Republic of Liberia
Integrated Disease Surveillance and Response (IDSR)
Semester Bulletin
Vol. 1 Issue 1
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Disease Outbreak Map, Liberia, January – June 2017

National Public Health Institute of Liberia
Division of Infectious Disease and Epidemiology
The Ebola Virus Disease (EVD) outbreak has left an indelible memory and the lessons have been the catalyst for the robust implementation of Integrated Disease Surveillance and Response (IDSR) in Liberia. As part of the implementation of the National Investment Plan to build a resilient health system, the National Public Health Institute of Liberia (NPHIL) has been established with a mandate to ensure prevention and control of public health threats by promoting healthy outcomes.

The country has also succeeded in the adaptation of the second edition of the National Technical Guidelines for IDSR and the subsequent training of surveillance officers at national, county, and district levels in 2016.

Within NPHIL, the Department of Infectious Disease Epidemiology (DIDE) has developed this first edition of the semester bulletin in order to communicate information on the implementation of IDSR including public health threats that have been monitored and controlled.

What is presented in this bulletin?

This semester bulletin for IDSR covers twenty-six (26) epidemiological weeks (from January to June). The focus is on five key areas of IDSR implementation, which include performance monitoring, trend of selected suspected cases reported, outbreaks and public health emergencies, other diseases of public health importance, and laboratory and public health diagnostics. The goal of this bulletin is to shed light on the robust implementation of IDSR across Liberia, provide contextual analysis, as well as proposed interventions.

The first section details reporting coverage by providing a summary of the methods and processes of reporting IDSR data to the next higher level as well as reporting performance of each level of the health system. An analysis of health facility supervision is also presented in this section.

The second section focuses on trend of selected IDSR priority diseases and conditions reported from the beginning of 2016 to epidemiological week 26 of 2017. A comparison of the total number of alerts for each disease and condition during semester I of 2016 and 2017 respectively is provided.

The third section presents outbreaks and public health emergencies recorded during the semester. A summary analysis of key performance indicators for measuring timely detection, reporting, and response is presented. Four disease outbreaks (Lassa fever, Pertussis, Meningococcal, Cholera) were selected for discussion based on their distinct mode of transmission and control measures. For each disease outbreak, a brief description of the event is provided, followed by public health responses and a situational analysis aimed at reviewing the circumstances of the event and proposing analytical processes to prepare and respond to future incidence.

The fourth section focuses on other diseases of public health importance under passive surveillance. The trend of Malaria is being discussed in this section due to the high burden of the disease across the country.

The fifth section looks at the role of the laboratory and public health diagnostics in the implementation of IDSR in Liberia. A description of the testing capacities of the public health laboratories and specimen transport mechanism is provided, followed by an analysis of the turn-around-time from sample collection to testing.

Summary of key findings

a. The cumulative IDSR reporting completeness and timeliness for health facility, district, and county levels were above the target of 80%. However, two health districts fell below the target for completeness and four health districts were below the target for timeliness.

b. Health facility supervision continue routinely in all counties. Cumulatively, the availability of data collection tool was found to be the highest performing category.

c. A total of 20 outbreaks were detected, reported, and responded to.

d. The average time for initial response to outbreaks was less than 48 hours, suggesting a marked improvement in the swiftness to respond to public health events.

e. Initial investigation reports and situational updates were received for a total of 18 out of 20 outbreaks

f. Seventy-six percent (76%) of total malaria deaths occurred in children below 5 years of age.

g. The National Reference Laboratory has capacity to conduct test for six IDSR priority diseases: Ebola, Measles/rubella, Yellow fever, Bloody Diarrhea (Shigellosis), Cholera, and Meningitis. Samples for Lassa fever and Acute Flaccid Paralysis (Polio) are sent out of the country for testing.

h. A total of 60 couriers from Riders-for-Health are transporting specimens from 302 health facilities across the country to the public health laboratories.

i. A total of 1631 specimens were collected for laboratory testing for 8 epidemic-prone diseases and conditions.

Other aspects of IDSR Implementation

It also is important to note that much work is ongoing in the areas of electronic disease surveillance, training, epidemic preparedness, point of entry screening, community events-based surveillance, among others. There is an electronic platform for AFP surveillance called Auto-visual AFP Detection and Reporting (AVADAR) that is currently being piloted in Montserrado County. A new eIDSR platform has been designed and is expected to be piloted in the coming months. Intermediate training has also started for a new corps of surveillance staff enrolled in the Liberia Field Epidemiology Training Program.

It is our hope that this first edition will provide the relevant insight into IDSR implementation in Liberia and will serve as an invaluable resource for reference.
I. Integrated Disease Surveillance and Response (IDSR) Performance

A. Reporting Coverage

i. Health Facility Level

A total of seven hundred sixty-one (761) health facilities submitted weekly IDSR data during the semester.

The National Technical Guidelines for IDSR requires each health facility to submit weekly summary data of immediately reportable diseases, conditions, and events to the district level, which is the next higher level, by 17:00 GMT every Saturday.

IDSR ledgers for collating weekly data were placed in each health facility and were completely filled in at the end of each day by the health facility surveillance focal points. A copy of the weekly summary of daily data was submitted to the District Surveillance Officer (DSO) at the end of each week.

The weekly average for health facility reporting completeness and timeliness was calculated to determine trend during the semester. The national trend for health facility completeness and timeliness was above the target of 80% for all weeks except for epidemiological week 23 (Figure 1, 2). The drop in week 23 is attributed to administrative challenges that eventually affected the implementation of IDSR.

ii. Health District Level

There are 90 health districts in Liberia. The National Technical Guidelines for IDSR requires each health District Surveillance Officer (DSO) to receive and collate weekly IDSR data from health facilities within the district and submit a summary of the data to the County level by 17:00 GMT every Sunday.

Each DSO has a summary ledger of weekly IDSR data of health facilities and submit a hard copy of the weekly report to the County Surveillance Officer (CSO). In four counties namely, Montserrado, Nimba, Margibi, and Bong, the DSOs compiled excel-based electronic copies of weekly data and sent to the CSO through email. However, in some instances, weekly reports were communicated through text messages or mobile phone calls.

A total of 88 health districts achieved reporting completeness of 80% and 86 health districts achieved reporting timeliness of 80%. From week 1 – 25, two health districts in Maryland County (Barrobo Whojah, and Barrobo Farjah) reported less than 80% of completeness. There were also four health districts (3 in Maryland and 1 in Margibi) below the 80% target for timeliness (Figure 3).

It was observed that while reporting was mainly paper-based, strong commitment of surveillance officers both at health facility and at district levels contributed to high rate of completeness and timeliness of IDSR reports. Those health districts below the target are being supervised and encouraged to improve during the next semester.

iii. County Level

Each of Liberia’s fifteen counties is required by the National Technical Guidelines for IDSR to submit weekly IDSR reports through the CSO to the national level by 17:00 GMT every Monday. This report reflects a summary of IDSR data obtained from health facilities and district levels for the previous week. All county weekly IDSR reports were compiled in excel spreadsheet and transmitted to the national level by email. In few instances when there was an internet disruption, the data was transmitted to the national level through mobile phone call or text messages.
### Figure 3. Weekly Health District IDSR Reporting Coverage, Liberia, Epi-week 1 – 25, 2017

**Table:** Weekly Health District IDSR Reporting Coverage

| County   | Health district          | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 |
|----------|--------------------------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|
| Bomi     | Montserrado              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bong     | Kollu                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Lofa     | Maryland                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Margibi  |                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bomi     | Montserrado              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bong     | Kollu                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Lofa     | Maryland                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Margibi  |                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bomi     | Montserrado              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bong     | Kollu                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Lofa     | Maryland                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Margibi  |                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bomi     | Montserrado              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bong     | Kollu                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Lofa     | Maryland                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Margibi  |                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bomi     | Montserrado              |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Bong     | Kollu                    |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Lofa     | Maryland                 |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |
| Margibi  |                       |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |   |

**Legend:**
- **Submitted on time:**
- **Submitted Late:**
- **No Report Submitted:**
- **Total Expected Report:**
- **Total sent on time:**
- **Completeness (%)**
- **Timeliness (%)**

**County Names:**
- Bomi
- Bong
- Lofa
- Margibi
- Bomi
- Bong
- Lofa
- Margibi
- Bomi
- Bong
- Lofa
- Margibi

**District Names:**
- Montserrado
- Maryland
- Maryland
- Maryland
- Montserrado
- Maryland
- Maryland
- Maryland
- Montserrado
- Maryland
- Maryland
- Maryland
- Montserrado
- Maryland
- Maryland
- Maryland
- Montserrado
- Maryland
- Maryland
- Maryland
- Montserrado
- Maryland

**Notes:**
- "No Report Submitted" indicates no data available.
- "Total Expected Report" and "Total sent on time" columns show the expected and actual number of reports submitted.
- "Completeness (%)" and "Timeliness (%)" columns indicate the percentage of reports submitted on time and completeness, respectively.

**Division of Infectious Disease and Epidemiology**
B. IDSR Health Facility Supervision

Monthly supervisions of health facilities were conducted in each county by the DSOs. All high priority facilities, which include hospitals and health centers, were visited at least once a week to conduct supportive supervision and mentorship of the health facility staff. Those considered medium priority were visited bi-weekly and the lowpriority facilities were supervised at least once a month. The priority level of health facilities are determined by a combination of factors such as patient load, accessibility, availability of human and other resources.

During each supervisory visit, a health facility supervision checklist was administered by the DSO to assess eight components of the surveillance system. These components included the following: Data collection tools, analysis and reporting, supervision and feedback, epidemic preparedness and response, safe and dignified burial, administration, community events based surveillance, and investigation and confirmation of cases.

Analysis of the findings from the supervisory reports for January to May 2017 showed that data collection tools has the highest performing component of the surveillance system. Over 90% of the health facilities reportedly had all data collections instruments such as weekly IDSR ledger, monthly HMIS reporting forms, and the IDSR case alert and lab submission forms.

The second best performing component was analysis and reporting. About 90% of the health facilities were found to have regularly submitted weekly IDSR reports on time. These reports included zero reports from the health facilities. Additionally, the display of IDSR data of priority diseases on notice board was found consistently among over 85% of health facilities supervised monthly.

The lowest performing component accounting for a cumulative score of close to 60% was investigation and confirmation of cases. Majority of the health facilities consistently reported challenges associated with pick-up of specimens and the timely receipt of laboratory results (Figure 4).

Figure 4. Cumulative Performance of Key IDSR Components, Health Facility Supervisory Visits, Liberia, January – May 2017

![Figure 4. Cumulative Performance of Key IDSR Components, Health Facility Supervisory Visits, Liberia, January – May 2017](image)

Data Collection Tools
Analysis and Reporting
Supervision and Feedback
Epidemic Preparedness and Response
Safe and Dignified Burial
Administration
Community Event Based Surveillance
Investigation and Confirmation of Cases

Performance Score (%)
Figure 4c. IDSR Health Facility Supervisory Report on Supervision and Feedback, Liberia, January – May 2017

Figure 4d. IDSR Health Facility Supervisory Report on Epidemic Preparedness and Response, Liberia, January – May 2017

Figure 4e. IDSR Health Facility Supervisory Report on Safe and Dignified Burial, Liberia, January – May 2017

Figure 4f. IDSR Health Facility Supervisory Report on Administration, Liberia, January – May 2017

Figure 4g. IDSR Health Facility Supervisory Report on Community Event-Based Surveillance, Liberia, January – May 2017

Figure 4h. IDSR Health Facility Supervisory Report on Investigation and Confirmation of Cases, Liberia, January – May 2017
A total of 2,996 suspected cases of IDSR immediately reportable diseases, conditions, and events have been reported in the first quarter of 2017 compared to 26,693 in the same semester of 2016. Ebola virus disease (EVD) alerts constituted 92% of the total suspected cases reported in 1st semester of 2016 but only 8% in 2017 (Figure 5).

In 2017, the highest number of suspected cases have been reported for measles followed by cases of animal bites.

IDSR operates on the early warning principles to detect outbreaks early through reporting of all suspected cases. Excluding EVD alerts there were more suspected cases reported in 1st semester of 2017 compared to 1st semester of 2016. This may be due to training of health workers in case definition of IDSR priority diseases and also transitioning the focus from EVD response to integrated disease surveillance.

Figure 5. Comparison of reported suspected cases of Selected IDSR Priority Diseases, conditions, and events, Liberia, Semester I, 2016 & 2017

Figure 5a. Cumulative Number of Alerts of Ebola Virus Disease, January 2016 - June 2017

Figure 5b. Weekly Trend of Alerts of Ebola Virus Disease, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5c. Number of cases of Acute Flaccid Paralysis, Liberia, Week 1, 2016 - Week 27, 2017
Figure 5d. Weekly Trend of suspected cases of measles, Liberia, Week 1, 2016 - Week 25, 2017

Figure 5e. Weekly Trend of suspected cases of Lassa Fever, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5f. Weekly Trend of Maternal deaths, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5g. Weekly Trend of cases of Animal Bites, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5h. Weekly Trend of suspected cases of Bloody diarrhea, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5i. Weekly Trend of suspected cases of Yellow Fever, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5j. Weekly Trend of suspected cases of cholera, Liberia, Week 1, 2016 - Week 26, 2017

Figure 5k. Weekly Trend of suspected cases of Neonatal death, Liberia, Week 1, 2016 - Week 26, 2017
A total of 20 outbreaks were recorded during the first semester of 2017. Nine out of 15 counties reported disease outbreaks during the semester with the most frequent being Measles and Pertussis. Although each outbreak has been limited to few cases and deaths, the relative recurring frequency of outbreaks of some epidemic-prone diseases and conditions is worth keen attention.

All outbreaks were managed at the county level except the outbreak of meningococcal septicemia in Sinoe County which led to intervention from the national level and international partners.

The average time for initiating investigation and response to outbreaks at the county level was 2 days with a range of less than 24 hours to 10 days.

Outbreak investigation reports were submitted to the national level for 18 (90%) of the outbreaks. This is a marked improvement compared to 2016 when only 53% of expected outbreak investigation reports were submitted to the national level. The lack of investigation reports for two of the outbreaks may have been attributed to delay in confirmation of these outbreaks.

After action review has been concluded for only one outbreak, meningococcal septicemia.

Table 1. Frequency of disease outbreaks reported in Liberia, January – June 2017

<table>
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<tr>
<th>Diseases</th>
<th>Outbreak Freq.</th>
<th>Investigation Reports</th>
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<tbody>
<tr>
<td>Measles</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Pertussis</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Lassa fever</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Unexplained cluster of illness &amp; death</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Chikungunya</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Cholera</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Meningococcal septicemia</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Scabies</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Unexplained cluster (Epizootic)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>20</td>
<td>18</td>
</tr>
</tbody>
</table>

Figure 6. Responding to an unexplained cluster of illness and deaths in Nana Kru community, Sinoe, January 2017

Figure 7. Rapid Response Team in preparation to investigate a suspected outbreak of Yellow fever, Grand Kru, January 2017

### A. Lassa Fever

**Event Description**

Lassa fever is endemic in Liberia with sporadic or wild outbreaks reported annually. From January to June 2017, 37 suspected cases with 17 deaths have been reported from 7 counties. Outbreaks have been confirmed in four counties namely, Montserrado, Nimba, Bong, and Grand Bassa counties. Out of the 37-suspected cases, 7 have been confirmed by PCR and ELISA-antigen tests, 11 discarded due to negative PCR test, 15 pending PCR test, and 4 are suspected cases without samples received by the laboratory. The case fatality rate among confirmed cases is 57% (4 deaths).

Excluding the discarded cases, there are 15 (68%) males and 7 (32%) females among the cases confirmed and pending epidemiological classification. The average age among these cases is 27 years with a range of 11 months to 62 years. Only one case was less than 5 years.

**Montserrado and Nimba Counties**

The first confirmed case reported during the semester was an ill 67 years old male who travelled from Ganta, Nimba County and presented at a hospital in Central Monrovia, Montserrado County, on 6 January 2017. Post-mortem Laboratory results of the case was released as ELISA antigen positive on 15 January 2017. One week later, two other cases, a male and female aged 15 years respectively, from Nimba County developed symptoms and were confirmed. One of the two cases was from the same health district of the first case but no epidemiological link was established. Excluding the first case which was reported by Montserrado County, a total of 8 suspected cases, three of which have been confirmed were reported from Nimba County. The case fatality rate among confirmed cases from Nimba County is 67% (2 deaths).
Bong County

Bong County in central Liberia and bordering Nimba County has reported 10 suspected cases with 5 deaths. Two cases have so far been confirmed by PCR and ELISA – antigen tests, two were discarded due to negative PCR test, 4 cases pending PCR test, and samples were not received by the Laboratory for two suspected cases. Case fatality rate among confirmed cases is 50%. All of the cases in Bong County have been reported from Suakoko (8 with 1 confirmed) and Jorquelleh (2 with 1 confirmed) health districts.

Grand Bassa County

Grand Bassa County reported 4 suspected cases with zero deaths during the semester of which one has been confirmed by ELISA – antigen and three are pending PCR testing. The cases reported are from Owensgrove district (2 with 0 confirmed) and District #3 (2 with 1 confirmed).

Figure 9. Number of cases of Lassa fever by Epi-classification, Liberia, Epi-week 1 – 24, 2017

- Confirmed
- Suspected
- Pending reclassification
- Not a case

Number of cases

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Epi-week (week of onset)

ii. Public Health Response

An investigation team involving Montserrado County Health Team and WHO field team was deployed immediately to conduct initial investigation upon receiving notification of the first case from the Hospital in Central Monrovia. Post-mortem heart blood was collected to confirm the case through laboratory testing. Case investigation led to tracing and monitoring of 40 contacts of the case for 21 days. None of the contacts developed symptoms. Safe and dignified burial of the case was carried out. The Health Team in Nimba County, the county of residence of the case was notified to conduct active case search and contact tracing.

In Bong County, an isolation unit for suspected Lassa fever cases is established at Phebe Hospital in Suakoko district. All suspected cases were isolated and case management initiated with the administration of ribavirin and other supportive therapy. Five cases recovered and were discharged. Active case search and contact tracing were carried out for each report of a suspected Lassa fever case. Community sensitization has been ongoing. Training of health workers in identification of cases of Lassa fever using the standard IDSR case definition has also been ongoing.

In Nimba County, there are two isolation units established – Saclepea Comprehensive Health Center and Kpein Clinic. Enhanced surveillance in Nimba and Grand Bassa Counties led to the detection of suspected cases of Lassa fever and subsequent confirmation of some of the cases. Like the other counties, case management was initiated for each case followed by active case search and contact tracing. Community sensitization has also been ongoing.

iii. Situation Analysis

Lassa fever is endemic in Liberia. In 2016, 69 suspected cases with 27 deaths were reported from 7 counties. Fourteen were confirmed by PCR and ELISA-antigen test with a case fatality rate of 35.7% among confirmed cases. Bong, Nimba, Lofa, Margibi, and Grand Bassa counties have been identified as constituting the Lassa belt due to yearly incidence of cases. Montserrat County, which hosts the capital Monrovia, has also been reporting confirmed cases yearly. However, cases reported from Montserrat over the past two years have been imported from other parts of the country, particularly from those counties identified as constituting the Lassa belt.

It is important to note that concerted efforts have been made in recent years to strengthen active surveillance for Lassa fever through training of health workers in IDSR. Worth keen consideration is the fact that no health facility or health worker infection has been recorded in the past two years possibly due to improvement in infection prevention and control practices as a result of numerous training after the Ebola outbreak in Liberia.

However, the relative high incidence and case fatality rate associated with Lassa fever in Liberia suggest the need for more actions aimed at sensitization, early detection and initiation of case management in order to reduce fatality. A national preparedness plan is needed for ensuring maintenance of essential stocks for case management, training of health workers in case detection and management, engagement of communities, and vector control of rodents, particular the mastomy rats, which is a known vector for the Lassa virus.
B. Pertussis

i. Event Description

One hundred eighty-seven cases with zero deaths have been recorded from 5 separate outbreaks of pertussis reported from Grand Gedeh and Grand Bassa Counties. A total of 118 cases (63.1%) constituted aged group 5-year and below and the above 5-year aged group constituted the remaining 69 cases (36.9%). Male to female ratio was 1.03 to 1. Vaccination status of the cases were as follow: Unvaccinated 89.9% (168 cases), fully vaccinated 1.6% (3 cases), partially vaccinated 1.1% (2 cases), and unknown 7.0% (13 cases).

The first outbreak was notified to the national level on 11 January 2017 by the Grand Gedeh County Health Team. The outbreak involved 115 cases with zero deaths from 5 communities (Geewon, Zean, Pannewon, Zeagbeh and Chayee Towns) in Gbao district. Seventy-three cases were five years old and below and 42 cases were above five years of age. A total of 59 cases were female and 56 cases were male. All cases were reportedly not previously vaccinated. The attack rate was 56.3 per 1000 population.

On 22 January 2017 Grand Bassa County Health Team notified the national level of an outbreak of Pertussis. The index case was a 9-year old female from Bah Town, Owensgrove district who presented at Bokay Town clinic on 19 January 2017 and was diagnosed of pertussis. A rapid investigation conducted by the district team the next day led to the identification of 27 additional cases in Bah Town. In total, 28 cases were identified and reported. None of the cases in the town were reported to have been previously vaccinated for pertussis. The town has a population of 69 persons. The attack rate was 40 per 100 population.

Another outbreak unrelated to the first was reported to the national level by Grand Bassa County Health Team on 31 January 2017. The outbreak involved a total of 9 cases from Gueh Town, District #4. All of the cases in Gueh Town were reportedly not previously vaccinated. The town has a population of 246. The attack rate was 3.7 per 100 population.

The third outbreak in Grand Bassa County was reported from Garjay community, District #3C. The first case was a 19-year old male with symptom onset on 7 March 2017 who presented at the Desoe Town clinic on 17 March 2017 and was diagnosed of having pertussis. A rapid investigation conducted by the district team the next day in Garjay community led to the identification of 24 additional cases. In total, 25 cases were identified and reported. The national level was notified on 20 March 2017. A total of 20 cases (80%) were reportedly not previously vaccinated for pertussis. The community has a population of 250. The attack rate was 10 per 100 population.

The fourth outbreak was reported on 20 May 2017 to the National level by Grand Bassa County Health Team. The outbreak involved 10 cases from Buegbo Town, District #4. All cases had unknown vaccination status. The town has a population of 501. The attack rate was 2 per 100 population.

ii. Public Health Response

On 14 January 2017, a district response team was dispatched to the affected communities in Gbao district, Grand Gedeh to investigate and respond to the outbreak. A total of 115 cases were identified and line listed. All cases were treated and vaccination services were provided to 40 children less than one year old. Engagement with community residents was also conducted during which sensitization on prevention and reporting of cases was emphasized.
On 20 January 2017, an initial investigation was conducted in Bah Town, Grand Bassa County by the district response team during which 27 cases were identified and line listed. A two-day response mission involving the County Health Team and partners was conducted from 26 – 27 January 2017 in Bah Town during which mass treatment was initiated for all cases with the administration of erythromycin and other supportive therapy. Nine (9) healthy children under (1) year old were also vaccinated.

A two-day integrated response mission was conducted in Gueh Town and surrounding communities from 3 – 4 February 2017. During the mission, all cases were treated. Forty-five people were treated for malaria. Additionally, thirty-eight pregnant women were provided ante-natal care services. Twenty-one children received a dose of pentavalent vaccine.

On 18 March 2017, an initial investigation was conducted in Garjay community by the district rapid response team during which 24 cases were identified and line listed. On 22 March 2017, an integrated response mission was conducted in the area during which all cases were treated. Sixteen cases of malaria were diagnosed and anti-malaria treatment was administered. There were also 19 people treated for acute respiratory infection.

From 20 – 21 May 2017, the district response team visited Buebgo Town and line listed 10 cases. All cases were treated. Additionally, 56 children were treated for other illnesses including malaria and acute respiratory infections.

**Figure 14a. Response Team conducts immunization session in Bah Town, Grand Bassa County, Liberia, January 2017**

**Figure 14b. Integrating Response with administration of tetanus toxoid vaccines to women in Gueh Town, Grand Bassa County, Liberia, February 2017**

### iii. Situation Analysis

Pertussis, a vaccine-preventable disease, is potentially a life-threatening childhood illness. Liberia’s routine immunization program offers pentavalent vaccines which provides immunity against pertussis and four other disease for all children below 1 year. The national immunization schedule requires 3 doses to be administered to infants at weeks 6, 10, and 14. Pertussis is also one of Liberia’s priority diseases and all health facilities are required to report monthly summary of cases to the national level through DHIS2. However, outbreaks of pertussis requires instant notification to the national level. In 2016, pertussis was the most frequent outbreak with a record 15 outbreaks reported from 9 counties.

Although efforts have been made to improve routine immunization coverage since the Ebola outbreak was declared over, there are still challenges especially in hard-to-reach areas. The average coverage for penta 3 vaccination from 2008 to the 1st quarter in 2017 is 75% according to Liberia’s routine immunization statistics in DHIS2. Coverage below the average were noted in hard-to-reach areas. Immunization coverage in hard-to-reach terrains tend to be very low in most parts of the country. All affected towns are more than 5km away from the nearest health facility thus posing impediment to access services. More besides, logistical constraints and limited skilled and motivated human resources also affected implementation of outreach activities.

There is a need to continue to expand access to immunization services through financial and logistical support for intensification of outreach services. More besides, engaging communities to improve health-seeking behavior and utilize available services provided routinely at health facilities must be mainstreamed into any plan seeking to prevent recurring outbreaks of pertussis.

### C. Meningococcal disease

#### i. Event Description

On 25 April 2017, Sinoe County Health Team (SCHT) notified the National Public Health Institute of Liberia (NPHIL) and the Ministry of Health (MoH) of a cluster of 14 cases with 8 deaths of unknown etiology in Greenville City. The event started on 23 April 2017 when the index case, an 11-year old female, presented to FJ Grante hospital with signs and symptoms of diarrhoea, vomiting and mental confusion and died within one hour of admission. The following day (24 April 2017), the second case-patient, a 51 year old woman from Teah town, Greenville developed sudden onset of vomiting, abdominal pain and confusion. She was admitted to FJ Grante hospital on 25 April 2017 and died the same day. On 25 April 2017 (the third day), a cluster of 13 case-patients from 5 communities in Greenville [Teah town - 6 cases, Congo town – 3 cases, Red hill - 2, Down town - 1, and Johnstone street - 1] developed similar acute onset illness. Seven out of the 13 case-patients died the same day on 25 April 2017. From 23 – 30 April 2017, a total of 27 cases with 10 deaths were reported from Sinoe County. All cases reportedly attended funeral events (wake, burial, repass) on 21 - 22 April 2017 in Greenville, Sinoe County.

Montserrado County reported a total of two cases with two deaths from 27 - 30 April 2017 related to the events in Sinoe County. One of the two cases, a 26-year old lady, thought to be the first secondary case, developed symptoms on 29 April and died a few hours later. This case did not directly participate in the funeral events, but reportedly attended to one of the cases from Sinoe.

Additionally, two cases with one death linked to the event in Sinoe were reported from Grand Bassa County from 4 – 7 May 2017. One of the two cases, a 40-year-old man, became ill on 1
May 2017, manifesting high fever (40°C), headache, cough, vomiting, mental confusion, diarrhoea, abdominal pain, and profuse sweating. He was admitted on 7 May 2017. This case did not directly participate in the funeral events, but reportedly shared food with a person who attended the funeral.

In total, 31 cases with 13 deaths (case fatality rate of 41.9%) were reported from three counties from 23 April – 7 May 2017. No new cases and deaths related to the event were reported after 7 May 2017. Majority of the cases reportedly attended funeral events (wake, burial, repass) on 21 – 22 April 2017 in Greenville, Sinoe County. However, there were two secondary cases, one from Grand Bassa and one from Montserrado who did not participate in the funeral events. A total of 14 cases were males and 17 were females. The affected age group range from 10 to 62 years with a median age of 15.

A total of 56 biological specimens (17 whole blood, 8 blood serum, 5 cardiac fluid, 9 oral swabs, 5 urine, 7 blood culture, 3 cerebrospinal fluid, 1 rectal swab, 1 stool) were collected from 26 patients for hematology, chemistry and microbiology analysis. Neisseria meningitidis serogroup C was confirmed by PCR in samples from 13 cases. Based on laboratory, pathological, and epidemiological investigations, it was concluded that the outbreak was due to meningococcal septicemia caused by Neisseria meningitidis serogroup C. On 16 May 2017, the outbreak was declared over by the National Public Health Institute of Liberia.

**Figure 15. Distribution of outbreak cases of Meningococcal septicemia, Liberia, 25 April – 17 May 2017**

### ii. Public Health Response

The national and county epidemic preparedness and response committees were reactivated within 24 hours to coordinate response to the event.

A multi-disciplinary national rapid response team involving NPHIL, LFETP, WHO, and CDC was deployed to Sinoe County to conduct detailed outbreak investigation and support response activities. WHO deployed an international pathologist to support with post-mortem investigation along with a team of experienced Epidemiologists. CDC-Atlanta deployed a team of experts to support laboratory investigation.

As part of active case search and contact tracing, a total of 110 funeral attendees from 6 counties (Sinoe, Montserrado, Maryland, Grand Gedeh, Grand Kru and Grand Bassa) and 207 contacts of cases in Sinoe (150), Montserrado (40) and Grand Bassa (17) were identified and followed-up on a daily basis for 15 days each. None of these people became ill.

Case management of all patients in Sinoe County was done at the F.J. Grante Hospital. Two isolation facilities [Redemption Hospital (9 beds) and ELWA Hospital (4 beds)] with a total capacity of 13 beds were prepared for response in Montserrado county. All contacts of the cases, attendees of the funeral, and 87 health workers at-risk in Sinoe and Grand Bassa Counties received prophylactic treatment.

Infection prevention and control interventions were re-enforced including hand hygiene practices, water points testing and safe burials.

County level advocacy meetings and community engagement were conducted in Sinoe County involving county authorities and residents to allay fear and panic. Mass public awareness and information dissemination was also conducted in affected counties. UNICEF supported 320 community volunteers in Sinoe County to conduct social mobilization activities.

### iii. Situation Analysis

Meningococcal disease is an infection caused by the bacterium Neisseria meningitidis. There are 12 serogroups of N. meningitidis that have been identified, 6 of which (A, B, C, W, X and Y) can cause epidemics. This bacterium can cause serious and sometimes fatal diseases including meningitis (infection of the brain lining) and meningococcal septicemia (infection of the blood). The most common symptoms are a stiff neck, high fever, sensitivity to light, confusion, headaches and vomiting. A person with meningococcal septicemia will not likely have a headache, stiff neck, or neck pain. Septicemia infections almost always result in a rash. It is the most specific and most noticeable symptom of meningococcal septicemia, primarily because it does not fade under pressure.

The bacteria are transmitted from person-to-person through droplets of respiratory or throat secretions from carriers. Close and prolonged contact – such as kissing, sneezing or coughing on someone, or living in close quarters (such as a dormitory, sharing eating or drinking utensils) with an infected person (a carrier) – facilitates the spread of the disease. The bacteria can be carried in the throat and sometimes, for reasons not fully understood, can overwhelm the body’s defenses allowing infection to spread through the bloodstream to the brain. The average incubation period is 4 days, but can range between 2 and 10 days.

Meningococcal septicemia is rare and this is the first recorded outbreak in Liberia. The rare nature of the disease couple with atypical presentation may have been a source of confusion in the clinical diagnosis of the event. It is also important to note that majority of the cases may have been exposed to the bacteria at
the funeral events. A case control study showed that the odds of becoming a case was 22 times higher among those who attended the wake compared to those who did not attend the wake (P<0.05). Further analyses showed association with food served at the wake including tea, bread, and egg nog. The strongest association was with tea, with an Odds Ratio of 11.2 (P<0.05). The probable sharing of the same utensil or a point source infection associated with the tea distribution may have facilitated the spread of the bacteria. There was no significant association observed with other potential exposures.

The swift response of the county and national levels as well as partners to the event is also worth commendation. The need to continue to educate health workers and build capacity for detection and response to future incidence must be given priority.

D. Cholera

i. Event Description

On 27 March 2017, the County Health Team of Nimba notified the national level about an outbreak of cholera in Gbor Clan, Tappita district, Nimba County. The first case, a 16-year old female presented at Diallah clinic on 25 March 2017 with symptoms of vomiting, diarrhea, and dehydration. From 26 – 29 March 2017, five other cases presented at the health facility with similar symptoms. In total, 6 cases with 2 deaths were reported. The case fatality rate is 33%. Vibrio cholerae was isolated from one of the two stool samples collected and tested at the regional laboratory at the Jackson F. Doe Regional Referral Hospital in Nimba County. All cases were residents of two communities in the Gbor clan. The attack rate in the area is 2 per 1,000 population. Five of the cases were females and one was male. Age range of the cases was from 10 – 24 years. The last case was treated and discharged on 31 March 2017. The cases were reportedly attending cultural rites in one of the communities in Gbor Clan and drank water from a nearby water source, Nenlah creek, possibly contaminated. Open defecation was observed due to lack of latrine in the area. There was also no functional hand pump in the area.

ii. Public Health Response

A county-level rapid response team involving the county health team and partners was dispatched to the area on 27 March 2017 to conduct initial response activities. All cases were transferred to the isolation unit at Jackson F. Doe Regional Referral Hospital for clinical management. Stool samples were obtained from two cases for laboratory testing.

An outbreak line list was developed by the investigation team and active case search involving community health assistants was initiated.

Daily messages on cholera awareness and prevention were aired on two community radio stations in the local dialects. The district health team also embarked on mass awareness in public places through distribution of fliers and community engagement meetings in the affected areas.

A hand pump was rehabilitated at Diallah clinic by AFRICARE, a non-governmental organization. Red Cross distributed buckets with faucets to 100 households in the affected area.

Safe and dignified burial was conducted for the dead and psychosocial counselling provided to the bereaved families.

The county epidemic preparedness and response committee was activated to coordinate outbreak response activities. With support from WHO and partners, Nimba County cholera contingency plan was finalized on 5 April 2017.

iii. Situation Analysis

Cholera is a diarrheal disease caused by the bacteria Vibrio cholerae type O1 and type O139. The disease has a fecal-oral transmission and V. cholerae attacks specifically the lower intestines leading to diarrhea and dehydration. All the age groups can be affected by cholera. Usually, the source of cholera outbreaks are contaminated water sources, since V. cholerae can survive long time or indefinitely in water. However, contaminated food can also be source of cholera outbreaks. Prior to the outbreak in Nimba, the last confirmed outbreak of cholera in Liberia was in Epi-week 29, 2012 when Montserrado County reported 19 cases. The last reported outbreak of cholera in Nimba County was in 2008 involving 6 cases from 3 communities in Sanniquellie-Mah district.

This outbreak may have been driven by a number of factors including the mass gathering of community members who had assembled to attend cultural rites, the use of unsafe water from the Nenlah Creek for drinking, open defecation, and lack of functional hand pump in the area.

It is worth commending the swift response of the County Health Team and the effective coordination and collaboration among partners which led to bringing the outbreak under control.

Because of the high case fatality associated with cholera outbreaks, efforts should be directed at ensuring early detection and treatment of cases and availability of needed supplies including cholera kits for rapid deployment when outbreaks are suspected or confirmed.

Figure 16. Distribution of Cholera Outbreak Cases in Nimba County, Liberia, March 2017
IV. Other Diseases of Public Health Importance

A. Malaria

A total of 826,535 confirmed cases (RTD +ve, microscopy+, and clinically confirmed) with 505 deaths have been recorded from January to June 2017. The case fatality rate is 0.06%. This is a 9.6% increase in the number of confirmed malaria cases reported compared to the same period in 2016 when a total of 754,195 cases with 605 deaths were recorded. However, the number of deaths decreased by 19.8%. The cumulative national incidence rate of malaria per 100,000 population from January – June 2017 is 18,895. Montserrado County accounts for the highest percentage (28.5%) of the total reported malaria cases and Lofa County reported the highest percentage (25.1%) of total deaths due to malaria. About 40% (324,774/826,535) of the total malaria cases are less than 5 years old and 76% (385/505) of total deaths occurred in children below 5 years of age.

Since the beginning of 2016, a total of 2,407,965 confirmed cases with 1,764 deaths have been recorded. Grand Kru County has the highest cumulative incidence rate of 27571 per 100,000 malaria cases from January to June 2017 (Table 2).

Table 2. Number of confirmed malaria cases and death by county, Liberia, January – June 2017

<table>
<thead>
<tr>
<th>County</th>
<th>Cum. Cases</th>
<th>Cum. Deaths</th>
<th>% of total cases</th>
<th>% of total death</th>
<th>Cumulative Incidence Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Montserrado</td>
<td>235839</td>
<td>55</td>
<td>28.5</td>
<td>10.9</td>
<td>18934.6</td>
</tr>
<tr>
<td>Nimba</td>
<td>139039</td>
<td>41</td>
<td>16.8</td>
<td>8.1</td>
<td>24636.3</td>
</tr>
<tr>
<td>Bong</td>
<td>85065</td>
<td>43</td>
<td>10.3</td>
<td>8.5</td>
<td>21156.8</td>
</tr>
<tr>
<td>Lofa</td>
<td>78313</td>
<td>127</td>
<td>9.5</td>
<td>25.1</td>
<td>21837.7</td>
</tr>
<tr>
<td>Margibi</td>
<td>43510</td>
<td>94</td>
<td>5.3</td>
<td>18.6</td>
<td>17190.9</td>
</tr>
<tr>
<td>Grand Bassa</td>
<td>42706</td>
<td>16</td>
<td>5.2</td>
<td>3.2</td>
<td>8092.6</td>
</tr>
<tr>
<td>Maryland</td>
<td>35909</td>
<td>8</td>
<td>4.3</td>
<td>1.6</td>
<td>22286.4</td>
</tr>
<tr>
<td>Grand Gedeh</td>
<td>28345</td>
<td>11</td>
<td>3.4</td>
<td>2.2</td>
<td>18623.2</td>
</tr>
<tr>
<td>Bomi</td>
<td>25792</td>
<td>36</td>
<td>3.1</td>
<td>7.1</td>
<td>26378.9</td>
</tr>
<tr>
<td>Sinoe</td>
<td>23232</td>
<td>15</td>
<td>2.8</td>
<td>3.0</td>
<td>19773.3</td>
</tr>
<tr>
<td>River Gee</td>
<td>21747</td>
<td>16</td>
<td>2.6</td>
<td>3.2</td>
<td>23364.0</td>
</tr>
<tr>
<td>Grand Cape Mount</td>
<td>19669</td>
<td>31</td>
<td>2.4</td>
<td>6.1</td>
<td>12871.6</td>
</tr>
<tr>
<td>Grand Kru</td>
<td>19252</td>
<td>2</td>
<td>2.3</td>
<td>0.4</td>
<td>27571.0</td>
</tr>
<tr>
<td>Rivercess</td>
<td>14901</td>
<td>1</td>
<td>1.8</td>
<td>0.2</td>
<td>18708.3</td>
</tr>
<tr>
<td>Gbarpolu</td>
<td>13216</td>
<td>9</td>
<td>1.6</td>
<td>1.8</td>
<td>13362.0</td>
</tr>
<tr>
<td>Liberia</td>
<td>826535</td>
<td>505</td>
<td>100.0</td>
<td>100.0</td>
<td>18895.3</td>
</tr>
</tbody>
</table>

There is a need for health workers and surveillance officers to improve outcome through early diagnosis and treatment of malaria cases. The need to intensify efforts to decrease the high burden of the disease especially fatality among under-five cannot be overemphasized. Integrated approaches involving health promotion, access and use of insecticide treated mosquito nets, as well as vector control among others are critical elements of the control program that must intensify.
V. Laboratory and Public Health Diagnostics

A. Overview

The Public Health Laboratory system of Liberia comprises the National Reference laboratory (NRL) and three regional laboratories at Redemption, Phebe and Tappita. These laboratories provide diagnostic services aimed at supporting the control of epidemic-prone diseases as well as aiding surveillance and research.

Nine out of the fourteen immediately reportable diseases and conditions contained in the national technical guidelines for IDSR require laboratory diagnosis for confirmation. However, specimens are currently being collected from cases of Acute Flaccid Paralysis (AFP), Meningitis, Acute Bloody Diarrhea (ABD), Cholera, Lassa fever, Measles, Viral Hemorrhagic fever (including Ebola) and Yellow fever. All but Polio and Lassa fever are tested in Liberia at the National Reference Laboratory. Specimens from suspected cases of Lassa fever and Acute Flaccid paralysis are sent out of the country for laboratory testing. The three other regional laboratories have capacity to test for Ebola.

The in-country testing capacity is however limited to culture and sensitivity for bacteria (meningitis, cholera, shigellosis); single platform PCR (Neisseria meningitides, EVD and Lassa fever); serology/ELISA (measles, rubella, and yellow fever). There is also a veterinary laboratory with screening capacity for rabies in animals but confirmatory test is referred out of the country.

<table>
<thead>
<tr>
<th>In-Country capacity</th>
<th>Referral to other Countries</th>
<th>No testing available</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute bloody diarrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute watery diarrhea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EVD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meningitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow fever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measles/Rubella</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AFP – Ivory Coast</td>
<td></td>
<td>Rabies</td>
</tr>
<tr>
<td>Lassa fever – Sierra Leone</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Specimen Transport Pathway

The framework for referral recognizes specimen movement as an indirect referral mechanism. To achieve this Riders for Health (RFH), a transport company, is responsible for the transportation of specimens from the point of collection to the public health laboratories. RFH covers all 15 counties and has 60 couriers stationed at 302 pick-up sites for collection and transportation of specimens. Each courier has a motorbike fitted with appropriate boxes for handling and storage of specimens. These specimens are usually transited along a linked pathway until reaching the designated laboratory.

C. Specimen Turn-around Time

During the semester, a total of 1631 samples were collected across all 15 counties for laboratory testing for 8 priority diseases of epidemic potential. These included Ebola, Meningitis, Cholera, Bloody diarrhea (shigellosis), Measles, Yellow fever, Lassa fever, and Acute Flaccid Paralysis (Polio). The proportion of specimens collected and tested within 72 hours was highest for Grand Bassa County and lowest for Maryland (Figure 21).

All specimens for alerts and suspected cases of Ebola were tested within 72 hours of sample collection. This is due to the high sensitivity as a result of the recent Ebola outbreak overall coupled with the availability of testing capacity at all four national public health laboratories. Samples from cases of Acute Flaccid Paralysis had the least proportion of specimens tested within 72 hours. This may be because AFP samples are sent abroad for testing at the Regional Reference Laboratory in Abidjan, Ivory Coast.

The sample turn-around-time (TAT) from date of samples reception to date of testing at the laboratory for all specimens except Ebola were as follow: within 3 days (24%), between 4-7 days (35%) and more than 7 days (41%) (Figure 22).

The sample turn-around-time (TAT) within 7 days from date of samples reception to date of testing at the laboratory per disease were as follow: Meningitis (100%), Acute Bloody Diarrhea (100%), Cholera (92%), Measles (85%), Yellow Fever (28%), Lassa Fever (39%) and AFP (0%).
Many efforts including training and deployment of material and human resources have been invested in Liberia’s public health laboratory system as a result of the response to the Ebola crises and realization of the dire need to build a resilient health system. These investments are reflected through the availability of a range of testing capacity for Ebola and other pathogens which were practically non-existing prior to the outbreak.

In spite of these gains, real-time laboratory investigation continue to be challenged due to issues with specimen management and transport, inadequate supply chain, inadequate power and water supply, poor equipment maintenance, among others.

There is a need for more support to strengthen biosafety, supply chain, and build human resource capacity. Efforts should also be directed at improvement of infrastructure including provision of adequate water supply and electricity. A laboratory information management system needs to be established and equipment standards improved.
## Annex

### List of Outbreaks Reported in Liberia, January – June 2017

<table>
<thead>
<tr>
<th>No.</th>
<th>Disease/Condition</th>
<th>County</th>
<th>District</th>
<th>Communities</th>
<th>No. of cases</th>
<th>No. of deaths</th>
<th>CFR (%)</th>
<th>Date of initial case investigation</th>
<th>Date Reported to National Level</th>
<th>Status (Ongoing, Under-controlled)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Lassa fever</td>
<td>Montserrado</td>
<td>Central Monrovia</td>
<td>Catholic community</td>
<td>1</td>
<td>1</td>
<td>100</td>
<td>13-Jan-17</td>
<td>15-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>2</td>
<td>Unexplained cluster of illness and death</td>
<td>Sinoe</td>
<td>Dugbe River</td>
<td>Nana Kru</td>
<td>3</td>
<td>3</td>
<td>100</td>
<td>11-Jan-17</td>
<td>11-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>3</td>
<td>Unexplained cluster (Epizootic)</td>
<td>Grand Bassa</td>
<td>District #1</td>
<td>Workden</td>
<td>8</td>
<td>7</td>
<td>87.5</td>
<td>14-Jan-17</td>
<td>15-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>4</td>
<td>Pertussis</td>
<td>Grand Gedeh</td>
<td>Gbao</td>
<td>Gboe</td>
<td>115</td>
<td>0</td>
<td>0</td>
<td>17-Jan-17</td>
<td>20-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>5</td>
<td>Pertussis</td>
<td>Grand Bassa</td>
<td>Owengrove</td>
<td>Bah's Town</td>
<td>28</td>
<td>0</td>
<td>0</td>
<td>22-Jan-17</td>
<td>22-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>6</td>
<td>Lassa fever</td>
<td>Nimba</td>
<td>Sanniquellie Mah, Saclepea Mah</td>
<td>Doupma, Blagay Town</td>
<td>2</td>
<td>1</td>
<td>50</td>
<td>24-Jan-17</td>
<td>24-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>7</td>
<td>Chickenpox</td>
<td>Grand Gedeh</td>
<td>Cavalla</td>
<td>Tojillah</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>20-Jan-17</td>
<td>20-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>8</td>
<td>Pertussis</td>
<td>Grand Bassa</td>
<td>District #4</td>
<td>Gueh Town</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>26-Jan-17</td>
<td>31-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>9</td>
<td>Measles</td>
<td>Maryland</td>
<td>Barrobo Whojah District</td>
<td>Tugbaken community</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>28-Jan-17</td>
<td>30-Jan-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>10</td>
<td>Cholera</td>
<td>Nimba</td>
<td>Tappita</td>
<td>Diallah</td>
<td>6</td>
<td>2</td>
<td>33.3</td>
<td>27-Mar-17</td>
<td>27-Mar-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>11</td>
<td>Measles</td>
<td>Grand Bassa</td>
<td>Campwood</td>
<td>Garvo town</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>1-Apr-17</td>
<td>3-Apr-17</td>
<td>Under controlled</td>
</tr>
<tr>
<td>12</td>
<td>Measles</td>
<td>Lofa</td>
<td>Foya</td>
<td>Karpee town, Kimbalo town</td>
<td>23</td>
<td>0</td>
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<td>31-Mar-17</td>
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</tr>
<tr>
<td>13</td>
<td>Measles</td>
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<td>Commonwealth</td>
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<td>14</td>
<td>Lassa fever</td>
<td>Bong</td>
<td>Jorquelleh</td>
<td>Iron Gate Community</td>
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<td>15</td>
<td>Measles</td>
<td>Nimba</td>
<td>Tappita</td>
<td>Tappita City</td>
<td>68</td>
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<td>27-Apr-17</td>
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</tr>
<tr>
<td>16</td>
<td>Meningococcal disease</td>
<td>Sinoe, Montserrado, Grand Bassa</td>
<td>Greenville, Central Monrovia, Buchanan</td>
<td>Greenville (Teah Town, Congo Town, Down Town, Red Hill); Monrovia (Police Academy, Baptist Seminary); Buchanan (New Barrack, pearchuzohn)</td>
<td>31</td>
<td>13</td>
<td>41.9</td>
<td>25-Apr-17</td>
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</tr>
<tr>
<td>17</td>
<td>Pertussis</td>
<td>Grand Bassa</td>
<td>District #4</td>
<td>Buegbo town</td>
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<td>18-May-17</td>
<td>20-May-17</td>
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<td>18</td>
<td>Unexplained cluster of illness and death</td>
<td>Grand Kru</td>
<td>Trehn health district</td>
<td>Behwan community</td>
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<td>1</td>
<td>50</td>
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<td>19</td>
<td>Scabies</td>
<td>Maryland</td>
<td>Barrobo Farjah</td>
<td>Rock town community</td>
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<td>District #3C</td>
<td>Garjay community</td>
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<td>17-Mar-17</td>
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</table>
OUR MISSION

To prevent and control public health threats by promoting healthy outcomes and serving as a source of knowledge and expertise.

Data Sources: Data were provided by County Surveillance Officers, WHO Field Offices, and Public Health Laboratories through weekly IDSR reports, outbreak situation reports, and laboratory results. The data on Malaria was obtained through Liberia Health Management Information System (HMIS) DHIS2.