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## Epidemiology of tuberculosis (TB) among children and adolescents in the United States, 2007–2017: an analysis of national surveillance data

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### Abstract

**Background.**—Understanding tuberculosis (TB) epidemiology among children and adolescents informs treatment and prevention efforts and efforts to eliminate disparities in TB incidence and mortality. We sought to describe the epidemiology of children and adolescents with TB disease in the United States (U.S.), including TB incidence rates by parental country of birth and for U.S. territories and freely associated states, which have not been previously described.

**Methods.**—We analyzed data for children aged <15 and adolescents aged 15–17 years with TB disease reported to the National Tuberculosis Surveillance System during 2007–2017, and calculated TB incidence rates using population estimates from the U.S. Census Bureau.

**Findings.**—During 2010–2017, 6,072 TB cases occurred among children and adolescents; of these, 85% (5,175/6,072) occurred in the 50 U.S. states or the District of Columbia and 15% (897/6,072) in U.S.-Affiliated Islands. In U.S. States, 68% (3,520/5,175) cases occurred among U.S.-born persons overall, including 76% (2,977/3896) among children and 42% (543/1,279) among adolescents. The incidence rate among children and adolescents was 1.0 per 100,000 person-years during 2007–2017 and declined 47.8% (95% CI –51.4%, –44.1%) during this period. We observed disproportionately high TB rates among children and adolescents of all non-white racial/ethnic groups, those living in U.S.-Affiliated Islands, and children born in or with parents from TB-endemic countries.

**Interpretations.**—Overall, TB incidence among children and adolescents in the U.S. is low and steadily declining, but additional efforts are needed to eliminate stark disparities in incidence and mortality.

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## Introduction

Globally, approximately one million cases of tuberculosis (TB) disease and 233,000 TB-related deaths occurred among children aged <15 years during 2018 (1). TB in children and adolescents is clinically and epidemiologically heterogeneous, making care and prevention challenging. TB is often difficult to diagnose in children because of nonspecific symptoms and limited sensitivity and specificity of laboratory tests for both latent TB infection (LTBI) and TB disease. Children aged <5 years are also more likely to progress to TB disease after infection and have the highest rates of severe, disseminated forms of TB, such as meningitis, compared to older age groups (2-7). Adolescents aged 15–17 years are more likely to develop infectious forms of pulmonary TB than younger children (3,8). Understanding heterogeneity in TB burden and clinical presentation in children and adolescents is critical to inform TB care and prevention efforts.

While TB rates in the United States (U.S.) are the lowest ever recorded, TB continues to affect many communities unequally, especially communities of color, Indigenous persons, persons born outside the U.S., and persons experiencing homelessness (9-13). In children and adolescents, current practice guidelines recommend TB testing for contacts of people with TB and those who were born or traveled outside the U.S. (14). While rates are 10–20 times higher among children and adolescents born outside of the U.S. than among those born in the U.S., more than two-thirds of children and adolescents with TB are U.S.-born, and therefore it is important to identify determinants other than origin of birth in these groups (15,16).

Previous studies suggest that U.S.-born children with non-U.S.-born parents may be at increased risk of TB (16,17). Approximately two-thirds of U.S.-born children with TB reported during 2009–2010 had at least one non-U.S.-born parent (15,16). Additionally, several large TB clusters with a high proportion of children have been reported in the freely associated states of the Republic of the Marshall Islands and the Federated States of Micronesia, and among Marshallese persons living in the U.S. (18,19). However, rates of TB among U.S.-born children by parental country of birth and among children and adolescents in the U.S. territories and freely associated states have not been systematically reported. Additionally, detailed analyses of national estimates of TB disease counts and incidence rates among children and adolescents were last published in 2010 and 2007, respectively (15,20).

In the present analysis, we describe the clinical characteristics and epidemiology of TB among children and adolescents reported to the U.S. National Tuberculosis Surveillance System (NTSS) during 2007–2017, including overall burden and trends in TB incidence rates by sociodemographic groups, country of birth for children and their parents, and reporting jurisdiction, including U.S. territories and freely associated states.

## Methods

We considered all verified cases of TB disease reported to NTSS among children aged <15 years and adolescents aged 15–17 years between January 1, 2007 and December 31, 2017,

excluding those with missing information for sex or country of birth. A verified TB case is one that has been reviewed at the local level (e.g., state or county) by a TB control official who is familiar with the NTSS surveillance definitions and has verified that NTSS criteria for a TB case are met. Verified cases include laboratory-confirmed TB and clinically diagnosed TB without laboratory confirmation. NTSS captures demographic, clinical, and laboratory characteristics of all TB cases reported in the 50 U.S. States and District of Columbia (D.C.) (hereafter referred to collectively as U.S. States), and in U.S.-Affiliated Islands which include five U.S. territories (American Samoa [AS], Guam, Commonwealth of the Northern Mariana Islands [CNMI], Puerto Rico [PR], and the U.S. Virgin Islands [USVI]) and three freely associated states (Federated States of Micronesia [FSM], Republic of the Marshall Islands [RMI], and Republic of Palau) (13,21). Under the Compacts of Free Association (COFA), the United States provides economic assistance to the sovereign nations of RMI, FSM, and Palau (22,23). CDC provides financial and technical support to public health programs in these jurisdictions. In this manuscript, the phrase “reported to NTSS” is used to refer to aggregate TB case data from all reporting jurisdictions, unless otherwise specified. In 2009, NTSS implemented new variables including how TB was initially identified (e.g., contact investigations, targeted testing of persons with risk factors, and evaluation for TB symptoms), country of birth for parents or guardians for children aged <15 years, and whether the child lived outside the U.S. for ≥ 2 months (Supplemental Table 1).

Consistent with U.S. Census Bureau definitions, we considered persons who were U.S. citizens at birth to be U.S.-born (i.e., anyone born in a U.S. state or territory, or born abroad to at least one U.S. citizen parent). All others were considered non-U.S.-born, including persons born in freely associated states (i.e., FSM, RMI, and Palau) (24).

To avoid gaps or overlaps with previous pediatric reports using NTSS data, we reported rates starting in 2007 and TB case counts starting in 2010 (15,16). We used Poisson models offset with log population size to obtain point estimates and 95% confidence intervals (CI) of overall and stratum-specific incidence rates, incidence rate ratios, and 10-year trends in incidence rates. We obtained population estimates from the U.S. Census Bureau’s American Community Survey (ACS) public use microsample (PUMS) 1-year data files for 2007–2017 compiled by the Integrated Public Use Microdata Series (IPUMS), or U.S. Census Bureau modeled estimates when ACS data were unavailable (i.e., for U.S.-Affiliated Islands) (Supplementary Material) (25–28). We conducted all analysis using SAS (Version 9.3, Cary, NC) and reported results from U.S.-Affiliated Islands separately from U.S. States unless otherwise specified. These data were collected as part of routine public health surveillance and therefore did not require institutional board review at CDC.

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## Results

During 2007–2017, 121,582 TB cases were reported to NTSS. We excluded 373 with missing age, sex, or country of birth. Of the remaining 121,209 TB cases, 9,276 (7.7%) occurred among children and adolescents aged <18 years. Both annual TB counts and proportion of TB that occurred among children and adolescents decreased from 2007 (n=1,125, 8.2%) to 2017 (n=701, 7.3%).

### Characteristics of children and adolescents with TB, 2010–2017

During 2010–2017, 6,072 cases of TB were reported to NTSS among children and adolescents; of these, 85% (5,175/6,072) were reported from U.S. States and 15% (897/6,072) from U.S.-Affiliated Islands (Table 1). In U.S.-Affiliated Islands, the majority (83%, 747/897) of TB was reported from either RMI (42%, 378/897) or FSM (41%, 369/897) (data not shown). Among children and adolescents with TB in U.S. States, 68% (3,520/5,175) occurred among U.S.-born persons; among children aged <15 years, 76% (2,977/3,896) were U.S.-born and among adolescents aged 15–17 years, 42% (543/1,279) were U.S.-born. Nearly half (47%, 1,659/3,520) of U.S.-born children and adolescents with TB were Hispanic compared with 27% (444/1,655) of non-U.S.-born persons. Non-U.S.-born children and adolescents with TB were most commonly of Asian (36%, 591/1,655) or Black (30%, 489/1,655) race.

Diagnostic evaluations for TB symptoms prompted a plurality of TB diagnoses (37%, 1,918/5,175) in children and adolescents in U.S. States; however, diagnoses were more likely to be made following contact investigations among the U.S.-born compared with non-U.S.-born (41%; 1,220/3,520 vs. 10%; 159/1,655) (Table 1). Culture confirmation of disease among children and adolescents was uncommon (39%, 2,032/5,175) in U.S. States, but adolescents were more likely to have culture confirmation than children (69% vs. 30%, data not shown). In total, 93% (4,800/5,175) of all children and adolescents completed treatment. Thirty-two deaths occurred; 18 among children and adolescents diagnosed in the U.S.-Affiliated Islands and 14 among the U.S.-born diagnosed in U.S. States.

Approximately two-thirds (2,565/3,896) of children aged <15 years with TB in U.S. States from 2010–2017 would have been recommended for TB testing under current targeted testing guidelines – 38% (1,465/3,896) were identified through contact tracing, and 21% (807/3,896) and 8% (294/3,896) were born or traveled outside the U.S. for ≥2 months, respectively (Figure 1). An additional 21% (806/3,896) did not meet guidelines for testing but did have at least one parent born abroad. The remaining 13% (524/3,896) had none of these characteristics reported.

### TB incidence among children and adolescents, 2007–2017

During 2007–2017, 8,030 TB cases were reported among an estimated 73.6 million children and adolescents living in U.S. States (Table 2). Overall, TB incidence among children and adolescents was 1.0 per 100,000 person-years (PY). Overall incidence rates were highest in children aged 1 year (2.2 per 100,000 PY), lowest among children aged 7–12 years (0.5 per 100,000 PY) and intermediate among adolescents aged 15–17 years (1.4 per 100,000

PY) (Supplemental Figure 1A). Although age-specific incidence rates were at least 10 times higher among non-U.S.-born children and adolescents compared with U.S.-born children, age-related trends in rates were consistent (Supplemental Figure 1B-1C).

Incidence varied substantially between racial/ethnic groups; rates were 14.4 per 100,000 PY among Native Hawaiian and Pacific Islander children and adolescents, more than three times as high as any other racial or ethnic group and 114.0 (95% CI 96.6, 134.4) times higher than non-Hispanic white children and adolescents. Rates among all other single race/ethnicity groups were at least 14 times higher than among non-Hispanic white children and adolescents (Table 2).

Incidence was 12.9 (95% CI 12.3, 13.5) times higher among children and adolescents born outside the U.S. compared with U.S.-born; nonetheless, incidence among non-U.S.-born children varied significantly according to their birth region. The highest rates (>40 per 100,000 PY) occurred among children born in Africa or Oceania (Table 2).

TB incidence among children and adolescents in U.S. States declined 47.8% (95% CI -51.4%, -44.1%) from 1.4 per 100,000 PY in 2007 to 0.8 per 100,000 PY in 2017. While rates decreased across all age categories, the greatest declines occurred among children aged <5 years (Table 2). Rates also decreased among all racial/ethnic groups, except Native Americans/Alaska Natives, Native Hawaiian/Pacific Islanders, and children and adolescents of two or more races. The greatest decreases were observed among Hispanics (62.1%, [95% CI -66.1%, -57.8%]) followed by Blacks (52.4%, [95% CI -58.5%, -45.4%]).

While consistent decreases in incidence occurred among both U.S.-born (-47.9%, [95% CI -52.2%, -43.3%]) and non-U.S.-born (-39.3%, [95% CI -46.2%, -31.4%]) children and adolescents, the most precipitous occurred among those born in Africa (-61.0%, [95% CI -69.4%, -50.2%]) and Europe (-88.7%, [95% CI -96.0%, -67.9%]). Smaller, but significant decreases occurred among children and adolescents born in Latin America (-36.2%, [95% CI -48.3%, -21.1%]) and Asia (-51.2%, [95% CI -60.2%, -40.2%]). There were no significant changes among those born in Oceania (-10.5%, [95% CI -57.6%, 89.3%]).

Rates were substantially higher in U.S.-Affiliated Islands than U.S. States (11.7 vs. 1.0 per 100,000 PY, respectively), but varied widely by reporting jurisdiction (Table 3, Supplemental Figure 2). Incidence in RMI and FSM exceeded 150 per 100,000 PY, while rates in PR and AS were lower than in the U.S. States (<1.0 per 100,000 PY). Despite small populations, FSM (n=526) and RMI (n=469) ranked third and sixth in absolute number of TB cases reported among children and adolescents, respectively, whereas the U.S. States with the greatest numbers of cases were California (n=1,483), Texas (n=1,227), New York (n=516), and Florida (n=490). TB incidence rates among children and adolescents in U.S. States ranged from 0.1 per 100,000 PY in Wyoming to 3.9 per 100,000 PY in Alaska.

## TB incidence by nativity of child and parents for children aged <15 years in U.S. States, 2010–2017

During 2010–2017, TB rates varied both by birthplace of the child and that of their parents. While incidence was highest among children born outside the U.S. (6.5 per 100,000 PY), rates among U.S.-born children with at least one parent born outside the U.S. were substantially higher than among those without (1.7 per 100,000 PY vs. 0.3 per 100,000 PY, respectively) (Table 4, Figure 2). U.S.-born children with two parents born outside the U.S. had higher incidence (2.4 per 100,000 PY) than those with only one parent born outside the U.S. (1.0 per 100,000 PY); these rates were 8.5 (95% CI 7.7, 9.3) and 3.5 (95% CI 3.0, 4.0) times higher than among children with two U.S.-born parents (Table 4).

Among children born outside the U.S., TB burden varied by country of birth (Figure 2). While children born in Mexico (n=99), Ethiopia (n=78), Philippines (n=61), Myanmar (n=60), and Haiti (n=42) accounted for the largest absolute number of TB cases, incidence rates were highest among children born in RMI (149.4 per 100,000 PY), Somalia (139.4 per 100,000 PY), Myanmar (79.0 per 100,000 PY), Malaysia (66.0 per 100,000 PY), and Ethiopia (41.2 per 100,000 PY).

Similarly, TB incidence among U.S.-born children with non-U.S.-born parents varied substantially by parents' birth country (Figure 2). While the most common birth countries for non-U.S.-born parents of U.S.-born children were Mexico (n=832), Guatemala (n=111), Vietnam (n=85), Philippines (n=71), and India (n=70), rates were highest among children with parents from RMI (78.2 per 100,000 PY), FSM (27.5 per 100,000 PY), Myanmar (11.9 per 100,000 PY), and Somalia (11.9 per 100,000 PY), for whom rates exceeded those among non-U.S.-born children.

## Discussion

Although overall TB incidence among children and adolescents during 2007–2017 was low at 1.0 case per 100,000 PY and TB rates in these age groups decreased substantially (48%) during this period, substantial heterogeneity in burden exists. During this examination of national surveillance data, we observed disproportionately high rates of TB among children and adolescents of all non-white racial/ethnic groups, children and adolescents living in U.S.-Affiliated Islands, and children born in or with parents from TB-endemic countries. In addition, we observed disproportionately high mortality among children and adolescents with TB in U.S.-Affiliated Islands compared to U.S. States. These wide-ranging and pervasive disparities likely reflect structural inequality that gives rise to disproportionate exposure, vulnerability to infection and disease, and unequal access to prompt diagnosis and treatment. Our findings suggest that U.S. TB care and prevention strategies are succeeding in reducing overall TB burden among children and adolescents, but that more attention and possibly new approaches are needed to address the stark disparities in TB incidence and mortality in these age groups.

TB in children and adolescents is preventable and curable. In the context of historically low TB incidence in the U.S. and limited sensitivity and specificity of available diagnostic tests for TB infection and disease, epidemiologic information may be useful in ascertaining

risk to inform TB testing decisions (14). In addition to those with compatible signs or symptoms and those with medical conditions that convey higher risk for progression to TB, current clinical practice guidelines recommend TB testing for contacts of persons with TB, as well as children and adolescents immigrating from, or who have traveled to, TB-endemic countries (14). Our findings are consistent with previous studies in the U.S. and Canada, and reinforce the importance of contact with a person with TB disease and birth or travel outside the U.S. as potential markers of increased TB risk and indicators for targeted testing (15,20,29). Thirty-one percent of children and adolescents with TB in U.S. States were diagnosed through contact tracing; 32% were non-U.S.-born, for whom rates of TB were roughly 13 times higher than among U.S.-born children and adolescents; and more than a quarter (26%) of children with TB lived outside the U.S. for two or more months. Taken together, targeted testing characteristics accounted for two-thirds (66%) of children with TB in U.S. States. Nevertheless, one-third of TB in children occurred outside of these groups, highlighting the opportunity to improve TB care and prevention efforts through consideration of additional characteristics, such as parental place of birth.

In our analysis, 21% of children with TB in U.S. States had at least one non-U.S.-born parent, but were not known contacts of persons with TB, and had neither been born nor lived outside the U.S. For children aged <1 year, this figure was 30%. We observed increasing TB rates with increasing numbers of non-U.S.-born parents for children with non-U.S.-born parents; rates were 8.5 and 3.5 times higher among children with two and one non-U.S.-born parent, respectively, compared to children with two U.S.-born parents. These findings are consistent with previous evidence among young children where TB rates among U.S.-born children with at least one non-U.S.-born parent were six times higher than those with two U.S.-born parents (17).

Importantly, TB burden in children varied widely by their country of birth and that of their parents. Rates in U.S.-born children with parents from RMI, FSM, Somalia, and Myanmar exceeded the overall rate in non-U.S.-born children. In contrast, children born in and with parents from several countries, including Mexico and Guatemala, contributed a large number of cases but had relatively low rates of TB. Variation in TB burden by country of birth of the children and their parents underscores the importance of local context, as the epidemiology, demography, and determinants of health may vary widely between settings. In addition to approaches already recommended to reduce TB burden, including overseas screening of U.S.-bound immigrants and current guidelines for targeted testing for LTBI, clinicians and public health professionals may find these data helpful to identify and reach children at highest risk for TB and optimize the predictive value of TB testing in the context of the populations they serve. The California Department of Public Health and California TB Controllers Association, for example, have developed a Pediatric TB Risk Assessment Tool and User Guide to help California providers identify asymptomatic children and adolescents who may benefit from TB testing (30). In addition to characteristics covered under current targeted testing guidelines, the guide also notes that TB testing can be considered in children and adolescents “with frequent exposure to adults at high risk of TB infection,” which, in some contexts, might include consideration of parental birthplace or extensive parental travel to areas with high TB rates. The user guide also encourages local TB control programs and clinics to further customize the pediatric TB risk assessment tool according to local

recommendations. Our findings support the role of local epidemiology in devising TB risk assessments for children and adolescents.

We observed pervasive racial/ethnic and geographic disparities in TB incidence and mortality among children and adolescents. Every racial/ethnic group examined had significantly increased TB incidence compared to non-Hispanic white children and adolescents, suggesting potentially broad influences of structural and social determinants of health that drive increased risk of TB exposure, infection, or disease progression among historically marginalized children and adolescents. Despite small population sizes, Native Hawaiians/Pacific Islanders living in U.S. States and persons in U.S.-Affiliated Islands arguably bear the most disproportionate burden of TB among children and adolescents. In U.S. States, TB rates among Native Hawaiian/Pacific Islander children and adolescents were more than 100 times higher than their non-Hispanic white counterparts. Additionally, incidence among children living in the U.S. with parents from RMI and FSM were higher than any other country. In RMI and FSM, TB incidence rates among children and adolescents were at epidemic levels, exceeding 150 per 100,000 PY. Children and adolescents living in RMI and FSM accounted for 11% of TB disease and more than half of all TB deaths during 2010–2017, despite representing <0.1% of the estimated population.

While we highlight heterogeneity in TB burden by race/ethnicity, geography, and place of birth, we note that this heterogeneity is likely attributable to underlying social, policy, and environmental conditions. We lack data in our analysis to determine causes of the stark disparities in TB burden among children and adolescents. However, TB occurrence is widely recognized to be inextricably linked with social deprivation and living conditions. Previous work suggests that coarse, area-level socioeconomic status explained more than half of racial disparities in adult TB, and a 1994 study of children in New York showed TB rates were closely tied to neighborhood crowding (31,32). In addition, research on a diverse array of health outcomes has identified additional factors that contribute to population-level health disparities (33,12,31,34-36). These factors may include food security and nutrition, access to economic and material resources, residential segregation, exposure to secondhand smoke, indoor and outdoor air quality, lasting effects of historical trauma (e.g., slavery, colonization, displacement, etc.), and healthcare policy, access, and infrastructure (e.g., insurance coverage, availability of providers, lack of translation services, etc.) (9,35,37-40). Additionally, physiologic responses to acute and chronic stress attributable to poverty, racism, stigma, and other forms of social trauma and deprivation can impact immune function and may shape population distribution of disease (33,40-44). In addition to efforts to prevent and treat TB among children and adolescents at highest risk, efforts to elucidate and ameliorate the underlying social and structural drivers of increased risk should be explored.

This analysis has limitations. Variables capturing parental nativity and international travel were introduced in 2009 only for children aged <15 years, limiting our ability to draw conclusions about trends for these variables. Second, information about other potential TB exposures, such as international travel or TB contacts who are not parents are not systematically captured. NTSS does not collect information on health insurance, household crowding, nutrition, or individual or household socioeconomic indicators such as income

or education. Consequently, we could not examine whether observed disparities might be explained by these factors. Finally, for approximately 31% of children, nativity of one or both parents is unknown. Therefore, incidence rates based on parental nativity likely underestimate rates among children with at least one non-U.S.-born parent.

**Conclusions**

Although overall TB rates among children and adolescents are low and steadily declining, substantial heterogeneity exists in burden and trends across geographies and sociodemographic groups. Given limited sensitivity and specificity of TB diagnostics in children and current strategies for targeted TB testing in low-incidence areas, variations in TB epidemiology among children and adolescents could be used to optimize the predictive value of TB testing by prioritizing groups with the highest rates. Furthermore, strategies to eliminate TB in the U.S. should account for the contextual factors that markedly increase TB risk in particular populations, so that disparities in TB-associated morbidity and mortality among children and adolescents do not persist or worsen, even as overall TB burden declines.

**Supplementary Material**

Refer to Web version on PubMed Central for supplementary material.

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**Disclaimer.**

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

**Abbreviations.**

<b>ACS</b>	American Community Survey
<b>CDC</b>	U.S. Centers for Disease Control and Prevention
<b>CI</b>	95% Confidence Interval
<b>DC</b>	District of Columbia
<b>FSM</b>	Federated States of Micronesia
<b>IPUMS</b>	Integrated public-use microsample data
<b>MDR TB</b>	Multi-drug resistant tuberculosis

<b>NTSS</b>	National Tuberculosis Surveillance System
<b>PR</b>	Puerto Rico
<b>PRCS</b>	Puerto Rico Community Survey
<b>PUMS</b>	Public-use microsample data
<b>PY</b>	Person-years
<b>RMI</b>	Republic of the Marshall Islands
<b>RR</b>	Rate Ratio
<b>RVCT</b>	Report of Verified Case of Tuberculosis
<b>TB</b>	Tuberculosis
<b>USVI</b>	United States Virgin Islands
<b>XDR TB</b>	Extensively drug resistant tuberculosis

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## Research in context

### Evidence before this study

While tuberculosis (TB) rates in the United States (U.S.) are the lowest ever recorded, TB continues to affect many communities unequally, especially communities of color, indigenous persons, persons born outside the U.S., and persons experiencing homelessness. Among children and adolescents, previous national estimates suggest that although TB incidence rates among persons born outside of the U.S. are 10–20 times higher compared to those who are U.S.-born, more than two-thirds of children and adolescents with TB are U.S.-born. Therefore, it is important to identify and address determinants other than origin of birth in these groups. Additionally, national rates of TB among U.S.-born children stratified by parental country of birth and rates among children and adolescents in the U.S. territories and freely associated states have not been systematically reported. Finally, national estimates of TB disease counts and incidence rates among children and adolescents were last reported in 2010 and 2007, respectively.

### Added value of this study

Using data from the National Tuberculosis Surveillance System and U.S. Census Bureau, this study summarizes the epidemiology and clinical characteristics of TB disease occurring in children and adolescents in the U.S. during 2007–2017, including overall burden and trends in TB incidence rates by sociodemographic groups, country of birth for both children and their parents, and reporting jurisdiction, including U.S. territories and freely associated states. Overall TB incidence among children and adolescents was low (1.0 case per 100,000 PY) and decreased substantially (–48%) during 2007–2017, however, substantial heterogeneity exists in burden and trends across geographies and sociodemographic groups. We observed disproportionately high rates of TB among children and adolescents of all non-white racial/ethnic groups, children and adolescents living in U.S. territories and freely associated states, and children born in or with parents from TB-endemic countries. Finally, compared to U.S. States, we observed disproportionately high mortality among children and adolescents with TB in the freely associated states of the Republic of the Marshall Islands and Federated States of Micronesia.

### Implications of all the available evidence

Although overall TB incidence among children and adolescents in the U.S. is low and steadily declining, additional attention and possibly new approaches are needed to address the stark disparities in TB incidence and mortality among these groups. Given limited sensitivity and specificity of TB diagnostics in children and current strategies for targeted TB testing in low-incidence areas, variations in TB epidemiology among children and adolescents could be used to optimize the predictive value of TB testing by prioritizing groups with the highest rates. Furthermore, strategies to eliminate TB in the U.S. should account for the contextual factors that markedly increase TB risk in particular populations, so that disparities in TB-associated morbidity and mortality

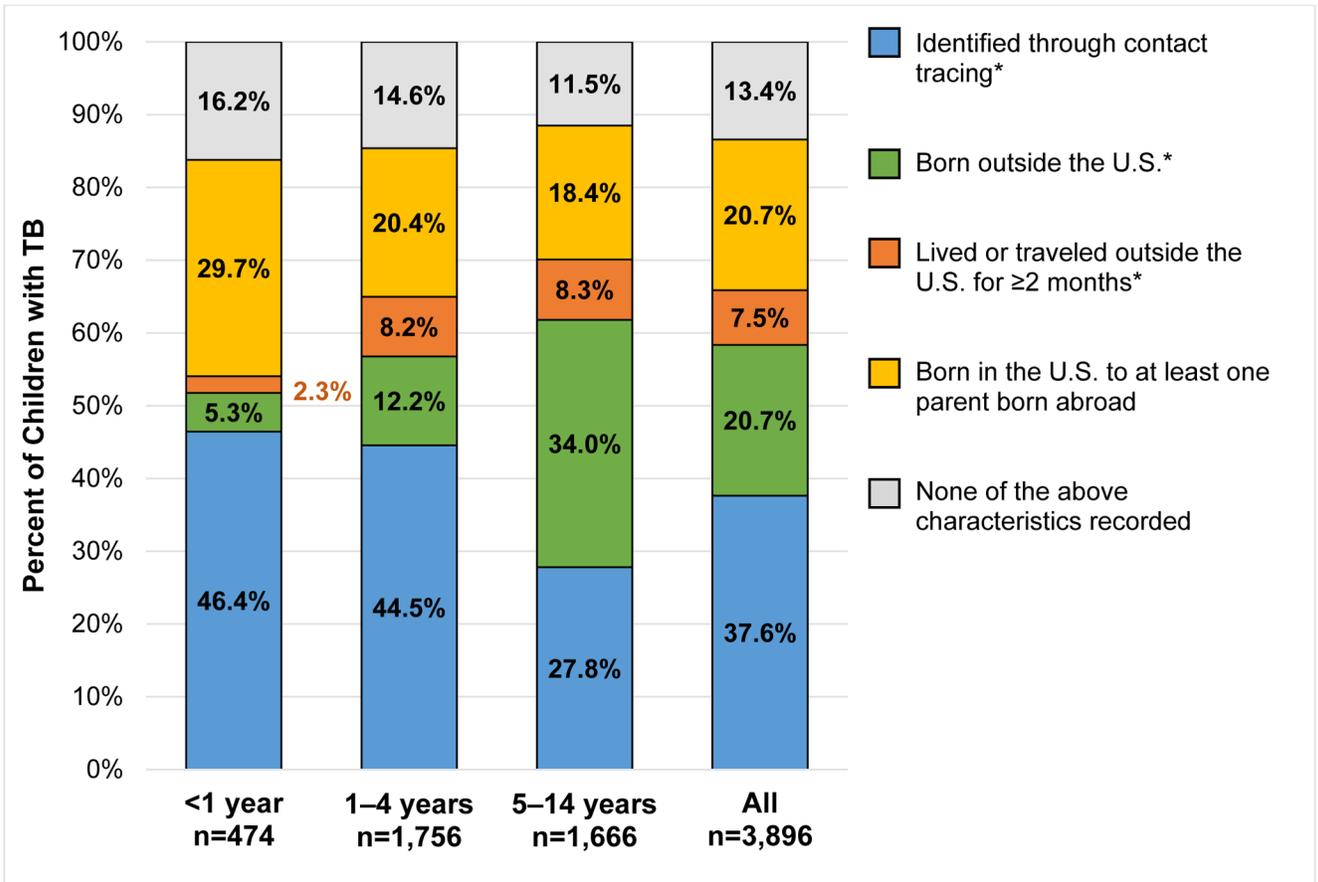
among children and adolescents do not persist or worsen, even as overall TB burden declines.

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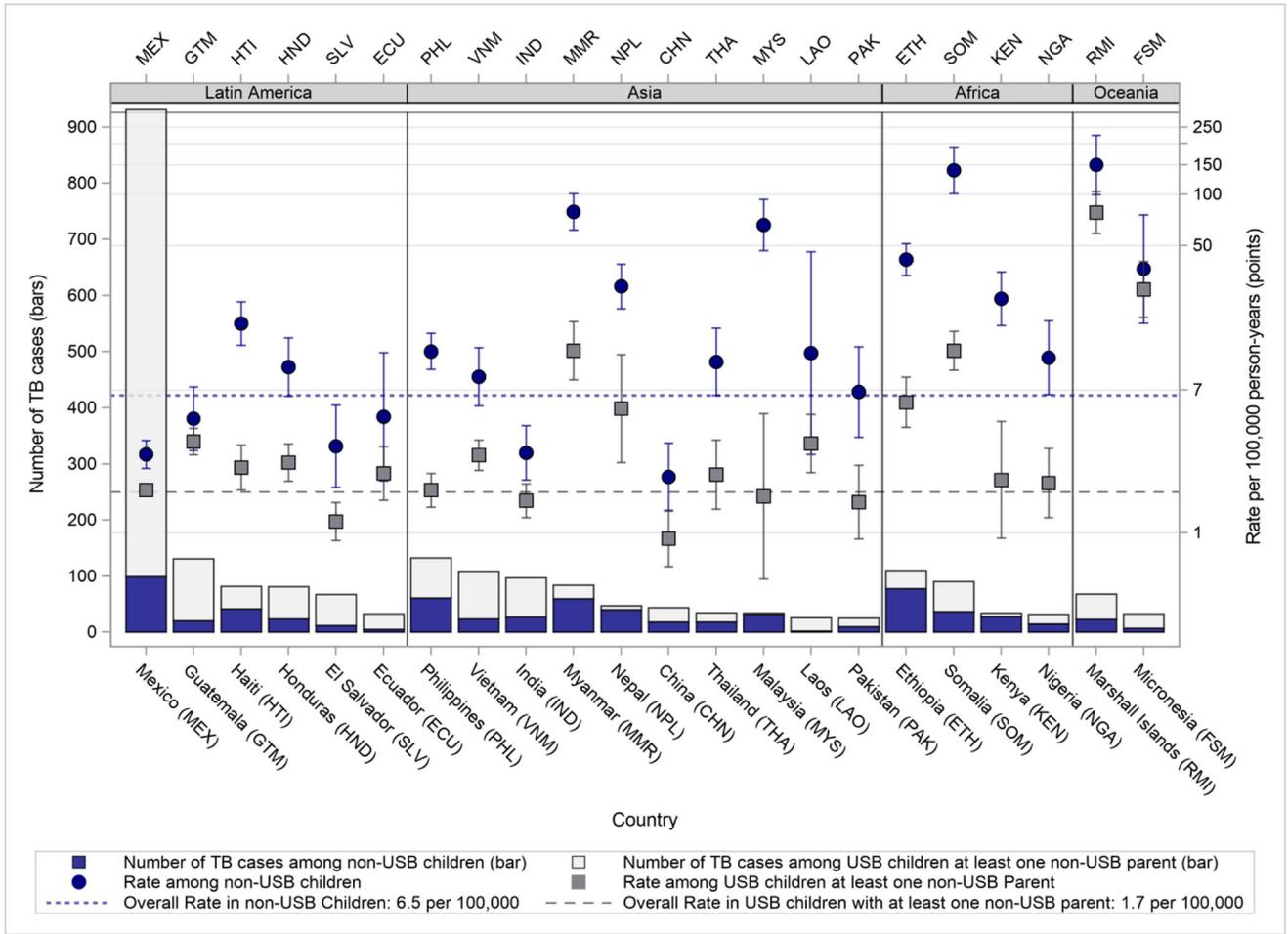
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**Figure 1. Characteristics of children aged <15 years with tuberculosis (TB), reported in U.S. States and District of Columbia, 2010–2017**

Categories are hierarchical in the order listed in the legend above (i.e., category ‘lived or traveled outside the U.S. for ≥2 months’ does not include children and adolescents identified through contact tracing or those born outside the U.S.). Starred (\*) characteristics are currently covered under U.S. targeted testing guidelines. The category, “none of the above characteristics recorded” includes n=136 (3.5%) children for whom nativity of both parents was unknown or missing, and n=119 (3.1%) children who had one U.S.–born parent and one parent of unknown or missing nativity status.



**Figure 2. Number of tuberculosis (TB) cases and TB rates by country of birth among non-U.S.–born children aged <15 years and by parental country of birth among U.S.-born children with at least one non-U.S.–born parent in U.S. States and District of Columbia, 2010–2017**

Countries are shown by descending case count (bars) within U.S. Census Bureau world regions (Latin America, Asia, Africa, and Oceania); All countries with at least 25 children who were non-U.S.–born or had non-U.S.–born parents from that country (total bar height) are shown. For U.S.-born children with at least one non-U.S.–born (non-USB) parent, includes children who have two non-U.S.–born parents, children with one non-U.S.- and one U.S.-born parent, and children with one non-U.S.–born parent and one parent with unknown nativity. For the n=100 children with two non-U.S.–born parents from different countries, children are counted twice for each country of birth for their parents (e.g., for a child with one parent born in El Salvador and one parent born in Ecuador, the child will appear in the calculations and totals for both El Salvador and Ecuador)

*Abbreviations:* USB=U.S.-born;

Table 1.

Demographic and clinical characteristics of persons aged <18 years with tuberculosis (TB) reported to the National Tuberculosis Surveillance System (NTSS) in U.S. States and U.S.-Affiliated Islands, 2010–2017

	Reported in U.S. States <sup>1</sup>							Reported in U.S.-Affiliated Islands <sup>2</sup>		Total (N=6,072)	
	U.S.-born <sup>3</sup> (n=3,520)		Non-U.S.-born (n=1,655)		Total (n=5,175)		Total (n=897)				
	n	%	n	%	n	%	p-value <sup>4</sup>	n	%	N	%
<b>Age Category</b>											
<15 years	2,977	(85%)	919	(56%)	3,896	(75%)	<.0001	754	(84%)	4,650	(77%)
<1 year	448	(13%)	26	(2%)	474	(9%)	<.0001	55	(6%)	529	(9%)
1–4 years	1,503	(43%)	253	(15%)	1,756	(34%)	<.0001	293	(33%)	2,049	(34%)
5–14 years	1,026	(29%)	640	(39%)	1,666	(32%)	<.0001	406	(45%)	2,072	(34%)
15–17 years	543	(15%)	736	(45%)	1,279	(25%)	<.0001	143	(16%)	1,422	(23%)
<b>Female Sex at Birth</b>	1,725	(49%)	784	(47%)	2,509	(48%)	0.2727	424	(47%)	2933	(48%)
<b>Race/Ethnicity of Patient<sup>5</sup></b>											
Asian	468	(13%)	591	(36%)	1,059	(20%)	<.0001	46	(5%)	1,105	(18%)
Black	861	(25%)	489	(30%)	1,350	(26%)	<.0001	0	(0%)	1,350	(22%)
Hispanic	1,659	(47%)	444	(27%)	2,103	(41%)	<.0001	7	(1%)	2,110	(35%)
Native American or Alaska Native	107	(3%)	0	(0%)	107	(2%)	<.0001	0	(0%)	107	(2%)
Native Hawaiian or other Pacific Islander	100	(3%)	47	(3%)	147	(3%)	0.9896	834	(93%)	981	(16%)
Two or more races	36	(1%)	9	(1%)	45	(1%)	0.0849	1	(0%)	46	(1%)
White	277	(8%)	65	(4%)	342	(7%)	<.0001	0	(0%)	342	(6%)
<b>Nativity of Primary Parents/ Guardians<sup>6</sup></b>											
Both U.S.-born	604	(20%)	40	(4%)	644	(17%)	<.0001	25	(3%)	669	(14%)
Both non-U.S.-born	1,205	(41%)	526	(57%)	1,731	(44%)	<.0001	372	(49%)	2,103	(45%)
Non-U.S.-born and U.S.-born	284	(10%)	19	(2%)	303	(8%)	<.0001	9	(1%)	312	(7%)
U.S.-born and unknown	280	(9%)	15	(2%)	295	(8%)	<.0001	3	(0%)	298	(6%)
Non-U.S.-born and unknown	355	(12%)	224	(24%)	579	(15%)	<.0001	137	(18%)	716	(15%)
Both unknown	249	(8%)	95	(10%)	344	(9%)	0.0654	208	(28%)	552	(12%)
<b>Patient lived outside U.S. for 2 months<sup>6</sup></b>											
Yes	346	(12%)	668	(73%)	1,014	(26%)	<.0001	55	(7%)	1,069	(23%)
No	2,383	(80%)	143	(16%)	2,526	(65%)	<.0001	384	(51%)	2,910	(63%)
Unknown	248	(8%)	108	(12%)	356	(9%)	0.0017	315	(42%)	671	(14%)
<b>Primary Reason Evaluated for TB<sup>7</sup></b>											

	Reported in U.S. States <sup>1</sup>							Reported in U.S.-Affiliated Islands <sup>2</sup>		Total (N=6,072)	
	U.S.-born <sup>3</sup> (n=3,520)		Non-U.S.-born (n=1,655)		Total (n=5,175)		Total (n=897)				
	n	%	n	%	n	%	p-value <sup>4</sup>	n	%	N	%
TB symptoms	1220	(35%)	698	(42%)	1,918	(37%)		457	(51%)	2375	(39%)
Contact investigation	1456	(41%)	159	(10%)	1,615	(31%)	<.0001	306	(34%)	1,921	(32%)
Abnormal chest x-ray	550	(16%)	360	(22%)	910	(18%)	<.0001	108	(12%)	1018	(17%)
Immigration medical exam	0	(0%)	208	(13%)	208	(4%)	<.0001	6	(1%)	214	(4%)
Incidental lab result	152	(4%)	72	(4%)	224	(4%)	0.9576	14	(2%)	238	(4%)
Targeted testing	95	(3%)	104	(6%)	199	(4%)	<.0001	2	(0%)	201	(3%)
Other <sup>8</sup>	16	(1%)	22	(1%)	38	(1%)	0.0006	0	(0%)	38	(1%)
<b>TB Disease Verification Criteria<sup>9</sup></b>											
Positive culture	1266	(36%)	766	(46%)	2,032	(39%)	<.0001	187	(21%)	2,219	(37%)
Nucleic acid amplification test	63	(2%)	26	(2%)	89	(2%)	0.5723	6	(1%)	95	(2%)
Positive smear, absent culture	22	(1%)	2	(0%)	24	(0%)	0.0137	6	(1%)	30	(1%)
Clinical case definition	1,759	(50%)	756	(46%)	2,515	(49%)	0.004	355	(40%)	2,870	(47%)
Provider diagnosis	410	(12%)	105	(6%)	515	(10%)	<.0001	343	(38%)	858	(14%)
<b>Initial Chest X-ray<sup>10</sup></b>											
Abnormal	2,806	(80%)	1,317	(80%)	4,123	(80%)	0.82	804	(90%)	4,927	(81%)
Normal	640	(18%)	311	(19%)	951	(18%)	0.616	59	(7%)	1010	(17%)
Not Done	66	(2%)	26	(2%)	92	(2%)	0.4359	22	(3%)	114	(2%)
<b>HIV Status at diagnosis</b>											
Positive	4	(0%)	14	(1%)	18	(0%)	<.0001	1	(0%)	19	(0%)
Negative	2,135	(61%)	1319	(80%)	3,454	(67%)	<.0001	479	(53%)	3,933	(65%)
Unknown	1,381	(39%)	322	(20%)	1,703	(33%)	<.0001	417	(47%)	2,120	(35%)
<b>Site of Disease<sup>11</sup></b>											
Pulmonary only	2,406	(68%)	1135	(69%)	3,541	(68%)	0.879	679	(76%)	4,220	(70%)
Extrapulmonary only	772	(22%)	382	(23%)	1,154	(22%)	0.3563	167	(19%)	1,321	(22%)
Both pulmonary and extrapulmonary	339	(10%)	137	(8%)	476	(9%)	0.1157	51	(6%)	527	(9%)
<b>Drug Resistance<sup>12</sup></b>											
DST Done	1240	(98%)	750	(98%)	1,990	(98%)	0.7652	176	(94%)	2,166	(98%)
INH resistance	114	(9%)	59	(8%)	173	(9%)	0.3009	5	(3%)	178	(8%)
RIF resistance	14	(1%)	16	(2%)	30	(2%)	0.076	3	(2%)	33	(2%)
Any first line resistance (INH, RIF, PZA, EMB)	198	(16%)	102	(14%)	300	(15%)	0.1527	6	(3%)	306	(14%)
MDR <sup>13</sup>	11	(1%)	14	(2%)	25	(1%)	0.0642	2	(1%)	27	(1%)

	Reported in U.S. States <sup>1</sup>							Reported in U.S.-Affiliated Islands <sup>2</sup>		Total (N=6,072)	
	U.S.-born <sup>3</sup> (n=3,520)		Non-U.S.-born (n=1,655)		Total (n=5,175)		Total (n=897)				
	n	%	n	%	n	%	p-value <sup>4</sup>	n	%	N	%
XDR <sup>14</sup>	1	(0%)	0	(0%)	1	(0%)	>0.999	0	(0%)	1	(0%)
<b>TB Treatment Outcome</b>											
Completed	3,256	(93%)	1,544	(93%)	4,800	(93%)	0.3048	721	(80%)	5,521	(91%)
Died	14	(0%)	0	(0%)	14	(0%)	0.0073	18	(2%)	32	(1%)
Other outcome <sup>15</sup>	32	(1%)	24	(1%)	56	(1%)	0.0794	19	(2%)	75	(1%)
Missing	218	(6%)	87	(5%)	305	(6%)	0.1822	139	(16%)	444	(7%)

Percentages may not add to 100% due to rounding

**Abbreviations** - DC: District of Columbia; DST: Drug susceptibility testing; EMB: Ethambutol; HIV: Human Immunodeficiency Virus; INH: Isoniazid; MDR: Multi-drug resistant TB; NTSS: National Tuberculosis Surveillance System; PZA: Pyrazinamide; RIF: Rifampicin; TB: Tuberculosis; XDR: Extensively Drug Resistant TB;

<sup>1</sup> U.S. States reporting areas include 50 U.S. States, New York City, and the District of Columbia.

<sup>2</sup> U.S.-Affiliated Island reporting areas include U.S. Territories: American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands; and freely associated states: Federated States of Micronesia, Republic of the Marshall Islands, and Republic of Palau).

<sup>3</sup> Consistent with U.S. Census Bureau definitions, anyone who was a U.S. citizen at birth (i.e., born in the U.S. or a U.S. territory, or born abroad to at least one parent who is a U.S. citizen) were considered to be U.S.-born; all others were considered non-U.S.-born, including those born in the freely associated states, RMI, FSM and Palau; [https://www.census.gov/topics/population/foreign-born/about.html#par\\_textimage](https://www.census.gov/topics/population/foreign-born/about.html#par_textimage);

<sup>4</sup> For the statistical test for differences between U.S.-born and non-U.S.-born children and adolescents

<sup>5</sup> Self-reported or reported by parent/guardian. Hispanic individuals may be of any race, including two or more races. Excludes 13 children missing race or ethnicity.

<sup>6</sup> Among n=4,650 children aged <15 years; NTSS does not collect this information for persons aged 15 years.

<sup>7</sup> "Situation or reason that led to the initial suspicion that the patient might have TB disease"; Excludes n=67 children with missing or unknown reason for evaluation.

<sup>8</sup> Other reasons evaluated include employment/administrative testing (e.g., testing at schools), testing for healthcare workers

<sup>9</sup> Disease verification criteria categories are hierarchical in the order listed. For definitions see <https://www.cdc.gov/tb/programs/rvct/instructionmanual.pdf>

<sup>10</sup> Excludes n=21 children with missing or unknown chest x-ray results

<sup>11</sup> Excludes n=4 missing site of TB disease

<sup>12</sup> Among n=2,219 children with a positive culture for *M. tuberculosis* and drug susceptibility results

<sup>13</sup> Resistant to at least isoniazid and rifampin

<sup>14</sup> Resistant to at least isoniazid and rifampin plus any fluoroquinolone and at least one second-line injectable (i.e., amikacin, kanamycin, or capreomycin)

<sup>15</sup> Other outcomes include adverse treatment event (n=3), lost to follow-up (n=16), refused (n=14), or other (n=42)

**Table 2.** Incidence rates of tuberculosis (TB) among children and adolescents aged <18 years in U.S. States and D.C., 2007–2017

	Overall (2007–2017)				2007		2017		% Change (2017 v. 2007)	
	Pop. aged <18 years / (2012)	n TB	Rate <sup>2</sup> (95% CI)	Rate Ratio <sup>3</sup>	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	Rate (95% CI)	% Change <sup>4</sup>	(95% CI)
<b>Total aged &lt; 18 years<sup>5</sup></b>	73,632,197	8,030	1.0 (1.0, 1.0)	-	1.4 (1.3, 1.5)	0.8 (0.7, 0.8)	0.8 (0.7, 0.8)	-47.8%	(-51.4%, -44.1%)	
<b>Age Category (years)</b>										
<1	3,675,358	798	1.9 (1.8, 2.0)	3.4	2.8 (2.3, 3.4)	1.4 (1.1, 1.9)	1.4 (1.1, 1.9)	-57.9%	(-66.3%, -47.3%)	
1–4	16,136,463	2,797	1.6 (1.5, 1.6)	2.8	2.1 (1.9, 2.4)	1.1 (0.9, 1.3)	1.1 (0.9, 1.3)	-52.9%	(-58.2%, -46.9%)	
5–14	41,339,646	2,508	0.6 (0.5, 0.6)	ref	0.8 (0.7, 0.9)	0.5 (0.4, 0.6)	0.5 (0.4, 0.6)	-44.2%	(-50.8%, -36.8%)	
15–17	12,480,730	1,927	1.4 (1.3, 1.4)	2.5	1.8 (1.6, 2.1)	1.2 (1.0, 1.4)	1.2 (1.0, 1.4)	-33.8%	(-42.5%, -23.7%)	
<b>Sex at Birth</b>										
Female	35,961,951	3,905	1.0 (1.0, 1.0)	ref	1.4 (1.3, 1.6)	0.8 (0.7, 0.9)	0.8 (0.7, 0.9)	-47.7%	(-52.7%, -42.1%)	
Male	37,670,246	4,125	1.0 (1.0, 1.0)	1.0	1.3 (1.2, 1.4)	0.8 (0.7, 0.9)	0.8 (0.7, 0.9)	-48.0%	(-52.8%, -42.7%)	
<b>Race/Ethnicity<sup>6</sup></b>										
Asian	3,255,938	1,555	4.4 (4.2, 4.6)	34.8	5.4 (4.7, 6.4)	1.3 (1.1, 1.5)	1.3 (1.1, 1.5)	-44.7%	(-52.8%, -35.2%)	
Black	10,137,456	2,145	1.9 (1.8, 2.0)	15.2	2.9 (2.6, 3.3)	1.4 (1.2, 1.7)	1.4 (1.2, 1.7)	-52.4%	(-58.5%, -45.4%)	
Hispanic	17,544,826	3,380	1.8 (1.7, 1.8)	14.1	2.8 (2.6, 3.1)	1.3 (1.1, 1.5)	1.3 (1.1, 1.5)	-62.1%	(-66.1%, -57.8%)	
Native American/Native Alaskan	568,812	133	2.2 (1.8, 2.6)	17.1	1.6 (0.8, 3.1)	2.7 (1.6, 4.5)	2.7 (1.6, 4.5)	39.8%	(-18.8%, 140.4%)	
Native Hawaiian/Pacific Islander	127,473	191	14.4 (12.5, 16.6)	114.0	16.4 (10.2, 26.3)	24.8 (17.4, 35.3)	24.8 (17.4, 35.3)	50.3%	(-5.3%, 138.5%)	
Two or more races	3,030,887	56	0.2 (0.1, 0.2)	1.3	0.2 (0.1, 0.5)	0.1 (0.1, 0.3)	0.1 (0.1, 0.3)	22.4%	(-47.6%, 185.7%)	
White	38,765,384	543	0.1 (0.1, 0.1)	ref	0.2 (0.2, 0.2)	0.1 (0.0, 0.1)	0.1 (0.0, 0.1)	-55.8%	(-66.3%, -41.9%)	
<b>Nativity<sup>7</sup></b>										
U.S.-born	71,061,556	5,424	0.7 (0.7, 0.7)	ref	0.9 (0.9, 1.0)	0.6 (0.5, 0.6)	0.6 (0.5, 0.6)	-47.9%	(-52.2%, -43.3%)	
Non-U.S.-born	2,570,641	2,606	9.0 (8.6, 9.3)	12.9	12.1 (10.9, 13.4)	7.0 (6.1, 8.1)	7.0 (6.1, 8.1)	-39.3%	(-46.2%, -31.4%)	
<b>Nativity &amp; World Area of Birth<sup>8</sup></b>										
U.S.-born										
U.S. State	70,332,800	5,380	0.7 (0.7, 0.7)	ref	0.9 (0.9, 1)	0.6 (0.5, 0.6)	0.6 (0.5, 0.6)	-48.3%	(-52.6%, -43.7%)	
U.S. Island Area, Oceania <sup>9</sup>	188,416	24	1.1 (0.7, 1.6)	1.6	3.2 (1.5, 7.2)	1.3 (0.4, 4.0)	1.3 (0.4, 4.0)	-33.9%	(-81.2%, 132.0%)	

	Overall (2007–2017)					2007		2017		% Change (2017 v. 2007)
	Pop. aged <18 years <sup>1</sup> (2012)	n TB	Rate <sup>2</sup>	(95% CI)	Rate Ratio <sup>3</sup>	Rate	(95% CI)	Rate	(95% CI)	% Change <sup>4</sup> (95% CI)
<b>Non-U.S.-born</b>										
<i>Latin America</i>	1,322,256	893	6.0	(8, 9.2)	8.6	(7.3, 10.1)	5.5	(4.3, 7)	-36.2%	(-48.3%, -21.2%)
<i>Asia</i>	781,065	938	10.8	(10.1, 11.5)	15.5	(11.4, 16.9)	6.8	(5.3, 8.8)	-51.2%	(-60.2%, -40.2%)
<i>Europe</i>	227,336	51	1.9	(1.4, 2.5)	2.7	(2.0, 3.5)	0.0	(0.0, 0.0)	-88.7%	(-96.0%, -67.9%)
<i>Africa</i>	178,612	641	32.3	(29.9, 34.9)	46.4	(42.8, 50.4)	59.7	(48.7, 73.3)	-61.0%	(-69.4%, -50.2%)
<i>Oceania</i>	17,535	67	30.3	(23.9, 38.6)	43.7	(34.3, 55.6)	36.3	(18.2, 72.6)	-10.5%	(-57.6%, 89.3%)

<sup>1</sup> Population estimates are from the U.S. Census Bureau ACS PUMS 1-year estimates, 2007–2017; Population estimate at midpoint (2012) displayed for each demographic group.

<sup>2</sup> All rates are reported per 100,000 person-years

<sup>3</sup> Incidence rate ratio for relative differences between demographic groups overall (2007–2017)

<sup>4</sup> 8-year percent change in rate for 2017 compared to 2007;

<sup>5</sup> Does not include children or adolescents with TB reported from U.S. territories or freely associated states (See Table 3).

<sup>6</sup> Self-reported or reported by parent/guardian. Hispanic may be of any race, including two or more races. n=27 cases aged <18 years occurred among those with unknown race/ethnicity

<sup>7</sup> Consistent with U.S. Census Bureau definition: [https://www.census.gov/topics/population/foreign-born/about.html#par\\_textimage](https://www.census.gov/topics/population/foreign-born/about.html#par_textimage)

<sup>8</sup> A total of n=36 children and adolescents with TB not shown (n=20 U.S.-born, born abroad to parents who are U.S. citizens; n=3 non-U.S.-born children born in North America, n=13 non-U.S.-born, with unknown world area of birth)

<sup>9</sup> Combined based on collapsed U.S. Census Bureau data categories; U.S. Island Areas: American Samoa, Guam, Commonwealth of the Northern Mariana Islands, US Virgin Islands, Puerto Rico, Republic of the Marshall Islands, Federated States of Micronesia, Palau; Oceania: Fiji, New Zealand, Australia, Tonga, Samoa, Oceania Not Specified, or at Sea

**Table 3.**

Incidence rates of tuberculosis (TB) among children and adolescents aged <18 years in U.S.-Affiliated Islands and selected U.S. States reported to the National Tuberculosis Surveillance System (NTSS), 2007–2017

Reporting Area	Population aged <18 years (2012) <sup>1</sup>	n TB	Rate <sup>2</sup>	(95% CI)
<b>U.S.-Affiliated Islands</b>	<b>1,022,536</b>	<b>1,246</b>	11.7	(11.1, 12.4)
American Samoa (AS)	21,656	1	0.6	(0.1, 4.3)
Commonwealth of Northern Mariana Islands (CNMI)	18,034	23	16.3	(10.8, 24.5)
Federated States of Micronesia (FSM)	42,508	526	159.7	(146.6, 173.9)
Guam (GU)	55,572	201	45.3	(39.5, 52.1)
Palau (PL)	5,684	11	24.8	(13.8, 44.9)
Puerto Rico (PR)	836,637	15	0.2	(0.1, 0.3)
Republic of the Marshall Islands (RMI)	29,819	469	195.3	(178.4, 213.8)
<b>U.S. States and DC<sup>3</sup></b>	<b>73,632,197</b>	<b>8,030</b>	<b>1.0</b>	<b>(1.0, 1.0)</b>
<i>Distribution by number of TB cases</i>				
California (Max)	9,229,544	1,483	1.5	(1.4, 1.5)
Virginia (Q3)	1,855,004	164	0.8	(0.7, 0.9)
Alaska (Median)	184,564	79	3.9	(3.1, 4.8)
Iowa (Q1)	721,858	26	0.3	(0.2, 0.5)
Wyoming (Min)	136,250	1	0.1	(0, 0.5)
<i>Distribution by TB incidence rate</i>				
Alaska (Max)	184,564	79	3.9	(3.1, 4.8)
Arizona (Q3)	1,619,974	207	1.1	(1, 1.3)
Alabama (Median)	1,125,653	94	0.8	(0.6, 0.9)
Vermont (Q1)	122,488	6	0.4	(0.2, 1)
Wyoming (Min)	136,250	1	0.1	(0, 0.5)

<sup>1</sup>Population estimates for Puerto Rico and U.S. States come from the U.S. Census Bureau's American Community Survey, Public Use Microsample Data 1-year estimates; Population estimates for AS, GU, NMI obtained from [https://www.census.gov/newsroom/releases/archives/2010\\_census/press-kits/island-areas.html](https://www.census.gov/newsroom/releases/archives/2010_census/press-kits/island-areas.html) and FSM, RMI, PL obtained from: <https://www.census.gov/data-tools/demo/idb/informationGateway.php>

<sup>2</sup>TB incidence rate per 100,000 person-years

<sup>3</sup>Total for all 50 U.S. States and D.C. combined. Selected states shown below for comparison to U.S.-Affiliated. Islands. States were selected based on the distribution of number of reported TB cases and TB incidence rates among children and adolescents. Data for all reporting jurisdictions are shown in Supplemental Figure 2.

**Table 4.**

Incidence rates of tuberculosis (TB) by nativity of child and nativity of parents for children with TB aged <15 years in U.S. States and DC, 2010–2017<sup>1</sup>

Nativity of Child	Nativity of Parents <sup>2</sup>	n TB	Population aged <15 years <sup>3</sup>	TB Incidence Rate (95% CI) <sup>4</sup>	Rate Ratio (95% CI)
Non-U.S.-Born	All nativities	919	1,765,819	6.5 (6.1, 6.9)	23.1 (20.9, 25.6)
U.S.-born	Both non-U.S.-born	1,205	6,310,790	2.4 (2.3, 2.5)	8.5 (7.7, 9.3)
U.S.-born	One U.S.-born, one non-U.S.-born	284	3,629,607	1.0 (0.9, 1.1)	3.5 (3, 4)
U.S.-born	Both U.S.-born	604	26,819,512	0.3 (0.3, 0.3)	ref.

<sup>1</sup> Variable was introduced in 2009 and only collected for persons with TB aged <15 years; Data are shown for children aged <15 years from 2010-2017 when variable was collected regularly; Does not include children with TB reported from U.S.-Affiliated Islands

<sup>2</sup> Only children with known nativity for two parents/guardians are shown. Children with at least one unknown or missing nativity for parent/guardian not shown to prevent misclassification between NTSS numerators and U.S. Census Bureau population estimates

<sup>3</sup> Annualized (average) population estimate

<sup>4</sup> TB incidence rate per 100,000 person-years