Status Update:
Global HIV/AIDS Testing & Surveillance

CDC Science Ambassador

Activity details

Age/grade level

This activity is intended for middle and high school teachers to teach public health to their students.

Learning objectives

- Calculate prevalence and incidence
- Interpret prevalence and incidence
- Perform a simulated laboratory test
- Explain how rapid laboratory testing is used in public health surveillance

Problem-based skill(s)

Identifying trends; Decision-making

National standards

HS-EPHS2-3: Use models (e.g., mathematical models and figures) that are based on empirical evidence to identify patterns of health and disease to characterize a public health problem; HS-EPHS2-4: Use patterns in empirical evidence to formulate hypotheses.
https://www.cdc.gov/careerpaths/k12teacherroadmap/pdfs/ephs-competencies.pdf

NGSS Science & Engineering Practice(s): Analyzing and interpreting data, Using mathematics and computational thinking; NGSS Crosscutting Concept(s): Patterns; Scale, proportion, and quantity
http://www.nextgenscience.org/get-to-know

Activity time

45 minutes

Handouts

- Country Data worksheet
- Cross-Sectional Study worksheet, including case cards and testing strips

Materials

White wax candle or white crayon, forceps or tweezers, one bowl per pair, paper towels, and red colored dye.

Introduction

Public health surveillance is measuring and describing disease occurrence over time. Public health workers monitor the health of populations through the ongoing, systematic collection and analysis of data regarding specific behaviors, infections, and diseases. Epidemiologists monitor global patterns and trends to make data-driven decisions about how to respond to public health events.

Two measures often used in public health surveillance are prevalence and incidence. Prevalence describes the number of all existing cases of disease in a population at a certain point in time. Incidence describes the number of new infections or cases of disease within a population at risk for developing the disease over a specified period. When calculating incidence, people who already have the disease are not included in the population at risk.

Epidemiologists collect and analyze disease data to calculate the incidence and prevalence. The results can be used to describe the frequency of illness or death to monitor how populations are affected by a pathogen. Sometimes, incidence and prevalence are also used to make inferences about the uptake of healthy behaviors (e.g., exercise). These patterns from year-to-year are used to make inferences about the health of populations while taking into consideration disease transmission and possible interventions. The data can then be used to design, tailor, deliver, and monitor responses and programs designed to prevent infections or disease. Exposures and health outcomes are measured simultaneously in studies that are cross-sectional.

Centers for Disease Control and Prevention
Center for Surveillance, Epidemiology, and Laboratory Services

Global HIV/AIDS Surveillance

To conduct public health surveillance for HIV/AIDS at the global level, epidemiologists design studies to estimate incidence and prevalence. Human immunodeficiency virus (HIV) which weakens a person's immune system by destroying important cells that fight infection. When we refer to HIV in surveillance, we are referring to people being infected with the virus. HIV infection leads to acquired immunodeficiency syndrome or AIDS if not treated. Without testing and treatment, HIV can weaken the immune system and kill the cells needed to fight off infections and disease. Without the cells needed to fight infections and disease, people develop opportunistic infections, such as cancers. The opportunistic infections take advantage of a very weak immune system and signal that the person has acquired immunodeficiency syndrome or AIDS, the last stage of HIV infection. With treatment for HIV (antiretroviral therapy or ART), persons with HIV can live long, healthy lives. ART reduces the amount of HIV in the body, or viral load, which can also reduce the risk for HIV transmission.

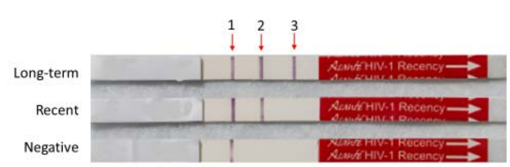
One method for conducting HIV surveillance is to test a sample of people in a population at one point in time, collate the data, and calculate prevalence and incidence measures. The ability to estimate prevalence versus incidence of HIV depends on the test used. Most HIV tests use enzyme-linked immunosorbent assay (ELISA) tests. These tests look for the presence of anti-HIV antibodies (proteins that attach to the HIV to try to destroy it) that are produced by the body when an HIV infection occurs. When the results of these tests are used for surveillance purposes, they can be used to estimate the prevalence of HIV within a population based on a sample of people. ELISA tests cannot tell how long ago an infection occurred.

More recently, tests have been developed to estimate the incidence of HIV. Tests that distinguish recent from long-term infections look for avidity of antibodies (binding strength) of antigens (toxin or foreign substance). Recent infections are those occurring in the past year and are usually identified by weak antibodies (low avidity). Avidity of antibodies represents the overall binding strength of the bonds between anti-HIV antibodies and HIV antigens. During early stages of infection, the strength of the protein peptide bonds is typically low. Weaker bonds are an indication of a recent infection (approximately <1 year). Over time, anti-HIV antibodies adapt. These adaptations make them better antibodies, allowing for a better fit and stronger bond. Detecting stronger bonds indicate a longer-term infection (approximately >1 year). When results of these tests from a sample of people are used for surveillance purposes, the tests can be used to estimate the incidence of recently acquired cases of HIV.

Typically, getting results from HIV ELISA tests takes a few days. However, a variety of rapid tests are now available. The Rapid Test for Recent Infection (RTRI) can detect HIV infection and simultaneously indicate if infection occurred recently (<1 year). The RTRI provides results within 20 minutes.

The RTRI test strip has three reaction lines: (1) the control line indicates the validity of results and proper performance of the test; (2) the verification line indicates whether the person has been infected with HIV; and (3) the "longer-term" or LT line appears only when a test indicates a longer-term infection (>1 year). (4) the long-term line doesn't appear the person is infected with HIV recently. For disease surveillance, results from a sample of people can be used to estimate the incidence (i.e., newly infected people) and prevalence of HIV. See Figure 1 below.

Figure 1. HIV-1 Rapid Recency Assay



HIV Incidence and Prevalence in Context

In performing surveillance over time, epidemiologists can use the patterns of estimated HIV incidence and prevalence to make inferences about disease transmission, treatment, and populations and locations with the greatest need for HIV prevention and other resources.

Note: For the purposes of this activity, we are using RTRI testing to show the concepts of incidence and prevalence. However, in real life RTRI tests is not being used to estimate incidence due to concerns that the testing population may not represent population at risk and because visual reading of RTRI may more subjective compared to other types of HIV testing.

In the example depicted in Figure 2, Population A has a higher proportion of recent cases (i.e., higher incidence) of HIV than Population B. Having more recent cases may be a sign of more ongoing transmission of HIV in population A.

Population B has a higher proportion of long-term cases. This may suggest stable transmission rates. Both populations have equal prevalence of HIV.

Your interpretation of the data is important for determining what public health actions are most urgently needed. Treatment programs are needed for both populations. Early treatment of HIV infection is important to reduce viral load in people living with HIV, regardless of whether the infection was recent or not. Having a low viral load reduces the likelihood of transmitting the virus to others and helps people living with HIV live longer and healthier lives.

Based on the incidence and prevalence of infection, treatment programs and resources may be allocated differently. In Population A, the high incidence and likely ongoing transmission of HIV may suggest the need for more targeted preventive efforts for populations at higher risk for HIV infection. Another consideration is the urgent need for treatment and education programs for people recently infected to reduce their viral load and minimize their risk for transmitting HIV to others. In Population B, the high prevalence may suggest the need for better and more frequent access to HIV testing and education, especially among groups at higher risk for transmission. This may also indicate a need for greater emphasis on the importance of sustained treatment in suppressing one's viral load among those who have long-term infections. On the other hand, the high prevalence may also suggest that is treatment is so successful in keeping people healthy, the prevalence of HIV has increased because HIV death rates falling. This may indicate that sustained access to treatment should continue to be prioritized.

Figure 2: HIV Prevalence and incidence in context of two populations.

In this activity, students will use UNAIDS surveillance data to calculate HIV incidence and prevalence for two countries in the eastern and southern regions of Africa. Then, students will use a simulated RTRI for one of the countries to rapidly "collect data" and calculate the incidence and prevalence. Using these measures, students will make data-driven recommendations for possible public health actions that would be most effective at preventing additional cases of HIV for the countries.

Teacher notes

In this lesson plan, incidence and prevalence estimates are calculated and reported as proportions. Incidence is often reported by the CDC and other agencies as a rate using person-years. A rate takes into consideration the time each individual contributed to the population, making it more difficult to calculate than a proportion.

Did you know? About 38,000 new HIV infections still occur each year in the US. About 4 in 5 people who could benefit from medicine to prevent HIV, Pre-exposure Prophylaxis, aren't getting it. https://www.cdc.gov/vitalsigns/test-treat-prevent/index.html

Resources

UNAIDS
http://www.unaids.org/

HIV/AIDS Terms, Definitions, and Calculations Used in CDC HIV Surveillance Publications
https://www.cdc.gov/hiv/statistics/surveillance/terms.html

Innovative Test Development and Expert Evaluations
https://www.cdc.gov/globalhivtb/who-we-are/resources/keyareafactsheets/innovative-test-development-and-expert-evaluations.pdf

Principles of Epidemiology, Lesson 1, Section 7, Lesson 3, Section 2
https://www.cdc.gov/csels/dsepd/ss1978/index.html

SEDIA Biosciences Corporation Rapid Recency Assay
http://www.sediabio.com/products/asante-rapid-hiv-1-recency-assay

Activity instructions

Preparation

In advance, prepare a Rapid Test for Recent Infection (RTRI) station for each pair of students. A station consists of the following:

- Participant cards
- Test strips
- Test kit

The participant cards and test strips are provided in the Cross-Sectional Study, Part 1 worksheet. Print and cut out participant cards and test strips. Then prepare the test strips.

To prepare the test strips, use the white wax candle or white crayon to mark each case using Table 1 in the answer key.

- Mark all control lines with the white wax or white crayon.
- Mark the verification line for positive infections: 01523, 00245, 00674, 08495, 09753 and 12556.
- Mark the LT line for long-term infections: 01523, 00674, 08495 and 12556.

> **Note**: If you want to emphasize the importance of the control, do not mark the control line for one of the test strips. This will facilitate a discussion about what to do when a laboratory test fails.

The following is needed to prepare the test kit

- Fill a bowl with water for each station. Add 3 drops of red colored dye.
- Set a pair of forceps or tweezers with each bowl.
- Set 2 or 3 paper towels with each bowl.

Explain

CDC Epidemic Intelligence Service (EIS) disease detectives collaborate with a variety of public health professionals including doctors, nurses, veterinarians, epidemiologists, microbiologists, and laboratorians to investigate outbreaks, monitor disease levels around the globe, and provide recommendations for control and prevention efforts.

In this activity, you will use a set of skills similar to CDC's disease detectives and work with in-country Ministry of Health staff to monitor patterns of HIV transmission in eastern and southern Africa. In 2020, an estimated 670,000 recent HIV infections and an estimated 20.6 million people living with HIV in this region were reported. The number of people living with HIV in this region accounts for more than half (55%) of all people living with HIV in the world. Being able to tell which infections are recent and which are not is important in planning prevention efforts and evaluating their effectiveness.

You will first learn how to monitor HIV infection levels and identify recent infections. You will do this using simulated RTRI. These tests are called "rapid" because they give results within a matter of minutes with the accuracy of the standard tests that may take hours or even days to produce results. You will use these rapid test results to help you make quick decisions on what resources you might recommend sending to this region for prevention and control of disease.

Prepare

Make copies of **Country Data**, **Cross-Sectional Study Part 1** and **Cross-Sectional Study Part 2** for each student. Cut out the **case cards** and **test strips** for each group of students. Prepare the test strips according to the instructions on the **test strips** worksheet.

> **Note**: You can also mark test strips with a Sharpie or pen if unable to do a wet lab.

Instruct

1. As a class, discuss the definitions of incidence and prevalence. Review the formula used to calculate each.

Country Data

2. Provide students with the Country Data worksheet. Review the Rwanda data from 2005 and 2016.

3. Using the formulas provided on the Country Data worksheet, explain how HIV incidence and prevalence are calculated. Use the calculation for Rwanda in 2016 as an example. Discuss why we use total population at risk when calculating HIV incidence rather than total population. Remind them that individuals can only acquire HIV one time. This means that after a person is infected, they are no longer at risk of being infected again with HIV.

> **Note:** These numbers are multiplied by 1000 to make the results easier to understand. It makes it easier to compare different populations.

4. Have students calculate the HIV incidence and prevalence for Namibia in 2016 on their own.

HIV Rapid Test for Recent Infection (RTRI)

5. Provide each student with the Cross-Sectional Study, Part 1 worksheet. Read the scenario and explain that they will perform the simulated HIV Rapid Test for Recent Infection (RTTI) in pairs.

6. Divide the class into pairs. Assign each pair to a HIV Rapid Test for Recent Infection (RTTI) station. See *preparation.*

7. Orient students to their station. Explain that the participant cards provide demographic information, including age, sex, and the region of Namibia in which they live. Explain that the test strips represent the testing of a specimen from each of the study participants using the HIV Rapid Test for Recent Infection (RTTI). To simulate this, show students how to dip their test strip in the bowl.
   a. Using the forceps or tweezers, carefully grab each test strip by the blue portion of the strip where the case number is written.
   b. Dip the test strip in the bowl until the strip is completely submerged or approximately 15–20 seconds.
   c. Remove the strip and lay flat on the paper towel.
   d. Read the test within 5 seconds.

8. Using the Cross-Sectional Study, Part 1 worksheet, review how to read the test based on the number of white lines that appear.

9. Assign each pair to complete the test for each of the 12 test strips.

10. Assign students to complete Table 1 on the Cross-Sectional Study, Part 1 worksheet using their case cards and the test results.

11. Have students clean up their testing station.
   a. Pour the water down the sink or into a bucket for later disposal.
   b. Throw all paper towels away.
   c. Wash forceps or tweezers and hang them on the drying rack.
   d. Wipe down testing station.

10. Hand out the Cross-Sectional Study, Part 2 worksheet. Assign students to complete Table 2, including calculations for HIV incidence and HIV prevalence, and the discussion questions.
11. As a class, discuss HIV incidence and HIV prevalence in Namibia. Using data from

Table 2, discuss the types of resources that might be recommended.

> **Note:** For additional discussion, have students analyze the data by age, by sex, and by regions in Namibia to provide more specific recommendations.

DISCUSS

1. What do incidence and prevalence data tell us about the state of the disease prevention and control in a given population?

2. What does HIV incidence tell us about what type(s) of resources to send to a region? About HIV prevalence?

3. How does surveillance support the success of prevention and control efforts?

INFORMATION

Activities were developed as a collaboration between the CDC Science Ambassador Fellowship program in CDC's Center for Surveillance, Epidemiology, and Laboratory Services; science, technology, engineering, and mathematics (STEM) teachers from across the country who participated in the 2018 CDC Science Ambassador Fellowship; CDC's Center for Global Health

CDC Science Ambassador Fellows
The following STEM teachers who participated in the 2018 CDC Science Ambassador Fellowship within CDC's Division of Scientific Education and Professional Development co-developed the educational activities in consultation with CDC experts: Jayne Kerner, BS, MEd (Newton, Massachusetts), Erika Kurt BA, LLB, BCL (New York, New York), Nikki Riley, BA, MS, MFA, EdD (Lancaster, California), Katherine Schilling, BS, PhD (New Orleans, Louisiana), Jessica Guccione, BS, MEd, 2018 Peer Leader (Irvine, California).

CITATION
Centers for Disease Control and Prevention (CDC). Science Ambassador Fellowship—Status Update: HIV/AIDS Diagnostic Testing. Atlanta, GA: U.S. Department of Health and Human Services, CDC; 2021. Available at: http://www.cdc.gov/careerpaths/scienceambassador/lesson-plans/

Country Data

Name(s): ___________________________________ Date: ________________

Directions: Examine the data provided for Rwanda and Namibia from 2005 and 2016. Using the formulas below, calculate the HIV incidence and prevalence for Namibia in 2005 and in 2016. Then, answer the questions. In these examples, recent HIV infections is equivalent to recent HIV infections.

FORMULAS

HIV Incidence $$\frac{number\ of\ persons\ with\ newly\ aquired\ HIV\ infections\ per\ year}{population\ at\ risk\ (total\ population - persons\ living\ with\ HIV)} \times 1{,}000$$

HIV Prevalence $$\frac{number\ of\ persons\ living\ with\ HIV\ per\ year}{total\ population} \times 1{,}000$$

1. Calculate
   a. HIV incidence in Namibia in 2016.
   b. HIV prevalence in Namibia in 2016.
2. From 2005 to 2016 in Namibia:
   a. Did the HIV incidence increase or decrease?
   b. Did the HIV prevalence increase or decrease?
   c. Explain what these trends mean in terms of recent cases and existing cases.
3. From 2005 to 2016 in Rwanda:
   a. Did the HIV incidence increase or decrease?
   b. Did the HIV prevalence increase or decrease?
   c. Explain what these trends mean in terms of recent cases and existing cases.
4. For 2016 and compared with Rwanda:
   a. Was the HIV incidence in Namibia higher or lower?
   b. Was the HIV prevalence in Namibia higher or lower?
5. We have limited resources to use for HIV prevention and control. Based on the incidence and prevalence data you calculated, what recommendation would you make regarding the allocation of resources for preventative efforts and for access to treatment in Rwanda and in Namibia?

RWANDA

	2005	2016
Population	9.2 million	11.92 million
Persons with recent HIV infections	13,000	7,500
Persons living with HIV	210,000	220,000
AIDS-related deaths	15,000	3,300
HIV Incidence	1.45 per 1,000	0.64 per 1,000
HIV Prevalence	22.8 per 1,000	18.5 per 1,000

NAMIBIA

	2005	2016
Population	2.08 million	2.48 million
Persons with recent HIV infections	13,000	9,600
Persons living with HIV	180,000	230,000
AIDS-related deaths	11,000	4,300
HIV Incidence	6.84 per 1,000 people	
HIV Prevalence	86.5 per 1,000 people	

*Some data has been changed for educational purposes.

Cross-Sectional Study
Part 1

Name: ________________________________ **Date:** _______________

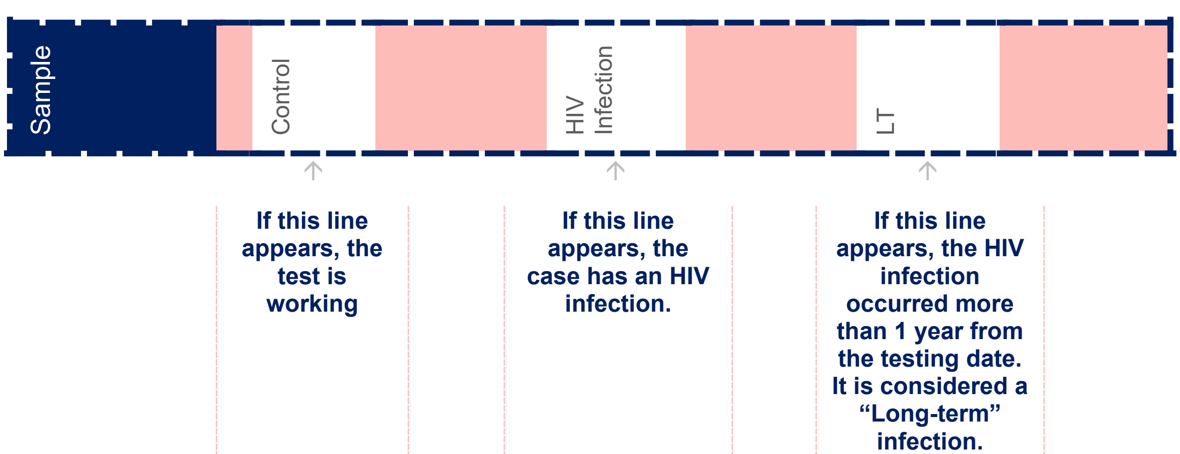
Directions
Part 1: You and your fellow EIS officers (CDC disease detectives) are asked to help in-country Ministry of Health staff estimate the current HIV incidence (<1 year since infection) in Namibia using the HIV Rapid Test for Recent Infection. Your team decides to conduct a cross-sectional study of people who were tested during a two-week period. You work with Ministry of Health staff to contact clinics in four major regions of Namibia, including Ohangwena, Omusati, Oshana, and Oshikoto. Your fellow EIS officers work with Ministry of Health staff to contact clinics in the other 10 regions in Namibia. In the last two weeks, 2,457 people were tested for HIV, of whom 2,000 provided their consent to make their specimens available for HIV surveillance testing.

You and your partner are responsible for a small sample (n = 12) of specimens from people tested in a clinic. Participant cards were provided with each specimen. Participant cards provide limited demographic information about the person who provided the specimen being tested. For each, you will need to conduct a HIV Rapid Test for Recent Infection to test for HIV infection and to identify if participants were infected recently (<1 year). Complete the participant cards. Then, using the information and results from the test, complete Table 1. You will be using these results to determine if the simulated HIV Rapid Test for Recent Infection (RTTI) gives an accurate representation of HIV prevalence and incidence in the entire country.

HIV Rapid Test for Recent Infection (RTRI) Guide

1. Use forceps or tweezers to grab each test strip by the blue portion of the strip where the case number is written.
2. CAREFULLY dip the test strip entirely into the red solution until the strip is completely submerged or for approximately 15–20 seconds.
3. Remove the test strip and lay flat on the paper towel.
4. Have your partner QUICKLY (within 5 seconds) read the test strip and write down which lines appear.

How to Read the HIV Rapid Test for Recent Infection (RTTI)



5. Check the appropriate box on each participant card based on the results: "Infected", "Recent infection" or "Long-term infection". Then, complete Table 1.

Table 1: A small sample (n = 12) of participants in Namibia, 2016.

Participant Number	Age	Sex	Region	HIV Infection (Positive, Negative)	Recent Infection (Yes, No)
01523					
00245					
00327					
04365					
05309					
00674					
07081					
08495					
09753					
10218					
11924					
12556					

Participant Cards (CUT OUT IN ADVANCE)

#01523

Age	31
Sex	Female
Region	Omusati
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#00245

Age	23
Sex	Female
Region	Oshana
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#00327

Age	56
Sex	Male
Region	Ohangwena
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#04365

Age	16
Sex	Female
Region	Oshikoto
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#05309

Age	19
Sex	Male
Region	Ohangwena
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#00674

Age	48
Sex	Female
Region	Oshana
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#07081

Age	51
Sex	Male
Region	Omusati
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#08495

Age	35
Sex	Male
Region	Ohangwena
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#09753

Age	18
Sex	Female
Region	Oshana
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#10218

Age	47
Sex	Male
Region	Oshikoto
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#11924

Age	42
Sex	Female
Region	Oshana
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

#12556

Age	33
Sex	Male
Region	Omusati
HIV status	☐ Infected ☐ Recent infection ☐ Long-term infection

Test Strips

(PREPARE IN ADVANCE)

- Cut out small strips from sturdy white paper.
- Mark all control lines with the white wax or white crayon. **Note**: If you want to emphasize the importance of the control, do not mark the control line for one of the test strips. This will facilitate a discussion about what to do when a laboratory test fails.
- Mark the HIV infection line for positive infections: 01523, 00245, 00674, 08495, 09753, 12556.
- Mark the LT line for long-term infections: 01523, 00674, 08495, 12556.

01523	Control	HIV Infection	LT
00245	Control	HIV Infection	LT
00327	Control	HIV Infection	LT
04365	Control	HIV Infection	LT
05309	Control	HIV Infection	LT
00674	Control	HIV Infection	LT
07081	Control	HIV Infection	LT
08495	Control	HIV Infection	LT
09753	Control	HIV Infection	LT
10218	Control	HIV Infection	LT
11924	Control	HIV Infection	LT
12556	Control	HIV Infection	LT

Cross-Sectional Study
Part 2

Name: ________________________________ **Date:** ______________

Directions

Part 2: The other EIS officers (CDC disease detectives) on your team worked with Ministry of Health staff to collect information and test the remaining 1,988 specimens. They identified 179 HIV-positive cases, 6 of which were recently infected. Complete Table 2. Then, calculate incidence and prevalence for the entire sample.

$$Incidence = \frac{number\ of\ recent\ HIV\ infections}{population\ at\ risk\ (total\ number\ of\ tested\ specimens - cases\ of\ long\ term\ HIV)} x\ 1000$$

$$Prevalence = \frac{number\ of\ HIV\ infections}{total\ number\ of\ tested\ specimens} x\ 1000$$

Table 2: HIV incidence among a small sample of people recently tested in Namibia (n = 2,000).

	Specimens Tested (#)	HIV Infections (#)	Recent Infections (#)
Other EIS officer's samples	1,988	179	6
Your sample	12		
Total	2,000		
HIV Incidence			
HIV Prevalence			

Discussion Questions

1. How does the HIV incidence among the sample (n = 2,000) compare with Namibia in 2016?

2. How does the HIV prevalence among the sample (n=2,000) compare with Namibia in 2016?

3. Based on this information, what recommendation would you make regarding the allocation of resources for preventative efforts and for access to treatment?

Answer Key

Part 1: Country Data

Answers

1. Namibia, (a) HIV incidence: 4.27 per 1,000 persons; (b) HIV prevalence: 92.7 per 1,000 persons
2. Namibia, (a) HIV incidence: decreased; (b) HIV prevalence: increased; (c) the trend tells us that the number of recent cases of HIV decreased by almost 50%, but that the number of people living with HIV was higher in 2016 than 2005.
3. Rwanda, (a) incidence: decreased; (b) prevalence: decreased; (c) the trend tells us that the number of recent HIV cases decreased by more than half, and that the number of people living with HIV was lower in 2016 than in 2005.
4. Compared with Rwanda, Namibia has a (a) higher HIV incidence, (b) higher HIV prevalence
5. Based on the information provided, resources are needed in Namibia to improve prevention efforts to reduce the number of recent cases and to improve treatment efforts to decrease the number of deaths. Compared to Rwanda, Namibia may require additional resources.

Table 1

Participant Number	Age	Sex	Region	HIV Status (Positive, Negative)	Recent Infection (Yes, No)
01523	31	F	Omusati	Positive	No
00245	23	F	Oshana	Positive	Yes
00327	56	M	Ohangwena	Negative	--
04365	16	F	Oshikoto	Negative	--
05309	19	M	Ohangwena	Negative	--
00674	48	F	Oshana	Positive	No
07081	51	M	Omusati	Negative	--
08495	35	M	Ohangwena	Positive	No
09753	18	F	Oshana	Positive	Yes
10218	47	M	Oshikoto	Negative	--
11924	42	F	Oshana	Negative	--
12556	33	M	Omusati	Positive	No

Part 2: Cross-Sectional Study

Table 2

	Specimens Tested (#)	HIV Infections (#)	Recent Infections (#)
Other officers' samples	1,988	179	6
Your sample	12	6	2
Total	**2,000**	**185**	**8**

HIV Incidence	$Incidence = \frac{number\ of\ recent\ HIV\ infections}{population\ at\ risk}\ x\ 1000$ $= \frac{8}{(2{,}000 - 177)}\ x\ 1000$ = 4.4 per 1,000 persons Note: To get the population at risk in this scenario, first subtract the number of cases with recent HIV infections (n = 8) from the total of HIV infections (n = 185). Then, subtract this number (n = 177) from the population studied (n = 2,000). This is done because individuals can only acquire HIV one time. This means that after a person is infected, they are no longer at risk of being infected again with HIV.
HIV Prevalence	$Prevalence = \frac{number\ of\ HIV\ infections}{total\ number\ of\ tested\ specimens}\ x\ 1000$ $= \frac{185}{2{,}000}\ x\ 1000$ = 92.5 per 1,000 persons

Discussion Questions

Answers

1. The HIV incidence in the cross-sectional study is similar to the HIV incidence in Namibia in 2016.
2. HIV prevalence in the cross-sectional study is similar to the prevalence in Namibia in 2016.
3. Based on the information provided, resources are needed in Namibia to understand why the country both a high prevalence and high incidence. It would be important to work with the country to see what types of resources would be helpful, such as ART or HIV testing.