

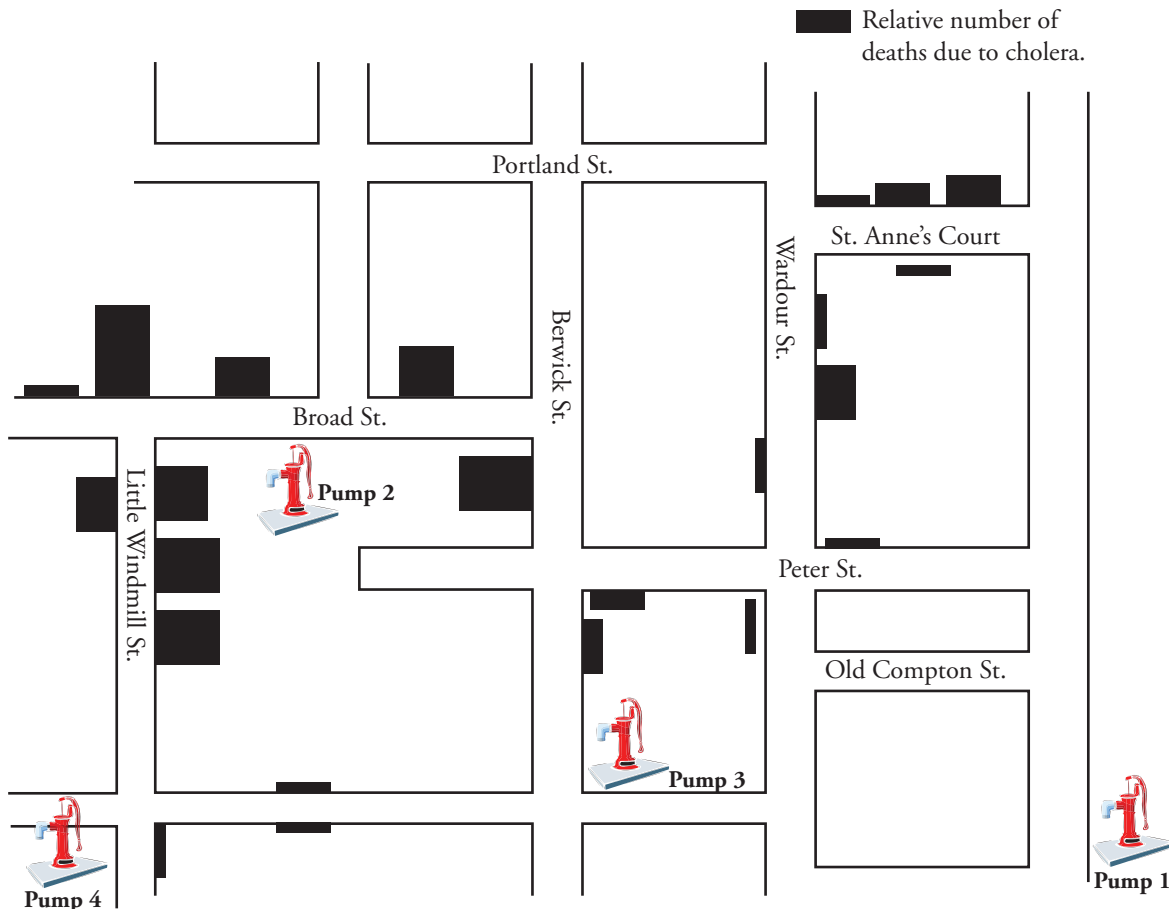
The Spread of Pathogens

How do we get sick?

Why?

Communicable diseases are spread between individuals by different methods, but they are all caused by **pathogens**, which are commonly called “germs.” Knowledge of pathogens and the ways in which they can be spread helps humans understand and prevent disease outbreaks.

Model 1 – The 1854 London Cholera Outbreak



1. Model 1 is a map of an area in London where a large number of cases of cholera occurred in 1854.
 - a. How many water pumps are shown on the map?
 - b. What do the black boxes represent on the map?
 - c. What do the relative sizes of the boxes represent?

2. Is the concentration and size of boxes the same at all locations on the map? Explain your answer.
3. Where exactly on the map does the size and concentration of the boxes appear to be the highest?
4. Is there a relationship between the number of black boxes and any of the water pumps? Be specific and detailed in your answer.
5. Based on the information provided in the map, propose a way cholera may be transmitted.



6. Based on this information, what action would you have taken if you had been responsible for public health in London in 1854?



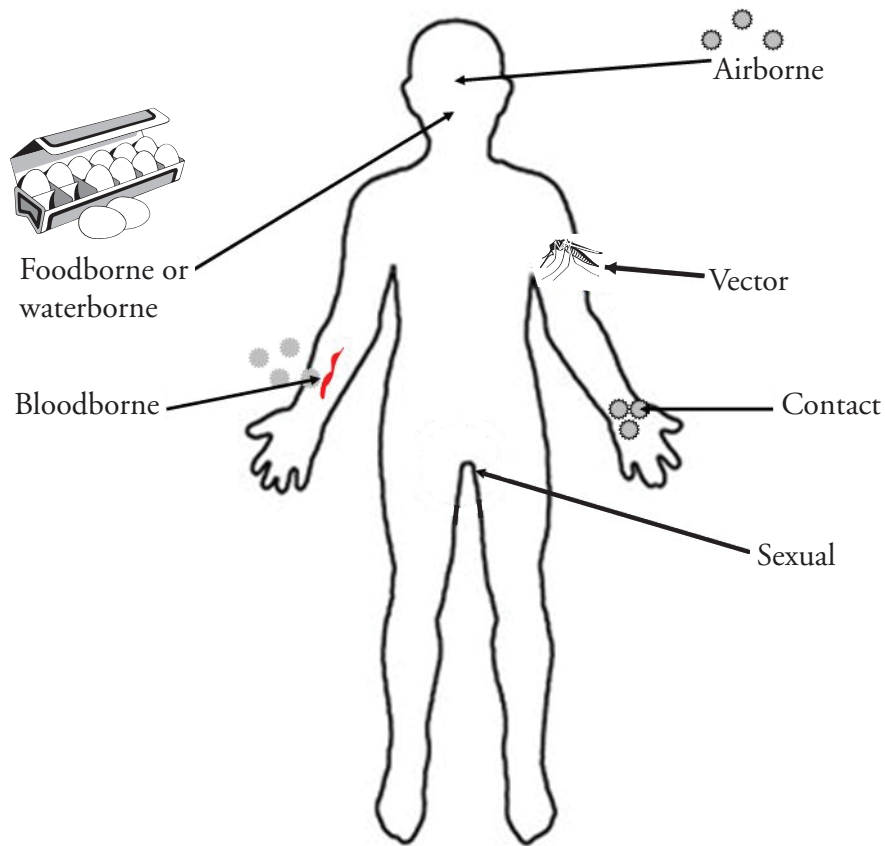
Read This!

Dr. John Snow is often referred to as the “father of epidemiology.” **Epidemiology** is the study of the causes and spread of infectious diseases. Dr. Snow’s study of the cholera outbreak of 1854 led to the discovery of the cause of this epidemic.

7. Cholera is caused by bacteria found in the fecal material of infected individuals. Brainstorm with your group the possible ways that cholera could have been transmitted from an infected individual into the water. Consider the distribution of deaths shown on the map as you develop your response.



Model 2 – Six Modes of Disease Transmission



8. Model 2 illustrates several methods by which diseases may be transmitted.
- List the six modes of disease transmission shown in Model 2.
 - Which of these modes of transmission require a bodily opening, either natural or artificial?
9. An organism that is used by a pathogen to move from one person to another is called a vector.
- What vector is shown in Model 2?
 - With your group, brainstorm a list of other organisms besides the one shown in the diagram that could be vectors for transmitting pathogens.

10. Considering all of the different ways disease may be transmitted, which modes are more likely to cause large numbers of individuals to get sick in the United States? Explain your reasoning.

11. Consider the information given below concerning several diseases. Identify the mode(s) of transmission from Model 2 that is most appropriate based on the description.

Name of Disease	Class of Pathogen	Scientific Name of Pathogen	Disease Transmission (How it is spread)	Mode of Transmission from Model 2
Cholera	Bacteria	<i>Vibrio cholerae</i>	Fecal contamination of water	
Syphilis	Bacteria	<i>Treponema pallidum</i>	Sexual contact with body fluids (can include saliva)	
Common cold	Virus	<i>Rhinovirus</i>	Touching contaminated objects and surfaces, and then touching eyes/nose; inhaling air contaminated from a cough or sneeze	
AIDS	Virus	Human immunodeficiency virus (HIV)	Body fluids, which include blood, semen, vaginal fluids, and breast milk	
Athlete's foot	Fungus	<i>Trichophyton sp.</i>	Moist areas where people walk barefoot	
Tuberculosis (TB)	Bacteria	<i>Mycobacterium tuberculosis</i>	Inhalation of respiratory secretions	
Malaria	Protist	<i>Plasmodium sp.</i>	Being bitten by certain mosquitoes	
Food poisoning	Primarily bacteria (and some viruses)	<i>Salmonella</i> is a common cause	Improperly handled food, fecal contamination of food.	
Lyme Disease	Bacteria	<i>Borrelia sp.</i>	Being bitten by deer ticks	



12. Below are several methods used by society to control disease. Under each method of control, list the diseases from Question 11 that could be prevented with that method. (You may list a disease under more than one category.)
- Preventing the contamination of food and water supplies.
 - Hand washing and good personal hygiene.
 - Avoiding contact with body fluids.
 - Controlling insect populations.
13. Why might diseases transmitted by vectors be harder to control than those transmitted by other means?
14. In the 14th century in Europe, the bubonic plague killed approximately one third of the population. Bubonic plague is caused by the bacteria *Yersinia pestis*, which is spread by an insect vector carried by rats and other rodents. This disease can be spread to other animals besides humans. How is control of a disease such as bubonic plague complicated by the fact that it spreads across multiple animal species?



Extension Question

15. In a recent *Scientific American* article (February 2010), *The Art of Bacterial Warfare*, the authors state that 33% of humans are carrying the *Mycobacterium tuberculosis* bacteria—many without actually getting sick. In addition, 50% of the human population is carrying the bacteria *Helicobacter pylori* (which causes stomach ulcers), and 50% is carrying *Staphylococcus aureus* (which causes skin infections). Knowing that carriers are individuals who often do not show any visible signs of disease, what challenges can you think of for health care officials trying to control these types of communicable diseases?