Section Two: Modes of Disease Transmission

Organizing Questions

- What is the Agent-Host-Environment triad?
- What are the five main ways a pathogen can be transmitted to a host?
- What are examples of diseases that are spread in each of the four modes of transmission?
- How is HIV transmitted, and who is at risk? How is this different from transmission of the common cold?

Introduction

Today, globalization closely links humans from all over the world. Any localized health issue can quickly concern the global community. Despite remarkable advances in medicine during the last century, infectious diseases remain among the leading causes of death worldwide. Many illnesses and deaths in high-income countries are due to non-communicable diseases such as heart disease and cancer. However, globalization is reintroducing infectious disease into industrialized nations such as the United States, Canada, Japan, and many European countries. Thus, it is important that students understand how infectious diseases are transmitted from one person to another so that they can protect themselves from infection and relieve fear and stigma resulting from misconceptions of disease transmission.

Section Two of this lesson consists of multiple activities. First, students will be introduced to the basic framework of disease transmission. They will read about the five main modes of transmission, learning critical examples of each, and complete written exercises individually to solidify understanding. In class, students will consider the transmission of HIV and the common cold as a case study and will come to understand both illnesses from a scientific perspective. They will also brainstorm a list of illnesses that commonly affect them and their schoolmates and will categorize them into their corresponding modes of transmission at the end of the lesson. Second, students will break up into small groups and become "experts" on one of the five modes of transmission through individual research and a critical thinking exercise. Each group will present what they have learned to the class. Throughout this lesson, students will be encouraged to think critically about how they can protect themselves from infection.

Objectives

In Section Two, students will

- conceptualize each mode of disease transmission through a fundamental framework of agent, host, and environment interaction;
- learn about the different ways in which a pathogen can be transmitted from one host to another;
- discuss both HIV and the common cold as a case study and apply their knowledge to compare each infection;

- play an active role in science learning through individual research;
- work in small groups in preparation for presentations to the class; and
- come to appreciate the varying components of an environment (natural and social) that inform the presence of particular diseases in a community.

Materials

Handout 1, *Modes of Transmission Reading*, pp. 86–89, 30 copies

Handout 2, *Disease Framework Worksheet*, p. 90, 30 copies

Handout 3, *Transmission by Direct Contact (HIV vs. Cold) Worksheet*, pp. 91–92, 30 copies

Handout 4, *Research Guidelines*, pp. 93–94, 30 copies

Handout 5, *Identifying Modes of Transmission*, pp. 95–99, seven or eight copies of each scene

Answer Key 1, *Modes of Transmission*, p. 100

Answer Key 2, *Transmission by Direct Contact (HIV vs. Cold)*, pp. 101–102

Answer Key 3, *Identifying Modes of Transmission*, pp. 103–104

Appendix A.3, *Lesson Three Glossary*, pp. 211–213, 30 copies (optional)

Transparency film

Poster board (optional)

CD-ROM, included with unit (optional)

Equipment

Whiteboard

Computer with CD-ROM drive (optional)

Computer projector (optional)

Computer with internet access

Teacher Preparation

Instructions and materials based on a class size of 30 students. Adjust accordingly for different class sizes.

1. Become familiar with the website www.stanford.edu/group/spice/ID/infectious_diseases.swf.
2. Make appropriate number of copies of Handout 1. If conducting the activity as an online survey, create the survey using a software such as Survey Monkey.
3. If conducting culminating activity in class, make copies of the illustrated scenes, Handout 2, *Identifying Modes of Transmission,* and distribute to students for reference during in-class discussion.
4. Note: All transparencies are also available as PDFs (for printing) or PowerPoint slides (for projection from a computer) in the folder titled "Lesson 3" on the CD-ROM included with the unit.

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Time

Approximately two 50-minute class periods

Procedures

Before Day One

Have students access the website, www.stanford.edu/group/spice/ID/infectious_diseases.swf, and read, *Modes of Transmission,* under **Readings** and complete the *Disease Framework* under **Activities** for homework. Instruct students that they can read online or download a PDF of the reading and glossary under Student Resources. Have students print a copy of the *Disease Framework* once they complete it.

A possible alternate activity is to distribute copies of Handout 2, *Disease Framework Worksheet*, and have students complete the paper copy rather than complete the online activity.

Day One

1. Introduce the lesson topic and its significance to the students based on the Agent-Host-Environment Triad presented in Handout One. Draw the triangle framework on the whiteboard and define each term. Briefly review the modes of transmission and answer any questions the students may have.
2. Distribute one copy of Handout 4, *Transmission by Direct Contact (HIV vs. Cold) Worksheet*, to each student. This activity is an evaluative exercise comparing HIV and the common cold, two examples of transmission by direct contact. Read the introduction to the handout aloud to the class while students follow along. Allow 20 to 25 minutes for quiet, individual work time.
3. When the students have completed the handout, review each statement, asking students to volunteer their answers. Using Answer Key 2, *Transmission by Direct Contact (HIV vs. Cold)*, as a guide, facilitate a discussion of each statement, clarifying any confusion.
4. Collect completed Handouts 3 and 4 for assessment.
5. Divide the class into four groups of approximately equal size and assign one mode of transmission to each group. Distribute one copy of Handout 4, *Research Guidelines*, to each student. Every student must research three diseases—two of their choice plus either tuber culosis (if assigned airborne transmission), the common cold (if assigned direct/indirect contact transmission), cholera (if assigned fecal-oral transmission), or malaria (if assigned vector-borne transmission). Instruct the students to complete the handout as homework.
6. **Optional:** Handout Three can be administered as an online survey, which students can access and complete in class. Class discussion can start by showing students the changing survey results.

Day Two

1. Instruct students to meet in their assigned groups with their copies of Handouts 1 and 4 for reference.
2. Distribute one copy of Handout 5, *Identifying Modes of Transmission*, to each student, corresponding to their assigned mode of transmission from Day One. Instruct students to work together, reading the scenario and answering the questions provided. Allow 15 to 20

minutes for group collaboration.

3. Instruct each group to present what they have detected from the scene to the rest of the class using the PowerPoint images or Modes of Transmission activity from website. Refer to Answer Key 3, *Identifying Modes of Transmission*, to help guide the students, if necessary. Ensure that students understand that many different types of pathogens can be involved in each mode of transmission. Help students to refrain from matching a single pathogen with a single mode of transmission.
4. Optional: After group presentations, provide each group with a blank poster board and allow students time to post pictures and diagrams or any other information about the diseases they have researched as homework. The posters may be displayed in the classroom.
5. Optional: If unable to allot time for Day Two activities, instruct students to access the infectious disease website and complete Modes of Transmission under Activities. Have students print the results page of the online quiz for grading. Lead a brief discussion the following class period, calling on students to answer a few of the question prompts from each illustrated scene and to answer any student questions regarding modes of disease transmission.

Assessment

The following are suggestions for assessing student work in Section Two of this lesson:

1. Assess the accuracy of Handout 3, *Transmission by Direct Contact (HIV vs. Cold) Worksheet*, using Answer Key 2, *Transmission by Direct Contact (HIV vs. Cold)*, as a guide. This activity is designed to highlight uncertainties and misconceptions about disease transmission by direct contact, which the teacher can discuss further as needed.
2. Evaluate student research from Handout 4, *Research Guidelines*, based on extent of completion as a reflection of effort.
3. Assess group presentations of Handout 5, *Identifying Modes of Transmission*, using the following criteria:
   - participation and cooperation among the group;
   - clearly stated explanations of the scene and the critical information that informs disease transmission;
   - respect and acknowledgement of other students' observations and comments;
   - sensitivity toward cultural differences that may be presented in scenes; and
   - creativity in presentation of individually researched disease examples (pictures, stories, etc.).

Advanced Topic

Below is a basic introduction to more advanced topics regarding modes of transmission as a guide to further study.

The definitive or final host is the organism in which adult parasites reproduce. An intermediate host is the organism in which a parasite

develops into its larval stage but does not reproduce. A reservoir host, or reservoir, is a non-human host that serves as a home for the infectious agent outside the human body. Reservoirs can be large domestic animals, small rodents, insects, crustaceans, or moist soil and warm bodies of water. A vector is a carrier of an infectious agent. Often an arthropod, or mosquito, a vector transfers a pathogen from one host to another. A vector can be 1) biological, meaning that the infectious agent develops or multiplies within it, or 2) mechanical, meaning that the vector is not essential to the life cycle of the parasite.