

Supplementary Materials

Table 1: Distribution of key informant interviews by Institution, Liberia, 2020

Institution/Organization	Number of Key informants	Position/Role
Ministry of Health	1	Director/Health Management Information System
National Public Health Institute	5	Surveillance Coordinator/Division of Infectious Disease and Epidemiology; Epidemic Preparedness and Response Coordinator/ Division of Infectious Disease and Epidemiology; Data Manager/ Division of Infectious Disease and Epidemiology; Director/Monitoring and Evaluation; Director/National Reference Laboratory
World Health Organization	1	Technical Assistant/Surveillance and Response
County Health Team (Montserrado, Lofa, Grand Bassa, Bomi & Rivercess counties)	5	County Surveillance Officers
District Health Team (Montserrado, Lofa, Grand Bassa, Bomi & Rivercess counties)	10	District Surveillance Officers

Table 2: Performance indicators for the assessment of Ebola Virus Disease surveillance in Liberia

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Surveillance System Structure						
Surveillance Legislation (laws & regulations)						
Existence of National legislative support for surveillance and response to EVD	Laws related to EVD surveillance and response recalled across surveillance managers	Total number of existing laws	Percentage	100%	Key Informants (KI)	Percent aggregate across all surveillance units
	Surveillance units with a copy of the National Public Health Law (NPHL)	19 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across all surveillance units
Surveillance strategy and coordination						
Presence of plan of action (POA) for EVD Surveillance and Response	Surveillance units with a strategic plan of action for Ebola surveillance and response	19 Surveillance Units	Percentage	100%	Paper and electronic documents	Percent aggregate across all surveillance units through document review
Existence of documented roles and responsibilities for EVD surveillance and response at all levels of the surveillance system	Surveillance units with a copy of roles and responsibilities of stakeholders of the EVD	19 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across all surveillance units through document review

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	surveillance and response system					
Networking and partnership						
Evidence of intersectoral collaboration, networking, and partnership	Intersectoral collaboration, networking, and partnership meetings held at the national level in the past one year	NA	Number	At least 1/quarter/year	Paper and electronic documents	Summary count of observations through document review
Cross-border collaborations	Cross-border collaboration activities implemented at the national level in the past one year	NA	Number	At least 1/quarter/year	Paper and electronic documents	Summary count of observations through document review
Core functions						
National County and District levels						
Case detections						
Mechanism for outbreak detection at managerial levels of the surveillance and response system	Surveillance units with standard case definitions for EVD on file	19 Surveillance Units	Percentage	100%	Paper and electronic documents	Percent aggregate across all surveillance units through document review

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	Surveillance officers at county and district levels with knowledge on a standard case definition for a suspected case of EVD (6)	15 Surveillance Officers	Percentage	100%	KI	Percent aggregate across 3 levels
	Surveillance manager at national level with knowledge on standard case definition for a suspected case of EVD	7 Surveillance Officers	Percentage	100%	KI	Percent aggregate across surveillance at national level
	Surveillance officers at county and district levels using standard case definitions to validate suspected cases of EVD	15 Surveillance Officers	Percentage	100%	KI	Percent aggregate across 3 levels
Case registration						
Mechanisms to record suspected EVD cases at the managerial levels of the surveillance and response system	Surveillance units with line list/databases of suspected EVD cases	19 Surveillance Units	Percentage	100%	Paper and electronic databases	Percent aggregate across 3 levels through database review

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Case reporting						
Case-based reporting of suspected EVD cases	Surveillance Officers reporting the use of case-based form to report suspected EVD cases	Total # of suspected case report observed during the recall period	Percentage	100%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Case Confirmation						
Confirmation of epidemic prone disease, including EVD	Samples tested in the past 3 months with results available within 72 hours of reception	Total # of sample tested during the recall period	Percentage	80%	Paper and Electronic Laboratory database	Percent aggregate across 3 levels through database review

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	EVD samples referred from county and district levels within 24 hours in the past 3 months	Total # of sample referred during the recall period	Percentage	100%	Specimen logbook	Percent aggregate across county and district levels through document review
Supplies for EVD specimen collection and transportation	Surveillance units reporting no stockout of supplies for EVD specimen collection in the past 3 months	15 Surveillance Units	Percentage	80%	Inventory logs	Percent aggregate across appropriate units through document review
Data analysis and interpretation						
EVD surveillance data analysis and interpretation	Surveillance units with evidence of descriptive (Person, place and time) analysis of EVD data	19 Surveillance Units	Percentage	80%	Bulletin boards, walls, electronic documents	Percent aggregate across 3 levels through document review
Epidemic Preparedness, Response and Control						
Epidemic preparedness plan for Ebola	Surveillance units with an epidemic preparedness plan for EVD	19 Surveillance Units	Percentage	100%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Emergency funds	Surveillance units with existing and adequate	17 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across 3 levels

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	funds for emergency response					through document review
Feedback						
Existence of regular feedback	Surveillance Officers who received lab results for suspected EVD samples	Total # of sample referred for confirmation during the recall period	Percentage	100%	Paper and Electronic Laboratory database	Total average percentage score
	Surveillance units reporting to have received feedback (bulletins/reports) received from the next higher level in the past 3 months	15 Surveillance Units	Percentage	100%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Health facility level						
Case detection						
Mechanism for outbreak detection within health facilities	Health facilities with standard case definitions for Ebola	149 health facilities	Percentage	100%	Paper documents	Weighted percentage through direct observation
	Surveillance Focal Persons with correct knowledge on standard	149 Surveillance Focal Persons	Percentage	100%	Surveillance Focal Person	Weighted percentage through survey interviews

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	case definitions to detect Ebola					
Case reporting						
Case-based reporting of suspected EVD cases	Health facilities with a case-based form for suspected EVD cases	149 health facilities	Percentage	100%	Paper documents	Weighted percentage through direct observation
Case confirmation						
Capacity for sample collection and referrals	Surveillance Focal Person with “correct” knowledge of sample collection and packaging	149 health facilities	Percentage	100%	Surveillance Focal Person	Weighted percentage through survey interviews
Supplies for Ebola specimen collection and transportation	Health facilities without stockout of laboratory supplies related to Ebola specimen collection in the past 3 months	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Data analysis and interpretation						

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
EVD surveillance data analysis and interpretation	Health facilities with evidence of descriptive (Person, place, and time) analysis of EVD data	149 health facilities	Percentage	80%	Paper documents	Weighted percentage through direct observation
Epidemic Preparedness and Control						
Availability of IEC strategy for surveillance and response to Ebola	Health facilities reporting use of EVD data for community mobilization for Ebola surveillance and response	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Feedback						
Existence of regular feedback	Health facilities with feedback during supervision	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
	Health facilities with monthly feedback from the next higher level	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Support functions						
National County & District levels						
Standards and guidelines						

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Availability of surveillance guidelines	Surveillance units with a copy of technical guidelines (2016) for EVD	19 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Standard operating procedures for collection, packaging and transportation of Ebola specimen	Surveillance units with SOPs for EVD specimen collection, packaging and transport	19 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Training						
Staff trained on integrated disease surveillance and response	Surveillance managers at national level reporting training in IDSR	7 managers	Percentage	80%	KI	Percent aggregate across surveillance at national level
	Surveillance officers at county and district levels reporting training in IDSR	15 Surveillance officers	Percentage	80%	KI	Percent aggregate across 3 levels
Surveillance units with trained Field Epidemiologist	Surveillance managers at national level reporting training in Field Epidemiology	7 Officers/managers	Percentage	80%	KI	Percent aggregate across surveillance at national level
	Surveillance officers at county and district	15 Surveillance officers	Percentage	80%	KI	Percent aggregate across 3 levels

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	levels reporting training in Field Epidemiology					
Supervision						
Conduct of Supervisions	Surveillance units that conducted supervision(s) to immediate lower level in the past 3 months	15 Surveillance Units	Percentage	80%	Paper and electronic documents	Percent aggregate across 3 levels through document review
Availability of budget for surveillance activities	Proportion of surveillance units with evidence of budget for surveillance activities	19 Surveillance Units	Percentage	80%	KI	Percent aggregate across 3 levels
Health facility level						
Standards and guidelines						
Technical Guidelines for Ebola Surveillance and Response	Health facilities with Technical Guidelines Ebola Surveillance and Response	149 health facilities	Percentage	80%	Paper documents	Weighted percentage through direct observation
Availability of case-based reporting forms at all levels of the surveillance system	Health facilities with no stock out of case-based	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	reporting forms in the past 3 months					
Training						
Staff trained on surveillance	Health facilities with trained staff in surveillance competences	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Supervision & Communication						
Mechanism for Supervisions	Health facilities reporting supervision from the higher level in the past 3 months	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
	Health facilities reporting supervision to catchment communities in the past 1 month	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Availability of communication at health facilities	Health facilities with functional phone for reporting of suspected EVD	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews and direct observation

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Surveillance system quality						
National County and District levels						
Usefulness	Surveillance units that produced reports/bulletin for decision-making in the past 3 months	17 Surveillance Units	Percentage	100%	Paper and electronic documents	Percent aggregate across 3 levels
Simplicity	Case-based reporting forms required by the system for reporting suspected EVD	NA	Number	1	KI	Summary count of observations through KI interviews
	Existing reporting channels required for reporting suspected cases of EVD	NA	Number	1	KI	Summary count of observations through KI interviews
Flexibility	Sub-systems with which the EVD system is interoperable	Total # of existing sub-systems	Percentage	80%	KI	Total average percentage score
	Changes made to EVD case detection and reporting in the past 1 year	NA	Frequency	At least 1 per year	KI	Summary count of observations through KI interviews

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Stability	Surveillance units reporting unscheduled electrical power outages that occurred in the past 3 months	17 Surveillance Units	Percentage	0	KI	Percent aggregate across 3 levels
	Surveillance units reporting EVD surveillance activities unhindered by lack of funds in the past 3 months	17 Surveillance Units	Percentage	100%	KI	Percent aggregate across 3 levels
Acceptability	Stakeholders actively participated in surveillance and response activities in the past 3 months	Total # of stakeholders required to participate in the system	Percentage	80%	KI	Percent aggregate across 3 levels
Representativeness	Reporting sites that sent weekly surveillance reports (including zero reports) of suspected EVD in the past 3 months	Total # of reporting sites observed during the recall period	Percentage	100%	Paper and electronic documents	Percent aggregate across 3 levels
Health facility level						

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Usefulness	Health facilities with analysis outputs (table, graph, map, etc.) of EVD surveillance data reported	149 health facilities	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews
Simplicity	Case-based reporting forms required by the system for reporting a suspected EVD case	NA	Number	1	Surveillance Focal Person	Weighted percentage through survey interviews
	Existing reporting channels required for reporting suspected cases of EVD	NA	Number	1	Surveillance Focal Person	Weighted percentage through survey interviews
Stability	Health facilities with designated phone, access to a mobile cellular network, daily internet services, uninterrupted electricity during operational hours	149 health facilities	Percentage	85%	Surveillance Focal Person	Weighted percentage through survey interviews
Acceptability	Respondents that considers EVD surveillance and response activities as part of their routine work	149 Surveillance Focal Persons	Percentage	80%	Surveillance Focal Person	Weighted percentage through survey interviews

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
Representativeness	Health facilities that sent weekly surveillance reports (including zero reports) of suspected EVD in the past 3 months	149 health facilities	Percentage	100%	Paper documents	Percent aggregate based on survey interviews and document review
Completeness	Health facilities without “unknown” or “blanks” to required variables in EVD line list for the past 3 months	149 health facilities	Percentage	80%	Paper documents	Percent aggregate based on survey interviews and document review
Sensitivity	Suspected EVD cases detected by the surveillance system	Number of suspected EVD cases detected	Percentage	100%	Healthcare workers interview, IDSR register	Percent aggregate based on follow up interviews with healthcare workers and document review
Timeliness	Suspect EVD cases reported to the next higher level immediately/within 24 hours of detection	Number of suspected EVD cases reported	Percentage	100%	Healthcare workers interview, IDSR register at health facility and district levels	Percent aggregate based on follow up interviews with healthcare workers

System parameters	Indicator	Denominator/Total sample	Unit of measurement	Target	Data source	Measurement method(s)
	Suspected EVD cases investigated within 48 hours	Number of suspected EVD cases reported	Percentage	100%	Healthcare workers interview, IDSR register at health facility and district levels	Percent aggregate based on follow up interviews with healthcare workers

Table 3: Description of Standardised Patients Scenarios, Liberia, 2020

Case	Presentation	Preferred management
A 5-year old child accompanied by mother/caregiver	Visit the health facility and report a history of intermittent fever, unexplained crying, vomiting, and diarrhoea with blood over four days. Have self-medicated with anti-malaria and antibiotics but symptoms persist.	<p>Enhance Standard (IPC) precautions at all times.</p> <p>Align patient symptoms with standard case definitions for suspected EVD.</p> <p>Probe for risks factors like travel history, contact with someone with similar symptoms and wild/bush animal.</p> <p>Request and collect specimen to confirm EVD; and isolate patient.</p> <p>Report case information immediately (via phone or text) to the appropriate level.</p>
A female 18 years and older	Visit the health facility and report a history of loss of appetite, nausea, fever, joint pains, and lower abdominal pains. She also complains of seeing her menses (unexpectedly) for longer than usual. These symptoms have lasted for about a week. Have self-medicated with anti-malaria and pain tablets, but symptoms persist.	
A male 18 years and older	Visit the health facility and report weakness, headache, muscles, joint pains, vomiting, watery diarrhoea with blood, and with history of fever. These symptoms have lasted for up to 5 days. Have self-medicated with anti-malaria and antibiotics, but symptoms persist.	