

## Tuberculosis in the United States

### National Tuberculosis Surveillance System Highlights from 2015

**Slide 1 (title slide). Tuberculosis in the United States—National Tuberculosis Surveillance System, Highlights from 2015.** This slide set was prepared by the Division of Tuberculosis Elimination, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention (NCHHSTP), Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services (HHS). It provides trends for the recent past and highlights data collected through the National Tuberculosis Surveillance System for 2015. Since 1953, through the cooperation of state and local health departments, CDC has collected information on newly reported cases of tuberculosis (TB) disease in the United States. The data presented here were collected by the revised TB case report introduced in 2009. Each individual TB case report (Report of Verified Case of Tuberculosis, or RVCT) is submitted electronically to CDC. The data for this slide set are based on updates received by CDC as of June 9, 2016. All case counts and rates for years 1993–2015 have been updated.

**Slide 2. Reported Tuberculosis (TB) Cases, United States, 1982–2015.** The resurgence of TB in the mid-1980s was marked by years of increasing case counts until its peak in 1992. Case counts decreased from 1993 and 2014. However, in 2015, a slight increase occurred in the total number of TB cases reported in the United States. From 1992 until 2008, the total number of TB cases decreased 2%–7% annually. An unprecedented decrease occurred in 2009, when the total number of TB cases decreased by more than 10% from 2008 to 2009. In 2015, a total of 9,557 cases were reported from the 50 states and the District of Columbia (DC). This represents an increase of 1.6% from 2014, but a 64.2% decrease from 1992.

**Slide 3. TB Morbidity, United States, 2010–2015.** This slide provides the total number of reported U.S. TB cases and the associated rates for each of the past 6 years. Rate is defined as the number of cases per 100,000 population. The number of TB cases decreased from 11,159 in 2010 to 9,557 in 2015, and the TB rate decreased from 3.6 in 2010 to 3.0 in 2015.

**Slide 4. TB Case Rates, United States, 2015.** Forty-three states reported a rate  $\leq 3.0$  cases/100,000 population, the 2015 national average. Seven states and DC reported a rate  $>3.0$  cases/100,000 population; these accounted for 53% of the national total in 2015.

**Slide 5. Map of U.S.-Affiliated Pacific Islands, by TB Case Rates, 2015.** The Federated States of Micronesia, Republic of the Marshall Islands, Northern Mariana Islands and Palau had case rates at or above 50/100,000 population. The lowest case rates were in Guam and American Samoa.

**Slide 6. TB Case Rates, U.S.-Affiliated Pacific Islands, 2015.** Case rates range from 7.4/100,000 population in American Samoa to 189.8/100,000 in the Republic of the Marshall Islands, compared with the substantially lower overall U.S. case rate (3.0/100,000).

**Slide 7. TB Case Rates, by Age Group, United States, 1993–2015.** During 2015, case rates in all age groups declined by  $>50\%$  from their 1993 values: persons aged  $\geq 65$  years, from 17.7 cases/100,000 population in 1993 to 4.8 in 2015; adults aged 45–64 years, from 12.5 to 3.6; adults aged 25–44 years, from 11.6 to 3.4; persons aged 15–24 years, from 5.0 to 2.1; children aged 5 to 14 years, from 1.7 to 0.5; and children aged  $\leq 4$  years, from 5.2 to 1.2.

**Slide 8. Reported TB Cases, by Age Group, United States, 2015.** Three percent of TB cases were among children aged 0–4 years; 2% were among those aged 5–14 years; 10% were among persons aged 15–24 years; 30% were among adults aged 25–44 years; 32% were among adults aged 45–64 years; and 24% were among adults aged  $\geq 65$  years.

**Slide 9. TB Case Rates, by Age Group and Sex, United States, 2015.** Case rates tended to increase with age, ranging from a low of  $<1$  case/100,000 children aged 5–14 years to a high of 6.7 cases/100,000 men aged  $\geq 65$  years. As age increased, the case rate among men increased faster than among women; the rates among

men aged  $\geq 45$  years were approximately twice those among women of the same age.

**Slide 10. TB Case Rates, by Race/Ethnicity, United States, 2003–2015.** By race/ethnicity, the rates indicate a declining trend in TB since 2003. Asians consistently had the highest yearly TB rates, but their rates declined from 29.3 cases/100,000 population in 2003 to 18.2 in 2015, a 38% decrease. Rates also declined among the following racial/ethnic groups: non-Hispanic blacks/African Americans, from 11.7 in 2003 to 5.0 in 2015 (–57%); Hispanics, from 10.2 to 4.8 (–54%); American Indians and Alaska Natives, from 8.3 to 6.1 (–26%); and non-Hispanic whites, from 1.4 to 0.6 (–56%). Rates increased among Native Hawaiian/Other Pacific Islanders, from 15.7 to 18.2 (16%) from 2003 to 2015. Because of the low TB case counts and population estimates for Native Hawaiians/Other Pacific Islanders in the United States, case rates for this group might appear high.

Certain key factors likely contribute to the disproportionate burden of TB among minority groups. For persons who were born in countries where TB is common, TB disease can result from infection acquired in their country of origin. Unequal distribution of TB risk factors (e.g., human immunodeficiency virus [HIV] infection) also might contribute to increased exposure to TB or to an increased risk for experiencing TB after becoming infected with *Mycobacterium tuberculosis*.

**Slide 11. TB Case Rates, by Age Group and Race/Ethnicity, United States, 2015.** After infancy (ages 0–4 years), risk typically increased with age across all racial/ethnic groups, except among Native Hawaiians/Other Pacific Islanders, which did not indicate a trend. Rates were consistently higher among minority racial/ethnic groups than among non-Hispanic whites. Rates were the highest among Asians and Native Hawaiians/Other Pacific Islanders. Because of the low TB case counts and population estimates for Native Hawaiians/Other Pacific Islanders in the United States, case rates for this group might appear high.

**Slide 12. Reported TB Cases, by Race/Ethnicity, United States, 2015.** During 2015, approximately 85% of all reported TB cases occurred among racial/ethnic minorities: Asians, 33%; Hispanics, 28%; non-Hispanic blacks/African Americans, 21%; American Indians/Alaska Natives, 2%; and Native Hawaiians/Other Pacific Islanders, 1%. In contrast, 13% of cases occurred among non-Hispanic whites. Persons reporting two or more races, not including persons of Hispanic or Latino ethnicity, accounted for 2% of all cases.

**Slide 13. Number of TB Cases Among U.S.-Born versus Foreign-Born Persons, United States, 1993–2015.** The graph illustrates the increase in the percentage of cases occurring among foreign-born persons during the study period, from 29% in 1993 to 66% in 2015. Overall, the number of cases among foreign-born persons remained stable before 2009, with approximately 7,400–8,000 cases/year. During 2009, the number decreased to 6,959, and that trend continued through 2013, with the number of cases among foreign-born persons decreasing to 6,186. However, since 2014, the number of cases among foreign-born persons has increased (6,350 cases during 2015). The number among U.S.-born persons decreased from >17,000 in 1993 to 3,186 in 2015.

**Slide 14. Trends in TB Cases Among Foreign-Born Persons, United States, 1993–2015.** The percentage of TB cases accounted for among foreign-born persons increased from 29% in 1993 to 66% in 2015.

**Slide 15. Reported TB Cases, by Origin and Race/Ethnicity, United States, 2015.** Among U.S.-born persons with TB in 2015, 36% were non-Hispanic black/African American; 31% were non-Hispanic white, 21% were Hispanic/Latino; 4% were Asian; 4% were American Indian/Alaska Native; and 3% were Native Hawaiian/Other Pacific Islander. Persons reporting two or more races totaled <1% of cases among U.S.-born persons. Among foreign-born persons with TB, 48% were Asian; 32% were Hispanic/Latino; 13% were non-Hispanic black/African American; 4% were non-Hispanic white; and 2% were persons reporting two or more races, not including persons of Hispanic/Latino origin. Cases among American Indians/Alaska Natives and among Native Hawaiians/Other Pacific Islanders constituted 0.2% of the cases among foreign-born persons and are not included on the charts.

**Slide 16. Percentage of Foreign-Born Persons Among TB Cases, United States, 2005 and 2015.** The number of states with <25% of their TB cases occurring among foreign-born persons decreased from 10 states in 2005 to 6 states in 2015. The number of states with ≥25%–49% of cases among foreign-born persons decreased from 17 states and DC in 2005 to 8 states in 2015. However, the number of states that had ≥50% of their cases among foreign-born persons increased from 23 states in 2005 to 36 states and DC in 2015.

**Slide 17. TB Case Rates Among U.S.-Born versus Foreign-Born Persons, United States, 1993–2015.** TB rates among foreign-born persons remain higher than those among the U.S.-born population. During 1993–2015, the rates among U.S.-born persons decreased from 7.4 cases/100,000 population to 1.2, whereas the rates among foreign-born persons decreased from 34.0 cases/100,000 population to 15.1.

**Slide 18. TB Case Rates Among U.S.-Born versus Foreign-Born Persons, United States, 1993–2015.** The chart presents the same data as on Slide 17, but uses a logarithmic scale to better illustrate the trends. The trend lines indicate a greater rate of decrease among U.S.-born, compared with foreign-born, persons during the study period.

**Slide 19. Countries of Birth Among Foreign-Born Persons Reported with TB, United States, 2015.** The top seven countries are displayed in the chart; those countries have remained relatively constant since 1986, when information regarding country of birth was first reported by all areas submitting reports to CDC. During 2015, the top seven countries accounted for >60% of all cases among foreign-born persons, with Mexico accounting for 20%; the Philippines, 13%; India, 9%; Vietnam, 8%; China, 7%; Guatemala, 3%; and Haiti, 2%. Persons from 136 other countries each accounted for ≤2% of the total, but altogether, accounted for 38% of foreign-born persons reported with TB.

**Slide 20. Percentage of Foreign-Born Persons with TB, by Time of Residence in U.S. Before Diagnosis, 2015.** The chart indicates that the distribution for the top three countries of birth is Mexico, the Philippines, and India. Among persons born in Mexico, 9.2% had been in the United States for <1 year; 6.7%, 1–4 years; 9.2%, 5–9 years; 23.9%, 10–19 years; and 38.9% for ≥20 years. Among persons born in the Philippines, 13.4% had been in the United States for <1 year; 9.9%, 1–4 years; 12.2%, 5–9 years; 20.4%, 10–19 years; and 33.8%, ≥20 years. Among persons born in India, 21.1% had been in the United States for <1 year; 21.6%, 1–4 years; 14.9%, 5–9 years; 19.5%, 10–19 years; and 16.2%, ≥20 years. Values for unknown length of residence in the United States for these top three countries ranged from 6.7 to 12.1% for 2015. For all other foreign-born persons, 19.3% had been in the United States for <1 year; 18.8%, 1–4 years; 12.8%, 5–9 years; 17.9%, 10–19 years; 22.3%, ≥20 years; and 8.4%, unknown length of residence. Overall, 16.7% had been in the United States for <1 year; 15.8%, 1–4 years; 12.2%, 5–9 years; 19.5%, 10–19 years; 26.5%, ≥20 years; and 9.2%, unknown length of residence.

**Slide 21. Primary Anti-TB Drug Resistance, United States, 1993–2015.** The graph starts in 1993, the year in which the individual TB case reports submitted to the national surveillance system began collecting information regarding initial susceptibility test results for patients with culture-positive TB. Data were available for >86.9% of culture-positive cases for each year. Primary resistance was calculated by using data from persons with no reported prior TB episode. Resistance to at least isoniazid was 8.2% in 1993; however, by 2015, this had increased to 9.0%. Resistance to at least isoniazid and rifampin, known as multidrug-resistant TB (MDR TB), was 2.5% in 1993. The percent of primary MDR TB has remained approximately stable since it decreased to 1.0% in 1998. In 2015 the percent of primary MDR TB was 1.1%.

**Slide 22. Primary MDR-TB, United States, 1993–2015.** This graph focuses on trends in primary multidrug-resistant TB (MDR-TB), which is based on initial isolates from persons with no prior history of TB. The number of primary MDR-TB cases, represented by the bars, decreased steadily from 407 in 1993 to 115 in 2001, with a slight increase to 132 in 2002. Since then, the total number of primary MDR-TB cases has fluctuated from 70 to 103 cases, with 73 cases reported for 2015. Primary MDR-TB, indicated by the trend line, decreased from 2.5% in 1993 to approximately 1.0% in 1998, and has fluctuated approximately 1.0% since then. During 2015, the percentage was 1.1%.

**Slide 23. Primary Isoniazid Resistance Among U.S.-Born versus Foreign-Born Persons, United States, 1993–2015.** On the basis of initial isolates from persons with no prior history of TB, the percentage of isoniazid resistance has remained higher among foreign-born persons than among U.S.-born persons for all years measured. Among foreign-born persons, the percentage declined from 12.1% in 1993 to 10.0% in 2015. In U.S.-born persons, the percentage decreased from 6.7% in 1993 to 4.2% in 2007, but has increased since then to 6.4% in 2015.

**Slide 24. Primary MDR-TB Among U.S.-Born versus Foreign-Born Persons, United States, 1993–2015.** The percentage of persons with primary MDR-TB has declined among both groups since 1993, although the decline among U.S.-born persons has been greater. Consequently, the proportion of primary MDR-TB cases in the United States that are attributed to foreign-born persons increased from approximately 25% in 1993 to 86% in 2015 (not shown on slide). Among U.S.-born persons, the percentage with primary MDR-TB has been <1% since 1997 and was 0.5% in 2015. The percentage among foreign-born persons has fluctuated year to year, although it has remained from 1.2 to 1.8% since 1995. During 2015, the percentage of primary MDR-TB cases among foreign-born persons was 1.4%.

**Slide 25. XDR-TB Case Count, Defined on Initial DST, United States, 1993–2015.** Extensively drug-resistant TB (XDR-TB) at first drug susceptibility test (DST) 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. One case of XDR-TB was reported in 2015, and the most reported in a single year was 10 in 1993. No cases were reported in 2003 and 2009, and no apparent trend exists in the number of cases over time.

**Slide 26. Reporting of HIV Test Results Among Persons with TB, by Age Group, United States, 1993–2015.** The percentage of TB patients for whom HIV test results were reported increased from 29.9% among all ages in 1993 to 89.5% in 2015. Among adults aged 25–44 years, the percentage increased from 45.1% in 1993 to 94.9% in 2015. California began reporting HIV test results to CDC in 2011, which accounts for the substantial percentage increase for that year.

**Slide 27. Estimated HIV Coinfection Among Persons Reported with TB, United States, 1993–2015.** Since the addition of HIV status to the individual TB case report in 1993, incomplete reporting has provided a challenge to calculating reliable estimates. However, reporting improved substantially beginning in 2011 (see Slide 26). For all ages, the estimated percentage of coinfection among persons with TB who reported HIV testing (positive, negative, or indeterminate results) decreased from 48.2% to 5.5% overall during 1993–2015, and from 62.5% to 7.6% among persons aged 25–44 years during that period.

**Slide 28. TB Cases Among Persons Aged ≥15 Years Residing in Correctional Facilities, United States, 1993–2015.** The number of cases among persons aged ≥15 years residing in a correctional facility has decreased from a high of 1,117 cases in 1994 to 330 cases in 2015. During 2000–2010, the number of TB cases reported from correctional facilities ranged from mid-to-high 400s to high 500s; 2011 was the first year cases decreased to <423 cases. Of total cases, the percentage of cases residing in a correctional facility has ranged from 5.0% in 1994 to 3.3% in 2002. The 1990s saw a decreasing trend in percentages until 2002. Since 2002, the trend has increased in percentages. However, during 2015, the percentage of total cases decreased to 3.6%.

**Slide 29. TB Cases Reported Among Homeless Persons During the 12 Months Before Diagnosis, Ages ≥15 Years, United States, 1993–2015.** The number of cases among persons aged ≥15 years who were homeless any time during the 12 months before the TB diagnosis has decreased from a high of 1,379 cases in 1994 to 495 in 2015. This category has experienced an overall decrease since 1994, with the exception of slight increases during 2003, 2006, and 2010. Of total cases, the percentages among homeless persons have had an overall decrease from 7.5% in 1993 to 5.5% in 2015.

**Slide 30. Mode of Treatment Administration Among Persons Reported with TB, United States, 1993–2013.** In 1993, the reporting areas began providing information regarding modes of treatment administration on the individual TB case report form. Treatment administered as only directly observed therapy (DOT) increased from 21.7% in 1993 to 63.2% in 2013, the latest year with available data. The proportion of patients

who received at least some portion of their treatment as DOT (on the basis of combining the percentage of patients who received only DOT and the percentage for whom some portion was self-administered) was 28.9% during 2013.

**Slide 31. Completion of TB Treatment Therapy, United States, 1993–2013.** Reporting areas began providing information regarding TB treatment therapy completion in 1993 through the individual TB case report form. The calculations include persons alive at diagnosis with an initial regimen of  $\geq 1$  drug prescribed, who did not die within 1 year of initiating therapy. The calculations exclude persons with an initial rifampin-resistant isolate; patients with bone and joint disease, meningeal disease, or disease of the central nervous system; pediatric patients aged 0–14 years with miliary disease or a positive blood culture or a positive NAA from a blood specimen; and those who moved out of the country within 1 year of initiating treatment. Overall completion of therapy had remained at approximately 92%–93% from 1998 through 2008, but increased to 95%–96% from 2009 to 2013. In 2013, the latest year with available data, completion of therapy was 95.9%. Completion in  $\leq 1$  year increased from 63.4% in 1993 to 89.6% in 2013. The *Healthy People 2020* objective is completion of therapy in  $\leq 1$  year for 93% of patients (Objective IID-30, available at: <https://www.healthypeople.gov/2020/topics-objectives/objective/iid-30>). CDC is working with state and local health departments to determine and evaluate reasons for apparent delayed therapy completion, which might vary by jurisdiction.

**Slide 32. Definition for *Mycobacterium tuberculosis* Genotyping in the United States.** The schematic shows the sequential assignment of unique spoligotype and 12-locus MIRU-VNTR combination (PCRTyp) or 24-locus MIRU-VNTR combination (GENTyp).

**Slide 33. National *Mycobacterium tuberculosis* Genotyping Surveillance Coverage, by Year, United States, 2004–2015.** During 2004, the proportion of positive cultures with  $\geq 1$  genotyped isolate was 52.6%; during 2015, it was 96.1%. The national indicator for genotyping surveillance coverage is 94.0%.

**Slide 34. Number and Percentage of Unique and County-GENTyp Clustered Cases, United States, 2013–2015.** Unique cases are those with a spoligotype and 24-locus MIRU-VNTR (GENTyp) that does not match any other case in that county during the specified 3-year period. Clustered cases are  $\geq 2$  cases with matching spoligotype and 24-locus MIRU-VNTR (GENTyp) within a county during the specified 3-year period. During 2013–2015, 78% were unique cases, and 22% were clustered cases.

**Slide 35. Number of County-Based *Mycobacterium tuberculosis* Genotype Clusters, by Cluster Size, United States, 2013–2015.** A genotype cluster is defined as  $\geq 2$  cases with matching spoligotype and 24-locus MIRU-VNTR (GENTyp) within a county during the specified 3-year period. During 2013–2015, clusters occurred as follows: 958 2-case clusters; 233 3-case clusters; 115 4-case clusters; 48 5-case clusters; 31 6-case clusters; 14 7-case clusters; 17 8-case clusters; 10 9-case clusters; and 38  $\geq 10$ -case clusters.

**Slide 36. *Mycobacterium tuberculosis* Genotype Clusters, by TB GIMS Alert Levels, United States, 2013–2015.** Alert levels are determined by the log likelihood ratio statistic (LLR) for a given cluster, identifying higher than expected geospatial concentrations for a TB genotype cluster in a specific county, compared with the national distribution of that genotype. TB GIMS generates alert level notifications as follows: A “No alert” is indicated if LLRs are  $0 < LLR < 5$ ; a “medium” is for LLRs of  $5 < LLR < 10$ ; and a “high” alert is for clusters with LLRs  $\geq 10$ . From 2013–2015, high alerts composed 6% of the total; medium alerts were 23%; and no alerts were 71%.