

**Activity 1.4.3 Life of an Epidemiologist**

Introduction

A group of scientists, doctors, and public health professionals touch down in Central Africa. Pulling respirators down over their faces, they make one last check of their protective suits. Even a tiny tear in the fabric could prove disastrous. Years of training have not prepared them for what they are about to see. Hemorrhagic fever has left bodies writhing in pain and seeping blood as organs and tissue liquefy under the direction of a tiny virus. This virus works fast, but the scientists must work faster if they are going to find the source of the outbreak and prevent further spread. The team cautiously steps out of the helicopter and begins work.

*Epidemiologists*, dedicated medical professionals at the heart of the public health field, monitor the health of populations and search for patterns in disease. They may assist in outbreak investigations or they may examine lifestyle factors and their relationship to chronic illnesses such as heart disease, diabetes, and cancer. Whether in the field, in a lab, or in an office, epidemiologists play a crucial role in maintaining human health.

In this activity, you will research the field of epidemiology and complete four small tasks as you play the role of an epidemiologist at work. You will investigate how to conduct an outbreak investigation, analyze disease data, design an epidemiologic study, and evaluate prevention and therapy for chronic and infectious diseases.

Equipment

* Computer with Internet access
* Career journal
* Laboratory journal

Procedure

1. Visit the Centers for Disease Control and Prevention’s EXCITE Introduction to Epidemiology site at http://www.cdc.gov/EXCITE/epidemiology.html. Also be sure to search the internet for more information on the field of epidemiology.
2. Write a one to two sentence definition of *epidemiology* in your own words in your laboratory journal.
3. Research a career as an epidemiologist using additional resources on the Internet. In your career journal, summarize the education and training required for a career in epidemiology, as well as a typical salary range.
4. Using information from your research in Step 3, list at least ten possible duties of an epidemiologist under the training and salary information in your career journal.
5. Use the Internet to research the disease *cholera*. In your laboratory journal, answer the following questions:

* What causes cholera?
* How is cholera transmitted?
* What are the symptoms of cholera?
* What preventive measures have helped eliminate the threat of cholera in the United States?

1. Read the article listed below about John Snow, a scientist considered by many to be the father of epidemiology. In your laboratory journal, list the steps Snow took to investigate and stop the spread of cholera in London in the 1850s. Describe the evidence he used to determine the source of the outbreak.

* UCLA Department of Epidemiology – Broad Street Pump Epidemic <http://www.ph.ucla.edu/epi/snow/broadstreetpump.html>

1. Answer Conclusion question 1.

Now, you will step into the shoes of an epidemiologist and work to analyze disease patterns and investigate potential outbreaks. Read the information presented below and complete the four tasks.

Task #1

Working as an epidemiologist, you are called in to a small, rural middle school. Over fifty students have reported to the nurse in the last three hours, complaining of nausea and vomiting.

1. Develop and write a list of at least five questions an epidemiologist would need to ask and answer in order to investigate and solve this case. Use information found at http://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/index.html and ideas from the John Snow case to help you come up with questions. Record your list in your laboratory journal.
2. Describe possible evidence you could collect to help you determine if these cases are connected, to identify the source of the infection, and to answer your questions from Step 8.
3. Share your ideas with the class.

Task #2

Given the severe gastrointestinal symptoms of the students, you suspect a food-borne pathogen. Something they ate is making these kids extremely sick. In an attempt to pinpoint the source of the infection, you decide to interview the students who are showing symptoms about the foods that they consumed in the school cafeteria. Once you know which foods each student consumed, you can calculate an attack rate for each specific food item. An *attack rate* is defined as the number of people at risk who develop a certain illness divided by the total number of people at risk. Thus, a *food specific attack rate* can be calculated using the following formula:

Number of people who ate a certain food and became ill

Total number of people who ate that food

Your survey results in the data sample listed below. The table lists the total number of students interviewed who consumed the given food item, as well as the number of students who are ill and the number of students who are well.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Food Survey Results** | | | | |
| Food | Ill | Well | Total | Attack Rate |
| Milk | 45 | 24 | 69 |  |
| Banana | 20 | 11 | 31 |  |
| Cheese Pizza | 10 | 48 | 58 |  |
| Chicken Nuggets | 40 | 24 | 64 |  |
| Potato Salad | 43 | 10 | 53 |  |
| Chocolate Pudding | 18 | 10 | 28 |  |
| Ice Cream Sandwich | 36 | 23 | 59 |  |

1. Calculate a food-specific attack rate for each item listed in the survey. Add the attack rate to the appropriate column on the table.
2. Analyze the data in the table. In your laboratory journal, describe conclusions you can make about the possible source of the outbreak. Provide a reason why the food item in question may be linked to the outbreak of food poisoning. What further questions would you have to answer in order to determine if this food item is responsible for the outbreak?
3. Note that another tool often used in outbreak investigations is an epidemic curve, a graphical distribution of the times of onset of disease. In your laboratory journal, explain what information an epidemic curve would lend to your investigation.

Task #3

Epidemiologists organize formal studies to test the possible associations between risk factors and disease. Not all epidemiologists study infectious diseases or investigate outbreaks. Many epidemiologists study the factors that may contribute to the development of chronic diseases such as cancer and heart disease. The most common study designs utilized by epidemiologists to investigate both infectious and chronic diseases are the *cohort study* and the *case-control study*.

* In a cohort study (also called a *prospective study*), the investigator selects a group of exposed individuals (individuals who have been exposed to the potential risk factor) and a group of non-exposed individuals and follows both groups over time to determine the incidence of disease.
* In a case-control study (also called a *retrospective study*), a group of individuals with the disease are identified (called *cases*) and compared to a group of people without the disease (called *controls*). Cases and controls are carefully matched on all criteria other than the one being studied. For example, cases and controls should be matched for age, gender or for underlying medical conditions. These individuals can then be surveyed about their exposure to the given risk factor.

1. In your career journal, describe how you would set up both a case-control and a cohort study looking at the link between smoking and elevated cholesterol levels. For each study design, include information about the participants in the study and describe how you might analyze study data.
2. Answer Conclusion question 2-5.

Optional Task #4

Epidemiologists study how disease is distributed in populations and the factors that influence this distribution, but they also evaluate and implement disease prevention and treatment and health care delivery.

1. Imagine you are working as an epidemiologist. Choose two diseases from the list below.

* Tuberculosis
* Hantavirus pulmonary syndrome (HPS)
* Mad cow disease
* Avian influenza (bird flu)
* Malaria
* Lyme disease
* Cervical cancer
* Legionnaire disease
* Plague
* Measles
* Ebola hemorrhagic fever
* AIDS
* Smallpox
* Polio
* Anthrax
* West Nile Virus
* SARS

1. Research each of the two diseases on the Internet. Take notes on relevant information you will need to complete Steps 18-20.
2. For one disease, write a short paragraph describing how you are working to prevent this disease. Make sure to mention your geographical location and to describe how the action or medication works to prevent this disease.
3. For the second disease, write a short paragraph describing your efforts in treating the disease or designing a new therapy. Make sure to mention how this treatment stops the symptoms of the disease or cures the patient.
4. Describe any barriers you encounter in delivering health care and completing your work in Step 18 and Step 19 that are unique to each situation. Add this information to the paragraphs for each disease.
5. Answer the remaining Conclusion questions.

Conclusion Questions

1. Describe how John Snow’s investigation may have differed if the cholera outbreak occurred today. Think about the interventions and tests you have explored in this lesson.
2. What are the advantages and disadvantages of studying disease using a cohort study?
3. What are the advantages and disadvantages of studying disease using a case-control study?
4. Why is it important to match case subjects and control subjects so closely in a case-control study?
5. Explain why a case-control study is often referred to as a *retrospective study*.
6. Describe at least four ways an epidemiologist could have helped in handling and analyzing the outbreak of hemorrhagic fever in Africa.
7. How do epidemiologists play a role in the diagnosis, treatment, and prevention of chronic illnesses, such as cancer or heart disease?
8. Explain why statistics and math are important tools for an epidemiologist.
9. What is the most appealing aspect of a career in epidemiology? What would be the most difficult part of being an epidemiologist?
10. Describe the role an epidemiologist could play in the series of events that occurred at Sue’s college.

Web Portfolio

1. Describe what an epidemiologist does.
2. Discuss how epidemiologists play a role in the diagnosis, treatment, and prevention of chronic illnesses, such as cancer or heart disease?