

# Outbreak Investigation

## Surveillance and Investigation Protocol

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### I. ABOUT THE DISEASE

An outbreak is defined as the occurrence of more cases of a disease or condition than expected in a specific area or time. The most frequently reported outbreaks are respiratory illnesses such as influenza and enteric illnesses like acute gastroenteritis. Most outbreaks are reported from healthcare facilities such as nursing homes, followed by outbreaks in schools. For some of the most common outbreaks, there are established outbreak definitions to indicate the number of cases that may indicate an outbreak is occurring. For less common pathogens, a single case would be considered an outbreak as there is a low incidence of the disease within the state. In West Virginia, outbreaks or clusters of any illness or condition in any setting are immediately reportable to the LHD and all reported outbreaks are investigated.

#### A. Clinical Presentation

Varies based on the suspected or confirmed pathogen identified.

#### B. Etiologic Agent

Varies based on the suspected or confirmed pathogen identified.

#### C. Reservoir

Varies based on the suspected or confirmed pathogen identified.

#### D. Incubation Period

Varies based on the suspected or confirmed pathogen identified.

#### E. Mode of Transmission

Varies based on the suspected or confirmed pathogen identified.

#### F. Period of Communicability

Varies based on the suspected or confirmed pathogen identified.

### II. DISEASE CONTROL AND PREVENTION

#### A. Disease Control Objectives

1. Prompt outbreak reporting, investigation, and implementation of control measures will prevent additional cases of the illness.
2. Identification of any emerging infectious diseases or the occurrence of a disease of unusual severity.

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### **B. Disease Prevention Objectives**

1. Thorough investigation of outbreaks along with analysis and dissemination of outbreak data will:
  - a. Characterize risk factors so that disease can be prevented in the future.
  - b. Test and/or evaluate interventions to prevent and control disease so that future outbreaks or cases of disease may be prevented effectively.
  - c. Remove, eliminate, or mitigate ongoing sources of infection or disease.
  - d. Provide education to strengthen infection control practices to reduce the risk of future outbreaks.

### **C. Disease Prevention and Control Intervention**

The basic elements of an infection prevention program are designed to prevent the spread of infection in healthcare and other congregate settings such as youth residential, and correctional settings. When these elements are present and practiced consistently, the risk of infection among patients and healthcare personnel is reduced. Commonly seen interventions include education on appropriate handwashing, environmental cleaning, and appropriate person protective equipment (PPE) usage. Identification and prompt implementation of infection control interventions will slow the spread and may prevent additional illnesses from occurring. Specific preventative interventions are based on the pathogen identified.

## **III. DISEASE INVESTIGATION**

### **A. Case Definition and Outbreak Definition**

Case and outbreak definitions can be found in the outbreak toolkit or the disease surveillance protocol for the suspected or confirmed pathogen identified. For outbreaks with no defined outbreak definition, the occurrence of more cases than expected in a specific time frame or geographic area may be used. Outbreaks are typically monitored for two incubation periods after the date of onset of symptoms of the last identified case or date of testing if the case was asymptomatic.

### **B. Reporting Timeframe to Public Health**

Outbreaks or clusters of any illness or condition in any setting are immediately reportable and investigated.

### **C. Steps of an Outbreak Investigation**

NOTE: This investigation protocol is NOT a substitute for training and experience in outbreak investigation. Consult an experienced trained epidemiologist for assistance with complex outbreak investigation.

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The following steps provide a systematic approach to an outbreak investigation. Although the steps are listed sequentially, they may occur simultaneously.

**1. Verify the diagnosis and confirm the outbreak.**

The first step in an investigation is to determine whether the reported number of cases is unusual. Baseline surveillance data is a useful resource for making this decision. Verifying the diagnosis through laboratory testing is also important, especially for new or uncommon pathogens. Consider the possibility of changes in reporting or lab testing procedures.

**2. Define a case and conduct case finding.**

Investigators should establish a case definition by characterizing cases by clinical signs and symptoms and epidemiologic information related to person, place, and time. Using the case definition, investigators can search for additional cases. The case definition may change as more information is acquired.

**3. Perform descriptive epidemiology: time, place, person**

Information about possible cases should be organized in a line listing and summarized according to time, person, and place. An epi-curve may be useful to visualize data.

**4. Take immediate control measures.**

If the source of the outbreak is apparent and still a potential threat to public health, appropriate control measures should be taken as quickly as possible. Examples of control measures include isolation and quarantine of ill and exposed persons, the use of personal protective equipment, increased hand hygiene, and education.

**5. Formulate and test hypothesis.**

At this point, investigators develop a hypothesis about the cause of the outbreak. Understanding the possible disease pathogen and mode of transmission is useful when creating hypotheses.

**6. Plan and execute additional studies.**

Depending on available resources, investigators may test a hypothesis using an analytic study, such as a case-control study or retrospective cohort study.

**7. Implement and evaluate control measures.**

Once the cause of the outbreak has been identified investigators should work to implement longer-term control measures to end the current outbreak and prevent future outbreaks. These control measures are more extensive than earlier control measures and should be evaluated to determine if they are effective. Examples of such measures are mitigation of any identified gaps in infection control practices, changes in education or training policies for staff, monitoring for compliance to existing policies, implementing better disinfection protocols.

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### **8. Communicate findings.**

Throughout the investigation, investigators should communicate findings within their agency, to other organizations, and to the public as needed. Outbreaks provide a unique opportunity to educate about health promotion and disease prevention, establish and build on existing relationships with the reporting party. Final reports should be completed for all confirmed outbreaks and shared with those involved in the investigation. These final reports serve as a record of the event and may be used by all parties involved to institute changes based on the results of the investigation.

### **D. Healthcare Provider Responsibilities**

1. Report suspected outbreaks or clusters of disease in any setting immediately to the local health department in the jurisdiction where the outbreak is identified.
2. Collaborate with the local health department to obtain appropriate diagnostic laboratory evaluation. For public health investigation of outbreaks, the services of the Office of Laboratory Services are available free of charge. Consult the Office of Epidemiology and Prevention Services (OEPS) or your local health department to inquire about testing. The local health department can assist with the collection of specimens.
3. Collaborate with the local health department to institute appropriate control measures.
4. Collaborate with the local health department on the investigation. Local health departments may request, as needed:
  - a. A line listing of ill persons.
  - b. Clinical and laboratory information on persons with a reportable condition.
  - c. Other epidemiologically necessary information for investigation and control of the outbreak.

### **E. Laboratory Responsibilities**

1. Report suspected outbreaks, including foodborne and waterborne disease outbreaks immediately by phone to the local health department in the jurisdiction where the outbreak is identified.
2. Collaborate with public health officials to obtain appropriate specimens for testing or confirmation.
3. Collaborate with local health officials on investigation of the outbreak. Local officials may request:
  - a. Isolates or specimens for further testing at WV Office of Laboratory Services, if necessary
  - b. Copies of laboratory reports for persons meeting the outbreak case definition.

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- c. A line listing of ill persons.
- d. Other epidemiologically necessary information for investigation and control of the outbreak.

### F. Local Health Responsibilities

1. Educate laboratories and providers to report outbreaks to the local health department immediately upon recognition of the outbreak. Outbreaks should be reported by phone to avoid delays in instituting control measures.
2. Report outbreaks to the Regional Epidemiologist (RE) or OEPS within one hour of identification or receiving notification of an outbreak.
  - a. Report the time of LHD notification.
  - b. Designate a lead investigator for the outbreak.
  - c. Expect an outbreak number to be assigned to your outbreak by the OEPS or RE.
    - i. Use this outbreak number in all correspondents related to this outbreak, including laboratory testing forms, email communications, and final report.
  - d. Discuss your initial investigation steps and control measures with OEPS or RE staff.
3. Share outbreak control measures with the facility.
  - a. Provide the facility with the appropriate outbreak guidelines, line list, and any additional information included in the toolkit. Toolkits can be found at <https://oeeps.wv.gov/toolkits/pages/default.aspx>
4. Facilitate laboratory testing at OLS. Laboratory specimens should be collected and shipped or transported as per OLS instructions. Include the outbreak number to ensure OLS will accept the specimens.
5. Consult OEPS or RE with any questions on outbreak management or recommendations.
6. Notify OEPS of outbreak closure including last case onset and final case count.
7. Each confirmed outbreak should have a final report completed within 30 days of the end of the outbreak. This report should be shared with the facility and OEPS upon completion. Final report templates are available on the OEPS website (linked above) as part of the toolkit.
8. Participate in Infection Control Assessment and Response (ICAR) visits when possible. This is an opportunity to build or strengthen relationships with public health partners, provide education, and facilitate communication with facilities in your county.

### G. State Health Responsibilities

1. Train local, regional public health personnel and other pertinent partners in outbreak investigation.

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2. Document and track all West Virginia outbreaks using the West Virginia Outbreak Reporting System (WVORS). Save all related documents including line lists, laboratory testing reports, medical records, results of data analysis, and final report in the system.
3. Update the investigation record in WVORS with details of the investigation in real time (daily). Include any recommendations made, summaries of phone calls and emails, changes to the cases count, and all efforts made to obtain information.
4. Report foodborne outbreaks to the CDC National Outbreak Reporting System (NORS) within 60 days of first disease onset.
5. Report chickenpox outbreaks to CDC using their outbreak line list (includes age, vaccination status and severity of illness, as well as outbreak setting).
6. Offer technical assistance and other resources, including epidemiologic support and laboratory testing to the local health department and RE during outbreak investigations.
7. OEPS may take a leadership role in the investigation if:
  - a. The LHD and RE lack capacity to conduct the outbreak investigation and request assistance.
  - b. The disease is an unusual or emerging disease.
  - c. The disease is unusually severe, i.e., resulting in hospitalization, death, or disability.
  - d. The disease requires complicated medical or diagnostic evaluation.
  - e. An analytical epidemiological study is required for full investigation.
  - f. The cases are identified in multiple counties or regions.
  - g. The disease is part of a multi-state or international outbreak.
8. For outbreaks of unusual diseases or diseases of unusual severity (e.g., pandemic or emerging infectious diseases) or outbreaks or cluster investigations that exceed the capacity of OEPS to investigate and manage, OEPS will recommend that incident command be put into operation to address the disease outbreak or cluster.
9. Perform ICAR site visits within the established time frame based on the outbreak type.
10. Communicate the findings of investigations where OEPS takes a lead role as soon as possible. This may consist of a site visit report and/or an outbreak report. These reports will be completed by the investigation team and reviewed by a OEPS senior epidemiologist and the OEPS Director, as well as the State Epidemiologist and State Health Officer if needed.
11. OEPS may arrange or request an After-Action Review (AAR) for outbreaks or cluster investigations that presented unusual difficulties for the investigation team or those with high morbidity and mortality to identify opportunities for improvement.
12. Summarize all outbreaks in the state on an annual basis, including lessons learned.
13. Consult public health partners including the Office of Environmental Health Services, Office of Health Facility Licensure & Certification, Center for Threat Preparedness,

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Department of Agriculture, Food and Drug Administration, Centers for Disease Control and Prevention, and others as needed.

### H. Response to Bioterrorist Event

An unannounced bioterrorist event would likely present as an outbreak of unusual disease or disease of unusual severity.

The epidemiological investigation for an outbreak due to an agent of bioterrorism would proceed in much the same way. Investigators should expect several additional challenges:

1. Documentation may become part of a law enforcement investigation and must be accurate, objective, complete, and up to date.
2. Investigation may need to be done jointly with law enforcement and other investigation partners.
3. Collaboration with multiple agencies and jurisdictions (federal, state, and local) will be necessary.

**Investigative authority:** The legal basis for investigation of outbreaks is found in the Reportable Disease Rule 64CSR-7-7. The legal basis for investigation of bioterrorism is found in 64CSR-7-10. Per 64CSR 7-10.7, the local health officer is required to collaborate in “an epidemiological investigation of the bioterrorist event, usually to include a complete outbreak investigation as described in section seven (7) of this rule.” The full document can be found at: [https://oeeps.wv.gov/reporting/documents/laws/64\\_CSR\\_7.pdf](https://oeeps.wv.gov/reporting/documents/laws/64_CSR_7.pdf)

## IV. DISEASE SURVEILLANCE

### A. Public Health Significance

Outbreak investigation is an important tool used by epidemiologists to understand the epidemiology of a disease. Through outbreak investigation, epidemiologists learn why the outbreak occurred and how further cases of disease can be prevented or controlled.

Outbreak investigations often present the opportunity to learn something new about disease prevention, diagnosis, and treatment and the investigation process. The investigator who can handle a routine influenza or gastroenteritis outbreak is better prepared to handle a more complex investigation. In the event of a pandemic, an unusually severe outbreak, or a bioterrorist attack, the epidemiological methods will be the same as for outbreak investigation. Therefore, health departments that regularly investigate outbreaks will be better prepared for more difficult challenges.

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The significance of outbreak investigation in learning about emerging infectious disease cannot be underestimated. Outbreak investigations have been used to characterize new diseases such as COVID-19, mpox, Candida auris, and other emerging pathogens.

Finally, outbreak investigation may help identify weaknesses in public health programs. This information can then be used to provide education and identify resources to strengthen the program and correct any problems identified.

### B. Disease Surveillance Objectives

1. Detect outbreaks at an early stage.
2. Detect and/or track emerging infectious diseases.
3. Track, characterize and summarize outbreaks in the state of West Virginia, including lessons learned on an annual basis.
4. Evaluate outbreak reporting, investigation, control, and prevention efforts.

### C. Surveillance Indicators

1. Number of outbreaks reported by each county and region.
2. Proportion of outbreaks with complete and appropriate laboratory confirmation.
3. Time lag between notification of the appropriate agencies:
  - a. Local health department
  - b. Division of Infectious Disease Epidemiology
4. Number of final outbreak reports generated by each county that contain the minimal requirements set by CDC.
5. Statewide availability of an outbreak summary for the year, including lessons learned.

### V. REFERENCES

1. OEPS outbreak webpage: <https://oeeps.wv.gov/outbreaks/pages/default.aspx>
2. CDC's Principals of Epidemiology, 3<sup>rd</sup> Edition: [Lesson 6: Investigating an Outbreak](#)
3. CDC Healthcare-Associated Infection (HAI) Outbreak Investigation Toolkit: <https://www.cdc.gov/hai/outbreaks/outbreaktoolkit.html>
4. Red Book Report of the Committee on Infectious Diseases 32<sup>nd</sup> Edition
5. American Academy of Pediatrics Managing Infectious Diseases in Child Care and Schools 4<sup>th</sup> Edition

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