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

Ethiopian Field Epidemiology and Laboratory Training Program (EFELTP)

Compiled Body of Works in Field Epidemiology

By

Belay Bezabih

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

March 2011
Addis Ababa

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Advisors

Dr Richard Luce
Dr Adamu Addissie

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Approval by Examining Board

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I would like to thank and appreciate enthusiastically my family and friends for their encouragement to pursue in this program through devastating circumstances that i was facing.

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I would also like to acknowledge all individuals from CDC Atlanta for their excellent transfer of skill and knowledge of field epidemiology.

Contents **Page**

List of Tables page

List of Figures

List of Annexes

List of abbreviations

ADA _Amhara development association

AFI _Acute febrile illness

AFP _ Acute Flaccid Paralysis

AHI _Avian Human Influenza

AMA _Anti- malaria association

AmRids _Amhara Regional Infectious Diseases Surveillance

ANC _Anti natal Care

ARHB _Amhara Regional Health Bureau

AWD _Acute watery diarrhea

BPR _Business Process Reengeenering

BPR _Business process Reengineering

CFR_Case Fatality Rate

CHW _ Community Health Workers

CSF _Cerebro spinal Fluid

CTC_ Case Treatment Center

DHO _District Health Office

EFY _Ethiopian fiscal Year

EHNRI _Ethiopian Health and Nutrition Research Institute

EMWATKit _ Emergency water treatment kit

EPI _Expanded Program immunization

EPR _Emergency Preparedness and Response

EPRDF_The Ethiopian people's Revolutionary Front

EPRP_Emergency Preparedness and Response Plan

FMOH_ Federal Ministry of Health of Ethiopia

FP _Family planning

GP_ General Practitioner

HEP _Health Extension Program

HEW _ Health Extension Workers

HF _ Health Facilities

HIV_Human Immune Deficiency Virus

HMIS _Health Management Information System

HW_ Health Worker

IDSR _Integrated Diseases Surveillance and Response

IHR _ International health Regulation

IP_ Intestinal Parasite

ITN_Impregnated Treated Nets

JICA _Japanese international Cooperation Agency

MEPR_ Multisectoral Emergency Preparedness and Response

MoH _ Ministry of Health

MUAC_ Mid-Upper Arm Circumference

NGOs _ Non- Governmental Organizations

NNT_ Neonatal Tetanus

ORHB_ Oromia Regional Health Bureau

ORS _Oral rehydration salt

OTP_Out Patient Program

PHE _Public Health Emergencies

PHEM _Public Health Emergency Management

PITC _Provider initiated testing and counseling

PMTCT_ prevention of mother to child transmission

RDT _Rapid Diagnostic Tests

RHB _ Regional Health Bureau

RHRL _Regional Health Research Laboratory

RL_Ringer Lactate

RRT _ Rapid Response Team

RUTF_Ready to Use Therapeutic Food

RVF _Rift Valley Fever

SAM_Sever Acute Malnutrition

SARS _Sever Acute Respiratory Syndrom

SC_Stabilization Center

SRS_Simple Random Sampling

STI _Sexually transmitted infections

TEVT_Technical education and vocational training

TF_ Task Force

TFP_Therapeutic Feeding Program

UNICEF_United Nation's Children's' Emergency Fund

VCT_Voluntary counseling and testing

VHF _ Vairal Heamorragic Fever

WASH_ Water sanitation and Hygiene

ZHD _Zonal Health Department

ZHO_ Zonal Health Office

Preface

The Ethiopian Field Epidemiology and Laboratory Training program (EFELTP) is a 2 years field based masters program. The School of Public Health/Addis AbabaUniversity, the Federal Ministry of Health of Ethiopia / Ethipian Health Nutrition Research Institute (EHNRI), and the Ethiopian Public Health Association (EPHA) / CDC Ethiopia are running the program together. The field work comprises 75% of the the program which is called residency; learning by working in public health emergency and other health related priority issues.

This combiled of works has nine main sections or chapters which all of them were done during the residency time of the program. The first eight sections are expected outputs during the residency time; such as outbreak investigation, report of analysis of surveillance data, evaluation of the surveillance system, description of a health profile report, writing of finalized scientific manuscript for peer review journals, abstract submition to /presntation in/ scientific conferences, writing protocol/proposal of epidemiologic reaserch project and a summery of disaster situation visited/risk assessment and other additional works are included in section nine. Inorder to accomplish all the above eight outputs of residency and other additional works, different techniques and methods were utilized. During an outbreak investigation in the field situation it was not always easy to conduct an investigation or study in well representative and propability sampled population within a limited time period. Some outbreaks couldn't be confirmed by laboratory because of the absence of any setup for confirmation of etiologies even at national level. Secondary data from patient register log books, line lists, suspected case definitions and non probability sampling technique were used to collect data in some of the outbreaks. Accessing data at national level inorder to analyze the surveillance report and evaluation of the surveillance system was also very challenging and time consuming because of unnecessary procedures and unclear reasons.

The overall outputs of the two years field residency in the program are presented in a summarized way as follows; in the outbreak investigations chapter or section four outbreaks were investigated and well documented. These were an acute bloody diarrhea outbreak at Alagie agricultural college, in Ziway, Oromiya in May 2009, Unknown respiratory disease outbreak in Dallol district, Afar in November 2009, Acute watery diarrhea outbreak in zone 3 of Afar in April 2009 and outbreak of mass psychogenic illness (mass hysteria) among high school girls in Bati, Amahara in April 2010. Two reports of surveillance data analyisis and description; one description of national tuberculosis report in March 2009 and the other is an analysis of national measles surveillance data in November 2010.

A surveillance system evaluation and a Health profile description report was also done in West Gojjam zone, Amhara, in October – December 2010.Three finalized scientific manuscripts submitted for peer reviwed journals between June and September 2010.Five abstracts were also prepared and submitted for scientific conferences of which two accepted for poster presentation abroad, one accepted for oral presentation and one poster presented in EPHA conference, and another abstract also presented in Mombasa,Keneya in September 2009 at APHINET/TEPHINET conference. A report on health nutrition needs assessment (risk assessment) on prioritized districts of Amhara regional state was also conducted with other team members from the food security center, WHO, UNICEF and EHNRI. A finalized epidemiologic reaserch project proposal on a title; Epidemiology and etiology of diarrhea among under five children in Bahir Dar, Ethiopa, was done and reviewed by the addis Ababa university-School of public Health and CDC-Ethiopa.

Under the other additional works/outputs section(chapter) a researchproject proposal on - Antimicrobial resistance and prescription patterns and relations in ethiopian regionla refereal hospitals' was prepared and submitted to the EFELTP academic coordinator and advisor in December 2009. In July 2009, technical support and monitoring of Intervention was undertaken in Oromia regional state during the occurrence of outbreaks of acute watery diarrhea (AWD) in various districts of the region.Two manuscripts were also published in the national peer reviwed journals; Prevalence of *Salmonella typhi* and intestinal parasites among food handlers in Bahir Dar Town, Northwest Ethiopia *[Bayeh Abera, Fantahun Biadegelgen, Belay Bezabih. Ethiop. J. Health Dev. 2010; 24(1):46-50]* and Antimicrobial susceptibility of *v. cholerae* in North West Amhara, Ethiopia *(Bayeh Abera, Belay Bezabih, Azene Dessie, 2010. Ethiop Med J, Vol. 48, No.1)*.Other activities like provision of training for public health emergency management (PHEM) officers working at different level (regional to health facility level) on public health surveillance and response were also undrtaken. The training conducted in Addis Ababa was organized by the Federal Minstry of HealthH and Family Health International in April 2009.The trainings organized by EHNRI/PHEM and regional health bureaus in Amhara regional state and in Benshangul Gumuz were under taken at four sites (four rounds) and at one site in April 2010 and in November 2010 respectivelly. Nonetheless inconveniences were facing to hinder this new program; the efforts exerted by the program actors from all sides let us to accomplish the expected outputs of the field based residency and other additional works or outputs.

Chapter I – Outbreak/Epidemic Investigations

1.1. Outbreak investigation of acute bloody diarrhea in Alagie Agricultural College, Ziway, Ethiopia, May 2009

Belay Bezabih, Beyene Kidu

Abstract

Background: Diarrheal diseases are a global problem, but are especially prevalent in developing countries in conditions of poor environmental sanitation, inadequate water supplies, poverty and limited education.

Objective: The study was conducted to investigate the outbreak epidemiologically & provide guidance on interventions to be taken in the control & prevention of the disease.

Methods: 58 cases were selected conveniently & interviewed with structured questionnaire. All clinic pharmacy prescriptions from 10/05/2009-16/05/2009 were reviwed & duplicate prescriptions were excluded. Student cafeterias, latrines, water supply, & cooking rooms were observed. Stool & drinking water samples were also collected to verify the etiologic agent. Then data were analyzed using Epinfo version3.3.2 & Microsoft Excel.

Results: A total of 538 cases were identified during the outbreak and 482 (89.6%) of them were males. The median & rang of age of cases was 20 & 31 years respectively. The attack rate and case fatality rate was 49% and <1% respectively. 69.0% (40), 22.4 %(13), & 8.6 %(5) of the interviewed cases had >6, 4 to 6 & <4 episodes of diarrhea per 24 hrs respectively. Only 22.4 % (13) of the interviewed cases practiced hand washing with soap after latrine while 89.7 % (52) of them made hand washing with soap before any meal. 57.9% (n=58) of cases had also contact history to an individual with similar illness, i.e. either they cared the case or sharing of drinking & eating utensils. Piped water source was used for cooking, cleaning utensils and hand washing. There was no bath room latrine for food handlers who were working in student cafeterias. No pathogen could have been isolated from stool samples which were analyzed in the microbiology laboratory.

Conclusions & recommendations: The overall attack rate was high (49%) and based on the case definition and characteristics observed on antibiotic treatment the cause of the outbreak could be shigellosis however the etiology was not confirmed by laboratory. But other agents like Enterotoxigenic *Escherchia coli* (ETEC) could not be excluded.

Hand washing & other hygienic practices were inconsistent among students & college food handlers & it needs continuous follow up and health education on sanitation issues should be strengthened. Training of health workers on recording and reporting of cases especially during outbreak is necessary. Responsible bodies (like local or regional health bureaus) should also offer training for health workers on epidemic diseases, supervise & monitor the college clinic regularly.

Key words: Alagie Agricultural College (Ziway), acute bloody diarrhea, hygienic practice

Introduction

Globally, around 1 billion people lack access to improved water and 2.5 billion have no access to basic sanitation In 2004 (1) and eighty-eight per cent of cases of diarrhoea worldwide are attributable to unsafe water, inadequate sanitation or insufficient hygiene (2).This could most probably contribute for diarrhea being the third largest cause of morbidity and the sixth largest cause of mortality among population of all ages worldwide (3). Diarrhoea is caused mainly by the ingestion of pathogens, especially in unsafe drinking-water, in contaminated food or from unclean hands (2).The major etiologic agents that account for the estimated 1.5 million deaths per year are enterotoxigenic *Escherichia coli* (ETEC), rotavirus, *Vibrio cholerae*, and *Shigella* spp. (4, 5)
In sub-Saharan Africa, repeated prolonged outbreaks of dysentery with high case fatality rates have increasedthe demand for antibiotics; causative pathogens such as *Shigella dysenteriae* type 1 have developed resistance to locally affordable and available antibiotics (6). Studies from Central and East Africa also confirm that *S. dysenteriae* type 1 is resistant to multiple drugs (7-10).Treatment of dysentery with antibiotics to which the etiologic agent is resistant may prolong illness and increase risk of hemolytic uremic syndrome and death (11,12).
Diarrheal infection caused by Shigella dysentery type 1 is most common in overcrowded areas like in refugee populations with poor sanitation, sub-standard hygiene, and unsafe water supplies, and during epidemics up to one-third of the population at risk may be infected (13).

On 14th of May 2009 the Ethiopian Health and Nutrition Research Institute (EHNRI) / Public Health Emergency Management (PHEM) received a report through the Federal Ministry of Health/ (FMOH/), which requested an immediate support for the increase number of students with diarrheal disease at Alagie agricultural college near Ziway which is found in Oromia Region. On 15th of May 2009 a team from PHEM/EHNRI prepared for field visit and went to Alagie. The overall aim this study was to investigate the outbreak and describe epidemiologically for providing guidance on intervention and prevention of the disease in the area.

Materials and Methods

Study area and population

Alagie College of Agriculture is located 215 Kms south of Addis Ababa (35 Kms from the main Addis to Hawassa road) bordering the two rift valley lakes Abiata and Shala. The total population of the college and nearby community is estimated to be around 10,080. It has three campuses namely Zeraideres, Sebele and Shalla with a total of 3330 students, 191 teachers, 1559 administrative staffs and around 5000 nearby communities. Each campus has around 2 km apart. The College has also a high school, an elementary school and a clinic.

Study Design, sampling and data collection

A descriptive study was employed in Alagie Agricultural College from 15-16 May, 2009. Both primary data and secondary data were collected. A line list of all students was not available to identify cases therefore college pharmacy prescriptions for Cotrimoxazole, Ciprofloxacilline, Chloramphinicole, Hyocine and oral rehydration salt (ORS) from 10-16/05/2009 were reviewed. Those receiving more than one prescription were excluded to eliminate duplication and a case definition was set.

Fifty eight cases (including cases which shown early onset of disease) were also selected conveniently and interviewed with structured questionnaire. Observation of student cafeterias, latrines, water supply, & cooking rooms were also made.

Three stool samples (in Cary-Blair transport medium) before starting antibiotic treatment & one water sample from source which used for drinking for campus students were also collected & send to EHNRI for microbiological investigation. Primary data was entered to computer software (Epi Info), secondary data also transcribed to Microsoft Excel from manual compilation, and checked for completeness. Then statistical analysis was made using Epi info version 3.5.1.

Results

According to our investigation a total of 538 cases & 1 death of acute bloody diarrhea were identified. All cases were students of the college which present themselves in the campus clinic & only 18 of them were referred to Hawassa hospital. 89.6% (482) of the cases were males and the median & age range of cases was 20 & 31 years old. The majority of cases [324(61.2%)] were those between 19-21years old (figure 1, * 9 cases were not included for unknown age).

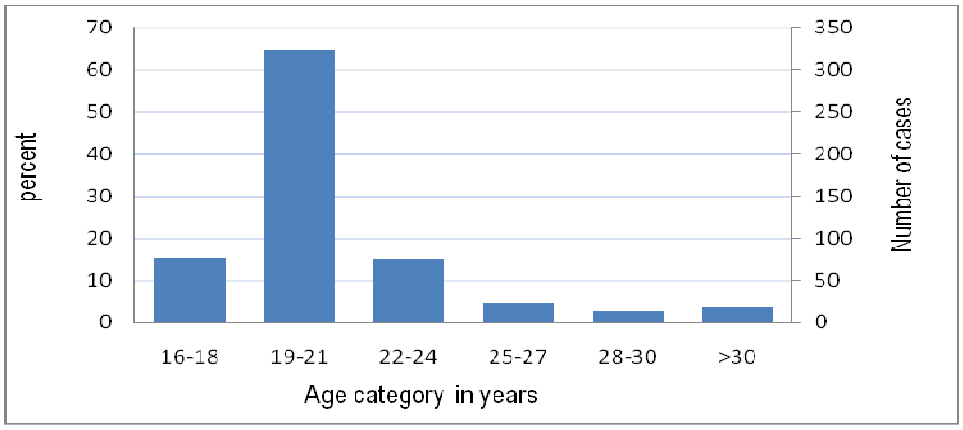

Figure 1.1.1: Age distribution of Alagie Agricultural College ABD cases, Ziway, May 2009

The first date of onset of illness was on 09/05/2009 & one day later; on 10/05/2009 cases present themselves to the college clinic for treatment (figure 1.1. 2 & 3).

These were identified by interviewing early cases & reviewing the pharmacy prescription. However the information from cases which show symptom of illness early (index cases) was not found to be different from other cases in having any recent travel history, feeding and drinking out of the campus, etc.

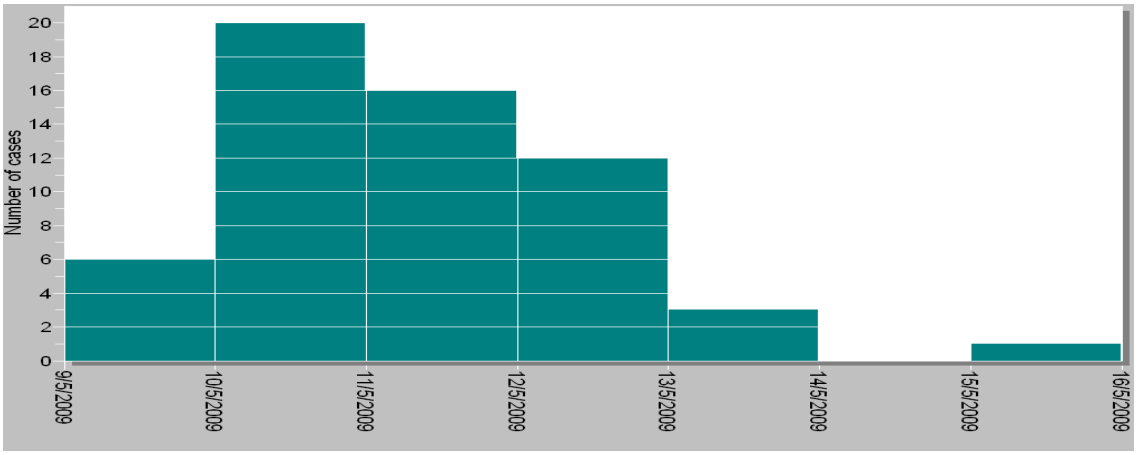

Figure 1.1.2: Epidemic curve by date of onset of illness (interviewed cases), Alagie Agriculture College, Ziway, Ethiopia, May 2009

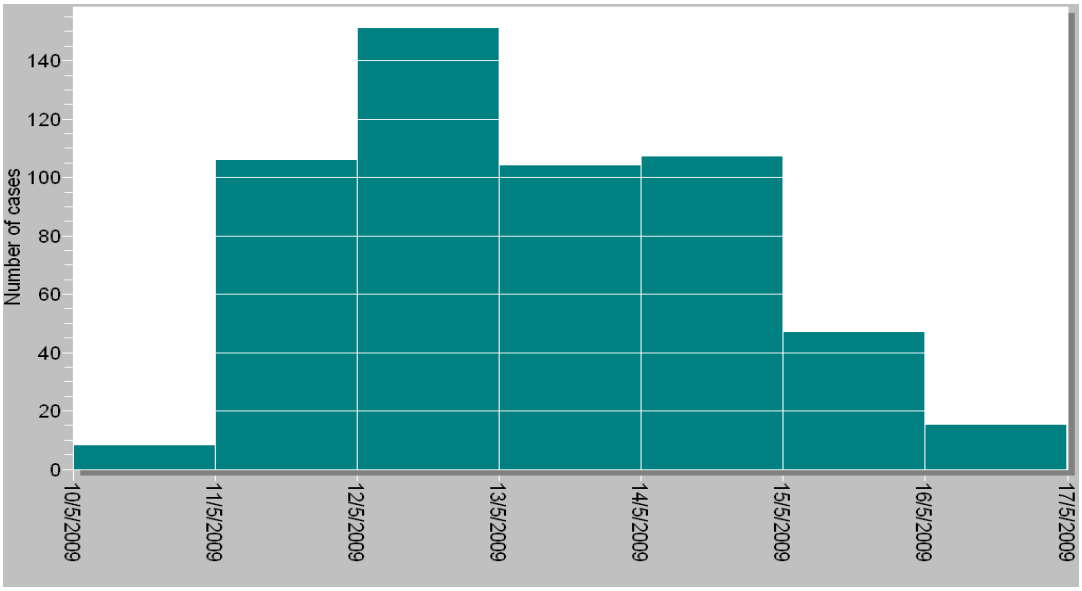

Figure 1.1.3: Number of cases by date of pharmacy prescription, Alagie Agricultural College clinic, Ziway, Ethiopia, May 2009

The highest percentage (28.1 %(151)) of cases were seen on 12/5/2009 (figure 1.1. 3). The attack rate & case fatality rate was 49% & < 1% respectively.

The major symptoms/signs among the interviwed group (n=580 were bloody or bloody mucoid diarrhea, abdominal cramp, fever, vomiting and altered state of consciousness (table 1.1.1).

Table 1.1.1: Signs and symptoms among the interviewed group (n=58) of ABD in Alagie, Ziway, Ethiopia, May 2009

Signs and symptoms	Frequency	Percent
Diarrhea (mucoid or bloody mucoid)	58	100
Vomiting	29	50
Fever	53	91.3
Altered state of consciousness	13	22.4
Abdominal cramp	56	96.6
Total	58	100

The duration of illness for all interviewed cases before visiting the clinic was < 6hrs up to >2 days & 67.2 %(39) of them visited the clinic with in 6hrs -24 hrs of their onset of illness (table 1.1.2).

69.0% (40), 22.4 %(13), & 8.6 %(5) of the interviewed cases had >6, 4 to 6 & <4 times episodes of diarrhea per 24 hrs respectively. It was also observed that most of cases started Co-trimoxazole treatment on the first two days revisited the clinic for compliant of similar symptoms (bloody diarrhea, fever, nausea, vomiting etc).

Table 1.1.2: cases by duration of illness before visiting the clinic, Alagie College of agriculture, May 2009

Duration of illness before visiting health facility in days/hrs	Frequency
< 6hrs	9(15.5%)
6 hrs-24hrs	39(67.2%)
1-2 days	9(15.5%)
>2 days	1(1.7%)
Total	58(100.0%)

Only 22.4 % (13) of the interviewed cases practiced hand washing with soap after latrine while 89.7 % (52) of them made hand washing with soap before any meal. Eating in a restaurant & traveling outside the college was low (table 1.1.3).

Table 1.1.3: Assessment of risk factors for acute bloody diarrhea outbreak at Alagie Agricultural College, Ziway, Ethiopia - May 2009

Risk factors	Frequency of cases (Number & %)
Contact history to an individual with similar illness (visiting or caring of cases)	33(58%)
Caring of a patient	27(46.5%)
Hand washing with soap after latrine	13(22.4%)
Hand washing with soap before having any meal	52(89.7%)
Any travel history within 7 days before illness	4(6.9%)
Eating at restaurant within 7 days before illness	2(3.4%)
Sharing feeding or drinking utensils	8(13.8%)
Latrine usage(always)	57(98.35)
Total	(n=58)

Discussion

The peak of epidemic curve was seen on 12/05/2009 which was on the 4th day of the first onset and the curve fall dawn within three days after getting its peak. This sharp rise and fall of the epidemic curve well fit with the typical characteristic of common source type of epidemic (Figure 1.1.3).The duration of this outbreak which passed within 7 days is very similar to Cameroonean outbreak of Shigellosis (14).

The overall attack rate (49%) was very high compared to some West African out break experiences of < 7.5% (14-16) however the case fatality rate of Alagie acute bloody diarrhea (ABD) outbreak was low(<1%).

According to the interviewed study group, 57.9% (n=58) of cases had contact history to an individual with similar illness, i.e. either they care the case or sharing of drinking & eating utensils. This might be an indication for extensive transmission and account for the high attack rate though the epidemic curve couldn't show a characteristic of propagated person to person type transmission. Establishment of propagated person to person type epidemic curve was likely to happen if co-trimoxazole couldn't quickly replaced by potent antibiotics like Ciprofloxacin for treating cases. Because at the beginning many cases were taken co-trimoxazole and which couldn't recover probably because of resistance which might also be indicated by various studies risk of resistance of Shigella dysentery. Practicing hand washing before having meal and after latrine usage with soap was very low (table 3) which should not be expected from students at college level.

Risk factors shown in table 3 couldn't be tested analytically; however they might have a potential contribution for the establishment of acute bloody diarrhea (ABD) outbreak in Alagie campus.

No food handlers working in the student's cafeteria were ill. But 3 %(n=58) of the students were often ate in a local restaurant which we could not able to evaluate it. Because the restaurant is found out the side the campus under SNNPR & it needs to go through Hawasa with local public health or administrative officials.

All stool samples which were sent to EHNRI microbiology laboratory to confirm the case definition couldn't show any growth of bacteria. The water sample was not also analyzed due to ignorance and not taking professional responsibility or lack of awareness about importance biological and environmental samples in epidemic investigation. However considering the major typical signs and symptoms like fever, abdominal, cramp, vomiting, bloody mucoid diarrhea & rectal pain; Shigellosis / entertoxigenic *Escherchia coli* (ETEC) was suspected to be the etiological agent.

Intervention activities

The college clinic staff & clinicians from SNNPR treated cases with antibiotics and fluids and made referral for those sever cases.

The Epidemic response team conducted health education on hygienic issues was given to students and food handlers who work in the college campus of students' cafeteria, stool samples from untreated cases and drinking water samples were collected and transported to EHNRI laboratory.

The team was also monitored the improvement cases and the antibiotic treatment and undertaken discussion with college leaders on controlling the outbreak and prevention of similar events.

Challenges identified

Delay in starting the investigation lead most cases to take antibiotic therapy which prevented to collect enough biological samples and even the available transported samples couldn't be processed and analyzed timely to identify the possible etiology.

Limited time of stay and absence legible recording of cases in the clinic outpatient and inpatient departments at the site also prevented thorough investigation of the outbreak.

A restaurant on the side of the campus without latrine and drinking water supply and absence of latrine and shower for food handlers could be major health risk for students. The clinic is not net worked to any responsible health sector (issue of ownership to the ministry of health and Agricultural sector not settled.

Conclusion

The overall attack rate was high (49%) and based on the case definition and characteristics observed on antibiotic treatment the cause of the outbreak could be shigellosis however the etiology was not confirmed by laboratory. but other agents like Entero-heamorrhagic *Escherichia coli* could not also be excluded. The attack rate & case fatality rate was 49% & 0.18% (n=538) respectively. Hand washing & other hygienic practices were inconsistent among students & college food handlers. The local restaurant (found under SNNPR) could also possibly being involved a source for the outbreak.

Recommendations

Provision of health education on sanitation issues both for students and food handlers and continuous follow up and supervision is necessary. Avail cleaning supplies for the cafeteria & adequate medical supplies for the clinic and training of clinic health workers on recording and reporting of cases especially during outbreak. The clinic activities should be followed by a body of health sector (either by zonal, regional or Federal level) and assessment of sanitation issues at the local restaurant (found under SNNPR) is important to minimize similar risks.

Acknowledgments

We appreciated administrative staffs & dean of the college for their cooperation and especially Mr Abdurahman; who gave us all the pharmacy prescriptions to screen out the cases overnight in the absence of any other

records. We thank also our resident advisor Dr Richard Luce for his meticulous reviewing of the whole document.

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1.1. Unknown respiratory disease outbreak in Dallol district, Afar, Ethiopia, Nov-2009

Belay Bezabih, Milliyon Wondabeku, Ali Hassen, Surafel Fantahun

Abstract

Background: According to the WHO 2004 report, lower respiratory tract infection (LRTI) was the third Leading causes of death of all ages 4.2 million and 7.1 % of the total deaths. On Monday 14/12/2009 the EHNRI/PHEM received an emergency call from Afar Regional Health Bureau which notified 6 deaths and many cases of unknown disease with symptoms of fever, cough, chest pain, difficulty of breathing, and some component of bleeding tendency at a village(kebele) in Dallol district. A team from central level was mobilized to the district (wereda) to verify the existence of an outbreak and made an investigation to give technical assistance in the district (woreda).

Material and Methods: An outbreak investigation was conducted in Dallol district specifically at Adukua health center and in Mao kebele at Wadi 'Got' from 18-21 December 2009. Dallol is one of the lowest depression in the world is located in this district (wereda). Case register log books, morbidity, mortality report forms at Adukua health center and line listing of cases were reviewed.Thirteen study subjects were also selected by convenient sampling technique and interviewed using a structured questionnaire in which all of them were cases (patients).Observation of the affected 'Gote' environment, households who lost family members and discussion with district's officials and rapid response team was also undertaken. Eighteen blood and 16 throat swab samples were collected for virology, serology, and bacteriological investigation. Culture and identification and Real Time PCR for Influenza virus identification was done at EHNRI. Then descriptive analysis was made both using EPi Info version 3.5.1. and Microsoft Excel.

Results: A total of 84 cases were identified which fitted with syndromic inclusion criteria in the epidemic site and 53.6 %(45) of them were males. The median age was 29 years old and the age ranges from 1 -65 years old. The first onset date of the disease was on 28th of November 2009 and report of notification was reached to federal level on 14th of December 2009 which was after 16 days of duration. 5 households identified with in one compound at Wadi Got and 4 deaths occurred from three houses which were family member of each other. In other two houses of the same close compound no death occurred. In-depth interview with old man revealed that there slaughtering of goat for Arafa and the family members with no death were not involved b/c they spent at Beri with another family. Patient registers and report forms from 12/11/2009 to 09/12/2009 in Aduka health center also showed 142 patients with major symptoms of illness of fever 62(43.7%), cough 37(26.1%), abdominal cramp plus diarrhea 40(28.2%), head ach 40(28.2%), and joint pain 34(23.9%). Presumptive bacterial isolation found Klebsiella pneumonia in 25% (4) and Proteus retregerii in 37.5% (6) of the samples

collected from the throat swab of cases. Only one throat swab from 18 cases were positive for influenza type B virus. A nasal specimen and serum sample collected from a goat couldn't be analyzed at national veterinary laboratory

Conclusion & recommendations: According to the findings the cause of the outbreak of acute respiratory tract infection could be zoonotic viral diseases; such as influenza and rift valley fever (RVF). However Q fever and brucellosis couldn't also be excluded as a cause of the outbreak. Although there is a great need to have the laboratory confirmation for the outbreak; risk factors like flooding due to heavy rainfall, presence of sick goats and slaughtering and take caring of the meat and skins of goats might contribute for the occurrence of the outbreak. However it could not be supported by case control or other studies during the investigation. Therefore strengthening close communication with communities especially for those found in pocket areas like Wadi Gote and immediate reporting of events to the next level is necessary. The district should also due attention to animal health, and improvement of environmental sanitation by constructing latrine and safe water facilities. The FMOH/EHNRI should also capacitate the national laboratory for confirmation of bacteriological and viral etiologies having a potential to cause similar outbreak.

Key words: acute respiratory infections, Dallol district, Afar, Ethiopia

Introduction

According to the WHO 2004 report, Lower respiratory tract infection (LRTI) was the third Leading causes of death of all ages 4.2 million and 7.1 % of the total deaths (1)

Acute respiratory infections may be classified into upper (AURI) and lower (ALRI) acute respiratory infections, depending on the main organs affected (nose, sinuses, middle ear, larynx and pharynx versus trachea, bronchi and lungs). AURIs are generally mild in nature and most often caused by viruses, sometimes with a bacterial component as in some cases of sinusitis and otitis media [2]. The overwhelming majority of ARI deaths and severe illness episodes are due to ALRIs, consisting mainly of pneumonia (3). Childhood pneumonia incidence estimated about 156 million new episodes each year worldwide, of which 151 million episodes are in the developing world which also responsible for about 19% of all deaths in children aged less than 5 years, of which more than 70% take place in sub-Saharan Africa and south-east Asia (4)

The majority of respiratory tract infections in general and of viral infections in particular are caused by rhinoviruses and corona viruses. In the category of respiratory infections, influenza was reported more frequently than the common cold, despite the fact that colds occur more frequently [5].

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On Monday 14/12/2009 the EHNRI/PHEM received an emergency call from Afar Regional Health Bureau which notified 6 deaths and many cases of unknown disease with symptoms of fever, cough, chest pain, difficulty of breathing, and some component of bleeding tendency at a village(kebele) in Dallol district. A team from EHNRI/PHEM including EFELTP residents and WHO surveillance officer was mobilized and arrived in the district (wereda) on the morning of Friday, 18/12/2009.The overall objective the field visit was to verify the existence of an outbreak and made an investigation to give technical assistance in the district (woreda).

Material and Methods

Study area, population and period

An outbreak investigation was conducted in Dallol district specifically at Adukua health center and in Mao kebele at Wadi 'Got' from 18-21 December 2009. Dallol is one of the 13districts (weredas) in Afar Regional State bordering Tigray and Eritrea .One of the lowest depression in the world is located in this district (wereda). Even though the district (wereda) is labeled as lowland, it has also very mountainous land escape. The district (wereda) has 15 villages (Kebeles) with 83,913 population and Mao village (Kebele) Mao village (Kebele) has a population of 7308.The community is Muslim by religion and engaged as pastoralist.

Study design, sampling and data collection

We reviewed case register log books, morbidity and mortality report forms at Adukua health center. A line listing of cases from the district rapid response team was also reviewed. Thirteen study subjects were also selected by convenient sampling technique in which all of them were cases (patients) and interviewing of cases was made using a structured questionnaire. Observation of the affected 'Gote' environment, households who lost family members and discussion with district's officials and rapid response team was also undertaken.

Blood and throat swab sample collection

Eighteen blood and 16 throat swab samples were collected for virology, serology, and bacteriological investigation. Samples from two goats were also collected for bacteriology and serology examination
16 blood films were prepared at Mekele regional health laboratory and 10 RDT in the village for Malaria
Serum was separated at Mekelle Regional Health Laboratory and VTM was used for the throat swab samples at collection site and transported to Ethiopian Health nutrition Research Institute keeping in cold chain[10].

Culture and identification

All samples were initially cultured on Manitol salt Agara (MSA), MacConkey, Blood and Xylose Lysine Desoxycholate agar (XLD) (Oxoid, UK). After 18-24hrs growth of distinct colonies were identified, and subsequent biochemical testing was done by further incubation 18-24 hrs on different Medias[10].

Real Time PCR for Influenza virus identification

All throat samples were processed for Influenza virus at EHNRI national Influenza virus Laboratory as per the international accepted guidelines[11-13].

Data Analysis

The secondary data from line listing, patient registry, and integrated disease surveillance and response (IDSR) report forms were compiled transcribed electronically to Excel file, checked and cleaned for quality. Then descriptive analysis was made both on all types of data using EPi Info version 3.5.1.

Ethical issue: The outbreak investigation was done after the approval of the Ethiopian Federal Ministry of Health / Public Health Emergency and Dallol district in Afar region. Consent was also secured from study participants.

Results

Health and infrastructure: Respiratory tract infection is the first from the ten top diseases in the wereda followed by intestinal parasitosis, Urinary tract infection and malaria. The wereda has 1 Health center & seven health posts,3 nurses,2 Medical Laboratory Techs, 1 Environmental Health officer, 18 Health Extension Workers (HEW) and 15 Frontline community health workers. The Health service coverage as of 2008/2009 was reported as 58% while the Sanitation coverage was very negligible /0%/ district, i. e, the district has no latrine facility even in Dallol town except from the health center however it was planned to reach 11% in June 2010. The district has one telecommunication and one water purification site in Dallol town. Most of the community is getting water from small pond called "Chirosh". No electricity & road facility was available within the district.

Narration of the event at district level

The district explained that a report was received from Mao kebele on 11/12/2009 which stated that people were sick of unknown disease and started to die. After getting this information the district informed the health team and sent to the site with available medical supplies.

The district health team identified 100 patients who had cough, fever, joint pain, abdominal pain and vomiting. Four deaths occurred in "a family" and one of them was pregnant, however any of the deaths were not attended (observed) by the team. Cases were treated with antibiotics, antimalaria, anti helmentic and antipyretics drugs. The district also informed to the Federal epidemic response team during the discussion about the occurrence of another 5thdeath at the health center on 17/12/2009.

Reviewing of reports and patient registry at health facility

On 16/12/2009, one patient with symptoms of urinary tract infection (UTI) admitted in the health center with complaints of "absence of urine" while he was on medication previously, but the patient expired on next day. According to the health center document and the nurse attended the deceased revealed the patient has not absence of cough or difficulty of breathing as well as any external hemorrhagic findings.

According to reviewing of patient registers and report forms from 12/11/2009 to 09/12/2009, a total of 142 patients visited Aduka health center. Of which 77(54.6%) were males, and the leading causes for visit were RTI 30(21.1%) in which 18 of the cases were seen in the first 2 weeks of November, intestinal parasitosis 25(17.6%), AFI (malaria) 23(16.1%), UTI 14(9.8%) and recently mumps 3(2.1%).

Based on symptoms of illness the same register showed fever 62(43.7%), cough 37(26.1%), abdominal cramp plus diarrhea 40(28.2%), head ach 40(28.2%), joint pain 34(23.9%), skin rash 1(0.7%) and etc. The median age was 19 yrs old and the age ranges from 1 month to 67 years.

Table 1.2.1: Distribution of patient visit by village (kebele) from12/11/2009 to 09/12/2009 at Adukua health center, Dallol, Afar, Ethiopia

Village (Kebele)	Frequency of cases	Percent	Remark
A.V	17	13.1	
Adgubu	29	22.3	
Aduka	15	15.3	
Alfen	2	1.5	
Asgarat	14	10.8	
Beheta	8	6.2	
Dallol	1	0.8	
Ellifan	6	4.6	
Garsat	7	5.4	
Lasgada	7	5.4	
Mao	8	6.2	
Senbili	9	6.9	
Wadi	2	1.5	
Total	130	100.0	

Outbreak of mumps

On 12/11/2009 the woreda health office team were conducted a campaign to see and manage an illness with symptoms of fever and bilateral swelling in the neck area in two adjacent villages(Mao and Asagarat).On this date a total of 24 cases (18 cases in Mao & 6 cases in Asagarat). On 25/11/2009 another nine cases of mumps were seen in Asagarat village. A total of 33 cases of mumps were registered in two days from two villages. 54.5 %(18) of the cases were males and the median & range of age 8 and 34.3(0.9-35) years old.

Table 1.2.2: Distribution of mumps cases by village and Gote, Dallol, Afar, Ethiopia, Nov-2009

Village (Kebele)	Gote (small Village)	Frequency of cases	Percent
Asagarat	Afera golo	15	45.5
Mao	Bagomila	5	15.2
	Kibidega	1	3.0
	Rali	1	3.0
	Salihili	9	27.3
	Sewa	1	3.0
	Sewine	1	3.0
Total		33	100.0

Description of the epidemic site; the "Gote" (small village)

The epidemic site, Wadi in Mao village, located at Lat N 14^0, 18', 13.6" and Long E 39^0, 54', 16.63" approximately 30 Kms far from Adekua (Dallol) town, crossing steep mountain cliffs and passing canyon through dried river basin. There is no road for vehicles and accessible only by foot which we spent 3 hours. The affected "family" is located beyond the "Vast Dry River" isolated from the other nearby community and it could be a custom that the community is living very sparsely.

Each house hold and the surrounding compound were physically clean, i.e., no debris in nearby households, elders also said that no abnormal wild and domestic life was observed recently and no malaria-like illness in the community even though there was massive rain in the last two weeks. During the in- depth discussion elders also mentioned about the occurrence of mild cough in the community in the past 2-3 wks and presence of sickness of goats which then after confirmed by the Veterinarian of the team member.

"Traditionally the community didn't eat sick goats and also didn't consume raw meat. This type of sudden onset of a disease and occurrence of such consequences in "these households" was not observed before & very new for the community", said community leaders in Wadi Gote.

Although 100 cases were identified at the epidemic site by the district health team, as it was mentioned in the narration of the event at district level, according to our verification using the syndromic exclusion criteria, only 84 cases fulfill the inclusion criteria of symptoms to be a case (table 1. 2.3).

Description of the interviewed study group and cases from the line listing

A total of 30 cases were interviewed using a questionnaire, of which 17(56.75%) were females. The median and the range of age of cases were 23 and 76 (2-78) years old respectively. The onset date was on 28/11/2009 and the peak was on 10 &12 of December 2009 (Graph 1). 29(96.6%) of the interviewed cases were from Mao Village (Kebele) and 27(90%) of them were from Wadi "Gote" only.

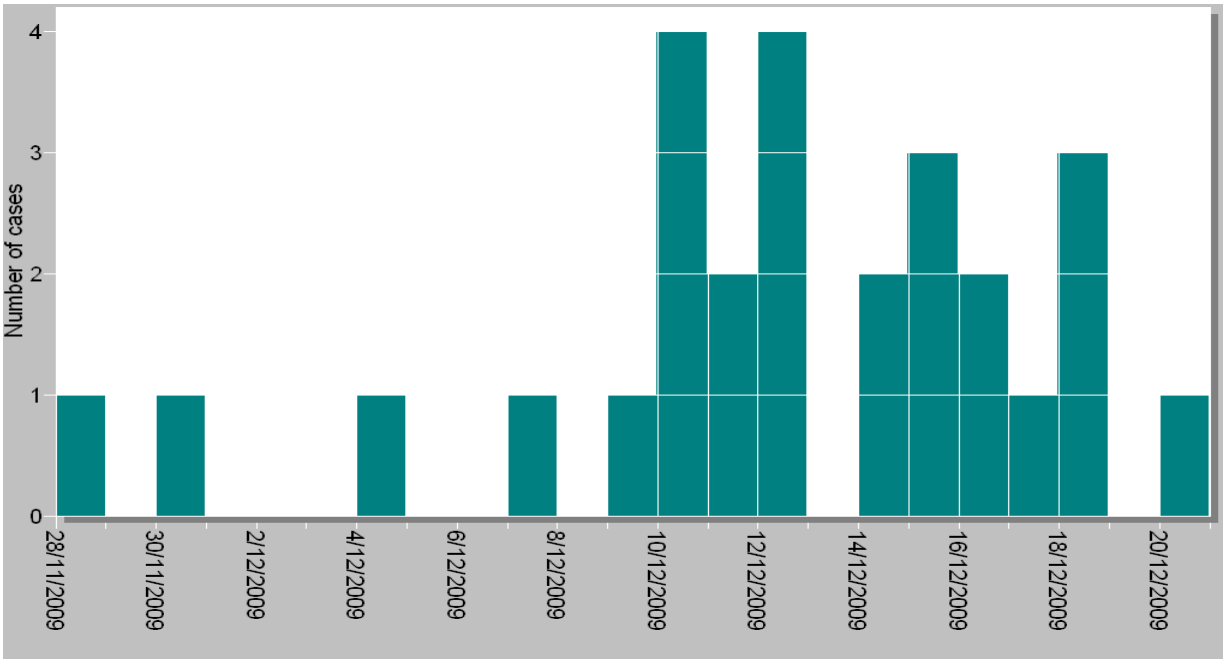

Figure 1.2.1: Epi curve of Dallol Zoonotic viral disease outbreak of interviewed cases, Dallol, Afar, November, 2009

Among the 30 people interviewed and examined clinically in Wadi community; Symptoms such as cough, fever head ache and joint pain (or muscle pain) were prominent (table 1.2.3)

Table 1.2.3: Symptoms of interviewed group and cases from the line listing of Dallol outbreak, Afar, Nov-2009

Symptoms of illness	Interviewed study group	line listing of cases from district team	Remark
Cough	28 (93.3%)	52(61.9%)	
Fever	22 (73.3%)	53(63%)	
redness of the eye	3(10.0%)		
shortness of breath/chest pain	5 (16.7%)	31(36.9%)	
Head ach	19(63.3%)	34(40%)	
Joint pain/Muscle pain	9(30.0%)	33(38.3%)	
Diarrhea	8 (26.7%)	1	
Vomiting	3(10.0%)	2	
Altered state of consciousness	1 (3.3%)		
Dehydration	0	0	
Epigastric illness/ abdominal cramp	1 (3.3%)	12	
lower back ach	2 (6.7%)	10	
sore throat/pain	1 (3.3%)	2	
Coryza (running nose)	1 (3.3%)	2	
Bleeding	0	0	
Skin rash	0	0	
Total	30	84	

According to the line listing, a total of 84 cases were identified which fitted with syndromic inclusion criteria and 53.6 % (45) of them were males. The median age was 29 years old and the age ranges from 1 -65 years old. The peak in the epidemic curve (by date of diagnosis) was observed on 15/12/2009 (Figure 1.2.2)

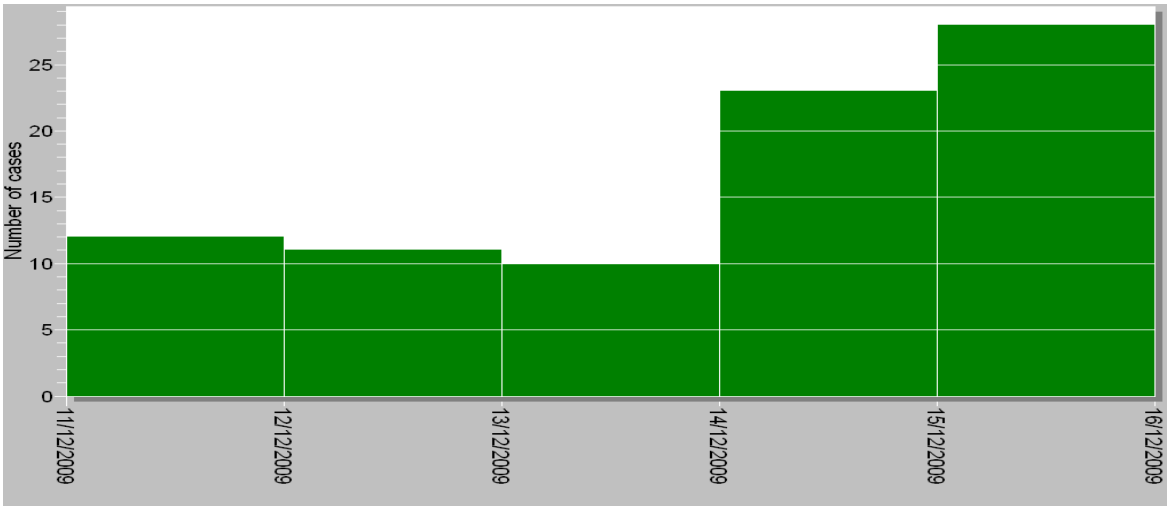

Figure 1.2.2: Epi curve by date of diagnosis at Mao village during a visit of the district health team, Afar, Nov-2009

Description of deaths at the affected households

The team identified 5 households with in one compound at Wadi Got. Three of the five households lost at least one person from each which was family member (table 1.2.4).

The head of one of the affected house hold is the father of the other two house wives, which were living in other two households with their husband and children in the same compound. During the visit the team meet the heads of the two affected households but the head from the third affected house hold was out of the village "to seek medical service"

There was no death in the remaining 4th and 5th households and also there was no complaint of illness during the reporting time.

The household heads reported that the family didn't travel outside their community recently and there was no change in family feeding pattern and items. During the In-depth discussion with leading question, the family head reviled that Goat on "Arafa", a Muslim Holiday, was slaughtered in those three households and consumed together. The two households who didn't report death and complaint during the reporting time and who were not participated in the Arafa ceremony who went to next Gote at Beri to spent with another family.

According to the description of the house hold heads, the first death was pregnant mother of 6 months gestation period who developed cough followed by fever on 28/11/2009. After four days she aborted and encountered excessive bleeding which then the retained placenta was identified and managed by a birth attendant in the community though the patient died on 03/01/2009 (table 1.2.4). The birth attendant reported having severe illness of similar symptom such as cough, fever, chest pain and joint pain for the district health team but during interviewing she was comfortable.

Table 1.2.4: onset date and date of death in the affected three house hold, in Wadi "Got", Moa village (Kebele), Dallol district (woreda), Afar, November 2009

House hold	House hold member	Date of onset	Date of death	Duration of illness
1	Mother	28/11/2009	4/12/2009	5 days
2	Mother	04/12/2009	11/12/2010	7 days
	Child	6/12/2009	12/12/2010	6 days
3	Mother	11/12/2009	13/12/2010	2 days

Symptoms of died persons (table 5) which reported by their family members were similar to the rest of the cases of the community, however their symptom's of severity was quiet different.

Table 1.2.5: Clinical presentations of the died during the outbreak in Wadi "Got", Moa village (Kebele) , Dallol district (woreda), Afar,November, 2009

House hold	Symptoms of the event / House Hold member	Fever	Head ache	Cough	Muscular/Joint pain	Throat pain	Epigastric pain	Vomiting	Abortion and vaginal bleeding	Chest pain	Diarrhea (bloody)	Difficulty of hearing	comatose
1	Mother	Yes	yes	No	No	Yes	Yes	yes	Yes	No	No	No	?
2	Mother	Yes	Yes	Yes	Yes	No	No	No	No	yes	No	No	Yes
	Child	Yes	yes	Yes	Yes	No	No	No	N/A	??	Yes	No	Yes
3	Mother	Yes	yes	Yes	yes	Yes	No	No	No	??	No	Yes	?
	% of occurrence of symptoms	100	100	75	75	50	25	25	25	25	25	25	50

Investigation also focused on the verification of one death occurred at the health center on 17/12/2009.The team went to the "nearby" village/Gote/ called Beri within the Mao kebele and discussed with family members and the community leaders. According to their report, "the person hadn't fever, cough, chest pain, & diarrhea other than chronic urinary tract complaint and longstanding abdominal swelling for which he followed in Mekele hospital. He went to the town of the district market on foot and was sick on his way. Then travelers supported him to reach to the health center and expired there. They added also the absence of any sick person in the family and no other death in the in Beri".

Laboratory confirmation

Presumptive bacterial isolation found Klebsiella pneumonia in 25% (4) and Proteus retregerii in 37.5% (6) of the samples collected from the throat swab of cases.

Only one throat swab from 18 cases were positive for influenza type B virus. A nasal specimen and serum sample collected from a goat couldn't be analyzed at national veterinary laboratory. All the 18 Serum and blood samples from human cases could not also be analyzed for any possible serological and viral identification. However all blood films and rapid diagnostic tests (RDTs) were negative for heamoparasites and malaria respectively.

Discussion

According to the patient registry and report forms from 12/11/2009 - 09/12/2009 cases with respiratory tract infection from Mao village (kebele) were very low (Table 1)and generally starting the 2nd week of November, cases with respiratory illness were decreasing. This could support that the outbreak occurred in Mao village at Wadi "Gote" was probably new and different from the usual in the district.

The first onset date of the disease was on 28th of November 2009 and report of notification was reached to federal level on 14th of December 2009 which was after 16 days of duration. Even the first death was occurred on 4th of December 2009 which also had 10 days of duration for the first notification. This could be because the first death was a pregnant woman from abortion and the community leader or government official didn't aware for another possible cause of death. However the second death from the same family on 11th of December 2009 alerted for notification and still the epidemic response team from the district couldn't attend the last death at the epidemic site. The minimum duration of illness of the deceases was 2 days and the maximum was 7 days (table 1.2.4) which indicated a severe common etiologic agent caused the event in that specific community. After the occurrence of the last death the district epidemic response team reached at the site and treated 100 patients with broad spectrum antibiotics and this could avoid death. One under five children and another teenager were severely sick with pneumonia like illness when the central team reached at the site. This probably also indicates that treatment of the cases with an antibiotic was worse less and the disease was self limiting.

The peak of epidemic curve which based the interviewed study group (figure1.2.1) and which based the line listing during diagnosis (figure 1.2.2) were completely different. This was because of people get panic of that very moment of the event and visited the district team day after day. But the leading symptoms proportion in both the interviewed study group and for cases from line listing and even in deceased was very similar (table 1.2.3 & 1.2.5).

Not eating the goat meat which slaughtered during the Arafa Holiday and absenteeism from victim compound was not go with illness and occurrence of death. But this couldn't be supported by analytical study, any laboratory investigation and could be influenced by recall bias.

The rain fall before 2 weeks of the occurrence of the event and sickness of goats could also be a risk factor for this unknown respiratory disease, but this also still not supported by laboratory confirmation and case control study.

According to the laboratory finding, Influenza virus type B was identified from one case who is the family member in that specific epidemic site. Although Influenza virus type B can cause an outbreak (6) it is less likely to cause severe acute illness as type A (7, 8). Kelebsiella pneumonia well known to cause severe community acquired pnuemonia (9) and could be responsible for this outbreak. However the laboratory result was not done from a sample of lower respiratory tract origin or by blood culturing rather from throat swab for isolation in which the bacteria may exist as normal flora.

The occurrence of mumps outbreak in two adjacent villages, i.e., Mao and Asagarat (table2) could also indicate the presence of multiple type of transmission of etiologies responsible respiratory infections in the area.

Conclusion

According to our findings the cause of the outbreak unknown respiratory tract infection could be zoonotic viral diseases; such as influenza andrift valley fever (RVF). Q fever and brucellosis couldn't also be excluded as a cause of the outbreak. Although there is a great need to have the laboratory confirmation for the outbreak; Risk factors like flooding due to heavy rainfall, presence of sick goats and slaughtering and take caring of the meat and skins of goats might contribute for the occurrence of the outbreak. However it could not be supported by case control or other studies during the investigation. The fifth death was difficult to link with the outbreak and it could better be excluded.

Recommendations

Provision of health education to the community shall be started on personal hygiene and especially hand washing after any meal and during preparation of meat, skins and slaughtering of animals to prevent similar illness in the area. Strengthening close communication with communities especially for those found in pocket areas like Wadi Gote and immediate reporting of events to the next level is necessary. The district should also due attention to animal health and improvement of environmental sanitation by constructing latrine and safe water facilities. The FMOH/EHNRI should also capacitate the national laboratory for confirmation of bacteriological and viral etiologies having a potential to cause similar outbreak.

Limitation of the study

The outbreak was almost declined totally and difficult to get acute cases because of visiting the site very lately Remoteness of the area (no any infrastructure); it was difficult to stay long time in the village and make deep investigation (absence of sleeping bags, bed nets, cooking materials, communication materials etc)

Absence of laboratory facility at national level to analyze the collected biological samples to rule out some etiologies that we suspect in the area (eg. rapid Zoonotic diagnostic kits)

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We would like to appreciate the Dallol district head and all other officials and health workers for their cooperation and hospitality during the entire field visit.

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1.2. EPIDEMIOLOGY OF ACUTE WATERY DIARRHEA OUTBREAK AND CHALLENGES OF CONTROL—AFAR, ETHIOPIA, 2009

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Abstract

Background

Acute watery diarrhea (AWD) is becoming a big problem in Ethiopia. The aim was to rapidly investigate the outbreak epidemiologically and guiding response activities in the affected districts of Afar from April-June 2009.

Methods

A line list and case register log book of the districts were reviewed as per the world health organization case definition. 31 cases and 23 controls were interviewed with a structured questionnaire. A checklist also applied to observe case treatment centers and investor camps. Stool and drinking water samples were also collected, transported and examined as per standard Microbiologic procedures. Then analysis was done using EPi Info version 3.5.1.

Results

A total of 1076 cases and 48 deaths were reviewed with an attack rate of 0.9% and a case fatality rate of 4.4%. 87.8% (945) of cases were males. Hand washing after latrine usage was protective of illness (OR = 0.13, p= 0.03) while unsanitary latrine (OR = 10.5, P-value= 0.001), contact with a case (OR = 200, P-value= 0.001) and visiting a place which has similar illness (OR=33.6, P=0.001) shown statistically significant association. Vibrio cholera 01 serotype Inaba and Escherichia coli were isolated from 89 % (9) of stool and100 % (4) of water samples respectively.

Conclusion

V. cholera 01 serotype Inaba was confirmed as etiologic agent in all districts. Drinking untreated water, close contact with a case, not practicing hand washing and unsanitary latrines were likely determinants for this outbreak. Therefore, provision of safe drinking water supply and raising community awareness about hygienic practices to control diarrheal disease is necessary.

Key words: Acute watery diarrhea, Vibrio cholera, Afar, Ethiopia

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Introduction

Cholera is a diarrheal disease caused by infection of the intestine with the bacterium Vibrio cholerae, either type O1 or O139; usually transmitted through faecally contaminated water or food and remains an ever-present risk in many countries(1). It becomes also a global threat to public health and a key indicator of lack of social development. In 2008 alone, a total of 190 130 cases were notified from 56 countries, including 5143 deaths. Many more cases were unaccounted for due to limitations in surveillance systems and fear of trade and travel sanctions. The true burden of the disease is estimated to be 3–5 million cases and 100 000–120 000 deaths annually (2). In 2007, 62% (110,837) of the global burden of cholera cases notified to WHO were from African Region which resulted in huge economic loss with millions of US$ in different life expectancies (3).

In Ethiopia it was indicated that, there was cholera epidemic in 1990 which persisted with recrudescence of cases till 1998(4). Moreover, from July 2008 to June 2009 in Ethiopia, there were a total of 9485 cases and 193 deaths (with case-fatality rate 2.0%) of acute watery diarrhea in six regions including Addis Ababa. Afar region took the highest share of cases [2,988(31.5%)] and deaths [99(51.25%)] of the country with a case fatality rate of 3.3% (5).

Afar National Regional State is one of the nine regional states of Ethiopia, according to the report of 2007 population and housing census the total population of the region was 1,411,092 out of which 55.7% were males and 44.3% were females(6), with 92.2% of population living in rural and 7.8% living in urban areas(7).

During 2006-2009, 8109 cases and 194 deaths were reported from three districts of Afar with a total case fatality rate of 2.4%. From these districts Burimedayto and Gewane reported cases of AWD only in 2007, but Amibara reported AWD in every four consecutive years.

On last week of May the Afar Regional health bureau requested the Federal Ministry of Health's Public Health Emergency Management (FMOH-PHEM) for assistance with investigating on an increased number of AWD cases. On June 06, 2009 a team from FMOH- PHEM which includes field epidemiology residents, prepared for field visit and deployed to Afar. The main objective of this investigation was to determine the cause of the increased number of cases, characterize the epidemiology of the disease that occurred from April – June 2009 and guide the intervention measures in three districts of Afar.

Materials and Methods

Study area and population

The outbreak investigation was conducted in three districts of zone 3, Afar Regional State. The population size was 63,280 in Amibara, 31786 in Burimedayto and 31,313 in Gewane districts. Many migrant laborers (around ten thousand; specific list couldn't discovered) were working for 11 companies (number of companies in Amibara were also not included) which engaged in cotton production. There were also wooden charcoal producers who came from other regions of the country especially from Wolyta Zone of South Nations, Nationalities and Peoples Region (SNNPR)

Study design and Sampling

We reviewed case register log books and morbidity and mortality report forms from May 7 to June 16 2009. An unmatched case-control study was conducted from a convenience and proportional sample of 31 cases and 23 controls within the three districts.

Data collection

Secondary data: line-lists of acute watery diarrhea cases were collected from all three district health offices and to verify that AWD cases recorded were consistent with the WHO case definition. A case log book in health facilities was also checked with the line list from the district health offices. Line lists contain variables such as date of onset of illness, age, sex, district and kebele (village) name, disease outcome. Variables recorded in the line lists and log books were few and lack uniformity among districts.

Case-control group: We developed a structured questionnaire to interview cases and controls. Cases were identified using the WHO case definition and controls were recruited among neighbors or family member of cases who did not report clinical symptoms consistent with AWD in the previous 2 weeks.

Case definition: The working case definition, "a patient aged 5 years or more which develops acute watery diarrhoea, with or without vomiting", was used to identify cases of AWD. This definition bases the WHO standard case definition of cholera in epidemics (1)".

Observation and intervention methods

The national assessment tool (checklist) for AWD, which based the WHO guideline (1), was used to collect data during observation of case treatment centers in health facilities, investor camps, and discussion with districts' epidemic teams. After conducting brief discussion with respected districts administrative and health officials, the team engaged in activating the districts epidemic response task force to participate in active case detection & educating the community to control the epidemic. The team also accomplished activities like reporting daily

cases and deaths, supportive supervision in case treatment centers (CTCs) on case management, communicated with Afar Regional Health Bureau and UNICEF in order to transmit messages of prevention methods through media by Afar language and gave advice for farm owners on how to control the epidemics and take care of their daily laborers.

Water and Stool sample collection

Nine stool samples from 9 cases and four drinking water samples from river source which served for the community were collected and transported to Ethiopian Health nutrition Research Institute Microbiology Laboratory keeping in cold chain. Cary-Blair transport medium was also used to transport the diarrheaic stool (8, 9).

Culture and identification

All samples were initially cultured on Thiosulphate Citrate Bile Salt Sucrose (TCBS) and Xylose Lysine Desoxycholate agar (XLD) (Oxoid, UK). After 18-24hrs growth of distinct colonies were identified, sub-cultured on non selective media and re-incubated for 18-24 hrs. Subsequent biochemical testing was done on Pink red colonies from XLD. Theconfirmation of Vibrio cholera was done by oxidase test and agglutination with polyvalent antiserum. Serotyping was made using Monovalent antisera (9, 10).

Antibiotic sensitivity testing of V. cholera isolates was also done on Muller Hinton agar by the Kirby & Bauer disc diffusion method (11, 12).

Bacteriological water quality was analyzed using multiple tube method in MacConkey broth following standardized microbiological procedures at Ethiopian health and nutrition research institute (EHNRI) (13).

Data quality and analysis

Secondary data was compiled manually using a new line list from the log book and line lists of the health facilities and district health offices. Then all data transcribed electronically to Excel file and checked for quality. Data entry for the case control group, importing the secondary data from Excel file and analysis was also made using EPi Info version 3.5.1.

Ethical issue: The outbreak investigation was done after the approval of the Ethiopian Federal Ministry of Health / Public Health Emergency and the districts of Gewane, Burimedayto and Amibara in Afar region. Consent was also secured from study participants.

Results

A total of 1076 cases and 48 deaths were registered during April 29 to May 16, 2009 in 3 districts (Gewane, Burimedayto, & Amibara) of Afar (figure 1.3.1) with an attack rate and case fatality rate of 0.85% and 4.4% respectively. Among cases 87.8% (945) were males and 52.1% were in age category of 15-44 years old.

The onset date of the first cases was recorded on April 29, 2009 in Gewane district. 639 cases and 24 deaths were reviewed from this district with a case fatality rate of 3.7%. Majority (83.2%) of cases were males and the age category 15-44 yrs old constitute78.3% (499). From Gewane district, the highest proportion of cases [28.0 %(178)] and deaths (26%) was seen in Geliadura village followed by Briforo with 19.7 %(125) cases and 26% deaths.

In Burimedayto district the onset date of the first case was on 3rd of May, 2009.From this date to 15th of June 2009, 329 cases and 22 deaths were reviewed from the district health office and health facility registry which gave a case fatality rate of 6.7%. Similar to Gewane district most of the cases [92.7 %(304)] were males and 38.80% (127) of the cases were in the age range of 19-24 yrs with median of 22 years old. All 13 villages / Kebeles in the district were affected by AWD and 68.6 %(225) of the cases were from Debel village followed by Fiaeto [18.3 %(60)]

In Amibara district, a total of 108 cases and 2 deaths were occurred from 13th -16thof June 2009.Only daily workers employed in a private cotton plantation farm which is found in Sheleko village were affected. All were males with age range of 15-44 years old. No report from the district health office or health facility was reviewed for any other village.

From a total of 24 villages affected in three districts the highest proportions of cases were reported from Debel (21 %), Geliadura (16.6%), Briforo (11.7%), & Sheleko (10.2%) villages (table 1.3.1).

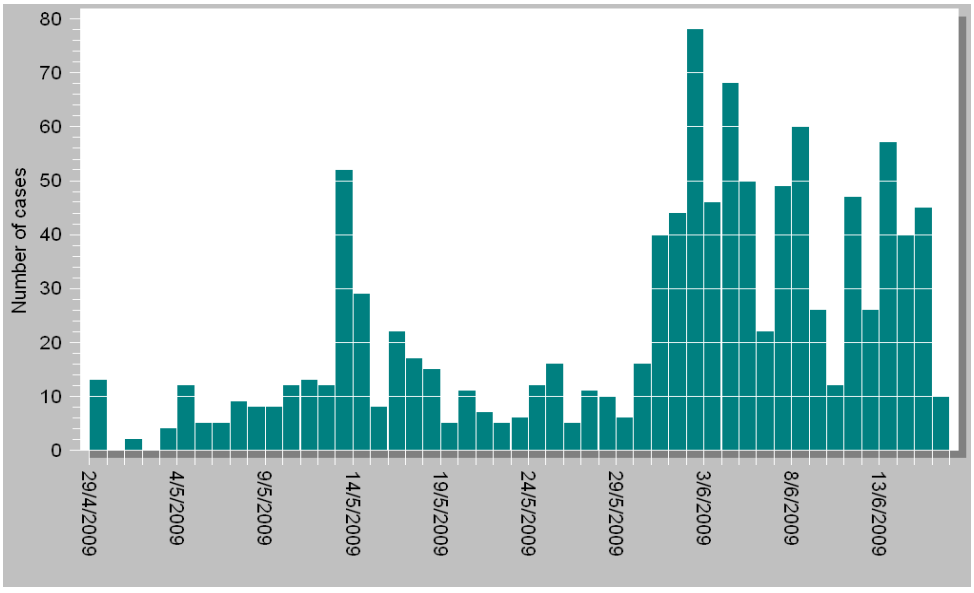

Figure 1.3.1: Epicurve of acute watery diarrhea by date of onset in three districts of Afar, Ethiopia, 2009

Table 1.3.1: Distribution of cases of AWD by villages/Kebeles, in three districts of Afar, Ethiopia, 2009

Ser. No.	Address Village/Kebele	Frequency	
		No	%
1	Amasabura	33	3.1
2	Bedula	1	0.1
3	Beida	1	0.1
4	Berimedayto	4	0.4
5	Briforo	124	11.5
6	Burka	2	0.2
7	Danglafia	1	0.1
8	Debel	225	20.9
9	Degita	1	0.1
10	Fiaeto	58	5.4
11	Geliabora	22	2.0
12	Geliadura	179	16.6
13	Gewane	63	5.9
14	Hengoyuo	1	0.1
15	Kodae	59	5.5
16	Leras	1	0.1
17	Melkawayou	1	0.1
18	Meteka	2	0.2
19	Morobiro	2	0.2
20	RassAdass	2	0.2
21	Sheleko	127	11.8
22	Subiro	1	0.1
23	Urafita	89	8.3
24	Yigil	77	7.2
Total		1076	100.0

Questionnaire based interviewed study group

From 31 cases and 23 controls (without symptoms of the disease), 85.5% were males and the median age was 20 years old.

It was shown that 80.6 % (25/31) of cases and 56.5 % (13/23) of controls were daily workers. Daily workers were also constitute 69.1% from the total respondents (cases & controls) followed by pastoralists (local community), which were 20% (figure 1.3.2).

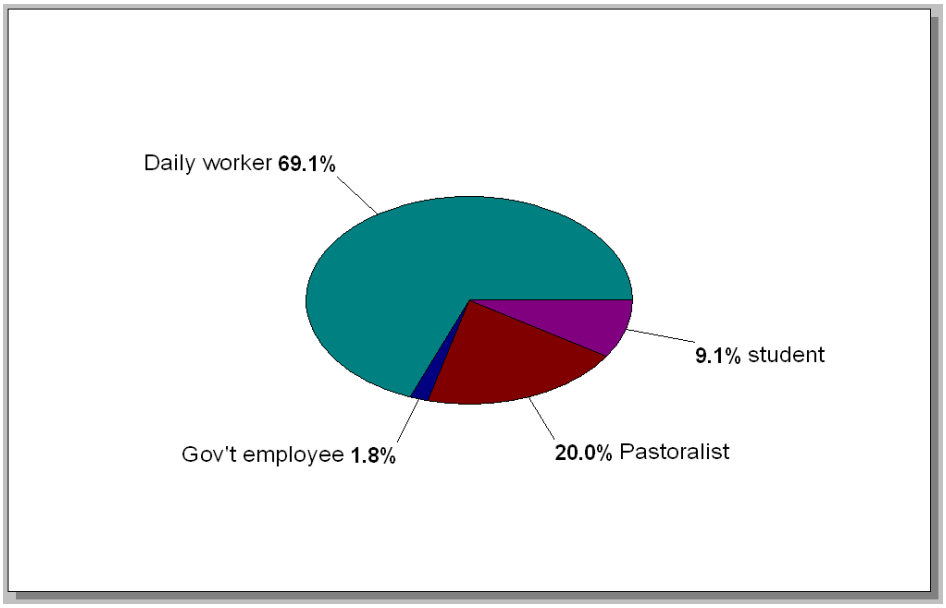

Figure 1.3.2: Distribution of interviwed subjects (combined, n=54) by occupation in three districts of Afar, 2009

Fifty eight percent (18/31) of cases and 91.6 %(22/24) of controls get drinking water from river. Of which only 12.9 %(4/31) cases and 34.7 %(8/23) of controls used treated water for drinking. 47.1 % of the respondents have access to latrine & from these 63.6% of them use it always. Only 13.2 % of respondents ate/drink in another's home/restaurant.94.4 % of the respondents wash their hands before having any meal/preparing food & 83.3 % practice hand washing after latrine usage.

Hand washing after latrine usage was protective of illness (OR = 0.13, p= 0.03), access to latrine (unsanitary latrine) [OR = 10.5, P-value= 0.001], contact with a case (OR = 200, P-value= 0.001) and visiting a place which has similar illness (OR=33.6, P=0.001) had shown statistically significant association with being a case. Whereas, Shortage of Water supply (OR=1.9, CI=.05-6.25, P=021), Washing hands with soap/detergent before having meal and preparing food (OR=0.65, CI= 0.05-7.74, P=0.61) and Eating /drinking in another's home in a week before your illness (OR=0.48, CI= 0.09-2.41, P= 0.3) could show statistically significant association (table 1.3. 2).

Table 1.3.2: Univariate analysis for possible risk factors of acute watery diarrhea in a case-control study (unmatched) in three districts, Afar, Ethiopia, 2009

Risk factors	Cases	Controls	OR (95%CI)	P-value
	Yes Number (%)	Yes Number (%)		
Access to latrine	19(61.2)	3(13.0)	*10.6[2.5-43.3]	0.001
Interruption of water supply (in this season than any other before)	13(41.9)	6(27.2)	1.9[.059-6.25]	0.21
Washing hands with soap before having meal and preparing food	29(93.5)	22(95.6)	0.65[0.05-7.74]	0.61
Washing hands with soap/detergent after latrine	23(74.1)	22(95.6)	.13[0.01-1.13]	0.03
Usage of water treatment chemicals before drinking	4(12.9)	8(34.7)	0.27[0.07-1.07]	0.05
Any travel history a week before your illness	3(9.6)	-	-	-
Presence of similar illness in the visited place	28(90.3)	8(34.7)	*33.6[7.13-158.15]	<0.001
Close contact with a case/person with similar illness	30(96.7)	3(13.0)	*200[19.4-2061.4]	<0.001
Eating /drinking in another's home in a week before your illness	3(9.6)	4(18.1)	0.48[0.09-2.41]	0.3

*Possible reasons for very wide confidence intervals explained in the discussion section

Regarding to treatment, 54.8% of the patients treated with antibiotics, IV fluid and ORS whereas 32.3 % of them get only IV fluid. 78.1 % (24/31) of cases had vomiting and 80.6 %(25/31) had more than 3 episodes of diarrhea within 24 hours. Of which 25.8(8/31) had 7 episodes within 24 hours. Only 9.6 % (3/31) of cases had fever.

Observation for farm camps situation

The team observed the daily workers hygiene and sanitation condition in all 11 investor camps and there were no latrines or safe drinking water sources for daily workers. Water was fetched directly from river Awash. They live in overcrowded (>60 persons/room) conditions, with shared drinking and eating utensils (1 utensil for > 50 individuals), inadequate /no provision of medical supplies, and except for one investor camp (in Amibara) all others have no any clinic and health worker to provide treatment and health education activities.

Observation for local community situation

The team visited and observed different villages in the districts; similar to the investor camps, the local communities reside in villages (rural) without access to safe drinking water (see photo June 16 2009) and latrines.

Health extension workers and & other health professionals are scarce, and there are inadequate medical supplies and other resources (hygienic materials, water treatment kits, etc). The team also observed the awareness of the rural community to personal hygiene, the causes and prevention of diarrheal disease and which found was low.

Figure 1.3.3: Afar women fetching water from canal used for irrigation (Awash River) for drinking and other household purpose, Geliadura village, Gewane, Afar - on June 16, 2009

Laboratory confirmation

Vibrio cholera 01 serotype Inaba was isolated from eight of the nine stool samples which were collected from three districts. All Vibrio cholera 01 Serotype Inaba isolates were sensitive to ciprofloxacin, doxycyclin, tetracycline, erythromycin, amoxicillin, and chloramphinicol. However, all isolates were resistant to co-trimoxazole. No any other enteric pathogenic bacteria were isolated from stool samples.

Escherichia coli type I and other faecal cloiform bacteria were also isolated from all four water samples collected from the canals that residents and daily laborers in Farm Companies were being used for drinking and other home purposes.

Discussion

The onset date of the first case was on April 29th in Gewane, on May 3rd in Buriemedayto, and June 13th in Amibara. The rapid spread from Gewane to Burimedayto was likely due to the proximity and frequent movement of residents and daily laborers from one village to the other. The outbreak in Amibara started late on 13th of June 2009 and stopped after a week. Amibara is 70 Km from Burimedaytu & 100 kilo meters from Gewane so there is less frequent contact with cases from the two adjacent districts. In addition, workers have access to health care services from their own company which may have reduced the magnitude and severity of the outbreak in Amibara.

The overall attack rate (AR) and case fatality rate (CFR) was 0.9% and 4.4 % respectively (total districts' population of & total cases were taken as denominator); which is almost similar with the cholera outbreak in Kampala-Uganda and Tanzania [11, 12]. Age and sex specific attack rate and case fatality rate could not be calculated due to lack of estimate population and uniformity in data compilation system in the districts.
The CFR was high as compared to the WHO guideline; which was supposed to be less than 1 % [1]. This could be ignorance in the investor farm camps, shortage of medical supplies & poor case management in CTCs. However when we compare with outbreaks occurred in other African countries, such as in Nigeria 6.1% (similar serotype isolated like in our outbreak investigation)[13], in Lusaka 5.1% [14], in Kenya 4% [15], and in Burundi 3% [16] ours case fatality rate became median value. Unreported & unregistered cases and deaths especially in the 11 villages/kebeles of Burimedayto district might underestimate the total number of cases as well as the case fatality rate.

In all districts most of the cases were males & daily laborers employed in the farm companies (cotton plantations). This could be due to overcrowding which in fact was similar like refugee camps). The highest numbers of cases (21 %, 16.6% &11.7% respectively) were occurred in Debel, Geliadura, & Sheleko villages (table 1.3.1). This might also be due to the high number of daily laborers residing in these villages/Kebeles and the prolonged duration of the epidemic which took more than one and half month. The Epi-curve has many peaks (figure 1.3.1) which showed a progressive person to person transmission, this could be due to the absence of health infrastructure in the investor companies and weak response activity of the districts Epidemic task force.

Risk factors like hand washing after latrine usage, drinking treated water, access to latrine (unsanitary latrines) & contact to a case and visiting someone with similar illness had shown statistically significant association with AWD in univariate analysis. The confidence interval was very wide for those risk factors with P-value of < 0.001 (table 13.2). This could be simply explained by the very small sample size which makes the power of the test weaker. Increasing the sample size and testing with multivariate analysis could allivate the encountered discrepancy (wide confidence interval and very small p-value). Shortage of Water supply, washing hands with soap/detergent before having meal and preparing food & eating/drinking in another's home were not significantly associated with illness by univariate analysis (table 1.3.2).

Challenges during intervention and limitations of the study

It was difficult to get gathered and give health education about the disease that came from other regions and engaged in the production of wooden charcoal. Eleven villages in Burimodayto district were inaccessible for vehicle transport because of Awash River during the investigation period. The epidemic response task force of Gwane district couldn't also involve full time on board for the intervention of AWD because of other priorities like resolving dispute among clans.

It was difficult to undertake probability matched case-control study and interview more subjects during rapid epidemic response and investigation in a dispersed population. The team also reached late in the area and couldn't spend much time on investigation of the outbreak rather engaged in the intervention activity.

In conclusion, in this outbreak the overall case fatality rate (4.4 %) was higher than the WHO's recommendation. Vibrio cholera 01 serotype inaba was responsible for the acute watery diarrhea outbreak in all three districts. Isolated organisms like Escherchia coli Type I and other faecal coliform bacteria from drinking water sources could also support the cause for the situation in the area. Drinking untreated water, close contact with a case, unhygienic latrine and not practicing hand washing were the possible risk factors for the outbreak. The hygiene and sanitation condition in the farm camps was found be nasty and the response was also weak in districts which could resulted in increased number of cases and prolonged duration of an outbreak.

So, stakeholders at all levels should work on AWD and other diarrheal diseases prevention and control activities such as the regional health bureau and district health offices should strictly conduct monitoring of hygiene and availability of safe water for daily workers in the investor companies and in the local community. Farm campany owners would also discharge their responsibility in take caring of the daily laboureres. Furthermore, The Federal ministry of health, NGO's and local health offices should strengthen early investigation and the rapid response to control further spread of the disease and not to encounter extended other similar outbreaks.

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1.3. Outbreak of Mass Hysteria at a High School, Amhara Region, Ethiopia – April, 2010

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Abstract

Background: Mass hysteria has long history with the potential for significant adverse public health consequences and economic implications. The objective of this study is to describe the outbreak, guide interventions and improve understanding and recognition of similar events in the future.

Materials and Method: Investigation of an outbreak was conducted at Bati high school in Amhara region from April 26-May 02, 2010. Data was collected using a line listing which contains socio-demographic characteristics, symptoms and perceptions of cases during the outbreak. Detailed discussions were also undertaken with school principal, teachers, surveillance officers and district administrator about the outbreak. Then data was analyzed using Epi Info version 3.3.2

Results: Fourty four cases were identified during the outbreak. All of them were females, the median age was16 years old, and 33(75%) of them were Muslims. The onset of the outbreak was on 07 of April 2010 and continued for 22 days. The major clinical symptoms were breathlessness, fear and crying, anxiety, unable to move limbs. The median duration of illness was 3 hours and with a range of 2 to 96 hours. 13 (27.3%) and 6(13.6%) of the cases reported the cause of the disease to be evil-devil force and Stress respectively, however the rest (59.1%) of the cases replied as 'I don't know'. No air toxicity, food poisoning, infectious disease, and any cause of conflict in the area were identified.

Conclusion & recommendations: This outbreak of apparent illness was consistent with mass hysteria. Socio-cultural beliefs in evil-devil forces together with academic pressure may have been triggering factors. Conducting short investigation, providing immediate reassurance, and timely psychiatric support and counseling at the school and community level could minimize this type of epidemic.

Key words: Epidemic hysteria, high school girls, Bati, Ethiopia

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Introduction

Mass hysteria has long history with significant public health problem and economic cost repercussion. It is characterized by the rapid spread of conversion disorder, a condition involving the appearance of bodily complaints for which there is no organic basis. In such episodes, psychological distress is converted or channeled into physical symptoms[1]. Conversion formerly known as hysteria is considered a psychiatric disorder in the International Statistical Classification of Diseases and Related Health Problems (ICD-10)[2] and Diagnostic and Statistical Manual of Mental Disorders 4th edition (DSM-IV) [3].

Symptoms of Hysteria/conversion disorder are most common in young women, more common in rural areas-among uneducated people and in the lower socio-economic classes and generally higher among patients from minority ethnic groups[4].

Studies suggest that a peak onset of conversion disorder occurs in the mid-to-late of 30s and it may present at any age but is rare in children younger than 10 years or in the elderly[5, 6]. During 1973-1993, 70 outbreaks of epidemic hysteria were identified all over the world and 50% of these outbreaks occurred in schools, 29% in factories 10% in towns/villages and 11% in other various settings[7]. The outbreak of mass psychogenic illness or hysteria in USA[8], in Jourdan[9], and in South Africa were also took place in schools and the majority of cases were females.

Another report on 21 February 2005 from Australia, at Melbourne's domestic airport indicated the suggestive occurrence of mass psychogenic illness among 57 cases which primarily believed to be caused by a mysterious "gas leak". The incident disrupted domestic flights over 2 days and cost an estimated three million dollars[10] .This report gave a lesson and clearly showed that epidemic hysteria need to be emphasized by the public health and other sectors too.

In Ethiopia, Epidemic hysteria reported from Gondar city, in north western part of the country in 1982 (only the article title accessed from pubmed) [11].

Ethiopia is a nation of multiethnic society with low income, different socio-cultural and existence of strong religious beliefs. However, epidemics of hysteria is under reported or not studied well across the country. Thus the objective of this study is to describe the outbreak which occurred in Bati, guide interventions and improve understanding and recognition of similar events in the future.

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Materials and Methods

Study area and population

In the 2nd week of April, 2010, the Amhara Regional State Health Bureau has got notification from Oromia zone health office about the occurrence of a mysterious illness in Bati high school. Soon after, the bureau delegated the nearby zone health office, south Wollo to visit the school. After getting feedback from south Wollo, a team lead by an officer from the Bureau visited Bati town and under took an investigation at Bati high school from April 26-May 02, 2010.

Bati town is 418 kilometers from Addis Ababa on a highway through Kombolcha town to Afar. The school had 1283 students with 0.56 male to female ratio and the total population of Bati district is estimated at 107, 343[12]. All girls affected by the event were taken as the study population.

Data collection

A case register log from the health center and line listing prepared by the district health officials was used to collect the initial data such as symptoms of illness and socio-demographic characteristics. The investigation team rebuilt the line listing and set working case definition based on the symptoms of illness. Then cases (new and prevalent) and their parents were interviewed for some characteristics using the new line listing.

The team also undertook detail discussions with school principal, teachers, district surveillance officers and town administrator about the physical, psychological, and social factors that may have contributed for the onset and spread of outbreak.

Statistical analysis

Data was entered to computer in Microsoft Excel, checked for completeness with original data sheet (line listing). Then analysis was made using Epi Info version 3.3.2

Ethical issue: The investigation was done after the approval of the Amhara regional state health bureau and Bati district health office. Consent was also secured from patients and parent's of patients (or guardian for those who couldn't give consent because of their under age, i.e., <18 years old).

Results

A total of 44 cases were identified in Bati high school during April 26-May 02, 2010. All of them were females, the median age was 16 years old, and 33 (75%) of them were Muslims. Twenty four (54.5%) of the cases address was in town from four different villages (kebeles) and the rest were from rural villages of the district.

The onset of the outbreak was on 07 of April 2010, when a 15 years old girl showed symptoms of unknown illness at school. On 09 of April 2010, twelve students showed similar types of symptoms during class hours. Two cases from different sections were identified who had underlying psychological problems on this date; one of them living with her grandmother while her mother lives abroad and her father had psychiatric problem. The second lived with a guardian after she lost her mother and father. She had conflict with her guardian a day before her attack in the school. But only two of the twelve affected students were classmates of the index case. New cases continued to occur up to 29 of April 2010 (figure 1.4.1).

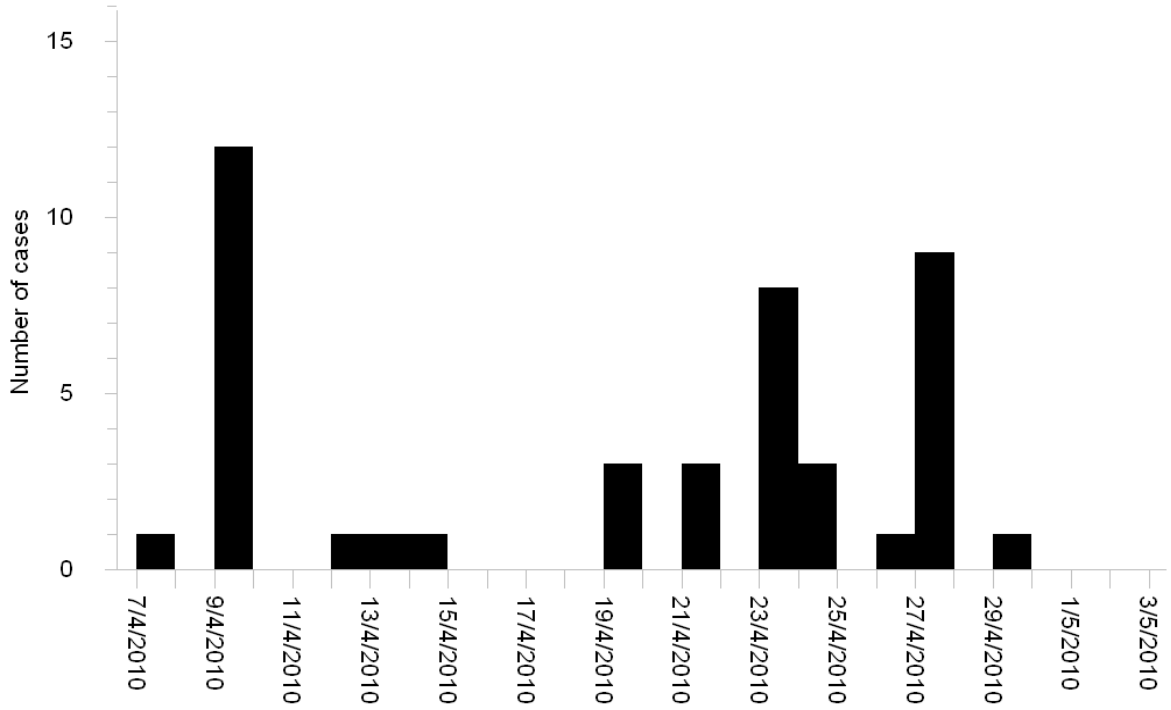

Figure 1.4.1: Epidemic curve of hysteria outbreak in Bati high school, Amhara, Ethiopia-April 2010

The major clinical symptoms were breathlessness, fear and crying, anxiety, unable to move limbs/falling, fatigue, epigastric pain/cramp, fainting/convulsions and head-ache (table 1.4.1). The duration of illness ranged from 2 to 96 hours and the median was 3 hours.

Table 1.4.1: Major symptoms manifested among Bati high school girls, Amhara, Ethiopia-April 2010

Symptoms	Frequency	
	No.	%
Shortness of breath	43	97.7
Fear and crying	30	68.2
Anxiety	27	61.3
Unable to move limbs/falling	13	29.5
Fatigue	8	18.2
Epigastric pain and cramp	6	13.6
Convulsions/fainting	4	9.1
Head ache	4	9.1
Sleepiness	2	4.5

The frequency of attack of illness among the majority [35(79.5%)] of cases was only ones, two times in 7(15.9%) cases, and three times in 2(4.5%) cases.

All affected cases were from grade 10 and 9 except one case from grade 11. The illness first observed among grade 10 students and later progressed to grade 9.Tewnty seven (61.4%) of the cases were grade (class) 9 in eight different sections(rooms), 16 (36.4%) were grade 10 in four different sections. School performance of cases also showed as 6 (13.6%) good, 25(56.8%) average and 13(29.5%) were below average performers. Twenty five (56.8%) of the cases response on perceptions about the root cause of the disease was “I don’t know”. But 13 (27.3%) and 6(13.6%) replied that evil-devil force and stress-psychological factors caused illness respectively. Parents' perception/belief about treatment of the event also indicated as ritual at school using Quran/Bible [15(44.1%)] and change to another school [7(20.5%)] (table 1.4.2).

Table 1.4.2: Socio-cultural characteristics and triggering factors of the outbreak, Bati high school, Amhara, Ethiopia-April 2010

	Frequency	
Characteristics	No.	%
Patient's perception about the root cause of the event (n = 44)		
Evil-devil force	13	29.5
Stress (psychological)	6	13.6
Food poisoning	0	
Air toxicity	0	
Infectious disease	0	
Unknown (I don't know)	25	56.8
Patients' perception on treatment of the event (n = 32)		
Religious ritual at the school	18	56.2
Parents and religious leaders discussion	10	31.2
Study to identify the cause	1	3.1
Unknown (I don't know)	3	9.3
Parents' perception for treatment of the event (n = 34)		
Change school	7	20.5
Epidemic committee bring solution	2	5.8
Religious ritual at school	15	44.1
Having strong religious belief	4	11.7
I don't know	6	17.6

Thirty (68.1 %) cases reported"I don't know" about the triggering factors for their illness whereas 10(22.8%) and 4(9.1%) cases replied seeing another case on attack and thought about the event triggered their illness respectively. Interviewing for underlying cause also revealed two cases had chronic illness and three with history of death of family member and 3 of the cases.

Based on the detail-discussion with school principal and teachers, it was found that the class rooms have good windows with nice ventilation, no unusual odor, and no dispute among school community. But in the school, blaming of unidentified teacher being as an evil (or 'buda'in Amharic) was disseminated by the students. Due to this rumor teachers faced difficulty in reassuring the cases.

The spiritual ceremony by religious leaders that has been conducted on 25 of April 2010 at the school was recognized during our discussion with the administrator and health officials. In this session, the exclusion of food insecurity, any tribal or religious conflict and infectious epidemic in the district or neighboring districts was scrutinized.

Discussion

The index case had no any underlying problems like chronic illness, parental divorce, death or imprisonment of family member. But had history of similar problem; "evil-devil attack" and get traditional treatment in home. She also had no conflict with teachers or students and no academic problem unlike a Zambian study which found educational problem (below average) and emotional problem in an index case prior to the epidemic[13].

Major symptoms which identified in this outbreak were similar with those outbreaks occurred in Los Angeles-USA[14], and in South Africa (SA) [15], however the frequency of symptoms are higher than from the above mentioned studies. Majority [30 (68.1%)] of cases respond "I don't know" about their perception on factors that triggers the illness. But 14 (32%) cases replied that seeing another while on attack and thought about the event triggered their illness. This type of spread of symptoms from one to another by watching a person on attack is indicated in different repots[10, 15, 16].

According to the cases and parents beliefs, the possible root cause and treatment of the disease is socio-cultural like, devil-evil forces caused the disease and religious ritual (using Quran and/or Bible) at the school will resolve the problem. Similar finding (25.0%) on evil forces as a root cause was indicated in a study in Taiwan[17]. In fact there were wide spread of rumors such as "the school is built on graves area of ancestors and has a strong sprit" and" unidentified teacher was blamed as being evil". These beliefs more strengthened during the incident of the event and religious leaders were asked and conducted spiritual ceremony at the school. We believe these triggering factors fit for the event as it was supported by another study that the exact trigger and content of an outbreak reflect the cultural setting of a society[18].

Another point which couldn't be neglected is the frequency of attack (97.7%, 43) occurred among Grade 9 and 10 students. In Ethiopia these two grades(classes) are very determinant to stay in high school for preparation to join university in addition the date of the outbreak was the time in which students prepared for national (grade 10) and end year final exam after 2 months. This could be supported by a study which showed a 42.8% (n=35) outbreaks occurrence during the last 2 months of the school year, at a time of intense group involvement and examinations[19]. However, our study is only based descriptions and it is difficult to underline the possible definitive risk factors of the outbreak.

In this outbreak all the affected cases were females and 75% of the cases were Muslims. The occurrence of higher proportion of Muslim cases could be the reflection population size of Muslims in the school and in the district.

The issue of frequent attack of females in similar outbreaks reported worldwide in various studies[4, 8-10, 13-15]. But it couldn't be explained why such outbreaks had been related to females early from ancient Greek thoughts up the modern era.

Interventions: The primary intervention conducted was education for the students and school staffs. The medical team of the district health center and psychiatric practitioner from Dessie hospital gave health care service, i.e., reassurance for new and follow up cases including parents and other school community members. It also supported the epidemic investigation team for any possible organic cause.

In conclusion, the outbreak occurred in Bati high school girls was an epidemic of hysteria. Overcrowding of students at school, conflict within the school staffs or among students, unusual climate change, outbreak of illness, and political or religious conflict in the area was excluded. But socio-cultural beliefs like evil-devil forces together with tension on the academia could be the triggering factors.

Conducting short investigation, providing immediate reassurance, separation of ill from non ill and follow up is necessary in minimizing an epidemic. Though prevention of this type of outbreak could be challenging, education on psychiatry and different risk factors related to mass hysteria shall be given at school.

Acknowledgements

We would like to acknowledge the district health officials, administrators and study participants for their full cooperation in the entire field work. We also thank Dr Richard Luce (FELTP resident advisor) and Dr Donna Jones (CDC Atlanata) for their support in writing this document.

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Chapter II – Surveillance Data Analysis Report

2.1. Tuberculosis in Ethiopia: Analysis of surveillance program report, 2004-2008

Belay Bezabih

Abstract

Background

The 2007 WHO estimate indicated that incidence of TB of all forms and smear positive tuberculosis in Ethiopia stand at 341 and 152 per 100,000 population respectively. Ethiopia ranks 7th from the 22 high tuberculosis burden countries in the world though strong efforts were made through the national tuberculosis and leprosy control program.The overall aim was to describe the national tuberculosis data epidemiologically and communicate the findings to those who have concern in the control and prevention of tuberculosis in Ethiopia.

Methods

The 2004-2008 annual tuberculosis control program report was collected on February 2009 from the Federal Ministry of Health of Ethiopia. Data was checked & cleaned for its completeness & relevant variables were included for the analysis of the report. Then Microsoft excel was used to analyze the data or report.

Results

The average annual estimate of all forms & smear positive pulmonary tuberculosis cases were 254,599 & 113,101 respectively during 2004-2008. From the above estimates the average detection was 125,885 (49.4%) & 39,163 (34.6%) for all forms & smear positive pulmonary tuberculosis respectively in similar years. From all forms of tuberculosis detected during 2004-2008, the proportion of EPTB, PTB smear positive, & PTB smear negative cases were 36%, 33%, & 31% respectively. The detection of all forms of tuberculosis was higher (175/100000 pop.) in 2008. Males constitute 107,463 (54.8%) of the pulmonary TB smear positive cases. The highest proportion of pulmonary TB positive cases lies in the age group 15-34 [70709 (61.2%)] followed by 35-44 [19984(17.3 %)]. The highest average case detection rate (86%) & the lowest (20%) were seen in Gambella & Somali respectively. But the highest average number of cases/year were reported from Oromiya region [41794(33%)]. Treatment success rate during 2005-2008 was below ≤ 85% (between 78% - 81%) and the highest death rate [4 per 100,000 population (2789 deaths)] was observed in 2006.

Conclusion & recommendations

The overall annual detection of all forms of tuberculosis & pulmonary tuberculosis positive cases were far low from the WHO estimate in five years period. Pulmonary smear positive tuberculosis cases were higher among males and between15 and 44 years age group. The detection rate of regions with big population was also much

lower (Example: Amhara & Oromiya). The proportion of extra pulmonary tuberculosis cases was inconsistently high from theoretical background. Treatment success rate was approaching the WHO target, but the cure rate and defaulter rate was very low. Therefore, Federal Ministry of Health regional Health Bureaus and other supporting partners should strengthen the surveillance / control program/ in order to detect cases, improve cure and defaulter rates and conduct further research for the escalating of EPTB cases and gender difference.

Key words: Tuberculosis control program, tuberculosis case detection, Ethiopia

Introduction

The recent discoveries that Mycobacterium tuberculosis has probably been a human pathogen for millions of years[1], and that cattle and other animals are likely to have acquired Mycobacteria from humans rather than the reverse[2, 3].TB is mainly a disease of adults, and affects more men than women. It is an important cause of death among young adults who are raising families and in their most productive working years. In regions where the transmission of M. tuberculosis has been stable or increasing for many years, the incidence rate is relatively high among infants and young adults, and most cases are due to recent infection or re-infection[4].

Tuberculosis remains one of the leading causes of death from infectious disease Worldwide. The estimates of the global burden of disease caused by tuberculosis in 2009 are as follows: 9.4 million incident cases (range, 8.9 million–9.9 million), 14 million prevalent cases (range, 12 million–16 million), 1.3 million deaths among HIV-negative people (range, 1.2 million–1.5 million) and 0.38 million deaths among HIV-positive people (range, 0.32 million–0.45 million). Most cases were in the South-East Asia, African and Western Pacific regions (35%, 30% and 20%, respectively). An estimated 11–13% of incident cases were HIV-positive; the African Region accounted for approximately 80% of these cases[5, 6]

WHO was also set two principal global targets for TB control such as Case detection and treatment success rates of ≥70% and a treatment success rate of 85% among sputum smear-positive cases of pulmonary TB respectively during the period 1991 to 2005. Case detection rate(CDR) is calculated as, for a given country, the number of notified cases of TB in one year divided by the number of estimated incident cases of TB in the same year, and expressed as a percentage. However Ethiopia could approach to the target (≥ 70%) for more than a decade[5].

Drug resistance tuberculosis (MDR & XDR-TB) became also increasingly a growing barrier to achieving any sustainable path to TB elimination[7]. MDR-TB is classified as resistance to isoniazid and rifampin among the first-line TB drugs[8]. XDR-TB is classified as meeting the criteria of MDR-TB, in addition to resistance to any fluoroquinolones and at least 1 of 3 injectable drugs (amikacin, capreomycin, or kanamycin) [9]. In 2007 an estimated 500,000 cases of multidrug-resistant (MDR) tuberculosis were reported in which the majority were from India, China, Russia, South Africa, and Bangladesh and 55 countries had also reported cases of extensively drug resistant (XDR) tuberculosis by the end of 2008[10].

However, TB can be controlled, in principle, by three methods: preventing transmission and infection (e.g. vaccination, isolation), stopping the progression from latent infection to active TB (e.g. vaccination, drug treatment), and treating active disease (presently, with a combination of drugs)[11].

In Ethiopia, tuberculosis is well known disease for many years and currently due to exacerbation of HIV/AIDS, it becomes major public health burden. WHO estimated the incidence of TB of all forms 341 per 100,1000 population and smear positive tuberculosis of 152 per 100,000 population in Ethiopia in 2007. Ethiopia ranks 7th from the 22 high tuberculosis burden countries in the world[12].

According to FMOH, hospital statistics data showed that tuberculosis is the leading cause of morbidity, the third cause of hospital admission (after deliveries and malaria), and the second cause of death in Ethiopia, after malaria[13]. Currently Tuberculosis and Leprosy are quarterly reportable diseases and it is believed that the national control program of Tuberculosis and Leprosy has been strong which other programs like HIV/AIDS get a good lesson. Nonetheless, for more than a decade the national TB cases detection rate was far below the WHO target.

The overall objective of this surveillance report (data) analysis was to describe national tuberculosis control program report (data) by person, place and time, generate hypothesis from findings for further possible research and communicate findings for those who work on control and prevention of tuberculosis.

Methods and Materials

Study design and data collection

A descriptive analysis was employed between February 25 and March 10, 2009 in Addis Ababa. The national tuberculosis annual report of five consecutive years, i.e., 2004-2008 (2004-2008) was collected from the Federal Ministry of Health of Ethiopia and checked for completeness of relevant variables. Revisiting of data manager at the FMOH was made for clarification of doubtful and incomplete reports.

The National Tuberculosis and Leprosy Guide Line definitions were also used for appropriate usage of the following indicators;

TB all forms: All types of Tuberculosis; i.e. pulmonary positive, pulmonary negative & extra pulmonary tuberculosis

New case (N):A patient who had never treatment for TB, or has been on previous anti-TB treatment for less than four weeks.

Relapse (R): A patient declared cured or treatment completed of any form of TB in the past, but who reports back to the health service and is now found to be AFB smear-positive or culture positive.

Treatment Failure (F): A patient who, while on treatment, is smear-positive at the end of the fifth month or later, after commencing. Treatment failure also includes a patient who was initially sputum smear-negative but who becomes smear-positive during treatment.

Cured: A initially smear-positive patient who is sputum smear-negative at, or one 'month' prior to, the completion of treatment and on at least one previous occasion (usually at the end of the 2nd or 5th month).

Treatment completed: A patient who completed treatment but for whom smear results are not available at 7th month or one month prior to the completion of treatment.

Died: A patient who dies for any reason during the course of treatment of tuberculosis

Defaulter: A patient who has been on treatment for at least 4 weeks and whose treatment was interrupted for 8 or more consecutive weeks.

Treatment success: The sum of patients who are declared "cured" and those who have "completed" treatment.

Data analysis

Microsoft Excel was used to made descriptive statistical analysis of the data (report).Then prominent findings of the analysis were presented on figures and tables.

Ethical Issue:

A letter was written to the Fedral Ministery of Health of Ethiopia from Addis Ababa University, School of Public Health of the Ethiopian Field Epidemiology and Laboratory Program for legal consent to use the data.

Results

The average annual estimate of all forms & smear positive pulmonary tuberculosis cases were 254599 & 113101 respectively from year 2004-2008. From the above estimates the average detection was 125885 (49.4%) & 39163 (34.6%) for all forms & smear positive pulmonary tuberculosis respectively in similar years (table 2.1.1 & graph 2.1.1).

Table 2.1.1: Annual estimate & detection of tuberculosis, 2004-2008, Ethiopia (The estimate is by WHO)

Year	Estimated all forms	Estimated New PTB positive	Detected All forms of TB	Detected PTB positive
2004	244467	108020	120614	**41275**
2005	251270	111026	123012	**39036**
2006	255978	114102	120163	**36674**
2007	263003	117233	126676	**38040**
2008	258277	115127	138960	**40794**
Average	**254599**	**113101**	**125885(49.4%)**	**39163(34.6%)**
Total	**1272995**	**565508**	**629425**	**195819**

The proportion of EPTB, PTB smear positive, & PTB smear negative cases were 36%, 33%, & 31% respectively from all forms of tuberculosis detected in 2004-2008 (Figure 2.1.1)

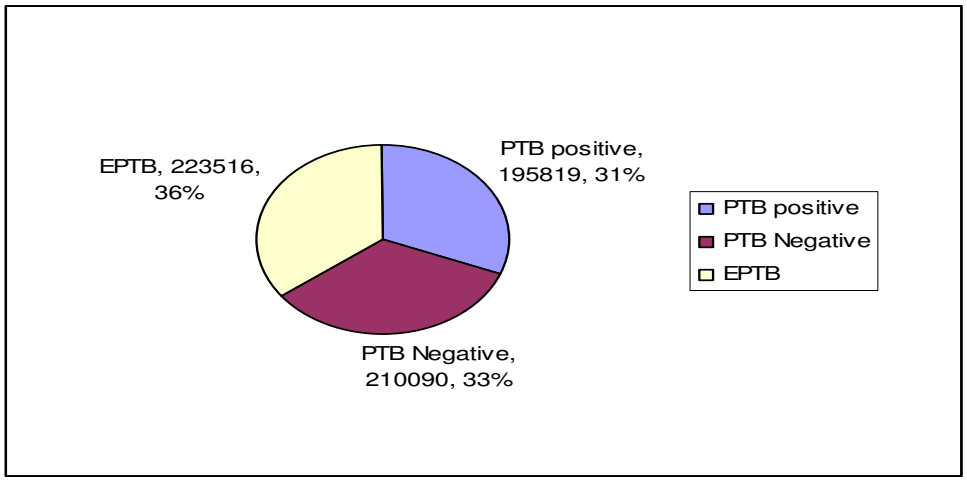

Figure 2.1.1: proportion of tuberculosis cases by classification from 2004-2008, Ethiopia

The annual report of pulmonary tuberculosis smear negative (PTB-) cases was increasing from year to year. Except in the year 2006, extra pulmonary tuberculosis (EPTB) cases were also increasing year to year. But pulmonary tuberculosis smear positive (PTB+) cases were markedly decreased from 2004-2007 and raised again in 2008 (figure 2.1.2 and in annex 4).

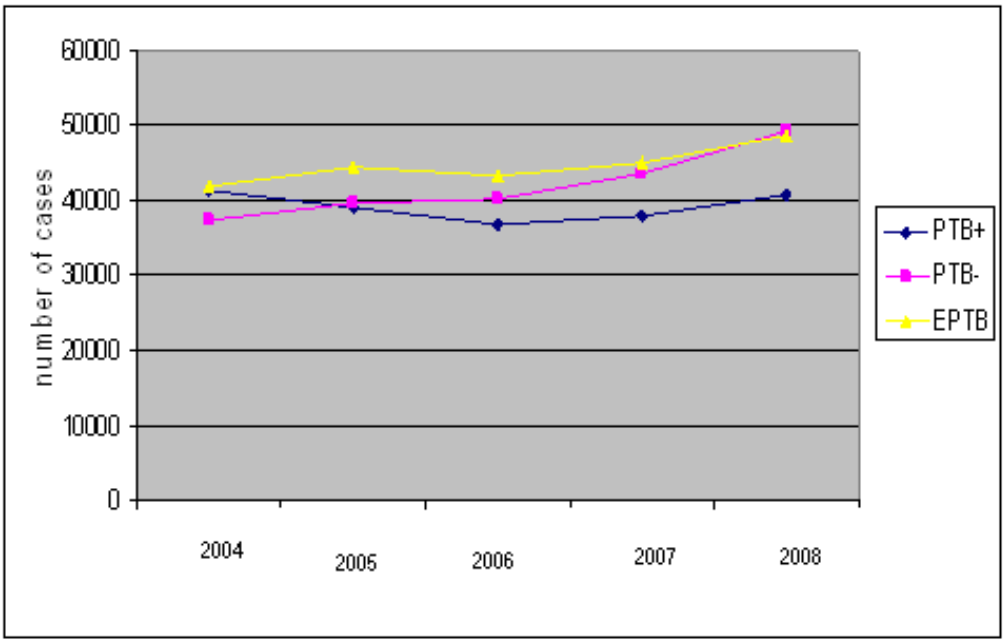

Figure 2.1.2: A five year trend of tuberculosis cases by classification, 2004-2008, Ethiopia.

In 2006 the detection rate of all forms of tuberculosis was lower (155/100,000 population) than from other years. But it was higher (175/100000 pop.) in 2008, which might be due to the millennium anti tuberculosis campaign (figure 2.1.3 and annex 4).

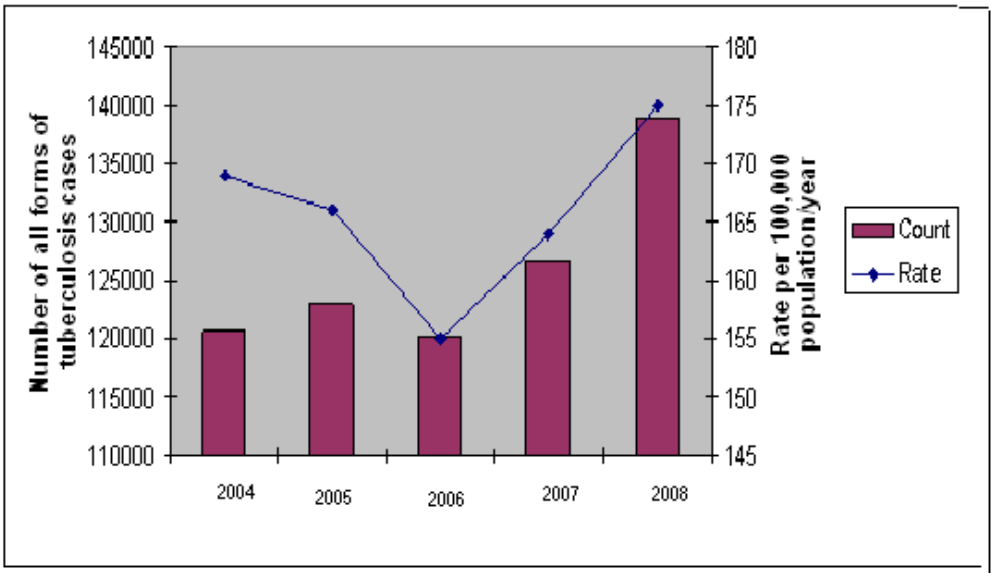

Figure 2.1.3: Annual number of all forms of tuberculosis cases and rate per 100,000 pop / year, 2004-2008, Ethiopia

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The detection rate of PTB smear positive cases was 49/100,000 population in2006 & 2007 and 58/100,000 population in 2004(figure 2.1.4).

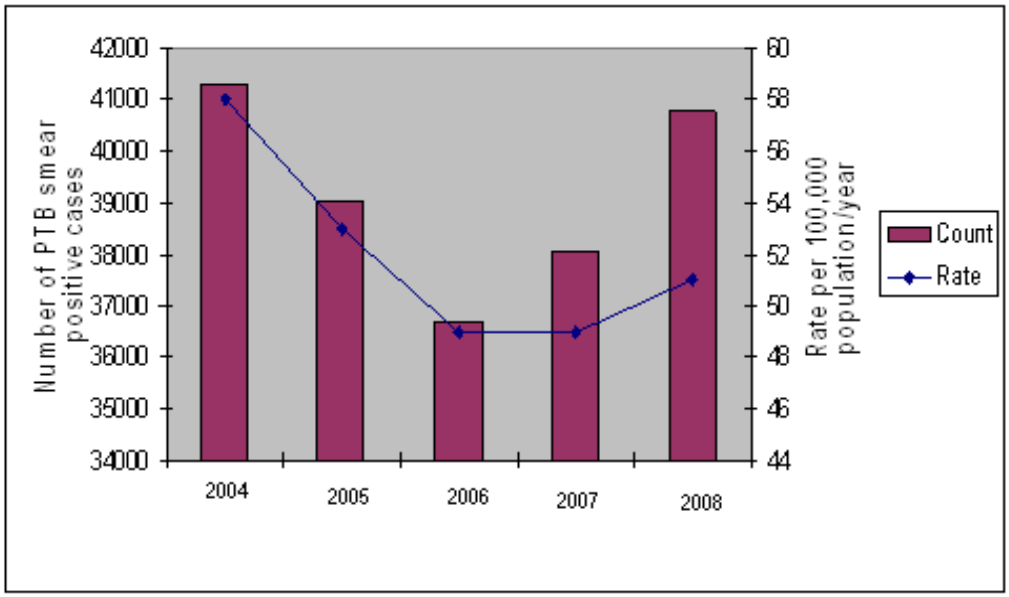

Figure 2.1.4: Annual PTB positive detection rate / 100, 000 pop / year, 2004-2008, Ethiopia

From a total of 195,819 pulmonary tuberculosis smear positive cases detected during 2004-2008, males constiuted 107,463 (54.8%). The number of male cases was higher than female cases in each year (table 2.1.2).

Table 2.1.2: Distribution of pulmonary smear positive cases by Sex 2004-2008 (2004-2008)

Year	male	female	Total
2004	22,544	18,731	41,275
2005	21,298	17,738	39,036
2006	20,235	16,439	36,674
2007	20,884	17,156	38,040
2008	22,502	18,292	40,794
Total	**107,463**	**88,356**	**195,819**

The highest proportion of pulmonary TB positive cases lies in the age group 15-34 [70709 (61.2%)] followed by 35-44 [19984(17.3 %)] between 2006-2008 (table 2.1.3).The annual average rate of PTB positive cases was 113/100,000 population/year in the age 15-44 years old for the same years (table 2.1.4).

Table 2.1.3: Number of pulmonary smear positive tuberculosis cases by age 2006-2008, Ethiopia

Year	Age category (in years)							Total
	0-14	15-24	25-34	35-44	25-34	55-64	65+	
2006	2,156	11,375	11,276	6,271	3,340	1,576	680	36,674
2007	2284	11948	11621	6395	3467	1553	772	38040
2008	2,145	12,002	12,687	7,318	3,843	1,792	1,007	40,794
Total	6,585	35,325	35,584	19,984	10,650	4,921	2805	115,508

Table 2.1.4: Rate of PTB positive cases per 100,000 population /year by age category, 2006-2008, Ethiopia

Year	Age category (in years)			
	0-14	15-44	45-64	65+
2006	6.2	111	40	30
2007	6.4	112	40	33
2008	5.8	116	44	42
Average	6.1	113	41	35

The highest average number of cases/year was seen in Oromiya [41794(33%)] & the lowest were in Hareri [534(0.4%)] from 2004-2008. The national annual average of tuberculosis cases was also 125,885 during during the same year (figure 2.1.5 & in annex 1)

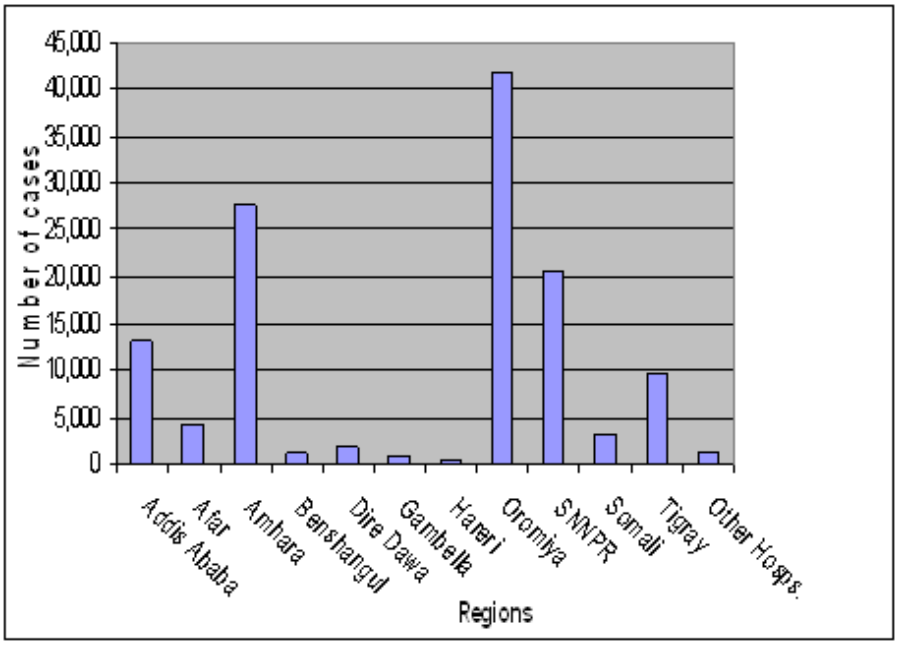

Figure 2.1.5: Average distribution of tuberculosis cases by region, 2004-2008, Ethiopia

The highest average case detection rate (86%) & the lowest (20%) were seen in Gambella & Somali respectively during 2004-2008 (annex 2). The national average was 34% for similar period (figure 2.1.6)

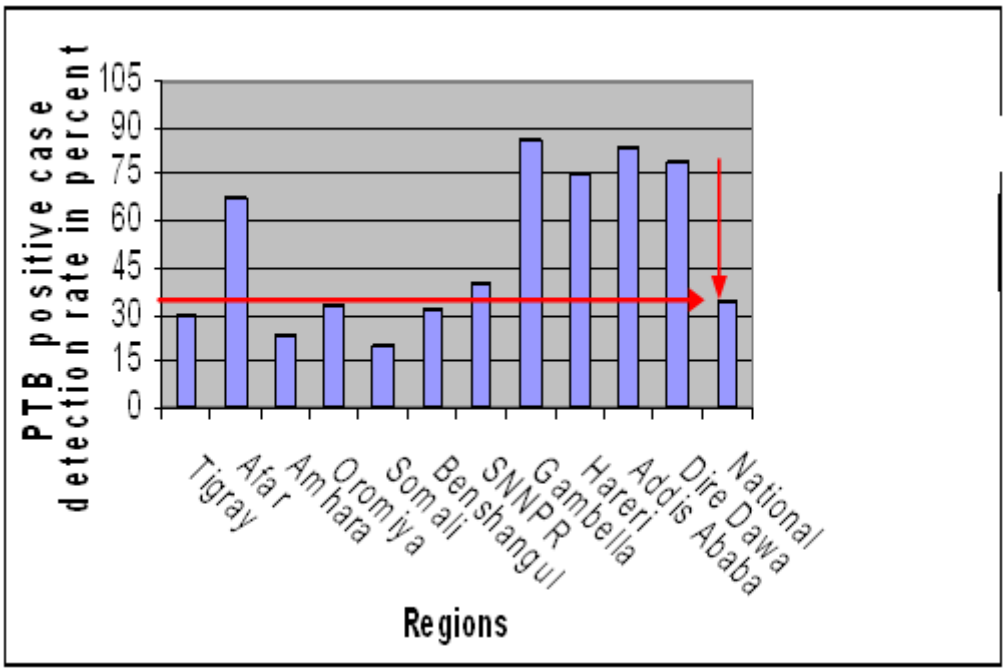

Figure 2.1.6: Average PTB positive case detection rate by regional state, 2004-2008, Ethiopia

From a total of 154832 smear positive pulmonary tuberculosis (PTB) cases 102,976 (64%) & 23651(16%) were cured from the disease & completed anti TB treatment during 2005-2008 respectively (annex 3).

The percentage (rate) pulmonary positive cases treatment completion was low in each year; only near to 17% (figure 2.1. 7).

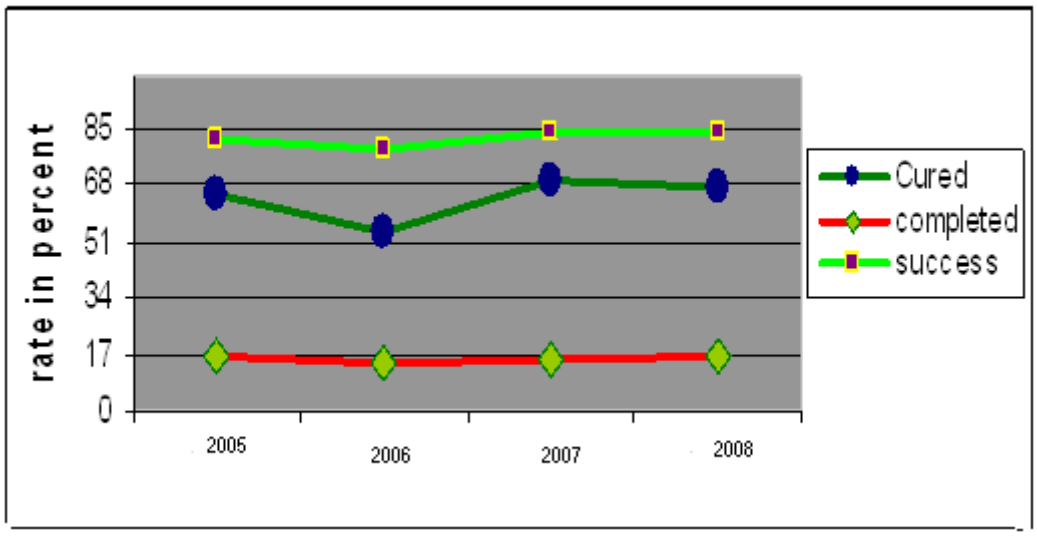

Figure 2.1.7: Annual treatment success rate of PTB positive cases, 2005-2008, Ethiopia

From 14,738 re-treatment cases of tuberculosis 10,497(71.2%), 1391(9.5%), & 2850(19.3%) were relapse, treatment failure & defaulters in the five years period (table 2.1.5).

Table 2.1.5: number of re-treatment cases of tuberculosis, 2004-2008, Ethiopia

Year	Relapse	Treatment failure	Defaulter	Total re-treatment cases
2004	1,915	272	615	2,802
2005	2,315	326	566	3,207
2006	2,035	298	513	2,846
2007	2,035	262	637	2,934
2008	2,197	233	519	2,949
Total	**10,497(71.2%)**	**1,391(9.4%)**	**2,850(19.3%)**	**14,738**

The highest death rate [6.7% (2789 deaths)] and the lowest [0.3% (220 deaths)] were observed in 2004 and in 2006 respectively during 2004-2008 (figure 2.1. 8).

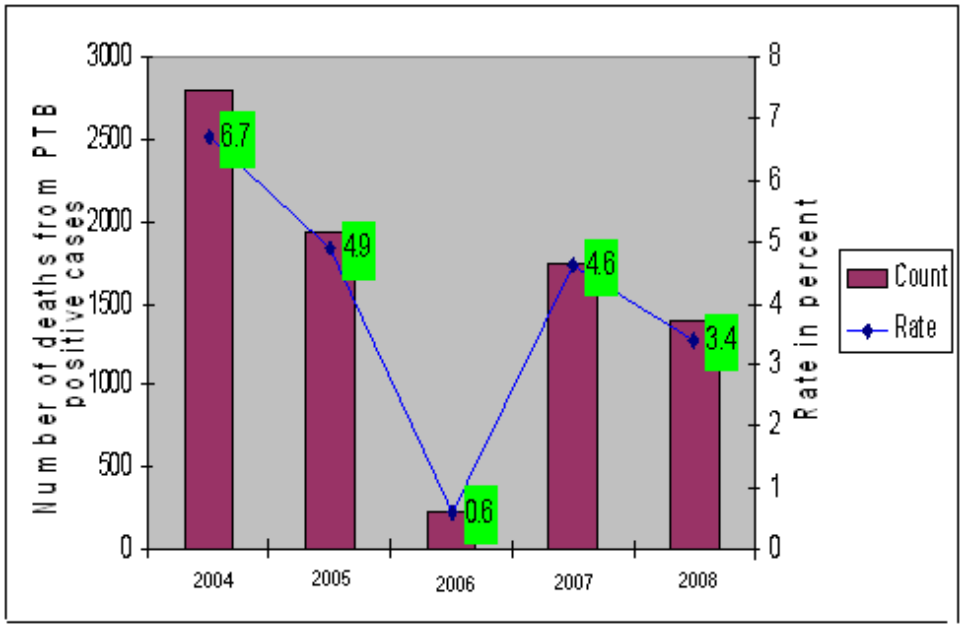

Figure 2.1.8: Number of deaths and death rate in percent/year of PTB positive cases, 2004-2008.

Discussion

The annual average of detection of all forms & pulmonary smear positive tuberculosis cases were only 49.4% (125885) & 34.6% (39163) respectively (table 2.1.1),which is very far from the WHO case detection rate target of ≥70%.

Theoretically EPTB only accounts < 15 % of all the tuberculosis cases, but in this finding it accounts 36 % (Figure 2.1.1).This might be because of HIV/AIDS & missed diagnosis in most health facilities. However it needs serious investigation to search the presence of actual increase of EPTB cases & its causation.

The detection rate (175/100,000 pop.) of all forms of TB in 2008 was similar with other high burden countries (174/100000 pop.) & it was also higher than other four years. This difference might be due to the millennium anti TB campaign (Figure 3 & in annex 4).

The dramatic decrease in the detection rate of PTB positive cases during 2004-2008 might be due to under reporting or weak surveillance. In 2008 PTB positive detection rate was raised to 51/100,000 population & this could be also due to the millennium anti TB campaign but still it was lower compared to high burden Africa countries (77/100,000 pop).

Pulmonary TB smear positive cases in males were higher than females from in all the five years report. Similar finding was indicated in a study that tuberculosis (TB) notification is twice as high in men as in women and further tried to explain the fact that socioeconomic and cultural factors leading to barriers in accessing health care may cause under notification in women, particularly in developing countries. Moreover biological mechanisms may actually account for a significant part of this difference between male and female susceptibility to TB[14]. Another study also mentioned that males have approximately twice the risk for disease[15]. On the contrary another study also mentioned that females and especially reproductive were mostly affected by tuberculosis[16]. However this gender difference in tuberculosis needs further research based explanation in our country setting.

The highest rate (110-112/100,000) of pulmonary tuberculosis positive cases was shown between 15 and 44 years old and the lowest among under 15 years old age category during five years period. This might be because of the high prevalence of HIV/AIDs in the adult population.

The average treatment success rate (83%) for the four years period (2005-2008) was near to WHO target of ≥ 85% (figure 2.1.7 & annex 2).But cure rate was <than 70% which is far from the average cure rate of other high tuberculosis burden countries(80 %). 30% of PTB positive cases were not known about their smear result status. This might be because of loss to follow up & weak monitoring activities

It observed also that from all retreatment cases of tuberculosis during 2004-2008, defaulter rate (19.3%) compared to high burden countries (11 %) was a beat higher in Ethiopia (table 2.1.5).

The highest annual death rate (6.7%) was shown in 2004 which was also higher from the high TB burden countries (4.2%)[17]. The number of deaths from tuberculosis & death rate in 2006 was differently lower from other four years period which could be due to under reporting to central level in which regions were in restructuring of the new business process reengineering.

Limitation of analysis

Findings could not be well explained & compared with other similar works due to the nature of the work (i.e., a two weeks student assignment based data analysis).

Because the data (report) very compiled at national level, it was impossible to see details and identify locations with high severity of the problem (especially to see rate at zonal and district levels and for age category population (denominator) was necessary).

Conclusion

The overall annual detection of all forms & PTB positive cases were far low in five years period from the WHO estimate. The detection rate of regions with big population was much lower (Example; in Amhara & Oromiya) and the surveillance/control program activity of in 2006 was also found very weak. The proportion of extra pulmonary tuberculosis cases was paradoxically high from theoretical background. Treatment success rate was approaching the WHO target, but the cure rate and the defaulter was not as good as the success rate. Male cases of pulmonary smear positive tuberculosis were higher than females for five consecutive years.

Recommendations

Federal Ministry of Health should give attention & emphasis for regions with big population to detect the high proportion of expected cases of the nation. The available data should be purified and checked with regions to have consistent and reliable information about the disease.

The PTB positive detection rate is very far from WHO target for cascade of years & it would better be questioned & investigated to address the gaps. Diagnosis of extra-pulmonary tuberculosis should also be monitored & further research is necessary to find out the theoretical fallacy.

The descriptive difference of pulmonary smear positive tuberculosis in males & females need to be tested in analytic studies and attention should be given for the lower defaulter rate from retreatment should b.

Acknowledgements

I appreciate Federal Ministry of Health for providing the tuberculosis annual report (data) and especially W/ro Azmera, for her honest cooperation during my visit to her office to get the data.

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Annexes (supplemental tables and figures):

Annex 1: Average number of tuberculosis cases by region, 2004-2008, Ethiopia

Region	Average cases
Addis Ababa	13,197
Afar	4,187
Amhara	27,767
Benshangul	1,077
Dire Dawa	1,907
Gambella	1,016
Hareri	534
Oromiya	41,794
SNNPR	20,626
Somali	2,981
Tigray	9,545
Other Hosps.	1,254
National	**125,885**

Annex 2: Average PTB positive cases detection rate by region, 2004-2008, Ethiopia

Region	Average of five years
Tigray	30
Afar	67
Amhara	23
Oromiya	33
Somali	20
Benshangul	31
SNNPR	40
Gambella	86
Hareri	76
Addis Ababa	84
Dire Dawa	79
National	**34**

Annex 3: Number of Pulmonary Smear Positive cases by treatment outcome, 2005-2008, Ethiopia

Year	Cases* (N)	Cured (N & %)	Completed (N & %)	Success (N & %)
2005	40650	26641(65)	6415(16)	33056(81)
2006	39430	25369(54)	5379(14)	30748(78)
2007	36674	25314(69)	5516(15)	30830(84)
2008	38,078	25652(67)	6341(17)	31993(84)
Total	**154832**	**102976(64)**	**23651(16)**	**126627(82)**
** Cases are those registered PTB + from2003/4-2005/6*				

Annex 4: Annual report of pulmonary and extra pulmonary tuberculosis, 2004-2008, Ethiopia

Year	PTB Positive	PTB Negative	EPTB	All forms of TB
2004	41275	37333	42006	120614
2005	39036	39651	44325	123012
2006	36674	40234	43255	120163
2007	38040	43500	45136	126676
2008	40794	49372	48794	138960
Total	**195819**	**210090**	**223516**	**629425**

2.2.Description of National Measles Surveillance, 2005– 2009, Ethiopia

Belay Bezabih, Ghidey Gebrelibanos

Abstract

Background: Measles is a well known vaccine preventable diseases which cause significant morbidity and mortality among children worldwide especially in developing countries like Ethiopia. The FMOH of Ethiopia included measles as one of the immediately reportable diseases in the surveillance system. The aim of this study was to assess the measles trend in the country, describe measles epidemiologically and identify locations where occurrence of cases is high for providing further investigation of causes.

Methods: A Descriptive study was undertaken on the national measles surveillance data of 2005-2009 from November to December 2010 in Addis Ababa, Ethiopia. We based on the database for analyzing of variables and the National Public Health Emergency Management and measles guideline were used for case definitions and the final classification of cases by the laboratory as it was kept in the data base. Then descriptive statistical analysis was made using Epi Info Version 3.5.1 and Microsoft Excel.

Results: A total of 17521 cases and 127 deaths (CFR=0.71%) were reported during 2005 -2009. 50.7 % (8894) were from rural site and 25.4 % (4460) not identified as rural-urban.51.9% were males, 0.34% with sex not reported and the median age was 4 years old. The age group 1-4 years old constitutes 41.7 % (7323) of the total suspected and 34.4 % (1032) of the confirmed cases by laboratory measles IgM antibody. 17.1% (3000) of laboratory confirmed cases were reported during 2005-2009 in which Oromia regional state accounted first with a proportion of 40.5%(1216) although the highest attack rate(12%)observed in Hareri region.The national measles vaccine coverage reached to 72.2% in 2008 but five regions were under 55%. The highest number of cases and incidence [5771(7.6 per 100,000 population)] was reported in year 2008. In 2008 & 2009 of Jan & Feb the national Epicurve showed the highest peaks because of the outbreaks occurred in Guji, west Arsi, West Haraghe and Sidama zones. 6.4% (1120) cases get two or more vaccine doses, 31.3% (5490) get one dose, 26.9%(4718) not vaccinated and 35.3%(6192) with unknown vaccination status. Fourty six (45.1%) zones reported measles outbreaks from 2005-2009. Except Tigray, Harar and Dire Dawa all regions reported cases of an outbreak.

Conclusion & recommendations: Generally there was a trend of increment of cases in the months of January, February and March. The national vaccination coverage showed progress year to year though the vaccination coverage of five regions was still under 55%.The age group 1-4 years was the most affected by measles from all other age categories and 62.2% of the cases were not vaccinated for measles or with unknown status of vaccination.

Oromia regional sate constituted most of the suspected and laboratory confirmed measles cases, however the highest attack rate was observed in Hareri region. Outbreaks which occurred in four zones were responsible for the highest peaks of the national epidemic curve of the five years period. Therefore, regions should be strengthened for the improvement of measles vaccination coverage. The surveillance activities need improvement in early detection of cases, for the completeness of variables and specificity of reporting suspected measles cases especially during outbreaks. The seasonality of disease transmission or occurrence of outbreaks could indicate when to conduct SIAs and needs further investigation and research to find out causes of outbreaks for the identified locations.

Key words: Measles, national surveillance, vaccination coverage, Ethiopia

Introduction

Measles is a highly infectious viral disease caused by a Morbillivirus and for which humans are the only reservoirs. In a non-immune person exposed to measles virus, after an incubation period of about 10 to 12 days (range 7-18 days), prodromal symptoms of fever, malaise, cough, coryza (runny nose), and conjunctivitis appear. Within 2 - 4 days of the prodromal symptoms, maculo-papular rash appears behind the ears and on the face. The rash spreads to the trunk and extremities and typically lasts 3-7 days[1]. Most persons recover from measles without complications. Some complications are associated with measles due to transient suppression of cellular immunity, which is a characteristic feature of the disease. Frequent complications in children less than five years of age include otitis media (5% -15%) and pneumonia (5% -10%)[2]. Transmission is primarily person-to-person via aerosolized droplets or by direct contact with the nasal and throat secretions of infected persons. Individuals with measles are infectious 4 days before through 4 days after rash onset[1].

Despite the existence of a safe, effective, and inexpensive vaccine, measles is still not being controlled in many parts of the world. However the use of measles vaccine over the last 30 years has reduced global measles morbidity and mortality by 74 and 85%, respectively, compared with the pre-vaccine era[3].The World Health Organization (WHO) estimates that almost one million measles-related deaths occur each year, the majority (85%) in Africa and Asia[4,5].

Measles is widely known in Ethiopia and it has many names in various ethnic languages, e.g., Kufign, Ankelis or Shifto. In 1980 Ethiopia introduced measles vaccination as part of the Expanded Programme on Immunization (EPI) [6]. A single dose of measles vaccine is recommended at 9 months of age[7,8.] Several developed and developing countries follow a strategy that differs in timing and in the number of doses delivered either through routine immunization or supplemental mass immunization campaigns[9].In determining the age for vaccination, countries must balance the consequences of an older age (lack of protection in the early months of life) and a younger age (reduced effectiveness). In many countries, where morbidity and mortality due to measles are uncommon in infants, choose an older age for vaccination (e.g., age 12 or 15 months). In other countries, where a high number of deaths due to measles occur in children aged <9 months, a younger age for vaccination has been advocated[10,11].

However, during supplemental immunization campaigns, a single dose of measles is given, irrespective of the immunization and disease history status, to all children in the target age group[12]. A study conducted in Ethiopia showed also that campaign vaccination elevated immunity in the target ages by between 30% and 50% according to age group, or an average of around 40%[13].

In Ethiopia the importance of disease surveillance in guiding health planning and interventions was recognized for a long time and “Quarantine" rules were proclaimed in 1947 with emphasis on surveillance. Another legal notice was issued in 1951, binding all public health practitioners in the country to report communicable diseases. The "Public Health Proclamation No.200/2000” orders any individual who knows the existence of communicable diseases in his/her vicinity to report immediately to the nearest health institution and the institution receiving the report to take the necessary measures and report to the appropriate health authority. In 1948 an anti-epidemic service was established to deal with prevention and control of communicable diseases. In 1951, 35 priority diseases were selected and classified into first and second class to be notified to MOH, immediately or weekly as necessary. In the mid-1970`s the anti-epidemic unit was converted to epidemic control and surveillance unit under communicable diseases control division and vertical programs were conducting their own disease specific surveillance. After the health system reform in 1994 nineteen diseases (including those which were under vertical programs) were selected for surveillance and measles also one of the priority[14].

According to the National PHEM guide line, every suspected measles case should be detected, reported using the cases based form and undergo laboratory investigation (or the first five cases in the situation of outbreaks) and during an outbreak all cases must be entered on a line listing, investigated and reported to next higher level[6,15].

Ethiopia has experienced numerous measles outbreaks and increasing morbidity. As a vaccine preventable disease, measles surveillance data analysis is critical to guide intervention and vaccination activities. So the aim of the study was to assess the measles trend in the country, describe measles epidemiologically and identify locations where occurrence of cases is high for providing further investigation of causes.

Methods and Materials

Study area, population and period

Ethiopia is administratively sub-divided into nine regional states and two city administrations and according to the third Population and Housing Census in the 1997 with a total population of 73,918,505 with an annual growth rate of 2.6%. 50.5%(37,296,657) were males, 45.0% of the population was under age 15 years old, 51.9 % was in the age group of 15-64 years and the proportion of population aged 65 years was 3.2 %[16]. The national measles surveillance data was analyzed from November to December 2010 in Addis Ababa, Ethiopia.

Design and data collection

A Descriptive study was undertaken on the national measles surveillance data of 2005-2009. Although the type of data was secondary we passed through certain procedural pathways to have it. First we developed a concept paper and reviewed by the school of public health of Addis Ababa University. Then the EHNRI/PHEM approved the request of a five year national measles data base to carry out this study. The data base has many field names(variables) but we analyzed selectively such as age, sex, date of onset of illness, reporting zone and province(Regional state), date of sample collection, sent to and received by the national laboratory, no of vaccine doses, type of reporting form, final classification of cases and presence of outbreaks.

Case definitions: The national Public Health Emergency Management and measles guideline was used for the case definitions and the final classification of cases by the laboratory as it was kept in the data base[6, 17, 18.] According to the Federal ministry of health of Ethiopia-Public health emergency management, measles is one of the immediately reportable diseases under surveillance. Suspected cases and deaths of fever with rash illness filled with case-based reporting form with serum sample collected are sent and tested for IGM antibody at Central (EHNRI) virology laboratory. Line listing was also used during an outbreak for reporting of cases.

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

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

All suspected cases of measles are finally classified based on the adequacy of the blood specimen collected, and sample taken or not in to the following categories;

Laboratory confirmed: A suspected measles case that is investigated, including the collection of an adequate blood specimen (5ml), and has serological confirmation of recent measles virus infection (IgM positive).

Epidemiologically linked: A suspected measles case that has not had a blood specimen taken for serologic confirmation, but is linked to a laboratory confirmed case (definitive serologic evidence of recent measles virus infection). Linked is interpreted as being in the same geographic area (place) during the infectious period (time) of a laboratory-confirmed case (person), i.e., in the same district within 30 days.

Discarded: A suspected measles case that has been completely investigated, including the collection of adequate blood specimen (5ml), but lacks serologic evidence of recent measles virus infection (i.e., IgM negative).

Clinical / Compatible: A suspected measles case that has not had a blood specimen taken for serologic confirmation and cannot be epidemiologically linked to a laboratory-confirmed case.

Statistical analysis: Descriptive statistical analysis was made using Epi Info Version 3.5.1 and Microsoft Excel.

Ethical issue: This work will be realized based on the ethical clearance of the public health emergency management / Ethiopian Health and nutrition research institute (EHNRI).

Results

According to the national measles surveillance data which include case based and line listing; a total of 17521 cases and 127 deaths were reported throughout the country during 2005 -2009. Of the total suspected cases about 50.7 % (8894) were from rural site, 23.7 % (4167) from urban and 25.4 % (4460) not identified as rural-urban.

About 51.9% were males, 0.34% with sex not reported and the median age was 4 years old and the age ranges from under 1 up to 79 years old.

The national measles vaccine coverage increased from 42 % in 2002 to 72.2% in 2008 and an increased number of reported cases was also observed from 2005 to 2008 (Figure 1).In the five years of reporting period, only 6.4% (1120) cases get two or more vaccine doses, 31.3% (5490) get one dose, 26.9%(4718) not vaccinated and 35.3%(6192) with unknown vaccination status.

It was observed that the cumulative number of suspected cases for five years was continuously increasing between December and January (Figure 2.2.2).

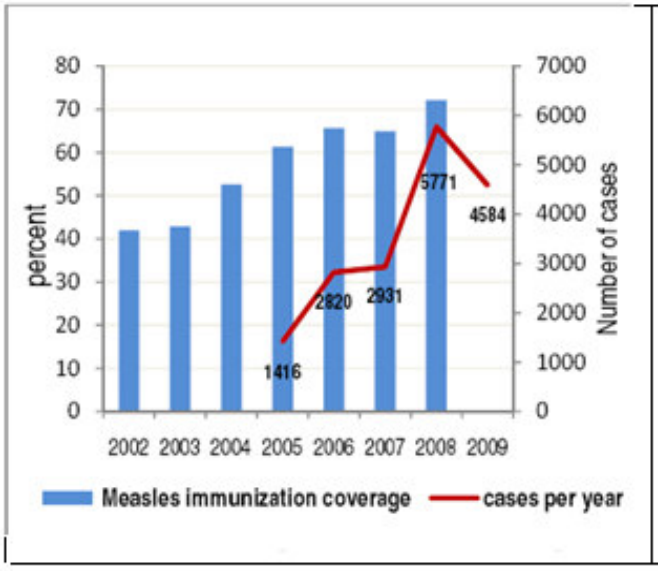

Figure 2.2.1: Measles cases and immunization coverage, 2005-2009, Ethiopia.

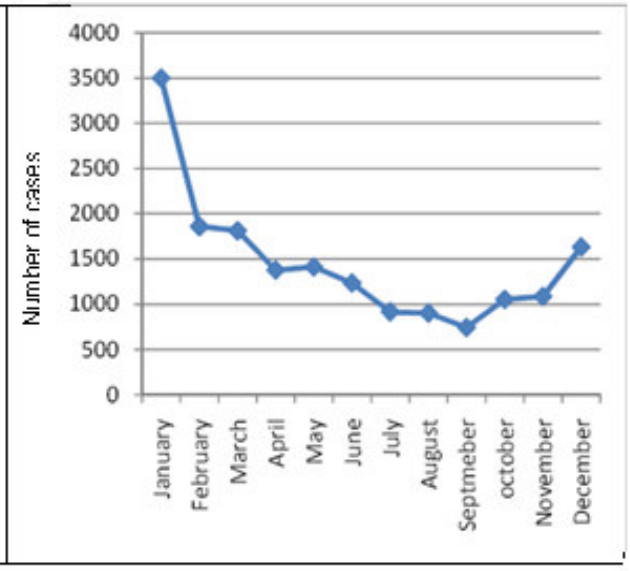

Figure 2.2.2: Trend of measles cases by month of onset of illness, 2005-2009, Ethiopia

N.B. Vaccination coverage of five regions was below 55% in 2008 and frequency of vaccination coverage for regions from 2002-2008 is presented in the annex section of table 6.

The highest number of cases and incidence [5771(7.6 per 100,000 population)] was reported in year 2008 (table 2.2.1).

Table 2.2.1: Distribution of cases per 100,000 population per year, 2005-2009, Ethiopia

Year	Population	Cases	Cases per 100,000 population
2005	54867674	1415	2.57
2006	56294233	2820	5.00
2007	73918505	2931	3.96
2008	75840386	5771	7.60
2009	77812236	4584	5.89

In each month of the five year period a minimum of 50 suspected cases were reported to the central level. As it is shown in the epidemic curve, the highest peak was from January to February 2008 and 2009 (figure 2.2.3).

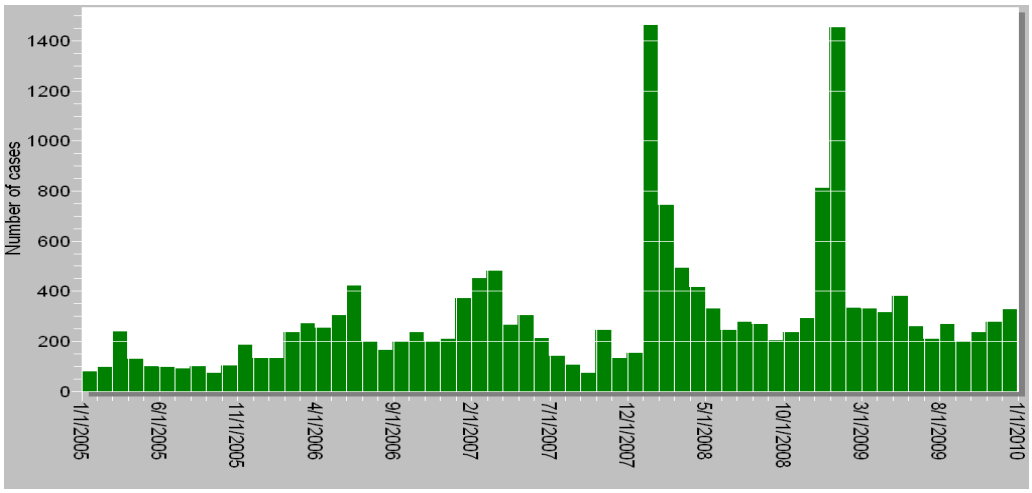

Figure 2.2.3: Epi-curve of suspected measles cases by date of onset, 2005-2009, Ethiopia

Through filtration of the data base for these specific months which showed the highest peaks in the epidemic curve (figure 2.2.3) Guji, west Arsi, West Haraghe and Sidama zones reported high number of cases using line listing form in which an outbreak indicated by their respective Epi-curves (figure 2.2.4 & 2.2.5)

The outbreak in Guji started on14/1/2008 and the highest peak was on 21/1/2009 and then continued to 5/2/2008.As it evidenced by the Epi-curve (figure 2.2.4) at least 40 cases per day were reported even after the highest peak.

A total of 1606 suspected cases were reported during the two months of an outbreak. 94.7% (1520) cases were under 15 years old,45.6% (733) unvaccinated, 43.7%(702) get one dose, 1.1%(18) 2 doses,9.5%(153) unknown status of measles vaccination.

In west Arsi, a total of 954 cases were reported in January 3-31, 2009 (Figure 5).During this period 99.6% of the cases reported using a line list form. Measles vaccination status was not known in 99.6% (951) of the cases and only one case was vaccinated for first dose. Sex was evenly distributed (50%) and no death was listed in the data base.

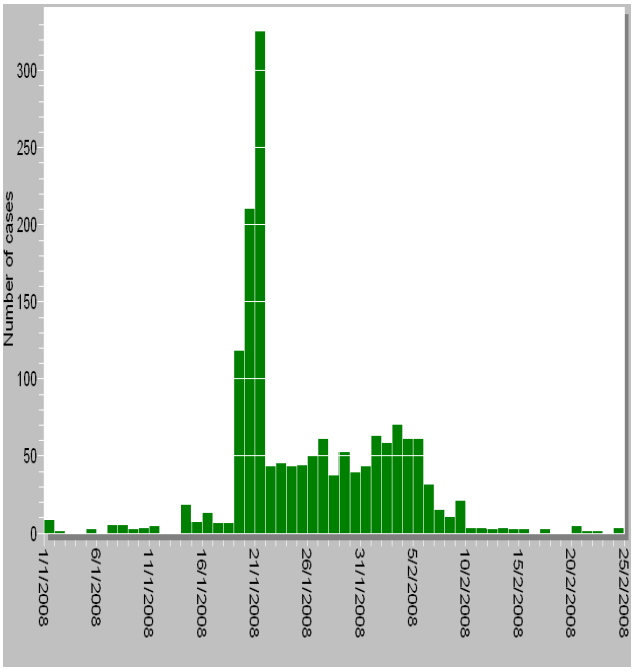

Figure 2.2.4: Epicurve of measles outbreak by date of onset Guji Oromia, Ethiopia, Jan-Feb 2008

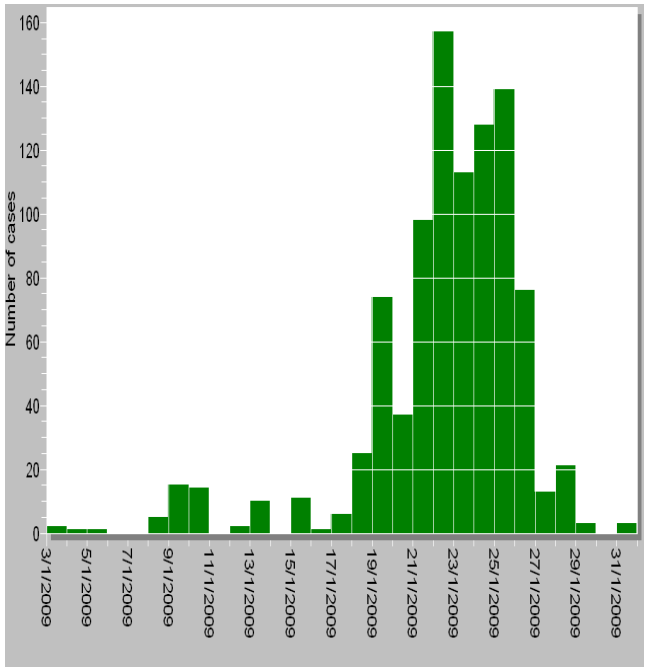

Figure 2.2.5 Epicurve of measles outbreak by date of onset in west Arsi, Oromia, January 2009

In West Hararghe an outbreak occurred in February 2007 (Figure 2.2.6) and two other outbreaks from March to April and December 2008. 237 cases were reported in December 2008 which was higher than the cases occurred in previous three outbreaks (Feb 2007, and march-April 2008). 54.7% (135) cases were females, 89.1% (220) were under the age of 15 years and only 17 cases have got one dose of measles vaccine.

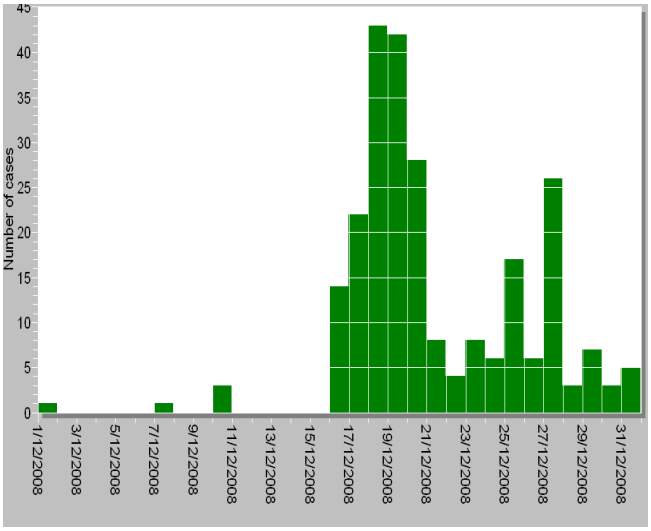

Figure 2.2.6: Epicurve of Measles outbreak in West Hararghe, Oromia, Ethiopia, December 2008

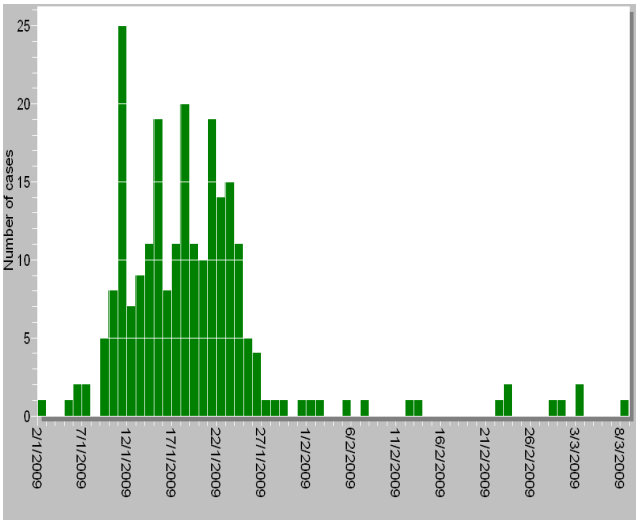

Figure 2.2.7: Epicurve of measles outbreak by date of onset in Sidama, SNNPR, Ethiopia, January 2009

In January 2009 there was also an outbreak in Sidama zone with 236 reported suspected cases (figure 2.1.7). 50.4% (119) were females, 55.1% (130) unvaccinated, 35 % (92) with vaccination history (one and more doses) and 5.9% (14) with unknown vaccination status and one death.Fourteen cases from Guji, 4 from West Arsi, 6 from West Haraghe and 21 from Sidama zones were confirmed for measles IgM antibody collected during the occurrence of increased number of cases as depicted in the respective Epi-curves shown above.

During 2005-2009 period, the age group 1-4 years old constitute 41.7 % (7323) of the total suspected and 34.4%(1032) of the confirmed cases by laboratory measles IgM antibody. 9.3% (1632) of the suspected and 6.5% (197) of the laboratory confirmed were under 1 year (figure 2.2.8 & 2.2.9).

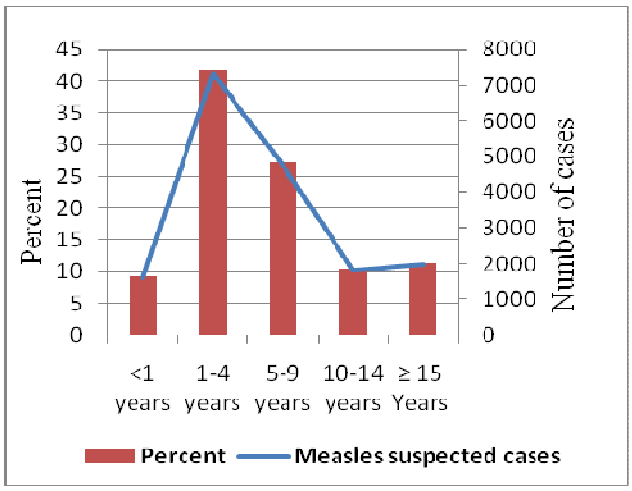

Figure 2.2.8: Distribution of Measles suspected cases by age category 2005-2009, Ethiopia

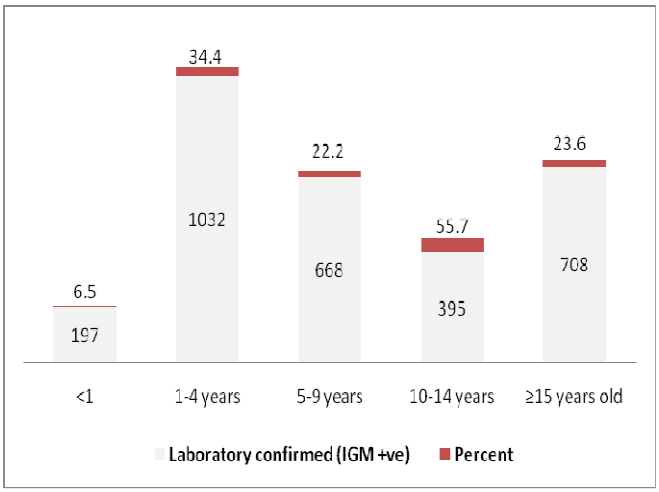

Figure 2.2.9: Distribution of Measles laboratory confirmed cases by age category 2005-2009, Ethiopia

A total of 11841 serum samples were collected and sent to the national laboratory(EHNRI).The highest annual proportion of samples collected was 67.3%(3087) in 2009 followed by 86.4%(1224) in 2005 (Figure 2.2.10).

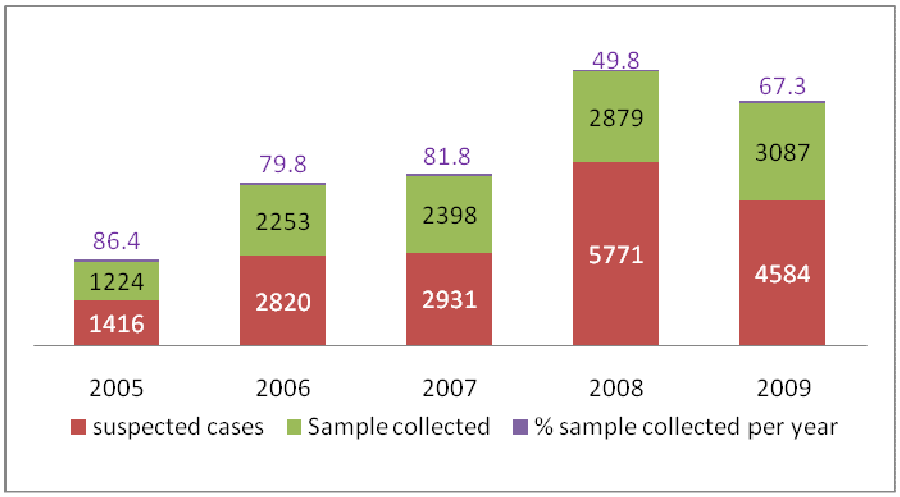

Figure 2.2.10: Frequency of samples collected and total suspected cases per year, 2005-2009, Ethiopia

The highest [31.1% (913)] confirmed cases of measles IgM antibody was reported in 2007 and the least [9.7% (447)] was in 2005 (table 2.2.2). 50.9 % (1524) of measles IgM confirmed cases were males during 2005-2009.

Table 2.2.2: Frequency of measles cases by final classification from 2005-2009, Ethiopia

Year	Confirmed (IGM +ve)	Discarded (IGM -ve)	Epi linked	Clinical / compatible	Total Cases	% IgM positive
2005	200	159	73	983	1415	14.1
2006	821	549	81	1369	2820	29.1
2007	913	533	53	1432	2931	31.1
2008	619	2892	63	2197	5771	10.7
2009	447	1527	679	1931	4584	9.7
Total	3000	5660	949	7912	17521	17.1

From all regional states, Oromia ranked first by notifying 44.8 % (7861) of the national total suspected cases during the five years period. Somali and SNNP regional states detected the highest [48.8% (153)] and lowest [12.4% (356)] proportion of confirmed IgM positive of their own total suspected cases respectively. But from total national confirmed IgM positive cases still Oromia regional state accounted first with a proportion of 40.5%(1216) and lowest 15%(1216) from its own total suspected (table 2.2.3).

Table 2.2.3: Distribution of measles cases by regional sate and final classification, 2005-2009, Ethiopia

Province of Residence	Confirmed (IGM +ve) No (%)	Discarded (IGM -ve) No (%)	Epi linked No (%)	Clinical / Compatible No (%)	Total suspected cases No (%)
Tigray	102(14.4)	0	49(6.9)	554(78.5)	705(4.0)
ADDIS ABABA	298(24.2)	43(3.5)	98(7.9)	788(64.2)	1227(7.0)
Afar	157(31.9)	197(40.0)	24(4.8)	114(23.17)	492(2.8)
AMHARA	526(17.2)	778(25.4)	196(6.4)	1557(50.9)	3057(17.4)
Ben-Gumuz	48(16.7)	96(33.4)	29(10.10)	114(39.7)	287(1.6)
Dire Dawa	27(45)	0	1(1.6)	32(53.3)	60(.3)
Gambella	28(19.4)	105(72.9)	2(1.3)	9(6.2)	144(.8)
Hareri	89(17.1)	0	24(4.6)	406(78.2)	519(2.9)
Oromia	1216(15.4)	3654(46.4)	348(4.4)	2643(33.6)	7861(44.8)
SNNPR	356(12.4)	719(25.17)	167(5.8)	1614(56.5)	2856(16.3)
SOMALI	153(48.8)	68(21.7)	11(3.5)	81(25.8)	313(1.7)
Total	3000(17.1)	5660(32.3)	949(5.4)	7912(45.1)	17521(100)

All regions/city administrations and 102 zones in the country reported cases in each year and at least in one year respectively. In all five years period the attack rate for measles sustained more than 2% in Harari regional state (figure 2.2.11).

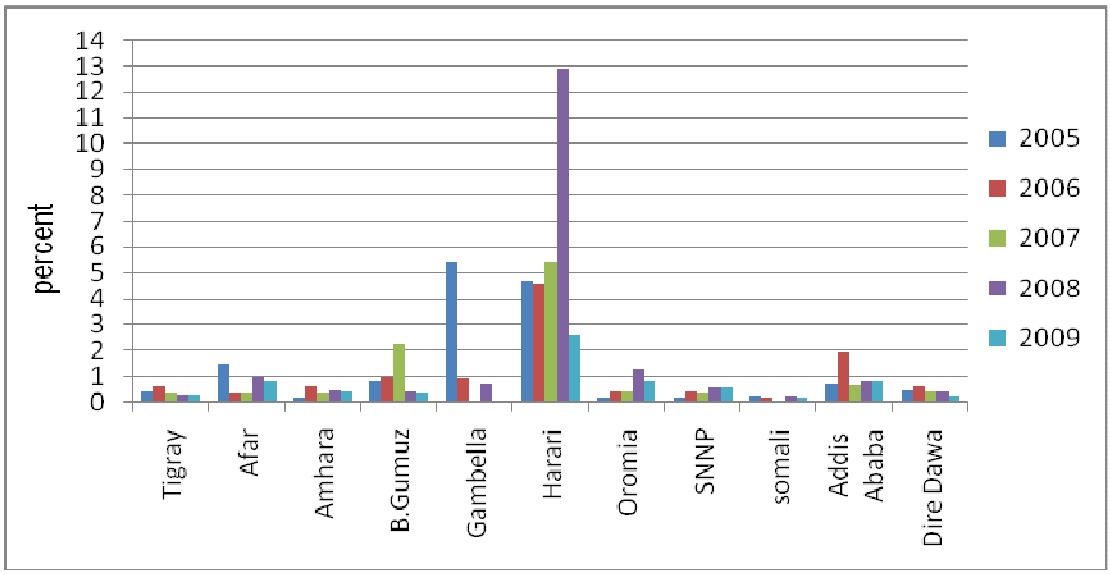

Figure 2.2.11: Measles attack rate by regional state from 2005-2009, Ethiopia

From all region the highest attack rate (12.9%) observed in Harari in 2008 and in Gambella(5.4%) in 2009 (figure 2.2.11). Oromia reported the highest number of cases (7861(44.8%)) from the total cases reported in the country during 2005-2009 (Table 2.2.3 & annex 2.1).

From 102 zones reported during 2005-2009, a total of 17521 cases were notified. Guji zone constituted the highest [1724 (9.8%)] number of cases, followed by west Arsi 1423(8.1%), West Hararge 823(4.7%), Sidama 791(4.5%) and North Gondar 725(4.1%). In 2006 23.5% (24) of zones had zero report of measles cases followed by 16.7 % (17) in 2005, but in 2009 all 102 zone reported suspected measles cases (Figure 2.2.12).

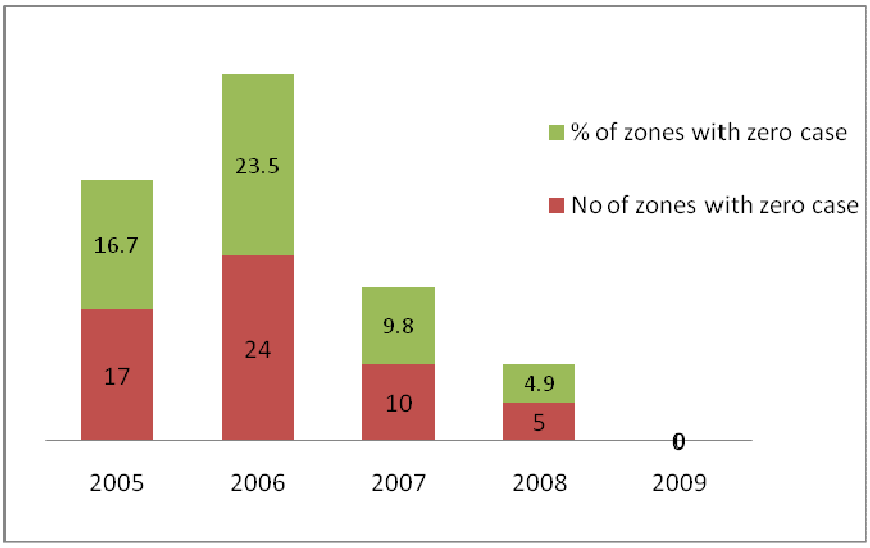

Figure 2.2.12: Frequency of zones with zero report of measles cases from 2005-2009, Ethiopia

From the total of 17522 registered cases 11842(67.6%) were reported using case based forms and 5680(32.4) were using line listing. 64.1% (3643) of the reports using the line listing were from Oromia region. Tigray, Harari and Dire Dawa had zereo report of line listing based data (Table 6 in annex).Fourty six (45.1%) zones reported measles outbreaks from 2005-2009, from which Guji 1593(28.2%), West Arsi 1100(19.4%), West Haraghe 512(9%), Sidama 320 (5.7%) and North Gondar 260(4.6%).Except Tigray, Harar and Dire Dawa all regions reported cases of an outbreak at least in 2 years from 2005-2009. Amhara, Oromia and South Nations, Nationalities and peoples region (SNNPR) reported an outbreak in all four years except in 2005 (table 2.2.4).

Table 2.2.4: Report of cases on outbreaks by region from 2005-2009, Ethiopia

Region	2005	2006	2007	2008	2009
Addis Ababa	0	17	0	4	22
AFAR	62	0	18	68	49
AMHARA	0	308	166	213	91
Ben-Gumuz	0	14	82	0	0
GAMBELLA	86	8	0	11	0
Harar	0	0	0	0	0
OROMIA	0	124	188	2286	1055
SNNPR	0	73	79	257	310
Somali	11	5	0	52	0
Tigray	0	0	0	0	0
National	159	549	533	2891	1527

From 16 zones, 126 deaths were reported during 2005-2009 in which the highest was reported from Gujji 23 cases (18.2%) followed by West Harerghe 21(16.6%) and from zone 2 of Afar 14(11.1%).The overall case fatality for the five consecutive years of the country was 0.72%.

Discussion

Measles Immunization coverage of Ethiopia showed a progress from 42% in 2002 to 72.2% in 2008 and it was also indicated starting from 1998 the Federal Ministry of Health conducted measles supplemental immunization activities (SIAs).moreover recently the African regional goal of a >90% measles immunization national level coverage and >80% in all districts was adopted by the Federal Ministry of Health of Ethiopia[15].

Nonetheless notification of measles cases increased year to year with a decline in 2009. It was also depicted by the Epi-curve that Ethiopia experienced outbreaks in 2008 and 2009 of January to February (Figure 2.2.3 & 2.2.4-7). This could probably be improvement of measles surveillance activities such as notification of any suspected cases of measles. In Oromia region for example, 3654 (46.4%) of the reported suspected cases were classified as discarded from 2005-2009 which might indicate an increase in awareness of for notifying suspected cases of measles. As it was evidenced, among the total cases 26.9% (4718) were vaccinated and 35.3% (6192) with unknown vaccination status; low immunization coverage and inadequate vaccine efficacy could be the main contributing factors for the occurrence of outbreaks and increment of measles cases in the country. The seasonality trend of the disease or Increase number of cases from December to February could not be explained within the scope of this work.

The two highest peaks of the Epi-curve (Figure 2.2. 3) in January 2008 and 2009 were due to the outbreaks of Guji and West Arsi-Sidama zones. As it was shown in Figures 4-7 in Guji, West Haraghe, West Arsi and Sidama zones an outbreak was occurred in a consecutive days with confirmation of laboratory of Measles IgM antibody in 30 days or less.

Cases were not evenly distributed by age and the most affected age group was observed from 1-4 years throughout the five years period (Figure 2.2.8 & 2.2.9).This could be the immaturity of immune system in this age group and it is also documented that in developing countries the most vulnerable children are between the ages of 9 months and 5 years [19].

Though an increased number of suspected measles cases notified in 2008 and 2009, the laboratory confirmed cases (10.7% & 9.1% respectively) were much lower than the rest three years. This could be due to the occurrence of outbreaks in 2008 and 2009, which minimized the number of serum samples to be collected, i.e., no more serum sample collection after five laboratory confirmed cases during an outbreak.

The incidence of suspected measles cases in all five years was more than 2 cases per 100,000 populations which kept Ethiopia as high burden of measles compared to all the other African countries[20]. The cumulative case fatality rate in five years period was too low (0.71%). This could be under reporting of deaths and weak surveillance activities to detect a case early which is a common situation like other causes of deaths in the country or it could be also due to improvement of case management in health facilities.

All big regions such as Oromia, Amhara, SNNP, and Tigray had low performance or proportion of detection of confirmed IgM positive cases. However except Ben-Gumuza and Harari all other regions and city administrations had good performance. This could be the fact that in big regions the notification of suspected cases was high and especially because of the occurrence of outbreaks in each year result in an increment of a denominator.
The highest attack rate (12.9%) in Harari and Gambela (5.4%) could not be explained at this point; however the probable hypothesis might be still due to cold chain management failure or presence of many susceptible groups in the community.
Three regions (Tigray, Harar and Dire Dawa) had zero report of measles cases in line listing form (outbreak) different from the rest of all other regions.The Tigray case could be explained by its consistent and hgher vaccination coverage (above 74%) which is better from other regions, but the absence of outbreak in Hareri and Dire Dawa in five years period couldn't be explained so far.

Primary indictors for the performance of measles surveillance[6] such as (i) a greater than 80 % of reported measles cases with a blood specimen collected within 30 days of rash onset excluding epidemiologically linked cases from the denominator, (ii) a target of >80% of districts that have reported at least one case of measles (or >1 reported case per 100,000 population) with a blood specimen per year, (iii) Annualized rate of investigation (with blood specimens) of suspected measles cases or a > 1 case investigated with blood specimen per 100,000 populations per year were tried to be assessed. The first indicated indicator couldn't be calculated b/c of the difficulty in the database which had no district to see the second indicator, but when we observed by zone; in 2009 102(100%) zones reported at least one measles case , 83.3% in 2005, 74.5% in 2006, 88.2% in 2007 and 93.1% in 2008.But the target set on the third indicator was met and found to be above 1(4.5 per 100000, i.e. 3511 blood samples in2009) for all four years except in 2005 which was 0.65 per 100,000 population (only 359 blood samples collected/year)

From the supplemental performance indicators of measles surveillance the target which indicate a 90% or more arrival of samples to the national laboratory in a good condition (i.e., adequate volume, no leakage, not desiccated) was found to be 99.9%(11829).17.12 %(3000) of measles cases were laboratory confirmed (Table 2.2.2) which was above the target set by the FMOH of Ethiopia and WHO[6,] i.e., < 10%.

Conclusion

A total of 17521 suspected and 3000 (17.1%) laboratory (IgM antibody) confirmed measles cases were notified at central level during 2005-2009.The overall case fatality rate was 0.71% for the same years period. Generally there was a trend of increment of cases in the months of January, February and March. The national vaccination coverage showed progress year to year though the vaccination coverage of five regions was still under 55%.Four zones (Guji, West Arsi, West Haraghe, and Sidama) were identified as places which were responsible for the highest peaks in the national epidemic curve of the five years period because of the occurrence of outbreaks. The age group 1-4 years was the most affected by measles from all other age categories and 62.2% of the cases were not vaccinated for measles or with unknown status of vaccination. Oromia regional sate constituted most of the suspected and laboratory confirmed measles cases, however the highest attack rate was observed in Hareri region. Tigray Dire Dawa, and Hareri regions had no report of cases of an outbreak.

Recommendations

The FMOH and other partners should collaborate and strengthen regions for the improvement of measles vaccination coverage. The seasonality of disease transmission or occurrence of outbreaks could indicate when to conduct SIAs and needs further investigation and research. The surveillance activities need improvement in early detection of cases, for the completeness of variables and specificity of reporting suspected measles cases especially during outbreaks. Improvement in the database management for ease analysis i.e, for example health facility names were inconsistent and districts were not filled. Further investigation or research better be conducted find out causes of outbreaks for the identified locations.

Acknowledgements

We appreciate Dr Richard Luce for his meticulous comments of our concept paper which lead us to look forward in writing this work. We also acknowledge the FMOH for providing the data base.

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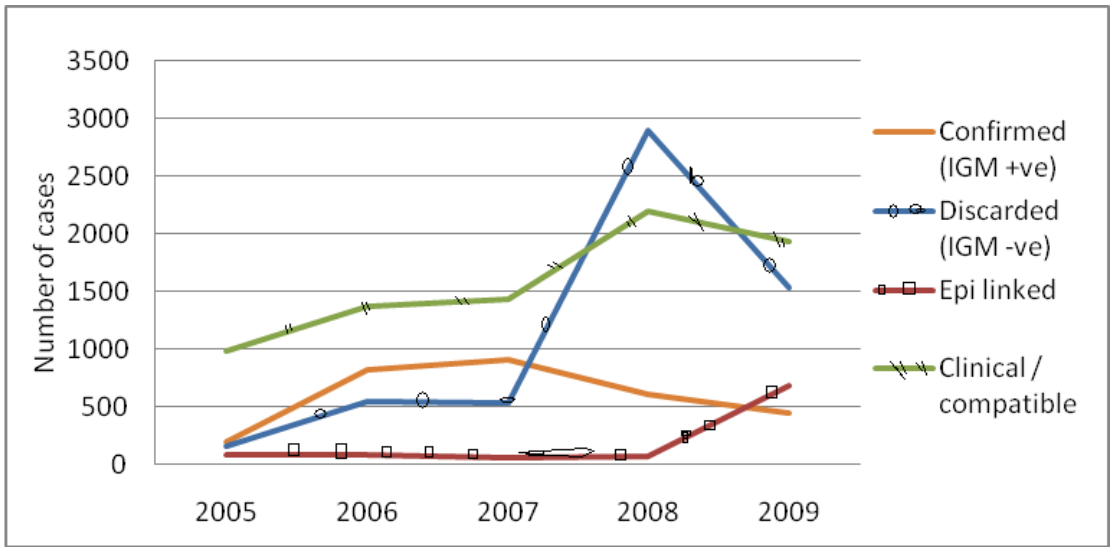
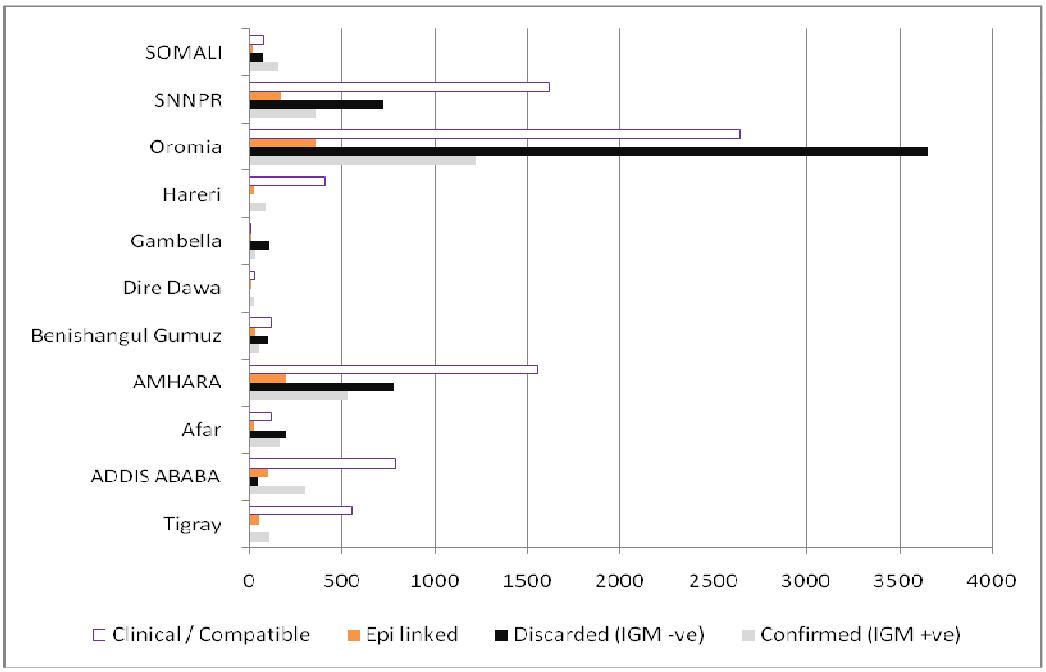
Annexes (supplemental tables and figures):

Annex 5: Distribution of cases and attack rate (%) by regions from 2005-2009, Ethiopia

Region/Year	2005	2006	2007	2008	2009	Total
Tigray	121(.37)	188(.57)	159(.36)	111(.25)	127(.28)	706
Afar	153(1.4)	33(.29)	47(.33)	141(.97)	118(.8)	492
Amhara	235(.16)	817(.57)	581(.33)	721(.41)	703(.39)	3057
B.Gumuz	37(.78)	48(.98)	153(2.2)	25(.36)	24(.33)	287
DIRE DAWA	11(.42)	15(.56)	13(.37)	13(.37)	8(.22)	60
Gambella	103(5.46)	18(.91)	0	22(.68)	1(.03)	144
HARERI	63(4.68)	63(4.56)	100(5.45)	243(12.91)	50(2.59)	519
OROMIA	280(.14)	755(.38)	1134(.41)	3367(1.2)	2325(.81)	7861
SNNPR	191(.17)	416(.37)	542(.36)	803(.51)	904(.56)	2856
SOMALI	74(.22)	45(.13)	14(.031)	97(.21)	83(.17)	313
Addis Ababa	148(.37)	422(.57)	188(.36)	228(.25)	241(.28)	1227
Total	1416	2820	2931	5771	4584	17521



Annex 6: Trend of Measles case by final classification from 2005-2009, Ethiopia



Annex 7: Frequency of measles final classification by region, 2005-2009, Ethiopia

Annex 8: Measles vaccination coverage by regional states, 2002-2008, Ethiopia

Region	(2002/2003)	(2003/2004)	(2004/2005)	(2005/2006)	(2006/2007)	(2007/2008)
Tigray	83.52	73.73	83.2	83.9	80.76	78.9
Afar	22.79	24.69	N/A	19	29.65	50.4
Amhara	50.03	61.91	64.1	63.9	67.56	72.5
Oromiya	33.91	43.21	52.7	58.9	60.88	73.6
Somali	6.09	7.24	13.4	35.7	18.46	26.2
Ben-Gumuz	27.56	36.28	42.9	80	68.2	55.4
SNNPR	47.05	64.24	83.4	100.9	87.06	91.3
Gambella	36.53	N/A	16.5	68.9	39.72	42.3
Harari	62.98	59	67.8	70.3	59.88	75.5
Addis Ababa	65.32	70.7	69.2	40.9	38.54	39.8
Dire Dawa	58.55	39.37	46.1	49.7	51.22	48.7
National	42.91	52.61	61.3	65.6	64.9	72.2

Annex 9: Frequency of types of data by region, 2005-2009, Ethiopia

Province of Residence	Case based		Line listing	
	No	%	No	%
Addis Ababa	1184	10.0	43	0.8
Afar	296	2.5	196	3.5
Amhara	2266	19.1	791	13.9
Benishangul Gumuz	174	1.5	113	2.0
Dire Dawa	60	0.5	0	0
Gambella	39	0.3	105	1.8
Hareri	519	4.4	0	0
Oromiya	4218	35.6	3643	64.1
SNNPR	2135	18.0	721	12.7
Somali	245	2.1	68	1.2
Tigray	706	6.0	0	0
Total	11842	100	5680	100

Annex 10: Distribution of serum sample's result by region, 2005-2009, Ethiopia

Province of Residence (Regional state/city administration)	IgM positive No (%)	IgM negative No (%)	Indeterminate result No (%)	Sample not done No (%)
ADDIS ABABA	298 (9.9)	788 (10)	20 (7.3)	78 (11.9)
AFAR	157 (5.2)	114 (1.4)	8 (2.9)	17 (2.6)
AMHARA	526 (17.5)	1557 (19.7)	55 (20)	128 (19.5)
Ben-Gumuz	48 (1.6)	114 (1.4)	4 (1.5)	8 (1.2)
DIRE DAWA	27 (0.9)	32 (0.4)	1 (0.4)	0
Gambella	28 (0.9)	9 (0.1)	2 (0.7)	0
Hareri	89 (3.0)	406 (5.1)	14 (5.1)	10 (1.5)
OROMIA	1216 (40.5)	2642 (33.4)	90 (32.7)	270 (41.2)
SNNPR	355 (11.8)	161 (20.4)	57 (20.7)	109 (16.6)
SOMALI	153 (5.1)	81 (1)	8 (2.9)	3 (0.5)
Tigray	102 (3.4)	554 (7)	16 (5.8)	33 (5)
National	2999 (100)	7911 (100)	275 (100)	656(100)

Chapter III – Evaluation of Surveillance System

2.2. Evaluation of the Surveillance System of Malaria, Acute Watery Diarrhea (AWD), Measles, and Polio in West Gojjam Zone, Amhara Regional State, Oct. –Nov. 2010

Mer'Awi Aragaw, Tadele Tsehaye, **Belay Bezabih**

Summary

Background: Ethiopia underwent different strategies to have functioning and effective surveillance system down from the community level up to the regional and national level. Currently, the PHEM is implemented in most of the regions to strengthen the surveillance and early warning system for public health emergencies and events. However, the performance of core surveillance activities and quality of the system is not yet assessed. So, the aim of this study is to assess the performance of core activities and attributes of surveillance system of malaria, AWD, Measles and Polio in west Gojjam zone, Amahara, Nov, 2010

Method: A cross-sectional descriptive study was employed from 25 Oct to 13 Nov 2010 in West Gojjam Zone, Amhara Regional State. A total of 9 study units/sites were included in the study, such as the Regional State Health Bureau, the Bahir Dar Regional Health Research Laboratory, West Gojjam Zonal health department, two district health offices, two health centers and two health posts. Selection of the zone, health centers and health posts was on convenience whereas random sampling was used for districts. Four priority diseases (AWD, Malaria, AFP/ Polio and measles) were used as proxy indicator for the evaluation of performance and attributes of the surveillance system. Primary data was collected using semi-structure questionnaire and observation using check-list. Secondary data was also collected from annual and weekly reports of the regional health bureau, Zonal Health Department, district health offices and health facilities. Data from partners -like WHO, JICA were also used as inputs. Data was entered, cleaned and analyzed using Excel; and qualitative data were also summarized to support the quantitative data.

Results: In the region and in the study zone in particular, malaria, measles, AFP (polio),and AWD remain as the major diseases of burden with a high rate of outpatient visit (for example, malaria accounts 16% of outpatient visit in 2001EFY[2008/09]in the region)and high reporting rates(for example in 2009-10(2002 EFY)The region reported 299 and 1167 suspected cases of AFP and measles respectively which are 141% and 274.5% of the expected numbers).The overall reporting rates of the visited districts to the Zonal Health Department in 2002 EFY were 73% (38/52) and 28.8% (15/52) for Mecha and Debub Achefer districts respectively. While the reporting rate of the Zonal Health Department to the Regional Health Bureau in 12 weeks period (WHO week 32-43) prior to the assessment was 50% (6/12). But the general report generation of the health facilities in the zone in the same

period to the Zonal Health Department was 11.95%; timeliness of reporting, analysis and use of the data at the local level is not satisfactory. Laboratory confirmation of cases took a wide range of time; from 15- 30minute for malaria up to 2-3 months for measles and AFP/polio. All assessed health officers responded that they investigated outbreaks and used the findings for intervention, but no written documents, standard procedures for outbreak investigations, and no feedback and Supervision was made. The users of the surveillance system well understood the usefulness the surveillance system but are not satisfied with the utility of the system. All respondents also agreed that the case definitions are simple and easy to understand and apply by all levels of health professionals. It was witnessed that during the change of IDSR to PHEM the reporting rate was affected and went down. But the change has made the reporting format more flexible to report other newly occurring health event without much difficulty.

Conclusion and recommendations: The overall structural set up of the surveillance system by the current reform with BPR and creation of responsible unit/focal person at each district and health facility level and involvement of the community is excellent.

The case detection of the surveillance system is affected by limited health facilities, health service capacity, communications, and infrastructure especially in the rural community which constitute more than 90% f the population. Volunteer participation of the community as Volunteer community health worker (CHW) was very limited for there are no incentives, or other means of encouragement. The poor health seeking behavior of the community for diseases like; AFP/polio, and measles and delay in the confirmation of cases by laboratory for these diseases also affecting the case detection. Because health posts are not providing the health care service, the community run to some other areas of care like holly water, traditional healers and so on which lead the diseases burden in the community remain covered. The reporting rate of the Zone and health facilities is very much low; which coupled with no timely analysis and use make the existence of the system invisible.

Therefore, it is necessary to strengthen the surveillance activity through active community participation and introducing community surveillance system; enforcement of health facilities to repot; regular supportive supervision and feedback mechanisms; capacity building for evidence generation and use of data, and strengthen and capacity building in logistics, communication and coordination. Furthermore, partners working in the area of surveillance shall set efforts in the coordinated and focused manner.

Introduction

Public health surveillance is an 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[1]. This is through revealing disease burdens and guiding the action to be taken, the health policy, planning, evaluation of health programs, providing a basis for research and so on.

It is carried out through a system which has legal support[2] 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.

Ethiopia underwent different strategies to have functioning and effective surveillance system. Too often, however, surveillance data for communicable diseases are neither reported nor analyzed on time [2]. As a result, the opportunity to take action with an appropriate public health response and save lives is lost. Even in cases where adequate information is collected, it is often not available for use at the local level. Cognizant of these problems African States adopted integrated disease surveillance (IDS) as a regional strategy (resolution AFRO/RC48/R2) for early detection and efficacious response to priority communicable diseases for the African region in September 1998, during the 48th Regional Committee for Africa meeting in Harare, Zimbabwe. Ethiopia as member state also endorsed this initiative[2] and is using it with frequent revision of the list of priority diseases.

Currently, since 2008 the FMoH launched a reform and restructuring of the health sector in to different core processes, and in particular the disease surveillance and response with the concept of Business process reengineering (BPR). This helps the surveillance of priority disease to be a dependable system as Public Health Emergency management (PHEM) center. This new structure is extended down to the district/woreda level in their capacities. This is designed as a cutting edge for better tracking and monitoring of diseases of public health concerns. Moreover, as member state of the WHO, Ethiopia is on preparatory phase to implement the International Health Regulation (IHR) which was declared by member states in 2005[3]. These are some of the good opportunities to strengthen surveillance.

The FMoH/ PHEM of Ethiopia identified 20 top priority diseases which are epidemic prone, of international concern and diseases on eradication and elimination programs for surveillance activities[4]. These diseases are monitored by a designated bodies through available means of communication- telephone, paper based reporting etc. These diseases are set to be reported as mandatory notification (which are immediately reportable) diseases and routine surveillance (which are to be reported weekly).

Measles, polio, malaria, and Acute Watery Diarrhea (AWD) are of the 20 priority diseases reported as immediately (AFP/Polio, AWD/cholera) and weekly (measles, malaria)[5]. They are significant disease burdens to the public.

Diseases like malaria are of the ten top diseases throughout the nation for more than a decade. Measles epidemic is becoming more frequent and dispersed to different corners of the country. In 2006 measles outbreaks were reported from ten of the 11 administrative regions and 74 districts throughout the country[6].

The overall purpose of surveillance of these diseases is to monitor the trend against the seated tolerance limits, as early warning and early response system, and pick any deviation from the limit at the earliest point in time for prompt response. Furthermore as early warning system, it guides risk mapping and preparedness; and prevention and risk aversion actions like immunization, vector control and so on.

For these purposes, each of these diseases has case definition(s) and integrated diseases reporting formats defined by the ministry of health and the WHO; and reporting is institutionalized into the health facilities and health offices. The general frame of work flow[2] is shown in figure 3.1.1.

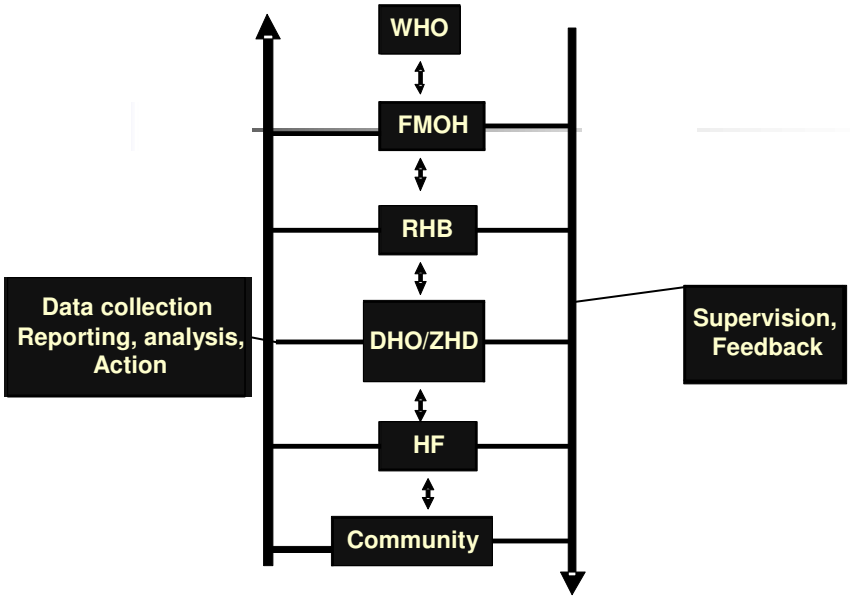


Figure 3.1.1: Data and information flow in IDSR indicating varying cycles at various levels

(Source: Ministry of Health, Federal Democratic Republic of Ethiopia. National Technical Integrated Disease Surveillance and Response Guideline, Version 1.1.September 2002*)*

Assessing the effectiveness and efficiency of this system in achieving the stated goals/ objectives is part of development or improvement of the existing resources, infrastructure and design[7]. This improves the information provided and thereby helps improve service provision and delivery[8]. Especially, with the implementation of the new

structure for surveillance system (PHEM) in the sector, the change in the quality of information need to be assessed particularly for diseases which exert high public health stress.

Malaria, polio, measles and AWD are of such diseases which can be impacted for the better or worse by the change in the structure.

Rationale of the Study

Malaria, measles AWD are the major diseases of the region with high frequency of epidemic and public health concern but relatively delayed in detection and reporting- for example, measles outbreak in Simada Woreda, South Gondar 2009 was reported late after 2 weeks[8]; polio is also a disease of eradication and it is necessary to assess the surveillance strength in detecting it. We believe that these four diseases could be used as proxy indicators of the surveillance system of the region.

Use of the collected data at the local level as evidence for public health decision making is not assessed in the recent years; Surveillance system evaluation is not done in the area; and little is known about the effectiveness and efficiency of the system.

Objectives

General objective:

The overall aim was to assess the performance of core activities and attributes of surveillance system of malaria, AWD, Measles and Polio.

Specific Objectives:

To assess the core activities such as case detection, reporting analysis and response surveillance system in the study area, to evaluate the attributes of the surveillance system of the selected diseases in the study area, to assess major challenges of quality surveillance system, and to assess the usefulness and utility of surveillance system in early detection of diseases and outbreaks and decreasing morbidity and mortality.

Materials and Methods

Study Design and Area

A cross-sectional descriptive study was employed from 25 October to November 13, 2010 in West Gojjam Zone, Amhara Regional State. This zone is selected for its easy accessibility and the relative high burden of the above selected diseases for evaluation. It has 15 districts with a total population estimated to be 2,217,054 (projection from the 2007 census) [9]. The surveillance system evaluation was employed on selected four priority diseases (AWD, measles, malaria and AFP) by based on three main elements:

1. Description of the importance of these diseases and the relevance of the Surveillance system
2. Description of the surveillance system
3. Description of the performance and attributes of the surveillance system

We assessed the structure and the core activities of the surveillance system in the region in general and in the study facilities in particular to describe the surveillance system of the region. The core activities and components included were case definitions, flow charts of the surveillance system (participating agencies and information flow in the surveillance system), population under surveillance, case detection, data collection, reporting, analysis, and result dissemination and resources used in the surveillance system.

The evaluation of the performance and attributes of the surveillance system involved assessment of the usefulness of the surveillance system, simplicity of the system, flexibility, quality of the data, acceptability, representativeness, timeliness and stability of the surveillance system.

Sample Size and Sampling

First, convenience sampling was used to select one Administrative Zone on the basis of its proximity to the Regional Health Bureau, and for the limited resources we got.

Study Units: The study subjects were the health facilities, health offices and the Regional Health Research Laboratory. A total of 9 study units/sites were included in the study. These were the Regional State Health Bureau, the Bahir Dar Regional Health Research Laboratory, West Gojjam Zonal health department, two district health offices, two health centers and two health posts. Selection of the districts and the district health facilities was done as follows:

From the zone, two districts were selected by simple random sampling (SRS) method and the district health offices were included in the study. From each selected district one health center and one health post were selected on convenience basis.

Data collection methods

Primary data collection tools: Data were collected using semi-structure questionnaire and observation using check-list. Data were collected by the principal investigators. We adapted our questionnaires according to our objectives from the WHO Guideline (1) and made interview to the surveillance officers or focal persons in the selected health facilities and health offices for the study.

Secondary data: We used different data sources such as; annual reports of the region, data from partners-like WHO and published articles in the areas of these diseases. The national integrated diseases surveillance and response (IDSR), the Public Health Emergency Management Guidelines

Data Analysis:

Data were entered and analyzed using the Microsoft Excel & Epi Info version 3.5.1 and qualitative data were summarized to supplement the quantitative findings.

Results

Meeting with Stake holders: The team had a brief meeting with the Regional PHEM core process head, and a stakeholder working in the area of surveillance in the region-Japan international cooperation Agency –JICA. We identified the areas interest of each party and got some important information about; and found previous baseline assessments done on our study population.

This meeting was also an important first step for our 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 zone and /or region.

Description of the importance of malaria, measles, AFP and AWD in Amhara Region; and the relevance of the Surveillance system:

In the region, malaria, measles, AFP and AWD are the major disease burdens of all the 20 priority diseases under surveillance in the nation.

Malaria: In Amhara Regional state, because of the climatic and environmental changes, 80% of the region is malarious and 75% of the populations are at risk of malaria[10]. In the region, in 2008/2009 of all outpatient and inpatient visits, malaria took 16% (with a total of 678,108 cases) and 15.1% (with a total of 1754 patients) respectively[11]. In West Gojjam Zone, all 15 districts in the zone with a total 365 of 397 (91.94%) kebeles are malarious. From week 10-46(March-Nov 2010) a total of 142,856 cases of suspected and confirmed malaria were reported[12](figure 2), from these 506 inpatient cases,52203 cases of fever suspected for malaria, 17092 cases positive for *Plasmodium falciparum* and 9454 were positive for *P.vivax.*

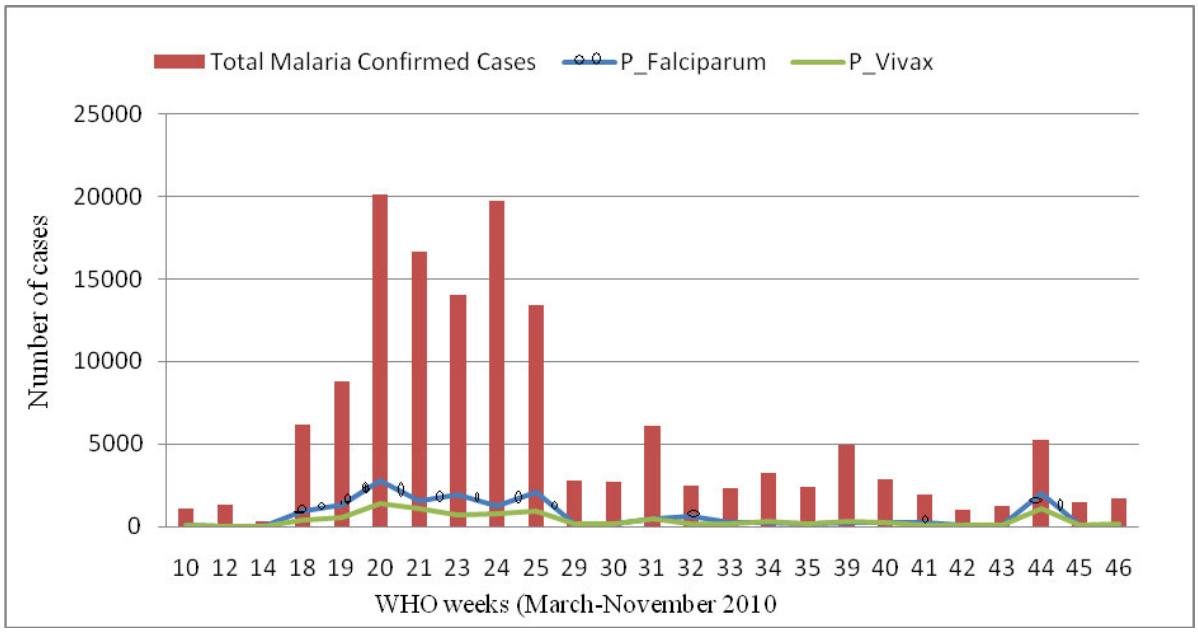


Figure 3.1.2: Weekly cases of malaria in West Gojjam zone, March-November 2010

Measles: In 2009/2010, the detection rate of measles and AFP/Polio in the region is more than 150% relative to the expected number of cases. The region reported 299 and 1167 suspected cases of AFP and measles respectively which are 141% and 274.5% of the expected numbers[13]. In West Gojjam zone, in 2009, all districts reported measles cases with a total of 190 cases, which raised from the expected annual rash illness detection rate of 2 per 100,000 to 8.4 per 100,000 population[14].

A total of 301 cases of measles were reported to FMOH & WHO from West Gojjam Zone in which Bahir Dar zuria account the highest number of cases; 51(16.9%) followed by Sekela 38(12.6%) and Jabi Tehnan (9.6%) (15); as seen in figure 3.1.3, since 2008, measles is becoming major burden of disease with epidemic.

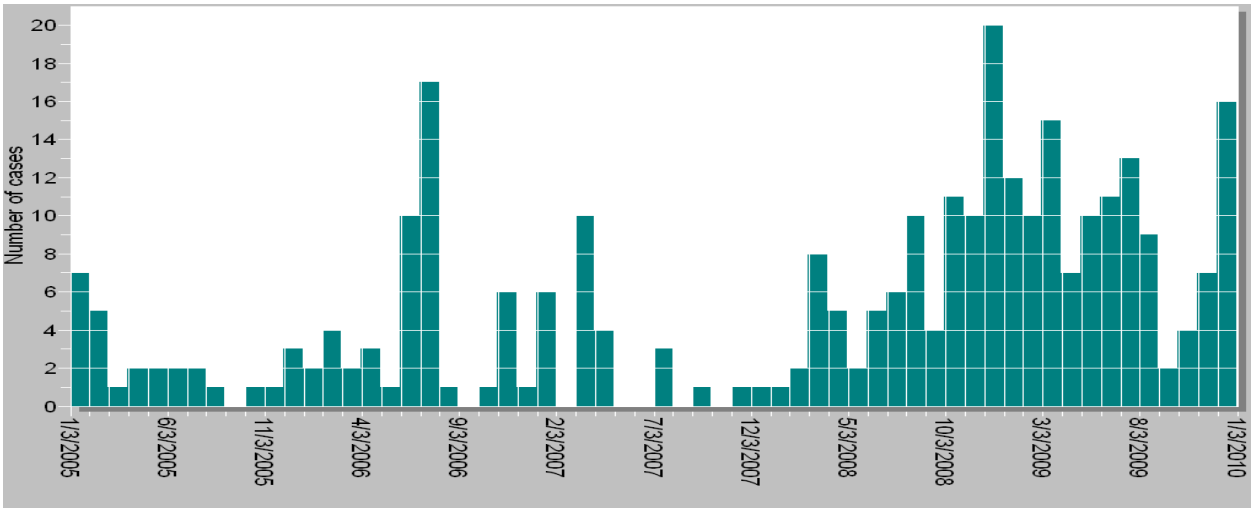


Figure 3.1.3: Measles cases by date of onset of symptoms in West Gojjam Zone, 2005-2009.

Acute Watery Diarrhea: Since 2006 AWD has been the major epidemic disease in Amhara region. From April 2008 to June 2009, AWD occurred in 7 zones/26 districts of the region with a total of 2303 cases and 31 deaths. In the recent past, in August 2009, in Mojana district, North Shewa Zone, about 1472 people were attacked in a single AWD outbreak[14]. This outbreak also overstretched the overall resources of the region for outbreak management and response.

AFP/polio: In 2009/2010, 29 cases of AFP/polio were reported from all districts except Burie town, Burie zuria, and Finote Selam town among under 15 yrs age-group. This made the annual Non Polio-AFP detection rate 2.6 per 100,000 <15 population, which is more than the expected 2 per 100,000 <15 population[15]. However these cases of AFP could not be verified by laboratory confirmation for polio (wether they were wild or vaccine induced polio) during the evaluation period in the district.

Description of the surveillance system

Systems in place: In Ethiopia, the health information system for surveillance of communicable and non-communicable diseases is organized in two main categories, the surveillance system under Public Health Emergency Management core process (PHEM) and the Health Information Management System (HMIS). These systems are set at the central level and extending down to the regions and the health facilities under MoH.
Public Health Emergency Management (PHEM) is defined as the process of anticipating, preventing, preparing for, responding to and recovering from the impact of epidemics and health consequences of natural and manmade disasters. The sub processes identified for the process include Preparedness, Early Warning, Response and Recovery[15]. The early warning sub-process contains the Integrated Public Health Surveillance. This surveillance focuses on diseases which have epidemic potential, diseases under eradication and elimination, diseases of international concern, and malnutrition. The health management information system (HMIS) collects all the general health related data from the health facilities. HMIS is a project on implementation.

Target diseases under surveillance in PHEM

The PHEM core process targets 20 selected diseases. Acute flaccid praralysis (AFP)/Polio, avian human influenza (AHI), cholera/acute watery diarrhea (AWD), Guinea Worm, neonatal tetanus (NNT), Rift valley fever (RVF), sever acute respiratory syndrome (SARS), Small Pox, Yellow fever, Anthrax, viral heamorrhagic fever (VHF), measles and Rabies are to be reported immediately on detection and weekly as zero report. Meningitis, malaria, typhoid fever, typhus, relapsing fever, dysentry and malnutrition are to be reported weekly.
The evaluation assessed the surveillance system of three immediately reportable (AWD/ cholera, AFP/ Polio and measles) and one weekly reportable disease (malaria). In all visited health facilities and health offices, the surveillance of these diseases exist and functioning.

Objectives of the surveillance system in PHEM

General objective:

The overall objective is to improve the ability of health workers to detect and respond to priority communicable diseases. Effective and timely decision-making based on good evidence increases efficient utilization of available resources for preventing and controlling communicable diseases and improving the health status of the population[2]. To effect, PHEM is established with the following specific objectives.

Specific objectives:

1. To establish robust early warning system;
2. To detect public health emergencies on a timely basis;

3. To strengthen communication/information exchange capacity at all levels;
4. To build capacity at all levels, especially at Woreda level to prepare, prevent, detect, verify, respond and contain epidemics/other public health emergencies (PHEs) at local level and recover quickly from their impacts;
5. To enhance community participation/involvement in Emergency Preparedness and Response (EPR) activities;
6. To establish and maintain coordination and collaboration framework;
7. To strengthen monitoring & evaluation capacity at all levels.

The objectives of the Malaria, AWD, Measles and AFP/Polio surveillance

To detect cases and respond quickly when their alert threshold is observed and to strengthen the report of cases and diseases whenever outbreaks of these diseases are occurred.

Case Definitions:

According to the PHEM guideline there are two case definitions i.e. standard case definitions and community case definitions:

Standard case definitions

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

Measles: 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.

Cholera: a patient age 5 years or more, with severe dehydration or death from acute watery diarrhea. If there is a cholera epidemic, a suspected case is any person age 5 years or more with acute watery diarrhea, with or without vomiting.

Acute Flaccid Paralysis: Any child under 15 years of age with acute flaccid paralysis (AFP) or any person with paralytic illness at any age in whom the clinician suspects poliomyelitis.

Community case definitions;

It is very important at the community level to strengthen the notification and increase the detection rate of the priority diseases.

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

Measles: Any person with fever and rash starts from face.

Cholera: Any person 5 years of age or more with profuse watery diarrhea and vomiting

Acute Flaccid Paralysis: Any person with sudden onset of paralysis of the limbs

Performance of core and support functions of existing surveillance and response systems

Population under surveillance:

The national PHEM targets all the population in the country to be under surveillance for all the twenty priority diseases. The Amhara Regional state follows the same structure, with a total population of more than 18 million (projected from the 2007 national census).

Table 3.1.1: The Population under Surveillance in the assessed Region and Administrative Areas, by Place of Residence (Population Projected from the 2007 National Census)

Areas Under Assessment	Total Population in 2010 (Projected from the 2007 cense)	Rural	Urban
Amhara Region	18,106,983	15,885,198	2,221,765
West Gojjam	2,217,056	2,024,038	193,018
Debub Achefer	167,392	149,914	17,478
Mecha	307,410	283,558	23,852

The majority of the communities live in the rural area of the region and the districts (table 3.1.1). Regarding the health care services the region has 2 Regional Referral hospitals and 2 Health Research laboratories. In terms of care the West Gojjam Zone, has one district hospitals; and at the peripheral level (at the district level) the health centers and five satellite health posts under each health centers give service for the community.

The overall health care coverage of the zone is 84%. In all assessed health facilities, the respondents agree that the population under surveillance have unsatisfactory health seeking behavior especially for measles, though there is relative improvement through the effort of the Health Extension Program (table 3.1.2).

Table 3.1.2: Number of health facilities in the study areas; West Gojjam Zone, Mecha & Debub Achefer Districts

Administrative Area	Number of Health Facilities Expected to report						Health Coverage	Potential representation of the community in the surveillance Data	Comment given on the health seeking Behavior of the community
	H / post	H / Center	Hospital	NGO	Others	Total			
Amhara Region							94.3%	Both Urban and rural equally	Unsatisfactory
West Gojjam Zone	376	103	1	4	97	581	84%	Both Urban and rural equally	Unsatisfactory
Mecha	11	14	-			25	86.5%	Both Urban and rural equally	Unsatisfactory
Debub Achefer	20	\8	-	-	17	45	75%	Both Urban and rural equally	Unsatisfactory

*The "unsatisfactory" health seeking behavior of the community was commented or given by the district health officials during interviewing.

Case detection and registration

The cases definition of malaria, measles and AFP was available in all the visited health facilities while the case definition of AWD/cholera was only available in 50% of the visited health facilities. The understanding of the available cases definitions by the health care providers was satisfactory, as demonstrated by some of the heath care providers at the time of the field visit.

In one of the health posts, the community cases definition of these priority diseases was distributed to the volunteer community health workers (called as Community Surveillance Officers), and monitoring of their surveillance activity by the Health Extension Workers was good.

The clinical register was found only in 50% of the visited health facilities; but the handling of these registers was poor. One of the health facilities without clinical register collects data from tally sheets distributed to the outpatient department on daily bases, but the tally sheets were not well collected and/or kept, especially on weekends. Evaluation of a one month period reports (4 weekly reports) submitted to the higher level against the tally sheet recordings showed a difference of 166 cases of malaria in a month period.

All health centers have the cold chain capacity and guideline to collect and ship samples for measles and AFP/Polio to the respective regional or national laboratories except for AWD/Cholera for which all health centers have no transport media. Laboratory confirmation of cases took a wide range of time. Malaria took only 15- 30

minutes, and AWD/cholera took 3-5 days; but measles and AFP/polio took 2-3 months and was mentioned as no more useful for timely intervention; and they wonder why they are collecting the samples.

Reporting: There was no shortage of reporting form in the past 6 months in all visited health facilities and health offices. But in one of the districts, the woreda health office and the health posts and health centers under it use a different reporting format for weekly reporting.The weekly reporting rates of the visited health facilities over the past 12 weeks prior to assessment were 45.8% (11/24) for health posts, and 50% (12/24) for health centers. The overall reporting rates of the visited districts to the Zonal Health Department in 2009/2010 were 73% (38/52) and 28.8% (15/52) for Mecha and Debub Achefer districts respectively. While the reporting rate of the Zonal Health Department to the Regional Health Bureau in 12 weeks period (WHO week 32-43) prior to the assessment was 50% (6/12).

The general report generation of the health facilities in the zone in the same period to the Zonal Health Department was only 11.95% (table 3.1.3). The reporting rate of the health post and centers was only slightly higher than 10%; and others facilities like the hospital had almost no report in 12 weeks time.

All the reports were sent to the next level via mail and telephone. However reporting through telephone is limited in health posts where there were no telephone services. In cases of emergency the HEWs uses their personal mobile phones, for which they were complaining for refund.

Table 3.1.3: Reporting Rates of Health Facilities of West Gojjam Zone in 12 weeks (Week 32- 43) period time, August- October 2010

Ser. No.	Reporting Week (WHO week Calendar)	H/post		H/center		Hospital		NGO		Others		Total number of health facilities	
		Reported	Expected	Reported	Expected	Reported	E xpected	Reported	Expected	Reported	E xpected	Reported in a week	Expected to report in a week
1	40	81	376	30	103	1	1	0	0	7	104	119	584
2	39	109	376	47	103	0	1	0	0	5	97	161	577
3	35	99	376	32	103	0	1	0	4	7	97	138	581
4	34	114	376	46	103	0	1	0	4	4	97	164	581
5	33	86	376	40	103	0	1	0	4	9	97	135	581
6	32	76	376	37	103	0	1	0	4	3	97	116	581
Average number of reports per week		47.08		19.33		0.08		0		2.92		69.42	
Average reporting Rate per week (%)by facility type			12.52		18.77		8.33		0.00		2.97		
Zonal Average Reporting Rates(%) in a week [average Number of Reports in 12 weeks in the Zone/ Expected number of Reports]*100%													11.95

NB. R = Reported in the week, E=Expected to report in the week

Data analysis

In all the sampled health offices and health facilities, there was a responsible person for data analysis; however, analysis of the surveillance data was variable for these diseases at the District, Zonal and Regional health offices. For example the Regional Health Bureau analyzes and follows trend for malaria, measles and AWD, where as the zone and districts has only for malaria. Moreover data analysis was not done on regular basis. The threshold for action was set for malaria at all districts. Only 50% of the visited health facilities analyzed the data collected for surveillance at their capacity.

The use of appropriate denominator was limited to the regional health bureau; raw numbers (not rates) were used to compare the incidences with the previous experiences at the zone, districts and health facilities.

Epidemic Preparedness and response

All the districts assessed have experienced one or more types of outbreaks in the previous years. These are outbreaks of malaria, measles, AWD; and all were responded within 48 hours of report to the respective health office. The sampled health offices (region, zone and district) responded that they set epidemic preparedness and response plans for their priority diseases, and have epidemic management committee with rapid response team. However, except for the regional health bureau which stock drugs and other supplies of about 25% of the last year consumptions, all district and zone health departments have no any stock, nor budget line for emergency. The epidemic management committee and the rapid response teams are activated only when there is an event. Moreover, they did not evaluate their experience and preparedness. In the zone and districts assessed, PHEM is raised as an agenda in the biannual health office performance review meetings.

All assessed health officers responded that they had investigated different outbreaks and used the findings for intervention, but there were neither written documents nor standard procedures for outbreak investigations.

Feedback and Supervision

There was no culture of dissemination of the surveillance information nor supervision at all levels of the health system assessed. Only one health post had regular supportive supervision from the partner organization working in that area on project for community surveillance. This partner organization has a newsletter concerning the surveillance activities of its project areas.

Training

All assessed health offices, region, zone and districts, responded that all the staffs working on surveillance units got short term training or workshops of 3-5 days by the Regional Health Bureau and partners. At the health facilities, only the focal person assigned for surveillance was trained, but the health care providers did not get orientation except for the health extension workers in the JICA project site, and on site orientation on AFP and measles sample collection procedure by the WHO surveillance officers.

Material resources available for surveillance

Resources for data management, communication, and logistics were all available at the region level. However, they all became very scarce down in the ladder. The computers at the zonal and district health office levels were not functional. The PHEM/ surveillance units at the zone, district, and health facility level did not have communication ways- like telephone, fax machines, internet and so on. The logistic and budget constraints were complained by all the health units assessed except the regional level. These were mentioned frequently as the reasons for poor supervision, and monitoring of the health facility reports.

There was no a radio call system in any of the remote areas of the visited districts; which impacted the timeliness of reports of both immediately and weekly reportable diseases.

The Laboratory

The laboratory capacity to collect, test, transport, and role in the surveillance of AWD, AFP/Polio, malaria and measles were assessed both at the health facility and regional level. The region has two regional health research laboratories. These are used in the outbreak investigation and confirmation at their capacities. They are able to do basic tests like blood film, gram stains, cultures and sensitivity, and quality assurance of facility level laboratories. They refer virology samples and samples for further analysis to the Ethiopian Health and Nutrition Research Institute (EHNRI).

The health center level laboratories were able to test malaria both by microscopy and RDT (health posts can use only RDT), and able to collect samples for measles and AFP/polio. But they have no the transport media for AWD/Cholera and they call to the regional health laboratory to come and collect samples. Health centers assessed have limitations of collecting samples of CSF (cerebrospinal fluid). Malaria was confirmed at all levels of the health facilities-health posts, health centers. But frequent lack of reagents and RDT were common problems.

Description of the performance and attributes of the surveillance system

Usefulness: Early detection of epidemics of diseases under surveillance was a common understanding of all the respondents as the major use of the surveillance system. But the use of the system for assessment of the effect of prevention and control programs was very limited or none. Moreover, this well understood use of the surveillance system has so many challenges in the area of case detection, reporting and response following it.

In general, the users of the surveillance system, though they understood the usefulness in this regard, are not satisfied with the system and the utility of the system was very low.

Detection of Cases: The surveillance system in the PHEM is organized in such a way that the community, health posts, and all other health facilities under the MoH will have active role in the detection of cases[15]. This is set with cases definitions which are tailored with respect to the reporting entity for early and easy case detection. However dissemination of case definitions of these diseases was very limited. There were no community cases definitions in all visited districts except in few kebeles in Mecha district which are project areas of JICA.

Practically, from the visited health posts, only one health post (Project area of JICA in Mecha District) had good networking with the community and with referral system. In this health post there were volunteer community health workers, selected by the community and responsible for reporting all the health events, diseases to the health extension worker (HEW) weekly including zero reports.

The health facilities are nearly 100% physically accessible by kebele to the community – there is at least one health post at each kebele in all visited districts. But because of different cultural reasons for low health seeking

behavior of the community (especially for measles) and at times when health extension workers have different commitments (like campaign for vaccination, Maltra (Malaria and Trachoma campaign of the Carter Center) etc.), the detection of the first few cases was usually late in all the visited sites as the focal persons suggested. Furthermore, limitations regarding the laboratory confirmations were also mentioned as the limiting factor for early cases detection. Some of these limitations were:

- Extreme overdue of the laboratory result particularly of measles and AFP for 1-3 months, even sometimes may not even be notified at all.
- Shortage of laboratory reagents- like rapid diagnostic tests (RDTs)
- Work load on the health extension workers
- Lack of experts for sample collection of AFP, measles, AWD at the health post level
- Lack of sample transport media- especially-AWD/Cholera sample transport media and collection tubes are being collected from the Regional Health Research Laboratory (RHRL), this may delay sample collection for 2-3 days
- Lack of resources and logistic for early case investigation at the community level
- Lack of budget for supervision of the health facilities, and early community level investigation & subsequently, the quality and shipment of the collected samples may not be assured.

Providing appropriate and rapid response to epidemics: Once there is a suspected epidemic, all visited woredas respond that, a rapid response team (RRT) from the woreda health office will be deployed for cases investigation and case management in less than a day or two except when there is lack of logistics and transport. But this was not satisfying for the surveillance user at all level (from health post to the regional health bureau) because of a delay in the detection of cases, and response was usually late after impacts like out of acceptable case fatality rates.

The usual response focuses on the case management. Investigation of potential causes and risk factors and guiding the response based on these findings was not accustomed in all visited sites. The epidemic management committee do not usually evaluated their preparedness and response activities except for annual woreda health review meetings with so many other agendas.

Simplicity: In the detection of cases;

All respondents agreed that the case definitions of these diseases for identification of suspected cases are easy to understand and apply by all levels of health professionals. But to confirm cases, it was found usually difficult for

factors related to sample collection, shipment and delay in laboratory result (up to 1-3 months) and shortage of RDT.

The influx of data: The route of the data flow is clear and simple as it was set in the surveillance guideline and the reporting entities do not complain any problem in this regard. There was no lack of reporting format but the data collection is assumed to be time taking particularly the weekly reporting and case based reporting formats which took 15 min or more to fill a single report.

The major problem mentioned here was lack of reporting means to report cases to the next higher bodies especially from the health post to the woreda health office. Logistics like telephone, public transport, internet, and fax were indicated as constraints. This impacted timeliness of the report. The health workers at the periphery usually use their personal mobile phones in case of urgent conditions.

In the data management: Data from the health facilities were sent to the woreda health office, the Zonal and Regional Health Bureau in a paper form and use of the data was also very limited at all levels. However, transcribing the paper based data in to a data base is tried at the Regional Health Bureau.

Flexibility

The previous IDSR system has been recently changed with the implementation of the current PHEM since 2009. This change has made the reporting format more flexible to report other newly occurring health event without much difficulty, and the formats are assumed to be easy and comprehensive, except for language barrier particularly at the health post level. The change from the IDSR to PHEM with BPR reform was not easy and flexible[16]. It led to reassignment of the work force and brought new staff to the system. Moreover, absence of written job description, duties and responsibilities worsen the situation. This took considerable time to introduce the system to the new staff. Hence, any change in the existing procedures of case detection, reporting and formats might not be easy to adapt at all level. All respondents pointed out concerns related to capacity building and intensive advocacy prior to any change in the system.

The Quality of data

The data quality was also assessed on the basis of completeness of the reporting format and the timeliness of the report as set in the guideline. Some of the missed variables in the weekly reporting formats are date of report was sent (but week of report), and the expected number of health facilities to report. The blank variables in the case based reports were hospital admission, date of admission, vaccination history, locating information, address (urban/ rural). Sometimes age was filled by year and also converted to months- like age 12 years was filled as 12 years and 144 months on the same form. The major reasons were language barrier, and not considering some of

the variable as important. The reporting sites were not well trained or regularly supervised in all visited sites. There were no any regular crosschecking of the data and feedback.

Acceptability

The acceptability of the surveillance system assessed based on the engagement of the reporting agents and active participation in the case detection and reporting. In the zone, the engagement of the reporting agents was not as expected and the reporting rate of the health facilities in the zone was below 50% as seen over 12 reporting weeks (table 3). The major reasons for poor engagement to the surveillance activity were poor means of communication, lack of feedback and /or of dissemination of the results or situations in their district or region, reporting formats are assumed to be time consuming, lack of understanding of the relevance of the data collected, and the health care providers are not interested to record each consultations in their clinic.

Sensitivity

The sensitivity of the surveillance of these diseases in the detection of the cases and outbreaks were seen separately;

The surveillance system to detect cases of malaria, AFP/Polio, AWD/Cholera, and measles:

Since the surveillance system is based in the health facilities, the capacity of the surveillance system to capture cases in the community is dependent on different reasons: one reason could be the health seeking behavior of the community- which was generally commented as poor, particularly for measles, AFP, though there is improvement with the HEP and the community HW; The study done on this community by JICA showed that the preference of the community between the holly water, traditional healer, and the health facilities under MoH depends on the type of the diseases and accessibility of the service (Unpublished preliminary assessment of the project)

The other reason is lack of case management capacity of the health posts; the health post record and report those whom they can give treatment like anti- malaria (coartem), otherwise, cases are not recorded and reported if they have no any drug. Hence, the number of cases reported from the health post will be high when they have anti-malaria and RDT at hand. The third factor could also be the technical and logistic capacity of the health facilities in detection and laboratory confirmation of cases. These factors undermine the burden of cases in the community and hence the sensitivity of the surveillance to pick the case to be low.

The surveillance system to detect an outbreak of malaria, AFP/Polio, AWD/Cholera, and measles:

The capacity of the surveillance system to detect an outbreak is influenced by the definition of the outbreak.

In case of AFP/Polio, AWD, in which one case is defined as outbreak, the sensitivity of the surveillance system to detect an outbreak is relatively low for the reasons mentioned above as barriers for case detection.

In case of malaria and measles, the sensitivity of the surveillance system is dependent on different reasons, like regular analysis of the data, definitions of the thresholds, case detection and reporting rate of the expected health facilities and so on. Unfortunately, the reporting rate of the health facilities was much lower than expected as shown in the table, there was no regular analysis of the collected data, and there are different definitions of thresholds - like "case build up" and hence, the sensitivity of the cases detection and outbreak detection of the surveillance system is high likely to be lower. However, the sensitivity of the system increases once the number of cases raises high or death starts to occur, i.e. the surveillance system would be sensitive for high epidemics.
The team found it difficult to assess the data completeness of reports delivered to the immediate higher level using capture –recapture method. Because, the reports were in crude number and no specific identifiers of each case; though we saw gross discrepancy between reported and registered cases at the health center.

Predictive value positive

It was not possible to measure the PVP of the surveillance system in our assessment of the surveillance of these diseases. Because, the laboratory confirmation of all suspected cases by the case definition couldn't be possible, or not practiced. For example, malaria in non epidemic seasons and whenever RDT is available, the health posts treat and register only RDT positives; which seemed to be 100% PVP, but RDT negatives cases are usually referred and not registered. Moreover, data (samples collected and laboratory results) for diseases like AFP/polio, measles and AWD/ cholera which use external laboratory were not found compiled in any of the study units.
But, in general, for the case definitions are broad for these diseases especially at the health post and community level, the PVP is expected to be low especially for febrile illnesses.

Representativeness

The representativeness of the surveillance system is related to the health service coverage, the reporting rate of the health facilities, the health seeking behavior of the community, and the technical capacity of the health care providers and so on. However, these factors are not well met for the reasons mentioned above. So the representativeness of the system is likely to be very low.

Timeliness

The reporting rates of the health facilities in the zone were found to be low (table 3). But of those which reported, the number of facilities which reported timely was difficult to know exactly; for the reports were not segregated, nor date report received were not recorded in almost all forms as mentioned earlier in the data quality.

Stability

With the implementations of the new BPR restructuring, the procedures and activities of the surveillance of these diseases were affected demanding to have different capacity building. Further change in this system and the work force will make the system more unstable and resource intensive. The change of IDSR to PHEM made the reporting rate to go down as assessed by JICA[17].

Discussion

The understanding of the healthcare providers including the health extension workers to the case definitions was found to be good but the collection and registration of data had some gaps and clinical registers and reporting formats are not uniform. Besides, the clinical registers and reporting formats are not distributed with good orientation to the surveillance focal persons and the health care providers. In some of the health facilities cases definitions of measles and AFP/Polio were posted to the public but not for malaria and AWD.

The tally sheets are better not to be used as clinical register which might be easy to loss and compilation of the report are difficult especially after a laps of time.

The structure of data reporting flow from the lower to the upper level is well organized with unidirectional flux of data, in simple and defined role and responsibility of each reporting entities. But the flow has so many obstacles with reporting means and infrastructure like transport, telephone, radio, fax and computers for data management and analysis. These impacted the overall generation of reports by the expected health facilities and make the surveillance system to relay on very limited reports (like 11.95% only in this zone). This low reporting rate coupled with delayed (or no analysis) of the collected data will make the surveillance system less useful to meet its objectives. For example, as stated above, if only 50% of the health facilities in the zone analyze and use the data, the utility of the surveillance system will only be 5.98% in the Zone. This makes the system too weak to pick highly public health sensitive diseases like Dengue Hemorrhagic fever and so on.

This could be due to the poor orientation of all parties, poor supervision and feedback system, low or no legal enforcement to the surveillance activities, lack of incentives, lack of appropriate training, lack of sense of ownership, and lack of logistics.

The epidemic preparedness of the zone and districts did only planning, with no financial and/ or logistic support, besides the epidemic response committees did not review their plans, actions, and learned experiences. This will make the districts and the zone to just wait and see the support of the Regional Health Bureau in case of disaster. This makes all responses to be late and give disasters to take the chance. Furthermore, the districts health offices were allowed for emergency budget from the District Administration Office only after an event has occurred; this hampers timely investigation, and mitigation of expected events in the district by the District Health office.

In case of epidemics, the rapid response usually focuses on case management with no any protocol for investigation of the risk factors and targeting response based on investigation. The woreda biannual review of the health sector activities did not have detailed revision of all activities related to surveillance, plans, and epidemic preparedness and response. This indicates the attention given to surveillance and response of epidemic prone diseases- like malaria, AWD and measles.

Limitation of the Study

There are several limitations of this evaluation mainly with regard to duration of the evaluation, the time of evaluation in which there was transition of the existing IDSR to PHEM, sampling method and sample size, unavailability of data to see trends and inadequate literatures of similar study for better approach.

Conclusions

The overall structural set up of the surveillance system by the current reform with BPR and creation of responsible unit /focal person at each district and health facility level and involvement of the community is excellent. But active involvement of all these parties is not satisfactory, so do the surveillance system.

Moreover, the case detection of the surveillance system is affected by; Volunteer participation of the community as Volunteer community health worker (CHW) was very limited for there are no incentives, or other means of encouragement- "Wealthiest nongovernmental organizations (NGOs) are impacting volunteer participation of the community in our community surveillance project" said the Community Surveillance Expert, working at the Japan internatioan cooperation agency (JICA) Amhara Regional Office.

The poor health seeking behavior of the community for diseases like AFP/polio, and measles

Limited health facilities, health service capacity, communications, and infrastructure in rural communities (in more than 90% of the population)

The health posts are not providing the health care service, the community run to some other areas of care like holly water, traditional healers and so on which then the diseases burden in the community remain covered.

Delay in the confirmation of cases by laboratory.

Except for AWD/cholera, which is not reported since 2009 in the districts, malaria and measles were the major disease burdens of the Zone in which both were reported from all districts and remain the main threats of epidemic to community.

The AFP / polio has relatively high detection rate and especially malaria are endemic which can end devastating epidemics with a high burden social, economical, and political stress, which could impact the national effort on diseases on eradication and / or elimination like AFP/Polio which has still have high reporting rate in the zone.

The potentials of outbreaks of malaria cannot be avoided in this zone for there is expansion of the large irrigation activities, poor sanitary condition in general.

Recommendations

From this assessment the team suggested the following major recommendations for immediate implementation, and some for long term actions;

- Awareness creation and building positive attitude of the community for voluntary and active participation in the diseases notification, should be stressed; the experience of the JICA project in the community surveillance should be more exploited and expanded,
- Building the capacity and attitude of the health care providers in the disease detection and reporting and use of data, legal enforcement of the reporting entities on timely and quality data reporting
- duties and responsibilities of all focal persons in the system should be given in written form; so that system hand over to the new staff will be easy whenever there is staff turnover,
- Time frame for the data analysis should be set at all level, so that timely detection of any abnormal deviation and investigation will be possible;
- Training on basic standard procedures for outbreak investigation and use of the result for action should be given to all district RRT members
- Regular revision of epidemic preparedness plan and local capacity and resource mapping should be done by districts and the Zonal Health Department and the Regional Health Bureau should follow and give feedback on regular basis at least biannually;
- Education and BCC should be done to all health and surveillance workers on the importance of high quality surveillance system and prompt identification of the cases; (specfic recommendations are presented see the table 3.1.4)

Table 3.1.4: Specific recommendations for Identified gaps and barriers for the assessement;

Case Identification and Reporting	
Main Barriers	Recommendations
Access to care: Poor health seeking for measles and AFP, The village level health posts have little or no therapeutic services	Health education with BCC at the community level; Involvement of the community elders and community volunteers to assist the family come to health facility
Case Definitions: Low dissemination of the cases definitions to the Health Posts and community;	The national case definitions for HEW and Community should be urgently distributed
Case detection: Poor involvement of the community and CHWs;	Some incentive mechanisms for the community VHW should be studied
Cases confirmation Late lab report of suspected cases of measles and AFP	Telephone reporting from the national viral laboratory should be established.
Reporting	
Lack of Reporting means and motivation Lack of mechanisms of reporting –like telephone and mail services- particularly for the health extension worker The reporting formats are not uniform Poor reporting and motivation of the health care providers	Create toll free telephone services, Distribution of uniform reporting formats The health workers should be encourage and be involved in the training and workshops concerning surveillance
Data Management and Analysis	
No good folder system at the district and zonal levels Data is not analyzed regularly	Training and developing uniform data filing and handling system Set time frame of data analysis at the local level and mandatory reporting of the local analysis both to the higher and lower levels
Data flow and Feedback	
There were limited supervision and feed back at all levels	Supportive supervision and feedback should be mandatory at least once per month at each level

Acknowledgement

Without active participation of the following people, getting this project done may be difficult. We really thank Ato Alemayehu Mesfin, Head PHEM, Amhara National Regional State Health Bureau for his encouragement and collaboration. It was his facilitation that made all the focal persons at the study units to be active participant. We sincerely appreciate W/ro Edemealem -- Secretary and Office Administrator, PHEM, Amhara RHB for her cooperation to get all relevant documents in her office and for her patience and assistance in all our visits.

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Chapter IV – Health Profile Description Report

4.1. South Achefer District Health profile, Amhara Region, Ethiopia, November 2010

Belay Bezabih, Tadele Tsehaye, Mer'Awi Aragaw

Summary

Background: Health profile is vital for prioritizing prominent health and health related problems of the community at any level. It is basic for planning and for appropriate intervention; and is an entry point for operational research. Stake holders in health and health related areas of the community will have evidence based information from well compiled health profile. The purpose of this document is to assess and describe the health and health related issues in the district and communicate the local burden of disease and other health related information for possible intervention.

Methods: From November 09-12, 2010 health and health related data was collected in south Achefer district. Interview and Standard check list were the main tools to collect the district health profile. The data sources were the district health office, district education sector, other district sectors and reports from national census and research articles. Data was compiled and analyzed manually and using Microsoft excel.

Results: the district has 20 sub districts/ kebeles. The district town, Durbete, has 24 hr electric supply, mobile and cable based telephone services, postal service and Bank. All except two kebeles/ sub-district (with 55&58 kms) are found within 30 km radius from the district capital; however, infrastructures like road, telephone, and electric power supply, are limited to few kebeles The 2009/2010 population estimate for the district was 167,392 in which females constitute 82739 (49.4%); with 18, 478 (11%of the district population) urban population of which female population of 9597(51.9%).The district has 16 first cycle (grades 1-4) and 30 second cycle (1-8) primary schools, 2 secondary and one technical and vocational education training (TVET) schools. The total student population in all the above schools is 43,862, with female population of 50.4 %(22,085). In 2009/10, the health service coverage of the district was 85%, with only one health center for inpatient service. Immunization coverage (<1 Year) was 83.8 %(4630/5523). Based on 3 times visit, the ANC achievement was 73.8% (4574/6194),but 4th times visit for ANC was 7.4%(457/6194). Proportion of skilled delivery was 12.3 % (761/6194), new and repeat family planning acceptance was 39% (13059/33344). All kebeles/ sub-districts are malarious. and it was the leading cause for outpatient visits accounted 43.7% of the total causes of visits; with incidence of 135.7per 1000 population per year based on only the outpatient visit records; followed by diarrhea and intestinal parasitosis which together constitute 14.7% with incidence of 45.8 per 1000 population per year. The 2009/2010 HIV prevalence of the district based on the health facility data such as from VCT, PMTCT, and PITC was 0.91%. The smear positive pulmonary tuberculosis

detection rate was 33.8%. In the same year, Safe drinking water supply coverage in the rural and urban community of the district were 67.8% and 76% respectively; with latrine coverage of 59%(23,230 households with latrine).But there was no system for vital statistic recording.

Conclusion and recommendations: Malaria is the leading cause of morbidity and public health problem of the district. Diarrhea and intestinal parasitosis was also found to be the major health problem of the region next to malaria. Proportion of delivery attended by skill health personnel and family planning acceptance was low (12% &40% respectively).no mortality records, birth records, and shortage of medical supplies and medium health professionals in the health facilities of the district.

Therefore prevention and control measures should be strengthened to reduce the morbidity of malaria, diarrhea, and other priority diseases. To meet the millennium development goal (MDG), concerted effort and attention should be given to ANC and skilled delivery. The district should also be supported by the higher level government entities and NGOS to have vital statistics recording.

Introduction

Health profile is summarized auditing and discussion of health related data and important health related indicators to describe the health and related social, economical, political and cultural factors in the geographic area under discussion. It is very vital for prioritizing prominent health and health related problems of the community at any level. It is basic for planning and for appropriate intervention; and is an entry point for operational research. Stake holders of health and health related issues will access evidence based information from well compiled health profile. However in low income countries like Ethiopia such information especially at district level is usually not complete and comprehensive.

Objectives

The purpose of this document is to assess and describe health related issues, like health status, health indicators and to identify problems for priority setting pack and simplify complex health information and communicate the local burden of disease and other health related information in a practical, accessible format.

Methods

From November 09-12, 2010 health and health related data were collected in south Achefer district. Interview and standard check list were the main tools for data collection. The data source was the district health office, district education sector, other district sectors and reports from national census and research articles. Finally data was compiled and analyzed manually and using Microsoft excel.

Results

Historical Background and Culture:

From 1965-1999 South Achefer and North Achefer were one district named by Achefer and Durbete was the district capital. But After October 12, 2006, Achefer separated in to two districts and Durbete town also continued to be the capital of South Achefer. Around 97% of the population is Orthodox Christian and the rest are Muslims. All the district population (almost 100%) is Amhara by ethnic.

In a village Kurbha Ankuasg 21km far from Durbete town, there is a rocky Hewan church, where St. Lalibela was first started his Architectural building of churches from rock[1].

Geography and Climate

The district town; Durbete is found on highway 60 kilo meters South-West of Bahir Dar, the capital of the Amhara Regional State, on the main road to Addis Ababa. South Achefer is neighboring with four districts: North Achefer in the North, Dangila in the South, Mecha in the East, and Jawi in the west. It has an area of 1183 square kilometers, with 851 Km^2 (71.9 %) "*Woina Dega",* 320 km^2 (27.9 %) "*Kolla"*, and 1.1 km^2 (0.2 %)"*Dega"* climatic zones. The median annual rain fall is 1498 mm (with range 1365- 1623 mm); and median temperature of 19.08 ^0C with a range of 15- 23^0C.

Administrative and political

The district is divided in to 18 rural and 2 urban kebeles/ sub-districts. The district has its own council and representative in the federal parliament. All sector or ministry offices are found in the town Durbetie. Anti-Malaria Association, Amhara Development Association, USAID, UNICEF, and WHO are the main supporting organizations in the district. The ruling political party in the district is the Amhara National Democratic Movement (ANDM/EPRDF) and at least two other parties were participated in the May 2010 national election.

[1] South Achefer district culture and tourism office communication,Nov,29,2010

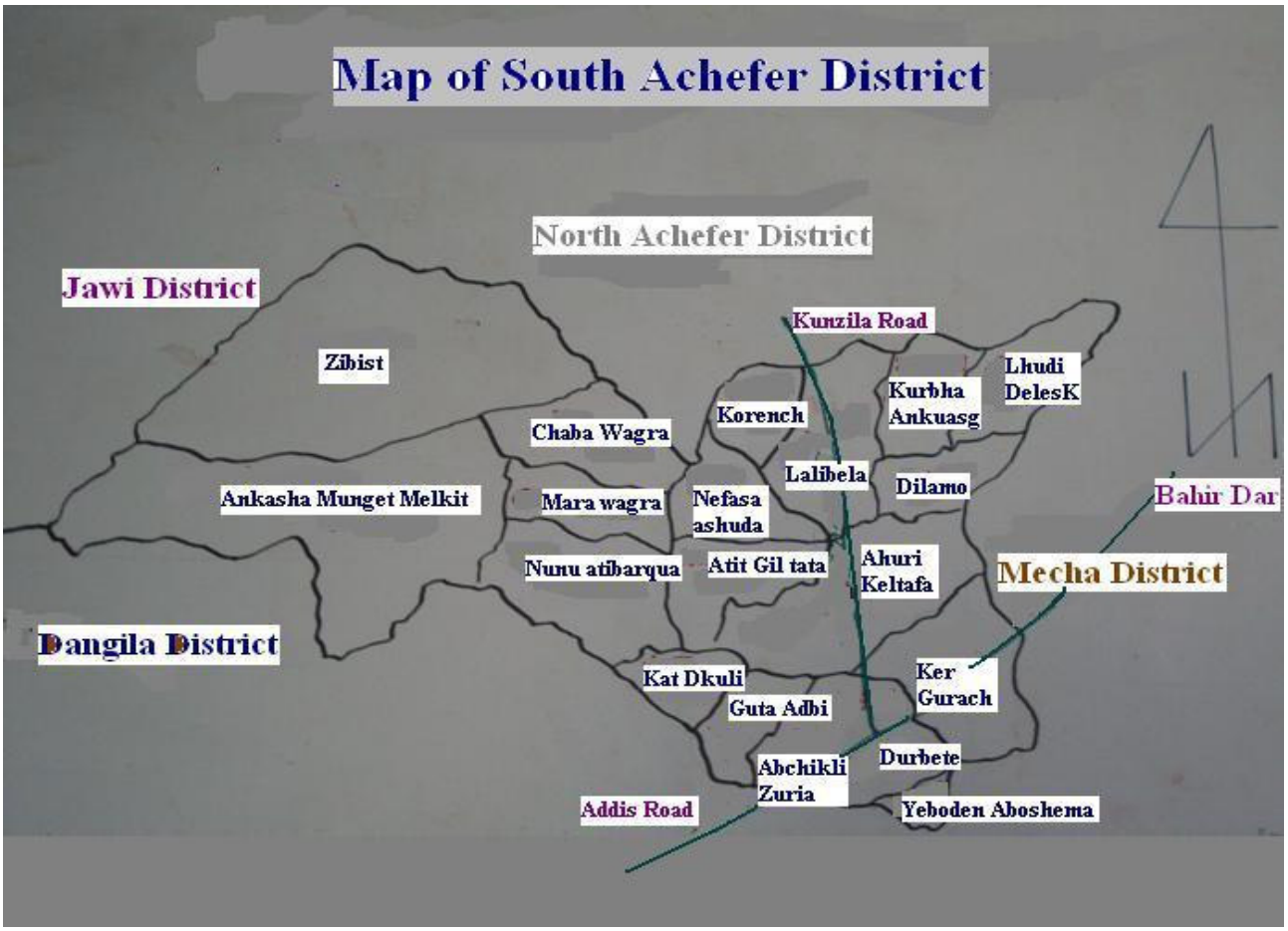

Figure 4.1.1: Map of South Achefer district, administrative and political, 2009/2010, Amhara, Ethiopia

Demographic information

The 2009/2010 population estimate for the district was 167,392 of which females constitute 82739 (49.4%); with 18, 478 (11%of the district population) urban population of which female population of 9597(51.9%); and other vital statistics are listed in table 3. The population estimation, which was used for planning, of the district by kebeles for 2010 / 2011 is presented in table 4.1.1(this estimate is higher than that estimated by the national census).

All rural population is Christian orthodox and few Muslims found in urban. The predominant (near to 100%) ethnic group in the district is Amhara.

Table 4.1.1: Population distribution by village/kebelle for 2010/2011 population estimate and Kilometers from the district town, South Achefer, Amhara, Ethiopia

Ser. No.	Name of Village/Kebele	Male	Female	Total population	Kilometer from Durbete town
1	Durbete 01	4708	5550	10258	town
2	Durbete 02	3214	4025	7239	town
3	Abchikli Zuria	5517	5527	11044	500m
4	Ahuri Keltafa	6485	6301	12786	11 Km
5	Keri Jarso	5948	5328	11276	5km
6	Yeboden Aboshema	4706	4405	9111	9km
7	Guta Abdi	5810	5400	11210	7km
8	Kata dikuli	4477	4460	8937	14km
9	Nunu Atibarqua	4829	4474	9303	21km
10	Lalibela	5208	5253	10461	18km
11	Korench	3472	3502	6974	22km
12	Kurbha Ankuasg	3900	3610	7510	21Km
13	Lhudi Delkes	4077	3673	7750	24km
14	Dilamo	2789	2686	5475	23km
15	Nifasa Ashuda	5439	5170	10609	28km
16	Atit Giltata	4921	4600	9521	15Km
17	Mara Wagira	4245	3913	8158	30Km
18	Chaba Wagira	5506	5186	10692	31Km
19	Ankesha Munget	5182	4847	10029	55Km
20	Zibest	5821	5179	11000	58Km
Total population		96254	93089	189343	

Facilities

The district town, Durbete, has 24 hour electric supply, mobile and cable based telephone services, postal service and Bank (Commercial Bank of Ethiopia). All except two kebeles/ sub-districts (with 55&58 kilo meters) are found within 30 kilo meters radius from the district capital town. Four kebeles/ sub-districts are not accessible by motor vehicle, 16 kebele/village offices have wireless telecommunication systems and 18 kebeles have access to mobile telephone network. However, only three kebeles/ sub-districts have electric power supply.

Education

The district has 16 first cycle and 30 second cycle primary schools, 2 secondary and one technical and vocational education training (TVET) schools. First cycle elementary schools (grade1-4) have a total student population of 26,657; with a total of 12804 (48%) females. Second cycle schools (grade1-8) have 11982 students; with 53.9% (6461) females. In the two high schools; there were 4127(with 56.1% (2314) females) students in grade 9-10 and 1096 students (with 46.2% (506) females) in the preparatory (grade 11-12) school.

There are also optional elementary schools (which are not permanent & well built) enrolling 2123 students in which students could finish grades 1-4 in three years.

The dropout rate and repeat in grades 1-8 was 5.7% and 26.9% respectively in 2009/2010. Twenty-two (45.8%) of schools have water supply in their compound, 21 (43.7%) schools have latrine with separate male and female; and 13 (27.1%) has common latrine (for both sex).

Productivity and income

About 88.9% of the district population live in rural and on agricultural economy. Teff, "Dagussa" and Maize are the major stable foods/crops in the district. The productivity of the land per hectare was 16.2 quintal for Teff, 62.6 for Maize, 24.4 for wheat, and 19.97 for "Dagussa". The gross domestic product (GDP) in Meher season (regular crop season) was 8.8 quintal per hectare, from irrigation(in dry season) was 2.3 quintal per hectare and the total GDP of the district for 2009/2010 was 11.3 Quintal per hectare (total crop production). However it was difficult to change this income in to dollar or Ethiopian birr.

District Health System

Organo-gram of District Health Office

The district health office has implemented a new organizational structure after the Business process reengineering (BPR) concept which was endorsed by the Regional sate in 2008/2009. The district has one main core process, four case teams and one case worker with in a direct command of the head of the district health office (Graph).However only 38.7%(12/31) of job positions are occupied in the district health office till the compilation of this report.

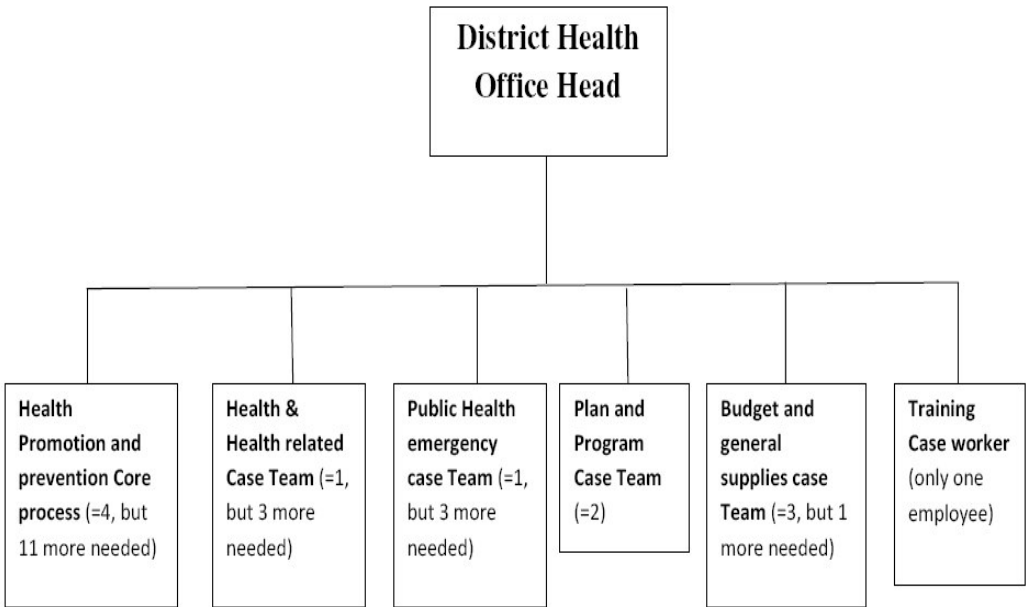

Figure 4.1.2: Organizational structure of South Achefer district Health office, Durbete, Amhara, 2009/2010

Health services institutions

The health service coverage of the district is 85% which based on an estimate of five health post and one health center could give service for 25 000 people. The only health center servicing for inpatient/admission is found in Durbetie town. Distribution of health facilities are shown in table 4.1.2.

Table 4.1.2: Type and number of health facilities in South Achefer district, Amhara, 2009/2010

Ser. No.	Type of health Facility	Number	Remark
1	Hospital	0	
2	Health center	8	Only one health center has inpatient service
3	Health post	20	
4	Diagnostic Laboratory	3	
5	Private Clinic	17	
6	Pharmacy store	3	
7	Rural drug vendor	3	

Vital Statistics and health indicators

Vital statistics like total death, total births, under one and under five deaths are not recorded in the district and indices for each specific indicator mentioned in the table 3 are from the national estimates, projected from the 2007 national census.

Table 4.1.3: Distribution of population groups and vital statistics, South Achefer, Amhara, 2009/2010

Ser. No.	Parameter	Number (%)	Remark
1	Total population	167392(100)	
2	Male	84653(50.57)	
3	Female	82739(49.43)	
4	Under 1 years old	5523(3.3)	
5	Under five years old	22597(13.5)	
6	Under 15 years old	71359(42.6)	
7	Urban	18464(11.03)	
8	Female 15-49 years old	79,846(47.7)	
9	Pregnancy	6194(3.7)	
10	Live birth	6194 (3.7)	
11	Non pregnant women	33,344(19.92)	
12	Average house hold size	4.25	
13	Dependency ratio	No Data	
14	IMR/1000	No Data	
15	Under 5 MR/1000	No Data	
16	CBR/1000/year	No Data	
17	CDR/1000/year	No data	

Immunization coverage

In 2009/10, of the 5523 target population for immunization, pentavalent (penta-3) immunization coverage was 97.4 %(5381), measles (<1 year) 93 %(5140) and fully immunization coverage (<1 Year) was 83.8 %(4630/5523).

Maternal health service coverage

In 2009/10, based on 3 times visit, the ANC achievement was 73.8% (4574/6194),but the 4th times visit for ANC was 7.4%(457/6194).Proportion of skilled delivery was 12.3 %(761/6194), new and repeat family planning acceptance was 39%(13059/33344).

Water, hygiene and sanitation

In 2009/2010, Safe drinking water supply coverage in the rural and urban community of the district were 67.8% and 76% respectively The district drinking water coverage progress in the last five years (table 4.1.4).With 59% (about 23,230 households) latrine coverage ;

Table 4.1.4: Drinking water coverage in rural and urban community by year, South Achefer, West Gojjam Amhara, 2009/2010

Year	Drinking water coverage (%)			Total number of beneficiaries		
	Urban	rural	district	Urban	Rural	District
2005/2006	74.13	13.18	17.3	18701	6874	25575
2006/2007	79	17.3	23	15330	9412	24742
2007/2008	81.3	28.31	33	13501	14294	27795
2008/2009	76	54	56	13466	30584	44050
2009/2010	76	67.86	68.7	13466	33548	47014
2010/2011						

Drinking water sources

The district water resource office is working to supply safe drinking water for the community from five types of water sources is presented table 5. But still there is a certain segment of the community using unsafe water for drinking like from rivers, small dams, wells and springs.

Table 4.1.5: Distribution of drinking water source types in South Achefer district, Amhara, 2009/2010

Ser. No.	**Type of drinking water source**	**Number**	**Functional**
1	Borehole(hand pump)	263	258
2	Protected spring	35	34
3	Shallow well	24	23
4	Deep well	2	2
5	Tie pump	12	12
Total		336	329

Health education

The health facility and house to house Health Education given by Health Care Providers and the health extension workers (HEW) reached about 241,416 people including repeat. The topics covered in the year were harmful traditional practice, essential drug use, nutrition, HIV/AIDS, Tuberculosis, Diarrheal diseases, Family planning, water, hygiene and sanitation.

Leading causes of outpatient visit

Malaria is the district's major public health problem and the top leading causes of outpatient visit (table 4.1.6). A total of 16,492 patients gave blood sample and diagnosed for malaria in which 40.65 % (6705) of them were positive for plasmodium parasite [*p.falciparum* (62.6%), *P.vivax* (32.2%) and mixed species (5.2%)]

Table 4.1.6: The top leading causes of outpatient visit In South Achefer district, Amhara, 2009/2010

Ser No.	Disease Type	Cases		
		Number	percent	Cumulative frequency (%)
1	Malaria	22717	43.73	43.73
2	AFI	4904	9.44	53.17
3	Bronchitis	4814	9.26	62.43
4	Intestinal parasites	4085	7.86	70.29
5	Diarrhea	3590	6.91	77.2
6	Gastritis	2647	5.09	82.29
7	Arthritis	1862	3.58	85.87
8	Skin diseases	1169	2.25	88.12
9	Eye diseases	871	1.67	89.79
10	Influenza like illness	804	1.54	91.33
12	Upper respiratory infection	766	1.47	92.8
13	Pharyngitis/tonsillitis	653	1.25	94.05
14	Injury	494	0.95	95.00
15	Epilepsy	140	0.26	95.26
16	STI	105	0.20	95.46
17	Other disease	2327	4.47	100.00
	Total	51948	100	100.00

Endemic diseases

Malaria: Malaria is prevalent throughout the year in South Achefer district and all 20 kebeles/ sub-district are malarious. In the period July 2009-April 2010, the highest pick of malaria cases were observed in October 2009 with an attack rate of 24.2 cases per 1000people for the district(based on the 2007 national census projected population size)., the lowest was in December 2009 with 7.14 cases per 1000people (total of 1196of malaria cases(figure 3).

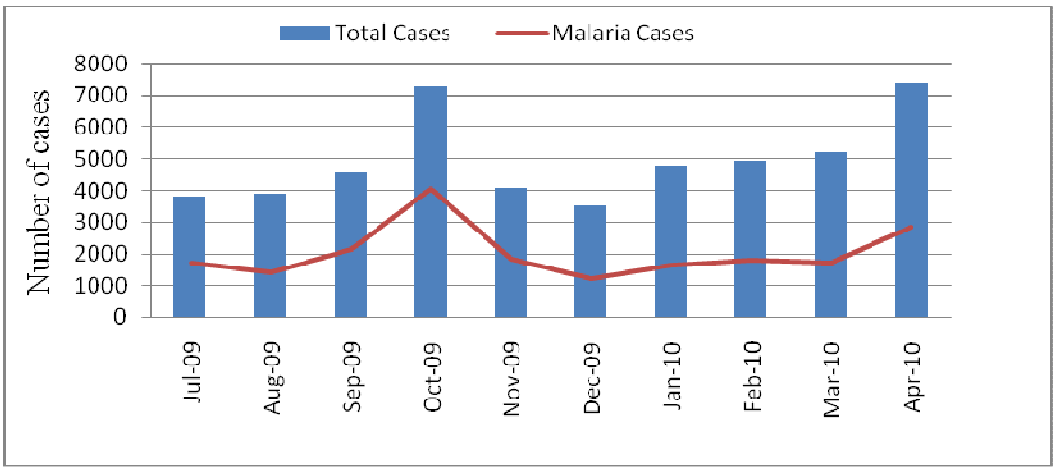

Figure 4.1.3: Total cases Vs malaria cases by month, 2009/2010, South Achefer, Amhara

HIV/AIDS

Of the 96,033 target people age above 15, a total of 21,774 (coverage 22.7%) people get voluntary counseling & testing service and from these 149(0.68%) were positive for HIV. In the PMTCT program, 1086 mothers got services and 12(1.1%) were positive; 3678 clients visited health facilities and provided PITC service from which 48(1.3%) were positive.

Fourty six patients were also registered for other type of STI and a total of 4910 condoms were distributed in the district. The 2009/2010(2002 E.C) HIV prevalence of the district based on the health facility data such as from VCT, PMTCT, and PITC was 0.91%.

Tuberculosis and Leprosy

A total of 385 Tuberculosis 9 leprosy (7 multibacillary & 2 pucibacillary) cases were registered in the district. The district's smear positive pulmonary tuberculosis detection rate was 33.8 % (table 4.1.7 for TB indicators).

Table 4.1.7: Distribution of tuberculosis cases by sex, south Achefer district, Amhara, 2009/2010

Indicator	Male	Female	Total
New pulmonary TB smear positive	48	38	86
New pulmonary TB smear negative	49	34	83
Extra pulmonary TB	109	103	212
Relapse	3	-	3
Treatment failure	-	1	1
Total	209	176	385

Immediately and Weekly reportable diseases

The following thirteen diseases are reported immediately to the next level (Zonal Health department) using case based reporting format and line listing depending on the number of occurrence of cases.

1. Viral hemorrhagic fever (VHF),
2. Yellow fever,
3. Acute flaccid paralysis (AFP/polio),
4. Anthrax,
5. Avian human Influenza (AHI),
6. Cholera,
7. Guinea worm,
8. Measles,
9. Neonatal tetanus (NNT),
10. New human influenza (H1N1),
11. Rabies,
12. Small pox,
13. Sever acute respiratory syndrome (SARS),

The rest seven diseases or conditions are reported on weekly bases to the next level;

1. Dysentery,
2. Malaria,
3. Meningitis,
4. Relapsing fever,
5. Typhoid fever,
6. Typhus,
7. Malnutrition

Three suspected acute flaccid praralysis (AFP) cases were reported to PHEM and stool samples were collected from all cases and sent to the national polio laboratory in EHNRI.

Nutrition, food shortage and any other disasters

The district is known for its good crop production and is one of the food secured areas in the region; hence no supplementary feeding units in the district. The health centers haven't any report or registry for any type of malnutrition. Any disaster has not also been reported in the area.

Health Budget allocation

The total budget for the district health office including health facilities was 483,480.00 Ethiopian Birr in 2009/2010. However UNICEF supported the district health office for the implementation of different programs with 145 231.00 Birr during the budget year.

Human resource; Health workers and supportive staffs

The district has a total of 110 health workers (table 4.1. 8) and ----supportive employees.

Table 4.1.8: distribution of health workers in south Achefer district, West Amhara, Nov, 2010

Ser. No.	Category	Number		
		Male	Female	total
1	Health officer	4	1	5
2	Clinical Nurse	14	24	38
3	Midwife	2	2	4
4	Medical Laboratory Technologist	1	-	1
5	Medical Laboratory Technician	4	1	5
6	Pharmacy Technician	5	5	10
7	Environmental Health officer	4	1	5
8	Health Extension worker	-	38	38
9	Primary Health Worker	1	3	4
Total		35	75	110

Essential drugs and other supplies

According to the district health office deputy head report, in 2009/2010 only 50,000 Ethiopian Birr was allocated for drug and other medical supplies. The acting head of Durbete health center also reported there was shortage of essential drug supply and diagnostic kits are not easily accessible in market to purchase. Understanding the shortage of 2009/2010 budget year, in 2010/2011 the district allocated 350 000 birr for drugs and other medical supplies. However, the district officials reported still there is shortage of budget for essential drugs supply.

Discussion

The leading cause of outpatient visit in the district was malaria which accounts 43.7% of the total causes of visits. The incidence of malaria in the district was135.7per 1000 population per year based on only the outpatient visit records; which needs serious attention. Since the incidence is quite high death due to malaria is expected but no death was reported from the district. This could be early diagnosis and treatment and quality of service or deaths could not be recorded.

Diarrhea and intestinal parasitosis together constitute 14.7% of the total health facility visit and 45.8 per 1000 population per year which is the highest next to malaria.

The HIV prevalence of the district based on the health facility data such as from VCT, PMTCT, and PITC was 0.91% which gave a total of 209 PLWHA in 2009/2010.

The smear positive pulmonary tuberculosis detection rate (33.8%) was very low compared to the minimum expected standard of WHO (i.e.70%).however it is similar with the national performance, which was below 35% for consecutive four years[2].

Absence of measles cases/outbreak, food shortage/malnutrition cases and drought in the district and the status of measles immunization (85%) in under 1 years seems well matched unless under reporting is masking the situation.

Medium level health professionals are very scarce at health center level; for example 4 health officers and only two midwives for 8 health centers were assigned.

Even though safe water supply coverage for the district is 68.7%; there was no strong water quality monitoring. Only eight water samples were tested in 2009, and three of them had fecal contamination. This may have contributed to the higher rate of diarrhea and intestinal parasitosis in the district, which was 14.77 % (7675/51,948) of the outpatient visit.

According to the district health officials, the main problems of the district are very limited regular budget, shortage of medical supplies, and restriction of the most allocated budgets to programmatic activities which are not flexible and used for other demanding activities.

Limitation

Unavailability /limited researches on health heath related issues and no accessible population survey.

Absence of mortality records/reports in the district, population size at start of school age is not known for the district

Conclusion and recommendations

Malaria is the leading cause of morbidity and public health problem of the district. Diarrhea and intestinal parasitosis was also found to be the major health problem of the region next to malaria. Proportion of delivery attended by skill health personnel and family planning acceptance was low (12% &40% respectively).no mortality records, birth records, and shortage of medical supplies and medium health professionals in the health facilities of the district.

Therefore prevention and control measures should be strengthened to reduce the morbidity of malaria, diarrhea, and other priority diseases and improve mothers' health. The district should also be supported by the higher level

[2] Health and health related indicators, FMOH, 2007/2008, pp. 34

government entities and NGOS to have under one, under five year death and other death records for better planning and success.

Acknowledgements

We are grateful to the deputy head of South Achefer District Health Office and staffs, to the head of South Achefer District Education Office, to Mr Abebe from District Finance Office, and to District Water Office for their unreserved cooperation to the realization of this document.

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Health and health related indicators, FMOH, 2007/2008, pp. 34

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Chapter V – Scientific Manuscripts for Peer reviewed Journals

5.1. DETECTION OF INDICATOR BACTERIA FROM DRINKING WATER SOURCES — WEST AMHARA, ETHIOPIA, 2004-2009

Belay Bezabih[1], Richard Luce[1], Feleke Mekonnen[2], Bayeh Abera[3]

Abstract

Background

Drinking water related diarrhea is a common cause of illness and death in developing world especially in under five children. The aim of the study is to assess bacteriological drinking water sources quality monitoring in districts of west Amhara Region.

Materials and methods

Drinking water samples were collected from 36 districts in West Amhara from 2004-2009.Sampling sources were from municipal water reservoir, pipe, well, spring and river. Samples were tested by culturing for water quality indicator bacteria using the multiple tube method and standard microbiologic techniques at the Bahir Dar Regional Health Research Laboratory Center. Data was transcribed from hand written logbook to an electronic data base and analyzed using Excel and EPi Info version 3.3.2.

Results

A total of 475 drinking water samples were analyzed. The highest rate (41.6%) of Escherichia coli isolation was observed in 2006. The overall Prevalence was 28.2% for Escherichia coli and 47.4% for total coliforms. The mean most probable number (MPN) count of total coliforms /100 ml sample was 31. In 53(11.2%) samples, the MPN count was found > 180/100ml sample. Chlorination showed statistically significant protective association with growth of Escherichia coli (OR=0.29, 95%CI=0.19-0.44, P-value= < 0.001) and total coliforms (OR=0.25, 95%CI=0.17-0.37, p <0.001). Source of drinking water (OR= 0.3, 95%CI=0.2-0.46, P-value=< 0.001) and source of sampling area (OR= 3.6, 95%CI=2.1-6.6, P-value=< 0.001) also showed statistically significant association with growth of E.coli.

Conclusion& recommendations

Feacal contamination of drinking water sources is present in the Western Amhara. This study reinforces the need to rigorously maintain and monitor chlorination levels in drinking water and to strengthen other water sanitation strategies to improve drinking water safety.

Key words: Drinking water quality, Indicator bacteria, Amhara, Ethiopia

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N.B. Two other manuscripts indicated in chapter 1.3 & 1.4 were also submitted to national peer reviwed journals.

5.1. DETECTION OF INDICATOR BACTERIA FROM DRINKING WATER SOURCES — WEST AMHARA, ETHIOPIA, 2004-2009

Introduction

Water is essential to life and health; however, more than one billion people worldwide do not have access to safe drinking water. Waterborne diseases have been estimated to cause more than two million deaths and four billion cases of diarrhea annually[1]. According to the World Bank estimate, it is also indicated that more than 3 million children below age 5 die annually from diarrheal diseases contracted through drinking water in the developing world[2].

In 2008 Ethiopian Federal ministry of health (FMOH) reported 156,346 cases of under 5 years age with diarrhea and 185 deaths due to diarrhea from inpatient only. Amhara region constitute 21,016 cases with the same age category and calendar year[3].

In Amhara Region, in 2009, diarrheal disease becomes second next to malaria from the 10 top diseases in the region. Water and sanitation/latrine coverage of the region was only 56% and 72.2% respectively[4].

The most common and widespread health risk associated with drinking-water is contamination, either directly or indirectly, by human or animal excreta, particularly faeces[5]. In developing countries, control of the microbiological quality of drinking-water is a much higher health priority, and the use of chlorine for the disinfection of drinking-water is also critical for the control of waterborne diseases[6]. Therefore it is necessary to monitor drinking water quality for faecal contamination.

Escherichia coli and to a lesser extent other thermo- tolerant coliform bacteria are recommended to be an ideal indicator of drinking water quality. E. coli must not be detectable in any 100 milliliter sample[7, 8].

A study Pakistan showed that 92 (81%) untreated and 42 (19%) treated water samples were positive for Coliforms which indicated contamination and inadequate treatment of water supplies. *Escherichia coli* was found in 43.28% of the samples, which is substantial indicator of faecal pollution[9].

A survey conducted in Kafafa, south west Ethiopia from May 1985 to June 1986 in eighty samples collected from six districts of 21 water supply sources found also unacceptable level of bacteriological water quality (more than 50 coliform organisms per 100 milliliter of samples and protected springs were in un desirable sanitary conditions [10].

In Ethiopia water quality monitoring is not well developed. Bacteriological drinking water quality testing is limited to few referral laboratories; with no any analysis of laboratory reported data for comprehensive intervention and trend monitoring. Thus the aim of this study is to assess the bacteriological drinking water sources quality monitoring in west Amhara, Ethiopia.

Materials and methods

Study period and area

A five years water quality data was reviewed from March 20-April 7, 2010 in Bahir Dar Regional health Research Laboratory center (BHRLC). Bahir Dar town is the capital of Amhara regional state and 565 Km far from Addis Ababa with a total population of around 180,000.

Data collection and sampling

Drinking water samples collected from various water sources from 36 districts in west Amhara and analyzed for indicator bacteria from year 2004-2009 were included in to the study. Environmental health experts, working in district health office or health center, collected and transported water samples in consultation with the BHRLC.

Culture and identification

Water samples were inoculated in MacConkey broth and cultured for indicator bacteria such as E.coli and total coliforms in BRHRLC of microbiology unit. Growth and Most probable number (MPN) of bacteria was determined using multiple tube method as per standard microbiologic techniques [11, 12].

Data quality and analysis

Data was compiled manually using data sheet from the log book of microbiology laboratory in BRHRLC, cleaned for completeness and transcribed electronically to Excel file. Then EPi Info version 3.3.2 was used to analyze the data.

Ethical issue

Ethical issue was cleared by Bahir Dar Regional health research laboratory center for using the data in writing this document and possible publication in a scientific journal.

Results

A total of 475 drinking water samples were analyzed for indicator bacteria, i.e., E.coli and total coliforms. The highest frequency [123(25.9%)] of samples were from Bahir Dar town followed by 50(10.5%) from Birsheleko. 271(57.1%) of the samples were collected from chlorinated drinking water sources.

The highest number [116 (24%)] of water samples analyzed were in year 2005 followed by in year 2008 [107 (23%)].However the highest rate (41.6%) of E.coli isolation was observed in year 2006 (Figure 5.1.1).

Bahir Dar town participated in water sample collection in all the six consecutive calendar years. Birsheleko, Shindi and Achefer were also participated for four years whereas 16(44.4%) of districts collected water samples for only one year.

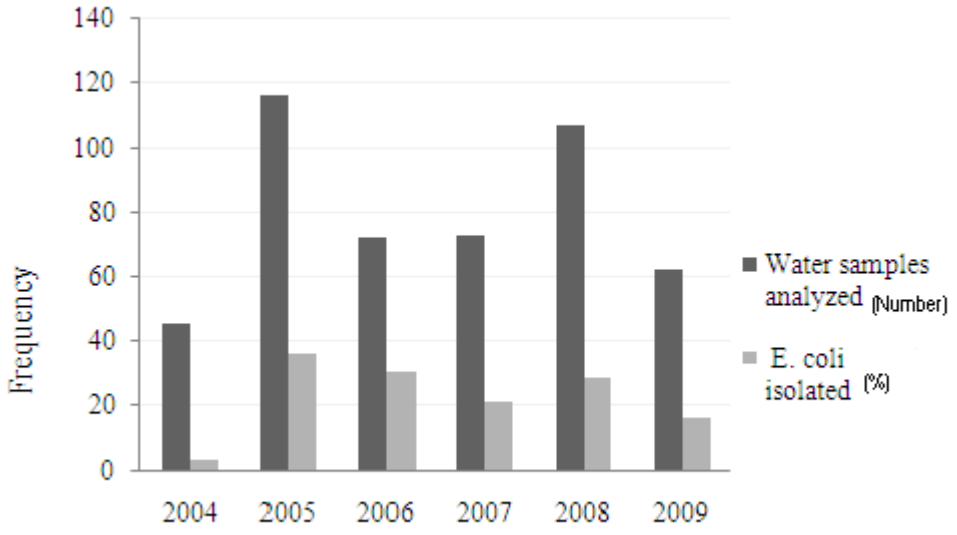

Figure 5.1.1: Number of drinking water sample analyzed and E.coli Type I isolation from 2004-2009, Bahir Dar, North west Ethiopia

Types of drinking water sources were pipe, municipal reservoirs, wells, springs and rivers.308 (64.8 %) of samples were collected from pipes followed by 93 (19 %) from wells. The highest rate (47.3%) of Escherichia coli isolation was observed in those samples collected from well source whereas the lowest (19.5%) was from pipe source (Table 5.1.1).

Table 5.1.1: Frequency of drinking water samples collected from different sources, 2004-2009, Bahir Dar, North West Ethiopia

Source of sample	Frequency of sample analyzed		Frequency of E.coli isolated	
	No.	%	No.	%
pipe	308	64.8	60	19.5
Reservoir	5	1.1	1	20.0
River	3	0.6	3	100.0
spring	66	13.9	26	39.4
well	93	19.6	44	47.3
Total	475	100.0	134	28.2

The mean most probable number (MPN) count/100 ml of total coliforms isolated was 31 and the range was 1 to >180. In 53(11.2%) of the water samples, which were positive for total coliforms, the MPN count was > 180/100ml. Water source type, chlorination of water source, and the site of sample collection showed statistically significant association with E.coli and other coliforms growth (table 5.1.2)

Table 5.1.2: Association of some characteristics of water samples with E.coli and other coli-form isolation, West Amhara, Ethiopia, 2004-2009

Exposure variable	Outcome variable E.coli isolated		OR	95% CI	P-Value
	Yes	No			
Pipe source	60	248	0.3		
Non pipe source	74	93		0.2-0.46	< 0.001
Chlorinated water source	48	223	0.29	0.19- 0.44	< 0.001
Non chlorinated water source	86	118			
Samples from Bahir Dar	15	108	3.6	2.1- 6.6	< 0.001
Samples other than Bahir Dar	119	233			
	Other coli-forms				
Pipe source	113	195	0.28	0.19-0.42	< 0.001
Non pipe source	112	55			
Chlorinated water source	90	181	0.25	0.17- 0.37	< 0.001
Non chlorinated water source	135	69			
Samples from Bahir Dar	29	94	4.1	2.5-6.5	< 0.001
Samples other than Bahir Dar	196	156			

Discussion

The overall prevalence of E.coli (28.2%) and coliforms (47.4%) found to be almost similar with studies done in Vietnam (25.7% and 44.5%) [13], and Nepal (E.coli, 26.4%) [14]. But a study in Peshawar-Pakistan [9] found an E. coli prevalence of 43.2%. A study in Gonder [15] also isolated high prevalence of E.coli from Pipe water (50%), but lower from spring (38. 7%) and wells (28.6%) compared to our study which was 19.5 %, 39.4% and 47.3% respectively. In our study 57.1% of the water sources were chlorinated and this could contribute for the decrease prevalence of E.coli compared to the studies indicated above. But our finding for E.coli and total coliforms is still very high when we stick with the WHO recommendation[7, 8, 16]; which indicated a zero level E.coli in each 100 milliliter of drinking water.

The frequency of water samples collected from Bahir Dar town and Birsheleko were high, these two sites also participated in all six and four calendar years. This could be Bahir Dar as the capital town of Amhara and Birsheleko as a military camp get a chance for emphasized and continuous sanitary monitoring. Shindi and Achefer sites also collected water samples for 4 years; this might be also the curiosity of individual health experts responsible for water quality. All other 32(88.8%) sites collected samples of drinking water for less than four years. High rate (47.3%) of contamination was observed in the well source samples; in which a similar finding was observed in Phillipines[17]. This could be supported by the fact that shallow depth, poorly protected or unprotected nature and less monitoring activities of wells prone for contamination.

The fact of inhibition of E. coli growth in samples collected from chlorinated water source was revealed with a significant statistical association (OR=0.29, 95%CI=0.19-0.44, P-value= < 0.001). However, various studies showed chlorination of drinking water at housholdlevel[18-20] and at the source[21] minimizes the contamination of E.coli. But complete clearance of water sources' contamination is still not successful. This could be because of socio-cultural and economical status of individual house hold or community and other water source characteristics. Source of drinking water being pipe (OR= 0.3, 95%CI=0.2-0.46, P-value = < 0.001) and source of sampling area being Bahir Dar (OR= 3.6, 95%CI=2.1-6.6, P-value=< 0.001) also showed statistically significant association with growth of E.coli.These might also be due to the improved type and easy nature of pipe water to disinfect than other sources, and all water sources found in Bahir Dar are pipe and has great chance of getting continuous supply of treatment chemicals respectively.

Conclusion & Recommendations

Feacal contamination of drinking water sources is present in the Western Amhara. Very few districts were not involved in drinking water quality monitoring. Therefore, this study reinforces the need to rigorously maintain and monitor chlorination levels in drinking water and to strengthen other water sanitation strategies to improve drinking water safety.

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Chapter VI – Abstracts for Scientific Presentation

6.1. DETECTION OF INDICATOR BACTERIA FROM DRINKING WATER SOURCES — WEST AMHARA, ETHIOPIA, 2004-2009

Belay Bezabih[1], Richard Luce[1], Feleke Mekonnen[2], Bayeh Abera[3]

Abstract

Background

Drinking water related diarrhea is a common cause of illness and death in developing world especially in under five children. The aim of the study is to assess bacteriological drinking water sources quality monitoring in districts of west Amhara Region.

Materials and methods

Drinking water samples were collected from 36 districts in West Amhara from 2004-2009.Sampling sources were from municipal water reservoir, pipe, well, spring and river. Samples were tested by culturing for water quality indicator bacteria using the multiple tube method and standard microbiologic techniques at the Bahir Dar Regional Health Research Laboratory Center. Data was transcribed from hand written logbook to an electronic data base and analyzed using Excel and EPi Info version 3.3.2.

Results

A total of 475 drinking water samples were analyzed. The highest rate (41.6%) of Escherichia coli isolation was observed in 2006. The overall Prevalence was 28.2% for Escherichia coli and 47.4% for total coliforms. The mean most probable number (MPN) count of total coliforms /100 ml sample was 31. In 53(11.2%) samples, the MPN count was found > 180/100ml sample. Chlorination showed statistically significant protective association with growth of Escherichia coli (OR=0.29, 95%CI=0.19-0.44, P-value= < 0.001) and total coliforms (OR=0.25, 95%CI=0.17-0.37, p <0.001). Source of drinking water (OR= 0.3, 95%CI=0.2-0.46, P-value=< 0.001) and source of sampling area (OR= 3.6, 95%CI=2.1-6.6, P-value=< 0.001) also showed statistically significant association with growth of E.coli.

Conclusion& recommendations

Feacal contamination of drinking water sources is present in the Western Amhara. This study reinforces the need to rigorously maintain and monitor chlorination levels in drinking water and to strengthen other water sanitation strategies to improve drinking water safety.

Key words: Drinking water quality, Indicator bacteria, Amhara, Ethiopia

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N.B.The above article was presented in EPHA conference at Mekelle, Nov. 2009 and also accepted for Poster presentation in Vienna, Austria, IMED Feb. 2011

6.1. Epidemiology and Antimicrobial Resistance of Vibrio cholera Serotype Inaba Isolated from Outbreaks in North Western Ethiopia, 2006—2008

Belay Bezabih[1], Bayeh Abera[2], Azene Dessie[2]

Abstract

Back ground: Acute watery diarrhea epidemics caused by Vibrio cholerae (V. cholerae) are a major public health problem in many African countries. This study was conducted to assess the epidemiology and antimicrobial susceptibility of V. cholerae in north western Ethiopia.

Methods: Diarrheic stool samples collected from the Amhara region of Ethiopia between August 2006 and September 2008 were processed using standard microbiology techniques to identify V. cholerae at Bahir Dar Regional Health Research Laboratory. Antimicrobial susceptibility testing was done by the disc diffusion technique.

Results: V. cholerae 01 serotype Inaba was the only etiological agent isolated during the study period. A total of 81 isolates were obtained from cases aged 9 months to 86 years. The isolates showed multiple-antibiotic resistance with 71.6% resistant to two antibiotics, 18.4% resistant to three antibiotics and 5% were resistant to four antibiotics. All isolates were resistant to Co-trimoxazol 81(100%); 76 (93.8%) to Chloramphenicol, 72 (88.8%) to Ampicilin, 12 (15%) to Erythromycin and 5(6.2%) to Tetracycline. All isolates were highly susceptibility to Doxycycline (100%) and Ciprofloxacilin (98.8%).

Conclusion & recommendation: Resistance to antibiotics commonly used in the study area is extensive. However, susceptibility to doxycycline or ciprofloxacin is high. This study provides evidence that empiric use of commonly available antibiotics is ineffective in the treatment of cholera and demonstrates the importance of monitoring antimicrobial susceptibility patterns to ensure effective treatment.

Key words: Vibrio cholerae 01 Inaba, Antimicrobial resistance, cholera epidemic, Ethiopia

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N.B. This abstract was accepted for poster presentation in ESCAIDE conference, Stockholm, Sweden in Oct.2009

6.2. Intestinal parasites and S. typhi among food handlers in Bahir Dar Town, Ethiopia, April -May, 2009

Bayeh Abera[1], Fantahun Biadglign[1], **Belay Bezabih[2]**

Abstract

Background: Food handlers play major role for the epidemiology of food-borne diseases.

Objectives: This study was aimed at exploring the prevalence of intestinal parasites, *S.typhi* and risk factors among food handlers at Bahir Dar town.

Methods: A cross -sectional survey was conducted among food handlers were working in the kitchens. A pre-tested structured questionnaire was used for collecting data. Stool samples were investigated for intestinal parasites and *S.typhi* as per the standard laboratory methods.

Results: Among 384 food handlers, females comprised 78%. The majority (96.6%) was young adults (12-40 years). The median year of service was 1 year (1 month to 24 years). All food handlers had had no previous any medical checkup and only 14% were certified. One hundred fifty eight (41.1%) food handlers had intestinal parasites and 6 (1.6%) were found positive for *S. typhi*. Of theses, 25 (6.5%) were suffering from diarrhoea. Nine species of intestinal parasites, 2 protozoa (*E. histolytica/dispar 12.76%* and *G. lamblia 7. 0%)* and 7 helminthes (*A. lumbricoides 11.7%, Hookworm 8.1%, S. stercoralis 2.86%, S. mansoni 1.8%, Taenia species 1.3%, H. nana 0.5% and T. trichiuria 0.5%)* were detected.

Conclusion: Inexperienced and poor personal hygiene food handlers play a role for transmission of food born infections. Intervention measures such as in-service health education on food safety and hygienic practices, medical check up including periodic stool examination need to be implemented in the study area.

Key words: Intestinal parasites, food handlers, S. typhi and Bahir Dar town

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N.B. This Abstract was presented at APHINET/TEPHINET conference in Mombasa, Kenya, Sept. 2009

6.3. Outbreak of Mass Hysteria at a High School, Amhara Region, Ethiopia – April, 2010

Belay Bezabih[1], Basazinew Alemu[2], Aschalew Teka[3]

Abstract

Background: Mass hysteria has long history with the potential for significant adverse public health consequences and economic implications. The objective of this study is to describe the outbreak, guide interventions and improve understanding and recognition of similar events in the future.

Materials and Method: Investigation of an outbreak was conducted at Bati high school in Amhara region from April 26-May 02, 2010. Data was collected using a line listing which contains socio-demographic characteristics, symptoms and perceptions of cases during the outbreak. Detailed discussions were also undertaken with school principal, teachers, surveillance officers and district administrator about the outbreak. Then data was analyzed using Epi Info version 3.3.2

Results: Fourty four cases were identified during the outbreak. All of them were females, the median age was16 years old, and 33(75%) of them were Muslims. The onset of the outbreak was on 07 of April 2010 and continued for 22 days. The major clinical symptoms were breathlessness, fear and crying, anxiety, unable to move limbs. The median duration of illness was 3 hours and with a range of 2 to 96 hours. 13 (27.3%) and 6(13.6%) of the cases reported the cause of the disease to be evil-devil force and Stress respectively, however the rest (59.1%) of the cases replied as 'I don't know'. No air toxicity, food poisoning, infectious disease, and any cause of conflict in the area were identified.

Conclusion & recommendations: This outbreak of apparent illness was consistent with mass hysteria. Socio-cultural beliefs in evil-devil forces together with academic pressure may have been triggering factors. Conducting short investigation, providing immediate reassurance, and timely psychiatric support and counseling at the school and community level could minimize this type of epidemic.

Key words: Epidemic hysteria, high school girls, Bati, Ethiopia

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N.B. This Abstract was also submitted to TEPHINET conferemce in Cape Town, South Africa in Dec. 2010 and and the world congress of federation of mental health in 2011, South Africa

6.4. EPIDEMIOLOGY OF ACUTE WATERY DIARRHEA OUTBREAK AND CHALLENGES OF CONTROL—AFAR, ETHIOPIA, 2009

Belay Bezabih[1], Million Tumato[1], Bayeh Abera[2]

Abstract

Background

Acute watery diarrhea (AWD) is becoming a big problem in Ethiopia. The aim was to rapidly investigate the outbreak epidemiologically and guiding response activities in the affected districts of Afar from April-June 2009.

Methods

A line list and case register log book of the districts were reviewed as per the world health organization case definition. 31 cases and 23 controls were interviewed with a structured questionnaire. A checklist also applied to observe case treatment centers and investor camps. Stool and drinking water samples were also collected, transported and examined as per standard Microbiologic procedures. Then analysis was done using EPi Info version 3.5.1.

Results

A total of 1076 cases and 48 deaths were reviewed with an attack rate of 0.9% and a case fatality rate of 4.4%. 87.8% (945) of cases were males. Hand washing after latrine usage was protective of illness (OR = 0.13, p= 0.03) while unsanitary latrine (OR = 10.5, P-value= 0.001), contact with a case (OR = 200, P-value= 0.001) and visiting a place which has similar illness (OR=33.6, P=0.001) shown statistically significant association. Vibrio cholera 01 serotype Inaba and Escherichia coli were isolated from 89 % (9) of stool and100 % (4) of water samples respectively.

Conclusion

V. cholera 01 serotype Inaba was confirmed as etiologic agent in all districts. Drinking untreated water, close contact with a case, not practicing hand washing and unsanitary latrines were likely determinants for this outbreak. Therefore, provision of safe drinking water supply and raising community awareness about hygienic practices to control diarrheal disease is necessary.

Key words: Acute watery diarrhea, Vibrio cholera, Afar, Ethiopia

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N.B. This abstract was accepted for oral presentation at EPHA conference in Mekelle, Tigray, Nov. 2010 and was also submitted to 2010 TEPHINET conference in Cape Town, South Africa

Chapter VII – Narrative Summary of Disaster Situation Visited

7.1. Belg Needs Assessment on Health and Nutrition in Amhara Regional State, July 2010

Executive Summary

A total of 17 woredas were assessed from 4 zones (N/Wollo, S/Wollo, Oromia and N/Shewa) for health and nutrition emergencies. Upper respiratory tract infection, intestinal parasites, malaria, diarrhea and gastritis are the top five cause of morbidity in the assessed woredas.

Disease of Epidemics assessment from Sept 2009-May 2010 indicated 357 AWD cases and 4 deaths (CFR=1.12%), 46,167 malaria cases and 53 measles cases and 1 death (CFR = 1.9%) were reported. IDSR timeliness reporting rate was found low, only 17.6 %(3) of weredas have IDSR timeliness rate of ≥80% for the last six months. Two weredas (Bati and Kelela) have reported 108 hysteria cases as unusual event. Risk factors for epidemic assessment revealed that most of the woredas(15) are at risk of AWD and malaria epidemic. As to disease prevention and control, 9 woredas (52.94%) have measles coverage less than 80%, 7(41.17%) woredas Pentavalent less than 80% and ITN coverage for 5(29.41%) woredas was less than 80%.

Concerning emergency drugs and supplies, of the assessed woredas, 15(88.24%) have no stock of drugs for AWD, 11(64.71%) for malaria, 15(88.24%) for meningitis, 9(52.94%) for measles. It was also reported, absence of stock for RL (64.71%), ORS (70.59%), Syringes and gloves (85.35%). It was reported that 11-15 woredas have guidelines for AWD, malaria, Measles for meningitis.

Only four weredas (23.53%) have reported less than 2 health officers. Otherwise, all the assessed woredas have nurses greater than 5, laboratory technicians and more than 10 health extension workers. As to trained manpower, all have trained health workers on PHEM and IDSR. However, some woredas reported untrained ones on EPI (11.76%), malaria (29.41%) and nutrition (5.88%).

Nutrition assessment result revealed that except Kelela in S/Wollo and MojanWodara in N/Shewa, all have nutrition program. In these woredas, there are 277 TFP sites (265 OTPs & 12 Stabilization Center) which reported 4153 new SAM cases from Jan-May, 2010. Meket and Habro woredas reported the highest number of (36%) new SAM cases. Bati and Argoba woredas have no SC; as a result they are referring complicated SAM cases to Dessie hospital and Kombolcha health center respectively.The assessment team faced challenges of time constraint, unavailability of complete data, and absence of PHEM/nutrition focal persons during assessment. Finally the team has summarized estimated beneficiaries of 410,970 people for AWD, 4224 for measles outbreak management, 19,531 for meningitis and 423,752 for malaria. This estimation is based on expected risk for each specific diseases and gabs of coverage in water supply, ITN, and immunization of the assessed weredas.

So we would like to recommend support of emergency drugs and supplies, capacity building for health workers on PHEM, allocation of budget of EPRP, improving communication and reporting. In addition, strengthening of TFP through regular monitoring and supportive supervision, establishment of SC and provision of routine drugs are some of the recommendations for nutrition.

Emergency Background

Amhara region is one of the 9 regional states that comprise 18,765,416 people with mean annual growth rate of 1.8%. Amhara is one of the regions that have been affected by AWD, meningitis and measles outbreaks in the year 2009 and 2010. The recent data review indicated that there were 3534 AWD cases and 48 deaths with 1.35% CFR in the year 2009, July to October. A total of 81 meningitis cases and 18 deaths with 22.22% CFR have been reported in July 2009.

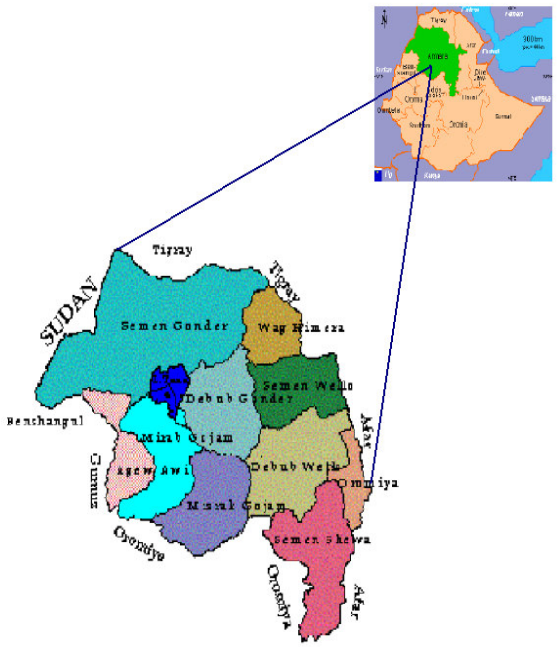

Figure 7.1.1: Map of Amhara Regional State

In addition, malaria is the major public health problems of the region. About 80% of the land and 75% of the population is at risk of malaria. The annual number of malaria cases reported from all health facilities ranges from 1 to 1.2 million cases. In the region, risk factors for emergency prone diseases such as AWD, malaria, measles and meningitis are still persistent

General objective

The overall objective of the assessment process is to contribute in ensuring appropriate and effective humanitarian planning and responses, which will lead to reducing morbidity, mortality and acute malnutrition in the most vulnerable areas of Amhara Region.

Specific objectives

1. To assess the type, magnitude, and likelihood occurrence of different public health emergencies in the most vulnerable (selected) woredas
2. To assess the existing capacity of the health system in managing public health emergencies
3. Based on the findings, to develop emergency preparedness plans for the region

Methods

This health and nutrition emergency needs assessment has been conducted as part of the 2010 Belg assessment in selected hotspot woredas of South Wello and North Wollo of the Amhara region, using the following major data collection methods:

- In-depth Discussion with zonal level disaster prevention and preparedness (DPP) committee, and non health sectors such as water resources, education and food security coordination and disaster prevention offices and with zonal and woreda level health officials.
- Review of secondary data against standard national checklists and observation of selected sites.

Findings: Section A. Health

Health Profile: Population: - Seventeen weredas were selected and assessed for health and nutrition needs from 4 zones of the Region. The total population in these weredas is 2,114,970 of which 1,059,600 are males, 1,055,370 females and 285,521 constitute under five years old children. Meket (11.4%) followed by kallu (10.8%) has the highest population from all the assessed wereds. Argoba (1.7%) is the least in population size (See table 1 for name of weredas and zones).

Morbidity and Mortality

The top five causes of the morbidity are upper respiratory tract infection, intestinal parasitosis, malaria, diarrhea, and Gastritis. However data were not available for causes of mortality.

Only 17.6 %(3) of weredas have IDSR timeliness rate of ≥80% for last six months. However 71 %(12) of them analyzed at least malaria data to see the trend of the disease. The major constraints in information management were; delayed reporting due to lack of transportation and communication facilities, shortage of computer, and shortage of trained man power and attrition of health workers.

Disease of Epidemics from Sept 2009-May 2010

Acute watery diarrhea (AWD): - Three hundred fifty seven cases and 4 deaths (CFR=1.12%) were occurred during this period. 41% and 23% of weredas reported AWD in September and October 2009 respectively. No cases were reported from all weredas from November 2009-May 2010.

Malaria: A total of 46,167 cases were reported from the assessed weredas and the attack rate is 2.2% with the highest rate in JileTimuga (12.6%) followed by Kalu (6.03%) .The peak month for the summarized cases found to be October 2009. No cases were reported from Mojana wodara during Sept 2009-May 2010.

Meningitis: Only one case was reported from JileTimuga woreda in Oromia zone in March 2010.

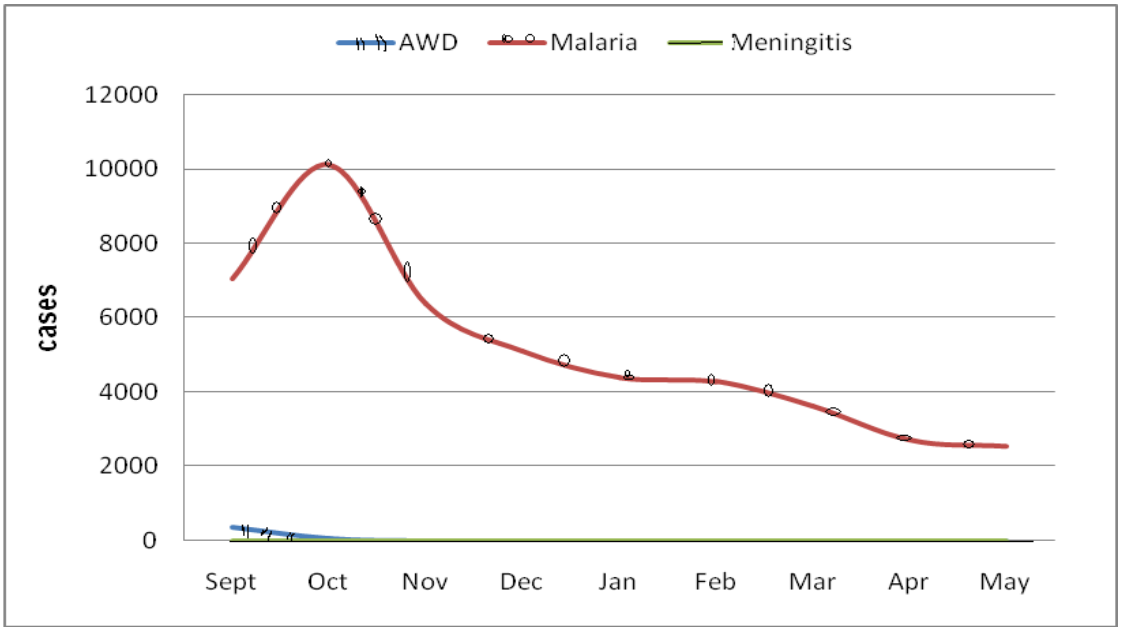

Figure 7.1.2: Acute watery diarrhea, measles and meningitis trend by month (Sept 2009.-May 2010) in the assessed districts, Amhara, July 2010

Measles: A total of 53 cases and 1 death (CFR = 1.9%) of measles were also reported from 71% (12) of the assessed woredas in four zones. More cases have been reported from Eferata Gidem in N/Shewa (13), Mekit (10) and Kalu (10) from N/Wollo zone. The death was from Mekit district in north wello administrative zone..

Unusual event disease occurrence: Hysteria was reported from Bati town (68 cases) and Kelela (40 cases).

Disease prevention and control

It was found that of the total assessed 17 woredas, 9 (52.94%) have measles coverage less than 80%, 7((41.17%) and Pentavalent less than 80%. In addition, five woredas reported ITNs coverage less than 80%, from which the list coverage was reported from Ankober (32%) in N/Shewa.

Water supply and latrine coverage

From the total 15 woredas that accessed information, 7(46.67%) woredas are providing improved water sources for more than 60% of the population and though information on treated water consumption could not be accessed from 9 woredas, 7(41.18%) woredas were reported provision of treated water for more than 60% of the population. Low latrine coverage reported from four woredas, Jile Timuga (18%), Argoba (21%), Bati Zuria (31%) and Mekit (36%) and the rest reported above 66%. In most weredas (9), information was not available on latrine utilization (8 wordas reported based on their assumption).

Emergency drugs and supplies

Of the total assessed woredas, 88.24% have no stock of drugs for AWD, 64.71% for malaria, 88.24% for meningitis, 52.94% for measles. It was also reported, absence of stock for RL (64.71%), ORS (70.59%), Syringes and gloves (85.35%). Even, the available reported drugs and supplies are not adequate for the coming 6 months (table 7.1.2).

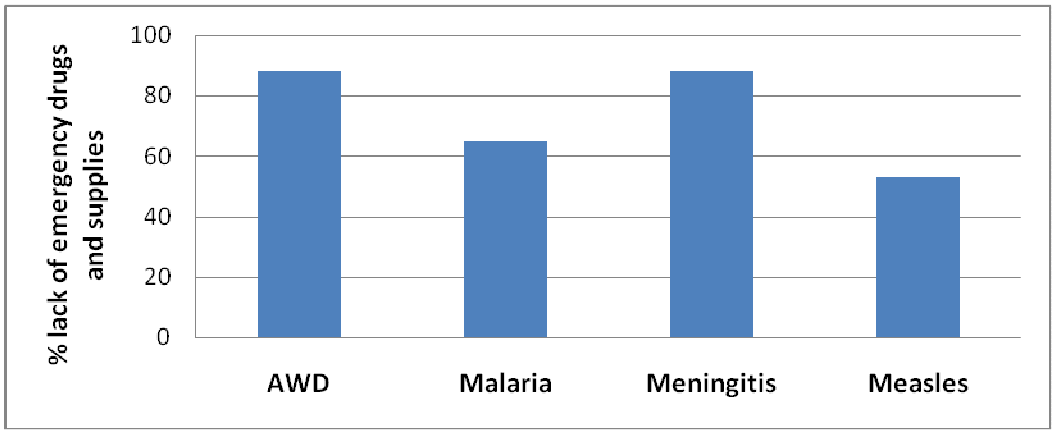

Figure 7.1.3: Emergency drugs and supplies by diseases, July 2010

In addition, stock supplies vary from zone to zone. Apart from Oromia zone, all assessed zones and RHB reported that they don't have meningitis vaccine in their stock, but all don't have oily CAF. RHB and all the assessed zones have coartem (43200 strips). 700 tabs Doxycycline are available in RHB and N/Shewa. A total of 5448 bags of ringer lactate and 17057 sachets of ORS were also available at Regional and Zonal level. Laboratory supplies (RDT for malaria and meningitis) are not available at all levels. Only S/Wollo reported that it has one CTC for AWD in the stock. The available stock reported by RHB and Zones was for the whole zones and woredas in the region (table 7.1. 2)

Guidelines for case management

A total of 15 (88.24%) woredas have guidelines for AWD and Measles, 13(76.4%) for malaria and 11(64.71%) for meningitis.

Human resource: Only four weredas (23.53%) reported less than 2 health officers in all over their health facilities. Otherwise, all the assessed woredas have nurses greater than 5, one laboratory technician and more than 10 health extension workers. As to trained manpower, all have trained health workers on PHEM and IDSR. However, some woredas reported untrained ones on EPI (11.76%), malaria (29.41%) and nutrition (5.88%).

Coordination forum and EPRP: Almost 13 (77.50%) woredas have coordination forum and EPRP. But all are not active this time and have no budget for response.

Coordination and PHEM

Coordination: At regional level, there is functional multisectoral health and nutrition emergency coordination forum on monthly basis for RHB, NGOs and UN agencies. However, the forum lacks representatives from water, education and agriculture governmental sectors. All the assessed zones have multisectoral coordination forum for the health when there is emergency. Participants are from government, NGOs in N/Wollo and S/Wollo.

PHEM: Except N/Shewa zone, the rest have developed multi disease EPRP. But all of them don't have PHE preparedness and response fund. Including regional health bureau, all the assessed zones have dedicated PHEM unit/team. However, they need seven (4 RHB/PHEM, 2 Oromia and 1 S/Wollo) additional pubic health emergency officers. With respect to trainings provided for PHEM members, all team members from both regional and zones trained on PHEM, IDSR and outbreak management of major epidemic prone diseases. Only regional and N/Shewa zone PHEM members have trained on EPRP preparation.

Challenges mentioned including absence of budget for monitoring and supportive supervision, shortage of computers, lack of communication means like phone, internet connection, CDMA, high staff turnover and lack of training for staff.

Major areas of supports they need from both Federal and health partners are financial support, emergency drugs and medical supplies, logistics like motorcycle, technical support and capacity building on data management and EPRP.

Risk factors epidemic diseases

Malaria: Among all the assessed 17 woredas, 76.5% are located below 2000m, 82.4% are malaria endemic, 88.23% have malaria breeding sites, and 58.82% have interrupted rivers and 88.24%(15 woredas) have unprotected irrigation.

Meningitis: 58.82% of the assessed woredas responded as they are located in the meningitis belt, however most of the woredas didn't know whether they are in the meningitis belt or not., 11.8% reported meningitis epidemic in the last three years and only one woreda (Kelela in S/Wollo zone) reported a total of 25869(74.5%) people vaccinated in July 2009.

Acute Watery Diarrhea (AWD): 82.4% of assessed woredas have history and reported AWD epidemic in 2007/2008 and 2008/2009 from July to October.

Health care financing and health partners

Health care financing: In all assessed weredas, HIV/AIDS, TB/leprosy, EPI, delivery, ANC, and FP services are provided to the community free of charge.

A waiver/exemption system is also available for poorest of the poor. Selection of users and decision is carried out by committee consisting kebele leaders and community representatives. All services in the health centres (OPD, Inpatient, drugs, operation and referral) are provided freely.

Partners working in Health: In all assessed werdas there is at least one partner/NGO is working in health. Some of the major programs which health partners participate are HIV/AIDS, WASH, and nutrition (Table 5).

Section B: Nutrition

Nutrition assessment result revealed that except Kelela in S/Wollo and MojanWodara in N/Shewa, all have nutrition program. In these woredas, there are 277 TFP sites (265 OTPs & 12 SCs) which reported 4153 new SAM cases from Jan-May, 2010. Meket and Habro woredas reported the highest number of (36%) new SAM cases. There is also lack of routine medicine such as Amoxicillin and Mebendazole/Albendazole in Bati woreda. Bati and Argoba woredas have no SC; as a result they are referring complicated SAM cases to Dessie hospital and Kombolcha health center respectively. It was also seen more cases were coming to TFP sites in March and April months

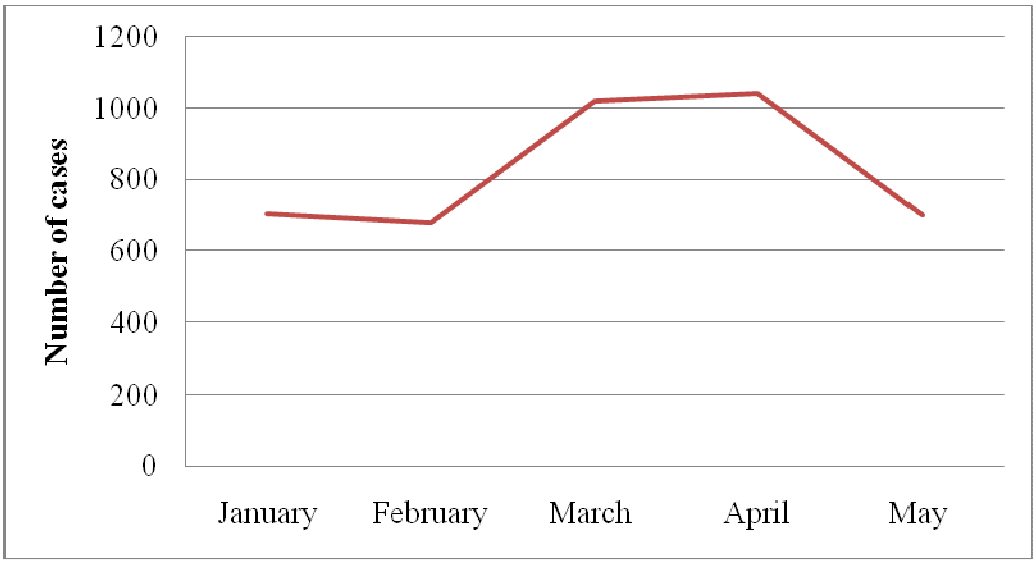

Figure 7.1.4:- Sever acute malnutrition (SAM) cases admission trend by month in all assessed districts, Jan-May 2010, Amhara, Ethiopia

Theraputic feeding program (TFP) sites, Jan- May, 2010

In all assessed woredas having nutrition program, a total of 341 TFP sites are expected to report every month, but on average 257 (75.3%) TFP sites were reporting (see table 6). Low attention is the reason given for low reporting rate performance in some woredas.

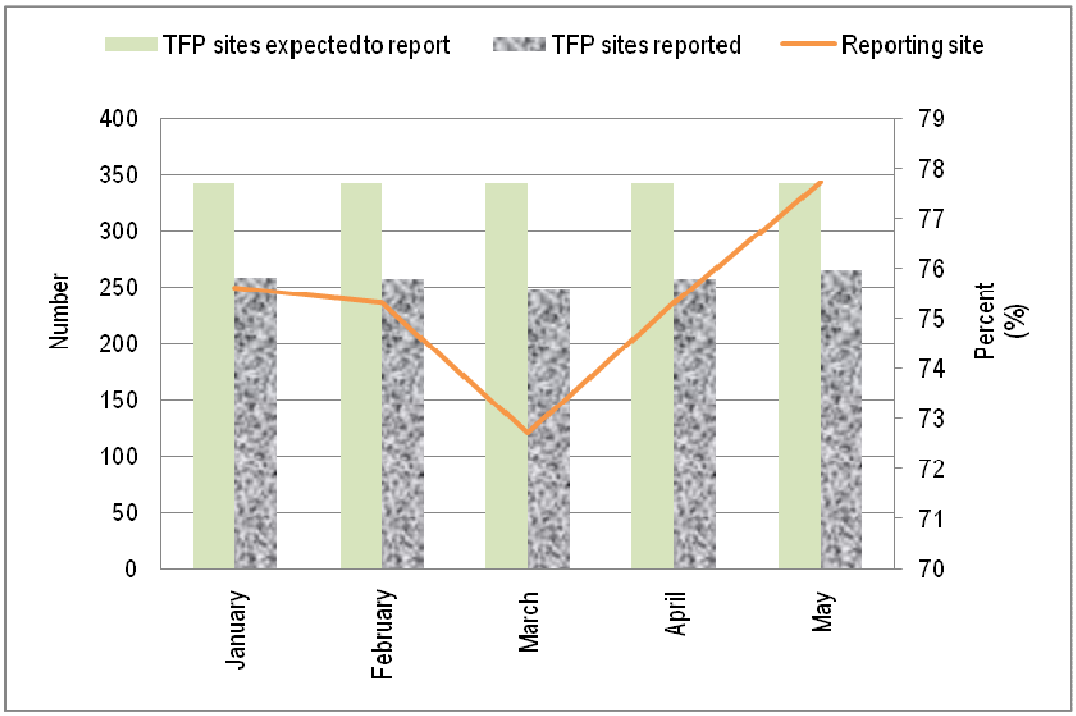

Figure 7.1.5: TFP sites expected to report, sites reported and report rate trend, July 2010

Estimated beneficiaries

Estimation of beneficiaries was calculated based on disease specific attack rate and standard risk percent for populations, coverage's of ITN and water. Total estimated beneficiaries are attached annex.

Limitation of the assessment

- Time constraint to visit each district/woreda
- Data unavailability in some districts/woredas
- Absence of focal persons in some districts
- The questionnaire is limited to collect complete information (stock, risk factor, nutrition)

Conclusion and recommendation

Based on the findings above all 17 assessed districts need emergency medical supplies for preparedness of any risk of epidemics or malnutrion. There for the team would like to recommend the following points:

For Health;

- Stocks of essential drugs and medical supplies for emergency needs should be secured both at woreda and zonal level
- Capacity building for health workers on PHEM, such as in preparedness planning, in forecasting emergencies, malaria monitoring chart and estimating supply needs
- Allocate budget for emergency preparedness and response to the assessed weredas
- Improve multisectoral information communication and reporting with in different levels of health structure.

For Nutrition;

- It is necessary to strengthen all OTP sites through regular and consistent supportive supervision.
- Link moderate cases, discharged cases to SFP and strengthen enhanced outreach strategy (EOS).
- Promote partners to work on nutrition program in the assessed weredas (especially in Sayint Ajiabr the program in the district is just phased out).
- Refreshment training for health workers and HEWs on nutrition
- Establishment of Stabilization center (Argoba and Bati woredas)

Annexes:

Annex 11: List of assessed weredas by their population size in 4 Zones, Amhara Region, and July 2010

Zone	Wereda name	Total population	Male	Female	Under 5	Above 5	Remark
North wello	Mekit	241833	121158.33	120674.67	32647.46	209185	
	Gidan	159532	79925.532	79606.468	21536.82	137995.18	
	Habru	203143	101774.64	101368.36	27424.31	175718.7	
	Gubalafto	155012	77661.012	77350.988	20926.62	134085.38	
South Wollo	Sayint Ajibar	155047	77678.547	77368.453	20931.35	134115.66	
	Kelela	144446	72367.446	72078.554	19500.21	124945.79	
	Kallu	229536	114997.54	114538.46	30987.36	198548.64	
	Werebau	105012	52611.012	52400.988	14176.62	90835.38	
	Argoba	37704	18889.704	18814.296	5090.04	32613.96	
Oromia	Batit Towen	38396	19236.396	19159.604	5183.46	33212.54	
	Bati Zuria	75792	37971.792	37820.208	10231.92	65560.08	
	Jile Timuga	77510	38832.51	38677.49	10463.85	67046.15	
North Shewa	Afrata Gidim	117505	58870.005	58634.995	15863.18	101641.83	
	Mojanawadira	75157	37653.657	37503.343	10146.2	65010.805	
	Ankober	80371	40265.871	40105.129	10850.09	69520.915	
	Qewat	110865	55543.365	55321.635	14966.78	95898.225	
	MenzGera	108109	54162.609	53946.391	14594.72	93514.285	
Total	17	2114970	1059600	1055370	285521	1829449	

Annex 12: Drugs and supplies stock needs estimation regional summary for assessed weredas, Amhara, July 2010

Item		Stock at hand visited Zonal level	needs in assessed weredas	Remark
Drugs , Laboratory and other supplies	ORS sachets	17057	27490.165	
	Ringer Lactate 1 liter	5448	5074.892	
	NG tub	0	422.93	
	Doxy cyclin 100 mg	700	2536.446	
	Erythromycin 250 mg	0	10148.784	
	Ciprofloxacilin	0	2536.446	
	Amoxacilin suspention	0	2536.446	
	Coartem	43200	929121	
	crystalin penecilin	0	15771.05	
	AC vacin	0	89431.836	
	RDT for malaria	0	54685	
	pastorex for meningite	0	400	
	AWD CTC kite	1	32	

Annex 13: Summary of Beneficiaries by disease type of intervention, Amhara, July 2010

No.	Disease Intervention	Activity	Estimated beneficiaries	Remark
1	AWD	Manage cases in CTCs	4397	
		Prevention f AWD;	406573	
2	Measles	case Management/ Vit A and antibiotics/	4224	
3	Meningitis	immunize population at risk	14931	
		Case Management	4600	
4	Malaria	Treat cases	126709	
		ITN distribution	297043	
	N.B. Beneficiaries could overlap for different diseases			

Annex 14: Estimation of beneficiaries by disease interventions for 17 districts, Amhara Region, July 2010

Woreda	Intervention	Activities	Risk population	Attack rate	Estimated beneficiaries
Bati Zuria	AWD	manage cases	75793	0.20%	151.586
		prevention of AWD	To avoid resource duplication(WASH)		
	Measles	managing of cases by Vitamin supplementation and antibiotics	75793	0.20%	151.586
	Meningitis	prevention of Meninigits: immunization	75793	0.70%	530.551
		Case MX	75793	0.20%	151
	Malaria	Treat cases	75792	2.90%	2197.968
		Distribute ITN	75792	31.00%	23495.52
Jile Timuga	AWD	Case Mx in CTC	77510	0.20%	155.02
		prevention of AWD	To avoid resource duplication(WASH)		
	Measles	managing of cases by Vitamin supplementation and antibiotics	77510	0.20%	155.02
	Meningitis	prevention of Meninigits: immunization	77510	0.70%	542
		Case MX	77510	0.20%	155
	Malaria	Case management	77510	12.60%	9766.26
		ITN	77510	25.00%	19377.5
Bati town	AWD	Case management	38396	0.20%	76.792
		prevention of AWD	To avoid resource duplication(WASH)		
	Measles	managing of cases Mx / Vit A and antibiotics/	38396	0.20%	76.792
	Meningitis	prevention of Meninigits: immunization	38396	1%	268.772
		Case MX	38396	0%	76.792
	Malaria	Treat cases	38396	1%	383.96
		ITN distribution	38396	0.20%	76.792
Kallu	AWD	manage cases	229536	0.20%	459.072
		Prevention of AWD	To avoid resource duplication(WASH)		
	Mealses	managing of cases Mx / Vit A and antibiotics/	229536	0.20%	459.072
	Meningitis	prevention of Meninigits: immunization	229536	0.70%	1606.752
		Case MX	229536	0.20%	459.072
	Malaria	manage cases	229536	6.00%	13772.16
		Distribute ITN	229536	20.00%	45907.2

Werebabu	AWD	Case Mx in CTC	105012	0.20%	210.024
		Prevention of AWD	To avoid resource duplication(WASH)		
	Mealses	managing of cases Mx / Vit A and antibiotics/	105012	0.20%	210.024
	Meningitis	prevention of Meninigits: immunization	105012	0.70%	735.084
		Case MX	105012	0.20%	210.024
	Malaria	manage cases	105012	0.30%	315.036
		ITN distribution	105012		
Kelela	AWD	Case MX	144446	0.20%	288.892
		prevention of AWD	To avoid resource duplication(WASH)		
	Measles	managing of cases Mx / Vit A and antibiotics/	144446	0.20%	288.892
	Meningitis	prevention of Meninigits: immunization	144446	0.70%	1011.122
		Case MX	144446	0.20%	288.892
	Malaria(Amhara Risk pon)	Treat cases	144446	1.00%	1444.46
		Distribute ITN	144446	27.00%	39000.42
Sayint Ajibar	AWD	Case MX	155047	0.20%	310.094
		Prevention of AWD	To avoid resource duplication(WASH)		
	Measles	managing of cases Mx / Vit A and antibiotics/	155047	0.20%	310.094
	Meningitis	prevention of Meninigits: immunization	155047	1%	1085.329
		Case MX	155047	0%	310.094
	Malaria	Treat cases	155047	0%	310.094
		Distribute ITN	155047	27%	41862.69
Argoba	AWD	Manage cases in CTCs	37704	0.20%	75.408
		Prevention of AWD	To avoid resource duplication(WASH)		
	Mealses	managing cases such as ;vitamin A supplementation and antibiotics	37704	0.20%	75.408
	Meningitis out break	immunize population at risk	37704	0.70%	263.928
		Case MX	37704	0.20%	75.408
	Malaria	case management	37704	2%	754.08
		ITN distribution	37704	29%	10934.16
Meket	AWD	Manage cases in CTCs	241833	0.20%	483.666
		preventionof AWD;	241833	38.00%	91896.54
	Measles	managing of cases Mx / Vit A and antibiotics/	241833	0.20%	483.666
	Meningitis	immunize population at risk	241833	1%	1692.831
		Case MX	241833	0%	483.666
	Malaria	Treat cases	241833	0%	918.9654
		ITN distribution	woreda coverage is 100%		

Gubalafto	AWD	Manage cases in CTCs	155012	0.20%	483.666
		preventionof AWD;	155012	55.00%	85256.6
	Mealses	managing of cases Mx / Vit A and antibiotics/	155012	0.20%	310.024
	Meningitis	immunize population at risk	155012	1%	1116.724
		Case Mx	155012	0%	310.024
	Malaria	Case MX	155012	0%	72855.64
		ITN distribution	woreda coverage is 100%		
Gidan	AWD	Manage cases in CTCs	159532	0.20%	319.064
		preventionof AWD;	159532	34.00%	54240.88
	Mealses	case Mx / Vit A and antibiotics/	159532	0.20%	319.064
	Meninigitis	immunize population at risk	159532	1%	1595.32
		Case Mx	159532	0%	319.064
	Malaria	Treat cases	159532	0%	319.064
		ITN distribution	159532	28%	43871.3
Habru	AWD	Manage cases in CTCs	203143	0.20%	406.286
		AWD prevenion	203143	32.00%	65005.76
	Mealses	managing of cases Mx / Vit A and antibiotics/	203143	0.20%	406.286
	Meningitis out break	Immunization	203143	1%	1422.001
		Case MX	203143	0%	406.286
	Malaria	Case MX	203143	5%	10157.15
		ITN distribution	203143	20%	40628.6
Eferat Gidim	AWD	Case Mx in CTC	117505	0.20%	235.01
		prevention of AWD	117505	68.00%	79903.4
	Mealses	managing of cases Mx / Vit A and antibiotics/	117505	0.20%	235.01
	Meningitis	prevention of Meninigits: immunization	117505	0.70%	822
		Case MX	117505	0.20%	235
	Malaria	Treat cases	117505	10.00%	11750.5
		ITN distribution	117505	2.80%	3290.14
Mojanawadira	AWD	managing cases at CTC	75157	0.20%	150.314
		prevention of cases	To avoid resource		
	Measles	case management	75157	0.20%	150.314
	Meningitis	Case MX	75157	0.20%	150.314
		mass vaccination	75157	1%	526.099
Ankober	AWD	Case Mx at CTC	80371	0.20%	160.742
		prevention of AWD	To avoid resource duplication(WASH)		
	Mealses	managing of cases Mx / Vit A and antibiotics/	80371	0.20%	160.742
	Meningitis	prevention of Meninigits: immunization	80371	0.70%	562.597
		Case MX	80371	0.20%	160.742
	Malaria	Distribute ITN	80371		
		Treat cases	80371	8%	6429.68

MenzGera	AWD	Case Mx in CTC	108109	0.20%	216.218
		prevention of AWD	108109	28.00%	30270.52
	Mealses	managing of cases Mx / Vit A and antibiotics/	108109	0.20%	216.218
	Meningitis	Case Mx	108109	0%	216.218
		mass vaccination of risk group	108109	1%	756.763
	Malaria	Treat cases	108109	0%	216.218
		ITN distribution	108109		
Qewat	AWD	Case Mx in CTC	110865	0.20%	221.73
		Prevention of AwD	To avoid resource duplication(WASH)		
	Mealses	managing of cases Mx / Vit A and antibiotics/	110865	0.20%	221.73
	Meningitis	prevention of Meninigits: immunization	110865	1%	776.055
		Case MX	110865	0%	221.73
	Malaria	Treat cases	110865	1%	1552.11
		ITN distribution	110865	20%	22173

Annex 15: partners working with wereda health offices during assessment period

Partners	Program				Woredas
	Health	HIV/AIDS	WASH	Nutrition	
WV	√		√	√	Eferata Gidim, Habiru
EMERDA		√			Eferata Gidim
Concern				√	Argoba
SC UK	√		√	√	Kelela, Sayint, Mekit, Gubalafto, Gidan
Carter Center	√				Gubalafto, Argoba
Water Action			√		Worebabu, Argoba
Action Aid		√	√		Ankober
ORDA			√		Habiru, Worebabu
ADA	√				Worebabu
IFHP	√				Gubalafoto
Clinton foun		√			Habiru,
In-gender Health	√				Ankober, kelela
OXFAM			√		Ankober
RWASH			√		Ankober

Annex 16: Districts with theraputic feeding program (TFP) admissions and trends of reporting rate, Amhara, January-May 2010

Woreda	Jananuary 2010		February 2010		March 2010		April 2010		May 2010	
	*Adm	*RR%	Adm	RR%	Adm	RR%	Adm	RR%	Adm	RR%
Bati Zuria	154	NA	116	NA	90	NA	NA	NA	No data	NA
Bati Town	48	100	20	100	34	100	8	100	0	100
Jile Tumuga	29	88	14	70.5	5	52.9	11	58.8	8	76.5
Efratana	4	25	13	18.7	13	62.5	7	62.5	27	93.7
Mojana	No TFP		-	-	-	-	-	-	-	
Ankober	12	62.5	17	31.2	0	25	5	37.5	12	43.7
Menze gera	16	35	50	60	4	25	11	25	10	30
Kewet	33	55.5	89	66.6	38	88.8	28	77.7	28	72
Kalu	57	82.3	51	85.3	42	76.4	73	85.3	45	85.3
Kelela	NoTFP	-	-	-	-	-	-	-	-	
Angober	18	100	15	100	7	100	61	100	13	100
Werebabo	29	68.2	30	63.6	34	50	7	68.2	18	68.2
Saint Anjiber	95	100	63	100	107	100	10	100	12	100
Meket	62	100	28	100	266	63.8	347	100	180	78.7
Gidan	23	100	31	100	87	84.6	207	100	117	80.7
Habro	124	83.3	91	86.8	242	86.6	89	76.6	73	90
Gubalafto	0	100	46	NA	41	NA	175	100	155	100

*Adm = admission, RR = reporting rate

Chapter VIII – Protocol/Proposal for Epidemiologic Research Project

8.1. Epidemiology and etiology of diarrhea among under five children, a case control study, Bahir Dar, Ethiopia

ADIS ABABA UNIVERSITY

FACULTY OF MEDICINE

SCHOOL OF PUBLIC HEALTH

MASTER OF PUBLIC HEALTH

RESEARCH PROJECT SUBMISSION FORM

Name of investigator	Belay Bezabih Beyene
Name of Advisor(s)	Dr Richard Luce Dr Fikre Enquoselassie
Full title of the research project	**Epidemiology and etiology of diarrhea among under five children, case control study, Bahir Dar, Ethiopia**
Duration of project	2 months
Study Area	Bahir Dar
Total Cost of the project	67,401.60 birr
Address of investigator	Tel:0910612637/0918764416 E-mail:fiametaye@yahoo.com

Summary

Background: Diarrhoea is one of the principal causes of morbidity and mortality among children in the developing world. In Ethiopia, over half a million children under the age of five die every year from diarrhea. Like in other developing countries, inadequate access to safe water supply, sanitation facilities, and better hygienic practices are major causes. It is estimated that about 35 million people do not have access to sanitation services and the sanitation coverage of the country is only 54.8%.Studies on identification of multiple etiologies and risk factors of diarrhea among under five children are few in Ethiopia or absent in the study area.

Objectives: The overall objective of this study is to assess risk factors of diarrheal disease and identify entero-pathogens among under five children visiting health facilities in Bahir Dar, Felege Hiwot hospital from Oct-Dec 2010.

Methods and materials: Unmatched case control study design will be employed among under five children attending health care service in Felege Hiwot Hospital, Bahir Dar. The sample size is estimated according to the unmatched- case control sample size calculation using Stat calc in Epi Info. 339 study subjects will be included to the study in a 2:1 control- case ratio based on the definition and inclusion criteria for selection of cases and controls. Data will be collected for risk factors using interview of care takers by standard questionnaire, stool samples from children will be also collected and examined for etiologic agents as per the standard laboratory procedures. Then Data will be analyzed by Epi Info version 3.3.2

Work plan and Budget: The data collection and analysis will be from October 15-December 15, 2010, however it depends on the school programme schedule change. The total cost is 67401.60 Eth. Birr. The detail break dawn is given in the budget section.

Dissemination of results: The final document of this study will be submitted and presented to the school of public health and the Regional Health Bureau of Amhara. It will also be submitted to journals for publication and presented in scientific conference.

Introduction

Diarrhoea is caused mainly by the ingestion of pathogens, especially in unsafe drinking-water, in contaminated food or from unclean hands. Inadequate sanitation and insufficient hygiene promote the transmission of these pathogens. Eighty-eight per cent of cases of diarrhoea worldwide are attributable to unsafe water, inadequate sanitation or insufficient hygiene. These cases result in 1.5 million deaths each year, most being the deaths of children[1], mainly in low income countries which only 34% of people have access to adequate sanitation[2]
A significant amount of disease could be prevented especially in developing countries through better access to safe water supply, adequate sanitation facilities and better hygiene practices[3,4]

Statement of the problem

A global estimate from studies published between 1992 and 2000, diarrhoea accounts for 1.6–2.5 million deaths annually, and each child in the developing world experiences an average of three episodes of diarrhoea per year, which clearly shows that diarrhoea remains one of the principal causes of morbidity and mortality in children[5].
In 2000–03, six causes accounted for 73% of the 10.6 million yearly deaths in children younger than age 5 years: pneumonia (19%), diarrhoea (18%), malaria (8%), neonatal pneumonia or sepsis (10%), preterm delivery (10%), and asphyxia at birth (8%), in which diarrhea ranks second[6]. In sub-Saharan Africa, mortality caused by acute diarrhea also reaches up to37% of all deaths, with most of the deaths occurring during the first year of life (4). Few studies conducted in Ethiopia also indicated that diarrhea is one of the leading cause of under five mortality[7, 8, 9].Moreover in Ethiopia, the sanitation coverage is only 54.8% and it is estimated that about 35 million people do not have access to sanitation services and over half a million children under the age of five die every year from diarrhea[10].

Rationale of the study

Studies on identification of multiple etiologies and risk factors of diarrhea among under five children are very few in Ethiopia or absent in our study area. This could be due to lack of laboratory infrastructure, costs, and other factors. However this study tries to identify etiologies of different category (viral, bacterial and parasitic) and risk factors responsible for diarrhea among under five children.

So the study could help in understanding various risk factors and multiple etiologies responsible for diarrhea and thereby it helps in guiding treatment and prevention strategies of diarrhea in children. Furthermore it initiates other researchers to work on in-depth scope of diarrhea among under five children.

Limitation of study

Risk factors data are only based on hospital visit interview from child care taker and other housing and environmental sanitation related risk factors which need observational assessment couldn't be addressed. This study also emphasize to identify only few selected bacterial, most parasitic and one viral (rota virus) pathogens in Bahir Dar Regional Health Research Laboratory setting.

Research question

This study tries to answer the etiologies and risk factors of diarrheal diseases among under five children in Bahir Dar town.

Literature review

Diarrhea: Mechanisms, types and definition

A standard definition of diarrhoea could be the passing of three or more liquid or loose stools in a 24-hour period[11]. However, mothers may use a variety of terms to describe diarrhoea, depending, for example, upon whether the stool is loose, watery, bloody or mucoid, or there is vomiting. Three clinical syndromes of diarrhoea have been defined; acute watery diarrhea, dysentery, and persistent, each reflecting a different pathogenesis and requiring different approaches to treatment[12].

Diarrhea may be caused by means of enterotoxin production, cytotoxin production, through interference with absorption, or through invasion of the intestinal mucosa [13]

Acute watery diarrhea that begins acutely, lasts less than 14 days (most episodes last less than 7 days), and involves the passage of frequent loose or watery stools without visible blood. Vomiting may occur and fever may be present. The most important causes of acute watery diarrhoea in young children in developing countries are rotavirus, enterotoxigenic Escherichia coli, Shigella, Campylobacter jejuni, and Cryptosporidium. In some areas, Vibriocholerae OI, Salmonella and enteropathogenic E. col; are also important[14, 15].

Dysentery is diarrhoea with visible blood in the faeces. Important effects of dysentery include anorexia, rapid weight loss, and damage to the intestinal mucosa by the invasive bacteria. The main cause of acute dysentery is Shigella; other causes are Campylobacter jejuni and, infrequently, enteroinvasive E. coli or Entamoeba histolytica Salmonella[16-19].

Persistent diarrhea-This is diarrhoea that begins acutely but is of unusually long duration (at least 14 days). The episode may begin either as watery diarrhoea or as dysentery.There is no single microbial cause for persistent diarrhoea; EAEC, Shigella and Cryptosporidium may play a greater role than other agents.

Persistent diarrhoea should not be confused with chronic diarrhoea, which is recurrent or long-lasting diarrhoea due to noninfectious causes, such as sensitivity to gluten or inherited metabolic disorders[12, 20, 21] .

Patterns of infectious diarrhea

The patterns of infectious diarrhea that occur in infants and young children differ throughout the world. In cooler and temperate regions, for example, childhood gastroenteritis tends to be a winter illness. In the tropics, diarrheal episodes tend to occur throughout the year, although seasonal increases can occur in the dry season, the wet season, the hot season, the cool season, or combinations depending on the local climate and associated risk factors such as: living conditions, crowding, community hygiene and the presence of vectors that can spread diarrhea-causing microorganisms[22]

Seasonal patterns to childhood diarrhea have been documented in many other tropical locations, e.g. in Pakistan[23] and in Thailand, where there are two definite seasonal peaks; the summer one associated with bacterial infections and the winter one related to viruses[24].

Etiology of diarrhea

In age- and sex-matched cases control study conducted in five hospitals (China, India, Mexico, Myanmar, and Pakistan) an enteric pathogen was detected in 66% of the cases and in 30% of the controls. In all the study centres, the pathogens most strongly associated with disease were rotavirus (16% of cases, 2% of controls), Shigella spp. (11% of cases, 1% of controls) and enterotoxigenic Escherichia coil (16% of cases, 5% of controls)[25]

Another study in Philippines isolated three most common pathogens; Rotavirus (17%), enterotoxigenic Escherichia coli (ETEC) (15%), and salmonella (15%). Significant differences between cases and controls were found in the isolation rates of rotavirus, ETEC, Entamoeba histolytica, and Vibrio cholera [26].

A study conducted in Ghana, Intestinal micro-organisms were isolated from 77% of patients and 53% of controls ($P < 0.0001$). The most common pathogens in patients were rotavirus (55%), adenovirus (28%) and norovirus (10%); intestinal parasites (5%) and bacteria (5%) were rare. Rotavirus was the only pathogen found significantly more frequently in patients than in controls (odds ratio 7.7; 95%CI, 4.2–14.2), and was associated with young age, fever and watery stools. Patients without an identified cause of diarrhoea more frequently had symptomatic malaria (25%) than those with diagnosed intestinal pathogens (12%, $P = 0.02$)[27]

A study done in Hanoi, Veitnam identified potential pathogens in 67.3% of children with diarrhea. 46.7%, 22.5%, 4.7%, and 7.3% prevalence of group A rotavirus, diarrheagenic Escherichia coli, Shigella spp, and enterotoxigenic Bacteroides fragilis respectively. Rotavirus and diarrheagenic E. coli were predominant in children less than two years of age. Diarrheagenic E. coli and Shigella spp showed high prevalence of resistance to ampicillin, chloramphenicol, and to trimethoprim/sulfamethoxazole [28].

In Ifakara, Tanzania also indicated a prevalence of 52.23% enteropathogens from stool samples of children without diarrhea. Shigella species were the only entero-pathogen statistically related with diarrhea (OR, 2.90; $P <$

0.029). Entero-toxigenic, entero-pathogenic, and entero-aggregative strains of Escherichia coli were not related with diarrhea, and neither were Giardia lamblia or Salmonella species [29]

A cross-sectional study in Addis Ababa showed 5.6 %(12/214) prevalence of Cryptosporidium oocysts from stools of children under five years of age with diarrhoea using the Modified Ziehl Nelson Technique [30].
Another study in Jimma also detected Rotavirus in 26.6 % (41/154) of fecal specimens collected from children of < 5 years of age with acute diarrhea using Enzyme Linked Immunosorbent Assay. The highest rate of Rotavirus Antigen detection was observed among the 7 to 12 months of age group (34%). Children infected with rotavirus were more likely to have watery stool (90.2% Vs 43.4%), vomiting (31.7% Vs 15.9%) and some (moderate) dehydration (31.7% Vs 12.4%) with P<0.05 than without rotavirus infection. No socio-demographic factors were found to be significantly associated with rotavirus infection among the studied subjects [31]

Mode of transmission

The infectious agents that cause diarrhoea are usually spread by the faecal-oral route, which includes the ingestion of faecally contaminated water or food, and direct contact with infected faeces [32,33]

Epidemiology of diarrhea: Magnitude of diarrhea (morbidity and mortality)

Global deaths from diarrhoea of children aged less than 5 years were estimated at 1.87 million; approximately 19% of total child deaths. WHO African and South-East Asia Regions combined contain 78% (1.46 million) of all diarrhoea deaths occurring among children in the developing world.73% of these deaths are concentrated in 15 developing countries[34] Each year, rotavirus causes approximately 111 million episodes of gastroenteritis requiring only home care, 25 million clinic visits, 2 million hospitalizations (approximately 39% of childhood diarrhea hospitalizations worldwide), and About 600,000 deaths <5 years of age and children in resource-poor countries of south Asia and sub-Saharan Africa account for 82% of rotavirus deaths[35,36]
Worldwide mortality caused by Shigella infection is also estimated to be 600,000 deaths per year among children under five, or a quarter to a third of all diarrhea-related mortality in this age group [37].

Risk factors

A case control study conducted in Bangladesh showed that exclusive breastfeeding appeared to protect infants against severe ETEC diarrhea, but breastfeeding not associated with protection after infancy, nor was it associated with a major overall reduction of severe ETEC disease during the first 3 years of life[38]
A study in Iran also showed use of formulas before 6 month age, tenantry and mother's employment found to be risk factors for cute diarrhea with a statistically significant relationship[39]. The prevalence of diarrhea predominates

in children with poor families, lack of piped water and latrine, whose mothers don't wash hands often before feeding children, low level of mother's education, households inaccessible to information on health and sanitation as it was indicated in Vietnamese study [28].

A Community Cohort Study from Guinea-Bissau showed that a recent (in the past 14 days) diarrheal episode, male sex, being weaned from breast milk, not being looked after by the mother, head of the household being <30 years old, eating cold leftovers, and drinking water from an unprotected public water supply were independently associated with an increased incidence of diarrhea. Major determinants of persistent diarrhea included weaning, lack of maternal education, and having pigs in the home[40].

A matched case-control study (103 cases and 206 controls matched for sex and age) conducted in Ifakara, Tanzania, in a rainy season in children under 5 years of age showed that a high number of siblings, the number of siblings surviving, the birth order and the distance from the house to the water source were associated with the risk of diarrhea [29].

In a cross-sectional community-based survey conducted in Gondar, Ethiopia; access to protected water source was significantly lower in children with diarrhoeal diseases than without and significantly a higher number of children with diarrhoea had recent attacks of diarrhoea than those without diarrhea[41].

In another community bases study in Ethiopia found that Young age, male gender, living in a house with fewer numbers of rooms, and obtaining water from storage containers by dipping showed statistically significant association with diarrheal morbidity. Type of water source, amount of water consumed, and latrine availability were not found to be significant risk factors [42]

A community based study in Jimma ,Ethiopia on 142 cases and 463 controls showed Well source of water, lack of complete immunization, attack of measles and acute respiratory infections (ARI) in the previous two weeks significantly associated with occurrence of diarrhoeal disease; however, only ARI and well water were retained in the logistic regression analysis [43].

Prevention and control

The key measures to prevent and control diarrhea are access to safe drinking-water, improved sanitation, exclusive breastfeeding for the first six months of life, good personal and food hygiene, health education about how infections spread, and rotavirus vaccination [44]

A meta-analysis of three observational studies in developing countries shows that breastfed children under age 6 months are 6.1 times less likely to die of diarrhea than infants who are not breastfed [45.] Introducing Improved Complementary Feeding Practices at age 6 months and continue breastfeeding up to two years also protects

diarrhea46. Poor sanitation, lack of access to clean water, and inadequate personal hygiene are responsible for an estimated 90 percent of childhood diarrhea [47]. Measles immunization to diarrhea prevention is also indicated in certain studies; in which Measles is known to predispose to diarrheal disease secondary to measles-induced immunodeficiency[48].

Objectives

General objective

The overall objective of this study is to assess risk factors of diarrheal disease and identify entero-pathogens among under five children visiting health facilities in Bahir Dar, Ethiopia Oct- Nov, 2010.

Specific objectives

1. To assess and analyze risk factors related to diarrhea among under five children
2. To identify etiologic agents such as, bacteria, viruses and parasites that cause diarrhea
3. To determine differences for the occurrence of etiologic agents and risk factors among under five children with diarrhea and without diarrhea.

Methods and Materials

Study setting and Study design

The study will be conducted in Bahir Dar town, North West Ethiopia, which is 560 kilometers far from Addis Ababa. Bahir Dar is the capital town of Amhara National Regional State which has a total population of 220,344(2009 projection). It has one referral hospital servicing for around 5,000,000 people in its catchment area, and it has also three health canters three private higher clinics.

The study design employed will be unmatched case control study. This study design is chosen because of its simplicity and cost effectiveness. Case control study also allow for the evaluation of a wide range of potential etiologic exposures that might relate to a specific disease [49]

Study population

The study population is all children under five years old visit Felege Hiwot Referral Hospital for health care service during the study period.

Definition of cases and controls

Cases: a child whose age is less than five years old with three episodes of liquid or loose stools in 24 hours and not more than 14 days duration of illness of diarrhea and not also on antibiotic treatment.

Controls: a child whose age is less than five years old without diarrhea and antibiotic treatment for the previous 15 days.

Sample size

The total sample size determined is 339 with 113 cases and 226 controls. The sample size is estimated according to the unmatched- case control sample size calculation using Stat Calc in Epi Info Version 3.3.2.

Baseline estimate for proportions and expected magnitude of effect are not available in published articles for the area, however assumption is made to come up with the above sample size and which could be big enough for a valid Statistical inference. More over taking 46 % of the unaccessed population of Ethiopia for hygiene and sanitation as p_0 gives a sample size less than 339.

Assumptions are the following;

Taking a control to case ratio =2,

Expected frequency exposure among controls (p0) = 30 %,

Proportion of exposure among cases (p1) = 46.15%, OR=2,

95% confidence ($Z_{1-\alpha/2}$, for a two-sided test) and power of 80 % ($Z_{1-\beta}$)

A formula of case control sample size determination for multiple controls per case also gives closer number to the above software[50].

$$n = \frac{\left[z_\alpha \sqrt{\left(1+\frac{1}{c}\right)\bar{p}'\bar{q}'} + z_\beta \sqrt{p_1 q_1 + \frac{p_0 q_0}{c}} \right]^2}{(p_1 - p_0)^2}$$

where

$$\bar{p}' = \frac{(p_1 + c p_0)}{1+c}$$

$$\bar{q}' = 1 - \bar{p}'$$

$$p_1 = \frac{p_0 R}{[1 + p_0 (R-1)]}$$

q_1=1-P_1; and q_0 = 1-p_0

Sampling technique (Selection of cases and controls)

All children less than five years old visiting the hospital during the study period and fulfilled the definition of cases and controls will be included in to the study. For every case two controls will be included until the total sample size is filled. For the sake of feasibility issue and to get enough sample size with in the limited study period, age and sex will not be matched to cases and probability sampling will not be utilized.

Inclusion criteria

All children qualify the selection criteria both for cases and controls, and whose care takers are willing to participate to the study

Exclusion criteria

All children who are on antibiotic therapy within 15 days, Stage three AIDS patients will be excluded from the study, and diarrhea with in14 days of hospital visit (for controls only)

Data collection procedures

Data collection tools: Questionnaire and interview

A questionnaire is designed to address socio economic, clinical data, water-sanitation, and behavior of care take care and child factors related to diarrhea.

The questionnaire is developed in English language and will be translated to local language Amharic.

Then face to face interview will be made with the care take care in charge of the child included in the study by a trained nurse in each examination room.

Laboratory Data collection

Two experienced medical laboratory professionals and one technical advisor (senior microbiologist) will be involved in the laboratory diagnosis for identification of etiologies.

Stool Sample collection: Stool sample will be collected from each child in a clean stool cup for parasitic & viral, and using Cary-Blair for bacterial identification by medical laboratory technicians and transported into the Microbiology laboratory at Bahir Dar Regional health research Laboratory within an hour of collection.

Microscopic examination of stool: Intestinal parasites were investigated microscopically from each stool samples using both direct smears mount in saline and modified acid fast staining technique per the standard operation procedures [51].

Culture and identification: For isolation of Shigella spp, Salmonella typhi/paratyphi, Campylobacter spp and E.coli stool samples were inoculated with respective culture Medias and after18-24 hours of incubation at 37 0c those which show growth will be subcultured and identified with biochemical testing following standard procedures[52-55]

Antimicrobial susceptibility testing: Antimicrobial susceptibility tests will be also performed using Mueller-Hinton agar disc diffusion method and following standard procedures [56-60]

Virus identification: The most widely used methods for rotavirus diagnosis are based on detection of protein antigens on rotavirus particles in stool specimens using specific antibodies by EIA method [60,61]. So Rota virus will be detected using ELISA test kit(which based EIA principle) after processing of stool samples as per standard procedures adapted from EHNRI virology laboratory and Kit insert instructions provided by WHO.

Variables

Dependent variables

The dependent or outcome variable is diarrhea. Variables, such as duration of diarrhea; stool frequency per day; presence or absence of blood in stool, occurrence of vomiting will be registered as symptoms of diarrhea.

Independent variables

The independent variables are risk factors for diarrhea among children under five years old such as; socio demographic factors, water-sanitation, behavior of care take care related factors ,vaccination , breast feeding status, and entero-pathogens that cause diarrhea.

Operational definitions

Acute diarrhea: three or more, loose, liquid, or watery stools or at least one bloody loose stool within 24 hours.

Persistent diarrhea is defined as diarrhea that begins acutely and lasts at least 14 day.

Care taker of a child: a mother, father or guardian of child who is giving care to the child.

Data quality control

Questionnaire for interview and laboratory standard operating procedures will be checked and reviewed before the study period. One day training will also be given for nurses and medical laboratory professionals for detail data collection procedures, then pretest will also be conducted before the actual study started.

Data processing and analysis

Data management plan

The data collection process will be monitored and coordinated by the principal investigator and technical advisor. After completing the data collection, data will be cleaned, entered in to computer using Epi Info v 3.3.2 software.

Data Analysis Plan

The data first presented with frequencies, mean or median for different variables. Then Bivariate, and final multiple logistic regression analysis will be utilized to see whether there is a statistical significance association is present at p value <0.05 and 95% CI logistic. The strength of association between dependent variable and independent variables will also be expressed in odds ratio (OR).

Ethical consideration

This study will be conducted after the ethical clearance given by the research and ethics committee of Addis Ababa University, school of public health. Then finally consent will be offered from study participants and Felege Hiwot Referral Hospital officials to start the study. Study participants are free not to involve in the study unwillingly and for those participated, their information is kept anonymous, and those found to be positive etiologies will be treated accordingly.

Dissemination of results

After analysis and compilation the final document will be submitted to Addis Ababa University, school of public health, and then findings of the study will be presented for the school community, to the Regional Health Bureau of Amhara, and also submitted to journals for publication.

Work Plan

This study is planned to be completed within five months of duration. The data collection and analysis will be from October 15-December 15, 2010, however it depends on the school programme schedule change. The whole work plan is presented in table 8.

Table 8.1: work plan for Epidemiology and etiology of diarrhea among under five children, a case control study, Bahir Dar, Ethiopia

Ser. No.	Activities	Duration (phases) of the study					Responsible bodies
		August 2010	Sept., 2010	Oct., 2010	Nov., 2010	Dec., 2010	
1	Proposal writing	First 2 weeks					Principal investigator
2	Submission to advisors and the school (Academic Coordinator)	August, 16					Principal investigator, Advisors, academic coordinator
3	Approval						Advisors, Ethical committee
4	Budget release						
5	Pretest			October ,15			Principal investigator, Technical advisor, Data collectors
6	Data collection			October , 16	to Nov., 30		Data collectors, Technical Advisor, Principal investigator
7	Analysis, writing, and Submission to advisors					Up to Dec,15	Principal investigator, Advisors
8	Final Draft writing, and Submission						Principal investigator

Budget plan

The plan budget presented is rationalized by the fact that to isolate predominant etiologies that cause diarrhea need supplies (their price is filled from known Medica pharma campany) for identification. Personnel cost plan is

also bases on the work duration and type of activity need, however many other supplies are not included which will be supported by EHNRI and Bahir Dar RHRLC. The total cost is 67401.60 Eth. Birr (table 8.2).

Table 8.2: Budget break dawn for Epidemiology and etiology of diarrhea among under five children, a case control study, Bahir Dar, Ethiopia

Ser. No.	Title	Qualification (for personnel)	Rate /item unit price	Duration of work/quantity	Total in Birr	Remark
	Personnel costs					
1	Two Nurses	Diploma	100	45X2 persons	9000	
2	Two Med. Laboratory Techs	Diploma	100	45X2 persons	9000	
3	One Microbiologist (Technical Advisor)	Assistant professor	300	15	4500	
4	One Principal Investigator		180	60	10800	
5	One Assistance in the Laboratory	Certificate	50	45X1 persons	2250	
6	Training for data collectors	(Nurses, Med.Lab.Techs)	180	1 X5 persons	900	
	Transport					
7	For principal investigator		Air ticket		1250	double trip
8	For taxi to transport samples to Lab		5 birr	45X1 person	225	
	Reagents and supplies					
9	Campylobacter Agar 500gram		825	2	1650	
10	Campygen 3.5 lit		277	1	277	
11	Kligler Iron Agar 500 gram		910	2	1820	
12	E.coli 0157 latex (1x100 tests)		935	3	2805	
13	EPEC antisera 1x100 tests		935	3	2805	
14	S.dysentry type 1 Antisera		935	1	935	
15	Cary Blair Medium		1421	1	1421	
16	Lysin iron Agar 500gm		929	1	929	
17	Muller Hinton Agar		732	1	732	
18	Nutrient broth 500gm		643	2	1286	
19	Nutrient Agar 500gm		727	1	727	
20	Selenit broth Base 500gm		366	1	366	

21	SS Agar modified)		645	2	1290	
21	Si. citrate Agar 500 gm		761	1	761	
22	Urea 40% 10x5ml		338	2	676	
23	Urea Agar Base 500gm		800	1	800	
24	TCBS Media 500 gm		532	1	532	
25	MacConkey Agar 500 gm (with crystal violet)		735	2	1470	
26	Dextrose Agar 500 gm		149	1	149	
27	Stool cup (standard cupped)		6	350	2100	
28	Kovac's reagent 1x100 ml		450	2	900	
29	Oxidase strips 1x50 tests		390	1	390	
30	ELISA kit for Rota virus isol.	Expected from WHO/EHNRI				
31	Anti. sensitivity discs (packet each)		262	7	1834	
32	Stationery materials				1500	7 types
Total Amount					66080	
2% contingency					1321.6	
Grand Total					67401.6	

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Annexes (annex numbers continued from the previous chapters):

17. Consent form for Questionnaire interview: English Version

Epidemiology and etiology of diarrhea among under five children, case control study, Bahir Dar, Ethiopia

Consent form that certify the respondents agreement before the interview

01. Town _____

02. Name of Health institution_____

03. Questionnaire Identification Number_____

04. Name of respondent_____ Telephone_____

Introduction: My name is ---------- I came from Addis Ababa University, Medical faculty, School of Public Health. I would like to inform you that you and I would have a short discussion concerning this study. Before we go to our discussion, I will ask you to listen carefully to what I am going to read to you about the purpose and general condition of the study and tell me whether you agree or disagree to participate in this study. I am interviewing child care takers visiting for getting health care service for their children < 5 years old visiting Felege Hiwot Hospital in Bahir Dar to assess risk factors of diarrhea, distribution and etiologic agents which predominantly found in stool and cause childhood diarrhea.

The duration of data collection for this study is 45 days and you are selected to be one of the participants in the study. The study will be conducted through interviewing you and laboratory examination of stool from children which only will take an hour without any harm. The information you give us will be kept confidential and will be used only for study purpose. A code number will identify every participant and names will only be used by the principal investigator and interviewer for the sake of treatment. If your result is positive we will contact you with in a maximum of four days after sample collection for treatment. You can buy drugs from the hospital or outside the hospital by yourself after you get prescriptions. If a report of the result is published, only summarized information of the total group will appear.

The interview is voluntary and you have the right to participate, or not to participate or to refuse at any time during the interview. Your refusal will not have any effect on your service you come to get. However, your participation is important to fulfill the study objectives and design appropriate prevention and control measures for diarrhea among under five children in this area and the country at large.

Are you willing to participate in the study? 1. ( ) Yes 2 ( ) No

Thank you!!

If the study subject agrees to participate in the study, start the interview.

Interviewer signature certifying that the informed consent has been given verbally!

Name---------- signature---------- Date----------month----------2011

Checked by supervisor: Name ----------signature---------- date ----------

Principal investigator's (contact person's) name: - Belay Bezabih Beyene

Telephone: 0910612637/0918764416

E-mail:- fiametaye@yahoo.com

18. Questionnaire

Ser. No.	Questions	Characters to be filled for respective questions	Skip to
A.	**Socio-demographic factors**		
1.	Identification number	_____	
2.	Address: Woreda_____ Kebele _____ Name of respondent & Telephone_____	1.Urban 2. Rural	
3.	Child age	_____ (years),	
4.	child's sex :	1.Male 2.Female	
5.	Care taker Sex	1.Male 2.Female	
6.	Care taker Age	_____(years)	
7.	Relation to child:	1. Father 2. Mother 3. Guardian	
8.	Education:	1. Illiterate 2. Primary 3. Junior –secondary 4. /Diploma & above.	

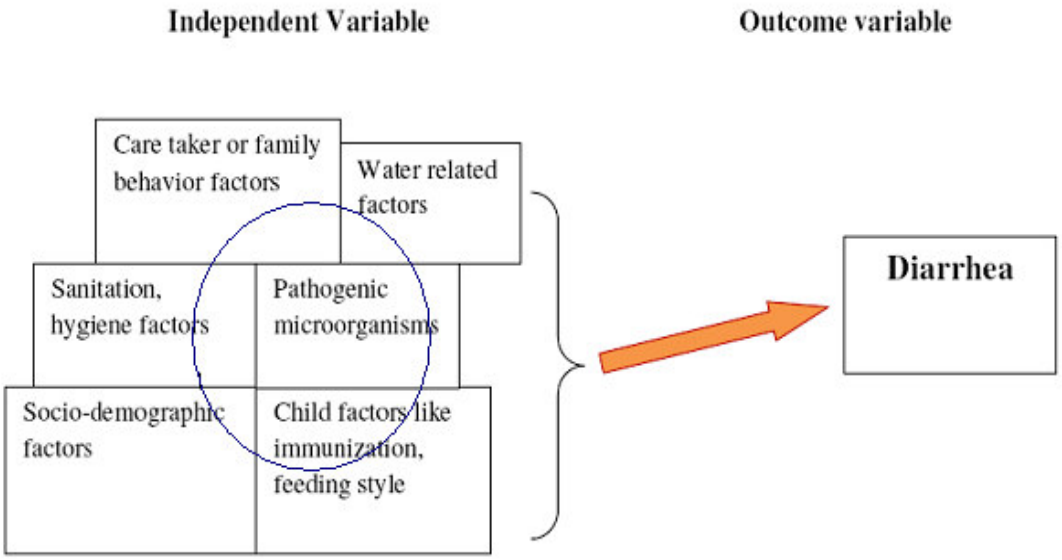
9.	Marital status:	1. Single 2. Married 3. Divorced 4. Widowed	
10.	Ethnic	1. Amhara 2. Tigre 3. Guragie 4. Other	
11.	Religion:	1. Muslim 2. Orthodox 3. Protestant 4. Other	
12.	Occupation:	1. Peasant 2. Employee 3. Merchant 4. House wife 5. unemployed	
13.	Family's income per month:		
14.	How many other children in home		
15.	Total family size		
16.	total rooms in your house		
	CLINICAL DATA - for the case Group		
17.	upper arm circumference	_____mm	
18.	Temperature:	_____^{0}C	
19.	Duration of diarrhea	:_____days.	
20.	Stool frequency per day:	……	
21.	Is there blood in stool?	a. Yes b. No	
22.	Has the child vomiting?	1. Yes 2. No	
23.	Did he encounter diarrhea before?	1. Yes 2. No	
24.	Is there any other person with diarrhea in home/neighbor?	1. Yes 2. No	
B	**Behavioral factors**		
25.	Do you know diarrhea?	Yes No, if no	skip to questi on 32

26.	If yes, what are the main signs/symptoms of diarrhea?	vomiting/bloody/mucoid/watery/nausea/fever	
27.	What do you think the causes of diarrhea in young children?	Indigestible foods/ Teething/germ infection/ Don't know	
28.	Do you give him more fluid during diarrhea?	1. Yes 2. No	
29.	What do you think that diarrhea is transmitted by	mention_____ _____	
30.	Do you know some ways of preventing diarrhea?	1. Yes 2. No	
31.	If yes,	mention_____ _____	
C	**SANITATION and HYGIENE PRACTICES**		
32.	Do you have access to latrine?	1. Yes 2. No	
33.	Do you use it?	1. Yes 2. NO	
34.	How often is the latrine cleaned?	1. Every day 2. 1-2 times a week 3. Not cleaned	
35.	How often you wash your hands after defecation?	1. Yes; Always 2. Yes; sometimes 3. not at all No	
36. 37.	Do you often wash your hands Before feeding your child?	4. Yes; Always 5. Yes; sometimes 6. not at all No	
38. 39.	Do you often wash your hands Before preparing foods for your child	1. Yes 2. No	
40.	Do you store cooked foods for later use?	1. Yes 2. No	
41.	What do you use to clean utensils/containers for feeding your child?	1. Water only 2. Water with soap 3. Chemicals	
42. 43.	How often clean the child with ash/soap after defecation?	1. Always 2. sometimes 3. not at all	

44.	Where do you dispose of household garbage?	1. Pit 2. Open filed 3. Other	
D	**WATER RELATED PRACTICES**		
45.	From what sources do you get your drinking water?	1. Pipe 2. well 3. Spring 4. River	
46.	Do you treat water with chemicals /boil for drinking?	1. Ye 2. /NO	
47.	How do you fetch water from your storage?	1. by deepening 2. inclining 3. with cup always inside the storage	
48.	How often clean water storage?	1. < a week 2. Weekly 3. 2 weeks 4. > 2weeks	
E	**Breast feeding and vaccination status**		
49.	Do you breastfeed your child? (for all ages)	1. Yes 2. /No	
50.	If yes, up to what age did you breast feed your child?	1. ½ years 2. 1 years 3. 2years 4. > 2 years	
51.	Have you exclusively breast feed the child in the first six month of his/her life?	1. Yes 2. No	
52.	Do you use bottle feeding?	1. Yes 2. No	
53.	If yes, at what age you start?	1. Before 6 month 2. ½ -1 years 3. >1 years	
54.	Has the child completed vaccination at age of 1 year old? (Hint: to assess vaccination status at least at the age of 12 months)	Yes/ No	

19. Conceptual frame work

All risk factors have interrelated to each other and in contact with etiologic agents responsible for diarrhea.



20. DUMMY TABLES

Table 20.1: Frequency of diarrhea cases by age and Sex among under five children, Bahir Dar, 2011

Ser. No.	Age	Sex				Total	
		Male		Female			
		Cases	Controls	cases	Controls		
		Number	(%)	Number	(%)	Number	(%)
	< 6 months						
	6 month-<1 year						
	1-<2 years						
	2-<3 years						
	3-<4 years						
	4-<5 years						

Table 20.2: Frequency of isolates of entero-pathogens by type of residency of children Bahir Dar, 2011

Ser. No.	Entero-pathogen	Urban		Rural		Total	
		Cases	controls	cases	controls		
		Number	(%)	Number	(%)	Number	(%)
	Rota virus						
	Shigella flexineri						
	Shigella dysentery type 1						
	Salmonella spp						
	E.coli 0157						
	E.coli (EPEC)						
	Campylobacter spp						
	G. lamblia						
	E. histolytica						
	Cryptosporidium						
	Other intestinal parasites						

Table 20.3: Frequency of risk factors of diarrheal disease among under five children, Bahir Dar, Ethiopia, 2011

Ser. No.	Risk factors		Cases	controls	Total
			Number (%)	Number (%)	
1	**Socio-demographic factors**				
	Age	< 1 year			
		1-2 years			
		3-4 years			
	Child sex	Male			
		Female			
	Care taker age	<18 years			
		18-35 years			
		>35 years			
	Care taker sex	Male			
		Female			
	Religion	Orthodox			
		Muslim			
		Protestant			
	Urban				
	Rural				
	No. of Children	<2			
		>2			
	Education	Illiterate			
		Primary			
		Junior & secondary			
		Collage & above			
	Marital status	Single			
		Married			
		Divorced			
		Widowed			

(Ser.No. 1. continued from table 20.3)	Risk factors		Cases	controls	Total
			Number (%)	Number (%)	Number (%)
	Family income				
	occupation	Peasant			
		Merchant			
		Employee			
		Other			
	House rooms	<3 rooms			
		3 or more			

Table 20.4: Frequency of Breast feeding and other host factors among care takers of under five children, Bahir Dar, Ethiopia, 2011

Ser. No.	Risk factors		Cases	Controls	Total
			Number (%)	Number (%)	Number (%)
2	**Breast feeding and other host factors**				
	Breast feed practice				
	Duration of breast feed	<1 year			
		1-2 years			
		>2 years			
	Exclusive breast feed in the first 6 months				
	Bottle feeding				
	Type of bottle feeding	Formula			
		Cow milk			
	Vaccination at the age of 1 year	Completed			
		Not completed			

Table 20.5: Frequency of Water, Sanitation, hygiene and behavior related factors among care takers of children, Bahir Dar, 2011

Ser. No.	Risk factors		Cases Number (%)	Controls Number (%)	Total Number (%)
3	**Water, Sanitation, hygiene and behavior related factors**				
	Knowledge of Diarrhea	Major symptoms			
		Way of transmission			
		Giving fluid during diarrhea			
	Access to latrine				
	Utilization				
	Cleaning latrine				
	Hand washing after defecation				
	Hand washing Before feeding child				
	Cleaning child feeding utensils	With soap & water			
		Water only			
	Cleaning the child c water after defe.				
	Disposal of garbage	Pit			
		Open field			
	Water source	Pipe			
		Well			
		Spring			
		River			
	Use of chemicals for drinking				
	Style of fetching from water storage	Deepening			
		Inclining			
		By leaving cun in the storage			
	Cleaning water store at least a week				

Table 20.6: Frequency of enteropathogens isolated from under five children with diarrhea and without diarrhea, Bahir Dar, 2011

Ser. No.	**Entero-pathogens**	**Isolated from cases**	**Isolated from controls**	**Total**
		Number (%)	Number (%)	Number (%)
1	Rota virus			
2	Shigella flexineri			
3	Shigella dysentery type 1			
4	Salmonella spp			
5	E.coli 0157			
6	E.coli (EPEC)			
7	Campylobacter spp			
8	G. lamblia			
9	E. histolytica			
10	Cryptosporidium			
11	Other intestinal parasites			

Table 20.7: Bivariate analysis for risk factors of diarrheal disease among under five children, Bahir Dar, Ethiopia, 2011

Ser.No.	Risk factors		Cases	controls	OR	95% CI	P value
			No (%)	No (%)			
1	**Socio-demographic factors**						
	Age	< 1 year					
		1-2 year					
		3-4 year					
	sex	Male					
		Female					
	Religion	Orthodox					
		Muslim					
		Protestant					
	Urban						
	Rural						
	No.Children >2						
	No.Children <2						
	Education	Illiterate					
		Primary					
		Junior & secondary					
		Collage & above					
	Marital status	Single					
		Married					
		Divorced					
		Widowed					
	Family income						
	occupation	Peasant					
		Merchant					
		Employee					
		Other					
	House rooms	>3					
		3or<					

Table 20.7(continued). Bivariate analysis for risk factors of diarrheal disease among under five children, Bahir Dar, Ethiopia, 2011

Ser. No.	Risk factors		Cases No (%)	controls No (%)	OR	95% CI	P value
2.Breast feeding and other host factors							
	Breast feed						
	Duration of breast feed	<1 year					
		1-2 years					
		>2 years					
	Exclusive breast feed at least 6 m						
	Bottle feeding						
	Type of bottle feeding	Formula					
		Cow milk					
3.Sanitation, hygiene and other care taker/family behavior related factors							
	Knowledge of Diarrhea	Major symptoms					
		Way of transmission					
		Giving fluid during diarrhea					
	Access to latrine						
	Utilization						
	Cleaning latrine						
	Hand washing after defecation						
	Hand washing Before feeding child						
	Cleaning child feeding utensils	With soap & water					
		Water only					
	Cleaning the child c_water after defe.						
	Disposal of garbage	Pit					
		Open field					
	Water source	Pipe					
		Well					
		Spring					
		River					
	Use of chemicals for drinking						
	Style of fetching from water storage	Deepening					
		Inclining					
		By leaving cup in the storage					
	Cleaning water store at least a week						

Table 20.8: Bivariate analysis for Entero-pathogens isolated form under five children with diarrhea and without diarrhea Bahir Dar, Ethiopia, 2011

Ser. No.	Risk factors	Cases	Controls	OR	95% CI	P value
		No (%)	No (%)			
5	Enteropathogens					
	Rota virus					
	Shigella flexineri					
	Shigella dysentery type 1					
	Salmonella spp					
	E.coli 0157					
	E.coli (EPEC)					
	Campylobacter spp					
	G. lamblia					
	E. histolytica					
	Cryptosporidium					
	Other intestinal parasites					

Table 20.9: Variables of in diarrhea among under five children that fit to multiple logistic regression, Bahir Dar, Ethiopia, 2011

Ser. No.	Variables	Crude OR (95%CI)	Adjusted OR (95%CI)	P value

21. Stool sample collection and procedures for identification

21.1. Stool sample collection

1. Collect stools (approximately a size of 2 beans or 2 ml) from study subjects in a labeled a clean leak-proof lids container with identification number labeled.
2. Specimens should not be collected from bedpans, as they may contain residual disinfectant or other contaminants.
3. Unpreserved stool should be refrigerated if possible and within a maximum of 2 hours after collection.
4. Specimens that cannot be cultured or processed for any other microbiological or parasitological within 2 hours of collection should be refrigerated immediately.
5. One stool sample will be used for all parasitological, bacteriological and viral identification.

21.2. Procedure for parasite identification

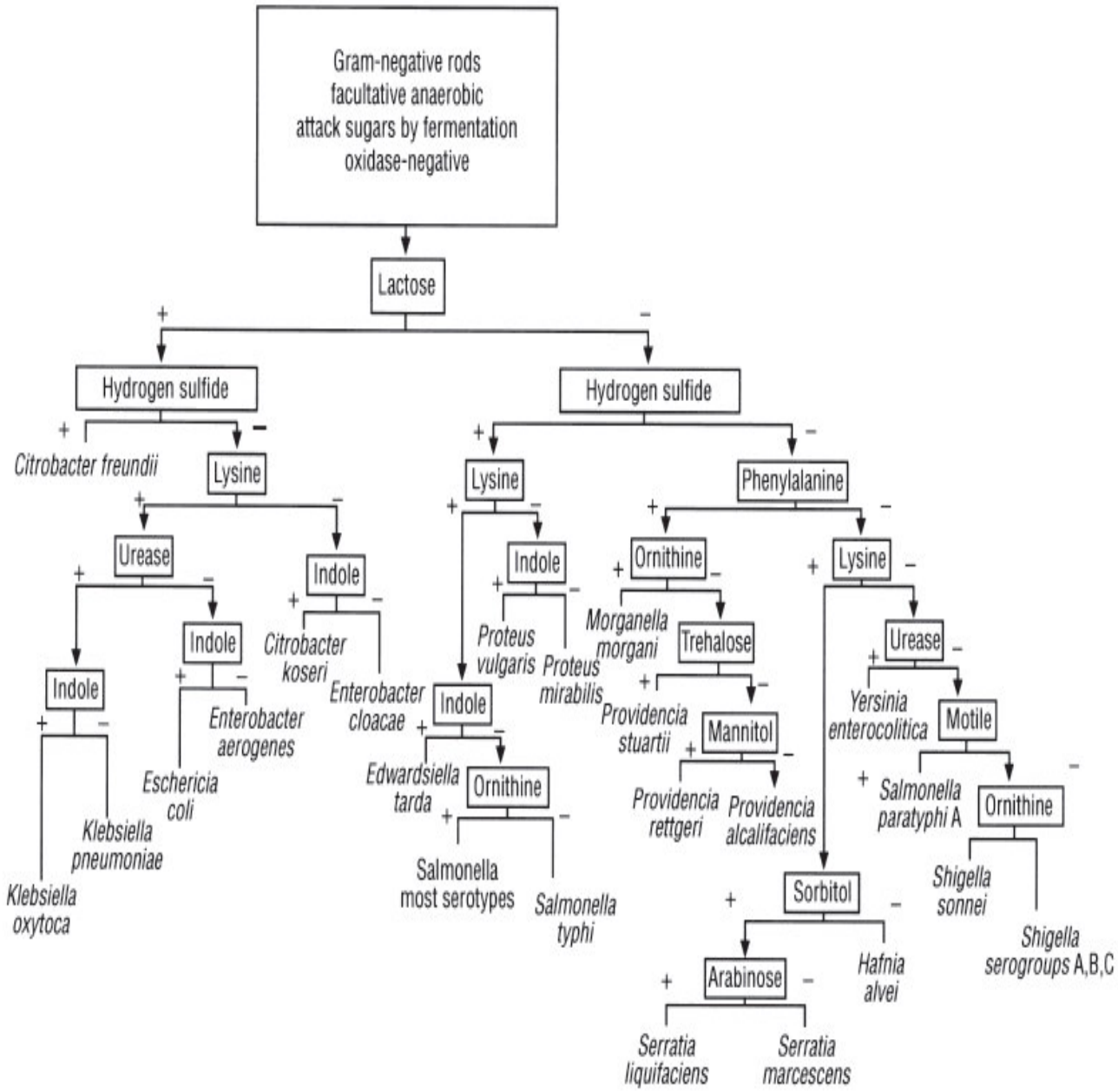
(Source: WHO. Manual of basic techniques for a health laboratory. Geneva; 2003, Second edition: 108)

1. Take a dry microscope slide and label it with the name or number of the study subject.
2. Put one drop of sodium chloride solution warmed in the middle of the slide;
3. Using an applicator or wire loop, take a small portion (about 2–3mm diameter) of the stool.
   a. If the stools are formed, take the portion from the centre of the sample and from the surface to look for parasite eggs.
   b. If the stools contain mucus or are liquid, take the portion from the mucus on the surface or from the surface of the liquid to look for trophozoites.
4. Mix the sample with the drop of sodium chloride solution on the slide and discard the applicator (or flame the wire loop) after use.
5. Place a coverslip over the drop and avoid the formation of air bubbles
6. Examine the preparations under the microscope in x10 and x40 objectives
7. Record results in reporting sheet

21.3. Procedure for bacteria identification

Appropriate media and procedures in the kit insert as per the manufacture instructions will be followed and the WHO guideline from page 41-50 in reference no. 53) and the flow chart below will also be utilized.

22. Flow diagram for preliminary identification of Enterobacteriaceae (enteric pathogens)



Chapter IX – Other Additional Output Reports / Works

9.1. Antimicrobial resistance and antimicrobial prescription patterns and relations in Ethiopian Regional Hospitals, 2010 (project proposal)

9.2. Technical Support and Monitoring of AWD Outbreak Interventions in Oromiya – July 2009

9.3. Training for Health professionals working at regional , zonal, district and health facility level on public health emergency priority diseases(public health surveillance and response)

9.4. **Published manuscripts in peer review journals**

a. Prevalence of *Salmonella typhi* and intestinal parasites among food handlers in Bahir Dar Town, Northwest Ethiopia [Bayeh Abera, Fantahun Biadegelgen, **Belay Bezabih**. Ethiop. J. Health Dev. 2010;24(1):46-50]

b. Antimicrobial susceptibility of v. cholerae in North West Amhara, Ethiopia (Bayeh Abera, **Belay Bezabih**, Azene Dessie, 2010. Ethiop Med J, Vol. 48, No.1)

9.1. Antimicrobial Resistance and Antimicrobial Prescription Patterns and Relations in Ethiopian Regional Hospitals, 2010

Belay Bezabih, Ghidey G/libanos, Mer'Awi Aragaw

Background

Although many patients, especially in sub-Saharan Africa, continue to die as a result of inadequate access to antimicrobials, an emerging problem globally is the widespread indiscriminate use of antimicrobials, especially antibacterial agents. Antimicrobial resistance costs money, livelihoods and lives and threatens to undermine the effectiveness of health delivery programs. It has recently been described as a threat to global stability and national security (1) Despite the enormous advances in health care in the last half-century, infectious diseases still account for 25% of deaths world wide and 45% of deaths in low income countries (2). Excess mortality rate due to antimicrobial resistant strains was also shown in different studies (3).

Antimicrobial use is the most important factor and key driver responsible for increased antimicrobial resistance(4) However, poverty and inadequate resources, natural calamities, human population growth, user-related factors, health care related factors, health service provision centers, policy and regulatory issues and use of antimicrobial drugs in veterinary are responsible risk factors for antimicrobial resistance in developing countries(5).

Origin and Mechanisms of Drug Resistance

Resistance may be inherent or acquired (6). Anaerobic bacteria, Enterococcus species are inherently resistant to aminoglycosides (7). Acquired resistance can be developed by mutation or gene transfer. Gene transfer can occur through transformation, transduction and conjugation. Mutation may occur in the gene encoding target protein, transport protein, protein for drug activation or promoter or regulatory gene affecting expression of the target transport protein or an inactivating enzyme (8). The well known mechanisms of drug resistance are; a) Inactivation of the drug: very common, for example, production of beta-lactamase by staphylococci. The enzyme which is plasmin coded destroys the betalactam ring responsible for the antibacterial activity of penicillins. b) Altered cell wall permeability: So that the drug is unable to enter the organism (for example, tetracycline resistance in Pseudomonas aeruginosa. c) Modification of the active site of the drug: modification of the enzyme or substrate with which the antimicrobial agent reacts enables the organism to function normally despite the presence of the drug, for example, Trimethoprim resistance where the bacterium acquires a plasmid or transposon coding for an enzyme with which the drug cannot interact (9).

Epidemiologic studies have also repeatedly demonstrated the influence of antimicrobial use on the emergence, persistence, and transmission of antimicrobial resistant bacteria (10). In two studies (11, 12) a close association

between the use of fluoroquinolones and the increase in the incidence of multi drug resistanct E.coli was observed. Other different studies also showed the correlation/association between antimicrobial drug use antimicrobial resistances (e.g. S. pneumonia resistance to penicillin use) in Europe (13-16).

A study in Finland demonstrated that Erythromycin resistance among group A streptococci decreased from 16.5-8.6% over a four-year period during a nationwide program relying on national guidelines to limit the use of Erythromycin (17). Other studies in the United States show that decreased use of antibiotics for prophylaxis and treatment correlated with decreasing rates of colonization with resistant organisms (18).

Geographical variation in antimicrobial resistance was also shown by different studies which is an indication of the importance of the numerous and interrelated factors driving the problem (19, 20). So, to better understand national, regional and local trends of antimicrobial resistance, it is important to critically assess national data on antibiotic consumption (21).

The drug administration and control authority (DACA) organized an antimicrobial resistance (ARM) stakeholders' meeting on March 2, 206, at Hilton Hotel in Addis Ababa in collaboration with RPM plus/ MSH and indicated that ARM is a growing problem in Ethiopia (22). Several studies were also conducted and indicated the prevalence of antimicrobial resistance for different bacterial isolates in different localities. To see some of them; A study in Gondar College of Medical Sciences Teaching and Referral Hospital that > 68% of isolates were resistant to two or more antimicrobials (23). In a study done at Gondar Health center, only 7.7 % of them were sensitive to cotrimoxazole, 87.5% were multi drug resistant, and one strain was resistant to as many as 8 antibiotics, including ceftiaxone (24). In a study conducted in Jimma Hospital during 1997/98, 25 (41%) of the 61 Staphylococcus aureus nosocomial infection isolates were found methicillin-resistant (25). It was also indicated the prevalence of multi drug resistance tuberculosis (MDR-TB) which is about 1.2% in new cases and 3.5-12% in re-treatment cases of pulmonary tuberculosis (PTB) (26, 27).

A study in a teaching hospital in Gondar, North-West Ethiopia showed seventy percent of the study subjects had received one or more anti-microbials. Most exposure was in surgical ward (84%) followed by pediatric (82%). Orthopedic (78%), medical (72%), gynecologic (58%) and obstetric (20%) wards. The antimicrobials most frequently prescribed were penicillin G (25%), followed by Chloramphenicol and Ampicillin (28). Other two studies in Ethiopia were also carried out to assess rational drug use and prescription patterns and indicated in a minimal drugs/encounter percentage (<2.5%) and other important points (29, 30).

However, studies in this issue are limited and we did not get any that showed about antibiotic prescription or usage trends, patterns and its relation with antibiotic resistance in Ethiopia. So this study may give some important views on the condition of antimicrobial resistance and antibiotic use in the country.

Significance of the Study

The study is useful to support and guide the empirical treatment for clinicians and dispensaries and aware in the containment of antimicrobial resistance by showing the national antimicrobial resistance and consumption pattern in the country.

General Objectives

The overall objective is to describe the epidemiology of antibiotic resistance pattern and relations with antibiotic prescription in three Regional Referral Hospitals of Ethiopia.

Specific Objectives

To assess antimicrobial prescription frequencies and resistance patterns

To determine the quantity of antibiotics prescribed for the diagnosed disease in each Hospital

To compare the type and frequency of antibiotic prescription among hospitals and in different units within a Hospital

To identify multi drug resistant pathogens and see the relation of resistance and prescription rate

Methods and Materials

Study area, period and population

The study will be conducted in three regional referral Hospitals: Mekele, Bahr Dar and Hawassa between January 01-10, 2010 at outpatient and inpatient units of the hospitals.

Study Design

A cross-sectional study will be employed and antibiotic resistance data will also be reviewed at three regional referral laboratories which are found in the study areas to get complete information and describe the data well for the intended objective.

Sample Size and Sampling Technique

All patients received antibiotic treatment during the study period will be included in the study. A five year antimicrobial resistance data will also be reviewed and included to the study from regional health laboratories which are found in the regions of each respective hospital.

Data Collection

A structured questionnaire will be used to collect information like type and number of antibiotic prescriptions, main diagnosis, microbiological findings, socio-demographic and Hospital details.

Statistical analysis

Data will be entered into a computer using Epi-info version 3.3.2 to analyze and see the relation of antimicrobial use and resistance rate and other relevant results.

Ethical Consideration

Ethical clearance will be obtained from the Research Ethics Committee of the School of Public Health (SPH) and Institutional Review Board (IRB) of the Faculty of Medicine (FOM), Addis Ababa University (AAU). Official permission will be secured from Regional Health Bureaus (RHBs) of the three Regional Hospitals. Respondents will be informed about the objective of the study and a verbal consent will be obtained from each respondent before the interview.

Work Plan

The activities for this research work are presented in table 9.1.1 below.

Table 9.1.1: Work paln of an antimicrobial resistance and antimicrobial prescription patterns and relations in Ethiopian regional hospitals, 2010

Ser. No.	Activity	Time	Responsible	Remark
1	Research proposal write-up First draft	Nov 30- Dec 17/2009	Investigators	
2	Review, Finalize and submission of proposal	Dec 18-23/2009	Investigators And advisors	
3	Approval and funding	Dec 24-30/2009	EPHA	
4	Data collection	January 01-05/2010	Investigators And data collectors	
5	Analysis	January 06-15/2010	Investigators	
6	Finalizing Document	January 16-23/2010	Investigators And advisors	
7	Dissemination and power point presentation to respective bodies	January 24-30/2010	Investigators	

Budget

In order for the project to attain the required objectives it needs an adequate allocation of budget for human, material and other resources. The number of data collectors are set according to the Hospital units, number of days also are planned to fit the forecasted sample size.

Table 9. 1.2: Detailed budget breakdown for an antimicrobial resistance and antimicrobial prescription patterns and relations in Ethiopian regional hospitals, 2010

Ser No.	Budget category	Unit cost	Multiplying factor	Total cost	Remark
1	Personnel	Daily wage	No of staff x d		
2	Principal investigators	180.00	180x3x20	10,800.00	
3	Data collectors in outpatients, ward and laboratory units	100	(100x14x5d) 3 sites	21,000.00	
4	Training for data collectors	20	(100x14) 3 sites	4,200.00	
5	Refreshment (tea break) for training		(20x14) 3 sites	840.00	
6	Transportation		1500x3 sites	4,500.00	
7	Paper trim (for printing)		30 packs of 450/400 pcsx100	3000	
8	Questionnaire Photocopy		1x200.00	200.00	
9	Writing pen		72 pcs x 2.00	144.00	
11	Pencil		72 pcs x 1.00	72.00	
12	Eraser		36 pcs x 3.00	108.00	
13	Sharpener		36 pcs x 4.00	144.00	
14	Contingency 5%			2250.4	
Total cost				47258.4	

Dummy Tables

Table 9.1.3: Total number of patients received antibiotics by Age and sex, January 1-10/2010

Ser. No	Age Group	Sex		Total
		Male	Female	
1	0-5			
2	6-14			
3	15-55			
4	> 56			

Table 9.1.4: Distribution of total number of patients received antibiotics, number of prescribed antibiotics and clinicians / prescribers in the three Hospitals, January 1-10/2010

Ser. No	Name of Hospital	Number of Antibiotics Prescribed	Number of clinicians/ prescribers
1			
2			
3			

Table 9.1.5:Trend of antibiotics prescriptions in different Hospital units between January 1-10, 2010

Ser. No	Hospital Unit	Days of data collection in the Month of January									
		1	2	3	4	5	6	7	8	9	10
1	Surgical										
2	Medical										
3	Gyn/Obs										
4	Pediatrics										
5	Adult OPD										
6	Child OPD										
Total											

Table 9.1.6: Distribution of prescription percent and Resistance rate (in RHL) for selected Antibiotics, 2010

Ser. No	Antibiotic	Prescription %	Resistance % (in RHL)	Correlation
1				
2				
3				
4				
5				

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Annex 23: Questionnaire

Antimicrobial resistance and antimicrobial prescription patterns and relations in regional hospitals, Ethiopia January 2010

1. Name of the Hospital _____

2. Patient code Number _____

3. Age _____ 4. Sex _____

5. Address: Region _____

District _____ Kebele _____

6. Date patient received the antibiotic treatment _____

7. Name/ Type of Antibiotic the patient received:

7.1. _____ Dose _____ duration _____(PO/IM/IV)

7.2. _____ Dose _____ duration _____(PO/IM/IV)

7.3. _____ Dose _____ duration _____(PO/IM/IV)

8. Total Number of Antibiotics received in the current visit:

8.1 One 8.2 Two 8.3 Three

9. In which Hospital unit did the patient get the treatment?

9.1 Medical Ward 9.2 Surgical Ward 9.3 Gyn/Obs

9.4 Adult OPD 9.5 Child OPD 9.6 Paediatrics ward

10. Was there any microbiological finding for this particular patient?

10.1 Yes 10.2 No

11. If the answer for Question 10 is Yes, Specify _____

12. What were the symptoms for the diagnosed disease?

12.1 _____

12.3 _____

12.3 _____

12.4 _____

12.5 _____

13. What was the disease diagnosed for this patient?

Specify _____

14. What was the total number of prescriptions you made for this day? _____

15. What was the total number of patients seen today? _____

Thank You for completing this questionnaire

9.2. Technical Support and Monitoring of Acute W atery Diarrhea Outbreak Interventions in Oromiya Regional state, Ethiopia – July 2009

Abyot Bekele[1], **Belay Bezabih[2],** Sirak Solomon[3], Karanja Gikongo[4], Biar Kwai[4]

Smmary of report

AWD became a priority concern of public health emergency in the country. The national working groups on AWD decided & send a team to Oromia, which is one of the most affected, for technical support and monitoring on AWD outbreak intervention activities from regional to woreda level.

A total of 3413 cases were registered from the affected woredas of three Zones (West Arsi, Arsi & East Shewa) until 21/07/2009.

Except in West Arsi the zonal multisectoral EPRC was not active enough & in all woredas also the committee was functional but had no regular meeting. All woredas has shortage of drinking water treatment chemicals & kits, the financial flow & distribution of supplies from region to woredas was very slow & the problem of operational cost & vehicle is serious. Lack of Guidelines for case management, infection prevention & materials for promotion of hygiene & sanitation, absence of registering & reporting deaths in CTCs was observed. All the visited woredas has no access to safe drinking water supply & very low latrine utilization.

The team was tried to address the identified problems through discussion at different levels (failed to get regional & east Shewa zone multisectoral EPRC), providing orientation & distribution of guidelines to the CTCs.

The epidemic trend of the disease is falling down in all three zones; however it needs strong coordinated interventions with the involvement of political leadership, NGOs & the community to avert the disease transmission & not being a threat any more in the area.

1. Ethiopian Health and Nutrition Research Institute / Public Health emergency Management Director Office (EHNRI/ PHEM)
2. Addis Ababa University, School of Public Health, The Ethiopian Field epidemiology and Laboratory Training Program (AAU/SPH/EFELTP) Resident
3. World Health OrganizationSurveillance Officer, Oromiya Regional office, Ethiopia
4. UNICEF- Water and Sanitation emergency unit

Background

Acute watery diarrhea became a problem in West Arsi, Arsi & West Shewa zones from 23/8/ 2009, 14/10/2009, & respectively. West Arsi Zone especially Shashemene & Kofele woreda are most affected by the epidemic.The outbreak has been on-going for more than two & half months. The national task force on epidemic response sent a team for technical support & monitoring on AWD outbreak interventions to the affected areas on 16th July 2009.

Objectives

- To reactivate the multi-sectoral epidemic preparedness and response committee at regional, zonal & woreda levels.
- To make site visit with local representatives & assess the intervention activities in the control and prevention of the outbreak.
- To give technical assistance and support based on the identified gaps & make debriefing / discussion session at all levels (Regional, Zonal, Woreda & case treatment centers).

Methods

In order to address the objectives of the mission, the team used the following methods:-
Observation of the visited case treatment centers (CTCs) & water sources, interviewing key informants using the standard acute watery diarrhea (AWD) check list & other individuals from the community, attending cross-sectional survey presentation on the outbreak and discussion with all concerned bodies.

Major Findings

Case Management in CTCs: 1. West Arsi

In all the CTCs the available cholera beds were not being used for cases. In Shashemene hospital CTC; shortage of HW is critical (only one health worker was managing 15-20 cases at a time) while the hospital has enough HWs (nurses, Health officers, GPs, medical students & specialists). In all visited CTCs including the Shashemene hospital children with malnutrition plus AWD were not managed well with the OTP protocol;

The major problems were:-Periodical laboratory confirmation of AWD for under 5 children & screening of malnutrition was not carried out (in Shahemene & Shala CTCs proportion of under 5 AWD cases were high than other age category). Malnourished cases were kept in CTCs; Anthropometric measurement was not taken even in the CTCs where trained HWs were present & no OTP protocol in CTCs. Except in Arsi Negele, in other CTCs Severe Acute Malnutrition (SAM) was being treated with ORS and ringer lactate instead of risomal solution (which is available in the zone). The pediatric cases of AWD were treated with cotrimexzole while Erythromycin is available. Albendazole is not available to treat intestinal helminthiasis. All CTCs visited in this zone had received water treatment chemicals & water treatment kits, disinfectants which were being used. Some CTCs (ex: Shashemene hospital) where located in health centres with no water supply scheme and water has to be trucked from other sources & it was observed that the available water was not adequate for proper sanitation and hygiene practice in the CTCs. In majority of the CTCs visited, there was no display of any promotional materials on safe sanitation & hygiene practices and water treatment messages (like in posters) & no information was being given to either the recovered patients or their care-takers.

Figure 9.2.1: AWD cases were sleeping in Sponge Mattress while cholera bed is available, Shashemene hospital CTC

Figure 9.2.2: Malnourished child with suspect AWD on IV fluid treatment

Figure 9.2.3: EMWAT kit supplied by UNICEF for water treatment positioned at the source so as to benefit as many people near to Kassa CTC site, Shashamane, July 2009

Actions taken

In regard to the malnutrition management; the team has discussed with HW in CTCs about the importance of using the OTP guideline and demonstrated the anthropometric measurements (like MUAC & others) and recommend pediatrician evaluation to children with complication. During revisit the team reassured the use of Erythromycin instead of Co- trimoxazole in Shashemene hospital and presented the seriousness of the problem to the ZHD Head during debriefing. In regard to Advocacy & social mobilization of the community in the control & prevention measures of the disease was discussed & agreed to be done in continuous manner using key messages. The team also raised the issue of unsafe water supply in the CTC and the zonal health department representative promised to take action and assured that water will be trucked to the CTC from the next day.

Recommendations

A multi disciplinary national team composed of FMOH, RHB, WHO, UNICEF and other partners should make urgent field visit to West Arsi with the following tasks:

- Monitor and evaluate the prevention and control activities of AWD in the community
- Provide technical assistance and reorganizing the case management of malnutrition plus AWD especially in Shashemene hospital such as;

- Introduce and familiarize the OTP protocol, provide the OTP guideline and MUAC tapes,
- Health experts including pediatricians & those with management skills in nutrition/OTP working in Shashemene hospital should be involved in supporting the CTC
- Take stool samples for confirmation test in CTCs where most of the cases are under 5 children.
- Reassure use of cholera beds in all CTCs & avail Albendazole for IP treatment.
- Adequate water should be supplied and stored in the CTC for safe sanitation and hygiene practices and water with disinfectant always made available for hand-washing.

2. Arsi Zone:

The first onset of the disease was on 21/06/2009. A total of 293 cases (262 in Merti & 31 in Jeju woreda) & only one death were reported. The epidemic curve is shown in the graphs below;

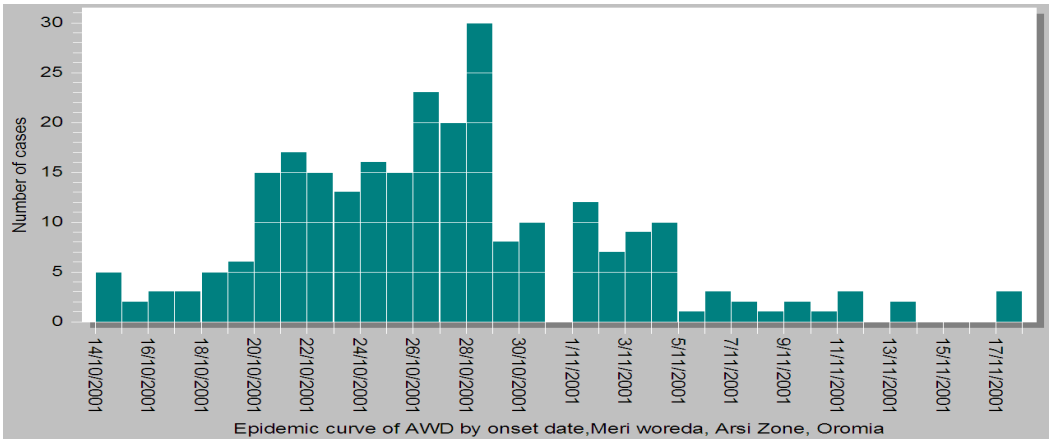

Figure 9.2.4: Epidemic curve of AWD by onset date in merti woreda, Arsi zone, Oromia from 21/06/2009-24/07/2009

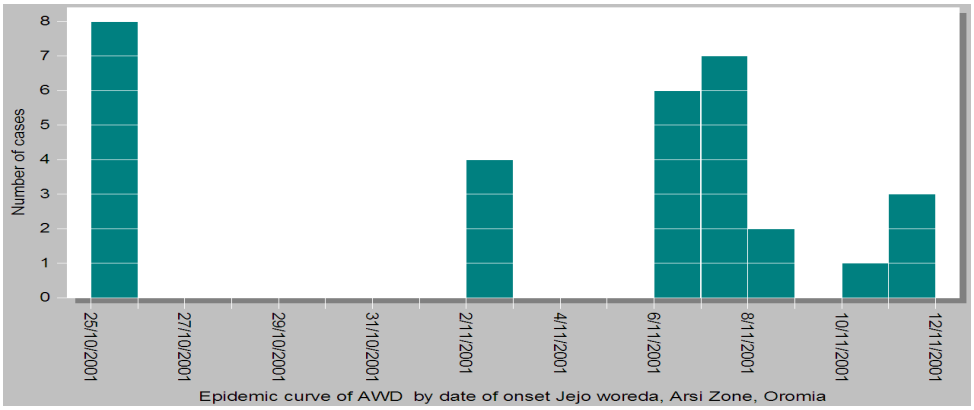

Figure 9.2.5: Epidemic curve of AWD by onset date in Jeju woreda, Arsi zone, Oromia from 02/07/2009-19/07/2009

In all visited CTCs no AWD guidelines were available & although cholera beds & OTP protocols were available, they were not being used. In Merti woreda, Golgota CTC had no clean water supply for 2 days at the time of visiting due to shortage of budget for fuel to transport pure water. CTCs in Jejo woreda which are inactive in terms of preparedness for new case occurrence, HWs were not at work place, case registration log book was not available & no water supply. No case reported from Merti state farm & its clinic was treating cases coming from the community and daily workers from private farms. It has safe water supply facility and the management is engaged in prevention & control of the disease.

In majority of the CTCs visited, there was no display of safe sanitation & hygiene practices and water treatment messages using posters and no such information was being given to either the recovered patients or their care-takers.

Figure 9.2.6: The team discussing with health workers in Golgota CTC site, July 2009

Actions Taken

The team together & zonal surveillance officer has discussed with HW in the CTCs; reluctance on the current situation is dangerous so that preparedness and response in case management and WASH should be continued actively until 45 days of zero report achieved. Guideline on AWD management & and water treatment provided to CTCs. The team held a meeting with the Zonal Administrator, Zonal Water Resource, Zonal Environmental Protection and Zonal Health Offices & discussed well. The issues were summarized below;

- The zone decided to bring private farms on board for better involvement in epidemic preparedness and response such as provision of basic health facilities and safe water supply to daily laborers
- Strengthen multi-sectoral epidemic preparedness and response committee & have regular meeting
- Strengthening of the preparedness and response in the non affected weredas.

Recommendations

- Social mobilization and advocacy should continue in sustainable manner with M&E activities to be carried out by all levels.
- The responsible body shall provide technical assistance to the zone in bringing on board private farms to involve in epidemic preparedness response to the zonal administration in matter.
- At higher level, the MoH or investment management authority should work together to ensure access to basic safe water supply and access to sanitation facilities for farm workers.
- Intensify sanitation and hygiene promotion in the communities with close monitoring to ensure effectiveness of the campaign activities.

3. East Shewa

Boset woreda: A total of 424 cases & only 2 deaths were registered in Boset woreda. The first onset date of the disease was on 19/06/2009 as shown in figure 9.2.7.

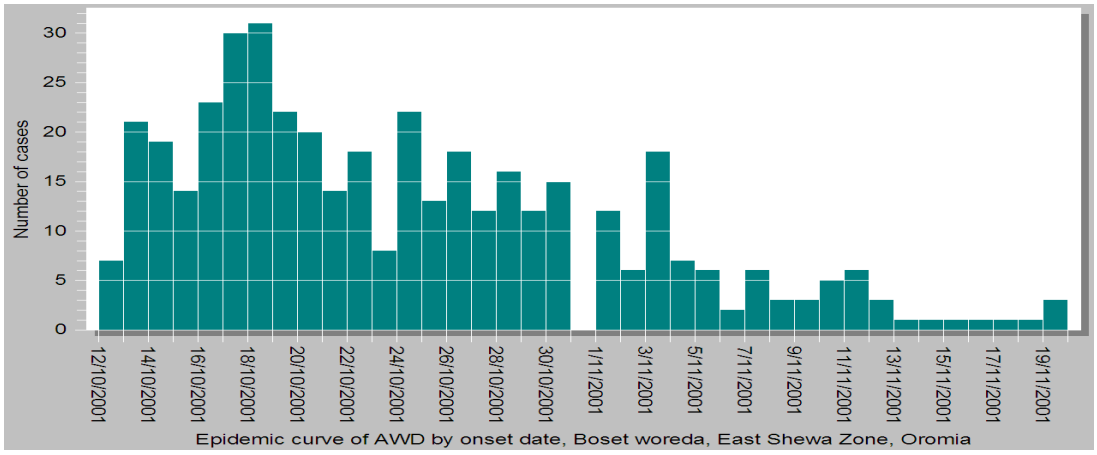

Figure 9.2.7: Epidemic curve of AWD by onset date in Boset woreda, East Shewa zone, Oromia Region from 19/06/2009-19/07/2009

Bole health center CTC:

No training on AWD & malnutrition management for HWs (even onsite), no OTP manual, cholera beds are not well in use, bathing and latrine rooms are not well maintained (potential source for infection).

Logistics: Shortage of pediatrics canula and antibiotics, no water pure and Water guard is being used for turbid water (Awash River is used for drinking), food & protective clothing support for daily laborers in the area when they attend to the sick at the CTC.

Coordination (woreda multisectoral EPR committee):

Regular meeting was interrupted for 5-7 days (other competing priority in the woreda), monitoring & evaluation, advocacy & social mobilization was not done.

Fentale Woreda:

A total of 333 cases were registered, but no death. The epidemic curve is shown below.

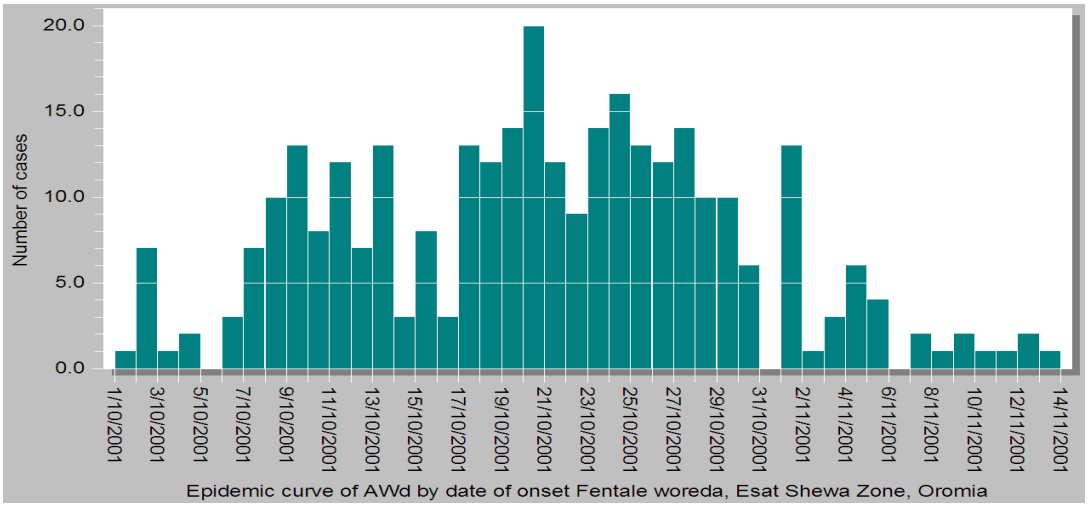

Figure 9.2.8: Epidemic curve of AWD by onset date in Fentale woreda, East Shewa zone, Oromia from 08/06/2009-21/07/2009

Metehara health center CTC:-

Rooms are not separated as screening/ observation/ admission, recovery, no bathing room & different %ages of chlorine are not prepared for different purposes, latrine was not cleaned (was full of dirt & used materials in the seat).

No guideline for case management, treating drinking water& infection prevention, HWs are not oriented how to work in CTC, co-trimoxazole was used for AWD. Shortage of medical supplies (ORS, RL, & antibiotics), no water pure and latrine utility is only 28% in the surrounding communities.

While the CTC was well supplied with water from the town water system, there was no chlorine disinfectant and hand washing was being done with untreated water. No disinfection of the latrine or compound was observed. The medical waste was scattered all over the compound including bloody cotton wool, used hand gloves, syringes and needles with some dumped in latrine and some just sprawling on the latrine floor. The situation in the CTC might expose the patients, care givers and the HWs to various infections including HIV.

There was no display of safe sanitation & hygiene practices and water treatment messages by e.g. posters etc and no such information was being given to either the patients on recovering or their care-takers.

Figure 9.2.9: Metehara health center CTC latrine condition, Fentale woreda, East Shewa, July 2009

Multisectoral EPR committee (Task Forces):

Meeting of the woreda multi-sectoral committee was interrupted 10 days back, monitoring and evaluation of the advocacy and social mobilization was not conducted & generally leadership was reluctant for the issue.The

woreda was visited on 24 th of July 2009The federal team couldn't get the zonal multi-sectoral epidemic emergency preparedness (EPR) committee.

Actions taken

- Guideline on AWD management and water treatment provided to CTCs.
- The team had express its concern the danger of negligence in waste disposal in the CTC.
- Debriefing made to woreda administrator, water and health offices. The main points of discussion summarized below;
- The woreda take responsibility to correct the the waste disposal activities.
- On job training to the HWs should be planned & the water pure from the zone should be transported to the woreda soon.

Recommendations

The RHB with ZHO should give attention & monitor basic intervention activities of the woreda multi-sectoral epidemic preparedness & response committee; such as in CTC management in terms of infection prevention and WASH related activities, Safe handling of medical waste to avoid contamination at the CTC, in addressing key messages to mobilize the community against AWD.

WASH supplies should be re-stocked as already available (supplied by UNICEF) at the zonal office and effective communication and follow-up should ensure supplies are replenished timely before they get exhausted to avoid lack of supplies that could lead to poor sanitation & hygiene at the CTC hence causing health threat through contamination.

Figure 9.2.10: Undistributed supplies for AWD response in Zonal health department, July 2009

Operational & logistics costs

- Need for independent monitoring of AWD response as due to status quo the brief reports from the filed may not highlight some critical issues that would require immediate attention for a timely and effective response which would subsequently reduce chances of losing lifes.
- For far-off/remote woredas/areas, the health department should maintain minimum level of supplies as part of their preparedness plans.
- From past experience, the high risk woredas or areas should map the time the surveillance mechanism should be intensified for AWD with HEW including AWD awareness and preparedness messages. Communication mechanism for response and support request mechanism should be worked out at the on-set of emergency response to ensure smooth, adequate and timely response.

Annex 24: Visited places

1. Kuyara hospital case treatment center (CTC)
2. Bulchana health center CTC
3. Awasho CTC
4. Kersa CTC
5. Kersa emergency water treatment
6. Kofele Health Center CTC
7. Awara CTC
8. Arsi Negele Health center CTC
9. Golgotha CTC
10. Abadiska Health center CTC
11. Tesfahiyot Health center CTC
12. Bole CTC
13. Metehara Health center CTC
14. House to house visit
15. Health office at each level

NB. During CTC visit the presence of Appropriate Latrine, bath room, screening room, observation room, admission room, recovery room, neutral room, washing materials, disposal system, disinfection chemicals availability, foot path, guidelines, and all CTC materials were ensured

Annex 25: persons met

1. West Arsi Zone Health office head
2. West Arsi Zone emergency preparedness and response committee
3. Shashemene town woreda Health office head with technical sub-committee
4. Shalla Woreda Health department head
5. Kofele woreda health office head with technical and surveillance sub-committee
6. Arsi Zone Health office head
7. Arsi Zone emergency preparedness and response committee
8. Merti Woreda health Administration

9. Merti State farm director
10. Boset woreda health department head
11. Boset woreda Emergency Preparedness and Response committee
12. Fentale woreda health department head
13. Fentale woreda Emergency Preparedness and Response committee

NB. Emergency Preparedness and Response committee includes Administration, Health office head, water office head, Municipality expert, Education office representative, Information office expert, Police, environmental health expert, Agricultural office head

9.3. Provision of training for Health professionals primarily on surveillance & response

1. Training for Health workers who will train (TOT) urban Health extension workers in Addis Ababa and other regions on public health surveillance
2. Training for public health emergency officers in Amahara Region at four training sites for four days in each site
3. Training for public health emergency officers in Benshangul Gumuz for three days

9.4. Published manuscripts in peer reviewed journals

9.4.1. Prevalence of *Salmonella typhi* and intestinal parasites among food handlers in Bahir Dar Town, North west Ethiopia [Bayeh Abera, Fantahun Biadegelgen, **Belay Bezabih**. *Ethiop. J. Health Dev.* 2010;24(1):46-50]

9.4.2. Antimicrobial susceptibility of *v. cholerae* in North West Amhara, Ethiopia (Bayeh Abera, **Belay Bezabih**, Azene Dessie, 2010. *Ethiop Med J, Vol. 48, No.1)*

9.4.1. Intestinal parasites and S. typhi among food handlers in Bahir Dar Town, Ethiopia

Bayeh Abera[1], Fantahun Biadegelgen[1], Belaye Bezabih[2]

Abstract

Background: Food handlers play major role for the epidemiology of food-borne diseases.

Objectives: This study was aimed at exploring the prevalence of intestinal parasites, *S.typhi* and risk factors among food handlers at Bahir Dar town.

Methods: A cross -sectional survey was conducted among food handlers were working in the kitchens. A pre-tested structured questionnaire was used for collecting data. Stool samples were investigated for intestinal parasites and *S.typhi* as per the standard laboratory methods.

Results: Among 384 food handlers, females comprised 78%. The majority (96.6%) was young adults (12-40 years). The median year of service was 1 year (1 month to 24 years). All food handlers had had no previous any medical checkup and only 14% were certified. One hundred fifty eight (41.1%) food handlers had intestinal parasites and 6 (1.6%) were found positive for *S. typhi*. Of theses, 25 (6.5%) were suffering from diarrhoea. Nine species of intestinal parasites, 2 protozoa (*E. histolytica/dispar 12.76%* and *G. lamblia 7. 0%)* and 7 helminthes (*A. lumbricoides 11.7%, Hookworm 8.1%, S. stercoralis 2.86%, S. mansoni 1.8%, Taenia species 1.3%, H. nana 0.5% and T. trichiuria 0.5%)* were detected.

Conclusion: Inexperienced and poor personal hygiene food handlers play a role for transmission of food born infections. Intervention measures such as in-service health education on food safety and hygienic practices, medical check up including periodic stool examination need to be implemented in the study area.

Key words: Intestinal parasites, food handlers, S. typhi and Bahir Dar town

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Introduction

Food borne diseases are a public health problem in developed and developing countries. World health organization (WHO) estimated that in developed countries up to 30% of the population has been suffering from food borne diseases each year whereas in developing countries up to 2 million deaths estimated per year(1,2) Intestinal parasitic infections are public health problem especially in the developing countries. Studies indicated that intestinal parasitic infections results in malnutrition, morbidity, mortality and socioeconomic impact owing to treatment cost and hospitalization (3). Intestinal parasites, which have direct life cycle, are transmitted by faecal oral route to human through poor personal hygiene (4, 5).

S. typhi is one of the major causes of food and water borne gastroenteritis in human (6) and remains an important health problem worldwide. An estimated 16 million new cases of typhoid fever each year, with 600,000 deaths (7). The emergence of antimicrobial resistant *S.typhi* including chloramphenicol has been an issue (8). Studies had demonstrated that food handlers harbour *S.typhi* asymptomatically (9, 10, 11).

Food handlers with poor personal hygiene and inadequate knowledge on food safety could be the source of food borne pathogens (12, 13). The consequence of food contamination varies among countries and regions of the world depending on climate, geography and degree of social and economical development (13).

Bahir Dar town is the capital of Amhara National Regional State and one of the tourist destinations in North West Ethiopia. In this town, eating and drinking in food services establishments, such as hotels, restaurants and snack bars is becoming a common practice. Information on intestinal parasites, *S. typhi* and risk factors among food handlers in the study area is limited. Thus, this study was aimed at determining prevalence of intestinal parasites, S *.typhi* and exploring risk factors among food handlers working in food service establishments at Bahir Dar town.

Materials and Methods

A cross sectional survey was conducted among food handlers working in food service establishments at Bahir Dar town in April 2009. Food handlers working in the kitchens from 15, 45 and 35 higher, medium and lower food service establishments respectively were enrolled. Each studied participants were selected by proportional to size sampling technique. A pre-tested structured questionnaire was used for collecting data on age, sex, educational level, years of service, status of training and hand washing practices.

Stool specimen was collected from each studied food handlers in a clean stool cup. Intestinal parasites were investigated microscopically from each stool samples using both direct smear mount in saline and formal-ether concentration sedimentation procedures (14). For isolation of *S.typhi*, stool samples were enriched in Selenit F broth for 18 hours prior to inoculating into the plates of Salmonella-Shigella agar (Oxoid, UK). After 24 hours of incubation at 37 ^{o}C, *S.typhi* was identified following the standard procedures (15).

The data were collected after written informed consent was obtained from all study participants, and the study was approved by the Research Ethics Committee of the Bahir Dar University. Participants found positive for intestinal parasites and *S.typhi* were treated appropriately. Data were analyzed by SPSS version 16 statistical package.

Results

Three hundred eighty four food handlers (300 females and 84 males) were included in the study. Their mean age was 22 years, ranging from 12-65 years. Significantly, the majority (96.6%) of food handlers were very young adults including children age between 12-40 years. The educational levels and work experiences were shown in (Table 9. 4.1.1).

Table 9.4.1.1: Sociodemography of food handlers versus intestinal parasites positively in Bahir Dar town, 2009

Characteristics	Frequency number (%)	Positive for parasites Number (%)
Sex		
Female	300 (78)	131
Male	84 (22)	27
Age (years)		
12-19	103 (26.8)	35
20-40	268 (69.8)	71
≥ 41	13 (3.4)	2
Educational levels		
Non-literate	113 (29.4)	53
1-6 grade	167 (43.5)	69
7-12 grade	69 (18)	27
>12 grade	35 (9.1)	9
Service year		
<1 years	202 (52.6)	98
1-2 years	119 (31)	39
Above 2 years	63 (16.4)	21
Total	384 (100)	158 (41.4)

Stool examination of food handlers reveled that 158 (41.1%) had one or more intestinal parasites. Mixed intestinal parasite infections were detected in 9 (2.3%). Twenty five (6.5%) of food handlers were suffering from diarrhea. The most prevalent intestinal parasite species were *E. histolytica* /dispar 49 (12.76%) and A. *lumbricoides* 45 (11.7%) as shown in (Table 2). Stool cultures of food handlers showed that 6 (1.6%) were carried *S.typhi*. The isolated *S.typhi* revealed multiple antibiotic resistances against the commonly prescribed antibiotics (Table 3.)

Table 9.4.1.2: Prevalence of intestinal parasites among food-handlers Bahir Dar town, 2009

Parasites species	Frequency number (%)
Protozoa	
E. histolytica /dispar	49 (12.76)
Trophozites form	10 (2.6)
Cyts form	39 (10.16)
G. lamblia	27 (7.0)
Trophozotes form	6 (1.56)
Cyst form	21 (5.44)
Helminthes	
A. lumbricoides	45 (11.7)
Hookworm	31 (8.1)
S. stercolaris	11 (2.86)
T. trichiura	2 (0.52)
S. mansoni	7 (1.8)
Taenia species	5 (1.3)
H. nana	2 (0.52)
Mixed Helminthiasis	
A. lumbricoides and Hook worm	4 (1.04)
A. lumbricoides and *S. stercolaris*	3 (.78)
A. lumbricoides and Taenia species	1 (0.26)
S. mansoniand and S. stercolaris	1 (0.26)
Total	9 (2.34)

Table 9.4.1.3: Antimicrobial resistance of *S.typhi* from food handlers, Bahir Dar town, 2009

Antimicrobial agents	Resistance Number (%)
Chloramphenicol (30µg)	2 (33.3)
Norfloxacillin(10µg)	1 (16.6)
Cotrimoxazole (25µg)	5 (83.4)
Tetracycline (30µg)	4 (66.7)
Ampicillin (10µg)	6 (100)
Gentamicin (10µg)	2 (33.3)

In hand washing practices, 348 (90.6%) food handlers had a habit of hand washing after toilet. However, a few (11.2%) number of food handlers had a habit of hand washing after touching dirty materials and different body parts (hair, nose and ear) between handling of food items. None of the participants had had medical check up including stool examination previously. Fifty four (14%) food handlers were certified for training in food handling and preparation (Table 9.4.1.4).

Table 9.4.1.4: Hygienic practices of food handlers and food services status in relation to parasites positively in Bahir Dar town, 2009

Variables	Frequency number (%)	Positive for parasites number (%)
Medical checkup /stool examination		
Yes	-	-
No	384	158
Hand washing after toilet		
Yes	348	147
No	36	11
Hand washing after Touching dirty materials		
Yes	41	9
No	343	149
Touching body parts		
Yes	2	-
No	382	158
Certified in food training		
Yes	54	19
No	330	139
Status of food service		
Higher (n=15)	223	91
Medium (n=35)	105	43
Lower (n=45)	56	24

Discussion

Food can be contaminated with bacteria, viruses, protozoa, helminthes and fungi during processing. In this study, the overall prevalence of intestinal parasites among food handlers was higher 158 (41.1%) compared to previous study at Gondar town (29.1%) in North West Ethiopia (16). However, T/ Mariam *et al* (1996) reported that 63% food handlers had intestinal parasites at Awassa town in Southern Ethiopia (17). High prevalence of intestinal parasitosis is attributed by multiple factors such as poor personal hygienic practices, poor environmental sanitation and low health-promotion activities.

It was noted that 25 (6.5%) food handlers working in the kitchens were suffering from diarrhea. Active trophozite forms of *E. histolytica*, *G. lamblia* and larva of *S. stercoralis* were associated with diarrheic food handlers as described in (Table 2). *G. lamblia* infected food handlers can directly transmit giardia to consumers if ingested via contaminated food and water because *G. lamblia* cysts does not need environmental maturation (18). Moreover, Mintz *et al* (1993) found that food handlers infected with *G.lamblia* were a vehicle for giardia outbreak in commercial food establishment (19). Thus, food handlers should be in a good health and those suffering from diarrhea must be excluded from work until they have been completely free of symptoms.

The study has also attempted to isolate *S. typhi* from stools of food handler. Six (1.6%) food handlers were found infected with *S.typhi*. However, in Gondar town, Andargie *et al* (2003) (16) did not isolate salmonella species among food handlers. Chronic asymptomatic *S. typhi* carrier food handlers may be a potential source of *S. typhi* infection. *S.typhi* showed multiple resistances against ampicillin, cotrimoxazole, tetracycline, and chloramphenicol, genentamicin and norfloxacillin (Table 3)(neeed comparing with other studies). These data indicated that antimicrobial resistance of *S.typhi* is an increasing concern.

In this study, most food handlers working in the kitchens were very young adults including children. The majority had inexperienced with low educational levels, which agrees with previous study in Mekelle town (20) North Ethiopia. None of the food handlers had had medical check up including stool examination in the past. However, in Mekelle town, Zeru K *et al* (2005) found that 63 (22.7%) food handlers had medical check up (20)

Assessment of hand washing practices revealed varied results. Food handlers' hand washing practices after toilet (90.6%) was in parallel with the previous reports in Gondar town (16). However, only few had practices of hand washing after touching dirty materials and different body parts (hair, nose and ear) between handling of food items. Theses reflected that food handlers were not aware of food contamination with poor hygienic

practices. Health education intervention on food safety and hygiene must be strengthening to ensure food safety during processing, preparation and storage in food services establishments.

In conclusion, food handlers working in the kitchens were suffering from multiple species of intestinal parasites with 1.6 % *S.typhi* carrier rate. The majorities were inexperienced with poor personal hygienic practices. We recommend that local health authorities should implement intervention measures such as in-service health education on safe food handling practices, personal hygiene and periodic medical check up including stool examination.

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9.4.2. ANTIMICROBIAL SUCEPTIBILITY OF V. CHOLERAE IN NORTH WEST AMHARA,ETHIOPIA

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Abstract

Objectives: Various Vibrio cholerae serogroups cause cholera, which occurs as major epidemic disease in most developing countries. This study was aimed at determining the antimicrobial susceptibility patterns of V. cholerae and its serotypes from cholera cases.

Methods: The study was undertaken during cholera epidemics in North West Ethiopia from August 2006 to September 2008. Diarrheic stool samples were processed per the standard microbiology procedures at Bahir Dar Regional Health Research Laboratory. Antimicrobial susceptibility tests were performed using disc diffusion technique per Kirby-Bauer method.

Results: Eighty one V. cholerae 01 serotype Inaba were isolated from stools of cholera cases. Antibiograms of V. cholerae 01 Inaba showed that 71.6% of isolates were resistant against two, 18.4% to three and 5% to four antibiotics. All V. cholerae Inaba isolates were resistant to co-trimoxazol 81 (100%). High levels of resistance were also shown to chloramphenicol 76 (94%) and ampicillin 72 (89%) with least resistance to erythromycin 12 (15%), tetracycline 5 (6.2) and ciprofloxacilin 1 (1.2%). However, all isolates remain susceptible to doxycycline 81 (100%).

Conclusion: In the study area, doxycycline or ciprofloxacilin could be used for treatment of adult cholera cases whereas erythromycin is alternative for young children. Antimicrobial susceptibility tests are strongly recommended for V. cholerae strains in treatment intervention during epidemics.

Keywords: V. cholerae, Antimicrobial susceptibility, Ethiopia

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INTRODUCTION

Cholera is a life-threatening diarrhea disease caused by the ingestion of V. cholerae O1or O139 serogroups through feacally contaminated water or food (1). It is characterized by the passing of extensive acute watery diarrhea, which rapidly leads to dehydration and kidney failure and death if no prompt treatment (1, 2). V. cholerae O1 is further classified into two biotypes, classical and El Tor, and into two major serotypes, Inaba and Ogawa (3, 4). V. cholerae is associated with overcrowding, inadequate excreta disposal systems, poor access to safe water and particularly in areas where basic environmental infrastructure are disrupted (5, 6).

Cholera is one of the major epidemic diseases of the tropical world. In some countries cholera has been re-emerged after having been absent for several years. World Health Organization (WHO) reported that there had been an increased number of cholera cases during 2005 compared to 2004 with 30% increment globally. A total of 131,943 cases, including 2272 deaths have been notified from 52 countries (7). Africa accounted for 90% of the cases and 96% of the deaths reported globally (8, 9). Few reports and studies had indicated that in Ethiopia there was cholera epidemic in 1990, which persisted with recrudescence of cases till 1998 (10). Moreover, recently in Ethiopia, there were a total of 22,101 cases and 219 deaths of cholera in five administrative regions (7).

Studies indicated that antimicrobial therapy of cholera cases have clinical and epidemiological values since they shorten the duration of diarrhea and V. cholerae excretion (1, 2). Moreover, it is recommended that selective chemoprophylaxis may be useful for households who share food and shelter with cholera patients as an intervention (3-4, 11-12).

Studies in Africa reported that V.cholera had shown multiple resistances to antimicrobial agents (13). However, with exception of data from surveillance centers in India and Bangladesh, information on antimicrobial resistance patterns of V. cholerae strains are limited (14). Therefore, this study was aimed at determining the antimicrobial resistance of V. cholerae and its serotypes from cholera cases in North-West, Ethiopia.

MATERIALS AND METHODS

Stool specimens were collected from patients during cholera epidemics in a clean stool cup. A portion of stool specimens were transferred to a cotton wool swabs and inserted in Cary-Blair transport media and then transported using cold chain. For isolation, stool sample were enriched for 6 hours with alkaline peptone water (pH=9.0) and then cultured to Blood agar, MacConkey agar and Thiosulphate Citrate Bile Salt Sucrose agar (TCBS) (Oxoid, Basing stoke Hampshire, UK) for 24 hours at 37 0c (15). Isolates from primary TCBS agar were sub-cultured to nutrient agar for biochemical and serotype testing. Serotypes were identified using polyvalence and monoclonal anti-sera per the manufacturer insert (Dennka Seiken UK).

Antimicrobial susceptibility tests were performed on Mueller-Hinton agar (Oxoid, Basing stoke Hampshire, UK) per the standard disk diffusion technique outlined by Kirby-Bauer method. The antimicrobial agents employed were: tetracycline (30 g), doxycycline (30 g), cotrimoxazole (25 g), ciprofloxacin (5 g), erythromycin (15 g), ampicillin (10 g), and chloramphenicol (30 g) (Oxoid, Ltd, Basingstoke, UK). Results of susceptibility testing were interpreted per inhibition zone break points of the National Committee for Clinical Laboratory Standards (NCCLS) (16). The study was approved by the Research Ethics Committee of the Bahir Dar University and Bahir Dar Regional Health and Research Laboratory.

RESULTS

Based on biochemical and serological identification, all isolates of V. cholerae from cholera outbreak were V. cholerae O1 serotype Inaba. Eighty one V. cholerae 01 serotype Inaba were isolated from stools of (52 males and 29 females). Their median age was 32.1 ranging from 9 months to 86 years. The outbreak was begun in North West Ethiopia in North Gondar administrative zone at Metema district (Woreda) near the Sudan border from August 2006 to September 2008 and propagated into other administrative zones (Table1).

Table 9.4.2.1: Distribution of V. cholerae 01 serotypes Inaba in reference to patients' age and sex in epidemic areas, North West, Ethiopia, 2006- 08.

Age group	Sex			Administrative zones				Total
	Female	Male	N. Gondar	S. Gondar	W. Gojjam	E. Gojjam	Ben-Gumuze	
0-5	1	3	1		2	-	1	4
6-15	3	4	2	3	2	-	-	7
16-30	11	19	14	7	6	3	-	30
31-45	9	12	6	5	6	4	-	21
>46	5	14	7	4	2	5	1	19
Total	29	52	30	19	18	12	2	81

Table 9.4.2.2: Antimicrobial resistance of V. cholera 01 serotype Inaba, Ethiopia, 2006-08.

Antimicrobial agents	Antimicrobial resistant Number (%)
Co-trimoxazol	81 (100)
Chloramphenicole	76 (94)
Ampicilin	72 (89)
Tetracycline	5 (6.2)
Erythromycin	12(15)
Ciprofloxacilin	1 (1.24)
Doxycycline	-

Antimicrobial susceptibility of V. cholerae 01 serotype Inaba exhibited that all V. cholerae 01 serotype Inaba were resistant against co-trimoxazol 81(100%). And high levels of resistance were also shown to chloramphenicol and ampicilin. However, V. cholerae 01 serotype Inaba remains highly susceptibility to doxycycline and ciprofloxacilin (Table 9.4.2.2.).

V. cholerae 01 serotype Inaba showed that each strain was resistant to at least one of the six antimicrobial agents tested (Table 3). Fifty eight (71.6%) of the isolates were resistant against two antibiotics namely co-trimoxazol and chloramphenicol and the other 18.4% of the isolates were resistant to three antibiotics, co-trimoxazol, chloramphenicol and ampicillin. The rest 5% of V. cholerae isolates were resistant to four antibiotics including tetracycline

Table 9.4.2.3: Multiple antibiotic resistance of V. cholerae 01 serotype Inaba, in North West Ethiopia, 2006-08

Antibiogram pattern	Frequency; Number (%)
R1	4 (5)
R2	58 (71.6)
R3	15 (18.4)
R4	4 (5)
R5	-
R6	-
Total	81 (100)

Key: R0: sensitive to all drugs, R1-R6: resistant to one drug, two drugs, up to six drugs,

DISCUSSION

In this study, the serotype Inaba was isolated in all age groups among children and adults. This profile of cholera case is confirmed by World Health Organization, which stated that cholera epidemic affects both children and adults (2). Even though, individuals with lower immunity such as malnourished children or people living with HIV are at greater risk of death, cholera can kill healthy adults within hours if no prompt treatment (17). The serotype Inaba showed high resistance to commonly used antimicrobial agents thus control measures using treatment intervention would not be effective.

Previous studies from cholera outbreaks had revealed that V. cholerae O1 strains could undergo serotype conversion between the Inaba and Ogawa serotypes during epidemics (18, 19). However, in this study, V. cholerae 01 serotype Inaba was verified throughout the outbreaks from August 2006 to September 2008 years. In contrast, Opintan A et al (2008) identified that all isolates were serotype Ogawa from cholera outbreak in Ghana (20). However, Scrascia et al (2006) reported that both serotypes Inaba and Ogawa were exist in outbreak from 1998 to 1999 in Kenya (21). Thus, the circulating serotype that was responsible for cholera epidemics in the study areas was V. cholerae 01 serotype Inaba based on serology and biochemical tests.

The main focus of the study was to determine antimicrobial sensitivity of V. cholerae isolates during intermittent outbreaks. In this study, antimicrobial susceptibility of V. cholerae 01 serotype Inaba showed high levels of multi-drug resistance to commonly used antimicrobial agents. This data was substantiated by previous findings from east Africa in Somalia and Ethiopia, which detected resistant gene IncC plasmid which was responsible for multi-drug resistance to V. cholera 01 (10, 22). However, the antibiogram of V. cholerae in this report was higher compared to the report of Shah M et al (1998) (23).

Astonishingly, all V. cholerae 01 serotype Inaba isolates were resistant against co-trimoxazol. This is confronted by the reports of Sabeena F et al (2001) in India and Archer et al (2009) in South Africa which detected 100% and 99.2% resistant to co-trimoxazol respectively (24, 25). High levels of co-trimoxazol resistances could be linked to the widespread use of co-trimoxazol for treatment of enteric gram negative bacteria. Since previous studies showed that co-trimoxazol resistance in epidemic V. cholerae O1 isolates from Africa were associated with plasmid-borne resistance genes which may be acquired from enteric bacteria (26, 27).

Therefore, co-trimoxazole, which is a first-choice of drug in treating of cholera in children, was not effective in vitro for all isolates of V. cholerae 01 serotype Inaba. Thus, the challenge would be serious particularly for young children as tetracycline is not recommended due to its side effects.

In the present study, the serotype Inaba revealed lower (15%) resistance to Erythromycin compared to 70% resistance in South Africa (25). It also showed lower (6.2%) resistance to tetracycline compared to Roychowdhury A et al (2008) report which was 15% in India (28).

However, 3.1% tetracycline-resistant was reported by Archer et al (2009) in South Africa (25). However, virtually all the serotype Inaba showed highly susceptible to doxycycline and ciprofloxacilin. Moreover, In Brazil, Ibarra JO and Alvarado et al (2008) stated that the effective antibiotics against all V. cholera strains were found to be doxycycline and ciprofloxacilin (29).

In conclusion, V. cholerae 01 serotype Inaba was the isolated serotype during intermittent cholera epidemics from 2006 to 2008 years. In this study, we recommend that cotrimoxzaole should not be used empirically for treating cholera cases. Thus, doxycycline or ciprofloxacilin could be used for treatment of cholera cases for adults and currently erythromycin would be a better option for young children. Antimicrobial susceptibility testing is strongly recommended for V. cholerae strains for evidence based antibiotic choice in treatment intervention during such epidemics.

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Annexes

For simplicity of reading and printing of separate chapters annexes are placed both at the end of each chapter title and in the table of contents.

Curriculum vitae

Name: Belay Bezabih Beyene

Place and Date of Birth: East Gojjam –Shebel, State City – Bahir Dar, Ethiopia, 01 May 1975

Sex: Male

Nationality: Ethiopian

Language: English, Amharic and Tigrigna

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Academic Background

Higher education / University:

From 2001-2004 in Jimma university, Ethiopia attended Medical Laboratory Technology and graduated with Bachelor of Science and CGPA of 2.91

From January 2009 – February 2011 in Addis Ababa University a Masters program in Field Epidemiology (CGPA of 4.00; excluding only last semester of 4 Cr hr)

Work experience

Four and half years working in a health research center as team leader of microbiology both the public and clinical branches, conducting research and training for health workers and cooperating with universities and other organizations working on health related issues.

During the two years of field based residency in Federal Ministry of Health of Ethiopia of public health emergency management; I was engaged on surveillance data analysis and system evaluation, outbreak investigation and containment, conducting training for surveillance officers, supervision and monitoring of interventions of epidemic responses in different regional states in the country.

Publications

1. Bayeh Abera, Atnaf Alem, Belaye Bezabih. METHICILLIN- RESISTANT STRAINS OF STAPHYLOCOCCUS AUREUS AND COAGULASE-NEGATIVE STAPHYLOCOCUS FROM CLINICAL ISOLATES AT FELEGE HIWOT REFFERAL HOSPITAL, NORTH WEST ETHIOPIA. *Ethiop Med J,2008, Vol.46, No.1*
2. Bezabih B, Assefa Y, Yismaw G, Mulu A. Determination of urinary iodine excretion to assess iodine deficiency level and iodine intake in primary school children, Bahir Dar, northwest Ethiopia. Ethiop Med J. 2007 Oct; 45(4):377-82.
3. Bayeh Abera, Fantahun Biadegelgen, Belay Bezabih. Prevalence of *Salmonella typhi* and intestinal parasites among food handlers in Bahir Dar Town, Northwest Ethiopia. *Ethiop. J. Health Dev.* 2010;24(1):46-50
4. Abera B, Bezabih B, Dessie A. Antimicrobial susceptibility of V. *cholerae* in North West, Ethiopia. Ethiop Med J. 2010 Jan; 48(1):23-8.

Certificate/Award: For the poster presentation on a title; "Detection of indicator bacteria from drinking water sources — West Amhara, Ethiopia, 2004-2009", on the 21th Ethiopian public health association annual conference (Oct. 2010) held in Mekelle and certificate of participation in Mombasa, keneya, in APHINET / TEPHINET- "One Health" scientific conference.

Submitted for journals and on process of review for publication

1. Epidemiology of acute watery diarrhea outbreak and challenges of control—Afar, Ethiopia, 2009 (Belay Bezabih, Milliyon Tumato, Bayeh Abera)
2. Outbreak of Mass Hysteria at a High School, Amhara Region, Ethiopia – April, 2010 (Belay Bezabih, Basazinew Alemu, Aschalew Teka)
3. Detection of indicator bacteria from drinking water sources — West Amhara, Ethiopia, 2004-2009 (Belay Bezabih, Richard Luce, Feleke Mekonnen, Bayeh Abera)

Training and seminars

Attended and presented manuscripts on an international and national scientific conference for five and four days in Mekele and in Keneya (Mombasa) respectively. I participated also in various trainings and workshops (for ≤ three weeks duration) at regional and national level.

References

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Declaration

I, the undersigned, declare that this is my original work and has never been presented by another person in this or any other University and that all the source materials and references used for this thesis have been duly acknowledged.

Name: Belay Bezabih Beyene

Signature: _____

Place: AAU, Addis Ababa

Date of Submission: _____

The thesis has been submitted for examination with my approval as a university advisor.

Name of advisor: _____

Signature: _____

Date: _____