

Slide 1:

**Tuberculosis in the United States—National Tuberculosis Surveillance System, Highlights from 2019.** 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 recent trends and highlights of data collected through the National Tuberculosis Surveillance System (NTSS) for 2019. 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 TB case reports for 1993–2019 received by CDC as of June 10, 2020. All case counts and rates for years 1993–2018 have been updated, and data from 2019 has been added.

Slide 2:

This graph shows the annual number of TB cases in the United States for each year from 1982 to 2019. In 1992, 26,673 cases were reported in the United States, with a case rate of 10.4 cases per 100,000 population. In 2019, 8,916 cases were reported, with a case rate of 2.7 cases per 100,000. The TB elimination threshold is <1 case per 100,000 population, which is approximately 330 cases per year for the current U.S. population.

Slide 3:

During 2019, the United States reported the lowest number of TB cases (8,916) and lowest incidence rate (2.7 cases per 100,000 persons) on record. With the exception of 2015, the U.S. TB case count and incidence rate have declined every year since 1992.

There was an annual incidence rate decrease (–1.7%) from 2018 to 2019.

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Annual incidence rate decreased from 2.8 cases per 100,000 in 2018 to 2.7 cases per 100,000 in 2019, a 1.7% decrease. The incidence rate of TB continues to decline, but the annual rate of decline has leveled off and is inadequate to achieve TB elimination in the United States this century.

Slide 5:

The National Vital Statistics System (NVSS) reported 542 TB-related deaths (0.2 deaths per 100,000 persons) where TB was the underlying cause of death for 2018, the most recent year for which data are available. This represents a 5.2% increase in deaths and a 4.7% increase in the mortality rate from 2017, above the historical low of 470 deaths (0.1 deaths per 100,000 persons) reported in 2015.

National Vital Statistics System accessed from CDC WONDER as of June 17, 2020:

<https://wonder.cdc.gov/controller/datarequest/D76;jsessionid=820CCEC1DEC9CBC40CFD9E610AF5>

Slide 6:

Among U.S. states, the majority (51%) of TB cases continue to be reported from 4 states: California (23.7%), Texas (13.0%), New York state (including New York City, 8.5%), and Florida (6.3%). These states are also the most populous states in the United States and estimates of the TB incidence rate are presented on the next slide to account for the size of the underlying population in each state.

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Nine states and the District of Columbia had incidence rates higher than the national rate in 2019. Alaska had the highest rate (7.9 cases per 100,000 persons, followed by Hawaii (7.0), California (5.3), Texas (4.0), New York (including New York city\*, 3.9), New Jersey and Maryland (3.5), Washington (2.9) and Georgia (2.8).

Note: New York City, which is a distinct reporting area, had an incidence rate of 6.8 per 100,000 persons. When New York City is analyzed separately, the remainder of New York state has an incidence rate of 1.7 per 100,000 persons.

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Among the U.S. territories, incidence rates ranged from 0.9 (U.S. Virgin Islands, not shown) to 98.6 (Commonwealth of the Northern Marianas Islands). For the three freely associated states, reported incidence rates were 33.3 for the Republic of Palau, 79.8 for the Federated States of Micronesia, and 383.1 for the Republic of the Marshall Islands.

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Demographic characteristics of persons with TB remain similar to previous years, with the majority of reported TB cases occurring among non-U.S.-born persons (6,364 cases; 71.4%). The incidence rate among non-U.S.-born persons continues to decrease, with the 2019 rate (14.2 cases per 100,000 persons) representing the lowest rate on record. However, the annual decline is smaller than in previous years. TB cases among U.S.-born persons decreased in 2019 with 2,541 cases (28.5%) and 0.9 cases per 100,000 persons.

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In 2019, 71.4% of TB cases occurred among non-U.S.-born persons. The rate among non-U.S.-born persons is 16 times the rate among U.S.-born persons.

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The most common countries of birth among non-U.S.-born TB patients remained similar to previous years, with Mexico (18.6%) the most frequently reported country of birth, followed by the Philippines (12.5%), India (9.1%), Vietnam (7.9%), and China (6.1%).

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Note: this slide is a duplicate of the previous slide to provide an alternative visual display of the same data.

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The countries of birth with the highest U.S. incidence rates are the Republic of the Marshall Islands (168.8 cases per 100,000 persons), followed by the Republic of the Congo (143.8 cases per 100,000 persons), Somalia (87.3 cases per 100,000 persons), and Myanmar (81.2 cases per 100,000 persons). U.S. population estimates by country of birth were used for the denominator and were obtained from the U.S. Census Bureau, American Community Survey (ACS) Public Use Microdata Sample data, 2014–2018, 5-year file.

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Almost 14% of TB cases reported among non-U.S.–born persons in 2019 were diagnosed within 1 year of arrival in the United States.

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The distribution of race/ethnicity among persons with TB has been relatively consistent since 2010.

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In 2019, non-Hispanic Asian persons continue to represent the largest proportion of TB patients (35.3%), followed by Hispanic persons (30.2%), non-Hispanic Black persons (19.7%), non-Hispanic White persons (11.4%), Native Hawaiian/Other Pacific Islander persons (1.2%), American Indian/Alaska Native persons (0.9%), and persons of multiple races (0.8%).

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The number of TB cases reported among U.S.-born persons has declined, but the distribution of race/ethnicity among U.S.-born persons with TB has been relatively consistent since 2010.

Slide 18:

The distribution of race/ethnicity among non-U.S.–born persons with TB has been relatively consistent since 2010.

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When expressed as incidence rates, non-Hispanic Native Hawaiians/other Pacific Islander persons had the highest incidence rate (17.6 cases per 100,000 persons), followed by non-Hispanic Asian persons (16.7 cases per 100,000 persons). Hispanic persons (4.5 cases per 100,000 persons) and non-Hispanic Blacks (4.3 cases per 100,000 persons) were essentially similar in rate. The rate for Non-Hispanic American Indians/Alaska Native persons was 3.4 cases per 100,000 persons, with persons of multiple races (0.9 cases per 100,000 persons) and non-Hispanic White persons (0.5 cases per 100,000 persons) having the lowest incidence rates. Downward trends continued among non-Hispanic Asian persons and non-Hispanic Black persons. Rates increased slightly from 2017 to 2018 among American Indians/Alaska Native and Native Hawaiians/Other Pacific Islander persons but decreased slightly from 2018 to 2019. Incidence rates remained essentially unchanged in 2019 among all other racial/ethnic groups.

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The distribution of race/ethnicity among persons with TB continued to differ markedly by origin of birth. Among U.S.-born TB patients, non-Hispanic Black persons represented the largest percentage of cases (35.9%), followed by non-Hispanic White persons (29.9%), Hispanic persons (24.2%), and non-Hispanic Asian persons (4.6%). Approximately half of TB cases reported among non-U.S.-born persons occurred among non-Hispanic Asian persons (47.6%), followed by Hispanic persons (32.6%), non-Hispanic Black persons (13.2%), and non-Hispanic White persons (4.0%).

The decline in TB cases since 2003 has been lower among US-born Hispanic persons (38.4%) and non-US-born Hispanic persons (32.8%) compared with US-born (68.0%) and non-US-born (39.5%) non-Hispanic White persons. TB cases have declined since 2003 among US-born non-Hispanic Black persons (70.5%) more than among non-US-born non-Hispanic Black persons (21.1%), which may be attributable, in part, to progress in preventing TB transmission in the United States (Table 3).

Slide 21:

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Distribution of TB patients by age group remains similar to past years with a plurality of cases occurring among persons aged 45–64 years (29.9%), followed closely by persons aged 25–44 years (29.3%) and persons aged ≥65 years (27.2%). In contrast, only 11.2% of reported TB cases occurred among children and young adults aged <25 years. Of note, the percentage of TB cases among persons aged ≥65 years has steadily increased from 19.9% in 2010 to 27.2% in 2019 while other age group percentage distributions have not fluctuated as markedly.

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Incidence rates by age group did not follow the proportionate distribution, however. The oldest age group (≥65 years) had the highest incidence rate overall (4.5 cases per 100,000 persons), and the incidence rate generally decreased with decreasing age. However, the youngest group (0–4 years) had an incidence rate approximately twice that of the second youngest group (5–14 years). This observation might be attributable to cohorts with increased risk for TB exposure and infection, compared with the present, moving through time into older age groups.

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Men continued to represent the majority (60.1%) of TB patients overall, although the male:female ratio is close to 1 among children aged ≤14 years. This might indicate that the factors that caused men to be disproportionately represented among TB patients might become more influential in adulthood.

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Overall, the number of TB cases in all pediatric age groups decreased from 1993 through 2019. The most notable drop was among the toddler/preschool group (age 1–4 years).

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TB case rates by age group also decreased since 1993. The case rate among children 1–4 years declined steadily, and the highest case rate for pediatric cases in 2019 occurred in children <1 year.

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In 2019, the toddler/preschool group (age 1–4 years) comprised 43% of pediatric TB cases. Next most common was the adolescent age group, ages 10–14 years, with 23%. This age group has TB most similar to adult TB.

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In contrast to overall U.S. TB cases, where over two-thirds of cases were among non-U.S.–born persons, only 74 cases (22.0%) of pediatric cases were among non-U.S.–born children in 2019, and the fraction has been fairly stable (20–30%) since 1993.

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The majority (78%) of pediatric TB cases in 2019 occurred among U.S.-born children, but the pediatric TB case rate remains higher among non-U.S.-born (4.2 per 100,000 persons) than U.S.-born (0.5 per 100,000 persons) children. However, the difference between case rates among U.S.-born compared with non-U.S.-children has declined over time. In 1994, the case rate was 11 times higher among non-U.S.-born children compared to U.S.-born children; in 2019, the case rate was 8 times higher.

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Since 2010, the ability to identify the origin of birth for parents/guardians of pediatric cases of TB has been available for all jurisdictions. For this timeframe, U.S.-born pediatric TB has been among patients where at least one parent/guardian was non-U.S.-born has been the largest group. U.S.-born children of non-U.S.-born persons may be more likely to travel to their familial homeland or be exposed to non-U.S.-born persons in the United States who have infectious TB.

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In 2019, the majority (175 cases; 59.7%) of U.S.-born pediatric TB cases continued to be in patients with at least one non-U.S.-born parent/guardian.

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The majority of U.S. TB cases continued to be verified through positive culture, with other laboratory-confirmation methods (i.e., nucleic acid amplification or smear microscopy) only representing a limited proportion of verified cases. In the absence of laboratory confirmation, many were also confirmed by meeting the clinical criteria for a verified TB case or diagnosed by a provider. Since 2009, there has been a sharp drop in the number of provider diagnosis cases with the corresponding expansion of the proportion of cases verified by clinical criteria related to the 2009 RVCT revision that included adding the ability to report IGRA and classifying clinical cases based on a positive IGRA as an alternative to a positive TST. However, the percentage verified among clinical criteria continues to decrease as proportionately more cases are verified through laboratory techniques. It is important to note that some cases verified by culture may also be positive on NAA as culture confirmation supersedes NAA in the case verification criteria classification.

Slide 33:

In 2019, the majority of U.S. TB cases continued to be verified through positive culture (7,087 cases; 79.5%), with other laboratory-confirmation methods (i.e., nucleic acid amplification or smear microscopy) representing a combined 2.7% (236) of verified cases. In addition, 1,177 cases (13.2%) were confirmed by clinical criteria and 416 (4.7%) by provider diagnosis. It is important to note that some cases verified by culture may also be positive on NAA as culture confirmation supersedes NAA in the case verification criteria classification.

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A vast majority of U.S. TB cases had pulmonary involvement (79.4%). Among the 20.6% of U.S. TB cases with only extrapulmonary involvement, TB of the lymphatic system remained most common (34.9%), followed by TB of the pleura (18.3%) and TB of bones and joints (8.4%). TB meningitis, a particularly serious form of the disease, continued to decrease, with 4.4% of extrapulmonary cases involving the meninges. "Other" includes all other extrapulmonary sites of disease, e.g., ocular, hepatic.

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Since the early 2000s, the percentage of patients on a drug regimen of four or more drugs that is not the recommended four-drug regimen of isoniazid, rifampin, pyrazinamide, and ethambutol has increased from 4.9% in 2004 to 11.5% in 2019.

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During 2019, 82.5% of all reported TB cases were started on IRZE, and an additional 11.5% of cases were started on a different 4-drug regimen.

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Since 1993, the percentage of TB patients receiving at least a portion of their medication through Directly Observed Therapy has risen from 36% in 1993 to over 94% in 2017, the most recent year with full data available.

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During 2017, the most recent year with treatment completion data available, 61.2% of cases were treated exclusively by using DOT, whereas an additional 32.9% of patients received a combination of DOT and self-administered treatment.

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The national goal for treatment completion is that, for patients with newly diagnosed TB disease for whom  $\leq 12$  months of treatment is indicated, 95% complete treatment within 12 months. Although the percentage of eligible patients completing therapy in 1 year has risen since 1993, the nation as a whole is still short of the 95% goal, and the percentage has been relatively level since 2009.

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Successful therapy completion for TB patients is a major performance indicator for TB programs. Among patients during 2017 who were alive at diagnosis and started on TB treatment, 87.2% had completed TB treatment successfully. However, 6.7% of all patients died before completing TB treatment; 1.8% moved out of the U.S. within one year; 1.2% were lost to follow-up before completing treatment; 0.7% refused treatment and 2.0% did not complete treatment for other or unknown reasons. Thirty 1patients (0.3%) had to permanently stop TB treatment because of an adverse treatment event.

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In 2019, 631 isoniazid-resistant TB cases were reported in the United States, a slight decrease from 637 cases during 2018. However, as a percentage of all TB cases, the proportion that were resistant to isoniazid has remained relatively steady at approximately 9%. The trend in the proportion of U.S.-born TB cases with isoniazid resistance remained relatively constant at 6.6% as did the trend for non-U.S.–born cases at 10.5%.

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The percentage of all MDR cases occurring among persons with no previous history of TB disease (i.e., primary MDR TB) has remained steady for the past several years at approximately 1%.

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Coinfection with HIV is a major risk factor for progression of latent TB infection to TB disease. Among 8,690 cases that were alive at diagnosis in 2019, HIV status was known for 90.7%, and 4.7% of persons with known HIV status were coinfecting with HIV. Among TB cases diagnosed in persons 25–44 years of age, 95.2% had known HIV status, and 7.6% of these persons were HIV positive. In persons 45–64 years old, 93.7% had known HIV status, and 6.0% were HIV positive.

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Among reported risk factors for TB, diabetes mellitus (20.7%) was most commonly reported, followed by having been a close contact of a person with infectious TB (8.2%) or having an immunocompromising condition other than HIV (8.2%). Having been a contact of a person with infectious TB was proportionately more common among U.S.-born persons (17.5%), compared with non-U.S.–born persons (4.5%). Diabetes mellitus, however, was proportionately more common among non-U.S.–born persons (23.1%), compared with U.S.-born persons (14.4%).

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Among persons  $\geq 15$  years of age, 1.8% of TB cases occurred among persons who were residents of a long-term-care facility at the time of their TB diagnostic evaluation, 3.1% occurred among persons who were residents of a correctional facility at the time of their TB diagnostic evaluation, and 4.6% occurred among persons aged  $\geq 15$  years who experienced homelessness in the year before their TB diagnostic evaluation.

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The percentage of cases diagnosed with TB while a resident of a correctional facility continued to decline in 2019, from 3.5% in 2018, compared with 3.1% in 2019.

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The states with the highest percentage of their cases diagnosed among residents of correctional facilities in 2019 were Arizona (25.3%, 43 of 170), Mississippi (15.4%, 8 of 52), South Dakota (12.5%, 2 of 16), West Virginia (10.0%, 1 of 10) and Texas (9.7%, 99 of 1,016).

Note: categories based on Jenks natural breaks method.

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Among residents of correctional facilities with TB during 2019 over 15 years old, 27.9% were from local jails, 15.5% from state prisons, 14% from federal prisons, and 39.6% from other correctional facilities.

In 2019, 119 (44.9%) of cases occurred in person under ICE custody, which can include ICE facilities or persons in any correction facility who are also under ICE custody.

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Substance use disorder is also a TB risk factor. Overall, 1.2% of all 2019 TB patients aged  $\geq 15$  years reported injection-drug use (IDU) during the year preceding diagnosis. Reported use of non-injection drugs among patients aged  $\geq 15$  years was higher (7.5%) than IDU, as was excessive use of alcohol (8.1%).

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In the past, healthcare personnel, migrant workers and correctional employees were more likely to be represented as occupations among persons with TB. In 2019, the percentages were 4%, 1%, and <1% respectively; the largest category of occupations fell into the other category. Unemployed persons comprised 22% of TB cases and almost 34% were either retired or not seeking employment.

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Among TB cases diagnosed during 2017, a total of 768 (8.6%) patients died, with 265 (33.3%) of those deaths attributed to TB disease or treatment. Of the 768 deaths, 165 (21.5%) were dead at the time of TB diagnosis; 29.7% of those deaths were attributed to TB. The remaining 603 (78.5%) deaths occurred after diagnosis; 34.3% of these deaths were attributed to TB.

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Conversion of a patient's positive sputum culture to negative is a key indicator of treatment effectiveness. Among 5,115 cases during 2017 with positive sputum cultures, 4,422 (86.5%) had documented sputum culture conversion to negative. Among the 632 (12.4%) cases for which sputum culture conversion was undocumented, the most common reason was that the patient had died (36.1%) before sputum culture conversion; however, a proportion of these cases (19.0%) did not have a known reason reported for not having documented sputum culture conversion.

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This slide shows the increase in genotyping surveillance coverage from 2004 to 2019. In 2004 the proportion of culture confirmed TB cases with at least one genotyped isolate was 52.6%; in 2019 it was 97.0%. The national goal for genotyping surveillance coverage is 100.0%.

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This slide shows the schematic for sequential assignment of unique spoligotypes and initial 12-locus MIRU-VNTR combination or 24-locus MIRU-VNTR combination.

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This slide shows the number of county-based TB genotype clusters by the size of the clusters; a genotype cluster is defined as two or more cases with matching spoligotype and 24-locus MIRU-VNTR (GENType) within a county during the specified 3-year time period. During 2017–2019, there were 900 two-case clusters, 222 three-case clusters, 95 four-case clusters, 37 five-case clusters, 25 six-case clusters, 21 seven-case clusters, 13 eight-case clusters, 10 nine-case clusters, and 28 case clusters that were greater or equal to 10 TB cases in size.

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Clusters are classified into alert levels on the basis of a log-likelihood ratio (LLR) calculation; clusters with an LLR of  $5 < \text{LLR} < 10$  are classified as a medium alert level, and clusters with an  $\text{LLR} \geq 10$  are classified as a high alert level. Clustered cases were often part of medium- (23.2%) or high-level alerts (17.2%). At the cluster level, 388 (28.7%) of 1,351 clusters identified nationally were either medium- or high-level alerts.

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Nationally, CDC attributed 1,703 (12.5%) of 13,577 genotyped cases reported during 2018–2019 to recent transmission.

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CDC has provided national estimates of recent transmission and extensive recent transmission throughout a 2-year period since the publication of *Reported Tuberculosis in the United States, 2016*. The number of cases attributed to recent transmission has declined. By comparison, estimates were 1,787 cases during 2016–2017 and 1,703 during 2018–2019.

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A greater proportion of genotyped cases were attributed to recent transmission among U.S.-born persons (24.9%) than among non-U.S.-born persons (7.7%).

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Greater proportions of cases attributed to recent transmission and extensive recent transmission were identified among Native Hawaiian/Pacific Islander, non-Hispanic Black, and American Indian/Alaska Native persons, compared with national average estimates.

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Lower proportions of cases attributed to recent transmission and extensive recent transmission were identified among non-Hispanic Asian persons, compared with national average estimates. Lower proportions of cases were attributed to extensive recent transmission among persons of Hispanic ethnicity, compared with national average estimates.

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For more information, please contact Division of Tuberculosis Elimination at <http://www.cdc.gov/tb/>.