A Simulation of the Spread of Infectious Diseases
The Human Immunodeficiency Virus

Introduction:
Pathogens are spread by a variety of vectors including air, water, food, and physical contact. Most pathogens are invisible and therefore difficult to avoid. This activity simulates disease transmission through exchange of bodily fluids in a manner similar to how HIV and hepatitis diseases are spread.

Objectives:
This activity illustrates how diseases are transmitted from person to person. We will experiment with how quickly a disease can infect a population. We will attempt to discover the source of infection.

How Do We Contract HIV?
Certain body fluids from an HIV-infected person can transmit HIV.

These body fluids are:
- Blood
- Semen
- Pre-seminal fluid
- Rectal fluids
- Vaginal fluids
- Breast milk

These body fluids must come into contact with a mucous membrane, damaged tissues, or be directly injected into your bloodstream (by a needle or syringe) for transmission to possibly occur. Mucous
membranes are the soft, moist areas just inside the openings to your body. They can be found inside the rectum, the vagina or the opening of the penis, and the mouth.

In the United States, HIV is Spread Mainly By:

Having sexual intercourse with someone infected with the HIV virus. In general:

- Anal sex is the highest-risk sexual behavior. Receptive anal sex (bottoming) is riskier than insertive anal sex (topping).
- Vaginal sex is the second highest-risk sexual behavior.
- Having multiple sex partners or having other sexually transmitted infections can increase the risk of infection through sexual contact.

Sharing needles, syringes, rinse water, or other equipment (works) used to prepare injection drugs with someone who has HIV.

Less Commonly, HIV May Be Spread By:

- Being born from an HIV-infected mother. HIV can be transferred from mother to child during pregnancy, birth, or breastfeeding.
- Being pricked with an HIV-contaminated needle or other sharp object. This is a risk mainly for health care workers.
- Receiving blood transfusions, blood products, or organ/tissue transplants that are contaminated with HIV. This risk is extremely small because of rigorous testing of the US blood supply and donated organs and tissues.
- Eating food that has been pre-chewed by an HIV-infected person. The contamination occurs when infected blood from a caregiver’s mouth mixes with food while chewing, and although very rare, it can still happen.
- Being bitten by a person infected with the HIV virus. A very small number of documented cases has involved severe trauma with extensive tissue damage and the presence of blood. There is no risk of transmission if the skin is not broken.
- Oral sex—using the mouth to stimulate the penis, vagina, or anus.
• Contact between broken skin, wounds, or mucous membranes and HIV-infected blood or blood-contaminated body fluids. These reports have also been extremely rare.

• Deep, open-mouth kissing if the person with HIV has sores or bleeding gums and blood is exchanged. HIV is not spread through saliva. Transmission through kissing alone is extremely rare.

Insects:

There is no evidence of HIV transmission from mosquitoes or any other insects—even in areas where there are many cases of HIV and large populations of mosquitoes. Unlike organisms that are transmitted by insect bites, HIV does not reproduce (and does not survive) in insects.

HIV and Graph:

The CDC awarded $55 million over 5 years to 34 community-based organizations to provide HIV testing to more than 90,000 young gay and bisexual men of color and transgender youth of color with the goals of identifying more than 3,500 previously unrecognized HIV infections and linking those who have HIV to care and prevention services. Additionally, CDC’s MSM Testing Initiative seeks to
identify at least 3,000 MSM with HIV who were previously unaware of their infection and link at least 85% to care.

The CDC is aligning surveillance and program activities more closely. For example, more people living with HIV should be linked to care, receive continuous care and antiretroviral treatment, and achieve a suppressed HIV viral load—the most important goal for maximizing a person’s health as well as reducing the risk of transmission. By increasing the reporting of CD4 and viral load data across the country, the CDC will aid health departments and clinicians monitor treatment progress toward viral load suppression. Currently, CDC estimates that only 25% of the 1.1 million individuals with HIV have their viral loads adequately suppressed.

**Lab Procedure:**

1. Each student will have to choose a numbered long test tube with a dropper pipette included. Each student will also receive a test tube rack with 5 short tubes. These short tubes represent samples that taken after each encounter and tested at the end.

2. Each long tube represents a person that may or may not be infected with the disease.

3. The instructor will let you know when to engage each of the five times. Wait for the “the green light” from you instructor to find a new partner.

4. When meeting with another student, each student should fill their pipette with about 2 mL of solution from their tube.

5. Without getting the pipette in the other persons’ long tube, dispense your liquid into theirs and vice versa.

6. After the exchange of liquids, mix your sample by lightly shaking your long tube. Then take a sub sample (about 2 mL) and place it in a short tube. Label the short tube with the number of the encounter (first, second, third, fourth, and fifth) and below place the number of your partner for that encounter.

7. Repeat this step with 4 other students in the lab after your instructor tells to begin each encounter, but do not exchange with the same person twice.

8. After 5 encounters, add a drop of indicator to each of the five short tubes. If you are infected,
the clear liquid will change to a pink or red.

9. Make a chart to track the disease as it was transmitted, eventually finding the origin of the disease.

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Lab Analysis and Questions:

1. How does this activity compare to the transmission of a real disease?

2. Where does a virus multiply in humans?
3. As the number of partners increases, how does this affect the rate of infection?

4. How might the results have been different if you had been given 5 minutes and were asked to make contact with as many partners as you would like?

Case:

Ronnie and Alyssa have been married for 12 years. Neither had engaged in premarital sex but Alyssa goes in for her yearly physical examination and discovers that she is HIV positive. Alyssa is faithful to Ronnie. How could this have happened? Give at least 2 scenarios when this could be possible. How common do you think this is?

Source