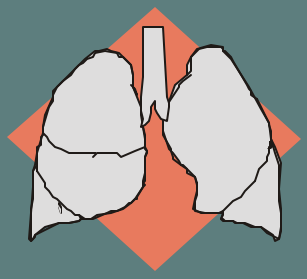

Self-Study Modules on Tuberculosis

2

Epidemiology of Tuberculosis

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention

National Center for HIV, STD, and TB Prevention
Division of Tuberculosis Elimination

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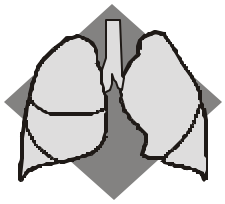

2 Epidemiology of Tuberculosis

CONTENTS

BACKGROUND

Epidemiology is the study of diseases and other health problems in groups of people. Epidemiologists determine the frequency and pattern (the distribution) of health problems in different communities. In other words, they find out who has a specific health problem, how often the problem occurs, and where the problem occurs. Using this information about who, when, and where, epidemiologists try to determine why the health problem is occurring.

Public health officials use epidemiologic information to design ways to prevent and control the diseases in the community. By finding out who is at risk for a specific health problem, they can target their prevention and control strategies at people who are at risk.

This module examines recent trends in TB in the United States and describes groups of people who are at higher risk for TB infection and TB disease. Groups of people who are at higher risk for TB vary from area to area; state and local health departments are responsible for determining specifically who is at risk in their area.

OBJECTIVES

After working through this module, you will be able to:

1. Describe how the number of TB cases reported in the United States changed between 1985 and 1992.
2. List four factors that contributed to the increase in the number of TB cases from 1985 through 1992.
3. List three factors that contributed to the decrease in the number of TB cases after 1992.
4. List the groups of people who are more likely to be exposed to or infected with *M. tuberculosis*.
5. List the groups of people who are more likely to develop TB disease once infected.
6. Describe the evidence that suggests that the HIV epidemic has contributed to the increase in the number of TB cases.
7. List the racial and ethnic groups that are disproportionately affected by TB.
8. Explain what TB disease in children indicates about the spread of TB in homes and communities.

NEW TERMS

Look for the following new terms in this module and in the Course Glossary.

case rate – the number of cases that occur during a certain time period, divided by the size of the population during that time period; the case rate is often expressed in terms of a population size of 100,000 persons

case reporting – informing the state or local health department when a new case (an occurrence) of TB disease has been diagnosed or is suspected

close contacts – people who spend time with someone who has infectious TB disease

contact investigation – a procedure for interviewing a person who has TB disease to determine who may have been exposed to TB. People who have been exposed to TB are screened for TB infection and disease.

epidemiology – the study of the distribution and causes of disease and other health problems in different groups of people

foreign-born persons – people born outside of the United States; foreign-born persons from areas of the world where TB is common (for example, Asia, Africa, Latin America, and the Caribbean) are more likely to become exposed to and infected with *M. tuberculosis*

health care facilities – places where people receive health care, such as hospitals or clinics

infection control procedures – measures to prevent the spread of TB

residential facilities – institutions where people live, such as nursing homes, correctional facilities, or homeless shelters

READING MATERIAL

TB infection is one of the most common infections in the world. It is estimated that 30% to 60% of adults in developing countries have TB infection. Every year, about 8 million people develop TB disease and 2-3 million people die of the disease. In fact, among people older than 5 years of age, TB disease is the leading cause of death due to infectious disease around the world.

An estimated 30% to 60% of adults in developing countries have TB infection.

In the United States, physicians and other health care providers are required by law to report TB cases to their state or local health department. Reporting is very important for TB control. When the health department learns about a new case of TB, it should take steps to ensure that the person receives appropriate treatment. The health department should also start a contact investigation. This means interviewing a person who has TB disease to determine who may have been exposed to TB. People who have been exposed to TB are screened for TB infection and disease.

Physicians and other health care providers are required by law to report TB cases to their state or local health department.

State and some big-city health departments report TB cases to the federal Centers for Disease Control and Prevention (CDC) based on certain criteria. These criteria are discussed in more detail in Module 3, Diagnosis of Tuberculosis Infection and Disease. CDC reports the number of TB cases that occur each year in the United States.

In 1953, when nationwide TB reporting first began, there were more than 84,000 TB cases in the United States. From 1953 through 1984, the number of TB cases decreased by an average of 6% each year. In 1985, the number of TB cases reached an all-time low of 22,201.

From 1985 through 1992, the number of new TB cases in the United States increased by 20%.

In 1986, however, there was an increase in TB cases, the first significant rise since 1953. Between 1985 and 1992 there was a resurgence of TB, with the number of new cases increasing from 22,201 in 1985 to 26,673 in 1992, an increase of 20% (Figure 2.1).

We can attribute the resurgence in TB cases between 1985 and 1992 to at least four factors:

- The HIV epidemic
- Immigration from countries where TB is common
- The spread of TB in certain settings (for example, correctional facilities and homeless shelters)
- Inadequate funding for TB control and other public health efforts

From 1993 through 1997, there was a steady decline in the number of TB cases reported annually in the United States.

In 1993, the upward trend in new TB cases reversed. From 1993 through 1997, the number of TB cases reported annually in the United States steadily declined (Figure 2.1). In 1997, a total of 19,851 new cases of TB were reported, resulting in the lowest number of reported TB cases since national reporting began in 1953.

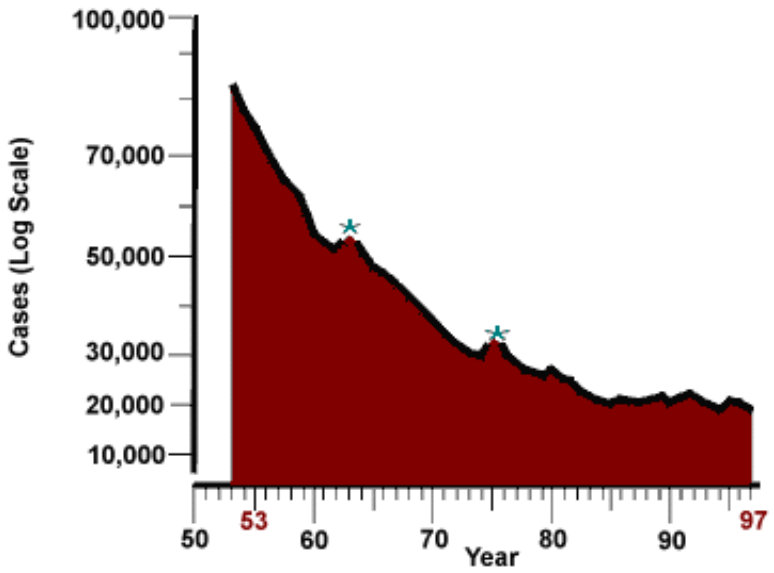

Figure 2.1 Reported TB Cases, United States, 1953-1997. (indicates years when the reporting criteria were changed.)*

The continued decrease in the number of TB cases reported annually in the United States since 1993 may be attributed to at least three factors:

- Increased federal resources for TB control and other public health efforts
- Improvements in TB prevention and TB control programs in state and local health department
- Increased attention to ensuring that patients complete drug therapy through directly observed therapy (DOT)

Despite national trends reflecting a steady decline in the number of TB cases reported annually in the United States between 1993 and 1997, there are still several areas of ongoing concern:

Despite trends reflecting a steady decline in TB cases in the U.S. between 1993 and 1997, there are still several areas of ongoing concern.

- While TB cases declined nationally, TB cases actually increased in some areas.
- TB patients who do not complete therapy can develop and spread strains of TB that are resistant to available drugs. For example, "Strain W," a deadly TB strain resistant to most of the best anti-TB drugs, has been found in several states.
- An increasing proportion of TB cases in the United States are among residents born outside of the United States (foreign-born).

In 1997 the TB case rate in the United States was 7.4 TB cases per 100,000 persons.

The number of TB cases at a certain place and time is often expressed as a **case rate**. A case rate is the number of cases that occur during a certain time period, divided by the size of the population during that time period. (The case rate is often expressed in terms of a population size of 100,000 persons.) For example, in the United States in 1997, there were 19,851 new TB cases in a population of approximately 267,284,000 people. In other words, the TB case rate was 7.4 TB cases per 100,000 persons. The TB case rates for each state, the District of Columbia, and Puerto Rico are shown in Figure 2.2.

Health departments, CDC, and others can compare the occurrence of TB cases in different places, time periods, and groups of people by using case rates. They have found that in certain groups, the rates of TB are higher than in others. These high-risk groups can be divided into two categories (Table 2.1):

In certain groups, the rates of TB are higher than in others.

- **People who are more likely to be exposed to or infected with *M. tuberculosis***
  This category includes people who live or work in certain settings (see Special Settings, pages 12-13).

- **People who are more likely to develop TB disease once infected**

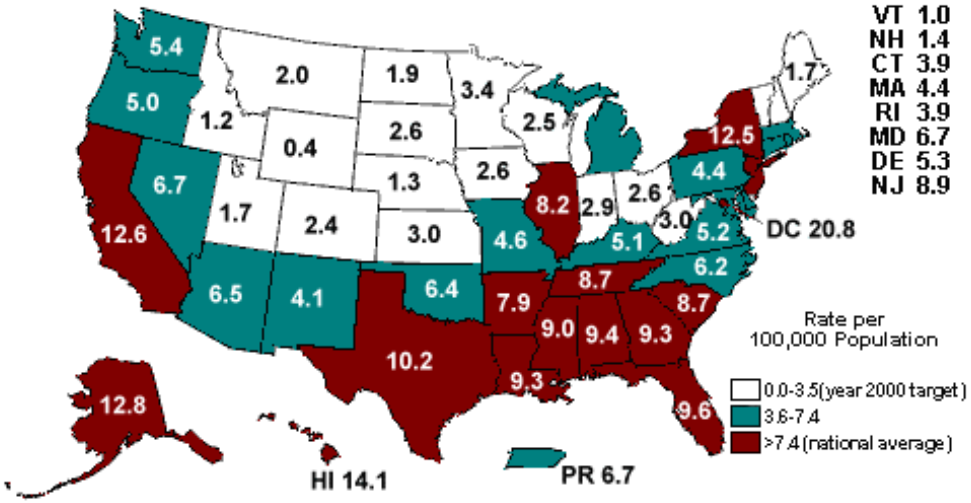

Figure 2.2 TB case rates by state, United States, 1997.

Table 2.1
Groups at High Risk for TB

People at Higher Risk for Exposure or Infection	People at Higher Risk for TB Disease
# Close contacts of people with infectious TB disease	# People with HIV infection
# People born in areas of the world where TB is common (for example, Asia, Africa, or Latin America)	# People with other medical conditions that appear to increase the risk for TB (see Module 1, Transmission and Pathogenesis of Tuberculosis)
# Elderly people	# People recently infected with *M. tuberculosis* (within the past 2 years)
# Low-income groups with poor access to health care, including homeless people	# People with chest x-ray findings suggestive of previous TB disease
# People who inject illicit drugs	# People who inject illicit drugs
# People who live or work in residential facilities (for example, nursing homes or correctional facilities)	
# Other people who may be exposed to TB on the job (for example, some health care workers)	
# People in other groups as identified by local public health officials	

Study Questions 2.1-2.3

2.1. What happened to the number of TB cases in the United States between 1953 and 1984?

2.2. What happened to the number of TB cases in the United States between 1985 and 1992?

2.3. Name four factors that contributed to the increase in the number of TB cases between 1985 and 1992.

Answers on page 31.

Study Questions 2.4-2.7

2.4. What happened to the number of TB cases between 1993 and 1997?

2.5. Name three factors that contributed to the decrease in the number of TB cases between 1993 and 1997.

2.6. Despite national trends reflecting a steady decline in the number of TB cases reported annually in the United States between 1993 and 1997, what are three areas of ongoing concern?

2.7. Name eight groups of people who are more likely to be exposed to or infected with *M. tuberculosis*.

Answers on pages 31-33.

People at Higher Risk for Exposure or Infection

Close contacts are at high risk of being infected with *M. tuberculosis.*

Of all TB cases reported to CDC in 1997, 39% were in foreign-born persons.

Close contacts, or people who spend time with someone who has infectious TB disease, are at high risk of being infected with *M. tuberculosis.* Close contacts may include family members, coworkers, or friends.

In the United States, TB infection and disease occur often among people born in areas of the world where TB is common, such as Asia, Africa, and Latin America. In most cases, these **foreign-born persons** become exposed to and infected with *M. tuberculosis* in their country of birth. Of all TB cases reported to CDC in 1997, 39% were in foreign-born persons. This is an increase from 1986, when 22% of cases were in foreign-born persons.

All people who apply for immigration and refugee status are screened for TB disease before coming to the United States. Immigrants with TB disease who are infectious at the time of screening are required to receive treatment before they enter the United States. (Infectiousness is discussed in Module 5, Infectiousness and Infection Control.) However, some immigrants have TB disease but are not infectious at the time of screening. Sometimes these immigrants become infectious after they enter the United States. Also, many immigrants have TB infection, but not TB disease, at the time of screening. These immigrants may develop TB disease months or years after they come to the United States. Finally, many people enter the United States without being screened for TB disease, such as students, tourists, and undocumented (illegal) aliens.

. . . . . .
Of all TB cases reported in 1997, 24% were in people 65 years of age and older.
. . . . . .

TB is also more common among the **elderly.** Many elderly people were exposed to and infected with *M. tuberculosis* when they were younger and TB was more common than it is today. Because a larger proportion of elderly people have TB infection, this group is at higher risk for TB disease. Of all TB cases reported in 1997, 24% were in people 65 years of age and older, even though this age group made up only 13% of the population. Elderly people living in nursing homes are at an even higher risk for TB (see Special Settings, pages 12-13).

. . . . . .
From 1985 to 1992, the average rate of TB cases was nearly eight times higher in zip code areas with the lowest household income than in areas with the highest household income.
. . . . . .

Another risk group is **low-income people.** From 1985 to 1992, the average rate of TB cases was nearly eight times higher in zip code areas with the lowest household income than in areas with the highest household income. The reasons for this are not entirely clear, but some possible reasons are crowding, inadequate living conditions, malnutrition, and poor access to health care.

. . . . . .
In 1997 about 7% of TB patients in 52 U.S. reporting areas were homeless.
. . . . . .

TB infection and disease are also more common among **homeless people.** In 1997 about 7% of TB patients in 52 U.S. reporting areas were homeless. In addition, according to studies published in 1986, from 18% to 51% of homeless people have TB infection. Homeless people may be at higher risk of developing TB disease once infected because of malnutrition and poor access to health care. Moreover, in some areas they may be more likely than the general population to be infected with HIV.

People who inject illicit drugs are more likely to be exposed to or infected with *M. tuberculosis*. They are also at high risk of developing TB disease once infected.

People who inject illicit drugs are more likely to be exposed to or infected with *M. tuberculosis*. This may be because a large proportion of people in this risk group have other risk factors for exposure to TB, such as being low-income and having poor access to health care. People who inject illicit drugs are also at high risk of developing TB disease once infected, perhaps because they are more likely to be HIV infected. Also, it is possible that injecting illicit drugs weakens the immune system.

Special Settings

The risk of being exposed to TB is higher in certain settings because many people in these facilities are at risk for TB.

In certain settings, such as nursing homes and correctional facilities, the risk of being exposed to TB is higher than in other places. This is because many people in these facilities are at risk for TB. The risk of exposure to TB is even higher if the facility is crowded.

In 1984 and 1985, elderly people living in nursing homes were twice as likely to have TB disease as those not living in nursing homes.

For example, TB is a problem in **nursing homes.** In a 29-state survey conducted in 1984 and 1985, CDC found that the rate of TB disease was twice as high for elderly people living in nursing homes as for elderly people not living in nursing homes.

In 1984 and 1985, people living in correctional facilities were four times as likely to have TB disease as those not living in correctional facilities.

TB is also a problem in **correctional facilities.** A CDC study conducted in 1984 and 1985 showed that there were four times as many TB cases in people living in correctional facilities as there were in people of the same age who did not live in correctional facilities. There are several reasons why rates of TB disease are higher in correctional facilities. First, many inmates already have TB infection and therefore are at higher risk of developing TB disease. Second, an increasing number of inmates are infected with HIV, which means that they are more likely to develop TB disease if they become infected with *M. tuberculosis*. Finally, some correctional facilities are crowded, which promotes the spread of TB.

Other settings where people at risk for TB are grouped together are **homeless shelters** and **drug treatment centers.** People who live or work in these settings are at higher risk of being exposed to TB.

People who work in health care facilities may be exposed to TB on the job.

People who work in **health care facilities,** such as clinics and hospitals, may be exposed to TB on the job. The risk of exposure depends on the number of TB patients in the facility, the employee's duties, and the effectiveness of the infection control procedures in the facility. Infection control procedures, or measures to prevent the spread of TB, are discussed in more detail in Module 5, Infectiousness and Infection Control.

Study Questions 2.8-2.9

2.8 Why is the risk of being exposed to TB higher in certain settings, such as nursing homes or correctional facilities?

2.9. What are some reasons why rates of TB disease are higher in correctional facilities?

Answers on pages 33-34.

Case Study 2.1

For each of the following people, circle the factor or factors known to increase the risk of being exposed to or infected with *M. tuberculosis*. Each person may have more than one risk factor.

a) Mr. Davidson: rides the subway every day
is 80 years old

b) Mr. LeFevre: works at a nursing home
immigrated from Europe

c) Ms. Montoya: was born in Latin America
has a father who had pulmonary TB disease

d) Ms. Parker: volunteers in the emergency room of an inner-city hospital
works in a day care center

e) Mr. Dudley: was released from prison last year
injects morphine

Answers on page 36.

People at Higher Risk for TB Disease

HIV-infected people are at very high risk of developing TB disease.

Anyone who has TB infection can develop TB disease, but some people are at higher risk than others (see Module 1, Transmission and Pathogenesis of Tuberculosis). **HIV-infected people are at highest risk.** High-risk groups include

- People with HIV infection
- People with other medical conditions that appear to increase the risk for TB (see Module 1, Transmission and Pathogenesis of Tuberculosis)
- People recently infected with *M. tuberculosis* (within the past 2 years)
- People with chest x-ray findings suggestive of previous TB
- People who inject illicit drugs

The areas that were the most affected by the HIV epidemic also reported the largest increases in TB cases.

The Connection Between TB and HIV

What evidence shows that the HIV epidemic contributed to the 1985-1992 increase in the number of TB cases? **First, the areas that were most affected by the HIV epidemic also reported the largest increases in TB cases.** Between 1985 and 1992, New York, California, Florida, Texas, and New Jersey reported the most AIDS cases and the biggest increases in TB cases.

Comparing 1985 to 1992, TB cases increased in most age groups; the largest increase in TB cases occurred among people aged 25 to 44, the age group most affected by AIDS.

Second, comparing 1985 to 1992, TB cases increased in most age groups; the largest increase in TB cases occurred among people aged 25 to 44, the age group most affected by AIDS (in 1991, 74% of all reported AIDS cases fell into this age group). Comparing 1985 to 1992, reported TB cases increased by 55% in this age group.

From 1981 through 1990, approximately 5% of the persons reported to have AIDS also had TB.

Third, TB is common among AIDS patients. TB cases and AIDS cases are reported to state and local health departments, and the case reports are compiled into registries. At CDC, the TB and AIDS registries were matched for the years 1981 through 1990. Researchers found that approximately 5% of the persons reported to have AIDS also had TB.

In 1991 about 8% of TB patients surveyed tested positive for HIV infection.

Fourth, HIV infection is common among TB patients. This was shown in a 1991 survey of patients recently diagnosed with or suspected of having TB disease. In this survey, blood samples were taken from patients in 35 TB clinics in 19 cities. About 3000 samples were tested for HIV infection. In some areas, none of the samples tested positive for HIV; in New York City, 61% of the samples tested positive. Overall, about 8% of the samples tested positive for HIV.

The risk of developing TB disease is about 7% to 10% **each year** for persons who are infected with both *M. tuberculosis* and HIV; in contrast, this risk is 10% **over a lifetime** for people infected only with *M. tuberculosis*.

The risk that people who are infected with both *M. tuberculosis* and HIV will develop TB disease was studied by Dr. Peter Selwyn in New York City. For 2 years Dr. Selwyn observed a group of people who injected drugs and who were infected with *M. tuberculosis*. Of those who were **also** infected with HIV, 14% developed TB disease. Of those who were **not** infected with HIV, none developed TB disease. This study suggests that the risk of developing TB disease is about 7% to 10% **each year** for people who are infected with both *M. tuberculosis* and HIV. In contrast, the risk of developing TB disease is 10% **over a lifetime** for people infected only with *M. tuberculosis*.

HIV infection is the strongest known risk factor for the development of TB disease.

The results of this study and other studies indicate that **HIV infection is the strongest known risk factor for the development of TB disease in people with TB infection** (see Table 1.2 in Module 1, Transmission and Pathogenesis of Tuberculosis).

Study Questions 2.10-2.13

2.10. **Name five groups of people who are more likely to develop TB disease once infected.**

2.11. **What evidence shows that the HIV epidemic played a part in the 1985-1992 increase in the number of TB cases? Name four examples of evidence.**

2.12. **If a person is infected with both *M. tuberculosis* and HIV, what are his or her chances of developing TB disease? How does this compare to the risk for people who are infected only with *M. tuberculosis*?**

2.13. **What is the strongest known risk factor for the development of TB disease?**

Answers on pages 34-35.

Case Study 2.2

For each of the following people, circle the factor or factors known to increase the risk of developing TB disease once infected. Each person may have more than one risk factor.

a) Mr. Sims: injects heroin
is HIV infected

b) Mr. Allen: has diabetes
has high blood pressure

c) Ms. Li: has chest x-ray findings suggestive of previous TB disease
has heart problems

d) Ms. Vinson: is obese
became infected with *M. tuberculosis* 6 months ago

Answers on page 37.

Race and Ethnicity

In 1997 more than 75% of the TB cases reported in the United States were in racial and ethnic minorities.

Information about the race and ethnicity of people who are reported to have TB shows that TB affects certain racial and ethnic minorities disproportionately. Of all the TB cases reported in the United States in 1997, more than 75% were in racial and ethnic minorities. This includes non-Hispanic blacks, Hispanics, Asians and Pacific Islanders, and American Indians and Alaskan Natives. (Hispanic is an ethnicity, not a race. People of Hispanic origin may be of any race.)

The percentage of U.S. TB cases that occur in blacks, Hispanics, and Asians is higher than expected based on the percentage of these minorities in the U.S. population.

In 1997, 33% of the reported TB cases in the United States were in non-Hispanic blacks, even though this group made up only 12% of the total U.S. population. Similarly, 21% of the TB cases were in Hispanics, a group which made up only 11% of the U.S. population; and 19% were in Asians and Pacific Islanders, who made up 3.5% of the U.S. population. In other words, the percentage of U.S. TB cases that occur in blacks, Hispanics, and Asians is higher than expected based on the percentage of these minorities in the U.S. population (Figures 2.3 and 2.4).

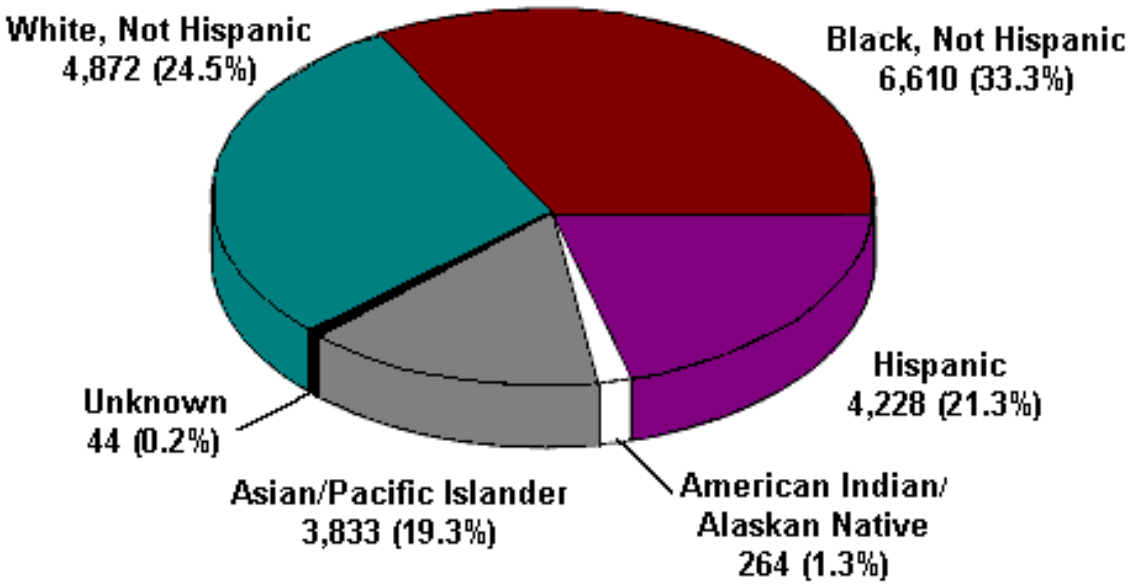

Figure 2.3 Reported TB cases by race and ethnicity, United States, 1997.
(Note: Percentages do not add up to 100 because of rounding.)

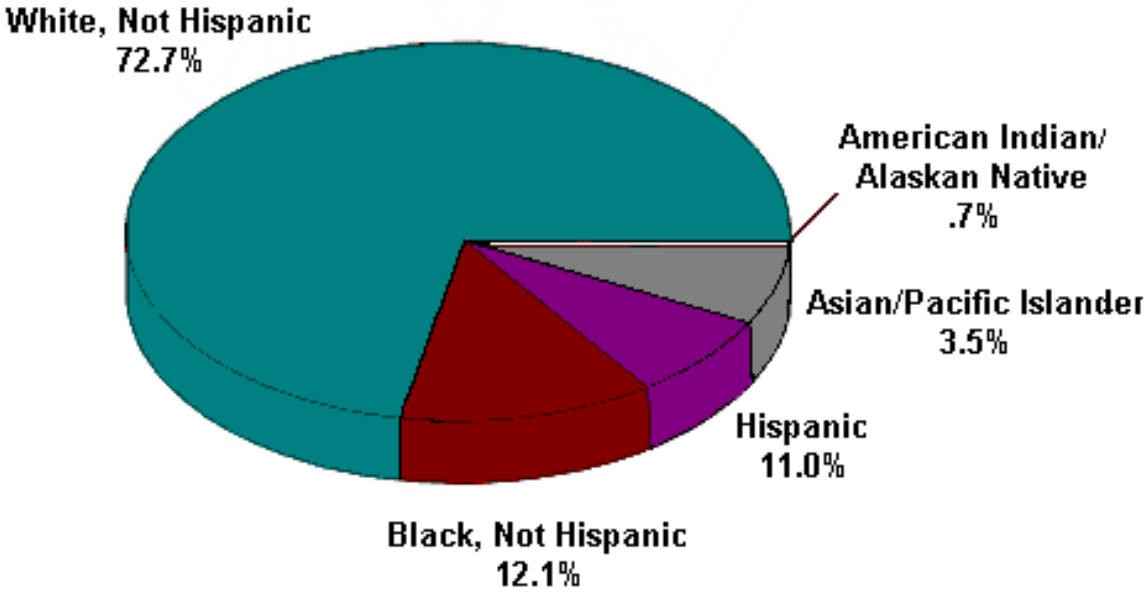

Figure 2.4 Racial and ethnic groups by percentage of U.S. population, 1997.
Population estimates are based on 1990 census data.

The idea that certain racial and ethnic minorities are disproportionately affected by TB can also be shown in terms of case rates.

The idea that certain racial and ethnic minorities are disproportionately affected by TB can also be shown in terms of case rates. In 1997, there were 2.5 TB cases in non-Hispanic whites for every 100,000 non-Hispanic whites in the general population. In other words, the TB case rate for non-Hispanic whites was 2.5 cases per 100,000 persons. The case rate for Asians and Pacific Islanders was 40.6 cases per 100,000 persons, about 16 times higher. This means that Asians and Pacific Islanders were 16 times more likely than non-Hispanic whites to have TB. Similarly, the case rate for non-Hispanic blacks was about 8 times higher than the case rate for non-Hispanic whites; for Hispanics, about 6 times higher; and for American Indians and Alaskan Natives, about 5 times higher (Table 2.2).

Table 2.2
Relative Risk* for TB by Race and Ethnicity, 1997

Race/Ethnicity	TB Case Rate (number of TB cases for every 100,000 persons in this race/ethnicity)	Relative Risk
Asians/Pacific Islanders	**40.6**	**16**
Non-Hispanic blacks	**20.5**	**8**
Hispanics	**14.4**	**6**
American Indians/Alaskan Natives	**13.4**	**5**
Non-Hispanic whites	**2.5**	**1**

*The relative risk is a comparison of case rates between two groups. In this table, all case rates are compared to the case rate for non-Hispanic whites because non-Hispanic whites have the lowest case rate. For example, the relative risk for Asians and Pacific Islanders is 16, because the case rate for this group is 16 times higher than the case rate for non-Hispanic whites.

TB rates are higher for some racial and ethnic groups, probably because a greater proportion of people in these groups have other risk factors for TB.

A major reason why rates of TB disease are higher for some racial and ethnic groups may be that a greater proportion of people in these groups have other risk factors for TB. These risk factors include birth in a country where TB is common, HIV infection, low socioeconomic status (for example, low level of employment or income), and exposure to TB in a high-risk setting (see Special Settings, pages 12-13).

TB in Children

TB cases in children have been decreasing since 1992.

In 1997, 6% of all reported TB cases were in children younger than 15 years old. Between 1985 and 1992 the number of reported TB cases in children 0-14 steadily increased. Since 1992, however, TB cases in children have been decreasing.

The occurrence of TB infection and disease in children provides important information about the spread of TB in homes and communities.

The occurrence of TB infection and disease in children provides important information about the spread of TB in homes and communities. For example, when a child has TB infection or disease, we learn that

- TB was transmitted relatively recently
- The person who transmitted TB to the child may still be infectious
- Other adults and children in the household or community have probably been exposed to TB; if they are infected, they may develop TB disease in the future

Study Questions 2.14-2.15

2.14. Which racial and ethnic groups are disproportionately affected by TB?

2.15. When a child has TB infection or disease, what may be true about the spread of TB in the child's home or community? Name three things.

Answers on page 35.

SUMMARY

From 1953 through 1984, the number of TB cases reported in the United States decreased by an average of 6% each year. Between 1985 and 1992 there was a resurgence of TB with the number of new cases increasing 20% — from 22,201 in 1985 to 26,673 in 1997. We can attribute the increase in TB cases between 1985 and 1992 to at least four factors: the HIV epidemic, immigration from countries where TB is common, the spread of TB in certain settings, and inadequate funding for TB control and other public health efforts. (page 4) (Figure 2.1)

In 1993, the upward trend in TB cases reversed. Since 1993, there has been a steady decline in the number of new TB cases reported annually in the United States. The decrease in the number of the TB cases since 1993 may be attributed to at least three factors: increased federal resources for TB control and other public health efforts; improvements in TB prevention and TB-control programs in state and local health departments; and increased attention to ensuring that patients complete drug therapy through directly observed therapy (DOT). (Page 6) (Figure 2.1)

Despite national trends reflecting a steady decline in the number of TB cases reported annually in the United States between 1992 and 1997, there are still several areas of ongoing concern: while TB cases declined nationally, TB cases actually increased in some areas; TB patients who do not complete therapy can develop and spread strains of TB that are resistant to available drugs (for example, "Strain W," a deadly TB strain resistant to most of the best anti-TB drugs, has been found in several states) and an increasing proportion of TB cases in the United States are among residents born outside of the United States (foreign-born). (Page 6) (Figure 2.2)

Some groups of people are at higher risk for TB disease because they are more likely to be exposed to or infected with *M. tuberculosis*. This category includes close contacts of people with infectious TB disease, people born in areas of the world where TB is common, elderly people, low-income groups with poor access to health care, and people who inject illicit drugs. It also includes people who live or work in certain settings such as nursing homes, correctional facilities, homeless shelters, and drug treatment centers and other people who may be exposed to TB on the job, such as health care workers. (Pages 7-15) (Table 2.1)

Other groups of people are at higher risk for TB disease because they are more likely to develop the disease once infected — for example, people with certain medical conditions, especially HIV infection. For people infected with *M. tuberculosis* and HIV, the risk of developing TB disease is about 7% to 10% **each year**. In contrast, for people infected only with *M. tuberculosis*, the risk of developing TB disease is 10% **over a lifetime**. (Page 18)

Studies show that there is a connection between the HIV epidemic and the 1985 to 1992 increase in rates of TB. First, the areas that were the most affected by the HIV epidemic also reported the largest increases in TB cases. Second, comparing 1985 to 1992, the largest increase in TB cases occurred among people aged 25 to 44, the age group most affected by AIDS. Third, TB is common among AIDS patients. Fourth, HIV infection is common among TB patients. (Pages 18-19)

More than 75% of TB cases reported in the United States in 1997 were in racial and ethnic minorities. This is probably because a greater proportion of people in these groups have other risk factors for TB. (Page 22)

Comparing 1985 to 1992, the number of TB cases in children increased by 35%. Since 1992, TB cases in children have been decreasing. The occurrence of TB disease and infection in children provides important information about the spread of TB in homes and communities. For example, when a child has TB disease or infection, we learn that TB was transmitted relatively recently. This means that the person who transmitted TB to the child may still be infectious. This also means that other adults and children in the household or community have probably been exposed to TB. If they are infected, they may develop TB disease in the future. (Page 26)

Additional Reading

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ANSWERS TO STUDY QUESTIONS

2.1. What happened to the number of TB cases in the United States between 1953 and 1984? (Page 3)

From 1953 through 1984, the number of TB cases reported in the United States decreased by an average of 6% each year.

2.2. What happened to the number of TB cases in the United States between 1985 and 1992? (Page 3)

From 1985 through 1992, the number of new cases increased by 20%.

2.3. Name four factors that contributed to the increase in the number of TB cases between 1985 and 1992. (Page 4)

- The HIV epidemic
- Immigration from countries where TB is common
- The spread of TB in certain settings (for example, correctional facilities and homeless shelters)
- Inadequate funding for TB control and other public health efforts

2.4. What happened to the number of TB cases between 1993 and 1997? (Page 4, 5)

In 1993, the upward trend in TB cases reversed. Since 1993, there has been a steady decline in the number of TB cases reported annually in the United States.

2.5 Name three factors that contributed to the decrease in the number of TB cases between 1993 and 1997. (Page 4)

- Increased federal resources for TB control and other public health efforts.
- Improvements in TB prevention and TB control programs in state and local health departments.
- Increased attention to ensuring that patients complete drug therapy through directly observed therapy (DOT).

2.6. Despite national trends reflecting a steady decline in the number of TB cases reported annually in the United States between 1993 and 1997, what are three areas of ongoing concern? (Page 5)

- While TB cases declined nationally, TB cases actually increased in some areas.
- TB patients who do not complete therapy can develop and spread strains of TB that are resistant to available drugs. For example, "Strain W," a deadly TB strain resistant to most of the best anti-TB drugs, has been found in several states.
- An increasing proportion of TB cases in the United States are among residents born outside of the United States (foreign-born).

2.7 Name eight groups of people who are more likely to be exposed to or infected with *M. tuberculosis* (Page 7) (Table 2.1)

- Close contacts of people with infectious TB
- People born in areas of the world where TB is common (for example, Asia, Africa, or Latin America)
- Elderly people
- Low-income groups with poor access to health care, including homeless people
- People who inject illicit drugs
- People who live or work in residential facilities such as nursing homes or correctional facilities
- Other people who may be exposed to TB on the job (for example, some health care workers)
- People in other groups as identified by local public health officials

2.8 Why is the risk of being exposed to TB higher in certain settings, such as nursing homes or correctional facilities? (Page 12)

The risk of being exposed to TB is higher in certain settings because many people in these facilities are at risk for TB. The risk of exposure to TB is even higher if the facility is crowded.

2.9 What are some reasons why rates of TB disease are higher in correctional facilities? (Page 12)

First, many inmates already have TB infection and therefore are at higher risk of developing TB disease. Second, an increasing number of inmates are infected with HIV, which means that they are more likely to develop TB disease if they become infected with *M. tuberculosis*. Finally, some correctional facilities are crowded, which promotes the spread of TB.

2.10. Name five groups of people who are more likely to develop TB disease once infected. (Page 16)

- People with HIV infection
- People with other medical conditions that appear to increase the risk for TB
- People recently infected with *M. tuberculosis* (within the past 2 years)
- People with chest x-ray findings suggestive of previous TB disease
- People who inject illicit drugs

2.11. What evidence shows that the HIV epidemic played a part in the 1985-1992 increase in the number of TB cases? Name four examples of evidence. (Page 16-17)

- The areas that were the most affected by the HIV epidemic also reported the largest increases in TB cases.
- Comparing 1985 to 1992, the largest increase in TB cases has occurred among people aged 25 to 44, the age group most affected by AIDS.
- TB is common among AIDS patients
- HIV infection is common among TB patients.

2.12. If a person is infected with both *M. tuberculosis* and HIV, what are his or her chances of developing TB disease? How does this compare to the risk for people who are infected only with *M. tuberculosis?* (Page 17)

The risk of developing TB disease is about 7% to 10% each year for people who are infected with both *M. tuberculosis* and HIV. In contrast, the risk of developing TB disease is 10% over a lifetime for people infected only with *M. tuberculosis.*

2.13. What is the strongest known risk factor for the development of TB disease? (Page 17)

HIV infection is the strongest known risk factor for the development of TB disease in people with TB infection. HIV infection weakens the body's immune system, making it more likely that a person who has TB infection will develop TB disease.

2.14. Which racial and ethnic groups are disproportionately affected by TB? (Page 20)

Asians and Pacific Islanders, non-Hispanic blacks, Hispanics, and American Indians and Alaskan Natives are disproportionately affected by TB.

2.15. When a child has TB infection or disease, what may be true about the spread of TB in the child's home or community? Name three things. (Page 24)

When a child has TB infection or disease, we learn that

- TB was transmitted relatively recently
- The person who transmitted TB to the child may still be infectious
- Other adults and children in the household or community have probably been exposed to TB; if they are infected, they may develop TB disease in the future

ANSWERS TO CASE STUDIES

2.1. For each of the following people, choose the factor or factors known to increase the risk of being exposed to or infected with *M. tuberculosis*. Each person may have more than one risk factor. (Õ Indicates correct answer)

a) Mr. Davidson
   rides the subway every day
   Õ is 80 years old

b) Mr. LeFevre
   Õ works at a nursing home
   immigrated from Europe

c) Ms. Montoya
   Õ was born in Latin America
   Õ has a father who had pulmonary TB disease

d) Ms. Parker
   Õ volunteers in the emergency room of an inner-city hospital
   works in a day care center

.

e) Mr. Dudley
   Õ was released from prison last year
   Õ injects morphine

2.2. For each of the following people, choose the factor or factors known to increase the risk of developing TB disease once infected. Each person may have more than one risk factor. (Õ indicates correct answer)

a) Mr. Sims
   Õ injects heroin
   Õ is HIV infected

b) Mr. Allen
   Õ has diabetes
   has high blood pressure

c.) Ms. Li

- has chest x-ray findings suggestive of previous TB disease
  has heart problems

d) Mr. Vinson

  is obese

- became infected with *M. tuberculosis* 6 months ago