Title: **HIV Transmission**

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Appropriate Level: Life Science, High School, Honors, or Advanced Placement Biology

Living Environment: 1-Inquiry, Analysis, Design: 1-Purpose of scientific inquiry: 1.1c; 3-Analyzing observations: 3.1, 3.3 4-Living Environment: 5- Dynamic Equilibrium: 5.2b, 5.2h

Abstract: This activity can be done easily in a classroom setting. The materials are readily available and are safe for students to handle. Role playing is involved and every student takes an active part. It’s FUN! (“Awesome” is the word my 10th graders used!) This is the best way I can imagine to introduce such a sensitive/vital issue in a non-embarrassing way and still get the message across: the HIV virus is transmitted by sharing body fluids, there are specific high risk behaviors, and what you choose to do is the greatest determining factor in whether or not you contract the disease. There is a concern that has been expressed by some teachers that this subject needs to be dealt with in a way that all students can feel comfortable. In some schools there may be HIV positive students and many students have personal experience with friends and relatives who are HIV positive.

Time Required: One, or more, 45-minute periods depending on how much discussion you choose to include.

Special Needs: Test tubes, transfer pipettes, silver nitrate solution, sodium chloride solution
Teacher Information

Technical information

There are many different ways of setting up this activity. We describe several different ways and we encourage you to submit others to us.

The Simple Test Tube Method

Set up a test tube rack containing the same number of test tubes as the number of students in the class. (Any container that is easy to pour from is good, but the clear test tubes or 15mL capped tubes are especially good because it is easy to see the silver nitrate reaction.) Fill one test tube with a solution of sodium chloride. (Somewhere around a 10% solution is good, but this is not an exact science. The teacher should test the solution to make sure it produces a positive reaction after 5-8 transfers.) This test tube represents the body fluids of an HIV infected person. Fill the other test tubes with distilled water (the chlorine in tap water reacts with the indicator, silver nitrate, giving a false positive). Prepare a dropping bottle of silver nitrate solution to serve as the HIV test. Care must be taken when using silver nitrate. Make a mental note of who picks up the “special” test tube when the game begins. You may want to make sure that the person who gets the “special” test tube has a behavior card that promotes the spread of HIV virus. Students will share “body fluids” by pouring some liquid from their test tube into the test tube of the person with whom they are sharing “body fluids”. The other person will pour some of his liquid back into the test tube of the first person.

Make up a set of role cards (3 x 5 cards each identifying the behavioral role that will be assumed by a participant). You must have one card for each student (a class set). Students should not be told who “has” the HIV virus.

The Vial and Role Package

If you have access to culture tubes, they make great containers to hold the “body fluids” and a slip of paper with the “role.” You can make a sleeve on the culture tube with tape and hang on it a cut out folded “role.” This has the advantage of you being able to choose the “role” for the first HIV infected person.

Here are some of the commonly used roles:

“You practice abstinence”: You choose not to exchange body fluids with any other person.

“You are heterosexual and monogamous”: You exchange body fluids only with your spouse. (Your spouse is a person of the opposite sex that you choose to marry - the first and only person with whom you exchange body fluids.) You need to exchange body fluids with your spouse at least twice before the end of the activity.

“You are heterosexual and promiscuous”: You exchange body fluids freely with as many other persons of the opposite sex as you can.
“You are a **prostitute** (male or female)”: You share body fluids with other persons in exchange for money (assume anyone who asks has the money to pay for your “time”).

“You are **gay and promiscuous**”: You exchange body fluids with other persons of the same sex (male). Note: female-to-female transmission has been only rarely documented.

“You are **gay and monogamous**”: You exchange body fluids only with your partner of the same sex – the first and only person with whom you exchange body fluids. You need to exchange body fluids with your partner at least twice before the end of the activity.

“You are **bisexual**”: You exchange body fluids with other persons, both male and female.

“You are an **intravenous drug user**”: You exchange body fluids with other persons when you share contaminated needles. Because the drugs reduce your inhibitions you are more likely to share body fluids with anyone.

“You are a **steroid abusing athlete**”: You share body fluids with other persons when you use contaminated needles.

“You are an **alcohol abuser**”: You are more likely to share body fluids with other persons because alcohol reduces inhibitions.

**HIV Testing**

Allow sufficient time for the exchange, test each student by adding a drop of silver nitrate to each test tube. The teacher will assume the role of the doctor and administer an HIV test to each student at the end of the activity (the doctor may want to wear a lab coat, rubber gloves, and a stethoscope). A white precipitate indicates a positive test; no precipitate is a negative test.

Other solutions may be used: phenolphthalein in the “HIV positive” test tube (test with sodium hydroxide, the positive result is a bright pink solution); a glucose solution in the “HIV positive” test tube (test with Benedict’s solution or test tape).

**Class Discussion**

Before tabulating the results of the test, have students speculate about the types of behavior most likely to result in an HIV+ test.

After getting results from the “HIV Test,” students try to figure out lines of transmission.

The chart in the student handout should be reproduced on the chalkboard. Determine the numbers of students for each behavioral role and the number of “HIV positive” students for each behavioral role. The students then can assign risk levels for each behavior.

The students can do an epidemiology study to trace the route of infection back to the original source.

Class discussion topics may include:
Teacher Comments

I recently did this activity with my Regents Biology class under the unit on blood. I judged it to be a great success. I haven’t received any complaints from irate parents, but just to be safe I discussed with my principal ahead of time what I intended to do, and she approved wholeheartedly. No moral judgments, no lectures - just information and the opportunity to ask questions. So far I’ve only received very positive feedback from students.

Suggestion

The next day in class repeat the activity, only this time all of the role cards say “Your choice: Whether you choose to exchange body fluids with any other person or not is your decision.”

It may also be powerful to run the activity in the context of Sub-Saharan Africa or Southeast Asia, areas where HIV prevalence reaches almost 1/3 of the population. The role cards would reflect the culture in which you have chosen to set the activity. For example, in many parts of Asia the spread of HIV is primarily through prostitution, and in Africa there is a high incidence of mother-to-child transmission. In either case instead of only having 1 “infected” student at the beginning of the activity up to 1/3 of the class would carry the HIV virus. This would help to demonstrate how HIV has become a raging epidemic in parts of the world.

Depending on your classroom situation, you may wish to change the type of virus being transmitted to either a different real virus/disease or a disease that you have completely made up. For example, you could use different hand washing criteria as “roles” that influence the spread of a cold or talk about what may be different about the HPV (human papillomavirus) - males do not know they have it and cannot be tested.

If you would like to attempt to keep track of the epidemiology of the disease, you can use the “dance card” on the next page. The epidemiology can become confusing very quickly, so we do not recommend allowing your students more than three exchanges. Also, it can be useful (although not realistic), to have your students transfer 1 ml of their bodily fluids to a tube after each exchange for later testing.
<table>
<thead>
<tr>
<th>Your Name:</th>
<th>Your Role:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Partner Name</th>
<th>Your number on partner’s card</th>
<th>Sample infected?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Yes/No</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Yes/No</td>
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<td></td>
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</tbody>
</table>
HIV Transmission

New York State Learning Standards

**Standard 1: Inquiry Analysis and Design**

**Key Idea 1:** The purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing and creative process.

1.1- Elaborate on basic scientific and personal explanations of natural phenomena and develop extended visual models and mathematical formulations to represent one’s thinking.

1.1c- Science provides knowledge, but values are also essential to making effective and ethical decisions about the application of scientific knowledge.

**Key Idea 3:** The observations made while testing proposed explanations, when analyzed using conventional and invented methods, provide new insights into natural phenomena.

3.1- Use various methods of representing and organizing observations (i.e., diagrams, tables, charts, graphs, equations, matrices) and insightfully interpret the organized data.

3.3- Assess correspondence between the predicted result contained in the hypothesis and actual result, and reach a conclusion as to whether the explanation on which the prediction was based is supported.

**Standard 4: Living Environment**

**Key Idea 5:** Organisms maintain a dynamic equilibrium that sustains life.

5.2- Explain disease as a failure of homeostasis

5.2c- Viruses, bacteria, fungi and other parasites may infect plants and animals and interfere with normal life functions.

5.2h- Disease may also be caused by inheritance, toxic substances, poor nutrition, organ malfunction, and some personal behavior. Some effects show up right away; others may not show up for many years.
HIV Transmission

Rules of the Activity

1. Each student gets a test vial half filled with fluid. The fluid represents body fluids (for example, blood, semen, or vaginal secretions). One of the vials contains the “HIV” and the rest contain distilled water.

2. A role card is attached to each vial. This identifies a behavioral role (telling when and with whom you can exchange body fluids).

3. When you exchange body fluids, use your pipette to remove some of your fluid and deposit in the vial of the other person. You should receive back an equal amount of their fluid.

4. You must ask the other person for permission to exchange fluids. You may NOT tell the other person what your role is.

5. You can exchange fluids **only** if the exchange is in keeping with your behavioral role, as stated on your role card.

6. After a short period of time exchanging fluids, it will be time to “get tested for HIV.” The teacher will assume the role of a doctor who will administer an “HIV test” to each student.

Analysis

1. Did you test positive for HIV?

2. What was your behavioral role?
3. Were you able to trace the route of infection back to its original source?

4. Describe the method you used to trace the route of infection.

5. From the class data fill in the following table and determine the risk for each of the roles.

<table>
<thead>
<tr>
<th>Role</th>
<th>Number who practiced this behavioral role</th>
<th>Number who tested “HIV Positive”</th>
<th>Risk of contracting HIV (low risk, some risk, or high risk)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Practice abstinence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hetero - monogamous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hetero - promiscuous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prostitute (male or female)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay - promiscuous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gay - monogamous</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisexual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intravenous drug user</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steroid abusing athlete</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol abuser</td>
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</table>
6. Describe one other role you feel should be added to the list of roles “played” in this HIV Transmission simulation.

7. Describe one way this activity could be modified to more accurately reflect today’s society?

8. State three things you learned from this activity.