

Epidemiology

Objectives

1. Define the following terms: endemic, epidemic, reservoir, and carrier.
2. Describe three methods of transmission.
3. Determine the source of a simulated epidemic.

Background

In every infectious disease, the disease-producing microorganism, the **pathogen**, must come in contact with the **host**, the organism that harbors the pathogen. **Communicable diseases** can be spread either directly or indirectly from one host to another. Some microorganisms cause disease only if the body is weakened or if a predisposing event such as a wound allows them to enter the body. Such diseases are called **noncommunicable diseases**; that is, they cannot be transmitted from one host to another. The science that deals with when and where diseases occur and how they are transmitted in the human population is called **epidemiology**. **Sporadic diseases** are those that occur occasionally in a population; an example is polio. **Endemic diseases** such as pneumonia are constantly present in the population. When many people in a given area acquire the disease in a relatively short period of time, it is referred to as an **epidemic disease**. Influenza often achieves epidemic status.

Diseases can be transmitted by **direct contact** between hosts. **Droplet infection**, when microorganisms are carried on liquid drops from a cough or sneeze, is a method of direct contact. Diseases can also be transmitted by contact with contaminated inanimate objects, or **fomites**. Drinking glasses, bedding, and towels are examples of fomites that can be contaminated with pathogens from feces, sputum, or pus.

Some diseases are transmitted from one host to another by vectors. **Vectors** are insects and other arthropods that carry pathogens. In **mechanical transmission**, insects carry a pathogen on their feet and may transfer the pathogen to a person's food. For example, houseflies may transmit typhoid fever from the feces of an infected

person to food. Transmission of a disease by an arthropod's bite is called **biological transmission**. An arthropod ingests a pathogen while biting an infected host and then transfers the pathogen to a healthy person in its feces or saliva. The continual source of an infection is called the **reservoir**. Humans who harbor pathogens but who do not exhibit any signs of disease are called **carriers**.

An **epidemiologist** compiles data on the incidence of a disease and its method of transmission and tried to locate the source of infection in order to decrease the incidence.

Materials per student

Petri plate containing nutrient agar

Small plastic sandwich bag or plastic glove

1 numbered swab, wrapped (one swab per group is inoculated with a pigmented microbe^{*}).

Procedure

1. Record the number of your swab in your lab report.
2. Divide the Petri plate into five sectors labeled "1" to "5."

Carefully read steps 3 through 5 before proceeding.

3. Put the plastic bag on your left hand. Carefully unwrap your swab without touching the cotton. Holding the swab with your right hand, rub it on the palm of your left hand (i.e., on the plastic bag). Discard the swab in a container of disinfectant.
4. Shake hands (using your left hand) with a classmate when the instructor gives the

* Use one of these two bacteria: *Kokuria rosea* or *Serratia marcescens*, or the yeast, *Rhodotorula rubra*.

- signal. Shake hands so your fingers touch the other's palm and vice versa. After shaking hands, touch your fingers to the first sector of the nutrient agar. Record the person's name and swab number.
5. Repeat step 3, shaking hands with four other classmates. Remember to touch your fingers to the corresponding sector of the nutrient agar after each hand-shake. *Keep good records.*
 6. Discard the plastic bag in the To Be Autoclaved basket. Incubate the plate inverted at room temperature 24-48 hr.
 7. Record your results in the class database. When all results are in, print the summary and determine who had the contaminated swab.

EpidemiologyName _____
Date _____

Purpose _____

Data

Your swab # _____ Which organism was on the contaminated swab? _____

Your results

Section	Student's name	Swab number	Appear of colonies on nutrient agar
1.			
2.			
3.			
4.			
5.			

Attach the class data.

Conclusions

- Who was the index case? _____
- Explain how you arrived at your conclusion.
- Diagram the path of the epidemic.

Questions

1. Could you be the "infected" individual and not have growth on your plate? Explain.
2. Do all people who contact an infected individual acquire the disease?
3. When does an epidemic stop?
4. Are any bacteria other than the test organism growing on the plates? _____
How can you tell?
5. What was the method of transmission of the "disease" in this experiment?
6. During one year, 21% of the patients in a large hospital acquired *Clostridium difficile* diarrhea and colitis during their hospital stay. These patients required longer hospital stays than uninfected patients. Epidemiological studies provided the following information.

Rate of infection for patients		Rate of environmental isolations of <i>C. difficile</i>	
Single room	7%	Bed rail	10%
Double room	17%	Commode	1%
Triple room	26%	Floor	18%
		Call button	6%
		Toilet	3%
Hands of hospital personnel after contact with patients that were culture-positive for <i>C. difficile</i>			
Used gloves	0%	Washed with nondisinfectant soap	40%
Did not use gloves	59%	Washed with disinfectant soap	3%
Had <i>C. difficile</i> before patient contact	3%	Did not wash hands	20%

What is the most likely mode of transmission of this bacterium in hospitals?

How can transmission be prevented?