CDC Science Ambassador Workshop
2015 Lesson Plan

No Cure for the Summertime Blues
Enterovirus D68 Case Study

Developed by

Johnna Doyle, MS
Nashoba Regional High School
Bolton, Massachusetts

Barbara S. Ridgway, MA
Henrietta Lacks High School
Vancouver, Washington

Amy Deacon, MEd
Pentucket Regional High School
West Newbury, Massachusetts

Valencia L. Williams, PhD
West Coast University
Ontario, California

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Michael E. King, PhD, MSW

Commander, United States Public Health Service EIS Field Officer Supervisor and Epidemiologist

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Contact Information

Please send questions and comments to scienceambassador@cdc.gov.

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Summary

During late summer 2014, hospitals across the United States were reporting increases in the number of children with severe respiratory illness. These increases were initially reported from Missouri and Illinois but other states were soon reporting similar increases. Infection with enterovirus D68 (EV-D68) was found to be the cause of many of these illnesses. Enteroviruses are members of the picornavirus family, a group that includes the rhinoviruses (causes of the common cold). Other enteroviruses include the polioviruses, coxsackieviruses and echoviruses, all of which are spread primarily through fecal-oral transmission. There is no vaccine or anti-viral medicine that is effective against EV-D68.

The following is a case study, based on a report in CDC's *Morbidity and Mortality Weekly Report* (*MMWR*) titled "Severe Respiratory Illness Associated with Enterovirus D68 — Missouri and Illinois, 2014", available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a4.htm.

In this case study, students will analyze data and information about the outbreak as if it were happening in real time. They will use this information to make decisions about how to effectively monitor and respond to an EV-D68 outbreak. Students will classify increases in numbers of persons with EV-D68 as a cluster, outbreak, epidemic, or pandemic to help justify planning decisions for conducting a field investigation. Students will apply a case definition to collect data needed to characterize an outbreak by using correct graphs and tables. Oral and written communication skills will be used to communicate findings to the public.

This case study is intended for students in grades 9–12 and lower division biology or microbiology college classes. The case study can be included as a part of lessons concerning epidemiology and public health concepts. Students might need supplemental information to understand the concepts of viruses, disease transmission, and mathematics related to creation and interpretation of graphs.

Figure 1. This poster was created during a 2014 increase in enterovirus D68 cases. Source: CDC PHIL ID #18056.

Learning Outcomes

After completing this lesson, students should be able to:

- classify increases in occurrence of disease as clusters, outbreaks, epidemics, or pandemics;
- justify planning decisions for conducting a field investigation;
- apply a case definition to a field investigation;
- use empirical data presented in multiple formats (e.g., graphs or tables) to characterize an outbreak;
- develop a video public service announcement that communicates public health information to a target audience.

Duration

This lesson can be conducted as one, 90-minute lesson, or divided into two, 45-minute ones.

Procedures

Day 1: Summertime Blues (45 minutes)

Preparation

Before Day 1,

- Make copies of Worksheet 1A: Summertime Blues Case, one copy per student;
- Review Worksheet 1B: Summertime Blues Case, Answer Key; and
- Review online resources as needed.

Materials

- Worksheet 1A: Summertime Blues Case
  Description: This case study uses a modified version of real outbreak. It encourages students to think critically about viral transmission and using data and information to solve a public health problem.
- Worksheet 1B: Summertime Blues Case, Guide
  Description: The guide provides background content and optional strategies to more fully engage students in the case study. It also has links to additional resources for information.

Online Resources

- Severe Respiratory Illness Associated with Enterovirus D68 — Missouri and Illinois, 2014
  URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a4.htm.
  Description: This resource was used to develop the case study portion of this lesson plan.
- CDC's Guidelines for Investigating Clusters of Health Events
  URL: http://www.cdc.gov/mmwr/preview/mmwrhtml/00001797.htm.
  Description: This resource was published by *MMWR* to provide guidelines for investigating clusters of health events. Review this resource before Part 1 of the case study.
- CDC's Guidelines for Investigating Unexplained Respiratory Disease Outbreaks
  URL: http://www.cdc.gov/urdo/outbreak.html.
  Description: This resource was published by *MMWR* to provide guidelines for investigating unexplained respiratory disease outbreaks. Review this resource before Part 2 of the case study.
- CDC Webinar: Enterovirus D68 in the United States: Epidemiology, Diagnosis & Treatment (2014)
  URL: http://emergency.cdc.gov/coca/calls/2014/callinfo_091614.asp.
  Description: This resource might be helpful to review immediately after the case study. The COCA call provides greater context of the larger outbreak occurring in the United States.

Activity

1. Ask students about a disease outbreak recently in the news. Ask students why investigating this outbreak was important. Writing headings on the board as students come up with answers might help. Headings can include the following: Magnitude (e.g., number of persons infected), Speed of Transmission, Severity of Disease, and Preventable. Conclude the conversation by explaining to students a variety of reasons exists that health departments and CDC investigate outbreaks. Reasons can include scientific, social, economic, environmental, cultural, and political.
2. Distribute Worksheet 1A: Summertime Blues to each student. Introduce the case study and discuss the learning objectives. Explain that students will investigate a modified version of a real outbreak scenario that occurred during 2014. After the introduction, consider having students read CDC's Guidelines for Investigating Unexplained Respiratory Disease Outbreaks. See online resources.
3. Guide students through the case study. Follow notes in the guide for background information and teaching strategies for each question.
4. For homework, have students watch the CDC webinar Enterovirus D68 in the United States: Epidemiology, Diagnosis & Treatment (2014). See online resources.

Day 2: Going Public without a Cure, 45 minutes

Preparation

Before Day 2,

- Make copies of Worksheet 2: Public Service Announcement, one copy per student.

Materials

- Worksheet 2: Public Service Announcement, one copy per student
  Description: Students will use this worksheet as a guide to developing a public service announcement (PSA) concerning EV-D68.
- Computers and Internet access

Online Resources

- CDC Videos
  Link: http://www.cdc.gov/parents/cdc_tv_videos.html.
  Description: This website provides samples of video PSAs concerning different topics.
- Social Media at CDC
  Link: http://www.cdc.gov/socialmedia/Tools/InfoGraphics.html.
  Description: This website provides examples of infographics used at CDC, and links to CDC-TV and the CDC Streaming Health channel on YouTube.

Activity

1. Ask students about the CDC webinar. Discuss how the case study completed on day 1 was only a limited representation of what was happening on a larger scale. Discuss with students that the information gained from the case study provides important information, but that in consideration of the larger outbreak, might need modification.
2. Explain to students that they will work in groups of four to develop a 60-second PSA that focuses on the spread of EV-D68 and a solution to the problem. Ask students to define their target audience before starting their PSA. Encourage students to use social math and to review CDC videos and social media to help them frame a message and design the PSA.

Conclusions

In this lesson plan, a case study will be used to teach concepts of viral disease transmission, while improving student skills in classification, critical thinking, and by using data to justify decision making. Students will learn epidemiology and a public health science vocabulary, and how to apply them to a modified version of an outbreak scenario. Students will practice by using questions to define problems, carry out investigations, and analyze and interpret data in different forms to develop a hypothesis, construct an explanation, and communicate information.

Assessments

- Worksheet 1A: Summertime Blues Case
  Learning Outcome(s) met:
  - classify an increase in the occurrence of a disease as a cluster, outbreak, epidemic, or pandemic;
  - justify planning decisions for conducting a field investigation;
  - apply a case definition to a field investigation; and
  - use empirical data presented in multiple formats (e.g., graphs or tables) to characterize an outbreak.

  Description: This case study uses a modified version of real outbreak scenario that encourages students to think critically about viral transmission and by using data and information to solve a public health problem.

- Worksheet 2: Public Service Announcement, one copy per student
  Learning Outcome met:
  - develop a video public service announcement that communicates public health information to a target audience.

  Description: Students create a unique video public service announcement that focuses on enterovirus D68 and disease control strategies. They create an audience-appropriate PSA concept and use social math to frame the message. Then, they write, plan, record, and edit a 60-second PSA.

Educational Standards

In this lesson, the following CDC Epidemiology and Public Health Science (EPHS) Core Competencies for High School Students[1], Next Generation Science Standards* (NGSS) Science & Engineering Practices[2], and NGSS Cross-cutting Concepts[3] are addressed:

HS-EPHS1-2. Discuss how epidemiologic thinking and a public health approach is used to transform a narrative into an evidence based explanation.

NGSS Key Science & Engineering Practice[2]
Obtaining, Evaluating and Designing Solutions Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically.)
NGSS Key Crosscutting Concept[3]
Cause and Effect Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects.

HS-EPHS2-3. Use models (e.g., mathematical models, figures) based on empirical evidence to identify patterns of health and disease in order to characterize a public health problem.

NGSS Key Science & Engineering Practice[2]
Analyzing and Interpreting Data Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
NGSS Key Crosscutting Concept[3]
Cause and Effect Empirical evidence is needed to identify patterns.

HS-EPHS4-2. Use a targeted health promotion and communication approach (taking into consideration scientific, the organization of systems and their patterns of performance, prioritized criteria, and trade-off considerations) to design intervention strategies.

NGSS Key Science & Engineering Practice[2]
Constructing Explanations and Designing Solutions Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade-off considerations
NGSS Key Crosscutting Concept[3]
Structure and Function Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function

*Next Generation Science Standards is a registered trademark of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

[1] Centers for Disease Control and Prevention (CDC). Science Ambassador Workshop—Epidemiology and Public Health Science: Core Competencies for high school students. Atlanta, GA: US Department of Health and Human Services, CDC; 2015.

[2] NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix F–Science and Engineering Practices). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at: http://www.nextgenscience.org/sites/ngss/files/Appendix%20F%20%20Science%20and%20Engineering%20Practices%20in%20the%20NGSS%20-%20FINAL%20060513.pdf

[3] NGSS Lead States. Next Generation Science Standards: For States, By States (Appendix G–Crosscutting Concepts). Achieve, Inc. on behalf of the twenty-six states and partners that collaborated on the NGSS. 2013. Available at: http://www.nextgenscience.org/sites/ngss/files/Appendix%20G%20-%20Crosscutting%20Concepts%20FINAL%20edited%204.10.13.pdf.

Appendices: Supplementary Documents

Worksheet 1A

No Cure for the Summertime Blues

Enterovirus D68 Case Study Answer Key

Directions: Read the case study scenario. Answer the questions.

Case Overview

During late summer 2014, hospitals across the United States were reporting increases in the number of children with severe respiratory illness. These increases were initially reported from Missouri and Illinois but other states were soon reporting similar increases. Infection with enterovirus D68 (EV-D68) was found to be the cause of many of these illnesses. Enteroviruses are members of the picornavirus family, a group that includes the rhinoviruses (causes of the common cold). Other enteroviruses include the polioviruses, coxsackieviruses and echoviruses, all of which are spread primarily through fecal-oral transmission. There is no vaccine or anti-viral medicine that is effective against EV-D68.

Figure 2. This poster was created during a 2014 increase in enterovirus D68 cases. Source: CDC PHIL ID #18056.

The following is a case study, based on a report in CDC's *Morbidity and Mortality Weekly Report* (*MMWR*) titled "Severe Respiratory Illness Associated with Enterovirus D68 — Missouri and Illinois, 2014", available at http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a4.htm.

At the end of this case study, students will be able to

- classify increases occurrence of disease as clusters, outbreaks, epidemics, or pandemics;
- justify planning decisions for conducting a field investigation;
- apply a case definition to a field investigation; and
- characterize an outbreak by using correct graphs and tables.

Note: This case is based on investigations conducted by Claire Midgley, PhD, MS, Epidemic Intelligence Service officer, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, and Mary Anne Jackson, MD, Infectious Disease Department, Children's Mercy Hospital, Kansas City, Missouri, with substantial contributions from the Department of Pathology and Laboratory Medicine, Children's Mercy Hospital, Kansas City, Missouri; Missouri Department of Health and Senior Services; University of Chicago Medicine; and the Illinois Department of Public Health. Their report can be found at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a4.htm. Details of the investigations have been modified for the educational purposes of this case study.

Part 1: Emergence of a mysterious respiratory illness in Chicago

On August 20, 2014, a boy aged seven years was brought to University of Chicago Medicine Comer Children's Hospital in Illinois. He had symptoms of a mild respiratory illness, including runny nose, sneezing, cough, and body and muscle aches. After examination, the physician sent him home. He instructed the mother to get him to drink plenty of fluids and prescribed cold medicine to make the boy comfortable.

Two days later, the boy's condition had deteriorated. He had shortness of breath, coughing, and wheezing. His mother brought him back to the hospital. The physician's diagnosis was acute respiratory distress. The boy's physician consulted with the emergency department physician, and the boy was admitted to the pediatric intensive care unit (PICU).

Later that night, three additional children, aged six to nine years, were admitted to PICU. They were admitted through the emergency department with similar symptoms. Two had a history of asthma. One girl, who had especially severe symptoms, was put on a ventilator. Health care providers interviewed each parent about their child's symptoms. All parents reported that the symptoms seemed to get progressively worse during a three-day to four-day period. The symptoms suggested a viral infection, perhaps due to the same virus. To confirm, health care providers collected stool and respiratory specimens for laboratory testing.

While awaiting laboratory results, health care providers consulted with the Chief of the Infectious Disease Department. Since this represented an unusual cluster of patients with this condition in the metro area, they also called the Chicago Board of Health to report the cases and to inquire if other hospitals in the area were reporting similar cases.

Question 1: How would you classify the four recent cases of the mysterious respiratory illness at Children's Hospital in Chicago? Choices include cluster, outbreak, epidemic, or pandemic? Explain.

Question 2: At this point, is a need for further investigation necessary? Yes or no, and why or why not? Should Centers for Disease Control and Prevention (CDC) be called in to assist? Yes or no, and why or why not?

Part 2: Confirming an outbreak of enterovirus D68

Local health authorities confirmed 13 similar cases were reported by three other Chicago area hospitals during the past week. Patients were male and female, ranging in age from six to 10 years. Two male patients, both aged seven years, died within a week of being admitted to PICU.

The Illinois Department of Public Health requested CDC assistance. Local diagnostic laboratory testing using polymerase chain reaction assay on a multiplex platform was able to determine if enteroviruses or rhinoviruses were present but not tell which (i.e., specimens were reported positive for enterovirus/rhinovirus). Viral genome sequencing at CDC was able to give more specific results. The CDC found samples from all four patients from University of Chicago Medicine Center Children's Hospital and 10 of 13 patients from the other area hospitals to be positive for EV-D68.

CDC epidemiologists arrived the next day and teamed up with local health department epidemiologists and physicians from affected Chicago hospitals to investigate the outbreak. An epidemiologist and physician interviewed the parent of each patient.

Question 3: What types of information should be collected during this investigation?

Part 3: First patients from Missouri

CDC was initially notified of 10 patients in Missouri with illness similar to that reported in Illinois. Three female children ranged in age from six to seven years and seven male children ranged in age from seven to 11 years. Seven patients had difficulty breathing, shortness of breath, cough, wheezing and fever, three required a respiratory breathing machine. Specimen testing confirmed EV-D68 in all patients.

Five patients in Colorado were reported. All were males ranging in age from eight to 10 years and presented with similar symptoms. Clinical specimens were sent to CDC for testing.

The state health departments in Missouri and Colorado requested CDC assistance. Teams of CDC epidemiologists were sent to each state to work with the health department and local hospitals.

This emergence of multiple outbreaks and investigations in different states led to the development of a standard case definition. A case definition is a set of standard criteria for classifying whether a person has a particular disease, syndrome, or other health condition. It typically consists of clinical criteria and often includes limitations on time, place, and person. The clinical criteria usually include confirmatory laboratory tests, if available, or combinations of symptoms (subjective complaints), signs (objective physical findings), and other findings.

CDC epidemiologists developed the following case definition for this outbreak

- under age 21 years;
- admitted to hospital with severe respiratory illness;
- reported symptoms began on or after August 1, 2014; and
- confirmed positive for EV-D68 in respiratory specimens.

Question 4: Why was it necessary to establish a case definition?

The teams in each state compiled data concerning age, sex, state where hospitalization occurred, symptom onset date, and clinical confirmation into a line list (Table 1). Teams shared all data with each other and uploaded data onto the National Enterovirus Surveillance System (NESS). Although isolated enterovirus infections are not reportable nationally[1], CDC sent out a directive nationwide requesting that all laboratory detections of enterovirus be reported to NESS.

Question 5: Indicate a reason why isolated enterovirus infections are not reportable.

Question 6: Why did CDC send out a directive nationwide requesting that all laboratory detections of enterovirus be reported to NESS? Should this system remain after the outbreak subsides?

Question 7: On the basis of the case definition, describe how you would identify which reports in Tables 1A–1D meet the case definition. Then, complete the last column of the table (titled *Case?)* using a *Yes* or *No* answer.

[1] Polioviruses are enteroviruses and polio is nationally reportable. The majority of states also require reporting of outbreaks or unusual increases in illnesses due to unknown or otherwise nonreportable causes. Only a fraction of cases get reported – even when the condition is reportable. Factors such a severity of illness, available time, interest, and especially resources influence reporting. Severe illnesses are more likely to be reported than milder ones. Facilities with more resources tend to be better reporting sources than those with less.

Table 1A: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Chicago Children Hospital, Illinois

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
1	6/30/2001	Female	Illinois	8/22/2014	Yes	
2	5/1/2003	Male	Illinois	8/22/2014	Yes	
3	1/26/2005	Male	Illinois	8/20/2014	Yes	
4	1/15/2006	Male	Illinois	8/22/2014	Yes	

Table 1B: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Colorado

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
5	8/11/1993	Female	Colorado	8/22/2014	Yes	
6	1/6/2000	Male	Colorado	8/22/2014	Yes	
7	10/20/2000	Male	Colorado	8/25/2014	Yes	
8	2/13/2001	Male	Colorado	8/26/2014	Yes	
9	6/4/2001	Female	Colorado	8/26/2014	Yes	
10	12/9/2001	Female	Colorado	8/25/2014	Yes	
11	5/17/2003	Male	Colorado	8/22/2014	Yes	
12	11/8/2003	Female	Colorado	8/21/2014	Yes	
13	3/6/2004	Male	Colorado	8/26/2014	Yes	
14	6/9/2004	Female	Colorado	8/21/2014	Yes	
15	7/13/2004	Male	Colorado	8/26/2014	Yes	
16	9/16/2004	Male	Colorado	8/27/2014	Yes	
17	2/19/2005	Male	Colorado	8/23/2014	Yes	
18	7/26/2005	Female	Colorado	8/27/2014	Yes	

Table 1C: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Illinois, other than Chicago hospitals

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
19	9/22/1997	Female	Illinois	8/21/2014	Yes	
20	3/10/1998	Male	Illinois	8/26/2014	Yes	
21	1/10/1999	Male	Illinois	8/23/2014	Yes	
22	5/29/1999	Male	Illinois	8/28/2014	Yes	
23	6/5/1999	Male	Illinois	8/26/2014	Yes	
24	7/5/1999	Female	Illinois	8/28/2014	Yes	
25	12/3/1999	Female	Illinois	8/26/2014	No	
26	12/6/1999	Male	Illinois	8/20/2014	Yes	
27	1/19/2000	Male	Illinois	8/29/2014	Yes	
28	4/6/2000	Male	Illinois	8/25/2014	Yes	
29	4/15/2000	Male	Illinois	8/27/2014	Yes	
30	6/9/2000	Female	Illinois	8/21/2014	Yes	
31	9/19/2000	Female	Illinois	8/24/2014	Yes	
32	9/25/2000	Female	Illinois	8/26/2014	Yes	
33	10/5/2000	Male	Illinois	8/27/2014	Yes	
34	10/29/2000	Male	Illinois	8/25/2014	Yes	
35	3/26/2001	Female	Illinois	8/21/2014	Yes	
36	5/20/2001	Female	Illinois	8/21/2014	Yes	
37	6/25/2001	Female	Illinois	8/27/2014	Yes	
38	8/21/2001	Female	Illinois	8/26/2014	Yes	
39	3/19/2002	Female	Illinois	8/26/2014	Yes	
40	11/7/2002	Male	Illinois	8/26/2014	Yes	
41	12/2/2002	Male	Illinois	8/22/2014	Yes	
42	2/6/2003	Female	Illinois	8/21/2014	Yes	
43	2/26/2003	Male	Illinois	8/22/2014	Yes	
44	2/26/2003	Male	Illinois	8/26/2014	Yes	
45	3/6/2003	Male	Illinois	8/24/2014	Yes	
46	4/5/2003	Female	Illinois	8/29/2014	Yes	
47	5/7/2003	Female	Illinois	8/26/2014	Yes	
48	12/6/2003	Male	Illinois	8/28/2014	Yes	
49	1/5/2004	Male	Illinois	8/24/2014	Yes	
50	3/5/2004	Male	Illinois	8/26/2014	Yes	
51	5/25/2004	Male	Illinois	7/29/2014	Yes	
52	6/5/2004	Male	Illinois	8/23/2014	Yes	
53	8/14/2004	Male	Illinois	8/24/2014	Yes	
54	10/3/2004	Female	Illinois	8/20/2014	Yes	
55	1/5/2005	Male	Illinois	8/19/2014	Yes	
56	7/26/2005	Female	Illinois	8/28/2014	Yes	
57	8/4/2006	Male	Illinois	8/20/2014	Yes	
58	3/26/2014	Male	Illinois	8/25/2014	Yes	

Table 1D: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Missouri

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
59	2/19/1991	Female	Missouri	8/25/2014	Yes	
60	1/10/1997	Male	Missouri	8/25/2014	Yes	
61	3/6/1999	Male	Missouri	8/25/2014	Yes	
62	3/16/2000	Male	Missouri	8/27/2014	Yes	
63	5/30/2000	Male	Missouri	8/28/2014	Yes	
64	9/3/2000	Female	Missouri	8/21/2014	Yes	
65	9/3/2000	Male	Missouri	8/22/2014	Yes	
66	4/5/2001	Female	Missouri	8/21/2014	Yes	
67	4/8/2001	Male	Missouri	8/21/2014	Yes	
68	4/21/2001	Female	Missouri	8/25/2014	Yes	
69	9/10/2001	Male	Missouri	8/26/2014	Yes	
70	10/6/2001	male	Missouri	8/19/2014	Yes	
71	7/5/2002	Male	Missouri	8/26/2014	Yes	
72	7/5/2003	Male	Missouri	8/26/2014	Yes	
73	7/21/2003	Male	Missouri	8/23/2014	Yes	
74	6/9/2004	Male	Missouri	8/24/2014	Yes	
75	7/5/2004	Female	Missouri	8/21/2014	Yes	
76	9/26/2004	Male	Missouri	7/22/2014	Yes	
77	1/14/2005	Female	Missouri	8/25/2014	Yes	
78	4/23/2005	Female	Missouri	8/29/2014	Yes	
79	5/9/2005	Male	Missouri	8/20/2014	Yes	
80	7/8/2005	Female	Missouri	8/26/2014	Yes	
81	7/25/2005	Male	Missouri	8/26/2014	Yes	
82	11/24/2005	Female	Missouri	8/24/2014	Yes	
83	12/30/2005	Female	Missouri	8/26/2014	Yes	
84	3/23/2006	Female	Missouri	8/21/2014	Yes	
85	9/1/2006	Male	Missouri	8/27/2014	Yes	
86	9/24/2006	Male	Missouri	8/20/2014	Yes	
87	8/2/2014	Male	Missouri	8/26/2014	Yes	

Question 8: Construct an epidemic curve by using data from Tables 1A–1D.

Question 9: On the basis of the epi curve, what kind of outbreak would you consider this; point source, continuous common-source, intermittent common-source, or person-to-person propagation?

Question 10: Make a hypothesis as to how the patients came became exposed. What additional information do you need to help formulate your hypothesis?

After further questioning, a determination is made that of the original 52 patients, 40 attended an overnight camp in St. Louis. Another 10 are family members who visited the camp to drop off or pick up their siblings. By using the criteria from the established case definition, seven more states reported cases of EV-D68 to the NESS.

No vaccines or specific treatments for EV-D68 are available, and clinical care is supportive. Health care providers should consider EV-D68 as a possible cause of acute, unexplained severe respiratory illness; suspected clusters or outbreaks should be reported to local or state health departments. CDC epidemiologists began to prepare literature for dissemination to the public and to health care professionals.

Appendix 1B

No Cure for the Summertime Blues

Enterovirus D68 Case Study Answer Key

Directions: Guide students through Part 1 (Appendix 1A). Introduce the case to students and discuss the learning objectives. Explain that this case was based on events that occurred during 2014. Before starting the case, you can consider having students read CDC's guidelines for investigating Unexplained Respiratory Disease Outbreaks available at http://www.cdc.gov/urdo/outbreak.html.

Student Directions: Read the case study scenario. Answer the questions.

Case Overview

During late summer 2014, hospitals across the United States were reporting increases in the number of children with severe respiratory illness. These increases were initially reported from Missouri and Illinois but other states were soon reporting similar increases. Infection with enterovirus D68 (EV-D68) was found to be the cause of many of these illnesses. Enteroviruses are members of the picornavirus family, a group that includes the rhinoviruses (causes of the common cold). Other enteroviruses include the polioviruses, coxsackieviruses and echoviruses, all of which are spread primarily through fecal-oral transmission. There is no vaccine or anti-viral medicine that is effective against EV-D68.

Figure 3. This poster was created during a 2014 increase in enterovirus D68 cases. Source: CDC PHIL ID #18056.

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At the end of this case study, students will be able to

- classify increases occurrence of disease as clusters, outbreaks, epidemics, or pandemics;
- justify planning decisions for conducting a field investigation;
- apply a case definition to a field investigation; and
- characterize an outbreak by using correct graphs and tables.

Note: This case is based on investigations conducted by Claire Midgley, PhD, MS, Epidemic Intelligence Service officer, Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, Centers for Disease Control and Prevention, and Mary Anne Jackson, MD, Infectious Disease Department, Children's Mercy Hospital, Kansas City, Missouri, with substantial contributions from the Department of Pathology and Laboratory Medicine, Children's Mercy Hospital, Kansas City, Missouri; Missouri Department of Health and Senior Services; University of Chicago Medicine; and the Illinois Department of Public Health. Their report can be found at: http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6336a4.htm. Details of the investigations have been modified for the educational purposes of this case study.

Part 1: Emergence of a mysterious respiratory illness in Chicago

On August 20, 2014, a boy aged seven years was brought to University of Chicago Medicine Comer Children's Hospital in Illinois. He had symptoms of a mild respiratory illness, including runny nose, sneezing, cough, and body and muscle aches. After examination, the physician sent him home. He instructed the mother to get him to drink plenty of fluids and prescribed cold medicine to make the boy comfortable.

Two days later, the boy's condition had deteriorated. He had shortness of breath, coughing, and wheezing. His mother brought him back to the hospital. The physician's diagnosis was acute respiratory distress. The boy's physician consulted with the emergency department physician, and the boy was admitted to the pediatric intensive care unit (PICU).

Later that night, three additional children, aged six to nine years, were admitted to PICU. They were admitted through the emergency department with similar symptoms. Two had a history of asthma. One girl, who had especially severe symptoms, was put on a ventilator. Health care providers interviewed each parent about their child's symptoms. All parents reported that the symptoms seemed to get progressively worse during a three-day to four-day period. The symptoms suggested a viral infection, perhaps due to the same virus. To confirm, health care providers collected stool and respiratory specimens for laboratory testing.

While awaiting laboratory results, health care providers consulted with the Chief of the Infectious Disease Department. Since this represented an unusual cluster of patients with this condition in the metro area, they also called the Chicago Board of Health to report the cases and to inquire if other hospitals in the area were reporting similar cases.

Question 1: How would you classify the four recent cases of the mysterious respiratory illness at Children's Hospital in Chicago? Choices include cluster, outbreak, epidemic, or pandemic? Explain.

Note: Defining each of the options with the students might be helpful. Consider writing the definitions on the board or cling sheets. In small groups, ask students to decide which classification makes the most sense. Ask a student volunteer from each group to present their answer and reasoning.

- Cluster: an aggregation of cases of a disease, injury, or other health condition (particularly cancer and birth defects) in a circumscribed area during a particular period without regard to whether the number of cases is more than expected (often the expected number is unknown).
- Outbreak: the occurrence of more cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a specific period. Usually, cases are presumed to have a common cause or to be related to one another in some way. Sometimes distinguished from an epidemic as more localized, or the term less likely to evoke public panic.
- Epidemic: the occurrence of more cases of disease, injury, or other health condition than expected in a given area or among a specific group of persons during a particular period. Usually, cases are presumed to have a common cause or to be related to one another in some way.
- Pandemic: an epidemic occurring over a widespread area (multiple countries or continents) and usually affecting a substantial proportion of the population.

Answer: Based on the information presented to this point, this situation may be best referred to as a cluster or aggregation of cases in a circumscribed area during a particular period. To call this an outbreak or unusual increase in the number of cases would require information about the baseline. The comparison with the number of cases during the same time period in previous in the Missouri case series in the MMWR article is a good indication of the type of information needed to call this an outbreak.

Question 2: At this point, is a need for further investigation necessary? Yes or no, and why or why not? Should Centers for Disease Control and Prevention (CDC) be called in to assist? Yes or no, and why or why not?

Note: Ask students to spend a couple of minutes with a partner discussing what types of cluster or outbreak characteristics might necessitate further investigation. Then, decide if a further investigation is needed. Remind students that CDC will only investigate if they are called in by health authorities. This will typically occur when the necessary resources exceed the capacity of the local and state health department or when outbreaks or clusters occur across state lines.

Answer: Answers will vary. When deciding how to respond to a respiratory disease outbreak, public health agencies must take into consideration multiple factors such as severity of the illness, the availability of resources, and competing agency priorities. Although each agency needs to determine the level of public health response needed for each outbreak, multiple characteristics of respiratory outbreaks typically warrant further investigation and an urgent response. The characteristics below should not be viewed as a comprehensive or definitive list, but serve as a guide to determine which outbreaks merit further investigation.

- Outbreaks of unknown etiology.
- Outbreaks associated with severe disease manifestations, such as need for hospitalization or death.
- Outbreaks that identification of the causative agent or potential dual infections is needed.
- Outbreaks that can be useful to answer epidemiologic, laboratory, or infection control questions.
- Outbreaks of possible vaccine-preventable diseases.
- Outbreaks associated with institutional settings or with a likely (controllable) environmental source.
- Clusters of respiratory infection potentially caused by a bioterrorism agent.
- Outbreaks among a vulnerable population.
- Outbreaks that have generated excessive public anxiety.
- Outbreaks that are either very large or rapidly progressing.

Source: Centers for Disease Control and Prevention: http://www.cdc.gov/urdo/outbreak.html.

Part 2: Confirming an outbreak of enterovirus D68

Local health authorities confirmed 13 similar cases were reported by three other Chicago area hospitals during the past week. Patients were male and female, ranging in age from six to 10 years. Two male patients, both aged seven years, died within a week of being admitted to PICU.

The Illinois Department of Public Health requested CDC assistance. Local diagnostic laboratory testing using polymerase chain reaction assay on a multiplex platform was able to determine if enteroviruses or rhinoviruses were present but not tell which (i.e., specimens were reported positive for enterovirus/rhinovirus). Viral genome sequencing at CDC was able to give more specific results. The CDC found samples from all four patients from University of Chicago Medicine Center Children's Hospital and 10 of 13 patients from the other area hospitals to be positive for EV-D68.

CDC epidemiologists arrived the next day and teamed up with local health department epidemiologists and physicians from affected Chicago hospitals to investigate the outbreak. An epidemiologist and physician interviewed the parent of each patient.

Question 3: What types of information should be collected during this investigation?

Note: Write the following headings on the board: Demographic Information, Activities, Animal Exposure, Physical Signs and Symptoms. Have students review the two forms used to collect data, available online at: http://www.cdc.gov/urdo/sampleforms.html. Ask students to consider what types of information could be collected in each category.

- Long Form: This extended form was developed to provide a comprehensive set of questions to consider when developing a case questionnaire for investigation of outbreaks of unknown respiratory illness. These questions cover a range of topic areas, including patient and family contact information, occupation, travel history and other exposures of interest, extensive past medical history review, and a comprehensive list of potential laboratory tests completed. Using the form in its entirety for any particular outbreak would be unusual; parts of the form should be utilized as necessary on the basis of factors surrounding the outbreak, including the differential diagnoses and the population affected. In contrast to the short-case questionnaire form, information needed to answer certain questions on this form might be unavailable, and data collection might require compiling information from different sources, including medical records, physician interviews, patient and family interviews, and public health departments.
- Short Form: This short sample case report form is a template that is ready to use for quick data collection for ill persons who are part of unexplained respiratory outbreak field investigations. The form is not intended to be comprehensive; rather, it should be modified as necessary to accommodate the particular data requirements of the current outbreak investigation. It is meant to collect important common or core data elements needed in most respiratory disease outbreak investigations. The first page of the form allows for collection of basic demographic, symptom, and exposure information from a patient interview. The second page collects objective clinical and laboratory testing information and is to be completed by an interview with the treating or reporting physician or a review of the ill person's medical record.

Answer: Answers will vary. Data should cover a range of topic areas, including patient and family contact information, occupation, travel history and other exposures of interest, extensive past medical history review, and a comprehensive list of potential laboratory tests completed.

Part 3: First patients from Missouri

CDC was initially notified of 10 patients in Missouri with illness similar to that reported in Illinois. Three female children ranged in age from six to seven years and seven male children ranged in age from seven to 11 years. Seven patients had difficulty breathing, shortness of breath, cough, wheezing and fever, three required a respiratory breathing machine. Specimen testing confirmed EV-D68 in all patients.

Five patients in Colorado were reported. All were males ranging in age from eight to 10 years and presented with similar symptoms. Clinical specimens were sent to CDC for testing.

The state health departments in Missouri and Colorado requested CDC assistance. Teams of CDC epidemiologists were sent to each state to work with the health department and local hospitals.

This emergence of multiple outbreaks and investigations in different states led to the development of a standard case definition. A case definition is a set of standard criteria for classifying whether a person has a particular disease, syndrome, or other health condition. It typically consists of clinical criteria and often includes limitations on time, place, and person. The clinical criteria usually include confirmatory laboratory tests, if available, or combinations of symptoms (subjective complaints), signs (objective physical findings), and other findings.

CDC epidemiologists developed the following case definition for this outbreak

- under age 21 years;
- admitted to hospital with severe respiratory illness;
- reported symptoms began on or after August 1, 2014; and
- confirmed positive for EV-D68 in respiratory specimens.

Question 4: Why was it necessary to establish a case definition?

Note: Discuss the importance of inclusion and exclusion of cases. Start the conversation with how different people can classify symptoms or characteristics differently than others. Discuss the importance for three different teams to be working under the same assumptions. See below for a complete answer to further this discussion.

Then, briefly discuss the following possible reasoning for each component of the case definition: (1) discuss why a range of ages are included, whereas current cases are aged from six to 10 years; (2) discuss that EV-D68 is believed to only cause severe respiratory illness in a small proportion of cases. Most infections with EV-D68 are likely to cause only a mild illness. Therefore, not all cases would be picked up by the proposed case definition; (3) discuss why August 1, 2014, was chosen as the date for the case definition; (4) discuss why clinical confirmation is required; and (5) discuss the importance of inclusion and exclusion of cases.

Answer: The development of a clear case definition is critical to effective investigation of an outbreak. Before counting cases, the epidemiologist must decide what to count, that is, what to consider a case. For that, the epidemiologist uses a case definition to collect information to perform descriptive epidemiology by characterizing the cases collectively according to time, place, and person.

Use of a common case definition allows for standardization of the cases of interest both within an ongoing outbreak investigation and possibly between outbreak investigations that differ over time or geographic location. Certain case definitions, particularly those used for national surveillance, have been developed and adopted as national standards that ensure comparability. Use of an agreed-upon standard case definition ensures that every case is equivalent, regardless of when or where it occurred, or who identified it. Furthermore, the number of cases or rate of disease incidence identified in one time or place can be compared with the number or rate from another time or place.

The teams in each state compiled data concerning age, sex, state where hospitalization occurred, symptom onset date, and clinical confirmation into a line list (Table 1). Teams shared all data with each other and uploaded data onto the National Enterovirus Surveillance System (NESS). Although isolated enterovirus infections are not reportable nationally[2], CDC sent out a directive nationwide requesting that all laboratory detections of enterovirus be reported to NESS.

[2] Polioviruses are enteroviruses and polio is nationally reportable. The majority of states also require reporting of outbreaks or unusual increases in illnesses due to unknown or otherwise nonreportable causes. Only a fraction of cases get reported – even when the condition is reportable. Factors such a severity of illness, available time, interest, and especially resources influence reporting. Severe illnesses are more likely to be reported than milder ones. Facilities with more resources tend to be better reporting sources than those with less.

Question 5: Indicate a reason why isolated enterovirus infections are not reportable.

Answer: Isolated enterovirus cases are not reportable because their symptoms are common, similar to those caused by other agents, infections are not easily identified without sophisticated testing, and knowledge of the cause has little influence concerning treatment of infected persons.

The debate surrounding the addition of a new disease to the notifiable disease list must balance the public health benefit (see below) against the additional reporting burden placed on health care providers, laboratories, and others who are supposed to report.

Adding a new disease to the list of reportable conditions improves public health agencies ability to
- take action to prevent or control a problem (e.g., identify and respond to outbreaks);
- establish baseline data if a new intervention is available (e.g., establish baseline incidence of influenza or chickenpox and monitor effect of vaccination.); or
- learn more about the epidemiology and natural history of the condition (e.g., AIDS during the early 1980s).

Surveillance allows public health agencies to monitor the patterns of disease occurrence and guides public health planning and action.

Conversely, overworked or resource-poor reporting sources (e.g., clinicians or laboratories) sometimes express concern that too many diseases are already on the list, forms are too complex or too much information is being asked for and that too little is done with the data already collected. The result may be widespread underreporting of all but the most serious and rare conditions with clear public health implications (e.g., botulism or plague).

Question 6: Why did CDC send out a directive nationwide requesting that all laboratory detections of enterovirus be reported to NESS? Should this system remain after the outbreak subsides?

Answer: NESS can be used to identify any additional cases occurring in different parts of the country during an outbreak. After the outbreak subsides, monitoring the situation closely is important because the virus might still be active.

Question 7: On the basis of the case definition, describe how you would identify which reports in Tables 1A–1D meet the case definition. Then, complete the last column of the table (titled *Case?)* using a *Yes* or *No* answer.

Answer: Answers will vary. Students should develop a systematic approach to identifying which should be considered cases, according to the case definition. For example, students should first exclude each case that is among persons aged >21 years. Then, exclude those who had an onset of symptoms before August 1, 2014, followed by those without clinical confirmation.

Table 1A: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Chicago Children Hospital, Illinois

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
1	6/30/2001	Female	Illinois	8/22/2014	Yes	**Answer:** Yes
2	5/1/2003	Male	Illinois	8/22/2014	Yes	**Answer:** Yes
3	1/26/2005	Male	Illinois	8/20/2014	Yes	**Answer:** Yes
4	1/15/2006	Male	Illinois	8/22/2014	Yes	**Answer:** Yes

Table 1B: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Colorado

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
5	8/11/1993	Female	Colorado	8/22/2014	Yes	**Answer:** Yes
6	1/6/2000	Male	Colorado	8/22/2014	Yes	**Answer:** Yes
7	10/20/2000	Male	Colorado	8/25/2014	Yes	**Answer:** Yes
8	2/13/2001	Male	Colorado	8/26/2014	Yes	**Answer:** Yes
9	6/4/2001	Female	Colorado	8/26/2014	Yes	**Answer:** Yes
10	12/9/2001	Female	Colorado	8/25/2014	Yes	**Answer:** Yes
11	5/17/2003	Male	Colorado	8/22/2014	Yes	**Answer:** Yes
12	11/8/2003	Female	Colorado	8/21/2014	Yes	**Answer:** Yes
13	3/6/2004	Male	Colorado	8/26/2014	Yes	**Answer:** Yes
14	6/9/2004	Female	Colorado	8/21/2014	Yes	**Answer:** Yes
15	7/13/2004	Male	Colorado	8/26/2014	Yes	**Answer:** Yes
16	9/16/2004	Male	Colorado	8/27/2014	Yes	**Answer:** Yes
17	2/19/2005	Male	Colorado	8/23/2014	Yes	**Answer:** Yes
18	7/26/2005	Female	Colorado	8/27/2014	Yes	**Answer:** Yes

Table 1C: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Illinois, other than Chicago hospitals

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
19	9/22/1997	Female	Illinois	8/21/2014	Yes	**Answer:** Yes
20	3/10/1998	Male	Illinois	8/26/2014	Yes	**Answer:** Yes
21	1/10/1999	Male	Illinois	8/23/2014	Yes	**Answer:** Yes
22	5/29/1999	Male	Illinois	8/28/2014	Yes	**Answer:** Yes
23	6/5/1999	Male	Illinois	8/26/2014	Yes	**Answer:** Yes
24	7/5/1999	Female	Illinois	8/28/2014	Yes	**Answer:** Yes
25	12/3/1999	Female	Illinois	8/26/2014	No	**Answer:** No
26	12/6/1999	Male	Illinois	8/20/2014	Yes	**Answer:** Yes
27	1/19/2000	Male	Illinois	8/29/2014	Yes	**Answer:** Yes
28	4/6/2000	Male	Illinois	8/25/2014	Yes	**Answer:** Yes
29	4/15/2000	Male	Illinois	8/27/2014	Yes	**Answer:** Yes
30	6/9/2000	Female	Illinois	8/21/2014	Yes	**Answer:** Yes
31	9/19/2000	Female	Illinois	8/24/2014	Yes	**Answer:** Yes
32	9/25/2000	Female	Illinois	8/26/2014	Yes	**Answer:** Yes
33	10/5/2000	Male	Illinois	8/27/2014	Yes	**Answer:** Yes
34	10/29/2000	Male	Illinois	8/25/2014	Yes	**Answer:** Yes
35	3/26/2001	Female	Illinois	8/21/2014	Yes	**Answer:** Yes
36	5/20/2001	Female	Illinois	8/21/2014	Yes	**Answer:** Yes
37	6/25/2001	Female	Illinois	8/27/2014	Yes	**Answer:** Yes
38	8/21/2001	Female	Illinois	8/26/2014	Yes	**Answer:** Yes
39	3/19/2002	Female	Illinois	8/26/2014	Yes	**Answer:** Yes
40	11/7/2002	Male	Illinois	8/26/2014	Yes	**Answer:** Yes
41	12/2/2002	Male	Illinois	8/22/2014	Yes	**Answer:** Yes
42	2/6/2003	Female	Illinois	8/21/2014	Yes	**Answer:** Yes
43	2/26/2003	Male	Illinois	8/22/2014	Yes	**Answer:** Yes
44	2/26/2003	Male	Illinois	8/26/2014	Yes	**Answer:** Yes
45	3/6/2003	Male	Illinois	8/24/2014	Yes	**Answer:** Yes
46	4/5/2003	Female	Illinois	8/29/2014	Yes	**Answer:** Yes
47	5/7/2003	Female	Illinois	8/26/2014	Yes	**Answer:** Yes
48	12/6/2003	Male	Illinois	8/28/2014	Yes	**Answer:** Yes
49	1/5/2004	Male	Illinois	8/24/2014	Yes	**Answer:** Yes
50	3/5/2004	Male	Illinois	8/26/2014	Yes	**Answer:** Yes
51	5/25/2004	Male	Illinois	7/29/2014	Yes	**Answer:** No
52	6/5/2004	Male	Illinois	8/23/2014	Yes	**Answer:** Yes
53	8/14/2004	Male	Illinois	8/24/2014	Yes	**Answer:** Yes
54	10/3/2004	Female	Illinois	8/20/2014	Yes	**Answer:** Yes
55	1/5/2005	Male	Illinois	8/19/2014	Yes	**Answer:** Yes
56	7/26/2005	Female	Illinois	8/28/2014	Yes	**Answer:** Yes
57	8/4/2006	Male	Illinois	8/20/2014	Yes	**Answer:** Yes
58	3/26/2014	Male	Illinois	8/25/2014	Yes	**Answer:** Yes

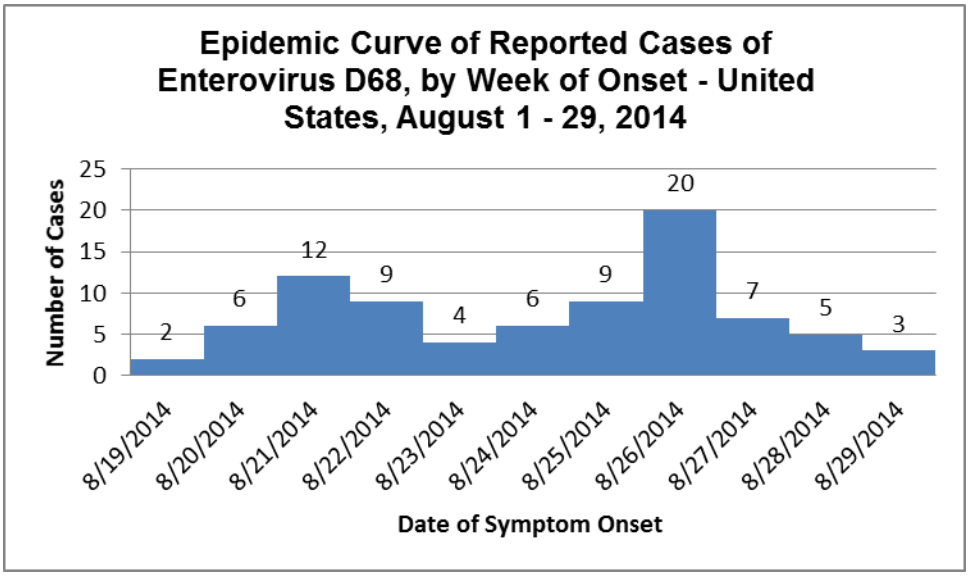
Table 1D: Reported cases of enterovirus D68 with severe respiratory distress, by onset week — Missouri

Case #	Date of Birth	Sex	State Hospitalized	Onset Date	Clinical Confirmation	Case?
59	2/19/1991	Female	Missouri	8/25/2014	Yes	**Answer:** No
60	1/10/1997	Male	Missouri	8/25/2014	Yes	**Answer:** Yes
61	3/6/1999	Male	Missouri	8/25/2014	Yes	**Answer:** Yes
62	3/16/2000	Male	Missouri	8/27/2014	Yes	**Answer:** Yes
63	5/30/2000	Male	Missouri	8/28/2014	Yes	**Answer:** Yes
64	9/3/2000	Female	Missouri	8/21/2014	Yes	**Answer:** Yes
65	9/3/2000	Male	Missouri	8/22/2014	Yes	**Answer:** Yes
66	4/5/2001	Female	Missouri	8/21/2014	Yes	**Answer:** Yes
67	4/8/2001	Male	Missouri	8/21/2014	Yes	**Answer:** Yes
68	4/21/2001	Female	Missouri	8/25/2014	Yes	**Answer:** Yes
69	9/10/2001	Male	Missouri	8/26/2014	Yes	**Answer:** Yes
70	10/6/2001	male	Missouri	8/19/2014	Yes	**Answer:** Yes
71	7/5/2002	Male	Missouri	8/26/2014	Yes	**Answer:** Yes
72	7/5/2003	Male	Missouri	8/26/2014	Yes	**Answer:** Yes
73	7/21/2003	Male	Missouri	8/23/2014	Yes	**Answer:** Yes
74	6/9/2004	Male	Missouri	8/24/2014	Yes	**Answer:** Yes
75	7/5/2004	Female	Missouri	8/21/2014	Yes	**Answer:** Yes
76	9/26/2004	Male	Missouri	7/22/2014	Yes	**Answer:** No
77	1/14/2005	Female	Missouri	8/25/2014	Yes	**Answer:** Yes
78	4/23/2005	Female	Missouri	8/29/2014	Yes	**Answer:** Yes
79	5/9/2005	Male	Missouri	8/20/2014	Yes	**Answer:** Yes
80	7/8/2005	Female	Missouri	8/26/2014	Yes	**Answer:** Yes
81	7/25/2005	Male	Missouri	8/26/2014	Yes	**Answer:** Yes
82	11/24/2005	Female	Missouri	8/24/2014	Yes	**Answer:** Yes
83	12/30/2005	Female	Missouri	8/26/2014	Yes	**Answer:** Yes
84	3/23/2006	Female	Missouri	8/21/2014	Yes	**Answer:** Yes
85	9/1/2006	Male	Missouri	8/27/2014	Yes	**Answer:** Yes
86	9/24/2006	Male	Missouri	8/20/2014	Yes	**Answer:** Yes
87	8/2/2014	Male	Missouri	8/26/2014	Yes	**Answer:** Yes

Question 8: Construct an epidemic curve by using data from Tables 1A–1D.

Note: First, have students set up the epidemic curve with a title and axis labels. Then, ask students identify the data that they will need for the epi curve, reminding students that they should only include cases in the epidemic curve. In groups, have students create the epi curves by using the data provided in Table 1A–1D. Students should be able to complete the epi curve without a computer. However, you can choose to do so. Have students complete Question 8.

Answer:



Question 9: On the basis of the epi curve, what kind of outbreak would you consider this; point source, continuous common-source, intermittent common-source, or person-to-person propagation?

Note: If your students are unfamiliar with these terms you can discuss what each type of outbreak is and what it would look like on an epi curve. Explain that the shape of the epidemic curve is determined by the epidemic pattern (for example, common source versus propagated), the period during which susceptible persons are exposed, and the minimum, average, and maximum incubation periods for the disease. For more detailed information see Quick Learn: Using an Epi Curve available at **http://www.cdc.gov/training/QuickLearns/CreateEpi/** for more information concerning how to interpret an epi curve.

- Point source: An epidemic curve that has a steep upslope and a more gradual down slope (a so-called log-normal curve) is characteristic of a point-source epidemic in which persons are exposed to the same source over a relative limited period. In fact, any sudden rise in the number of cases indicates sudden exposure to a common source one incubation period earlier.
- Continuous common-source: If the duration of exposure is prolonged, the epidemic is called a continuous common-source epidemic, and the epidemic curve has a plateau instead of a peak.
- Intermittent common-source: An intermittent common-source epidemic (exposure to the causative agent is sporadic over time) usually produces an irregularly jagged epidemic curve reflecting the intermittence and duration of exposure and the number of persons exposed.
- Person-to person-propagation: In theory, a propagated epidemic — one spread from person-to-person with increasing numbers of cases in each generation — should have a series of progressively taller peaks one incubation period apart, but in reality a limited number produce this classic pattern.

Answer: The epidemic curve indicates that it is person-to-person propagation. The fact that multiple states were involved with no common link had been identified weakened arguments for point or common source.

Question 10: Make a hypothesis as to how the patients came became exposed. What additional information do you need to help formulate your hypothesis?

Note: Students should focus on the answer to Question 9, person-to-person propagation.

Answer: Because the epi curve indicates that the outbreak is transmitted through person-to-person propagation, the virus was likely transmitted from one person, or patient zero to other people. Because EV-D68 causes respiratory illness, the virus can be found in an infected person's respiratory secretions, such as saliva, nasal mucus, or sputum. EV-D68 likely spreads from person to person when an infected person coughs, sneezes, or touches a surface that is then touched by others. Knowing how students interacted with each other can be helpful in identifying exposure.

After further questioning, a determination is made that of the original 52 patients, 40 attended an overnight camp in St. Louis. Another 10 are family members who visited the camp to drop off or pick up their siblings. By using the criteria from the established case definition, seven more states reported cases of EV-D68 to the NESS.

No vaccines or specific treatments for EV-D68 are available, and clinical care is supportive. Health care providers should consider EV-D68 as a possible cause of acute, unexplained severe respiratory illness; suspected clusters or outbreaks should be reported to local or state health departments. CDC epidemiologists began to prepare literature for dissemination to the public and to health care professionals.

Worksheet 2

Public Service Announcement

Name: _____ Date: _____

Directions: Create a unique video public service announcement that focuses on the spread of enterovirus D68 and a solution to the problem. You will need to develop a concept for the public service announcement (PSA) by framing your message for your audience. You might consider using social math. Then, plan, write, record, and edit a 60-second PSA. Use the guidelines on the back of this worksheet.

What is a public service announcement?
A PSA is an advertisement that relates to public issues. The Ad Council (initially called the War Advertising Council) originally shaped PSAs. Their first campaigns focused on the country's needs during World War II. After the war, the Ad Council expanded its focus to address issues such as forest fires, blood donations, and highway safety. Today, hundreds of nonprofit and government agencies create PSA campaigns. On average the National Association of Broadcasters contributes an estimated $10 billion a year in free time for different public causes. The most popular topics of PSAs now are health and safety. The following is a link of an example of a PSA by the Ad Council. https://youtu.be/wVZJJukXfpk?list=PLvLKVdN7PzZdiHwQgYeRaQ_B4mvafj-FB.

What is social math?
Social math is the practice of translating statistics and other data so they become meaningful to the audience and make statistics and numbers concerning an issue meaningful to persons by vividly communicating those numbers. Social math helps messages resonate with the target audience by referencing or comparing the issue numbers to certain characteristics

- familiar numbers or costs (e.g., cost of car payment);
- dramatic events (e.g., the number of residents displaced following Hurricane Katrina);
- costs that are smaller and understandable (e.g., the program would cost less than the cost of a school lunch each day); and
- numbers from other concerns (e.g., it's more than one-third of what we spend on prescription medication each year).

For more information concerning framing and social math see http://www.cdc.gov/injury/framing/CDCFramingGuide-a.pdf.

Guidelines

Step 1: Developing a Concept

1. Choose your target audience.
2. Brainstorm the following questions with your group.
   - What is the problem?
   - What connection to everyday life can you make to link this problem to your target audience?
   - What do you want to say about the problem? (e.g., How big is the problem? What is the risk? What is a solution to the problem?)
   - What action do you want your audience to take? (e.g., How can they protect themselves and those they care about?)

Step 2: Write a PSA

3. Develop the following components:
   - Description: Turn in a written description of the PSA, answering questions above, plus any other information and research about the problem, or the population the PSA addresses or serves.
   - Narration: Share your message in unexpected or novel ways. Elements in the message should be woven together with insight and imagination grabbing the attention of the intended audience. The message needs to be clear and concise. A single thought or phrase at the end of the PSA should summarize the entire message (tag line). Make sure the message is based on accurate and verifiable information. Time out your script by reading it aloud with a stopwatch.
   - Story Board: Create a storyboard for approval BEFORE you begin shooting. A storyboard is a visual representation of the different shots (shot sketches) in the order they will appear in the finished work. In addition include the following: (1) audio (where the narration comes in, or if music with images); (2) written description of the images you are planning, including locations, actions, objects, and actors; (3) compositional information (e.g., close up, pan, or wide shot). Your drawings can be simple stick figures.

Shoot and Edit your PSA

4. As a group, decide who will play what role in acting, shooting, editing, and finalizing your PSA. Then, work together to finalize your PSA.
   - Shooting: By using your device (e.g., mobile phone or video camera), record your footage of the PSA. Remember to record more material than you need. You will edit your footage for your final PSA project.
   - Final PSA: Your final PSA should be edited, contain voice or music, and any titles and endings. Be sure to view your PSA before final submission.