

ACTIVITY

THE OPERATION OUTBREAK TEAM

ACTIVITY DETAILS

AGE or GRADE LEVEL

Middle and High School

LEARNING OBJECTIVES

- Identify steps during an influenza outbreak investigation.
- Identify roles and responsibilities of public health and animal health professionals in an influenza outbreak investigation and the skills each needs to fulfill their roles.

PROBLEM-BASED SKILL(S)

Collaborative performance

NATIONAL STANDARDS

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

<https://www.cdc.gov/careerpaths/k12teacherroadmap/pdfs/ephs-competencies.pdf>

NGSS Science & Engineering Practice(s): Obtaining, evaluating, and communicating information; Crosscutting Concept(s): Cause and effect

<http://www.nextgenscience.org/get-to-know>

ACTIVITY TIME

45 minutes

HANDOUTS

- Role Play Cards

MATERIALS

The Junior Disease Detectives, Operation: Outbreak graphic novel
(www.cdc.gov/flu/graphicnovel)

Scissors, tape

INTRODUCTION

The outbreak investigation portion of the story begins after the Thomas County Fair. At the fair, Eddie shows his pig named Hamlet, and he notices that Hamlet appears sluggish.

Later, Eddie becomes very sick with flu-like symptoms, including a fever of 101 degrees, a cough, and muscle aches. His mother takes him to visit his primary care physician, Dr. Walker. Dr. Walker collects clinical information and a respiratory specimen (a nasal swab) from Eddie, which she sends to a local clinical laboratory for testing. Laboratory testing is used by physicians to identify the cause of a patient's illness. Clinical specimens from patients are also used as part of routine monitoring, or surveillance, of an illness.

Both the clinical laboratory and, subsequently, the state public health laboratory are unable to identify the source of Eddie's illness. Therefore, per federal and international health regulations reporting protocols, the state public health laboratory scientist reports Eddie's case to the Centers for Disease Control and Prevention (CDC), a federal public health agency, and sends the specimen there for additional testing.

The state epidemiologist and his staff are particularly concerned with Eddie's illness because testing at the state public health laboratory is unable to identify the pathogen responsible. This suggests the cause of Eddie's illness could be something new or uncommonly associated with human infections.

As the story continues, the state epidemiologist, Jim Jefferies, then contacts a CDC epidemiologist, Dr. Lee, and explains the situation. Because the state public health laboratory was unable to identify the cause, Jim Jefferies and Dr. Lee decide to work together

on an investigation and Jim Jefferies submits a formal request to CDC for short-term epidemiologic assistance.

Dr. Lee is joined by his CDC team of [Epidemic Intelligence Service \(EIS\)](#) (<https://www.cdc.gov/eis/index.html>) officers, including Drs. Alison, Kim and Alex, to help with the investigation. EIS officers are CDC epidemiologists, or disease detectives, who complete a two-year training and serve on the front lines of public health. CDC epidemiologists work with their state public and animal health colleagues to assist with the investigation, including on-site data collection, analysis, and interpretation. After a cause of Eddie's illness is determined, they will work together to implement prevention and control measures. People they contact include the following: Eddie and his friends in 4-H, Eddie's parents and his primary care physician, the state fair organizer, other fair attendees, local hospitals and doctors' offices, and the state veterinarian who inspected animals at the fair.

Later in the story, Eddie's friends and CDC's EIS officers realize that there might be a link between the source of Eddie's illness and his pig, Hamlet, which he showed at the Thomas County Fair. CDC conducts laboratory testing on the specimen obtained from Eddie, while USDA conducts laboratory testing on the specimen obtained from Hamlet. CDC and USDA laboratory scientists (i.e., laboratorians) share their respective test results with each other, which indicate that Eddie and Hamlet have been infected with an influenza virus with very similar genomes. (Note: the term *genome* refers to the complete set of genes present in an organism; in this case, a virus.) This leads the public health and animal health authorities to conclude that the influenza virus that infected Hamlet is the same virus that infected Eddie. This virus represents a variant influenza, which is also known as a novel influenza virus infection in a human. (For more information, see the Educational Overview description of zoonotic diseases, variant influenza, novel influenza, and pandemics.)

Public and animal health authorities investigate novel influenza virus infections among people to determine if these viruses are changing in ways that would allow them to spread more easily among people and potentially cause a pandemic.

During the course of an outbreak investigation, there is a need for many professionals to consult with one another. Depending on the size and scale of an outbreak investigation, the number of public and animal health professionals involved may vary and their roles can expand and change. Overall, the collaboration of professionals with expertise in the areas of epidemiology, laboratory testing, animal health, communications, policy, statistics, and clinical care is what makes the investigation possible.

As part of the investigation, CDC experts, including informaticians, data managers, biostatisticians and laboratory scientists work behind the scenes. The data managers set up databases to store information that EIS officers and other epidemiologists collect in a manner that will allow for efficient data analyses with the support of biostatisticians. Public health laboratory scientists work to characterize the virus that infected Eddie, while staff at USDA's laboratories analyze specimens collected by the state veterinarian from some of the animals present at the Thomas County Fair. The virus specimen testing results from both CDC and USDA's laboratories are compared to determine if there are similarities between the viruses collected from people and animals.

Throughout the investigation, health communications specialists formulate a strategy based on well-established risk communications principles. They help to create communication products based on data and guidance from other public health officials to educate the public, media and other audiences about what is known and not known about the outbreak, and what actions people should take to protect themselves and their families. Health communications specialists help coordinate communications efforts and messages between local, state and federal partners, and then

communicate necessary information to external audiences.

DID YOU KNOW

Influenza viruses circulate among pigs and other animals, like birds and dogs that are different from the viruses that circulate in people. Experts believe all four influenza pandemics that occurred in the last 100 years were caused by viruses that originated from birds or pigs, and later gained the ability to spread among people.

RESOURCES

Careers at CDC

(<https://jobs.cdc.gov/career-fields>)

Careers in public health

(<http://www.careersinpublichealth.net/careers/>)

CDC influenza (flu)

(<https://www.cdc.gov/flu/index.htm>)

CDC swine/variant influenza virus

(<https://www.cdc.gov/flu/swineflu/index.htm>)

USDA influenza in swine

(<https://www.usda.gov/topics/animals/one-health/influenza-swine>)

CDC stay healthy at animal exhibits

(<https://www.cdc.gov/features/animalexhibits/>)

CDC Says “Take 3” Actions to Fight the Flu

(<https://www.cdc.gov/flu/protect/preventing.htm>)

ACTIVITY INSTRUCTIONS

EXPLAIN

Different public health professionals play key roles in outbreak investigations based on their areas of expertise. By leveraging their diverse skill sets, they enhance collaboration and carry out the investigation efficiently.

Establishing data collection, management and reporting protocols as well as communication procedures allow different public and animal health professionals at the local, state and federal levels to work together to identify the cause of Eddie’s illness and establish measures to ensure additional people do not get sick.

In this activity, students will learn about the roles of different characters from the graphic novel. Then, together, they will decide the action sequence of the outbreak investigation using the graphic novel as a guide.

DIRECTIONS

1. Print enough sets of the role play cards so that each student in the class has at least one role. There are 14 roles in a set. Mark each set with a letter: A, B, C, etc.
2. Hand out the role play cards, and then have students find other students with the same role play card. Have each team consider the following:
 - What general responsibilities does this person have in their job?
 - What professional skills might this person need to do their job?
 - What role might this person have during an influenza outbreak investigation?
 - Who might this person communicate with during an influenza outbreak investigation?
3. Group students based on their role play card set marked with a letter A, B, C, etc. Within each group, have each student present 3-4 key facts about their role to the group.
4. Have each group work together to determine the steps of the influenza outbreak investigation by ordering their set of role play cards according to when each role would become involved in the outbreak investigation.
5. When each group comes to a consensus on the order of the steps of the influenza outbreak investigation, have each group tape their role play cards on a wall, accordingly.
6. Then, instruct each group to add arrows that show communication pathways among the roles.
7. Assign students to write up a 1 or 2 page story about how the outbreak was investigated based on the steps of the influenza outbreak investigation and the communication pathways.

DISCUSS

- Why would one case of respiratory illness caused by an unidentified virus in a person who recently attended an agricultural fair be cause for concern?
- Why is it beneficial to have public health and animal health professionals with different roles, skills, and disciplines involved in an influenza outbreak investigation?

INFORMATION

Activities were developed as a collaboration between the CDC Science Ambassador Fellowship; ten Science, Technology, Engineering, and Mathematics (STEM) teachers from across the country who participated in the 2017 CDC Science Ambassador Fellowship; and CDC's Influenza Division.

CDC's Division of Scientific Education and Professional Development

The following experts in education from the U.S. Centers for Disease Control and Prevention provided leadership, content development, and editing for these activities: Kelly Cordeira, MPH, Student Programs and Partnerships Lead, Division of Scientific Education and Professional Development, Center for Surveillance, Epidemiology, and Laboratory Services.

CDC Science Ambassador Fellows

The following STEM teachers who participated in the 2017 CDC Science Ambassador Fellowship within CDC's Division of Scientific Education and Professional Development co-developed the educational activities in consultation with CDC experts: Richard Blauvelt, MPH, MAT (Harper Woods, Michigan); Tami Caraballo, MEd (Snohomish, Washington); Karen Krieger, MSSE (Phnom Penh, Cambodia); Sarah Sletten, PhD (Fargo, North Dakota); Tina Gibson, MS EdD, 2017 Peer Leader (Columbus, Mississippi); Clara Bennion, MEd (Camdenton, Missouri); Pam Gilmore, MS (Muskego, Wisconsin); Larisa Masson (Portland, Oregon); Susannah Miller, MA (Indianapolis, Indiana); Valencia LaPrelle' Williams, PhD, 2017 Peer Leader (Ontario, California).

CDC's Influenza Division

The following experts from the U.S. Centers for Disease Control and Prevention provided consultation: Douglas Jordan, MA, Influenza Division, National Center for Immunization and Respiratory Diseases; Lt. Col. (R) Joe Gregg, Influenza Coordination Unit, National Center for Immunization and Respiratory Diseases; Alicia Budd, MPH, Influenza Division, National Center for Immunization and Respiratory Diseases; James Kile, DVM, MPH, Influenza Division, National Center for Immunization and Respiratory Diseases; Michael Jhung, MD, MPH, Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases

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CITATION

Centers for Disease Control and Prevention (CDC). CDC Science Ambassador Fellowship—Operation Outbreak: Educational Activities,

Eddie

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Primary Care Physician

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Clinical Laboratory Scientist

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

State Laboratory Scientist

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

State Epidemiologist

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

State Public Health Veterinarian

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Thomas County Fair Director

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

State Veterinarian

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

CDC Epidemiologists

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

CDC Biostatisticians

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

CDC Laboratory Scientists

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

USDA Laboratory Scientists

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Health Educators

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Communications Specialists

General responsibilities

Role in an outbreak investigation

Professional skills

Communicate with during an outbreak investigation

Note: Sample answers are provided below, but are not meant to be comprehensive or exhaustive. Additional information on these and other careers in public health can be found using the Careers in Public Health websites. See Resources.

	General responsibilities	Professional skills ¹	Main role in an influenza outbreak investigation	Communicate with during an influenza outbreak investigation
Eddie	A 4-H exhibitor who should follow safe animal handling and flu prevention practices	Knowledge about owning, caring for, and keeping records of livestock. Following guidelines or requirements for showing livestock	Report symptoms and information that could help identify the cause of illness	Primary care physician; epidemiologists or others who interview him as part of the investigation
Primary care physician	A medical doctor who provides direct treatment for the patient	Medical knowledge and awareness of public health, ability to communicate clearly, ability to think critically and problem solve, and attention for detail	Collect clinical information and specimens for laboratory testing; treat the patient, as needed	Eddie; local clinical laboratory; local or state public health department
Clinical laboratory scientists	A laboratory scientist who tests and analyzes samples from patients sent by physicians at hospitals or clinics, and who should follow recommended protocols for specimens to send for additional testing	Laboratory procedure skills, such as skills in identifying appropriate lab test to run, specimen preparation and testing, maintaining lab equipment, ensuring lab safety, following lab protocols, accurately reporting of results, interpreting results, knowing when to send specimens for further testing if needed, and attention for detail	Test specimens; report results back to physician, and, depending on the result, to the local or state public health department or public health laboratory	Primary care physician; local or state health department epidemiologist; state public health laboratory
State public health laboratory scientists	A laboratory scientist who tests and analyzes samples from patients at hospitals or clinics that have been sent from clinical laboratories for additional testing, and who should follow recommended protocols for specimens to send to CDC for additional testing	Laboratory procedure skills, research and data analysis, developing and implementing new testing methods, ability to communicate clearly, attention to detail	Test specimens, confirm test results; send specimens to CDC, if requested by the state public health department and CDC	Local clinical laboratory; state public health department epidemiologist and staff; CDC laboratory scientist
State epidemiologist	An epidemiologist with a specific focus on the	Knowledge of descriptive and analytic epidemiology, ability to	Collect and analyze information about who is sick, when they	Local health department epidemiologist; state

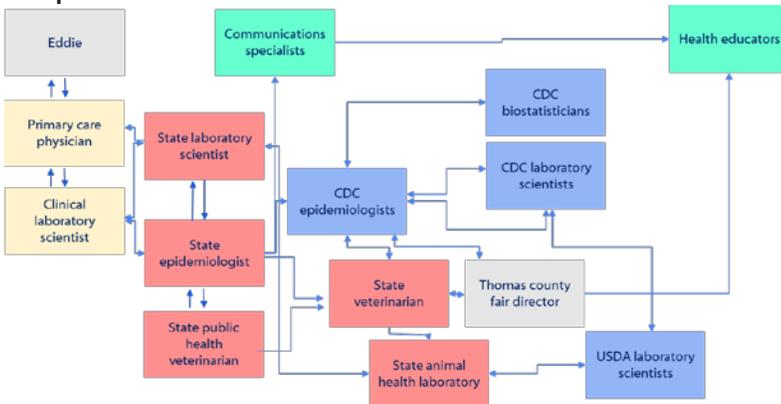
¹ Professional skills are derived from positions or similar positions on the Careers in Public Health website provided in the resource section: <http://www.careersinpublichealth.net/careers>.

	General responsibilities	Professional skills ¹	Main role in an influenza outbreak investigation	Communicate with during an influenza outbreak investigation
	population of an entire state	analyze data and interpret findings, ability to think critically and problem solve, strong math skills, ability to communicate clearly, willingness to work in different environments and ability to work collaboratively with other specialists, including federal, state, and local public health partners	became sick, and exposures they may have had before becoming sick to determine where, when, and how each person may have become infected; Coordinate with the local health department, others in the state health department including the laboratory, CDC, animal health partners (depending on the situation), and physicians (sometimes this is left for local health departments and sometimes it's handled by the state)	laboratory scientist; CDC epidemiologist, CDC laboratory scientist. Health educators or communication specialists
State public health veterinarian	A veterinarian who works for the state health department, focusing their efforts on protecting human populations from infections caused by zoonotic diseases and from injuries caused by animals	Knowledge of clinical animal medicine and general public health knowledge, willingness to work in different environments and ability to work collaboratively with other animal and public health specialists at the federal, state, and local level	Coordinate public health activities, collect human epidemiologic information; coordinate with animal health authorities and activities	State animal health official; state public health epidemiologist, CDC representatives, including epidemiologists, laboratory staff, and communications specialists
Thomas County fair director	A person who coordinates fair activities and communicates with all stakeholders	Knowledge and oversight of local, state, and federal requirements and recommendations from public health officials at the fair; and ability to communicate clearly	Support communication between the state health department and state fair attendees	Animal health official or veterinarian, state epidemiologist; state public health veterinarian, fair attendees
State veterinarian	A veterinarian who works for the state agriculture department, focusing their efforts on protecting livestock and other animal populations from zoonotic and animal diseases	Knowledge of clinical animal medicine, ability to think critically and problem solve, ability to communicate clearly, willingness to work in various environments and ability to work collaboratively with other specialists, including federal, state, and local animal and public health partners	Coordinate animal health activities within their jurisdiction, authorize testing of swine samples, direct sample collection of animals, make decisions regarding animal health and coordinate with public health activities	State public health veterinarian; State Epidemiologist; State agricultural authorities; fair director/organizers; Producers and exhibitors

	General responsibilities	Professional skills¹	Main role in an influenza outbreak investigation	Communicate with during an influenza outbreak investigation
CDC epidemiologists	A person who investigates the causes of disease, how they are spread and how they can be prevented	Knowledge of descriptive and analytic epidemiology, ability to analyze data and interpret findings, ability to think critically and problem solve, strong math skills, ability to communicate clearly, willingness to work in different environments, and ability to work collaboratively with other specialists, including federal, state, and local public health partners	Support the state epidemiologist in collecting and analyzing information about who is sick, when they became sick, and exposures they may have had before becoming sick to determine where, when, and how each person may have become infected; translate this information into recommendations for prevention and control measures	State epidemiologists; state and local public health officials, CDC data manager or biostatistician, CDC laboratory scientists, USDA as appropriate, health educators or communication specialists, animal health personnel, fair organizer, and state public health veterinarian
CDC data managers or biostatisticians	A data manager is proficient at creating databases to store collected information in a manner that it can be efficiently analyzed and shared as needed; a biostatistician is a professional who utilizes statistical techniques and tools to drive forward research in the health field and by applying statistics to their scientific research, a statistician in this field will help develop reports that can be used to improve health	Knowledge of biostatistics, knowledge of descriptive and analytic epidemiology, ability to analyze data and interpret findings, and strong math skills	Organize and aggregate data from disparate sources, analyze data to identify patterns in who was infected and how the virus was transmitted	CDC epidemiologists, and state public health officials
CDC laboratory scientists	Laboratory scientists at the CDC who test and analyze samples from human cases and potential cases, and who provide laboratory science assistance to states that have requested CDC aid	Laboratory procedure skills, research and data analysis, developing and implementing new testing methods, ability to communicate clearly, and attention to detail	Verify test results and performing genomic sequence analyses on the specimens provided by the state laboratory	CDC epidemiologist and state laboratory scientists
USDA laboratory scientists	Laboratory scientists at the USDA who test and analyze samples from animal or food, usually related to agriculture, and researches findings	Laboratory procedure skills, research and data analysis, developing and implementing new testing methods, ability to communicate clearly, and attention to detail	Test animal specimens to identify and characterize the virus causing the infection	CDC laboratory scientists, state laboratory scientists, state epidemiologist and veterinarian

	General responsibilities	Professional skills ¹	Main role in an influenza outbreak investigation	Communicate with during an influenza outbreak investigation
Health educators	Professionals who develop, oversee, manage, and provide health education programs to a group of people	Knowledge of education theory and strategies, ability to communicate clearly, willingness to work in various environments and ability to work collaboratively with other specialists, including federal, state, and local public health partners	Develop educational materials and resources used to communicate with the public about prevention measures	Communication specialists; state epidemiologist
Communications specialists	Professionals who develop communication strategies, messages and products, and communicates public health risks, concerns, trends, and recommendations to the public, as well as media, policy makers and other health professionals; a communications director will oversee the communications of a public health group within a public health department or agency	Knowledge of risk communication principles and practice, public speaking, leadership, ability to communicate clearly, ability to condense and summarize complex scientific information into easy to follow information and recommendations, willingness to work in different environments and ability to work collaboratively with other specialists, including federal, state, and local public health partners	Develop messages and materials to communicate with the public, media, government officials, and partners about the outbreak and the investigation	General public, media, public and animal health stakeholders and partners, businesses, schools, politicians, state epidemiologist; health educator; laboratory scientists, statisticians, veterinarians

Sample Connection of Roles



Note: This is an example of the connection of the roles, but it is not meant to capture all possible lines of communication. As you can see in the novel, there are many professionals involved in an outbreak situation. Early planning for how to communicate among and between local teams (e.g., physicians and clinical laboratories), state-level teams, and knowing how to request federal assistance (CDC and USDA) are key elements to initiating an outbreak investigation. Clear protocols for responsibilities including data collection, analysis and communication of results are essential for the investigation to progress efficiently.