

Chapter 1

Overview of Tuberculosis Epidemiology in the United States

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Chapter Objectives

After working through this chapter, you should be able to

- Discuss progress toward tuberculosis (TB) elimination in the United States;
- Identify TB disease trends in the United States; and
- List the racial and ethnic groups that are disproportionately affected by TB disease in the United States.

Progress Toward TB Elimination in the United States

In 1989, the Centers for Disease Control and Prevention (CDC) announced the goal of eliminating TB from the United States by the year 2010. A Strategic Plan for the Elimination of Tuberculosis in the United States was published in 1989 and reassessed in 1999 to identify the actions necessary to achieve elimination. The achievement of this goal was thwarted by the TB resurgence that occurred in the late 1980s and early 1990s. This resurgence was fueled by the following factors:

- The onset of the human immunodeficiency virus (HIV) epidemic;
- Increases in immigration of persons from countries where TB disease was common;
- TB transmission in congregate settings; and
- The development of multidrug-resistant (MDR) TB.

These factors occurred at a time when decades of cuts in funding had resulted in inadequate support for TB control and other public health efforts, and in the deterioration of TB control programs. As a result, federal, state, and local TB control officials had very few resources for TB control activities. Subsequently, the United States renewed its commitment to TB control in the 1990s and mobilized new resources. In 1993, the upward trend of new TB cases reversed, and the number of new cases has continued its decline up to and through 2011. This can be attributed to the increase in funds and resources which enabled TB programs to improve their control efforts to

- Promptly identify persons with TB disease;
- Start appropriate treatment for persons with TB disease; and
- Ensure patients complete treatment.

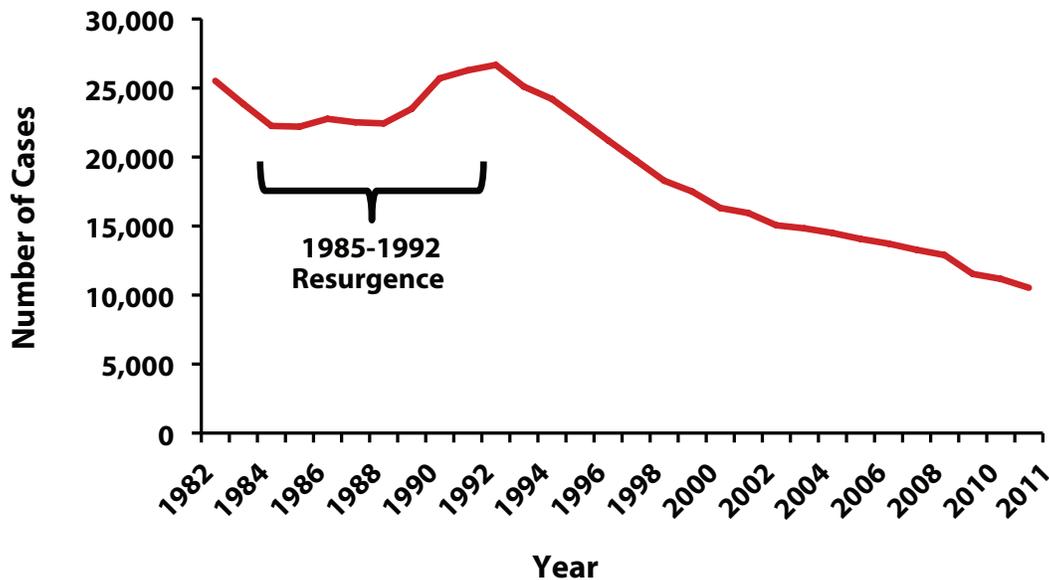
Despite unprecedented low rates of TB disease, elimination of TB faces some major barriers including

- TB disease in high-risk populations where it is difficult to detect, diagnose, and treat;
- Persistence and growth of the global TB epidemic; and
- Limitations of current control measures and the need for new tests and treatments, including an effective vaccine.

TB Disease Trends in the United States, 1982–2011

The resurgence of TB disease, which began in the mid-1980s, was marked by several years of increasing case counts until its peak in 1992. Case counts began decreasing in 1993, and 2011 marked the 19th year of decline in the total number of TB cases reported in the United States since the peak of the resurgence (Figure 1.1). From 1993 until 2002, the total number of TB cases decreased 5%–7% annually. Although rates continued to decline from 2003 through 2008, it was at a much slower rate. However, an unprecedented decline occurred in 2009, when the total number of TB cases decreased by more than 10% from 2008 to 2009. In 2011, a total of 10,528 TB cases were reported. This represents a decline of 5.8% from 2010 (Table 1.1).

Fig 1.1
Reported TB Cases*
United States, 1982–2011



*Updated as of June 25, 2012.

Table 1.1
TB Morbidity
United States, 2006– 2011

Year	No.	Rate*
2006	13,727	4.6
2007	13,278	4.4
2008	12,895	4.2
2009	11,528	3.8
2010	11,171	3.6
2011	10,528	3.4

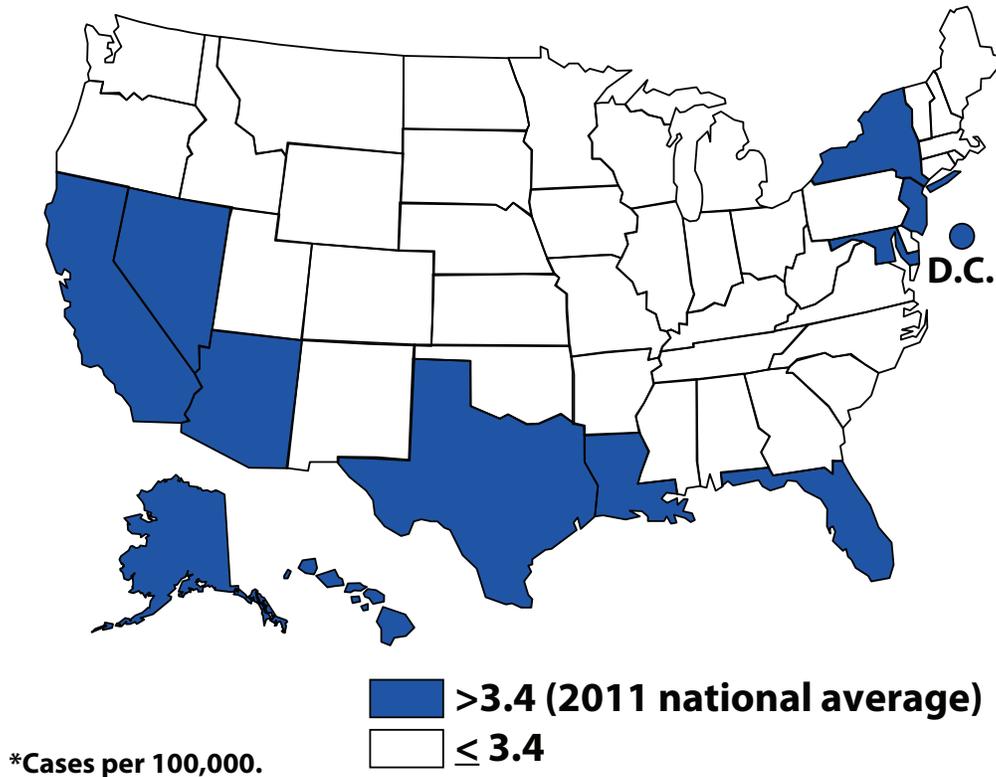
*Cases per 100,000, updated as of June 25, 2012

While national trends indicate that there has been a decline in the overall number of cases since 1993, cases continue to be reported. It is important to focus on local epidemiology to identify trends in individual states or regions.

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In 2011, a total of 38 states reported a rate less than or equal to 3.4 TB cases per 100,000, the 2011 national average. Twelve states and D.C. reported a rate above 3.4 TB cases per 100,000; these areas accounted for 67% of the national total in 2011 and have also experienced substantial overall decreases in cases and rates from 1992 through 2011 (Figure 1.2).

Figure 1.2
TB Case Rates*
United States, 2011



TB Case Rates by Origin

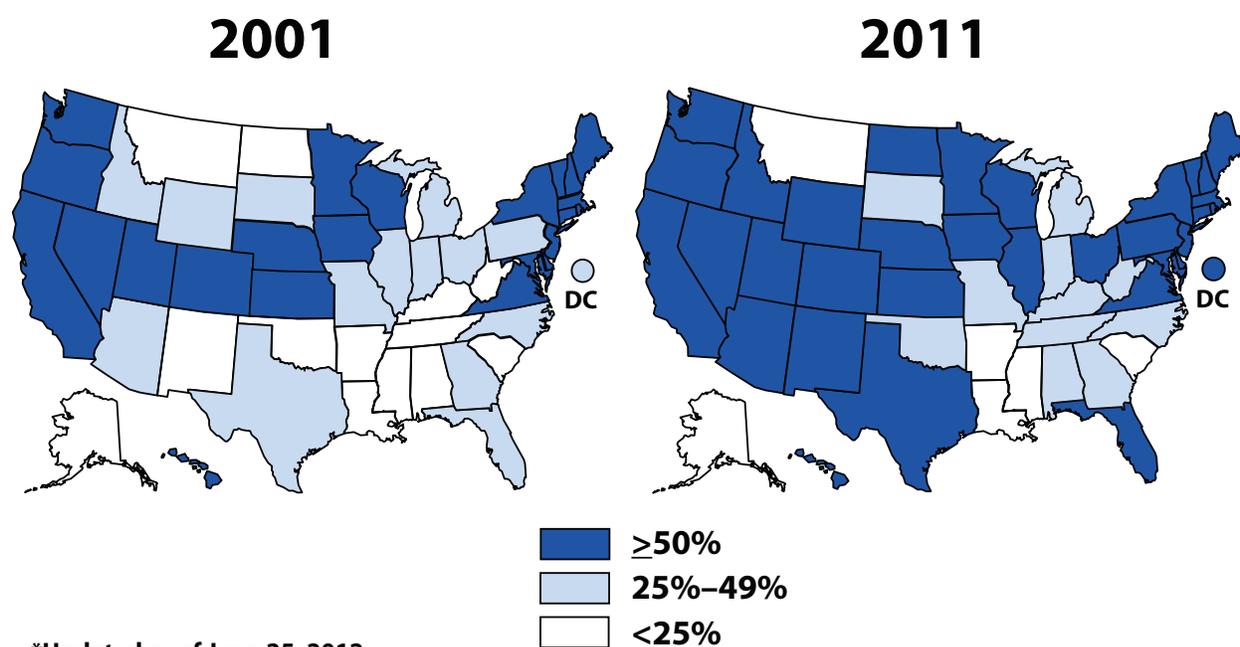
During 1993 to 2003, rates declined in both the U.S.-born and the foreign-born populations; however, the decline was substantially less among foreign-born populations. In 2002, for the first time, TB cases among foreign-born persons accounted for the majority (51.2%) of TB cases in the United States. Overall, the number of cases in foreign-born persons has remained virtually level with approximately 7,000–8,000 cases each year, until 2009 when the number dropped to 6,854. That decreasing trend continued in 2011 with the number of cases in foreign-born persons dropping to 6,510. The number of cases in U.S.-born persons decreased from more than 17,000 in 1993 to 3,981 in 2011.

In 2002, for the first time, TB cases among foreign-born persons accounted for the majority (51.2%) of TB cases in the United States.

Percentage of TB Cases among Foreign-Born Persons in the United States, 2001–2011

The percentage range of the total number of TB cases that occurred in foreign-born persons in each state is high-lighted for 2001 and 2011 in side-by-side maps (Figure 1.3). The number of states with less than 25% of their TB cases among foreign-born persons decreased from 13 states in 2001 to 6 states in 2011. The number of states with 25%–49% of cases among foreign-born persons decreased from 14 states in 2001 to 11 states in 2011. However, the number of states that had 50% or more of their cases among foreign-born persons increased from 23 states in 2001 to 34 states in 2011.

Figure 1.3
Percentage of TB Cases Among Foreign-Born Persons
United States, 2001–2011*

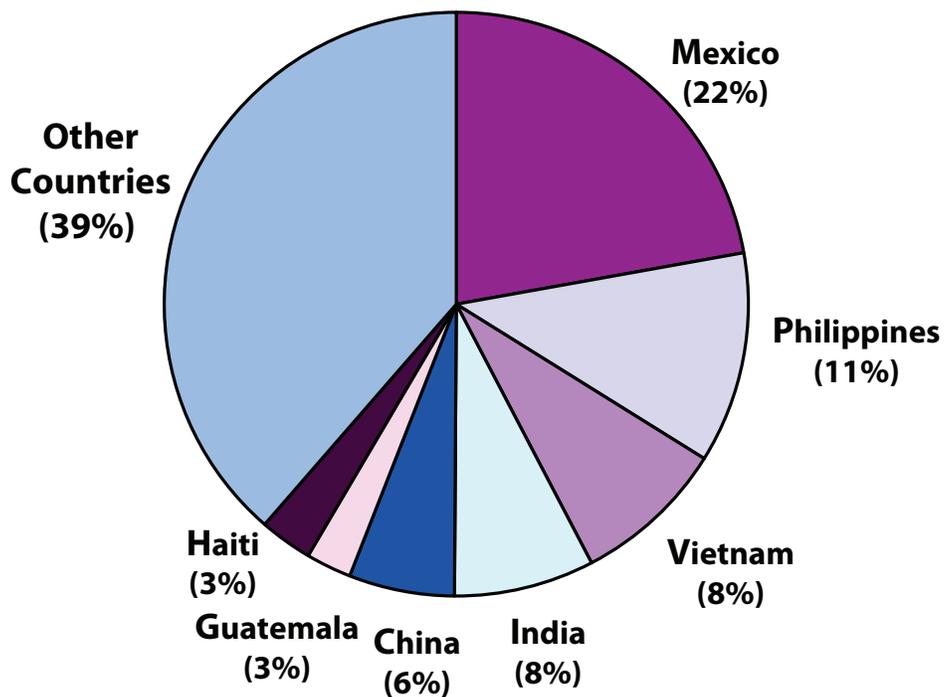


The countries of birth of foreign-born persons reported with TB disease in the United States have remained relatively constant since 1986. Seven countries accounted for 61% of the total cases in foreign-born persons in 2011 (Table 1.2 and Figure 1.4).

Table 1.2
Countries of Birth of Foreign-Born Persons
Reported with TB in the United States, 2011

Country	Percent of Total Foreign-Born Cases in the United States
Mexico	22%
Philippines	11%
Vietnam	8%
India	8%
China	6%
Guatemala	3%
Haiti	3%
Other Countries (135)	39%

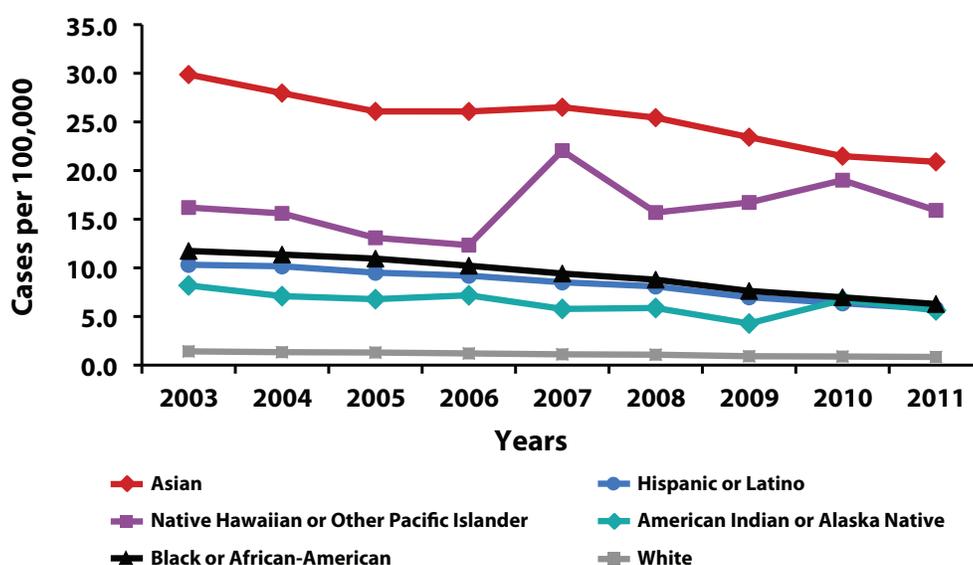
Figure 1.4
Countries of Birth of Foreign-Born Persons Reported with TB
United States, 2011



Race and Ethnicity

Figure 1.5 shows the declining trend in TB rates by race/ethnicity during the years 2003–2011. Asians had the highest TB rates, which declined from 29.9 per 100,000 in 2003 to 20.9 in 2011, and had a percent decline over the time period of 30%. Rates also declined in the following racial/ethnic groups: among non-Hispanic blacks or African-Americans, from 11.7 in 2003 to 6.3 in 2011 (-46%); among Hispanics, from 10.3 to 5.8 (-44%); among American Indians and Alaska Natives, from 8.2 to 5.6 (-32%); and among non-Hispanic whites, from 1.4 to 0.8 (-43%). Rates decreased among Native Hawaiian or Other Pacific Islanders after two years of increase since 2008, from 16.2 in 2003 to 15.9 in 2011 (-2%).

Figure 1.5
TB Case Rates by Race/Ethnicity*
United States, 2003–2011**



*All races are non-Hispanic

**Updated as of June 25, 2012.

Several important factors likely contribute to the disproportionate burden of TB in minorities, including the following:

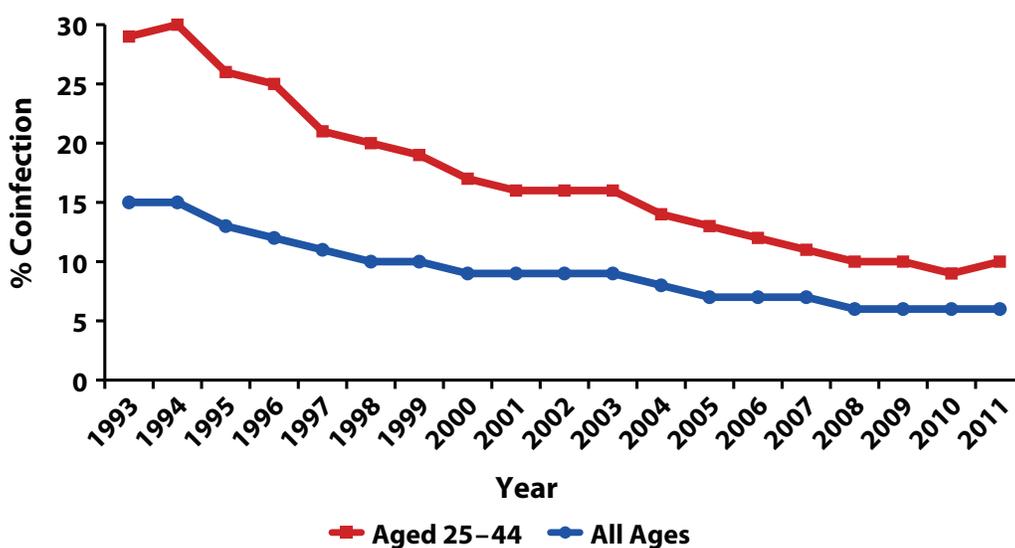
- Infection acquired in the country of origin in foreign-born minorities;
- Unequal distribution of TB risk factors contributing to
 - » An increased exposure to TB
 - » An increased risk of developing TB disease once infected with *M. tuberculosis* (e.g., HIV infection);
- Lower socioeconomic status and the effects of crowding

HIV-Infected Persons

HIV-infected persons are at high risk for developing TB disease after infection with *M. tuberculosis*. In the age group of 25–44 among persons reported with TB disease, the percentage of HIV coinfection declined from a high of 29% in 1993 to 10% in 2011. In all ages, the percentage of HIV coinfection decreased from 15% in 1993 to 6% in 2011.

Figure 1.6 provides minimum estimates of HIV coinfection among persons reported with TB from 1993 through 2011. Since the addition of the request for HIV status to the individual TB case report in 1993, incomplete reporting has provided a challenge to calculating reliable estimates. Results from the cross-matching of TB and AIDS registries have been used to supplement reported HIV test results.

Figure 1.6
Estimated HIV Coinfection in Persons Reported with TB
United States, 1993–2011*



*Updated as of June 25, 2012

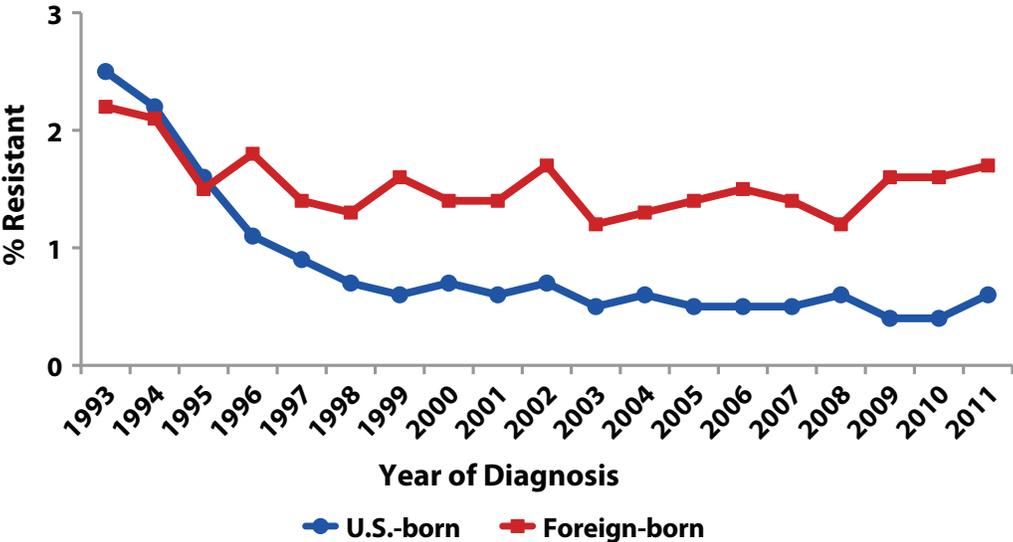
Note: Minimum estimates based on reported HIV-positive status among all TB cases in the age group.

HIV-infected persons are at high risk for developing TB disease after infection with *M. tuberculosis*.

Multidrug-Resistant TB

Multidrug-resistant TB (MDR TB) is caused by an organism that is resistant to at least isoniazid and rifampin, the two most potent TB drugs; it is a serious public health concern. Both U.S.-born and foreign-born persons had decreases in the number and percentage of cases of MDR TB, although the decline in U.S.-born persons has been greater (Figure 1.7). As a result, the percentage of all primary MDR TB cases reported and associated with being foreign born increased from approximately 25% of all MDR TB cases in 1993 to 83% in 2011.

Figure 1.7
Primary MDR TB in U.S.-Born vs. Foreign-Born Persons
United States, 1993–2011*



*Updated as of June 25, 2012.

Note: Based on initial isolates from persons with no prior history of TB. MDR TB defined as resistance to at least isoniazid and rifampin.

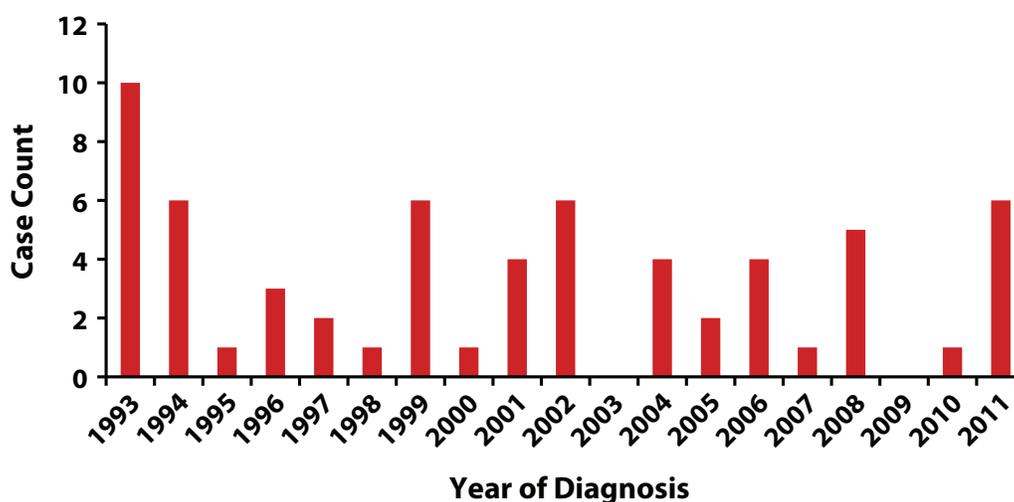
Primary MDR TB cases reported in foreign-born persons increased from approximately 25% of all MDR cases in 1993 to 83% in 2011.

Extensively Drug-Resistant TB

Extensively drug-resistant TB (XDR TB) is a rare type of MDR TB that is resistant to isoniazid and rifampin, plus any fluoroquinolone and at least one of three injectable second-line drugs (i.e., amikacin, kanamycin, or capreomycin). For 1993–2011, the annual numbers of reported XDR TB cases, as determined by the initial drug-susceptibility test (DST), are shown below (Figure 1.8). There is no apparent trend in the number of XDR TB cases over time in the United States. The greatest number of cases reported in a single year that met the XDR TB case definition was 10 in 1993. There were no cases reported in 2003 or 2009. One case of XDR TB was reported in 2010 and six cases in 2011.

There is no apparent trend in the number of XDR TB cases over time in the United States.

Figure 1.8
XDR TB Case Count Defined on Initial DST* by Year
1993–2011**



* Drug susceptibility test

** Updated as of June 25, 2012.

Note: Extensively drug-resistant TB (XDR TB) is defined as resistance to isoniazid and rifampin, plus resistance to any fluoroquinolone and at least one of three injectable second-line anti-TB drugs.

Identifying Groups at High Risk for TB

The decrease in TB cases and MDR TB is encouraging; however, the earlier resurgence of TB provides a valuable lesson. Every TB case is a potential outbreak. Health departments must be prepared to identify promptly and treat persons who have active TB disease, as well as identify and treat close contacts who may have become infected from persons with active TB disease. By understanding which groups are at higher risk for becoming infected with *M. tuberculosis*, health departments can better focus TB prevention and control efforts (Table 1.3).

Table 1.3
**Persons at Higher Risk for Exposure to
and/or Infection with *M. tuberculosis***

Description
<ul style="list-style-type: none">• Close contacts of persons known or suspected to have TB disease• Foreign-born persons from areas that have a high incidence of TB disease (e.g., Africa, Asia, Eastern Europe, Latin America, and Russia)• Persons who visit areas with a high prevalence of TB disease, especially if visits are frequent or prolonged• Residents and employees of high-risk congregate settings (e.g., correctional facilities, long-term care facilities, and homeless shelters)• Health-care workers who serve clients who are at increased risk for TB disease• Populations defined locally as having an increased incidence of latent <i>M. tuberculosis</i> infection or TB disease, possibly including medically underserved, low-income populations, or persons who abuse drugs or alcohol• Infants, children, and adolescents exposed to adults who are at increased risk for latent tuberculosis infection or TB disease

Study Questions

- 1.1 In 2011, how many TB cases were reported from the 50 states and D.C.?**
(circle the one best answer)
- A. 5,466
 - B. 10,528
 - C. 21,553
- 1.2 Which of the following statements is true about TB case rates between 1993 and 2011?**
(circle the one best answer)
- A. Rates increased in both foreign-born populations and U.S.-born populations.
 - B. Rates decreased in both foreign-born populations and U.S.-born populations.
 - C. Rates remained level in both foreign-born populations and U.S.-born populations.

The following countries of birth of foreign-born persons accounted for 61% of the total number of TB cases in the United States in 2011. Match the country of birth with its percentage of total TB cases among foreign-born persons. (Choose the one best answer and write the letter for the correct answer on the line next to the question number.)

Country of Birth	Percent of Total TB Cases in Foreign-Born Persons in the United States, 2011 (Answers may be used more than once)
___ 1.3 China	A. 3%
___ 1.4 Guatemala	B. 6%
___ 1.5 Haiti	C. 8%
___ 1.6 India	D. 11%
___ 1.7 Mexico	E. 22%
___ 1.8 Philippines	
___ 1.9 Vietnam	

1.10 Which of the following statements about trends in TB rates by race/ethnicity in the United States, from 2003 to 2011, are true? (circle the one best answer)

- A.** Rates declined among Asians and Pacific Islanders from 29.9 per 100,000 in 2003 to 20.9 in 2011.
- B.** Rates declined by at least 22% among non-Hispanic blacks or African Americans, Hispanics, American Indians and Alaska Natives, and non-Hispanic whites from 2003 to 2011.
- C.** Rates increased among Hispanics, from 8.1 per 100,000 in 2003 to 19.9 in 2011.
- D.** A, B, and C are all correct.
- E.** Only A and B are correct.

1.11 Which of the following factors contribute to the disproportionate burden of TB disease in minorities? (circle the one best answer)

- A. Infection acquired in the country of origin in foreign-born minorities.
- B. Unequal distribution of TB risk factors (e.g., HIV), contributing to increased exposure to TB disease or to an increased risk of developing TB disease once infected with *M. tuberculosis*.
- C. Lower socioeconomic status and the effects of crowding.
- D. A, B, and C are all correct.
- E. Only A and B are correct.

1.12 Which of the following statements about MDR TB and XDR TB in the United States are true? (circle the one best answer)

- A. Primary MDR TB cases reported in foreign-born persons increased from approximately 25% among all MDR TB cases in 1993 to 83% in 2011.
- B. There is no apparent trend in the number of XDR TB cases over time in the United States.
- C. The annual number of cases of counted XDR TB cases during 1993–2011 was 160.
- D. A, B, and C are correct.
- E. Only A and B are correct.

1.13 Of the following persons, who is LEAST likely to be exposed to TB disease? (circle the one best answer)

- A. Trang was born in Vietnam and recently immigrated to the United States.
- B. Frank lives in a homeless shelter.
- C. Joshua attends high school in Canton, Ohio.
- D. Ellen is a nurse at the Texas State Penitentiary at Huntsville.

Chapter Summary

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There is no apparent trend in the number of XDR TB cases over time in the United States. The greatest number of cases reported in a single year that met XDR TB case definition was 10 in 1993. There were no cases reported in 2003 or 2009. One case of XDR TB was reported in 2010 and six cases in 2011.

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