TEACHER PAGES

Controlling the Pandemic: Public Health Focus

If you were a member of a team of experts convened to control the spread of HIV/AIDS in a certain country, how would you use statistical data to help determine the most effective regional public health plan?

Purpose:
This activity is designed to engage students in scientific inquiry as they examine issues surrounding the spread of HIV/AIDS and the effectiveness of public health measures in several developing countries around the world.

Objectives:
1- Students will examine factors contributing to the spread of HIV/AIDS in different regions of the world.
2- Students will compare and analyze the impact of various public health measures on controlling the spread of HIV/AIDS.
3- Students will gain an awareness and understanding of the regional socioeconomic factors affecting treatment measures.
4- Students will apply mathematical and graphical analysis to determine trends in HIV/AIDS distribution around the world.

Suggested Time:
Two forty-minute class periods (80 minutes)

Grade Level/Teaching Suggestions:
This activity is designed for high school students. It would be best facilitated as a cross-curricular lesson collaboratively taught with science, social studies (world geography), and math classes. This activity can be adopted at the middle school level, but extended time would be necessary to give students the opportunity to process and evaluate the information provided.

Prior Knowledge:
Students should have an understanding of the nature of viruses and the difference between HIV and AIDS.

Topics for Follow-up Lessons:
Some possible follow-up topics to teach are vaccine and drug development, and how socioeconomic factors affect how diseases are spread and controlled..

National Science Standards *(High School):*
- *Content Standard A* – All students should develop abilities necessary to do scientific inquiry.
- *Content Standard C* – All students should develop an understanding of biological evolution and behavior of organisms.
- *Content Standard E* – All students should develop understandings about science and technology.

- *Content Standard F* – All students should develop understanding of personal and community health, environmental quality, science and technology in local, national, and global challenges, and natural and human-induced hazards.
- *Content Standard G* – All students should develop understanding of nature of scientific knowledge, historical perspectives, and science as a human endeavor.

Background:

Just 25 years since it was first reported, HIV/AIDS has become one of the world's greatest public health crises. More than 39 million people worldwide are estimated to be living with HIV/AIDS, mostly in developing countries. In this exercise, students are asked to participate first-hand in the scientific process as they study one of the world's most pressing problems. They will examine the effectiveness of public health measures such as promotion of safe sex practices and education about risk factors. In addition, students will study the importance of antiretroviral therapies for treating people with AIDS and possibly slowing the spread of the disease. Your students will gather epidemiological information and compare data from several countries around the world to collaboratively determine factors contributing to the spread of HIV/AIDS.

Procedure:

1. Introduce the topic by presenting students with questions that focus discussion on HIV prevention and treatment options. These questions should draw upon students' prior knowledge of the topic (not all students will know all of the answers). Before viewing the video, discuss students' answers. However, resist correcting inaccuracies and allow them to use inquiry as they proceed.

2. Students should watch the video "Controlling the HIV Pandemic" (http://koshlandscience.org/exhib_infectious/hiv_antivirals_01.jsp). Direct students to the "After-viewing" questions and make sure that they have these questions in mind as they watch the video.

3. Make sure students have completed the "After-viewing" questions. Review the answers to the questions with students. This would be an appropriate time to assess student understanding of the material.

4. Divide students into small groups of three to five. Each group will focus on one country from the following list: *Armenia, Botswana, Cambodia, China, Costa Rica, India, Indonesia,* or *Kenya.*

5. Students need to understand the categorization of economic status in different countries. You may want to point out this information to your students early in the activity to encourage informed discussion about the issue.
    a. As of 2006, the World Bank divided countries into the following categories based on average annual household incomes:
        i. *low income:* $875 or less per year
        ii. *lower middle income*: $876 - $3,465 per year

iii. *upper middle income*: $3,466 - $10,725 per year
iv. *high income*: $10,726 or more per year

Please see the URL below for more information:
http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html.

6. Each group will look at World Health Organization (WHO) data about the state of the epidemic in their assigned country and region. Blackened cells in all data sheets indicate that there are no data available for the majority of the countries or regions for that year.

7. Student groups will then fill in the data tables and use them to answer questions on the accompanying activity sheet.
   a. See the chart below to provide students with 2003 population numbers for their assigned countries, and for population numbers of their assigned regions in 2005 (or the most recent year for which data is available)

Country/Region	2003	2005
Sub-Saharan Africa		751,000,000
Asia		3,938,020,000
Latin America & Caribbean		548,948,000
Eastern Europe & Central Asia		472,900,000
Armenia	3,037,193	
Botswana	1,771,556	
Cambodia	13,531,280	
China	1,288,400,000	
Costa Rica	4,176,372	
India	1,064,399,000	
Indonesia	214,674,200	
Kenya	32,733,770	

   b. The 2003 country populations are found on the World Bank data query. http://devdata.worldbank.org/hnpstats/query/default.html.
   c. The 2005 regional population sizes are found on the websites listed below. Please reference these sites for updated population sizes.

Region	Website Reference
Sub-Saharan Africa	http://go.worldbank.org/DNX9RAH3L0
Asia	http://esa.un.org/unpp/
Latin America & Caribbean	http://esa.un.org/unpp/
Eastern Europe & Central Asia	http://go.worldbank.org/RP56P6FY11

   d. **Note:** The information collected above for each of the regions is from different websites. One point of discussion with students could be the lack of consistent data from a single organization. Additionally, organizations group data into

different subsets. This makes data comparison difficult. Different countries collect information about their populations with varying levels of accuracy because of socioeconomic and political factors.

8. Before class, prepare an overhead or PowerPoint slide with the graph that includes the information for the United States, including the information below for 2003 and the most recent year for which data are available:
    a. Total HIV prevalence rate (%)(including children and adults) for your assigned country, and for adults only in your region
    b. Cause-specific mortality rates (%) due to AIDS (including adults and children) in your assigned country and region
    c. ART coverage (%) for adults in your assigned country and region

9. Hold a discussion with students about how the epidemic is being handled in the United States compared to the countries they studied. (U.S. information is provided by the WHO). Please see the accompanying excel graphs for data comparison. **It is highly recommended that you provide students with information on the United States beforehand as a point of reference.**

    a. Total Number of cases among U.S. adults and children:
    2003: 1,100,000
    2005: 1,200,000

    b. Estimated number of deaths among U.S. adults and children:
    2003: 16,000
    2005: 16,000

    c. HIV/AIDS prevalence among U.S. adults and children:
    2003: (1,100,000/292,868,340)*100= 0.38%
    2005: (1,200,000/298,212,000)*100= 0.4%

    d. AIDS cause-specific mortality rates among U.S. adults and children:
    2003: (16,000/292,868,340)*100= 0.005%
    2005: (16,000/298,212,000)*100= 0.005%

    e. ART Coverage among adults in U.S.:
    2003: data N/A
    2005: data N/A

10. **Please note** that the U.S. data are grouped differently. Much of the U.S. data are divided into subsets based on segments of the population. In addition, no data are provided on U.S. ART distribution. This could be another point of discussion with students.

11. After gathering their data, each group will briefly present its findings to the class.

a. To facilitate the class discussion, graph the variations between the prevalence, mortality rates, and ART coverage in the countries studied to compare the results. Please reference the accompanying graphs to compare student results.
b. Students in different groups can then compare the regional aspects of their analyses and discuss factors contributing to these variations – or lack thereof – and ways to control the spread of the pandemic.

12. For more information about the state of HIV/AIDS in the United States, visit the following websites:
    a. http://www.aids.gov/index.html
    b. http://www.cdc.gov/hiv/topics/surveillance/basic.htm#plwha
    c. http://www.statehealthfacts.org/cgi-bin/healthfacts.cgi?action=compare&welcome=1&category=HIV%2fAIDS
    d. http://www.aids.gov/basic/factsheets/index.html
    e. http://www.cdc.gov/hiv/resources/factsheets/At-A-Glance.htm

- Answer keys, based on 2005 data, are included for all of the assigned countries.

Follow-up Questions for Classroom Discussion:

These questions are suggested to expand discussion on the topics and focus on making connections between HIV/AIDS and other related topics.

1- How do each country's per capita expenditures and general government expenditures on health compare? Use the U.S. expenditures in these areas as a baseline for your discussion.

2- Given your understanding of how different populations in each country are affected by HIV/AIDS, would you recommend governments target the entire population or focus on certain groups to control the spread of the pandemic? Support your answer with evidence from your research.

3- Did you feel that the data for your assigned country were credible? Why or why not?

4- What cultural, socioeconomic, and political issues may interfere with treatment/prevention in different regions of the world?

5- Think about the three major approaches for fighting infectious diseases: public health measures, vaccines, and therapeutic drugs. How could these three approaches contribute to ending the spread of the HIV pandemic?

6- How would the development of a vaccine against HIV or a new ART drug impact the countries studied?

Possible Variations

1. You may choose to extend the initial part of the activity by instructing students to find information on their own using the following websites. By doing so, students will become aware of the varying quality of available information and the importance of reliable data for making informed decisions.

   http://www.who.int/GlobalAtlas/predefinedReports/EFS2006/index.asp
   http://www.who.int/globalatlas/DataQuery/default.asp
   http://www.who.int/hiv/countries/en/index.html

2. You may instruct students to prepare a final presentation that integrates the follow-up discussion questions. Students would be responsible for completing their initial research on their countries, sharing that information with the class, and then writing a formal report analyzing the discussion questions.

SEPA SCIENCE EDUCATION PARTNERSHIP AWARD
Supported by the National Center for Research Resources, a part of the National Institutes of Health

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