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African Case Studies in Public Health

Participants' Guide

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Detecting, Reporting, and Analysis of Priority Diseases for Routine Public Health Surveillance in Liberia

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Abstract

An essential component of a public health surveillance system is its ability to detect priority diseases which fall within the mandate of public health officials at all levels. Early detection, reporting and response to public health events help to reduce the burden of mortality and morbidity on communities. Analysis of reliable surveillance data provides relevant information which can enable implementation of timely and appropriate public health interventions. To ensure that a resilient system is in place, the World Health Organization (WHO) has provided guidelines for detection, reporting and response to public health events in the Integrated Disease Surveillance and Response (IDSR) strategy.

This case study provides training on detection, reporting and analysis of priority diseases for routine public health surveillance in Liberia and highlights potential errors and challenges which can hinder effective surveillance. Table-top exercises and group discussion lead participants through a simulated verification and analyses of summary case reports in the role of the District Surveillance Officer. This case study is intended for public health training in a classroom setting and can be accomplished within 2 hours 30 minutes. The target audience include residents in Frontline Epidemiology Training Programs (FETP-Frontline), Field Epidemiology and Laboratory Training Programs (FELTPs), and others who are interested in this topic.

How to Use the Case Study

General instructions: Ideally, 1 to 2 instructors facilitate the case study for 8 to 20 students in a classroom or conference room setting. The instructor should direct participants to read a paragraph out loud, going around the room to give each participant a chance to read. When the participant reads a question, the instructor directs all participants to answer or engage in discussions. The instructor may split the class to play different roles or take different sides in answering a question. As a result, participants learn from each other, not just from the instructors. Specific instructor's notes are included with each question in the instructor's version of this case study.

Audience: Residents in Frontline Field Epidemiology Training Programs (FETP-Frontline), Field Epidemiology and Laboratory Training Programs (FELTPs), and others who are interested in this topic

Prerequisites: Before using this case study, case study participants should have received training in Integrated Disease Surveillance and Response protocols

Materials needed: Laptop with Microsoft Office applications, flipchart or white board with markers

Level of training and associated public health activity: Basic – public health surveillance

Time required: Approximately 2 ½ hours

Language: English

Participant's Guide

Goal of Case Study – To simulate case detection, reporting, and analyses for routine surveillance of priority diseases in the role of a district surveillance officer

Learning Objectives – After completion of this case study, the participants should be able to:

1. Identify national priority diseases
2. Identify steps and resources needed to implement case identification and reporting for IDSR
3. Understand the procedure and levels in reporting priority diseases from community to national level
4. Differentiate between zero reporting and no reports from a facility
5. Characterize a record in a line list as a suspected or probable case
6. Develop a summary of key reporting events for weekly reporting
7. Present morbidity rates due to priority diseases using figures and charts

Introduction

Liberia adopted the revised 2012 Integrated Disease Surveillance and Response (IDSR) guidelines based on lessons learned from the 2014 Ebola outbreak [1–3]. The national IDSR guidelines listed priority diseases reportable in Liberia, including diseases targeted as a potential public health emergency of international concern under the International Health Regulations (IHR [2005]) [1,3,4].

As part of implementation, the Ministry of Health (MoH) conducted a workshop to train the county health teams (CHTs) from each of the 15 counties in Liberia to conduct surveillance of priority diseases. Training was based on core functions of public health surveillance outlined in the IDSR (identify, report, analyse and interpret, and investigate and confirm), each with dedicated activities defined at every level of health administration (Appendix 1) [1].

After IDSR training, the MoH provided the CHTs with the necessary logistics to enable them to successfully implement and roll out IDSR at the district, health facility, and community levels.

Question 1. Identify steps needed to implement 1) case identification and 2) reporting for IDSR at the district, health facility, and community level.

Question 2. Draw a flow chart to illustrate the flow of data and process of case reporting for priority diseases from the community to national level according to national IDSR guidelines (Appendix 1). Clearly list the responsible role or organization for each step in the flow chart.

Question 3. What major categories does the following group of reportable diseases in Liberia fall under?

A	B	C
Acute bloody diarrhoea (*Shigella)* Acute flaccid paralysis (AFP)[1] Cholera (severe AWD) Human rabies Lassa fever Maternal deaths Measles Meningitis[2] Neonatal tetanus Viral haemorrhagic fever (including Ebola virus disease) Yellow fever Unexplained cluster of health events Unexplained cluster of deaths	Guinea worm Dracunculiasis Human influenza (due to new subtype) Severe Acute Respiratory Syndrome (SARS) Smallpox Other Public Health Events of International Concern (PHEIC) that may be infectious, zoonotic, foodborne, chemical, radio nuclear, or due to unknown condition[3]	Acute watery diarrhoea Acute viral hepatitis Adverse events following immunization (AEFI) Cataracts Diabetes Diarrhoea with dehydration in <5 years Encephalitis Epilespy HIV/AIDS (new cases) Hookworm Hypertension Injuries (RTAs, domestic violence) Malaria Malnutrition in <5 years Mental health Onchocerciasis Pertussis (whooping cough) Severe pneumonia <5 years Schistosomiasis Sexual assault Sextually transmitted infections (STI) Trachoma Trypanosomiasis Tuberculosis Typhoid

Part 1

Three weeks after the roll out of IDSR, the district surveillance officer for District A received a report of suspected cases of measles in his district through the community event–based surveillance system. However, out of three health facilities located in District A, Facilities A and B submitted reports with no counts of priority disease cases (including measles), while Facility C submitted no report for the same week. An investigation team was dispatched to verify the reported cases and assess the three health facilities.

Continued on next page →

Question 4. What is community event-based surveillance?

Question 5. What is the difference between reporting zero cases and not reporting?

Question 6. In an outbreak situation, what does zero reporting from a facility in the affected area imply?

On arrival in the community, the team confirmed that the cases reported by community informants met the standard case definition for suspected measles. Additional cases were identified through active case finding by going from house to house, and to nearby communities. A master line list was shared with the County Health Officer. Samples were collected and transported to the reference laboratory for confirmation.

Next, the team visited the three health facilities to assess surveillance activities. On reviewing the medical records at Facility A, the DSO noticed some cases which met the standard case definition for suspected measles but were not reported. The surveillance focal person at this health facility indicated that they were not able to collect specimens from the suspected cases, which was why they did not report. Further review of medical records showed that suspected cases of other priority diseases were not reported over the past weeks for the same reason.

At Facility B, none of the staff trained in IDSR was present. The facility was under the management of the laboratory aid, nurse aid, administrator, and pharmacist who were unfamiliar with IDSR guidelines. The IDSR guidelines were not readily available in the facility to serve as reference. Review of their medical records showed that some cases met the case definitions but were not diagnosed or reported as priority diseases.

Review of medical records at Facility C, which did not submit any report for the week, showed that none of the patients met the case definition for a priority disease. When the surveillance focal person was questioned as to why he didn't report, he said, "No priority diseases were detected. That is why I didn't submit a report."

The DSO instructed the facilities to capture all priority diseases, including those previously missed or unreported, and classify them for reporting to the district surveillance office as per national IDSR guidelines.

Question 7. Do you agree with the reasons given by Facility A and C? Justify your answer.

Question 8. What actions should the DSO take to ensure health facilities have the capacity to report?

Question 9. What action will you take in Facility B as a DSO to ensure reporting of priority diseases?

With support from the World Health Organization (WHO), MoH and other organizations, the DSO conducted a refresher training for IDSR for health workers at the three health facilities. During the training, it was observed that trainees were having challenges with identification and classification of priority diseases. After training, the DSO followed up with trainees at the health facilities to assess how the case definitions were applied.

Question 10. Using the information below, identify the disease/event and case classification where applicable. Refer to Appendix 3 for the case definitions of priority diseases.

Case Description	Possible Disease/Event	Case Classification
1. Tony travelled to spend 4 days with his uncle. He observed that children in the household had cough, redness of the eye and rash all over their face. Upon his return, he started to develop the same symptoms.		
2. Agnes needed water to drink while working on her father's farm on Saturday afternoon. There was no potable water around so she decided to drink from a creek nearby. Two days later, she started passing bloody-slimy stool with abdominal cramps.		
3. Linda had a safe delivery at the hospital. Unfortunately, the baby died after 4 days of life.		
4. A four-year old girl climbed a mango tree, but fell in the process. A day after, she developed weakness in the arm and legs, making it difficult for her to walk.		
5. An eleven-year old boy was bitten by a stray dog. A few days later, he started having abnormal tingling sensations with pain at the wound site, fever, and fear of water. The dog died 2 days after onset of his symptoms.		
6. A patient was seen in the consulting room 7 days after acute onset of fever and jaundice.		
7. A 10-year-old energetic boy in the neighbourhood was suddenly not able to walk for the past two weeks due to weakness in the arm and legs.		
8. Two children, aged four and five years old, purchased food from a roadside vendor. Eight hours after eating, one of the children started passing rice-water-like stool with vomiting and severe dehydration.		
9. A woman with an unwanted pregnancy terminated the pregnancy. Two weeks after the procedure, she started complaining of a sharp pain in her lower abdomen and died two hours later.		
10. A man complained of a suddenly developed fever with cough, conjunctivitis and generalized rash.		

Part 2

After training, the DSO instructed each health facility to submit their summary report on priority diseases for the week with a line list of all reported priority diseases over the past six weeks. This would enable the DSO to verify that the weekly summary report reflected an accurate count of priority diseases recorded in the line list. On receiving the reports and line list from the facilities in his district, the DSO analysed the data and developed a district summary report. He then shared this report with the county health team as part of his routine feedback to the county on surveillance activities in his district.

Question 11. Using the line list (Appendix 4), verify the information in the weekly summary reports for all the facilities (Appendix 5). Identify discrepancies.

Question 12. Using the line list (Appendix 4), develop a summary report for the district.

DISTRICT A	Cumulative Week 6					Cumulative YTD				
Disease/Condition	**Live**		**Dead**		**SC**	**Live**		**Dead**		**SC**
	<5	**≥5**	**<5**	**≥5**		**<5**	**≥5**	**<5**	**≥5**	
Acute flaccid paralysis										
Acute watery diarrhoea (cholera)										
Diarrhoea with blood (*Shigella*)										
Human rabies										
Lassa fever										
Measles										
Meningitis										
Neonatal tetanus										
VHF (incl. Ebola)										
Yellow fever										
Maternal death										
Neonatal death										
Unexplained cluster of health events										
Unexplained cluster of deaths										
Diseases/events of international concern reportable under IHR 2005										
Human Influenza (new subtype)										
SARS										
Smallpox										
Diseases targeted for eradication/elimination										
Dracunculiasis										
Total consultations										

Question 13. Using the line list (Appendix 4), develop a line graph for cumulative cases of priority diseases per week in the district.

Question 14. Using the line list, create a histogram of cases by Epi-Week of acute watery diarrhoea.

Conclusion

A key consideration in any public health surveillance system is its ability to detect cases at all levels using standard criteria. Uniform protocols, units, and formats for data collection enable comparison of data from different facilities and jurisdictions to detect trends and aberrations. Early detection of an epidemic-prone disease helps in timely intervention to avoid spread of an infection. Surveillance units from community to national levels are expected to report reliable data that can influence decision making by authorities at the Ministry of Health. This can be achieved through regular analysis and interpretation of surveillance data.

Although Liberia adopted the IDSR in 2005, the district level was not initially established as a level for reporting. However, the 2014 Ebola outbreak revealed gaps in the surveillance system which included late detection and reporting of suspected cases. Post-Ebola, the IDSR system in Liberia has shown an improvement through implementation and roll-out of revised guidelines by WHO and Ministry of Health. The Liberian Field Epidemiology Training Program improved outcomes measured by IDSR indicators by building the capacity of surveillance officers through field mentorship and hands-on practical training of surveillance activities.

Background Reading

Liberia Ministry of Health, World Health Organization, and Centers for Disease Control and Prevention. *National Technical Guidelines for Integrated Disease Surveillance and Response.* 2016. Monrovia, Republic of Liberia.

Acknowledgements

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References

1. Liberia Ministry of Health. *National Technical Guidelines for Integrated Disease Surveillance and Response*. 2015. Monrovia, Liberia
2. CDC. *IDSR Technical Guidelines*. 2012.
3. Liberia Ministry of Health, World Health Organization, Centers for Disease Control and Prevention. *National Technical Guidelines for Integrated Disease Surveillance*. 2016. Monrovia, Republic of Liberia
4. WHO. *International Health Regulations (IHR)*. 3rd editio. 2016. Geneva, Switzerland. World Health Organization. http://www.who.int/ihr/publications/9789241580496/en/

Appendices

Appendix 1. Core functions and activities of the Integrated Disease Surveillance System (IDSR) across health levels. Excerpt from source [3].

	Identify	Report	Analyse and Interpret	Investigate and Confirm
Community and Points of Entry	• Use alert triggers to identify priority diseases, events, conditions or other hazards in the community • Support community in case finding and promote use of alert triggers	• Report essential information on alert triggers to healthcare facility (HCF) and appropriate authorities	• Involve local leaders in observing, describing, and interpreting disease patterns, events, and trends in community • Map community catchment area	• Support investigation activities • Follow up on rumours or unusual events reported by community leaders or members • Act as liaisons for feedback to community on follow-up actions
Health Facility (HCF)	• Use standard case definitions to detect, confirm, and record priority diseases or conditions • Collect and transport specimens for laboratory confirmation • Verify alert triggers from community • Ensure appropriate storage of surveillance materials	• Report case-based information for immediate reportable diseases • Report weekly summary data to next level • Feedback weekly summary data to community level • Report laboratory results to community event-based surveillance (CEBS) worker	• Prepare and periodically update graphs, tables, and charts to describe time, person, and place for reported conditions • Immediately report disease/condition that 1) exceeds the threshold for action, 2) occurs in a new location, or 3) demonstrates unusual trends or patterns	• Take part in investigation of reported outbreaks • Collect, package, store, and transport specimens for laboratory confirmation during investigation
District	• Support HCF to verify alerts from the community • Collect surveillance data from HCF and the community and review the quality • Ensure reliable supply of data collection and reporting tools at reporting sites • Ensure all HCF have materials for laboratory collection and transport	• Make sure HCF and CEBS workers known and use standard case definitions for reporting priority diseases and conditions • Maintain list of reporting sites • Provide instructions and supervision for surveillance and reporting priority diseases and conditions for HCF and communities • Report data on time to the County Surveillance Officer (CSO)	• Aggregate data from HCF • Use and refine denominators for rates • Analyse data by person, place, and time • Assist HCF to update graphs, tables, and charts to describe reported diseases, events, and conditions weekly • Compare data and make conclusions about trends and thresholds	• Arrange and lead investigation of verified cases or outbreaks • Maintain an updated line list of suspected cases • Assist HCF in safe collection, packaging, storage, and transport of laboratory specimens for confirmatory testing • Receive and interpret laboratory results from county and give to HCF • Report finding of initial investigation to county

	Identify	Report	Analyse and Interpret	Investigate and Confirm
County	• Ensure coordination between Community Health Department Director to oversee and support community services and CEBS with district • Ensure reliable supply of data collection and reporting tools are available at reporting sites • Ensure laboratory specimen collection and transport material are available • Track specimens for laboratory confirmation	• Make sure districts know and use standard case definitions for reporting and verifying priority diseases and conditions • Provide instructions and supervision for surveillance and reporting priority diseases and conditions for HCF and communities. • Receive surveillance data from the District Surveillance Officer (DSO) and review the quality • Harmonize monthly IDSR and HMIS data • Report data on time to the national MoH	• Ensure accuracy of denominators for county • Aggregate data from DSO reports • Analyse data by time, place and person • Weekly update graphs, tables, and charts to describe reported diseases, events and conditions • Calculate rates and thresholds and compare current data with previous periods to make conclusions • Describe risk factors for priority diseases or conditions	• Arrange and support investigation of reported diseases or events • Receive and interpret laboratory results • Compile district level line lists of suspected cases • Report the confirmed outbreak to the national level • Ensure specimen collection kits for investigation activities are available
National	• Define and update national policy and guidelines and ensure compliance • Set policies and procedures for the reference laboratory networks including quality assurance systems • Use reference laboratories for confirmatory and specialized testing if necessary • Collect and transport specimens for additional analysis at World Health Organisation (WHO) HO Collaborating Centres as necessary	• Train, inform and support lower levels on surveillance and response • Aggregate county reports of immediately reportable diseases and events • Report other priority diseases and events on time to relevant programs and stakeholders • Include all relevant laboratories in the reporting network • Use IHR Decision Instrument (Annex 2A) to determine risks for priority diseases, events, conditions or hazards • Inform WHO as indicated by the International Health Regulations (2005)	• Set policies and procedures for analysing and interpreting data • Define denominators and insure accuracy • Analyse and interpret data from a national perspective • Calculate national rates and compare current data with previous periods • Describe risk factors for priority diseases or conditions • Regularly convene a meeting of the technical coordinating committee to review the analysed and interpreted data before wider dissemination • Carry out special analyses to forecast magnitude and trends of priority events	• Ensure guidelines and standard operating procedures for outbreak investigations are available at all sites • Coordinate and collaborate with international authorities as needed during investigations • Coordinate response with county and district health teams as needed during investigations • Alert and support laboratory participation • Provide surveillance and response logistic support • Share information with regional and international networks about confirmed outbreak • Process specimens from investigation and send timely results

Appendix 2. Community and standard case definitions for measles and cholera [1]

Measles (community): Any person with hot skin (fever) and spot-spot (rash)

Measles (standard – suspected case): Any person with generalized maculo-papular rash and fever plus one of the following: cough, coryza, (runny nose), or conjunctivitis; OR Any person in whom a clinician suspects as measles

Measles (standard – laboratory confirmed case): A suspected case with serological confirmation (IgM positive) of measles who had not received measles vaccination within 30 days of blood specimen collection

Measles (standard – epidemiological link): A suspected case that has not been laboratory confirmed, but is linked (in person, place, and time) to confirmed laboratory cases

Cholera (community): Any person passing three (3) or more water pu-pu within one day OR any person five (5) years of age or more passing three (3) or more rice water-like pu-pu.

Cholera (standard – suspected case): A patient >=5 years old with severe diarrhoea or death from acute water diarrhoea OR Any person who has watery diarrhoea during a cholera epidemic.

Cholera (standard – laboratory confirmed case): A suspected case from who Vibrio cholerae O1 or O139 has been isolated in stool or detected by approved rapid dipstick test

Appendix 3. Case definitions for priority diseases in Liberia, 2015 [3]

Disease	Case Classification	Case Definition
Acute bloody diarrhoea (Shigella)	Suspected	A person with diarrhoea with visible blood in stool
	Confirmed	Suspected case with stool culture positive for *Shigella dysenteriae* type 1
Acute flaccid paralysis (AFP)/polio	Suspected	Any child under 15 years of age with AFP or any person with paralytic illness at any age in whom the clinician suspects poliomylelitis
	Confirmed	A suspected case with virus isolation in stool
Cholera (severe AWD)	Suspected	• In an area where the disease is not known to be present a patient aged 5 years or more develops severe dehydration or dies from acute watery diarrhoea • In an area where there is a cholera epidemic, a patient aged 5 years or more develops acute watery diarrhoea, with or without vomiting
	Confirmed	A suspected case in which *Vibrio cholerae* O1 or O139 has been isolated in the stool
Guinea worm (Dracunculiasis)	Suspected	A person presenting a skin lesion with itching or blister living in endemic area of Guinea worm
	Confirmed	At the last phase of the programme, confirmation of last cases by knowledgeable health staff is required. Visual recognition of the adult worm protruding from a skin lesion or by microscopic identification of larvae.

Disease	Case Classification	Case Definition
Human influenza caused by a new subtype	Suspected H5N1 case	Any person presenting with unexplained acute lower respiratory illness with fever (>38 ºC) and cough, shortness of breath or difficulty breathing AND one or more of the following exposures within the 7 days prior to symptom onset: • Close contact (within 1 meter) with a person (e.g. caring for, speaking with, or touching) who is a suspected, probable, or confirmed H5N1 case • Exposure (e.g. handling, slaughtering, de-feathering, butchering, preparation for consumption) to poultry or wild birds or their remains or to environments contaminated by their faeces in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month • Consumption of raw or undercooked poultry products in an area where H5N1 infections in animals or humans have been suspected or confirmed in the last month • Close contact with a confirmed H5N1 infected animal other than poultry or wild birds • Handling samples (animal or human) suspected of containing H5N1 virus in a laboratory or other setting
	Confirmed H5N1 case	A person meeting the criteria for a suspected case **AND** positive laboratory results from a laboratory whose H5N1 test results are accepted by WHO as confirmatory
	Suspected pandemic H1N1 2009 virus infection	An individual presenting with influenza-like-illness (sudden onset of fever >38°C and cough or sore throat in the absence of another diagnosis) with a history of exposure to a pandemic (H1N1) 2009 virus.
	Confirmed H1N1 2009 virus infection	An individual with a laboratory-confirmed pandemic (H1N1) 2009 virus infection by one or more of the following tests: PCR; viral culture; 4-fold rise in pandemic (H1N1) 2009 virus-specific neutralizing antibodies
Human rabies	Suspected	Any person with one or more of the following: headache, neck pain, nausea, fever, fear of water, anxiety, agitation, abnormal tingling, pricking or burning sensations or pain at the wound site, when contact with a rabid animal is suspected
	Probable	A suspected case with history of contact with a suspected rabid animal
	Confirmed	A suspected case that is laboratory confirmed
Lassa fever	Suspected	Any person with fever (>38°C) and two or more of the following signs: malaise, headache, sore throat, cough, nausea, vomiting, diarrhoea, myalgia, chest pain, hearing loss, bleeding, swollen neck or face, absence of a response after 48 hours of antimalarial treatment and/or broad spectrum antibiotic, history of contact with rodents or with a case of Lassa fever
	Confirmed	A suspected case that is laboratory confirmed (positive IgM antibody, PCR, or virus isolation) or epidemiological linkage to a confirmed case

Disease	Case Classification	Case Definition
Maternal deaths	N/A	The death of a woman while pregnant or within 42 days of the delivery or termination of the pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes
Measles	Suspected	• Any person with generalized maculo-papular rash and fever plus one of the following: cough or coryza (runny nose) or conjunctivitis (red eyes), OR • Any person in whom a clinician suspects measles
	Confirmed	• A suspected measles case with laboratory confirmation (positive IgM antibody) or epidemiological link to confirmed cases in an outbreak
Meningitis	Suspected	Any person with sudden onset of fever (>38.5ºC rectal or 38.0ºC axillary) and one of the following signs: neck stiffness, altered consciousness or other meningeal signs
	Confirmed	A suspected case confirmed by isolation of *N. meningitidis, H. influenzae, or S. pneumoniae* from CSF or blood
Neonatal death	N/A	The death of a baby at birth or within the first 28 days of life
Neonatal tetanus	Suspected	Any newborn with a normal ability to suck and cry during the first two days of life, and who, between the 3rd and 28th day of age, cannot suck normally, and becomes stiff or has convulsions or both
	Confirmed	Cases are confirmed through clinical investigation using the AFRO standard investigation form in Annex 11 P (of Liberia National IDSR manual). No laboratory confirmation recommended.
Severe Acute Respiratory Syndrome (SARS)	Suspected	• A history of fever, or documented fever ≥ 38 °C **AND** • One or more symptoms of lower respiratory tract illness (cough, difficulty breathing, shortness of breath) **AND** • Radiographic evidence of lung infiltrates consistent with pneumonia or ARDS or autopsy findings consistent with the pathology of pneumonia or ARDS without an identifiable cause **AND** • No alternative diagnosis can fully explain the illness
	Confirmed	An individual who tests positive for SARS-CoV infection by the WHO recommended testing procedures
Smallpox (variola)	Suspected	An illness with acute onset of fever ≥ 38.3°C (101°F) followed by a rash characterized by vesicles or firm pustules in the same stage of development without other apparent cause
	Probable	A case that meets the clinical case definition, is not laboratory confirmed, but has an epidemiological link to a confirmed or probable case
	Confirmed	A clinically compatible case that is laboratory confirmed
Viral hemorrhagic fever (including Ebola virus disease and Marburg virus disease)	Suspected – routine setting	Any person, alive or dead, with onset of fever and no response to treatment for the usual causes of fever in the area AND at least one of the following signs: Bloody diarrhoea, bleeding from gums, bleeding into skin (purpura), bleeding into eyes or urine OR clinical suspicion for Ebola or Marburg Virus Disease

Disease	Case Classification	Case Definition
	Confirmed – routine setting	A suspected case with laboratory confirmation (Positive IgM antibody, positive PCR from blood), or epidemiologic link to confirmed cases or outbreak
	Suspected – outbreak setting (more sensitive)	• Any person (alive or dead) with sudden onset of high fever and at least three of the following symptoms: headaches, vomiting, anorexia/loss of appetite, diarrhoea, lethargy, stomach pain, aching muscles or joints difficulty swallowing, breath difficulties, hiccups; OR • Any person with acute fever and inexplicable bleeding; OR • Any sudden, inexplicable death; OR • Clinical suspicion of VHF; OR • A person (alive or dead) suffering or having suffered from a sudden onsite of high fever and having had contact with: a dead or sick animal (for Ebola); a mine (for Marburg)
	Probable – outbreak setting (more sensitive)	A suspected case (alive or dead) evaluated by a clinician or surveillance team having an epidemiological link with a confirmed case
	Confirmed – outbreak setting (more sensitive)	A suspected case with laboratory confirmation (positive IgM antibody, positive PCR or viral isolation)
Yellow fever	Suspected	Any person with acute onset of fever, with jaundice appearing within 14 days of onset of the first symptoms
	Probable	A suspected case AND one of the following: • Epidemiological link to a confirmed case or an outbreak • Positive post-mortem liver histopathology • Presence of yellow fever IgM antibody in the absence of yellow fever immunization within 30 days before onset of illness
	Confirmed	A probable case and absence of yellow fever immunization within 30 days before onset of illness AND one of the following: • Detection of YF-specific IgM • Detection of four-fold increase in YF IgM and/or IgG antibody titres between acute and convalescent serum samples • Detection of YFV-specific neutralizing antibodies OR one of the following: • Detection of YF virus genome in blood or other organs by PCR • Detection of yellow fever antigen in blood, liver, or other organs by immunoassays • Isolation of the yellow fever virus

Disease	Case Classification	Case Definition
Unexplained cluster of health events or deaths	N/A	The proposed definition for events to be reported by clinicians and health care facilities is: "Any outbreak of disease, OR any uncommon illness of potential public health concern, OR any infectious or infectious-like syndrome considered unusual by the clinician, based on frequency, circumstances of occurrence, clinical presentation, or severity" The proposed definition of a reportable event for laboratories is: "Any situation considered unusual related to received samples (frequency, circumstances of occurrence or clinical description) OR test results (unexpected number of the same species/subspecies, strain type/subtype or antimicrobial resistance pattern, or failure/uncertainty in diagnostics)"

Appendix 4. Line list of reportable diseases

No	Facility	Week	Age (years)	Date of Onset	Condition	Dead/Alive	Specimen collected?
1	A	Week 6	2	08/Feb/2016	Acute watery diarrhoea	Alive	No
2	A	Week 6	5	08/Feb/2016	Acute watery diarrhoea	Alive	No
3	A	Week 6	2	09/Feb/2016	Acute watery diarrhoea	Alive	No
4	A	Week 6	3	10/Feb/2016	Acute watery diarrhoea	Alive	No
5	A	Week 6	3	12/Feb/2016	Acute watery diarrhoea	Alive	No
6	A	Week 2	4	12/Jan/2016	Acute watery diarrhoea	Alive	Yes
7	A	Week 3	1	20/Jan/2016	Acute watery diarrhoea	Alive	Yes
8	A	Week 5	2	06/Feb/2016	Acute watery diarrhoea	Alive	Yes
9	A	Week 5	4	04/Feb/2016	Acute watery diarrhoea	Alive	Yes
10	A	Week 6	5	12/Feb/2016	Measles	Alive	No
11	A	Week 6	8	10/Feb/2016	Measles	Alive	No
12	A	Week 6	16	09/Feb/2016	Measles	Alive	No
13	A	Week 6	12	09/Feb/2016	Measles	Alive	No
14	A	Week 6	7	11/Feb/2016	Measles	Alive	No
15	A	Week 6	10	14/Feb/2016	Measles	Alive	No
16	B	Week 6	3	10/Feb/2016	Shigellosis	Alive	No
17	B	Week 2	7	12/Jan/2016	Acute flaccid paralysis	Alive	Yes
18	B	Week 3	4	24/Jan/2016	Shigellosis	Alive	No
19	B	Week 3	3	21/Jan/2016	Shigellosis	Alive	No
20	B	Week 6	8	08/Feb/2016	Measles	Alive	No
21	B	Week 6	19	14/Feb/2016	Measles	Alive	No
22	B	Week 6	4	13/Feb/2016	Measles	Alive	No
23	C	Week 6	2	09/Feb/2016	Acute watery diarrhoea	Alive	No
24	C	Week 6	2	10/Feb/2016	Acute watery diarrhoea	Alive	No
25	C	Week 6	4	12/Feb/2016	Acute watery diarrhoea	Alive	No
26	C	Week 6	2	09/Feb/2016	Acute watery diarrhoea	Alive	No
27	C	Week 6	3	10/Feb/2016	Acute watery diarrhoea	Alive	No
28	C	Week 3	4	24/Jan/2016	Acute watery diarrhoea	Alive	No
29	C	Week 2	7	12/Jan/2016	Maternal death	Dead	No

Appendix 5. Weekly reports from 3 health facilities in District A

HEALTH FACILITY A	Cumulative Week 6					Cumulative YTD				
Disease/Condition	Live		Dead		SC	Live		Dead		SC
	<5	≥5	<5	≥5		<5	≥5	<5	≥5	
Acute flaccid paralysis	0	0	0	0	0	0	0	0	0	0
Acute watery diarrhoea (Cholera)	5	0	0	0	0	9	0	0	0	4
Diarrhoea with blood (*Shigella*)	0	0	0	0	0	0	0	0	0	0
Human rabies	0	0	0	0	0	0	0	0	0	0
Lassa fever	0	0	0	0	0	0	0	0	0	0
Measles	0	6	0	0	0	0	6	0	0	0
Meningitis	0	0	0	0	0	0	0	0	0	0
Neonatal tetanus	0		0		0	0		0		0
VHF (incl. Ebola)	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0
Maternal death				0					0	
Neonatal death			0					0		
Unexplained cluster of health events	0	0	0	0	0	0	0	0	0	0
Unexplained cluster of deaths	0	0	0	0	0	0	0	0	0	0
Diseases/events of international concern reportable under IHR 2005										
Human influenza (new subtype)	0	0	0	0	0	0	0	0	0	0
SARS	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0
Diseases targeted for eradication/elimination										
Dracunculiasis	0	0	0	0	0	0	0	0	0	0
Total consultations	55					452				

HEALTH FACILITY B	Cumulative Week 6					Cumulative YTD				
Disease/Condition	Live		Dead		SC	Live		Dead		SC
	<5	≥5	<5	≥5		<5	≥5	<5	≥5	
Acute flaccid paralysis	0	0	0	0	0	0	1	0	0	1
Acute watery diarrhoea (Cholera)	0	0	0	0	0	0	0	0	0	0
Diarrhoea with blood (*Shigella*)	1	0	0	0	0	3	0	0	0	0
Human rabies	0	0	0	0	0	0	0	0	0	0
Lassa fever	0	0	0	0	0	0	0	0	0	0
Measles	0	3	0	0	0	0	3	0	0	0
Meningitis	0	0	0	0	0	0	0	0	0	0
Neonatal tetanus	0		0		0	0		0		0
VHF (incl. Ebola)	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0
Maternal death				0					0	
Neonatal death			0					0		
Unexplained cluster of health events	0	0	0	0	0	0	0	0	0	0
Unexplained cluster of deaths	0	0	0	0	0	0	0	0	0	0
Diseases/events of international concern reportable under IHR 2005										
Human influenza (new subtype)	0	0	0	0	0	0	0	0	0	0
SARS	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0
Diseases targeted for eradication/elimination										
Dracunculiasis	0	0	0	0	0	0	0	0	0	0
Total consultations	38					320				

HEALTH FACILITY C	Cumulative Week 6					Cumulative YTD				
Disease/Condition	Live		Dead		SC	Live		Dead		SC
	<5	≥5	<5	≥5		<5	≥5	<5	≥5	
Acute flaccid paralysis	0	0	0	0	0	0	0	0	0	0
Acute watery diarrhoea (Cholera)	5	0	0	0	0	6	0	0	0	0
Diarrhoea with blood (*Shigella*)	0	0	0	0	0	0	0	0	0	0
Human rabies	0	0	0	0	0	0	0	0	0	0
Lassa fever	0	0	0	0	0	0	0	0	0	0
Measles	0	0	0	0	0	0	0	0	0	0
Meningitis	0	0	0	0	0	0	0	0	0	0
Neonatal tetanus	0		0		0	0		0		0
VHF (incl. Ebola)	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0
Maternal death				1					1	
Neonatal death			0					0		
Unexplained cluster of health events	0	0	0	0	0	0	0	0	0	0
Unexplained cluster of deaths	0	0	0	0	0	0	0	0	0	0
Diseases/events of international concern reportable under IHR 2005										
Human influenza (new subtype)	0	0	0	0	0	0	0	0	0	0
SARS	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0
Diseases targeted for eradication/elimination										
Dracunculiasis	0	0	0	0	0	0	0	0	0	0
Total consultations	60					492				

Appendix 6. District A weekly summary report template

DISTRICT A	Cumulative week 6					Cumulative YTD				
Disease/Condition	Live		Dead		SC	Live		Dead		SC
	<5	≥5	<5	≥5		<5	≥5	<5	≥5	
Acute flaccid paralysis										
Acute watery diarrhoea (Cholera)										
Diarrhoea with blood (*Shigella*)										
Human rabies										
Lassa fever										
Measles										
Meningitis										
Neonatal tetanus										
VHF (incl. Ebola)										
Yellow fever										
Maternal death										
Neonatal death										
Unexplained cluster of health events										
Unexplained cluster of deaths										
Diseases/events of international concern reportable under IHR 2005										
Human influenza (new subtype)										
SARS										
Smallpox										
Diseases targeted for eradication/elimination										
Dracunculiasis										
Total consultations										