

Global Learning Activity: Submitted by Laurel Young**Infectious Disease**

This lab activity involves an infectious disease simulation and the exploration of past epidemics/pandemics.

Purposes:

- Identify modes of infectious disease transmission
- Simulate how an infectious disease spreads through a population
- Explore past/current epidemics/pandemics to gain perspective of global impact
- Select a past/current infectious disease that originated/severely affected part(s) of Europe, Asia, Africa, and/or Central & South America/Caribbean.

Time:

3 hour lab period

Materials:

- Computers with internet access , presentation software (Power Point/Prezi), Google Earth
- Test tubes and dropper (@ student)
- Distilled water
- 0.1 molar NaOH
- phenolphthalein solution (pH indicator)

Procedure:

What is an Infectious disease? (10 minutes)

Work as a group at your lab table to complete this activity:

1. Search the web for a definition of “infectious disease”. In your own words, define infectious disease, using verbiage that clearly articulates how infectious disease differs from other diseases (i.e. diseases due to inheritance or nutritional deficiencies)
2. The information listed below will be used later in this lab. Infectious diseases are spread in different ways (modes) within a population. Read over the modes of transmission and their associated infectious diseases. Note: there can be overlap in some of these categories (i.e., HIV can be transmitted via blood and sexually). In addition, some of these disease-causing organisms can survive on inanimate objects, such as doorknobs or faucet handles and therefore can also be transmitted via indirect contact.

| Mode of Transmission | Example of Infectious Disease |
|--|--------------------------------------|
| Direct skin contact: Disease transmitted by direct skin contact with infected individual | MRSA |
| Blood Transmission: Direct contact with infected blood or via used needles | HIV |
| Sexual Transmission: Via intercourse or other sexual contact | Chlamydia |
| Airborne transmission: Inhalation of droplets or suspended particles due to infected individual coughing or sneezing or to infectious organisms travelling in air currents. | measles |
| Insect vector: Disease-causing organisms initially infect and multiply within an insect. The insect becomes a vector; capable of transmitting the disease-causing organism when it bites/stings a human | malaria |
| Food/water contamination: ingestion of contaminated food or water | cholera |

Simulating the spread of an infectious disease (45 minutes)

Some infectious diseases become epidemics because their infection and transmission rates are high. Epidemiologists and public health officials study and plan how to prevent infectious diseases from becoming epidemics. This exercise will simulate the spread of one imaginary infectious disease.

Simulating an Epidemic: Instructions for professors

Materials:

- test tube and dropper for each student
 - distilled water
 - 0.1 molar NaOH
 - phenolphthalein solution, dissolved in alcohol and diluted in water (pH indicator)
1. Let students know they are going to model the transmission of a disease by exchanging some of their test tubes' contents with that of other students. Mention that one of the test tubes is "infected" with an imaginary infectious disease. (Prepare the test tubes prior to class: Fill one tube halfway with 0.1 molar NaOH; fill the rest of the tubes halfway with distilled water.)
 2. Distribute prepared test tubes and droppers randomly to the class. Make a mental note of who receives the test tube containing NaOH.
 3. Have students walk around the room with the test tubes. When you say "Stop!" each student should use a dropper to trade a drop of fluid with the person nearest them. Repeat until at least three trades have occurred.
 4. Now it's time to test for the imaginary infection. Put a drop of phenolphthalein in each test tube. If the fluid turns pink, the test tube is "infected" with NaOH. How many students are now "infected"?

CAUTION: Sodium hydroxide (NaOH) and phenolphthalein can irritate the eyes and skin. Alert students to avoid spilling.

An Educators Guide. In A Science Odyssey: Resources for Educators. Retrieved June 29, 2015, from <http://www.pbs.org/wgbh/aso/resources/guide/medact4index.html>

Simulation: Instructions for students

1. Clearly write your first name and initial of your last name on the board.
2. Obtain a test tube and dropper from your instructor. The contents may irritate eyes and skin so use caution.
3. Return to your seat.
4. When instructed, walk casually around the room until signaled to stop.
Place a drop of fluid into the test tube of the person nearest to you and allow them to place a drop in yours. Be careful not to touch the fluid or the dropper of this person.
5. Repeat this fluid trade as guided by your instructor. Each fluid exchange should be novel.
6. Return to your desk and put 2 drops of phenolphthalein into your test tube.
 - If the fluid remains clear, it indicates you have not been infected.
 - If the fluid turns pink, it indicates an infection.
7. If infected, go to the board and draw an asterisk (*) next to your name.

Assignment: Tracing the source of infection

Each table now works together as a team of epidemiologists.
The team's challenge is to trace the path of the epidemic and locating the source of the infection.
Your team grade will be based on

- 1) correctly identifying the source of infection
- 2) turning in a neatly written and organized paper (see instructions)
- 3) teamwork: how quickly the team accomplishes its task; (time is important in an epidemic)

Assignment Instructions:

- Use the list of student names on the board (* = infected) to trace the path of infection from infected team members to the source
- You may have to collect info from other teams (i.e. their names!)
- Infected (*) and non-infected individuals should be named on your paper.
- Use the paper available in lab to answer the seven questions below.
- Turn in the completed assignment for a grade.

Questions

1. Based on the infectious disease simulation;
 - a. What was the mode of transmission of the 'infectious agent'?
 - b. Public health officials educate the public to minimize the impact of disease transmission. How could you have prevented yourself from becoming infected in today's simulation?
 - c. List the challenges your team of epidemiologists encountered when tracing the spread of infection?
 - d. Assume 5 classmates died as a result of this infectious disease. Use the info at this website and calculate the mortality rate:
<http://health.mo.gov/training/epi/CrudeRate.html>
For this exercise n=100.
 - e. Predict how the infection rate might have been different in this simulation if the mode of transmission was suspended airborne particles.
2. Define epidemic:
3. Define pandemic:

Epidemic/Pandemic Group Assignment: (60 minutes)

Each group will be either be assigned to one of the seven infectious diseases listed in the table or submit an infectious disease that originated in a country outside of the US (i.e. Europe, Asia, Africa, and/or Central & South America/Caribbean) . The submission will need to be evaluated and approved by your instructor. Each of the listed diseases was classified as an epidemic or pandemic. Use teamwork to gather information for a 10-15 minute group presentation to be presented at the end of class (see grading rubric in resources). The presentation should provide information enabling your peers to complete the table.

Group Presentation should include:

1. A map pinpointing the geographic origin and spread of the infectious disease. Include this this map in your presentation.
2. A summary of the following important aspects of your disease:
 - a. Epidemic or pandemic?
 - b. Time period(s) of critical concern
 - c. Morbidity & Mortality rates
 - d. Death Toll
 - e. Scientific name & classification of disease causing agent
 - f. Mode of transmission
 - g. What social, cultural or political impacts have been made by this disease?
 - h. How did/does this disease affect global trade, business, and travel?
 - i. Include an article/story from a foreign news agency regarding your specific disease
3. Include the image of an artifact, photo or media headline that epitomizes the epidemic/pandemic.

The table below doesn't include everything that needs to be covered but is an example of a method that may help you to organize your research as you work on your project.

| Infectious Disease | Geographic Location: origin and spread Epidemic or Pandemic? | Time Period | Mortality rate: #died/#infected or approximate death toll | Scientific name of disease-causing agent | Classification of disease-causing agent (viral, bacterial, fungal, zoonotic) | Mode of Transmission |
|--------------------|---|-------------|---|--|--|----------------------|
| Bubonic Plague | | | | | | |
| Smallpox | | | | | | |
| Spanish Influenza | | | | | | |
| Asian Flu | | | | | | |
| HIV/AIDS | | | | | | |
| SARS | | | | | | |
| Ebola | | | | | | |

Connection:

Many infectious diseases are caused by viruses. The fact that you are living today means that your ancestors inhabited uninfected regions of the globe, survived the infection, or resisted infection due to immunity. Our next class period will involve immunity and vaccinations. To be prepared for this class, please complete the following and be prepared to discuss:

- 1) How do vaccines work? (3.5 minutes) <https://www.youtube.com/watch?v=kwVfcc1S7IU>
- 2) How might vaccinations prevent an epidemic? Your answer should involve the concept of herd immunity (4.5 minutes) https://www.youtube.com/watch?v=ZuiHFg_nfnE
- 3) Think about: What immunizations have you received?

Resources:

General

<http://www.who.int/en/>

<http://www.flu.gov/pandemic/global/index.html>

<http://www.cdc.gov/globalhealth/healthprotection/>

<http://worldview.unc.edu/educator-resources/community-college-resources/>

Response to a pandemic:

www.globalsecurity.org (search: write in pandemic)

<http://www.gleamviz.org/challenges/>

Why do we hear about some health alerts but not others?

<http://www.gapminder.org/videos/swine-flu-alert-news-death-ratio-tuberculosis/>

History of vaccines

<http://www.historyofvaccines.org/content/timelines/all>

How vaccines work?

<https://www.youtube.com/watch?v=kwVfcc1S7IU>

How might vaccinations prevent an epidemic? Your answer should involve the concept of herd immunity

https://www.youtube.com/watch?v=ZuiHFg_nfnE

Assessment

- Instructor grading of the 'Tracing the Source of Infection' assignment
- Peer grading of the presentation using grading/scoring rubrics

Grading Rubric

| CATEGORY | (FULL) ___ points | (PARTIAL) ___ points | 0 points |
|---|--|---|---|
| Clearly identifies infectious disease | | | infectious disease NOT clearly identified |
| Group members equally present (list names) | | | One member of the group dominates the presentation. |
| Geographic origin and spread of infectious disease is represented by a map | | | No map is provided. |
| Morbidity & Mortality rates | | | No rates given |
| Scientific name of disease-causing agent | | | Scientific name (genus and species) is NOT given |
| Classification of disease-causing agent (viral, bacterial, fungal, zoonotic) | | | Classification of disease causing agent is NOT given; or is not correct |
| Mode of Transmission | | | No mode of transmission was mentioned. |
| Images of artifact, photo or media headline that epitomizes the epidemic/pandemic | | | No images given |
| How did/does this disease affect global trade, business, and travel? | | | |
| Peer (Group) Evaluation OPTIONAL | Fills out peer (group) evaluation completely and always gives scores based on the presentation rather than other biased factors (e.g., person in group is a close friend). | Fills out most of the peer (group) evaluation and always gives scores based on the presentation rather than other biased factors. | Fills out most of the peer (group) evaluation but scoring appears to be biased. |

| | | | |
|---|--|--|--|
| Epidemic or pandemic? | | | |
| Time period(s) of critical concern | | | |
| Death Toll | | | |
| What social, cultural or political impacts have been made by this disease? | | | |
| Include an article/story from a foreign news agency regarding your specific disease | | | |