. Perceptions on the use of ITNs and other malaria preventives have been conceptualized based on the Health Belief Model developed by Becker 21. In this model, two main factors influence the likelihood that a person will adopt a recommended preventive action. First, a person must feel susceptible and threatened by the disease, with perceived serious consequences. Secondly the person must believe that the benefits of practicing prevention outweigh the perceived barriers to the preventive action. Therefore, four constructs can be derived from this model: perceived susceptibility, perceived severity, perceived benefits and perceived barriers. [18]

Across a range of transmission settings in Africa, high levels of LLIN use have been shown to reduce malaria related mortality, especially in children under 5 years. To determine the effectiveness of distribution channels, assessments of LLIN ownership are important. However, usage rather than ownership is the crucial indicator for whether distribution will lower the burden of malaria. [19]

Long-lasting insecticidal nets (LLIN) are important preventive measure deployed in Ethiopia along with indoor residual spraying (IRS), environmental management and larval control. With free mosquito net distribution in some countries including Ethiopia, universal coverage might be assumed to be attainable. However, there is large gap both in terms of ownership and utilization particularly in SSA where 90% of

the malaria burden exists. Ownership of LLIN/ITN ranges between 34 and 98.4% of households at risk of malaria in SSA. The utilization trend in the same region has even higher variation although net use is becoming more commonplace with time. Among households which claim to own at least one LLIN/ITN, the utilization rate was found to be from 33.5 to 69% in SSA. In addition, a considerable proportion of the nets in use have been reported to be a poor condition [20]

In Ethiopia experiences have shown that possession and appropriate use of ITNs do not automatically go hand-in hand. Many people who received ITNs did not sleep under them, reduced their efficacy through inappropriate washing practices, or failed. Despite the large scale distribution, there was a wide variation in the availability and use of ITNs /LLINs at the household level. [21]

High ITN coverage in sub-Saharan Africa has been reported; however, discrepancies in ITN use in the region remain problematic.[114]LLIN universal coverage and ownership is slightly higher in urban areas compared to rural areas (66 % versus 63% and 42% versus 30% respectively) in the malarious areas. Households in Amhara and Tigray reported the highest LLIN ownership, with 73 percent of them owning at least one LLIN. However, households in Oromia and reported the ownership, with 58 percent of them owning at least one LLIN. LLIN ownership differed by wealth status, with 73 percent of the households in the fourth quintile owning at least one LLIN, compared to 51 percent in the lowest quintile. [3]

As a consequence of reduced malaria mortality rates, particularly among children aged under 5 years, it is estimated that life expectancy at birth has increased by 1.2 years in the WHO African Region. This increase represents 12% of the total increase in life expectancy of 9.4 years seen in sub-Saharan Africa, from 50.6 years in 2000 to 60 years in 2015. Globally, reductions in malaria mortality have led to an increase in life expectancy of 0.26 years in malaria endemic countries, representing 5% of the overall gain of 5.1 years. [12]

3 Research Methodology

3.1 Study Design: - A community based cross sectional survey study will be employed to assess long-lasting insecticide net utilization and associated factors in Ilu Gelan woreda, west shoa Zone, Oromia.

3.2 Study area & period: - The study will be conducted in Elu Gelan District from April 1/2020 to May 30/ 2020. Elu Gelan district established as an independent district in 1999 E.C and it is one of the 22 districts in West Shoa Zone of Oromia regional state. It is 90 KM away from Ambo, the capital of West shoa zone, and 205 KM from Addis Ababa, the capital city of Ethiopia. It is bordered by Caliya in the

East, Bako Tibe in the west and Dano in the south. The woreda has a total population of 86,006 of and. (43,863 are male and 42,143 female) and 14,131 and 71,875 accounts for under 5 and above 5 age group respectively. The woreda divided in to 3 cluster and 18 Kebles. Concerning health care service, there are 3 health center and 18 health posts. Conducted from

3.3 Scope of the study: The study covers the assessment of the utilization of long lasting Insecticide Treated Nets as a preventive tool against malaria and associated factors.

3.4 Population: - The woreda total number of population and households are 86,006 and 17,918 respectively.

3.5 Source population: - The source population will be total households in Ilu Gelan woreda.

3.6 The study population: - Households which are going to be selected and included in the study during the sampling procedure

3.7 Sampling technique: - By using systematic sampling technique the households will be selected from each malarious kebele to identify the study subjects. Assigning of the households from each kebele will be done by using proportional allocation to the size of the households of each selected kebeles. Sampling interval will be determined by dividing the total number of households in each kebele by the corresponding number of households to be interviewed in each kebele. The first household will be selected randomly then the next household will be selected systematically based on the sampling intervals.

3.8 Sample Size determination: - The sample size is calculated by using the standard sample size calculation formula using one sample proportion. Taking the recent findings of 59.2% utilization of LLIN by under-five children in Limu Seka District of south west Ethiopia[8], the confidence interval will be 95% ($\alpha=0.05$), the marginal error of the study will be 5 % ($e=.05$) and 10% non-response rate will be added. Based on the above assumptions the minimum sample size required for the study will be $n = (z\alpha/2)^2 \times p \times q / e^2$
 $n = \frac{1.96 \times 1.96 \times 0.592 \times 0.408}{0.05^2} = 371$

$$0.05 \times 0.05$$

by adding 10% non-response rate, the final sample size will be $371 + 37 (371 \times 0.1) = 408$ households

3.9 Development of tools and instruments

3.9.1 Questionnaire development: - after reviewing different literatures on LLIN, a structured questionnaire (Annex 4) developed based on the objectives of the study and local situation of the study area. The structured questionnaires prepared in English and will translate in to Oromic language and then

back translated to English. Before starting filling questionnaire their willingness will be asked using consent form (Annex 3). The structured questionnaire will include questions related to socio-demographic and economic characteristics, knowledge questions related to malaria, mosquito, and mosquito nets and also questions related to bed net use. Before the actual data collection process starts, the structured questionnaire will be pretested on similar population using 5% of the sample size by involving the data collectors, supervisors and the principal investigator, after pretesting if any ambiguity or difficulty occurs, related to data collector or questionnaire, any modification and correction measures will be given before the actual data collection process will be carried out.

3.9.2 Data collection procedures: - for data collection either grade 10 completed, grade 12 completed or above will be recruited. They will be residences of the study area and who know the local culture and belief of the community. Data collectors will be oriented by the principal investigator. The orientation will include discussing about the objective, significance of the study, and how to administer the questionnaires. For supervisor either BSc or diploma graduate health professionals will be selected. And they will orient on the objective of the study, the relevance of the study and how to supervise the data collectors. The supervisor together with the principal investigator will supervise data collection process. Completed questionnaires will be collected every day after checking for possible inconsistencies, errors and omissions. Questionnaire formats with problems will return back to interviewers for re-interview. The principal investigator will responsible for overall coordination of data collection process.

3.10 Data analysis: - Data will be entered, cleaned and analyzed using Epi-info software version 7.2.2.6 and SPSS V 20 and displayed using tables and figures.

3.11 Data quality measures: - To control the quality of the data, before the actual data collection procedure starts, pretesting will be carried out in the study area and thorough discussion, will be done with the data collectors and supervisors about the overall procedures that will be carried out. The principal investigator will check all of the questionnaires filled by the data collectors daily whether it is filled correctly or not. Five percent of the completed questionnaire will be re-interviewed again by the principal investigator to check the validity of the collected data. Every day at the field, data will be checked for completeness and consistency by supervisors. If there is any mistake made by data collector while filling the questionnaires. The data collector will be send back to the household to fill the questionnaire again.

3.12 Operational definitions.

Bed net: Any mosquito nets used for sleeping either treated or untreated with insecticide.

Household: A domestic unit consisting of the numbers of a family who lives together along with non-relatives such as servants.

Net ownership: Households owning at least one mosquito net of any type in their house

ITN: Either a long-lasting net that does not require re-treatment or a pre-treated net obtained within the last 12 months inclusive, or a net that has been soaked with insecticide within the last 12 months inclusive.

ITN use: Household members (especially children under five and pregnant mothers) Sleeping under the hanging ITN the night before the survey.

Household ITN ownership: Households having at least one ITN in their house.

Variables

Dependent variables; - ITN ownership, ITN utilization.

Independent variables:-Socio demographic characteristics, such as

- Residence,
- Age,
- Religion,
- Education,
- Sex,
- Marital Status,
- Occupation ,
- Monthly Income,
- Ownership of Radio,
- Knowledge About Mosquitoes,
- Knowledge About ITN And Malaria ,
- Housing Condition ,
- Attitude Towards Use Of Nets ,
- Family Size ,
- Condition of Nets ,
- Treatment Status and Sleeping Arrangement.

3.14 Ethical Consideration: The ethical approval and clearance will be obtained from Medical Faculty of Addis Ababa University ethical committee. Permission will be also obtained from the concerned bodies of Oromia Regional State Health Bureau, West Shoa Zonal Health Department and Ilu Gelan woreda Health Office. The data collectors will be oriented to provide proper advice for the respondents regarding any malpractice they have come across. Similar information provision will be done by the principal investigator for the participants of the focus group discussions. Interview will be carried out only with full consent of the person being interviewed. Before each interview, clear explanation will be given about the aim of the study will not neither to evaluate the performance of the individual nor to blame anyone for weakness but to gather information and opinions that may lead to eventual improvement in the utilization of ITN. Each respondent will assured that the information provided by them would be confidential and used only for the purpose of research.

3.15 Dissemination of findings: Results will be submitted to AAU Department of public Health and presented orally. To help in future interventions the result will be communicated to governmental and nongovernmental bodies. These include the Ilu Gelan Woreda Health Office, west shoa Zonal Health Department, Oromia regional health bureau, Federal Ministry of Health (FMoH), WHO country office, United Nation Children’s Fund (UNICEF), The Carter Center (TCC) and others. One day conference will arranged at district level to present the study results. In addition effort will be exerted to publish the paper and disseminate it via presentation on different national and international conferences.

3.16 Expected outcomes: No of households owned ITNs, source of ITNs; (Free, subsidized or cash base) Proportion of households uses ITN, under 5 age children slept under ITN in the previous night, pregnant women slept under ITN in the previous night and how is the perception of the community towards ITN for malaria prevention.

Reference

- [1] U. S. President and M. Initiative, “PRESIDENT ’ S MALARIA INITIATIVE ETHIOPIA,” 2019.
- [2] K. T. Id, M. Yohannes, F. Mardu, and B. Berhe, “Assessment of community knowledge, practice, and determinants of malaria case households in the rural area of Raya Azebo,” pp. 1–14, 2019.
- [3] M. Indicator, “No Title.”
- [4] I. Kleinschmidt et al., “Implications of insecticide resistance for malaria vector control with long-lasting insecticidal nets : a WHO-coordinated, prospective, international, observational cohort study,” vol. 18, no. June, 2018, doi: 10.1016/S1473-3099(18)30172-5.
- [5] H. Koenker and A. Kilian, “Recalculating the Net Use Gap : A Multi-Country Comparison of ITN Use versus ITN Access,” vol. 9, no. 5, pp. 1–7, 2014, doi: 10.1371/journal.pone.0097496.
- [6] K. D. Konlan, M. Japiong, K. D. Konlan, A. Afaya, S. M. Salia, and J. M. Kombat, “Utilization of Insecticide Treated Bed Nets (ITNs) among Caregivers of Children under Five Years in the Ho Municipality,” vol. 2019, 2019.
- [7] I. M. Quive, B. Candrinho, and D. Geelhoed, “Household survey of availability of long-lasting insecticide-treated nets and its determinants in rural Mozambique,” *Malar. J.*, pp. 1–5, 2015, doi: 10.1186/s12936-015-0811-3.
- [8] M. T. Hambisa, T. Debela, Y. Dessie, and T. Gobena, “Long lasting insecticidal net use and its associated factors in Limmu Seka District,” no. December, 2018, doi: 10.1186/s12889-018-5022-8.
- [9] S. Biadgilign, A. Reda, and H. Kedir, “Determinants of Ownership and Utilization of Insecticide-Treated Bed Nets for Malaria Control in Eastern Ethiopia,” vol. 2012, 2012, doi: 10.1155/2012/235015.
- [10] World malaria report 2019.
- [11] M. M. Janko, T. S. Churcher, M. E. Emch, and S. R. Meshnick, “Strengthening long-lasting insecticidal nets effectiveness monitoring using retrospective analysis of cross-sectional , population-based surveys across sub-Saharan Africa,” *Sci. Rep.*, no. July, pp. 1–9, 2018, doi: 10.1038/s41598-018-35353-z.
- [12] World malaria report 2016. .
- [13] “Global technical strategy for malaria 2016–2030,” 2016.
- [14] G. T. Strategy, “Achieving and maintaining universal coverage with long-lasting insecticidal nets for malaria control,” no. December, 2017.

- [15] L. C. Steinhardt et al., “Effectiveness of insecticide-treated bednets in malaria prevention in Haiti : a case-control study,” pp. 96–103, 1996, doi: 10.1016/S2214-109X(16)30238-8.
- [16] M. B. Alemu, M. A. Asnake, M. Y. Lemma, and M. F. Melak, “Utilization of insecticide treated bed net and associated factors among households of Kola Diba town , North Gondar , Amhara region , Ethiopia,” *BMC Res. Notes*, pp. 1–5, 2018, doi: 10.1186/s13104-018-3697-7.
- [17] T. Edition and A. Ababa, “Third Edition,” no. January, 2012.
- [18] C. Um et al., “Perceptions on the Use of Insecticide Treated Nets in Parts of the Imo River Basin, Nigeria : Implications for Preventing Malaria in Pregnancy,” vol. 14, no. 1, pp. 117–128.
- [19] D. Smet et al., “Long-lasting insecticide-treated net usage in eastern Sierra Leone - the success of free distribution. Authors Long-lasting insecticide – treated net usage in eastern Sierra Leone – the success of free distribution,” 2020, doi: 10.1111/j.1365-3156.2010.02478.x.
- [20] A. Tassew, R. Hopkins, and W. Deressa, “Factors influencing the ownership and utilization of long - lasting insecticidal nets for malaria prevention in Ethiopia,” *Malar. J.*, pp. 1–9, 2017, doi: 10.1186/s12936-017-1907-8.
- [21] A. S. Ragasa, L. T. Wodajo, and H. F. Demissie, “Proper utilization of long lasting treated net and associated factors at Zuway Dugda district , Arsi zone , Ethiopia,” vol. 11, no. January, pp. 13–24, 2019, doi: 10.5897/JPHE2018.1067.
- [22] O. Nkoka, T. W. Chuang, K. Y. Chuang, and Y. H. Chen, “Factors associated with insecticide - treated net usage among women of childbearing age in Malawi : a multilevel analysis,” *Malar. J.*, pp. 1–16, 2018, doi: 10.1186/s12936-018-2522-z.
- [23] Abay Woday, Ahmed Mohammed, Abel Gebre, Kussie Urmalie. Prevalence and Associated Factors of Malaria Mong Febrile Children in Afar Region, Ethiopia: A Health Facility Based Study. *Ethiop J Health Sci.*2017;29 (5):613.doi:http://dx.doi.org/ 10.4314/ejhs.v29i5.12.
- [24] Eshetu Molla and Basha Ayele; Prevalence of Malaria and Associated Factors in Dilla Town and the Surrounding Rural Areas, Gedeo Zone, Southern Ethiopia;2015.
- [25] World malaria report 2019. Geneva: World Health Organization; 2019

Work plan

Activity	Responsible person	Time										
		March	April	May	June	July	August	September	October	November	December	
proposal development	principal investigator	■	■	■	■							
Proposal defence	principal investigator					■						
Proposal submission	principal investigator					■						
Obtaining ethical clearance	AAU					■						
Recruitment and training of data collector	principal investigator						■					
Pre-testing	principal investigator						■					
Data collection	principal investigator						■	■				
Data entry, Data analysis and clearance	principal investigator							■				
Submission of preliminary report	principal investigator								■			
Submission of final report	principal investigator									■		
Thesis defence and submission	principal investigator										■	
Mock defence (self-preparation)	principal investigator											■
Final defence	principal investigator											■

Table 52: Gantt chart showing the work plan of the study on assessment of LLITN Utilization among under five children in Elu Gelan district in 2020.

7. Budget break down

7.1 Personnel

Budget break down and human capital needed for data collection

Category	Number of persons	Number of days	Per-diem (unit cost in ETB)	Total cost in ETB
Training of data collectors, coordinator and supervisor	2	6	300	2,520
Data collectors	10	6	300	1,2600
coordinator	1	6	300	1,260
Field supervisor	1	6	300	1,260
Data Entry clerk	1	6	300	1,260
Total	15	6	300	18,900

Table 53: Budget break down and human capital needed for data collection

7.2. Supplies □

category	unit	quantity	unit cost in ETB	Total cost in birr
Copy questionnaires	Page	12*422	1.50	7596
Pen	Pcs	10	8	80
Pencils	Pcs	10	3	30
Notebooks	Pcs	10	15	150
Eraser	Pcs	10	5	50
Binder	Pcs	10	60	600
Total				8506

Table 54: Cost of supplies for assessment of LLITN utilization among under five children and associated factors in Elu Gelan district in 2020.

7.3. Summary of Budget Break Down

Category	Amount in birr
Cost Of Supplies	8,506
Payment/Per-Diem	18,900

Total	27,406
Contingency (5%)	$27,406 * 5 / 100 = 1,370.30$
Grand total □□□□□□□□	28,776.30 □□□□□□□□

Table 55; summary of budget breakdown.

Chapter Nine: other additional output reports

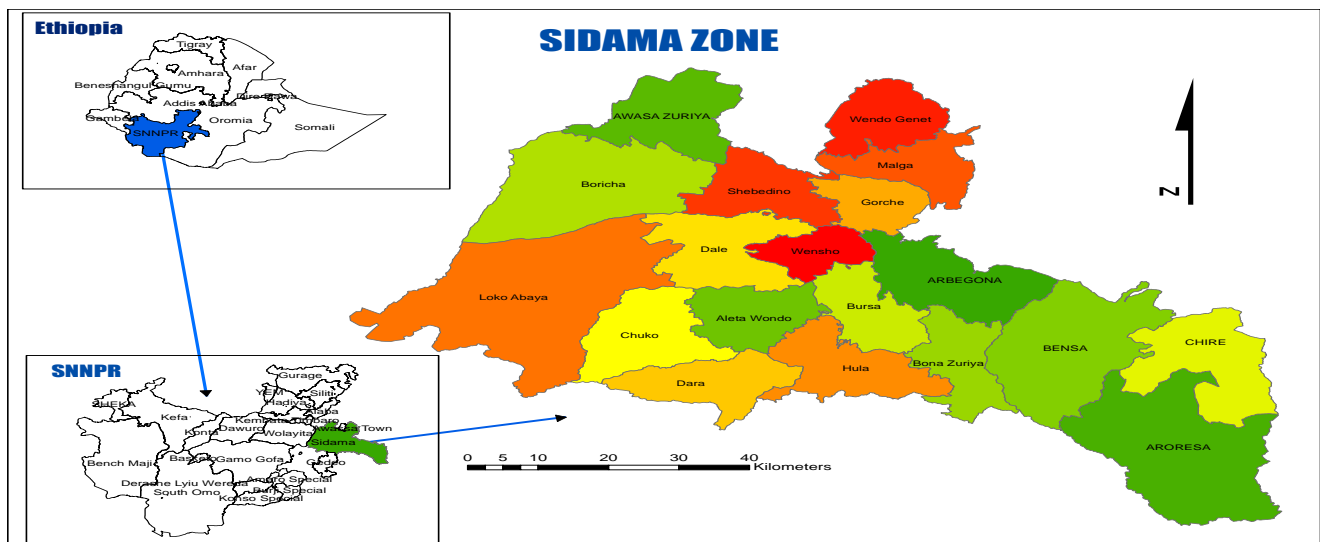
9.1. Bulletin of weekly surveillance report at Sidama Zone Health Department, Public health emergency management, 2019

Epidemiologic Week 11, 2019

Background

Sidama is one of the 15 zones in SNNPR located in the north eastern part of the region. The zone covers the total area of about 698.8 Km² and it consists 19 woreda and 4 administrative towns. It is one of the most densely populated in the region with population density of 451.83 per square Km. According to the 2007 the Ethiopian central statistical agency (CSA) census the population estimate for the year 2018/2019 is 4,270,356 from which 2,126,637 (49.8%) are male and 2,143,719 (50.2 %) are females.

Figure 45; Map of Sidama Zone in SNNPR, Ethiopia, 2019



Highlight of the week

- Week surveillance report completeness and timeliness were 96% and 100% respectively.
- Confirmed Malaria case were increased by 8 as compared to week 10
- Malnutrition have been increasing since week 5
- 3 in patient malnutrition deaths (2 in week 3 and 1 in week 11) were reported from Leku Hospital (Shebedino Woreda).

I. Introduction

This bulletin serves to summarize weekly surveillance data and performance of Sidama zone health department PHEM on epidemic prone diseases and other public health emergencies. It comprises completeness, timeliness, trends of priority diseases and response activities. It also provides feedback on surveillance activities for WHO week 11, 2019. (Table 60)

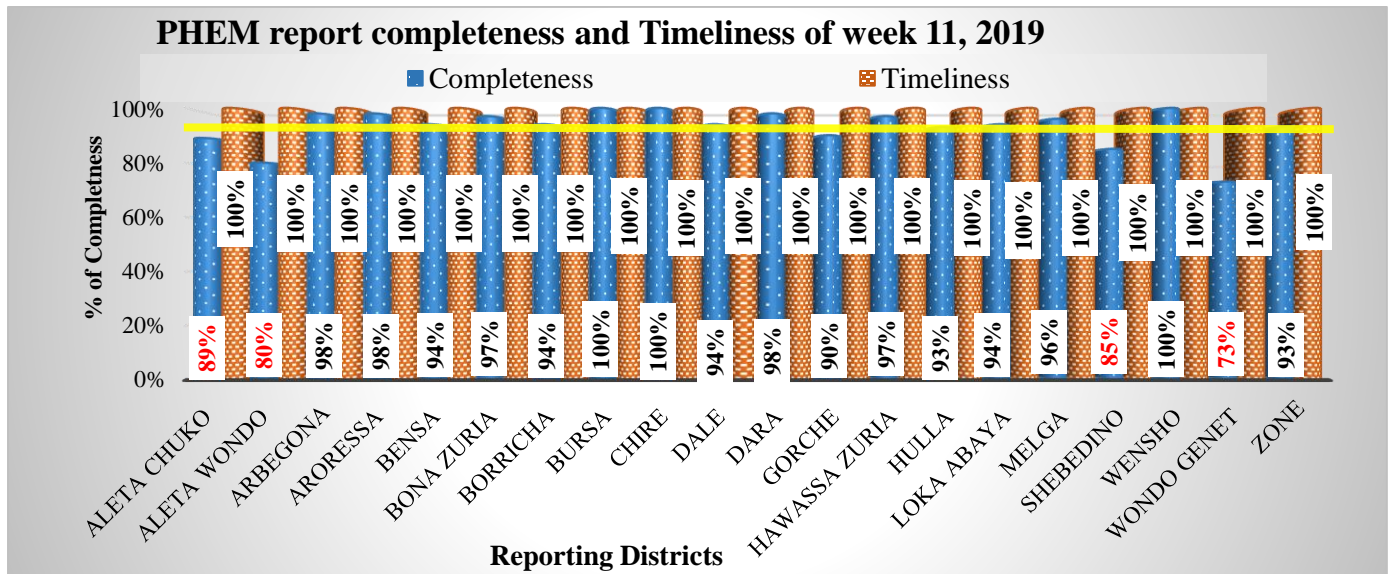
Table 56; Key indicators/ diseases/ conditions reported in week 11, March, 2019

Indicators	Week 11 reported
Total suspected malaria cases	1,328
Confirmed malaria cases	41 (PF=15, PV = 26)
Dysentery	165
Typhoid Fever	543
Typhus	258
Sum of Severe acute malnutrition (SAM)	125 (115 from OTP and 10 from SC)
Report Completeness	96%
Report Timeliness	100%
The rest of weekly surveillance data	0

II. Weekly surveillance report Completeness and Timeliness

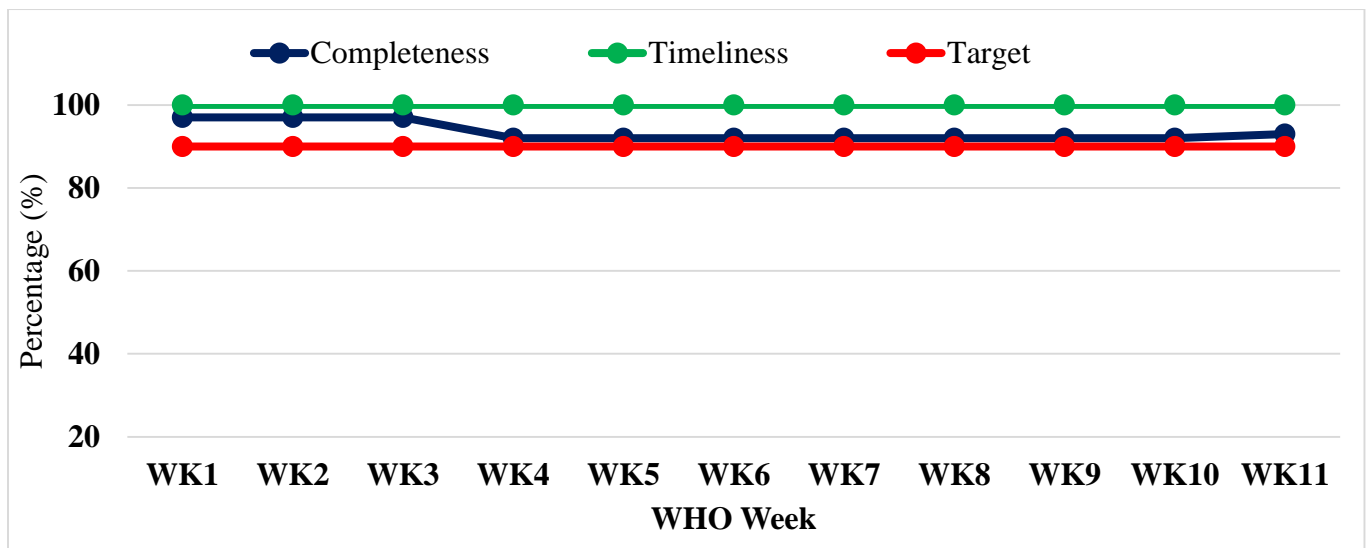
Weekly surveillance report in Sidama zone was expected from all private and public health facilities. From 717 expected health facilities in the zone, 687 of them submitted their week 11 weekly surveillance report despite their completeness. The cumulative surveillance report completeness and timeliness of the zone was 96% and 100% respectively. Four district (Aleta Wondo, Wondo Genet, Aleta Chuko and Shebedino) report completeness was below the target (<90%) but the rest of all districts report completeness were maintained above the target (>90%) in this week. (Figure 42)

Figure 46; Week 11 PHEM report completeness and timeliness by district in Sidama zone of SNNPR, 2019



Zonal report completeness and timeliness of the past eleven consecutive weeks were above the target.

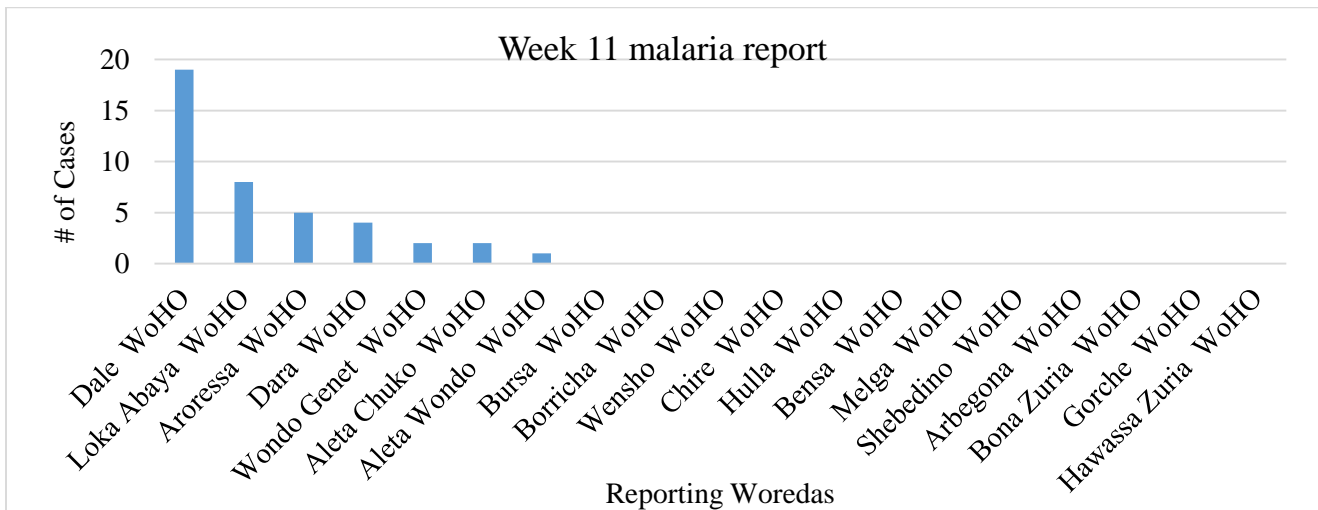
Figure 47; Trends of Zonal surveillance report completeness and Timeliness of 11 Consecutive weeks (WHO week 1-11) 2019



1. Malaria

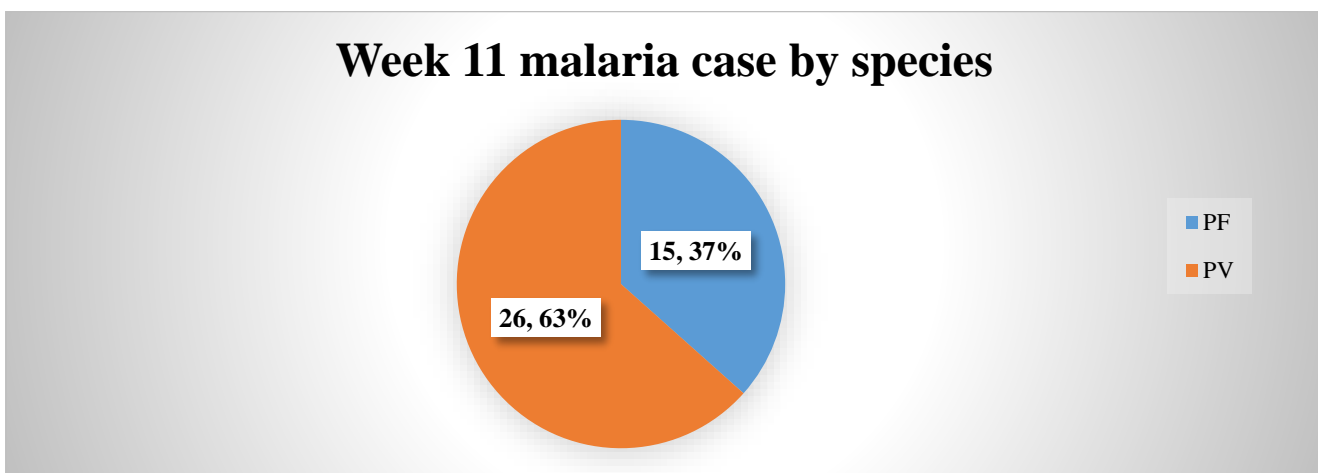
In this week a total of 1,328 febrile cases were laboratory tested, yielding a positivity rate of 3.1% (41) this week. From this 37% (15) were *P. falciparum* and 63% (26) were *P. vivax*. In general all (41) confirmed cases with zero deaths were reported from outpatient department.

Figure 48; week 11 malaria cases report by district, in Sidama zone, SNNPR Ethiopia, 2019



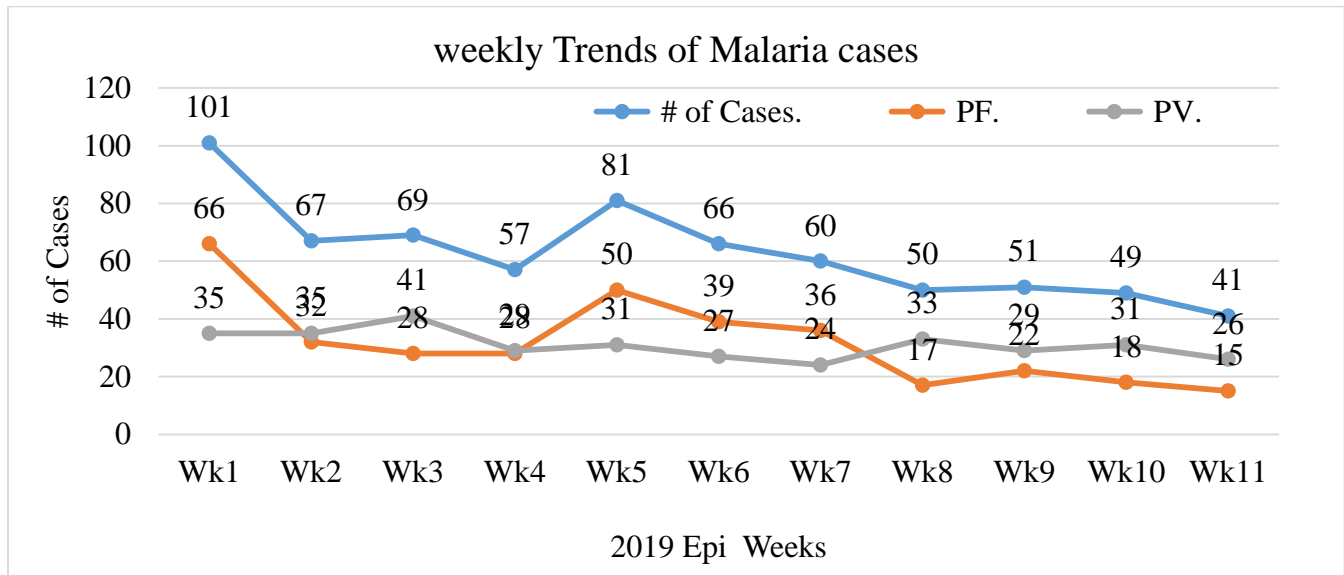
As it shown from figure 42. Dale woreda (19), Loka Abaya Woreda (8) and Aroressa Town (5) reported the highest case. These 3 woreda contributed to about 78% of the total malaria cases reported to zone in this week.

Figure 49; Week 11 malaria case report by species in Sidama zone, SNNPR Ethiopia, 2019



Zonally the malaria cases during the week is decreased by 8 cases compared to the total malaria cases reported in the previous week 49 (41 total malaria cases of this week).

Figure 50; Trend of Malaria cases over the last 11 weeks (1-11 week) in Sidama zone of SNNPR, 2019



As it was shown in the above figure, Malaria has been decreasing especially from week five to this week

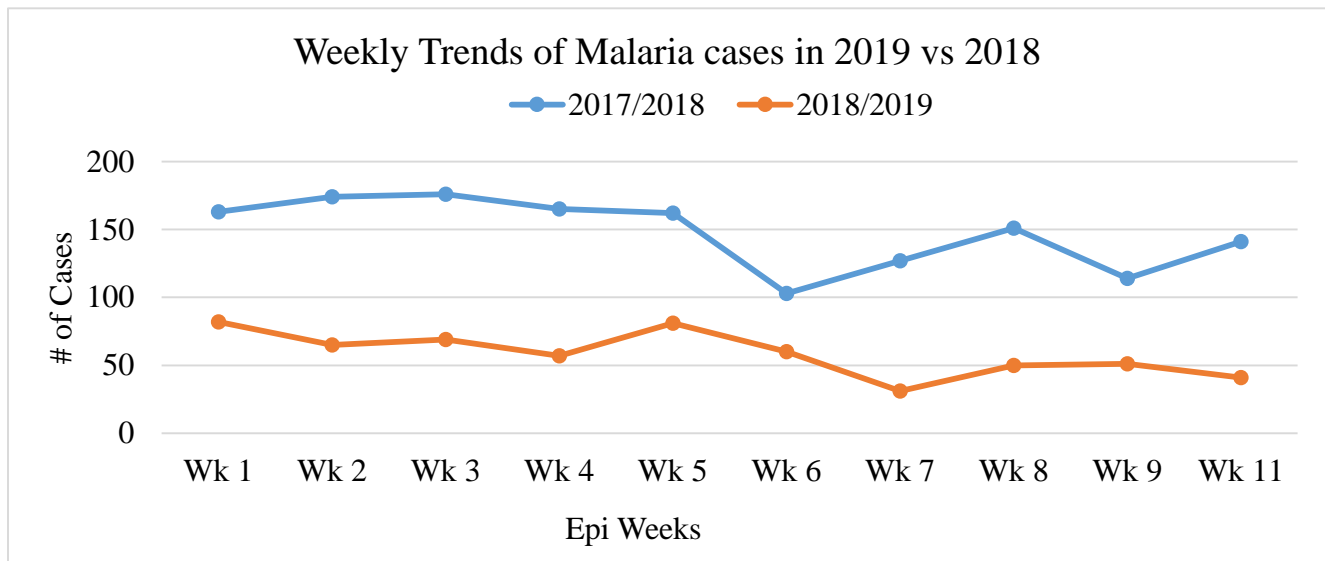


Figure 51; Trend of Malaria cases by epidemiologic week in Sidama zone of SNNPR, 2019.

From the above figure, we can see that, Malaria case was consistently decreased from the same period of last year and within this year from week five to this week (Wk. 11).

2. Dysentery

There were a total of 165 dysentery cases reported in this week of which all were out patient cases. Boricha Woreda reported the highest number of cases (47), followed by Dale (26), Aleta Chuko (14) and Wonsho (12). These 4 woreda contributes about 60% of dysentery cases reported to the zone in this week. There were 28 case increment in this week from the previous.

When we compare Dysentery cases of 11 weeks of 2019 with that of 2018, it was decreased but in this year it was consistently increased especially from week 6 to this week (Wk.11) (figure 6)

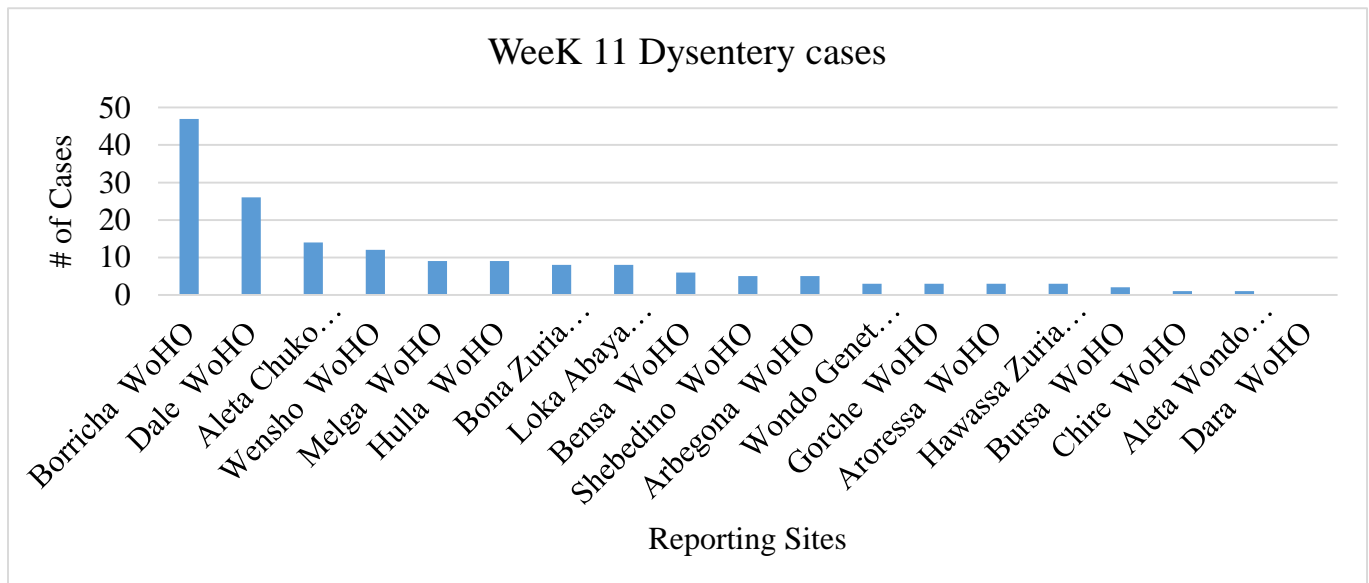


Figure 52; Week 11 Dysentery case by reporting sites in Sidama zone of SNNPR, 2019.

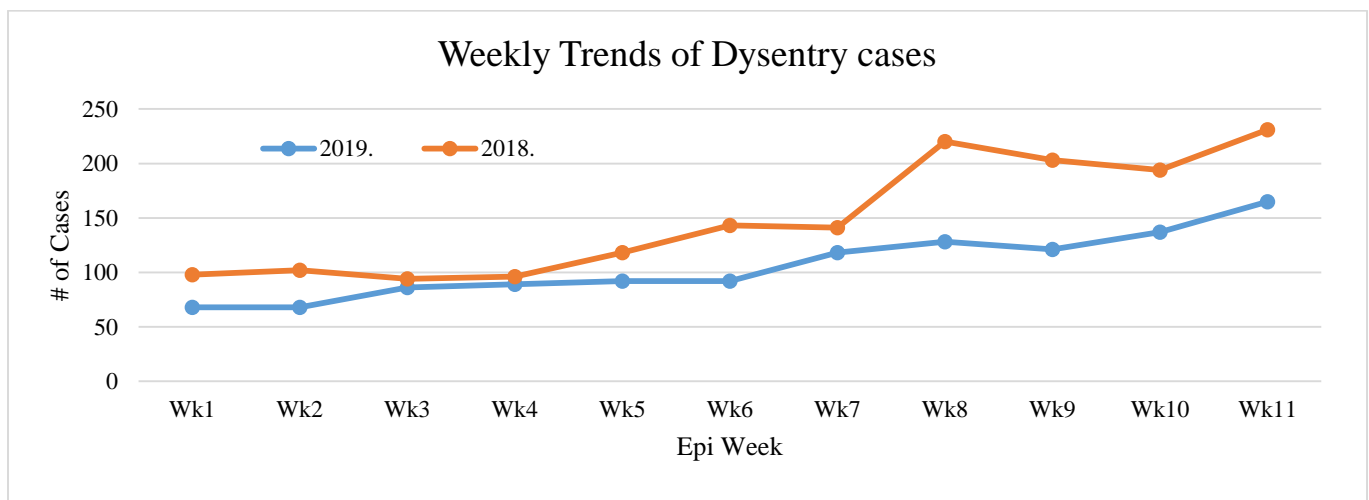


Figure 53; Trends of Dysentery cases over the last 11 weeks in Sidama zone of SNNPR, 2019.

3. Typhoid Fever

A total of 543 typhoid fever cases were reported to the zone in this week from which 4 were in patient and 539 were out patient.

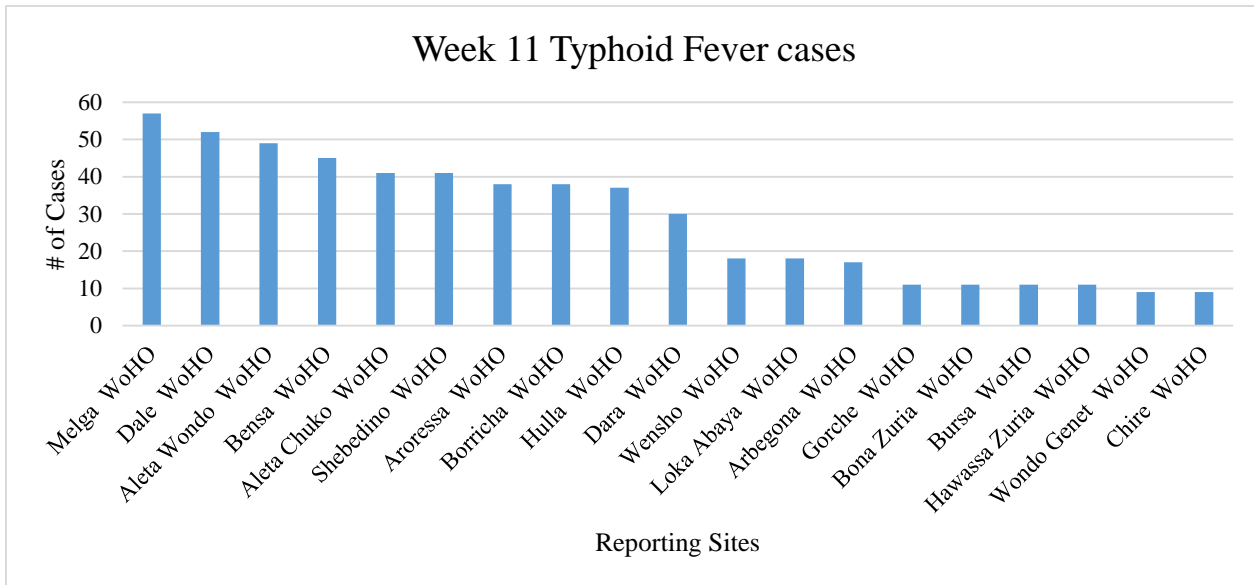


Figure 54; Week 11 Typhoid Fever cases by reporting sites in Sidama zone of SNNPR, 2019.

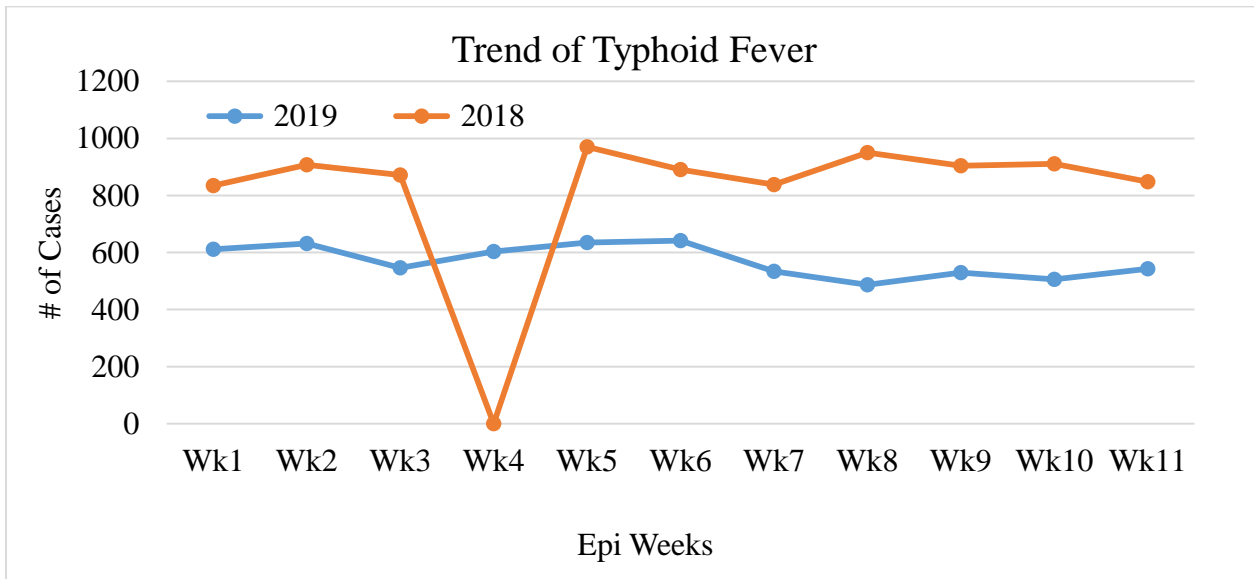


Figure 55; Trend of Typhoid Fever cases over 11 weeks in Sidama zone of SNNPR, 2019.

5. Epidemic Typhus

A total of 258 cases of epidemic typhus were reported in this week from which 257 were out patient and 1 was in patient. Melga woreda reported the highest number (85) followed by Aleta Wondo woreda (45), Borricha Woreda (25) and Aleta Wondo Woreda (24). Zonally the total number of cases are increased by 63 cases from the previous week total cases of 150.

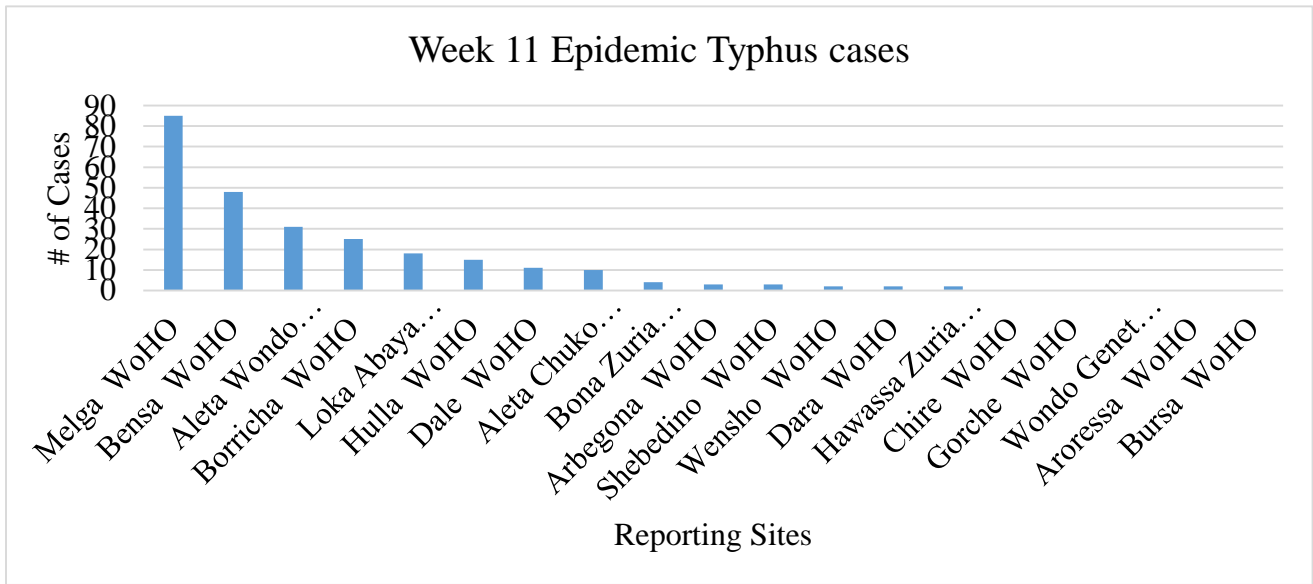


Figure 56; Week 11 Epidemic Typhus cases by reporting sites in Sidama zone of SNNPR,2019.

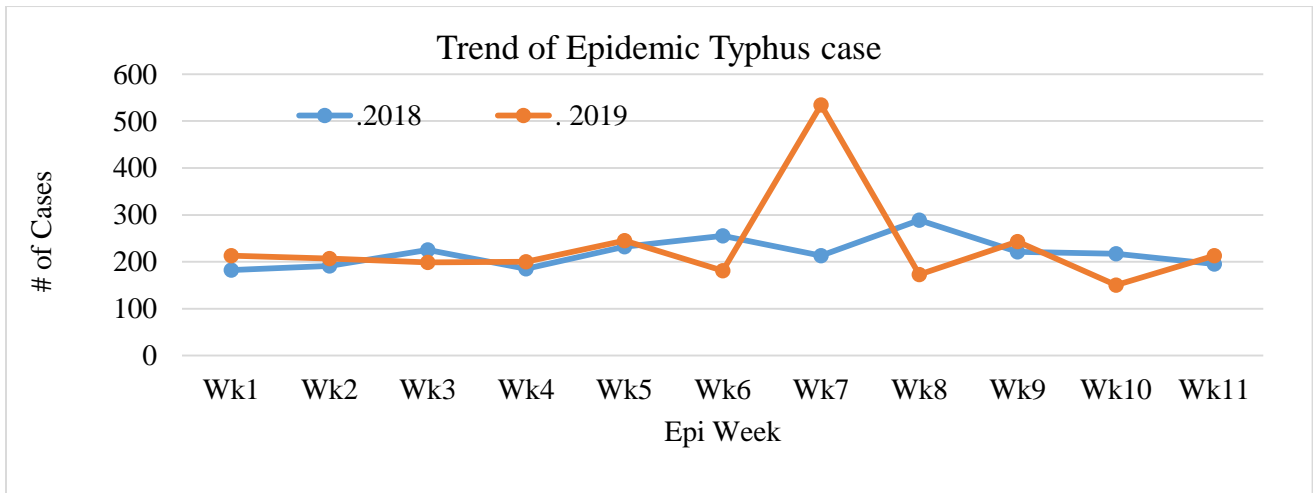


Figure 57; Trend of Epidemic Typhus over 11 weeks in Sidama zone of SNNPR, 2019

6. Sever Acute Malnutrition

A total of 125 sever acute malnutrition (SAM) cases were reported to Zone in this week from which 115 cases were out patient (from OTP program) and 10 cases were inpatient cases (from stabilization center). There was one (1) in patient death of SAM reported in this week from Shebedino woreda. Bensa Woreda 18, Aroresa Woreda 16 and Aleta Chuko Woreda 10 reported the highest cases to the zone in this week. Malnutrition remain a public health problem in the zone. As we compare SAM data of 2019 versus 2018 it shows some progress but it has been increasing from week to week (Figure 55). In week 3 two death (2) and this week (week 11) one (1) death, totally three (3) deaths from severe acute malnutrition were reported to the zone in this eleven week of 2019.

Zonally, severe acute malnutrition shows some increment from week 8 to week 10. The total SAM cases increased by 13 cases as compared to previous week.

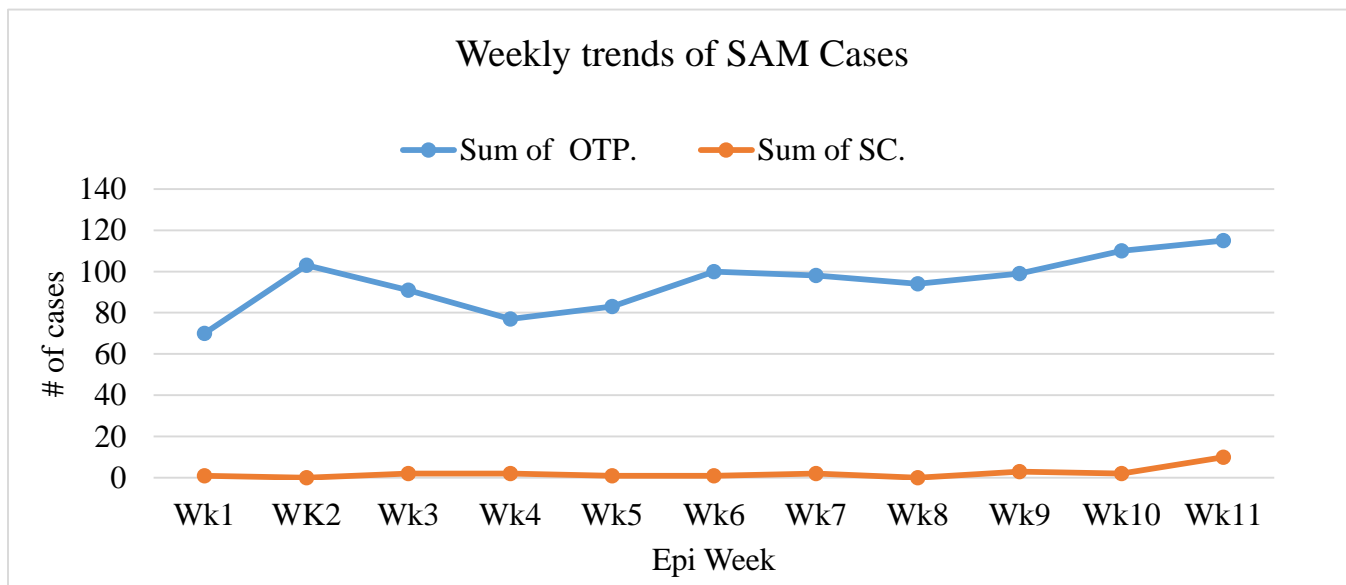


Figure 58; Trend of SAM cases over 11 weeks by type of service in Sidama zone of SNNPR, 2019

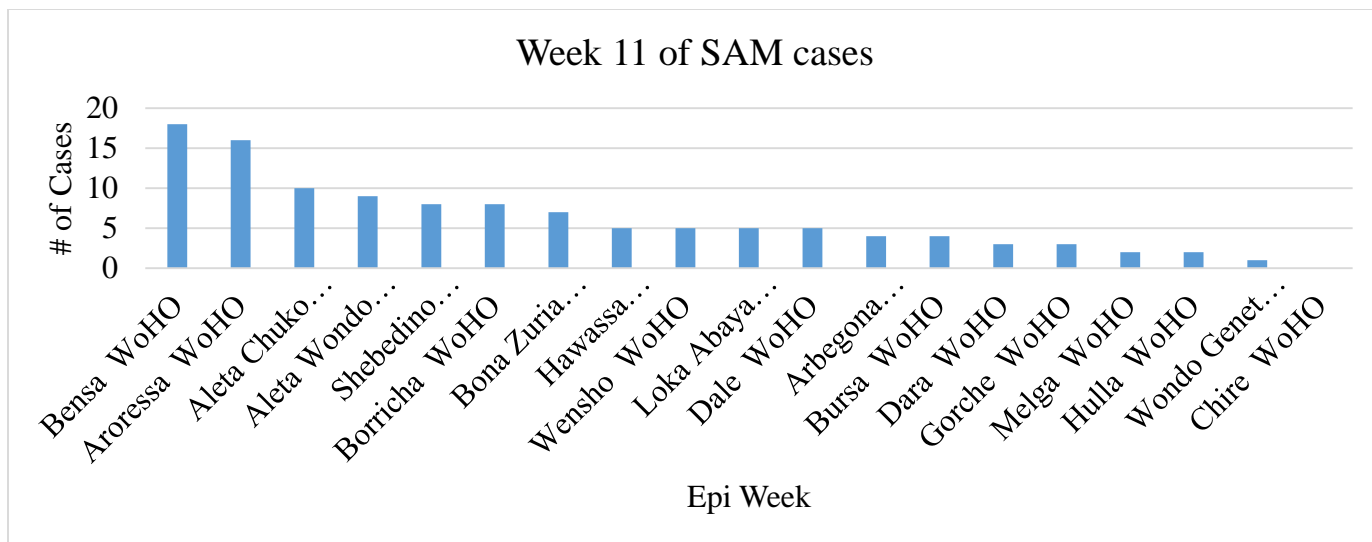


Figure 59; Week 11 SAM cases by reporting sites in Sidama zone of SNNPR, 2019

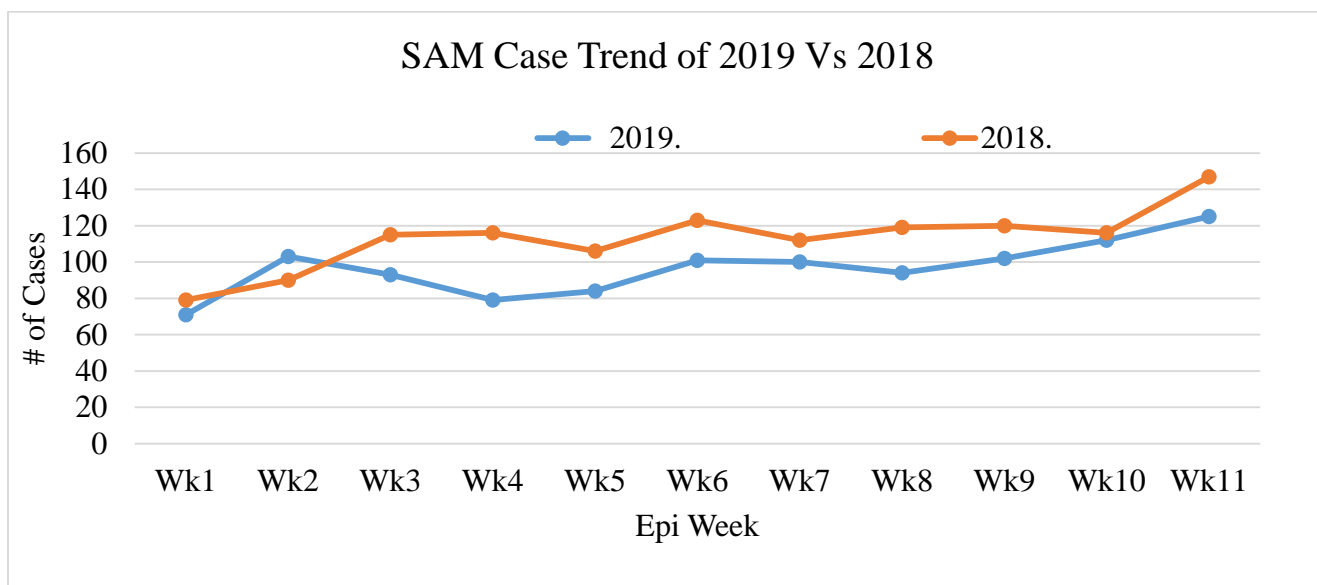


Figure 60; Trend of SAM cases over 11 weeks in 2018 and 2019 in Sidama zone of SNNPR, 2019

7. Other surveillance report

No cases of Meningitis, Measles, AFP, Maternal death, NNT, Rabies, Yellow fever, AWD, AHI, guinea worm, anthrax and other weekly reportable diseases were reported in the Zone in this reporting week.

9.2. Cholera outbreak surveillance in N/lafto S/city of Addis Ababa, Ethiopia, 2019

Highlights of activities performed during outbreak response.

Introduction

Ethiopian public health institute deployed field epidemiology residents following cholera outbreak in some parts of Addis Ababa City. It was conducted from 25 May to July 5, 2019.

Cholera is preventable and treatable acute diarrhoeal disease caused by infection of the intestine with the bacterium *Vibrio cholerae*, either serogroup O1 or O139. Cholera is usually transmitted through consumption of water or food contaminated by faeces bearing the cholera organism. Cholera prevention and control is a multi-sectorial responsibility that requires many sectors. The Ministry of Health is responsible for coordination of prevention, preparedness and response to cholera outbreaks.

The pillars of cholera prevention and control are WASH promotion, surveillance and case management.

Oral Cholera Vaccine (OCV) has been introduced as a complementary intervention to prevent and control cholera specifically in “Cholera hotspots

General Objective

This cholera outbreak response activities is performed

- To control the outbreak
- To identify the risk factor
- To identify the risk areas
- To prevent further expansion

Surveillance activities performed in N/ Lafto Sub city

- Document 12 suspected cases on the Line list.
- Contact tracing was conducted for 8 suspected cases.
- House hold disinfection was performed for 8 suspected cases.
- Water Treatment chemical was distributed for 8 households.
- Active case search was conducted daily.
- Environmental assessment was conducted and risk areas were identified in all woredas

- Water sources were identified and inspected (Tape water, spring and well).
- Water sample was taken from spring in woreda 3 ketene 1.
- Document suspected cases on GPS with their residency.
- WTC was distributed for all risk group of population in the Sub City.
- Conduct RRT meeting.
- Awareness creation was given for more than 20 Household who have contact with suspected cases

Environmental assessment activities

S/N	Name of Woredas	Name of Ketena	# of Holy water				# of spring	remark
			Tape water	Spring	well	Total		
1	Woreda 1	Ketena 6	1	0	1	2		
2	Woreda 2	Ketena 3	0	1	0	1		
3	Woreda 3	Ketena 1	0	1	0	1	1, (Ketena 1)	
4	Woreda 4	Ketena 4 \$ 5	0	2	0	2		
5	Woreda 5	Ketena 1	0	0	1	1		
6	Woreda 6	Kebele 43 \$ 53	1	1	0	2		
7	Woreda 7							
8	Woreda 8	Ketena 4 \$ 3	0	2	0	2		
9	Woreda 9	Ketena 4 \$ 5	2	0	1	3		
10	Woreda 10	Ketena 4	0	0	1	1		
11	Woreda 11	Ketena 2	0	1	0	1		
12	Woreda 12	Ketena 1, 4,5 \$ 6	1	0	3	4		

Identified risk areas in Woreda 3 Ketena 1



Identified risk areas in woreda 5 ketene 4 and 2



5 people in the HH used this toilet (Latitude =8.97658, Longitude= 38.74559)



30 people or 9 HH were used this toilet but now they have no toilet they defecate on bed pan and dispose in the ditch (Latitude = 8.97893, Longitude= 38.74317)



Already filled toilet but used by 20 people or 5 HH. (Latitude = 8.97690, Longitude= 38.74568)

Risk area identified in woreda 1, locally called Dula Mariam



This is spring water used for drinking and other purpose.

Unprotected spring water used for drinking and cooking



Risk area identified in Woreda 6 Gofa Camp, locally called Xolay Sefer.



Leakage of Pipe water in the camp for more than a week.

Over flow of toilet to the place where children used to play.

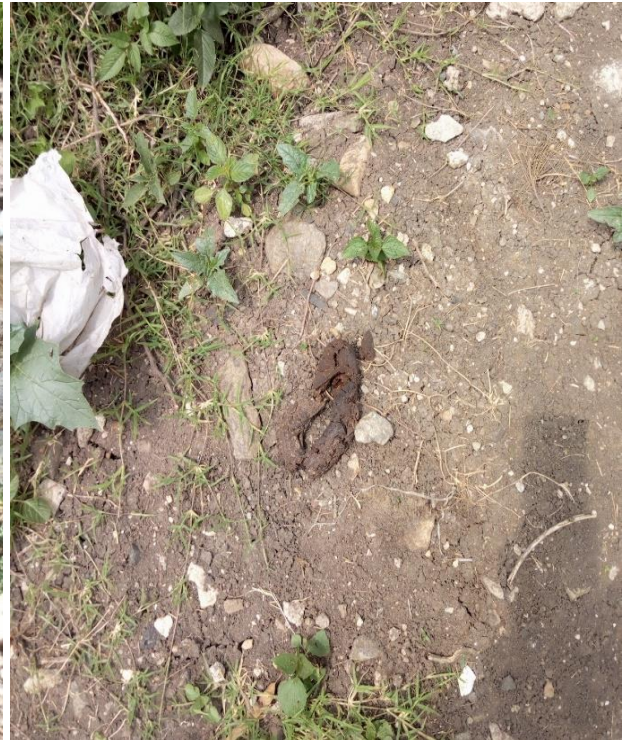


Risk area identified in Woreda 6 locally called Ihil Aderash Sefer

This is not a river it is stream of feces from condominium at the back of Ihil Aderash



Risk area identified



Cholera outbreak sensitization given for stakeholders in N/Lafto S/C



Challenges

- Irregular RRT meeting.
- Lack of coordination with stakeholders.
- Skill gap of Health worker to identify suspected cases.
- Some suspected cases were not voluntary to disinfect their house.
- Many Household do not have toilet in the sub-city.
- There was open defecation in some areas of the sub-city
- Some ORP are not well organized.
- Irregular Taskforce meeting
- Unable to provide safe drinking water for outreach areas. (Dula Mariam, Mango Sefer, Ertu Mojo, Qarsa Bella...)
- Some health facility doesn't have proper place to dispose contaminated faces for cholera suspected patients.
- Inaccessibility to supply safe drinking water in some places

Recommendation

- RRT and TF meeting should be conducted regularly
- ORP should be fulfilled at least with minimum standard.
- Safe drinking water should be supplied for outreach population.
- Strengthen coordination with stockholders

Annex 1: Questionnaire for Malaria Outbreak Investigation in Elu Gelan Woreda, West Shoa Zone Oromia Ethiopia, 2019

Malaria Epidemic Investigation Questionnaire

I. Zone/woreda Health Information

A. Back ground

1. Zone: _____ Woreda: _____ Total kebeles: ____ Urban _____ Rural ____
2. Total population: _____ M: _____ F: _____ <5 children: _____ pregnant _____
3. Number of HF: Hospital: ____ HC: _____ HP: _____
4. Health services coverage : _____ (%)

B. Malaria related information

1. Total number of malarias kebeles: _____ Total pop at risk: _____
2. Woreda ITNs coverage : _____ (%)
3. was there recent Deltamethrine spray: 1/ Yes 2/ No
4. If yes, total number of kebeles sprayed: _____
5. Total number of household spray _____
6. Was there malaria epidemic in the last 2 years: 1/ Yes 2/ No
If yes, when (year & month) _____ No. of cases _____ & Deaths _____
7. Did you sent the report to higher level zone/woreda? 1/Yes 2/No
8. This report is in response to a registered epidemic alert A/ yes B/no
(Specify source and date of alert).....
9. This report is a new epidemic alert 1/ yes 2/No
10. Case numbers have crossed the previously defined epidemic threshold 1/ Yes 2/ No
11. There is no threshold value, but case numbers are very much higher than at the same time last year
1/yes 2/No
12. If yes, by how many times?
13. There is no threshold value, but case numbers have risen very rapidly in the past few (2– 4) weeks
1/ Yes 2/ No
14. There is a high case-fatality rate from malaria 1/ Yes 2/ No
15. There is a rising slide positivity rate in adults with symptoms of malaria 1/ Yes 2/ No
16. There has been an unusually high consumption of antimalarial drugs in the past 2 weeks
1/ Yes 2/ No

17. Trigger factors have been identified 1/ Yes 2/ No

18. If yes, list main trigger factors -----,-----,-----&-----

19. Human resources are adequate to deal with the outbreak 1/ Yes 2/ No

20. Do you have enough supplies stocks of anti-malaria drugs 1/ Yes 2/ No

21. The laboratory service is overloaded 1/ Yes 2/ No

22. Access to some affected areas is very difficult 1/ Yes 2/ No

23. There is an opportunity for vector control 1/ Yes 2/ No

24. List last five years number of malaria cases:

Year	July				Aug				Sep				Oct			
	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
2015																
2016																
2017																
2018																
2019																

II. Health Facility information

Zone: _____ Woreda: _____ Faculty Name: _____

1. Total catchment population: _____ M: _____ F: _____ <5 children: _____ Pregnant ----- 2. Total kebeles: _____

Total number of malarias' kebeles: _____

3. Total number of OPD visits in the last 3 months: July___ Aug___ Sept___

4. Total number of febrile OPD visits in last 3 months: July___ Aug___ Sept___

5. Total number of OPD malaria cases in last 3 months: July___ Aug___ Sept___

5.1. Children <5 years: July___ Aug___ Sept___

5.2. Pregnant: July___ Aug___ Sept___

6. Total number of malaria lab confirmed malaria cases in the last 3 months.

Year	July				Aug				Sep			
	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4	Wk1	Wk2	Wk3	Wk4
2015												
2016												

2017												
2018												
2019												

7. Total admissions in the last 3 months:

July----- Aug-----Sept ----- Children <5 years----- Pregnant -----

8. Total malaria admissions in the last 3 months:

1/ in Year 2011E.C July___ Aug___ Sept___ Children <5 years----- Pregnant -----

2/ in year 2012E.C: Feb___ Mar___ Apr___ Children <5 years----- Pregnant -----

9. Total number of IPD deaths in the last 3 months: July___ Aug___ Sept___

Death in Children <5 years _____Death in pregnant:_____

10. Total IPD malaria deaths in the last 3 months:

July___ Aug___ Sept___ Death in Children <5 years _____Death in pregnant:_____

11. Number of doses of anti-malarial dispensed in the last 3 months:

1/ In Year 2011E.C July___ Aug___ Sept___ 2/ In Year 2012 E.C Feb___ Mar___ Apr___

Epidemic risk

- 1. Is the area known to be affected by epidemics of malaria? 1/Yes 2/No
- 2. Is this area having high malaria transmission all year round? 1/Yes 2/No

Factors in the human

- 1. Has a large group of people arrived recently? 1/Yes 2/No
- 2. If yes: are these the people who are mainly affected by the epidemic? 1/Yes 2/No
- 3. was there malaria in their place of origin? 1/Yes 2/No
- 4. Have they travelled through a malarial area? 1/Yes 2/No

Increased vulnerability due to other (medical) conditions

- 1. Other health problems affecting the community more than usual hunger or malnutrition 1/Yes 2/No
- 2. (Forced) migration 1/Yes 2/No
- 3. Others

Factors related to the vector

- 1. Has the weather in the past few months been: unusual for this season? 1/Yes 2/No
- 2. Wetter than usual for this season? 1/Yes 2/No
- 3. Hotter than usual for this season? 1/Yes 2/No

4. If yes: are meteorological trend data available? 1/Yes 2/No
5. Are there any major environmental changes in the district that could have increased mosquito breeding sites (e.g. a new dam, or construction work, irrigation, rice-cultivation)?
6. Is a new mosquito vector present in the region? 1/Yes 2/No
7. Have mosquito vectors become resistant to insecticides? 1/Yes 2/No
8. Has there been interruption of a malaria control Programme in the past few years?
1/Yes 2/No (Describe))
9. What building materials are most commonly used for?
 - a) Houses?
 - b) Shelters for displaced persons?
10. Are there any cultural or other restrictions that could make it difficult for some people? (E.g. women or religious or ethnic groups) to access the health facility?

Malaria prevention – vector control

1. Are houses sprayed indoors with insecticide? 1/Yes 2/No
2. If yes, when were the houses last sprayed and what % coverage was achieved? -----
3. Do people use insecticide-treated bed nets? 1/Yes 2/No
4. If yes, is there a system of regular re-impregnation with insecticide? 1/Yes 2/No
5. What is the estimated current coverage of households/high risk groups with ITNs? -----
6. Is there reason to suspect insecticide resistance? 1/Yes 2/No
7. If yes, why?

Annex 2: Malaria case control study Questionnaire

I. Socio-demographic information:

1. ID number of respondent _____
2. Sex; M F
3. Age in years _____
4. Address; Region _____ Zone _____ Woreda _____ kebele _____ village _____ GPS Coordinates;
E _____ N _____
5. Occupation; Employed unemployed Student Pastoralist farmer Other
6. Total family members' _____
7. Ethnicity; Sidama Oromo Amhara Tigre Gurage Kembata Other
8. Religion; Orthodox Protestant, Muslim Catholic Other
9. Marital status; Married single Widowed Divorced Not Applicable

10. Educational status; Illiterate Primary Secondary tertiary non-formal

11. Case status; a) Case b) Control

II. Clinical presentations: *(For case only)

1. What was the first symptom? _____

2. When was the 1st symptom started (date of onset of symptoms) DD/MM/YY _____

3. What were others symptoms?

a) Fever: Yes No , if yes duration of fever _____ was it constant fever? Yes No or every other days fever? Yes No

b) Vomiting: Yes No

c) Sweating: Yes No

d) Diarrhea: Yes No

e) Anorexia: Yes No

Ask the following signs (M to Y) for complicated malaria only

c) Altered consciousness Yes No ,

d) Not able to drink or feed yes No

e) Convulsion Yes No

f) Difficult breathing Yes No

g) Bleeding Yes No

h) Jaundice (yellowish coloration) Yes No

4. Did you visit health facilities? Yes No , if yes, when did you visit health facilities? DD/MM/YY _____

5. was your blood samples taken? Yes- No

6. If yes Q 5, what was the result: Positive negative

7. Did you get any treatment? Yes No , if yes, what treatment did you get?

(a) Coartem Yes No , was it for PF Yes No ,

(b) Chloroquine? Yes No , was it for PV Yes No ,

(c) Quinine tablets Yes No , was it for pregnant and <5 Kg? Yes No ,

(d) Quinine injection Yes No , was it for sever malaria Yes No ,

8. Other treatment given _____

9. Did you recover completely after the treatment? Yes- No

10. Place of residence during 2 weeks before onset of illness; _____

III. Risk Factors: *(For both cases and controls)

1. Sleeping areas in side home _____ outside home _____

2. Do you stay outside over night? Yes- No

3. Is there anybody in your home with similar malaria signs and symptoms? Yes- No

4. Did you travel outside your village in the past 2-3 weeks? Yes- No

5. If Q 4 yes, indicate

(a) Date of travel DD/MM/Y _____

(b) The place of travel _____

(c) Date when you returned back DDMMYY _____

(d) Were there sick patients (same symptoms) in the place where you have been? Yes- No

6. Do you have bed net in your household Yes- No

If is yes, how often do you use Always Sometimes Never

7. Do mothers and children given priority of using bed nets? Yes- No

8. Number of bed nets in your home _____

9. Was indoor chemical spray conducted last year prior to the outbreak? Yes- No

10. If Q 9 yes, how many times was sprayed? Once twice Three times and more

IV. Environmental investigation

11. Place of stay during night; inside home outside home , Specific living area _____

12. Is there any artificial water -holding containers close to your home and inside your home those could be a potential for mosquito breeding sited? Such as:

a. Old tires; Yes- No

b. Plant in the containers /flower –pots; Yes- No

c. Plant with temporary water pools; Yes- No

d. Open deep well; Yes No

e. Broken glass bottles; Yes- No

f. Cans; Yes- No

g. Uncovered plastic container; Yes- No

h. Gutter to collect rainwater; Yes- No

i. Uncovered water storage/ septic tank; Yes- No

j. Stagnant water Yes- No

13. Presence of larvae in breeding sites around the home or vicinity; Yes- No

14. Types of house; screened unscreened

15. Do you use repellents? Yes- No ,

16. Do you use protective clothing? Yes No

17. Availability of Solid and liquid waste collection; Yes- No

18. Presence of unprotected irrigation; Yes No

19. Presence of Intermittent rivers cloths to the community Yes- No ,

20. Presence of tick grass; Yes- No

V. Awareness assessment

21. Do you know sign and symptoms of malaria? -----

22. How it is transmitted? -----

23. How it can be prevented? -----

Annex 3:- CHECKLIST for measles outbreak investigation in Caliya woreda of west shoa zone, Oromia, Ethiopia January 2020

Status of Respondent: 1. Case 2. Control

Patient/Respondent Name _____ Date of Data collection _____

Region _____ Zone _____ District _____

Kebele _____ Got _____ Phone _____

Respondent Status Case _____ Mother _____ Father _____ Other _____

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 laborer 6. Merchant 7.Gov't 8.NA (for under 5 child) 9.Other (specify) _____
1.4	Family Occupation(HH head)	1.Farmer 2.Housewife 3.Student 4.Unemployed 5.Daily laborer 6.Merchant 7.Gov't 8.Other (specify) _____
1.5	Religion	1.Orthodox 2.Protestant 3.Muslim 4.Catholic 5.Other (specify) _____
1.6	Ethnic group	1.Mareko 2.Gurage 3.Silti 4.Hadiya 5.Other (specify) _____
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 N/A

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) 7. Ear discharge 8. Pneumonia 9. Vomiting 10. Others_____
2.2	Ask ONLY if complication	Pneumonia: 1.yes 2. No Cornea: 1. yes 2.no Blindness: 1. yes 2. no Convolution 1.Yes 2.No Otitis media (ear discharge): 1.Yes 2.No Diarrhea: 1. yes 2. no Feeding problem 1.Yes2.No Encephalitis 1. Yes 2. No
2.3	Date of rash on set	___/___/___ 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?	yes2. 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 seen 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 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) recovered after the treatment?	1. Recovered / cure 2.partially improved 3. Referred to next level HF 4.disabled after illness 5.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_____/_____/_____
3.3	Number of vaccine doses received	1. One dose 2.Two dose 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, why?	1. Health facility far apart 2.lack of knowledge about vaccination campaign, 3.absence during vaccination campaign, 4. Site of vaccination unknown 5. Fear of Pain of vaccination 6. No need of measles vaccination for child 7. She/he took other vaccine differ from measles 8. other, specify .
3.6	Did you have any travel history 7-18 days to areas with active measles cases before onset of symptoms?	1.Yes 2.No If Yes where _____

3.7	Did you contact with a person with measles symptoms within the last 2-3 weeks?	1.Yes 2.No where_____	If yes,
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	Nutritional status of the cases (use MUAC and weight for <5 children)	1.Normal 2.Moderate 3.Severely malnourished	
3.14	What is the estimated area of the house in sq. m?	_____	
3.15	Is your house well ventilated?	1.Yes 2.No	
3.16	Distance from house to HC	<1km 2. Between 1 – 5km 3. >5km	
3.17	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)_____	
3.18	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)	

3.19	How could you (she/he) suffer from Measles?	<ol style="list-style-type: none"> 1.Contact with a virus from ill person 2.From God 3.Bad attitude of other people 4.Other(Specify)
3.20	Do you know how could spread /infection of measles be stopped?	<ol style="list-style-type: none"> 1.By vaccination 2.By modern treatment 3.By isolation of infected ones /minimizing 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
3.21	Do you know measles is vaccine preventable?	<ol style="list-style-type: none"> 1.Yes 2.No 3.I don't Know
3.22	Who do you think can be affected by measles?	<ol style="list-style-type: none"> 1.Children of aged less than 5 years 2.Children of aged less than 18 years 3.Women of any ages 4.Any age groups of both male and women 5.Other (specify):_____
3.23	How do you think measles can be cured?	<ol style="list-style-type: none"> 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)_____

Annex 4:- Questionnaire for Evaluation of Malaria Surveillance System in Elu Gelan Woreda, west shoa zone, Oromia, Ethiopia 2019

I. REGIONAL /ZONAL LEVEL QUESTIONNAIRE

Identifiers: ----- Date: -----

Respondent name: ----- Responsibility: -----

A. Surveillance system

1. Is there national Malaria guideline?

1. Yes 2.No 3. Not applicable 4.Unknown

2. Do you have standard case definitions for the Country's priority diseases like malaria?

1. Yes 2.No 3. Not applicable 4.Unknown

3. Is the central level responsible for providing surveillance reporting forms to the health facilities?

1. Yes 2.No 3. Not applicable 4.Unknown

4. If yes, have you lacked appropriate surveillance forms (Line list, weekly reporting form, and epidemic reporting form, rumor investigation) at any time during the last 6 months?

1. Yes 2.No 3. Not applicable 4.Unknown

5. What are the reporting entities for the surveillance system?

1. Public health facilities
2. NGO health facilities
3. Military health facilities Private health facilities
4. Others (Specify) _____

6. Percent of district reports (either directly or through an intermediate level) received during each reporting period at the central level during the past 3 months:

6.1. Number of reports in the last 3 months compared to expected number (completeness)

6.2. Weekly: /12 times the number of districts (timeliness)

6.3. Immediately: /----- times the number of districts

7. Was there any report of the immediately reportable diseases in the past 1 month? 1. Yes 2. No

8. If yes, with in what time is the report received after detection of the case/ diseases?

1. Less than 1 hour 2. 2-24 hours 3. 1- 2 days 4. 3- 7 days 5. After 1 week

9. How do you report? (Multiple responses are possible)

1. Mail 2. Fax 3. Telephone 4. Radio 5. Electronic 6. Other (specify) _____

A. Data analysis

1. Does the Zonal level describes the data by age, sex, time and places:

1. Yes 2. No 3.Unknown 4.Not applicable

2. List disease(s) for which line graph is observed _____

3. If they do not made analysis for Malaria ask the reason why they don't _____

4. Do you have an action threshold defined for, malaria?

1. Yes 2. No 3. Unknown 4. Not applicable

5. Who is responsible for the analysis of the collected data? _____

6. How often do you analyze the collected data?

1. Daily 2. Weekly 3. Every 2 weeks 4. Monthly 5. Quarterly 6. As needed...
7. Do you have appropriate denominators?
1. Yes 2. No 3. Unknown 4. Not Applicable
8. Do you give feedback for woredas?
1. Yes 2. No
9. If the answer is yes for Question 7, how often?
1. Daily 3. Every 5. Weekly 2. Monthly 4. Quarterly

B. Outbreak Investigation

1. Percent of suspected outbreaks that were investigated in the past 6 months _____ (# of suspected outbreak) _____ (# of investigated) _____ (%)
2. List the diseases: _____

C. Epidemic Preparedness (relevant for epidemic prone diseases)

3. Existence of a Regional/Zonal plan for epidemic preparedness and response
1. Yes 2. No 3. Unknown 4. Not applicable
4. Has the zone had emergency stocks of drugs, LLITN, and supplies at all times in past 1 year (2012)?
1. Yes 2. No 3. Unknown 4. Not applicable
5. Has the region experienced shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)? 1. Yes 2. No 3. Unknown 4. Not applicable
6. Existence of standard case management protocol for Malaria
1. Yes 2. No 3. Unknown 4. Not applicable
7. Is there budget line for epidemic response?
1. Yes 2. No 3. Unknown 4. Not applicable
8. Does the region have rapid response team for epidemic?
1. Yes 2. No 3. Unknown 4. Not applicable

D. Response to Epidemics

- 1 Ability of the regional level to respond within 48 hours of notification of most recently reported outbreak
1. Yes 2. No 3. Unknown 4. Not applicable
2. How many feedback bulletins or reports had the regional level produced in the last year?

3. How many supervisory visits have you made in the last 6 months? _____
4. the most usual reasons for not making all required supervisory visits: _____
5. Have you been trained in disease surveillance?
1. Yes 2. No 3. Unknown 4. Not applicable
6. If yes, specify when, where, how long, by whom? _____
7. What percent of your subordinate personnel have been trained in surveillance? _____
8. Have you received any post-basic training in epidemic management?
1. Yes 2. No 3. Unknown 4. Not applicable
9. If yes, specify when, where, how long, by whom? _____
10. Data management 1. Computer: 2. Printer: 3. Photocopier: 4. Data manager: 5. Statistical package:

11. Communications 1. Telephone service: 2. Fax: 3. Radio call: 4. Satellite phone: 5. Computers that have modems:

12. Budget line _____

13. Logistics _____ Surveillance

14. Do you have computerized surveillance network at this level?

1. Yes 2.No 3.Unknown 4.Not applicable

F. Budget for surveillance

15. Is there a budget line for surveillance in the Regional Health Bureau budget?

1. Yes 2.No 3.Unknown 4.Not applicable

16. How could surveillance be improved? _____

17. What opportunities are there for integration of surveillance activities and functions (core activities, training, supervision, guidelines, resources etc.)?

G. Questionnaire for Attributes and level of Usefulness:

1. Total population under surveillance _____

2. What is the incidence / Prevalence of Malaria in your area/region?

Malaria _____cases _____Deaths _____

I. Level of Usefulness of the Surveillance System for these selected priority diseases

Does the surveillance system help?

1. To detect outbreaks of these selected priority diseases early? 1. Yes 2.No

2. To estimate the magnitude of morbidity and mortality related to these diseases, including identification of factors associated with these diseases? 1. Yes 2.No

3. To permit assessment of the effect of prevention and control programs? 1. Yes 2.No

4. To Observe (confirm): interventions and diseases trends analyzed

1. Available 2.Not available

II. Describe Each System Attributes:

i. Simplicity:

1. Is the case definition of malaria and case detection known by all level health professionals?

1. Yes 2. No

2. What are the organizations which need to receive reports of the surveillance data?

3. Do you feel that additional data collected on a case are time consuming?

1. Yes 2. No

4. How long it takes to fill the format? 1. <5 minute 2.-10-15minuts 3. >15 minutes

5. How long does it take to have laboratory confirmation of Malaria?

1. <5 minute 2.10-15minuts 3. >15 minutes

ii. Flexibility:

1. Can the current reporting formats be used for other newly occurring health event (disease) without much difficulty? 1. Yes 2. No

2. Do you think that any change in the existing procedure of case detection, reporting, and formats will be difficult to implement? 1. Yes 2.No

iii. Data Quality: (Completeness of the reporting forms and validity of the recorded data)

1. Are the data collection formats for these priority diseases clear and easy to fill for all the data collectors/ reporting sites? 1. Yes 2.No

2. Are the reporting site / data collectors trained/ supervised regularly? 1. Yes 2.No

3. Observe: Review the last months report of these diseases

A. Average number of unknown or blank responses to variables in each of the reported forms

B. Percent of reports which are complete (that is with no blank or unknown responses) from the total reports _____

iv. Acceptability:

1. Do you think all the reporting agents accept and well engaged to the surveillance activities?

1. Yes 2. No

2. If yes, how many are active participants (of the expected total)? _____

3. If No, what is the reason for their poor participation in the surveillance activity?

A. Lack of understanding of the relevance of the data to be collected

B. No feedback or recognition given by the higher bodies for their contribution; i.e. no dissemination of the analyzed data back to reporting facilities

C. Reporting formats are difficult to understand

D. Report formats are time consuming

E. Other (specify): _____

v. Representativeness:

1. What is the health service coverage of the district/ zone/ region? _____ (#) _____ %

2. Do you think, the population under surveillance have good health seeking behavior for these diseases?

1. Yes 2. No

3. Who do you think is well represented by the surveillance data? The urban/ the rural and what is the reason?

vi. Timeliness:

1. Timeliness of reporting in the past one year (by Zone and Woreda)

1. on time----- 2. Late

vii. Stability:
2. Was the new BPR restructuring affect the procedures and activities of the surveillance of these diseases?

1. Yes 2. No

3. Was there lack of resources that interrupt the surveillance system? 1. Yes 2. No II.

DISTRICT (WOREDA LEVEL) QUESTIONNAIRE

Identifiers: ----- Date: -----

Province: ----- Interviewer -----

Respondent: ----- Responsibility-----

A. Surveillance system

1. Is there national guideline for Malaria and PHEM at this site?

1. Yes 2. No 3.unknown 4.Not Applicable.

Case confirmation:

2. Does the district have the capacity to transport specimens to higher level lab?

1. Yes 2.No 3.Unknown 4.Not applicable

3. Does the district have guidelines for specimen collection, handling and transportation to the next level?

1. Yes 2.No 3.Unknown 4.Not applicable

Data reporting:

1. Have you faced lack of forms recommended for the country at any time during the last 6 months?

1. Yes 2.No 3.Unknown 4.Not applicable

1. Number of reports received in the last 3 months compared to expected number

2. Weekly: _____/12 times the number of health facilities

3. Immediately: _____/----- times the number of health facilities

4. on time (use national deadlines)

5. Number of weekly reports submitted on time: ____/12 times the number of health facilities

6. Number of immediately reports submitted on time: _____/3 times the number of health facilities

2. How do you report (Multiple answers are possible):

1. Mail 2. Telephone 3. Fax 4. Electronic 5. Radio 6. Others (specify).....

3. How can reporting be improved? _____

Data Analysis:

1. Percent of sites that: Describe data by person, time and place (case based, outbreaks, sentinel) 1.

- Yes 2.No 3.Unknown 4.Not applicable

2. Do you have an action threshold for any of the country priority diseases?

1. Yes 2.No 3.Unknown 4. Not applicable

3. If yes, what is it? _____cases _____% increase _____rate

(Ask for 2 priority diseases) _____

4. Do you have appropriate denominators? Observe presence of demographic data at site (E.g. population <5 yr. population by village,)

1. Yes 2.No 3.Unknown 4.Not applicable

5. Who is responsible for data analysis? _____

6. How often do you analyze the collected data?

1. Daily 2. Every 2 weeks 3. Weekly 4.Monthly 5. Quarterly 6.As needed

Outbreak investigation:

1. Number of outbreaks suspected in the past 6months:_____

2. Observe: Of those, number investigated (Observe reports and take copies if possible):

3. Has your district ever investigated an outbreak?

1. Yes 2.No 3.Unknown 4.Not applicable

4. Existence of epidemic preparedness and response plan at district level_____

1. Yes 2.No 3.Unknown 4.Not applicable

5. Do the districts have written plan of epidemic preparedness and response

1. Yes 2.No 3.Unknown 4.Not applicable

6. Has the district had emergency stocks of drugs and supplies at all times in past 1 year?

1. Yes 2.No 3.Unknown 4. Not applicable

7. Has the district experienced shortage of drugs, vaccines or supplies during the most recent epidemic (or outbreak)?

1. Yes 2.No 3.Unknown 4. Not applicable

8. Is there budget line or access to funds for epidemic response?

1. Yes 2.No 3.Unknown 4. Not applicable

9. Percent of districts that have an epidemic management committee

10. Observation: Observe minutes (or reports) of meetings of epidemic management committee

1. Yes 2.No 3.Unknown 4. Not applicable

11. Does the district have rapid response team for epidemics?

1. Yes 2. No 3.Unknown 4. Not applicable

Responses:

1. Has the district implemented prevention and control measures based on local data for at least one reportable disease or syndrome?

1. Yes 2.No 3.Unknown 4. Not applicable

2. Does the district responded within 48 hours of notification of most recently reported outbreak (from written reports)

1. Yes 2.No 3.Unknown 4. Not applicable

3. Has epidemic management committee evaluated their preparedness and response activities during the past year? (Observe written report to confirm)

1. Yes 2.No 3.Unknown 4. Not applicable

Feedback:

1. Is there written feedback reports has the district produced in the last year?

1. Yes 2.No 3.Unknown 4. Not applicable

2. How many feedback bulletin or reports has the district received in the last year? _____

3. Supervision _____

4. How many times have you been supervised in the last 6 months?

5. How many supervisory visits have you made in the last 6 months? _____ (Obtain required number of visits from central level) _____

6. the most usual reasons for not making all required supervisory visits.

Reason 1 _____

Training _____

7. Percent of health personnel (in position of responsibility) trained in disease surveillance

8. Have you been trained in disease surveillance?

1. Yes 2.No 3.Unknown 4. Not applicable

9. If yes, specify when, where, how long, by whom? _____

10. What percent of your personnel in the district have been trained in surveillance and epidemic management? _____

Resources:

1. Percent of sites that have: Logistics

CSF: 1. Yes 2.No 3.Unknown 4.Not applicable

7. Do you have the capacity to handle sputum, stool, blood/serum and CSF until shipment at this facility?

1. Yes 2.No 3.Unknown 4.Not applicable

8. Do you have RDT to test Malaria at this facility?

1. Yes 2.No 3.Unknown 4.Not applicable

9. Do you have functional microscope to test for Malaria at this facility?

1. Yes 2.No 3.Unknown 4.Not applicable

10. Observation: Observe presence of functional cold chain at health facility

1. Yes 2.No 3.Unknown 4.Not applicable

11. Is there transport media for stool at health facility?

1. Yes 2.No 3.Unknown 4.Not applicable

12. Observation: Observe presence of packing materials for shipment of specimens at health facility

1. Yes 2.No 3.Unknown 4.Not applicable

III. Data reporting

13. Have you faced lack of appropriate surveillance forms at any time during the last 6 months? 1.

Yes 2.No 3. Unknown 4.Not applicable

14. Is the last monthly report agreed with the register for malarial diseases?

Major public health importance

Observation: Malaria 1. Yes 2.No 3.Unknown 4.Not applicable

15. Percent of sites that reported each reporting period to the next higher level during the past 3 months

Number of reports in the last 3 months compared to expected number Observe Weekly:

/12 times the number of sites Observe immediately: /-- times the number of sites

16. on time (use national deadlines)

Observe: Number of weekly reports submitted on time:-_____/12 times the number of sites

Observe: Number of immediately reports submitted on time: ____/-- times the number of sites

17. How do you report? 1. Mail 2. Telephone 3. Fax 4. Radio 5. Electronic

6.Other (specify):_____

18. Strengthening reporting how can reporting be improved? _____

IV. Data analysis

Percent of sites that:

19. Describe data by person, place and time

20. Do you have an action threshold for any of the Country priority diseases?

1. Yes 2.No 3.Unknown 4.Not applicable

21. If yes, what is it (Ask for malaria diseases)? _____cases ____ % increase _____rate

22. Who is responsible for data analysis? _____

23. How often do you analyze the collected data?

1. Daily 2. Weekly 3. Every 2 weeks 4. Monthly 5. Quarterly 6 .As needed.....

24. Do you have appropriate denominators? Observe demographic data at site (E.g. population <5 yr., population by village, total population)

1. Yes 2.No 3.Unknown 4.Not applicable

V. Epidemic preparedness

25. Is there written case management protocol for malaria epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

VI. Epidemic response

26. Has the health facility implemented prevention and control measures based on local data for at least one epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

VII. Feedback

27. How many feedback bulletins or reports has the health facility received in the last year? ____ 28. How many meetings has this health facility conducted with the community members in the past six months?

VIII. Supervision:

29. How many times have you been supervised in the last 6 months?

IX. Training

30. Have you been trained in disease surveillance and epidemic management?

1. Yes 2.No 3.Unknown 4.Not applicable

31. If yes, specify when, where, how long, by whom? _____

X. Resources

Percent of sites that have:

32. Logistics

1. Electricity 2. Motor cycles 3. Vehicles 4.Bicycles

33. Data management

1. Stationery 2. Printer 3.Computer 4. Calculator

34. Communications

1. Telephone 2. Fax 3.Radio 4.Computers that have modems

35. Information education and communication materials

1. Posters 2. Megaphone 3. Flipcharts or Image box 4. Projector (Movie
5. Screen 6. Generator 7. Other (Specify):_____

36. Hygiene and sanitation materials

1. Spray pump 2. Disinfectant

37. List Protection materials _____

38. Are you satisfied with the surveillance system?

1. Yes 2.No 3.Unknown 4.Not applicable

39. If no, how can the surveillance system be improved? _____

Health Post Level Questionnaire

Identifiers:

Assessment team:

Type of health facility:

Date:

District:

Interviewer:

Region/province:

Respondent:

Country:

Name of health facility:

Surveillance system:

1. Is there national manual for malaria surveillance at this site?

1. Yes 2.No 3.Unknown 4.Not applicable

I. Case detection and registration

2. Is there a clinical register book health facility?

1. Yes 2.No 3.Unknown 4.Not applicable

3. Do you have standard case definition for malaria?

1. Yes 2.No 3.Unknown 4.Not applicable

II. Data reporting

4. Have you faced lack of appropriate surveillance forms at any time during the last 6 months?

1. Yes 2.No 3.Unknown 4.Not applicable

5. Percent of sites that is accurately reported cases from the registry into the summary report to go to higher level? _____

6. Percent of sites that reported each reporting period to the next higher level during the past 3 months

Number of reports in the last 3 months compared to expected number

Observe Weekly:

Observe Immediately:

7. Percent of HF that have means for reporting to next level by e-mail, telephone, fax or radio? _____

8. How do you report?

1. Mail 2.Fax 3. Telephone 4. Radio 5. Electronic 6. Others (specify): _____

III. Data analysis

9. Performing trend analysis observed line graph of cases by time

1. Yes 2.No 3.Unknown 4.Not

IV. Epidemic response

10. Has the health facility implemented prevention and control measures based on local data for at least one epidemic prone disease?

1. Yes 2.No 3.Unknown 4.Not applicable

V. Feedback

11. How many feedback bulletins or reports has the health facility received in the last year? ____

12. How many meetings has this health facility conducted with the community members in the past six months? _____

13. How many times have you been supervised in the last 6 months? _____

VI. Training

14. Have you been trained in disease surveillance and epidemic management?

1. Yes 2.No 3.Unknown 4.Not

15. If yes, specify when, where, how long, by whom? _____

VII. Resources

Percent of sites that have:

16. Logistics 1. Electricity 3. Motor cycles 2. Bicycles 4.Vehicles

17. Data management 1. Stationery 3.Computer 2. Calculator 4. Printer

18. Communications 1. Telephone service 2.Radio call 3. Fax 4. Computers with modems

19. Information education and communication materials

1. Posters
2. Screen
3. Megaphone
4. Projector (Movie)
5. Flipcharts or Image box
6. Other (specify): _____

20. Hygiene and sanitation materials 1. Spray pump 2. Disinfectant 21. List Protection materials

VIII. Satisfaction with surveillance system

22. Are you satisfied with the surveillance system?

1. Yes
2. No
3. Unknown
4. Not applicable

23. If no, how can the surveillance system be improved? _____

24. What opportunities are there for integration of surveillance activities? _____

Annex 5:-Checklist for Health Profile Description at Bona Zuria District in Sidama Zone SNNP region, 2019

1. Historical Aspects of the District

Name of the District _____

When the District was established _____

How & why the name given _____

Any other historical aspect _____

2. Geography and Climate (including map, altitudes, agro ecological zones etc.)

District map _____ Location (distance from Regional city _____

Direction _____ Surface Area _____ square kilometer

District boundaries:-North, _____ South, _____ East _____ West _____ Southeast _____

3. Political and Administrative Organization

Total no. of kebeles _____ Rural _____ Urban _____

4. Population and Population structures

A. Demographic data

Total Population ____ Male ____ Female ____ sex ratio male/female _____

- Urban Population ____ Male ____ Female ____ Sex ratio male/Female _____
- Rural Population ____ Male ____ Female ____ Sex ratio male/Female _____
- Population under 1yrs _____
- Population under five yrs. _____
- Population < 15 years _____
- Population 15-24years _____
- Population 15-59 _____
- Women 15_49 years of age _____
- Total number of estimated pregnancies / Births _____
- Estimated deliveries _____
- Non-pregnant women in fertile age _____
- Total population of >=64 years _____
- Average household size _____

B. Ethnic/language

- Sidama ____ (____%), Oromo ____ (____%), Wolayita ____ (____%), Others ____ (____%)

C. Religion

- Muslim ____(__%), Orthodox ____(__%), Protestant ____(__%), Other ____(__%)

5. Economy (mainstay of the economy, average income levels etc.)

Main Income Sources

SN	Main income sources	Plan	Achievement	%	Remark
1	Government employment				
2	Agriculture				
3	NGO employment				
4	Tourism				
5	Trade				
6	Other business				
Total					

6. Education and school Health

A. Number of educational institution

K.G ____ Primarily and Secondary School ____ Preparatory ____ College/ University ____ TVET ____

Number of educational institution and students enrolled by 2010EFY

SN	Level of the school	# of schools	Students enrolled to the school								
			Male			Female			Total		
			Plan	Achi	%	Plan	Achi	%	Plan	Achi	%
1	1-4 Grade										
2	5-8 Grade										
3	9-10 Grade										
	Total										

B. Total School Age Children (target) _____

- Total Enrolment _____ Male _____ Female _____
- School dropout in 6 months or year _____

School dropout in 6months or year

SN	Level of school	Male	Female	Total
----	-----------------	------	--------	-------

1	1-4 Grade			
2	5-8 Grade			
3	9-10 Grade			
Total				

If there is school dropout, why. _____

C. Educational status of the community

- Total non-Educated people _____ Male _____ Female _____

D. Number of teacher in the District _____ Male _____ Female _____

of teachers in the District

	Educational Level of teachers	Male	Female	Total
1	Certificate			
2	Diploma			
3	Degree			
Total				

7. Facilities

A. Transport

- Road network with respect to health facility _____
- How many kebeles/ketena have access to transportation _____

B. Telecommunication

- How many people have access to fixed telephone? _____
- How many people have access to mobile phone? (coverage) _____

C. Power supply

How many house hold get power supply _____ (_____ %)

D. Water

- Total safe water coverage _____ House hold _____ Safe water supply coverage by kebele/ketena _
- Main source of water supply _____
- Population getting safe water _____

8. District Health system

- The general health system structure of the District health center (flow chart) _____

- Is there rapid response team (RRT) at District level? Yes/No
- If yes, describe the HMT in detail (composition and function) _____
- Do you have NGOs working on health and health related issues? Yes /No
- List the NGOs and their work in related to health. _____

9. Vital Statistics and Health Indicators

- Infant Mortality Rate (IMR) (total <1 yr. deaths):2008 E.C ___2009 E.C ___2010 E.C ___
- CMR(this year’s total <15 yr. Deaths):-2008 E.C___2009 E.C ___2010 E.C ___
- Crude Birth Rate(Total birth):2008 E.C _____2009 E.C _____2010 E.C _____
- Crude Death Rate(total deaths) 2008 E.C_____2009 E.C _____2010 E.C _____
- Maternal Mortality Rate(total maternal deaths):-2008 E.C ___2009 E.C ___2010 E.C ___
- ANC rate 2008 E.C ___2009 E.C ___2010 E.C _____
- ANC rate: 2008 E.C _____2009 E.C _____2010 E.C _____
- Percentage of deliveries attended by skilled birth attendants:
2008 E.C _____2009 E.C _____2010 E.C _____
- PNC 1ST 24Hrs:- 2008 E.C _____2009 E.C _____2010 E.C _____

Immunization Coverage (for children and Women);

VARIABLE	2008 E.C			2009E.C			2010E.C		
	plan	Number	%	Plan	Number	%	plan	Number	%
BCG									
OPV-1									
OPV-3									
Penta-1									
Penta-3									
PCV-1									
PCV-3									
Rota-1									
Rota-2									
IPV-1									
Measles									
FV									

PAB									
Malnutrition screened									
SAM									
MAM									
ANC 1 st									
ANC 4 th									
SBA									
PNC 1 st									

10. Health Service

A. Type and Number of Health Institution

Types of HF	Government	NGO	Private	Total	Population Ratio
Hospital					
Health Center					
Health post					
Medium clinic					
Primary clinic					
Drug stores					
Drug Venders					
Diagnostic Lab only					
Herbal medicine center					
Hospital under construction					
HC under construction					
HP under construction					

B. Type and Number of health professionals

Types of H/Professionals	Numbers				Population Ratio
	Government	NGO	Private	Total	
MD					

HO					
All types of Nurses					
All Types of Mid wives					
Medical lab.					
Pharmacies and druggists					
HEW					

C. Ten Top causes of morbidity and mortality in adults in 2010 E.C

No	Diseases	Number	%
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

D. Five Top causes of morbidity and mortality of under 5 in 2010 E.C?

No	Diseases	Number	%
1			
2			
3			
4			
5			

E. Health budget allocation and Utilization

Source of Budget	Budget allocation and Utilization	2008 E.C	2009 E.C	2010 E.C	

Governm ent		Plan	Achi	%	Plan	Achi	%	Plan	Achi	%
	Annual of budget allocated for the Zone/ District									
	Annual of budget allocated for the Zone/ District Health office									
	Utilization of health budget									
Fund/NG O	Budget allocated for health service									
	Budget utilization for health service									
For drug and medical supply purpose										

F. Core Activities of Primary Health Coverage and SDG

Activities	Types	2008E.C			2009E.C			2010E.C		
		Plan	Achi	%	Plan	Achi	%	Plan	Achi	%
Family Planning	LAFP(IUD+Imp)									
	SAFP(Depo+OC									
Hygiene & sanitation	Improved latrine									
	Solid waste Management									
	Liquid waste Management									
	ODF Coverage									
TB/Lepros y	All form of TB									
	PTB +Ve									
	PTB-Ve									
	Extra PTB									
	TB Rx completion rate									
	TB cure rate									
	TB Defaulter									
	TB Rx success rate									

	Death on TB Rx									
	Total TB patients screened for HIV									
	Positive for HIV									
	Total Leprosy cases detected									
	Leprosy case treated									
HIV/AIDS	Total MARPs screened for HIV									
	HIV prevalence									
	HIV Incidence (new cases/ yr.									
	Total PLWHA									
	Current ON ART									
	Pre-ART									
	CC Performed on HIV /AIDS									
Malaria	Confirmed(BF/ RDT)	PF								
		PV								
		Others								
	Clinical									
	Malaria deaths									
	INT utilization									
	IRS(Unit Structure)									
	Environmental management									

Was there shortage of Essential drugs for the last one year? Yes/No

Essential Drug _____

The District Integrated disease surveillance and Report in 2010 E.C

PHEM reportable disease	Case	Death
Cholera		
Measles		

NNT		
AFP		
Anthrax		
SARS		
Smallpox		
VHF		
YF		
Rabies		
Dracunculiasis/Guinea worm		
Pandemic Influenza		
Malaria		
Meningitis		
Dysentery		
Relapsing Fever		
Typhoid Fever		
Epidemic Typhus		
SAM		
MDSR		

11. Disaster situation in the District

- Was there any disaster (natural or manmade) in the District in the last one year?

If yes what type _____

- Was any recent disease outbreak/other public health emergency
- If yes cases _____ and deaths _____

Annex 6:-Epi Project Consent Form

Title: Assessment of long-lasting insecticidal net utilization and associated factors among under 5 Children in Ilu Gelan District, West Shoa Zone, Oromia Region, Ethiopia, 2020.

Objective: To assess the coverage and use of insecticide treated mosquito nets and associated factors among under 5 Children in Ilu Gelan District, West Shoa Zone in order to produce information to point public health intervention. .

Procedure: This project will take about 30 minutes of your time. There are two parts. First, we will clearly explain you the purpose, benefits and risks of the study. We will give you a chance to ask questions and get answers about the study. Second, we will ask you about bed net utilization and associated factors among under five children in your family. All information collected during this study will be kept private and will only be known by the investigators.

Benefits: This project will help the government of Ethiopia and all level government health sectors to enhance the utilization of bed nets and maximize the benefits.

Risks: There is no risk to you from answering the questions or being participated in this study. We will give you a copy of this consent.

Privacy: We will keep information about you private. We will not collect your name. Only the investigators will have access to the data and only for study purpose. We will not use any information that might identify you when we present or publish the study's results.

Payment: There is no cost to you for being part of the project. The approximate time that this study will take is 30 minutes. There will be no involvement past today.

Participant Agreement: The project has been explained for me. I have been given a chance to ask questions. I feel that all my questions have been answered. Being in this study is my choice. I may change my mind and leave the study any time during the interview.

The purpose of the study and confidentiality procedures has been explained to me and me on my own consent: a) Agree _____ b) Disagree _____

Signature of Interviewer_____

Date of interview _____ Time started _____ Time completed _____

Checked by supervisor: Name _____ Signature _____ Date _____

Annex 7:-Epi project Structured and Semi-structured questionnaire

HOUSEHOLD QUESTIONNAIRE

District Name _____ Kebele Name _____ Gote Name _____

SECTION 1. General Information

INTRODUCTION AND CONSENT

INFORMED CONSENT

Introduction

Questionnaire ID NO _____

Hello. My name is _____ and I am part of a team of people who are carrying out a Research on “Assessment of LLITNs Utilization among under five children and associated factors in Elu Gelan District” (Show a letter of approval from EGHO). Thank you for taking the time to speak with us today. We wanted to speak with head of house and/or spouse. Our aim is to figure out factors affecting the utilization of bed net among under five children in the community. We are very interested in your experience and your point of view. We will start by asking your willingness to participate in the study and clearly explain you the objective, benefit and risks of the study to get your consent. And then we will ask you all a multiple of questions for discussion. Questions are simple and what you are clearly known in your daily activities. Please feel free to speak your mind; your name, position, and anything that could identify you personally will not be used in any official reports or presentations. (Fill consent Form). The Questions will take about 30 minutes. Your answers will remain confidential, and we will not be taking down your name or address, so your answers will be anonymous. Participation in this study is voluntary and you can choose not to answer any individual question or all of the questions. However, we hope that you will participate in this study since your views are important. At this time, do you want to ask me anything about the study? May I begin the interview now?

Identification Code

Name of House hold head _____

House number _____

115. Do you have toilet/latrine? 1 Yes 2 No
116. If your answers yes what kind of latrine do you have?
1 individual Pit latrine 2 common pit latrines 3 others
117. Type of energy used for cooking
1 wood 2 cow dung 3 Charcoal 4 Electricity 5 Gas 6 others-----
118. Do you have functioning radio in your house? 1 yes 2 no
119. Total number of people living in this house -----
120. Total number of under-five children's living in this house -----
121. Number of pregnant mothers in the house hold (if there is pregnant mothers) -----
122. How many rooms do you have in your house? -----
123. How many beds do you have in your home? -----
124. How many people usually sleep in your home? -----
125. How many sleeping mats do you have in your home? -----
126. How many people in your home usually sleep on beds? -----
127. How many people in your home usually sleep on mats? -----

PART II Questions Related To Malaria Knowledge

201. Is malaria the major health problem in your area? 1 Yes 2 No 3 I don't know
202. What main symptoms of malaria you aware of? (Multiple answers is Possible)
1 Fever (hotness of body) 2 Feeling cold (Chills/shivering 3 Headache 4 Vomiting 5 Body weakness 6 Loss of appetite 7 Body pain or joint pain 8 Eye become yellow
9 Profuse sweating 10 Diarrhea 11 don't know 12 other specify-----
203. What is the main cause of malaria? 1 Being in the rain 6 another person with malaria
2 Working in the sun 7 Mosquitoes bites 3 Exposure to cold weather 8 God/Allah 4 Drinking dirty water 9 don't know 5 living near collected water
10 other specify -
204. Which group of people are more affected by malaria (multiple answer are possible) 1 Adults
4 pregnant women 2 Elderly people 5 Children less than five year 3 Younger people 6 All are equally affected 7 other (please specify) -----
205. Do you think malaria can be transmitted from one person to another? 1 Yes 2 No
3 I don't know 206. How is malaria transmitted from one person to another? 1 Sleeping together
5 Mosquito bites 2 Eating together 6 sharing clothes 3 Living in the same house 7 I don't know 4 Nursing the sick 8 others specify-----
207. Do you think that malaria is a preventable disease? 1 Yes No 3 I don't know
208. If yes to Q 207. Would you tell me the preventive measures of malaria you aware of?

407. Bed net has different colors which colors would you prefer (one answer only) 1 White 2 Black
3 Blue 4 Green 5 Others-----
408. Bed nets has different size which size would you prefer (only one answer) 1 Single size 2 Double size
3 Family size
409. For whom do you give priority in case of shortage of bed nets in the house hold? 1 under five children only
3 parents 2 pregnant mothers only 5 Children greater than five years 4 both under five
children and pregnant mothers 6 Others specify-----

PART V QUESTION S RELATED TO BED NET UTILIZATION

501. Do you have a bed net in the house hold currently? 1 Yes 2 No (skip to question 523)
502. If yes to question 501, what type of bed net do you have (verify by observation) 1 ITN (LLITN or
Retreat able) 2 Local made bed net 3 others specify
503. How many bed nets do you have -----?
504. How did you obtain your bed nets? (Multiple responses possible) 1 Were given to me free 3 I can't
remember/don't know 2 I bought it/them 4 other specify____
505. Where do you obtain the bed net? 1 At the health center/post 4 from market 2 from kebele 5
from private drug vendors 3 From Shops 6 Others
506. How much would you paid for the bed net (if you bought it) ----- birr
507. How long ago did your household obtain the bed net-----months/years?
508. If there is no free distribution of ITN in your locality are you willing to buy the bed net? 1 Yes 2 no
509. If yes how much will you pay to buy the bed net----- birr?
510. Is the net (are the nets) being used currently? 1 yes 2 no
511. If yes, to question 510, how many? -----
512. If yes to question 510, what is the main reason you use bed nets in your house? 1 To prevent against mosquito
bites 2 To prevent malaria 3 To prevent annoyance by other insects 4 To prevent other boring insects and
vermin 5 Prevent falling roof debris /dusts 6 Others specify---
513. If NO to question 510, why? 1 it is too hot 2 Mosquito still bites through the net 3 Difficult to get up during
the night 4 It takes time to tuck the net each night 5 Cause irritation 6 Others specify
514. Did any one of the family members sleep under the mosquito net(s) last night? 1 yes 2 no

515. Did you personally sleep under the bed net last night? 1 Yes 2 no
516. If yes for question 514 use the following chart about bed net use in the family members. Start by filling the youngest children age in the family.
517. If all family members is not sleep under the net why? -----
518. How often do you use bed net? 1 Daily 2 occasionally 3 during malaria season 4 others
519. If not daily why? -----
520. Did you wash your bed net? 1 yes 2 no
521. If yes to Q How often do you wash the bed net? 1-- Times a week 2--- Times in month 3 ----
---Times in three months 4 ----- Times in six months 5 ----- Times in year 6 others
522. What was the reason for washing your bed net? 1 Net is dirty 2 net is soiled 3 due to bad smelling of chemicals
523. If NO to Q 501, what are the reasons for not having (buying) bed nets for your Household? 1. I do not know what mosquito (bed) net is 2. Net is not a priority to my household 3. I do not have money to buy 4. Net is too expensive to buy 5. Net is not available in this area 6. I do not know where to buy net 7. Waiting for free distribution of bed nets by the government 8. I do not like sleeping under net 9. I do not know its benefit 10. Other (Specify):

PART VI Fill the following by observing the bed net

1. Number of bed net in the house during observation -----
2. Things to be observed 1st bed net to be Observed Put "X" mark for each option given below 2nd bed net to be observed Put "X" mark for each option given below 3rd bed net to be observed Put "X" mark for each option given below
3. Type of bed net Permanent (long lasting ITN) Treatable ITN Locally made net Others
4. Size of bed net Small (W x L X H =70x180x150) Medium (100x180x150) Large (130x180x170)
5. Shape of bed net Conical Rectangular
6. The bed net Hanged In the package Used for other purpose
7. If hanged on the bed on the sleeping floor / mat If not hanged why? Used for other purpose Hang during the night We don't know how to hang It is not convenient to hang Others
8. Nets for holes and tears No holes and tears(intact) Small Visible holes and tears Large visible holes and tears (damaged)
9. Cleanness of the bed net clean Dirty

The interview is now finished. Thank you for taking the time to answer these questions.

Data collector	Checked by Supervisor	Checked by Principal Investigator	Data Entered
NAME _____ DATE _____ Signature _____	NAME _____ DATE _____ Signature _____	1. Yes 2. No	1. Yes 2. No Date _____