

EPIDEMIOLOGY OF TUBERCULOSIS

GLOBAL AND NATIONAL

Shona Smith, MPH
Tuberculosis Epidemiologist
Michigan Department of Health and
Human Services

DISCLOSURE

- I have no actual or potential conflicts of interest in relation to this presentation
- I have no financial relationships to disclose

LEARNING OBJECTIVES

- Describe the burden of active TB disease (TB) in terms of susceptible groups
- Describe major factors that will affect future trends in TB

GLOBAL TB BURDEN

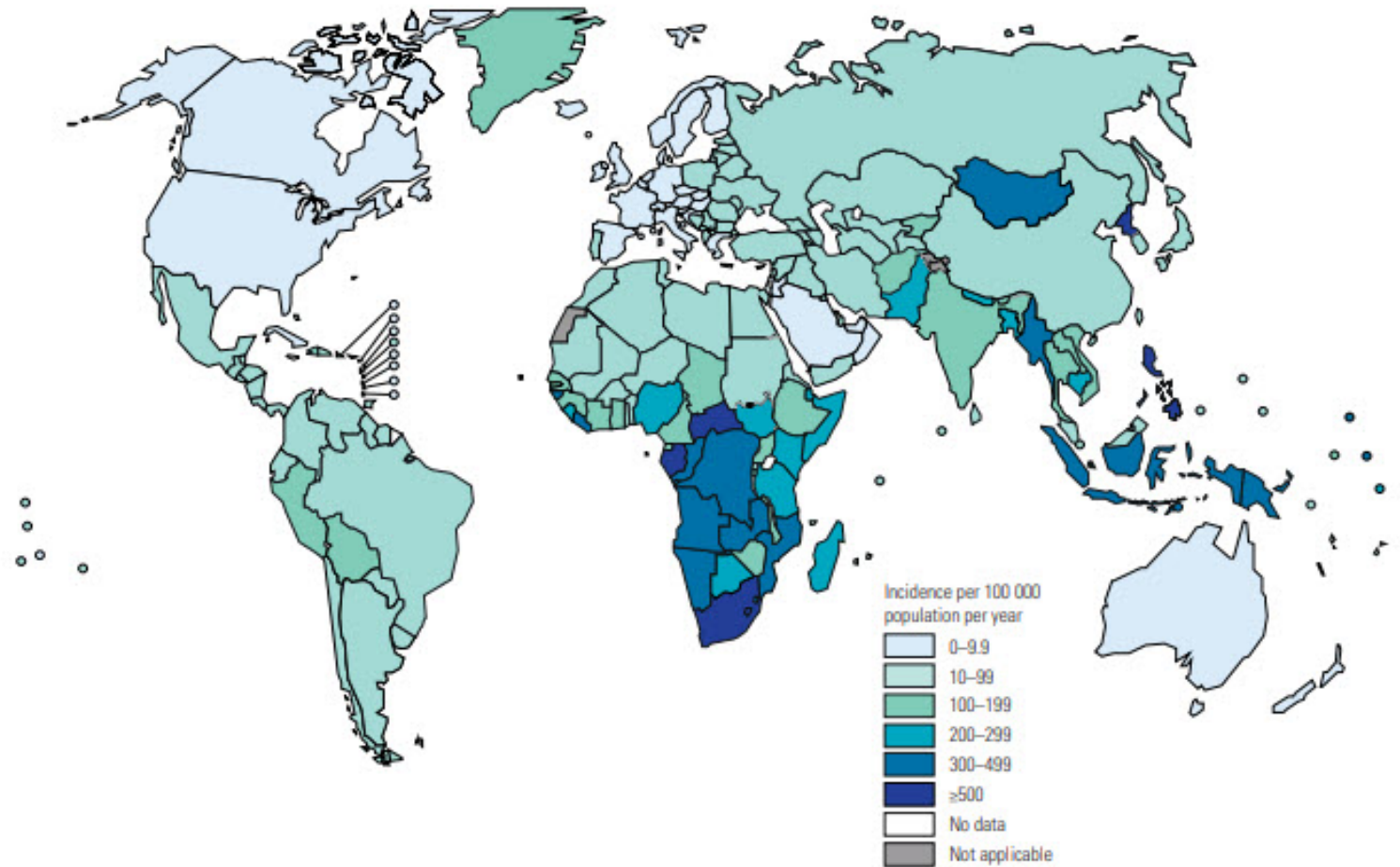
TB is one of the top 10 causes of death globally and the leading cause from a single infectious agent, ranking above HIV/AIDS

An estimated 10 million developed TB disease in 2019:

- 5.5 million men (56%)
- 3.2 million women (32%)
- 1.2 million children (12%)
- 8.2% people living with HIV
- Two-thirds in eight countries: India, Indonesia, China, the Philippines, Pakistan, Nigeria, Bangladesh, and South Africa

GLOBAL TB BURDEN

FIG. 4.4
Estimated TB incidence rates, 2019



GLOBAL TB-DRUG RESISTANCE BURDEN

465,000 rifampicin (RR-TB) TB cases reported with 78% resistant to isoniazid and rifampin (MDR)

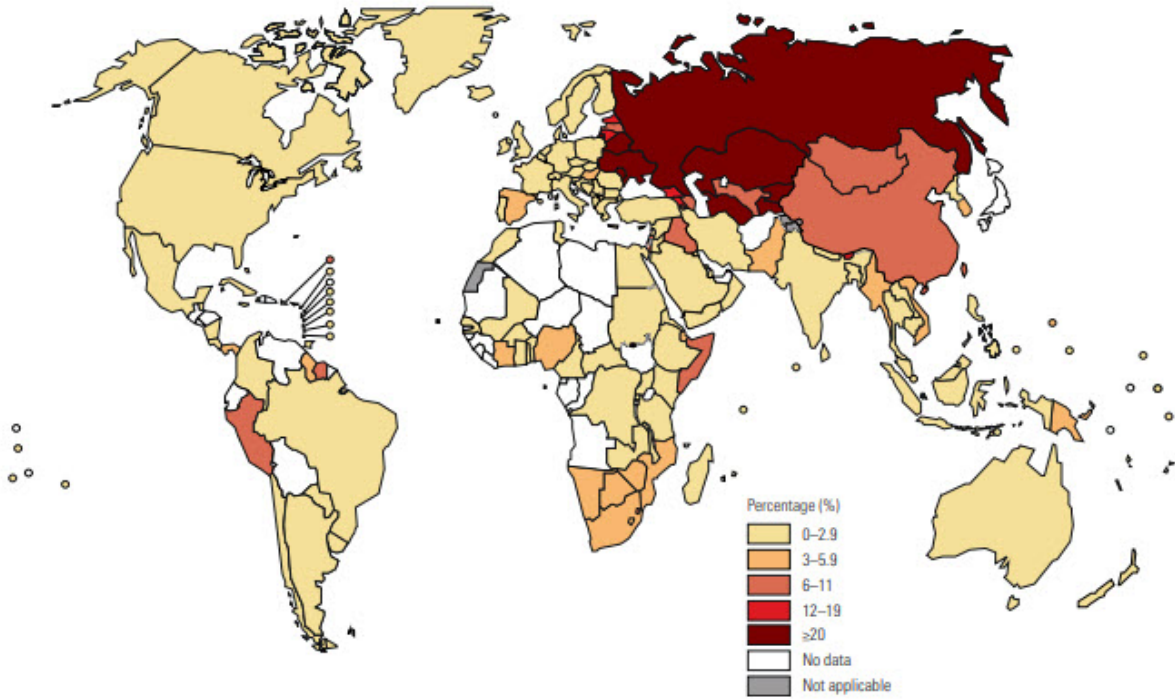
Almost half of new MDR/RR-TB cases reported from India (27%), China (14%), and the Russian Federation (8%)

Additional 1.1 million TB cases resistant to isoniazid

Burden of MDR/RR-TB remains stable

FIG. 4.30

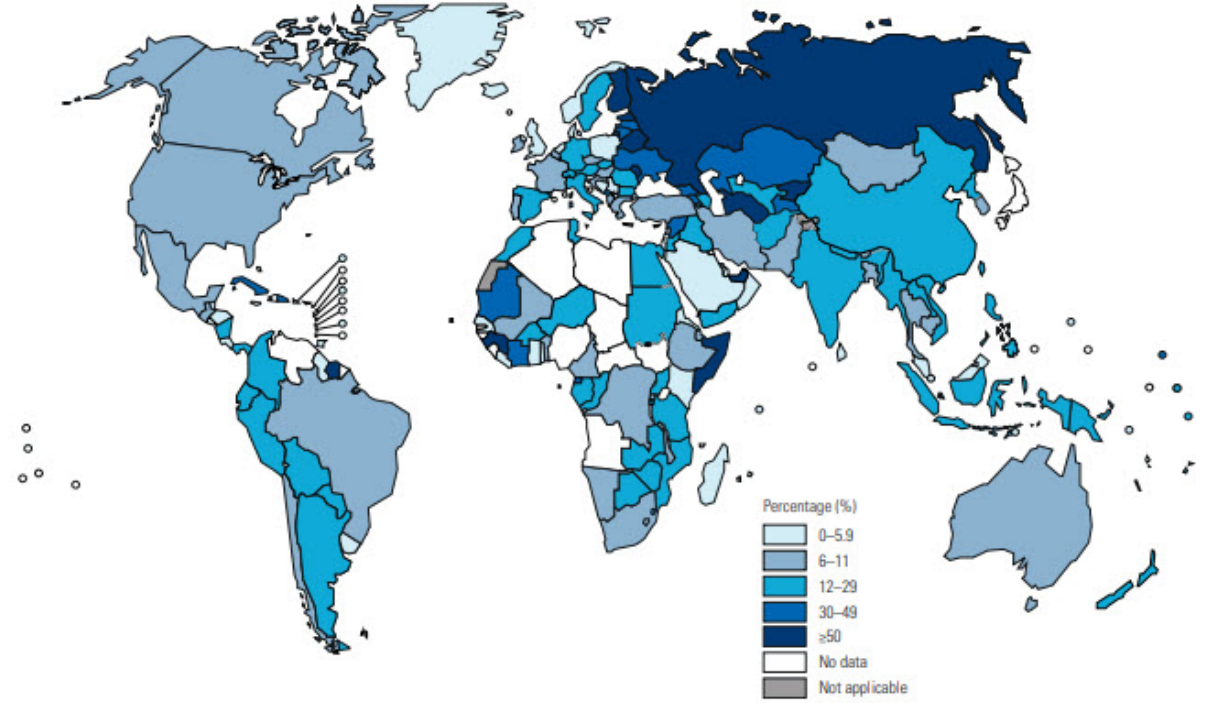
Percentage of new TB cases with MDR/RR-TB^a



^a Percentages are based on the most recent data point for countries with representative data from 2005 to 2020. Model-based estimates for countries without data are not shown. MDR-TB is a subset of RR-TB.

FIG. 4.31

Percentage of previously treated TB cases with MDR/RR-TB^a



^a Percentages are based on the most recent data point for countries with representative data from 2005 to 2020. Model-based estimates for countries without data are not shown. MDR-TB is a subset of RR-TB.

GLOBAL MDR/RR-TB BURDEN

World Health Organization. Global Tuberculosis Report 2020. Geneva, Switzerland: World Health Organization; 2020.

https://www.who.int/tb/publications/global_report/en/

GLOBAL MDR/RR-TB BURDEN

FIG. 4.32

Estimated incidence of MDR/RR-TB^a in 2019, for countries with at least 1000 incident cases



^a MDR-TB is a subset of RR-TB.

NATIONAL TB BURDEN

8,916 TB cases reported in 2019 at a rate of 2.7 per 100,000

1.0% decrease in cases counted from 2018

Incidence rate decreased 1.7% from 2018

Lowest rate ever reported

Persons born outside the U.S. accounted for approximately two thirds of cases with 16 times the rate among U.S.-born persons

Among persons born outside the U.S. incidence was highest among Asians

Among U.S. born persons incidence was highest among Native Hawaiians/Pacific Islanders

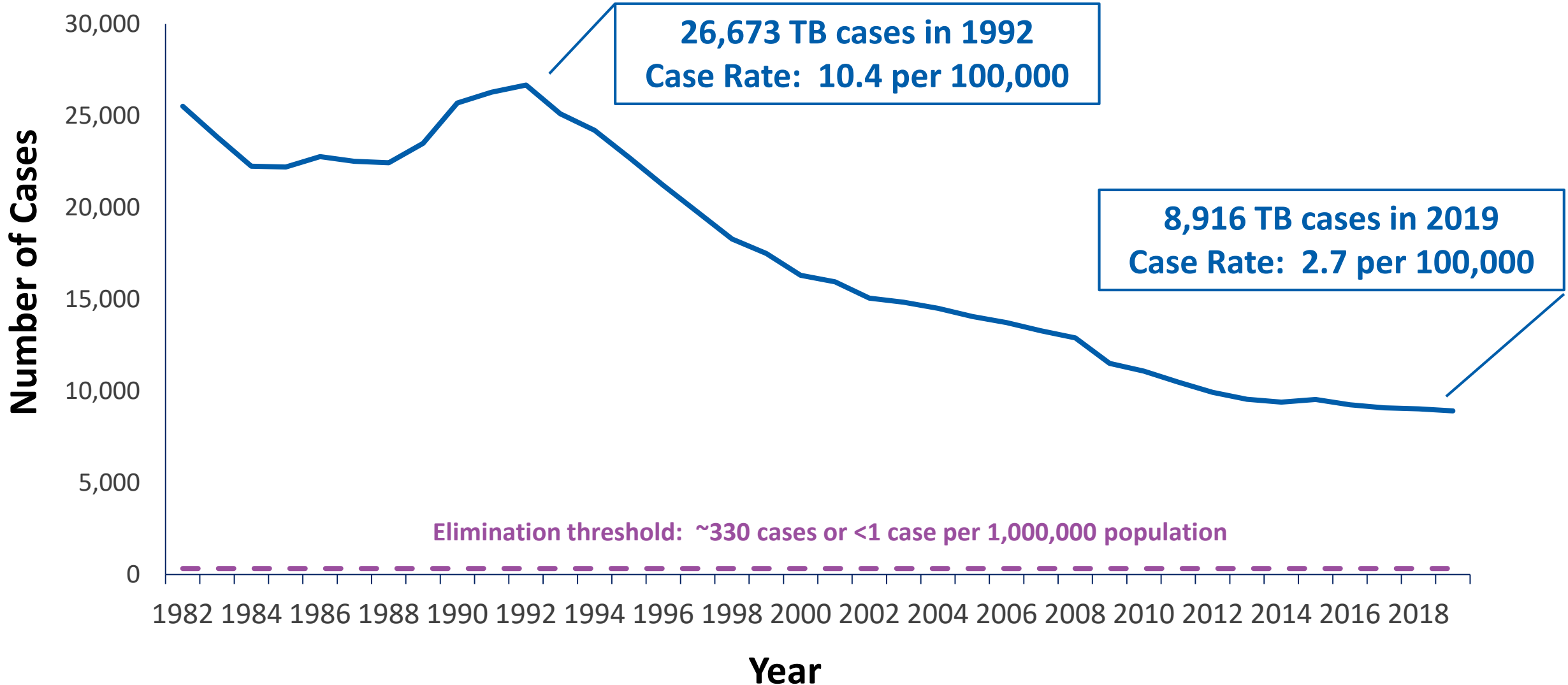


Tuberculosis in the United States 1993–2019*

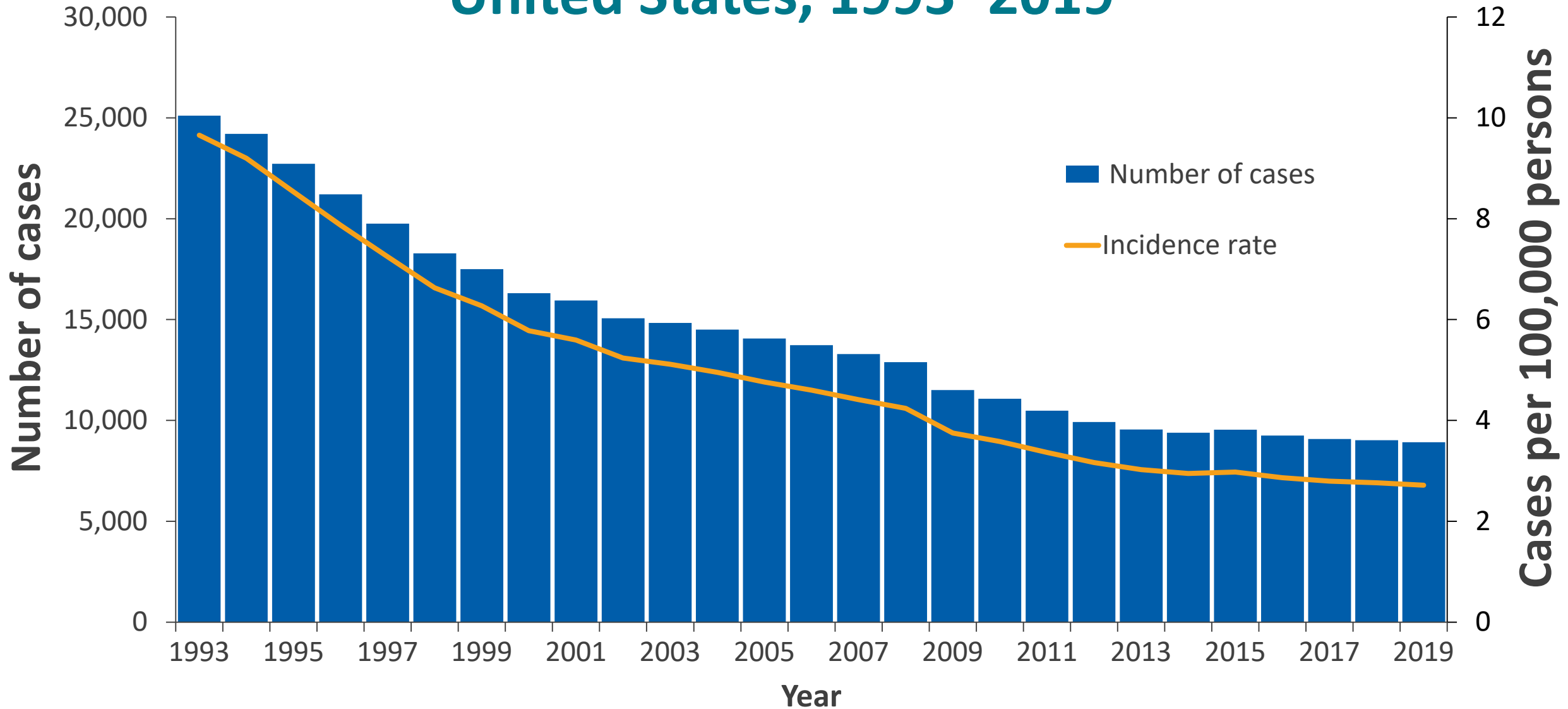
National Tuberculosis Surveillance System

*Data updated as of June 10, 2020

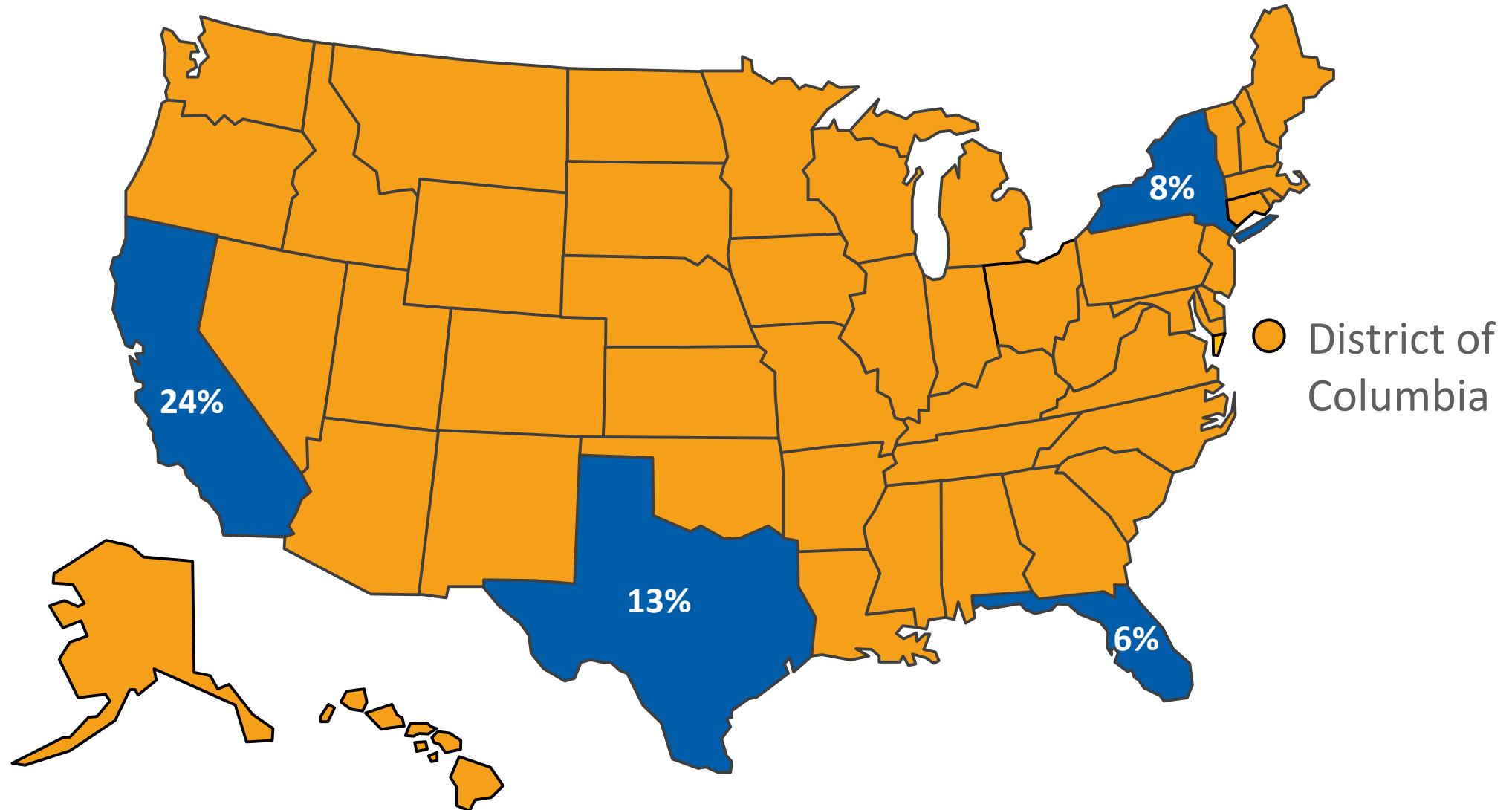
Progress Towards Tuberculosis (TB) Elimination, United States, 1983–2019



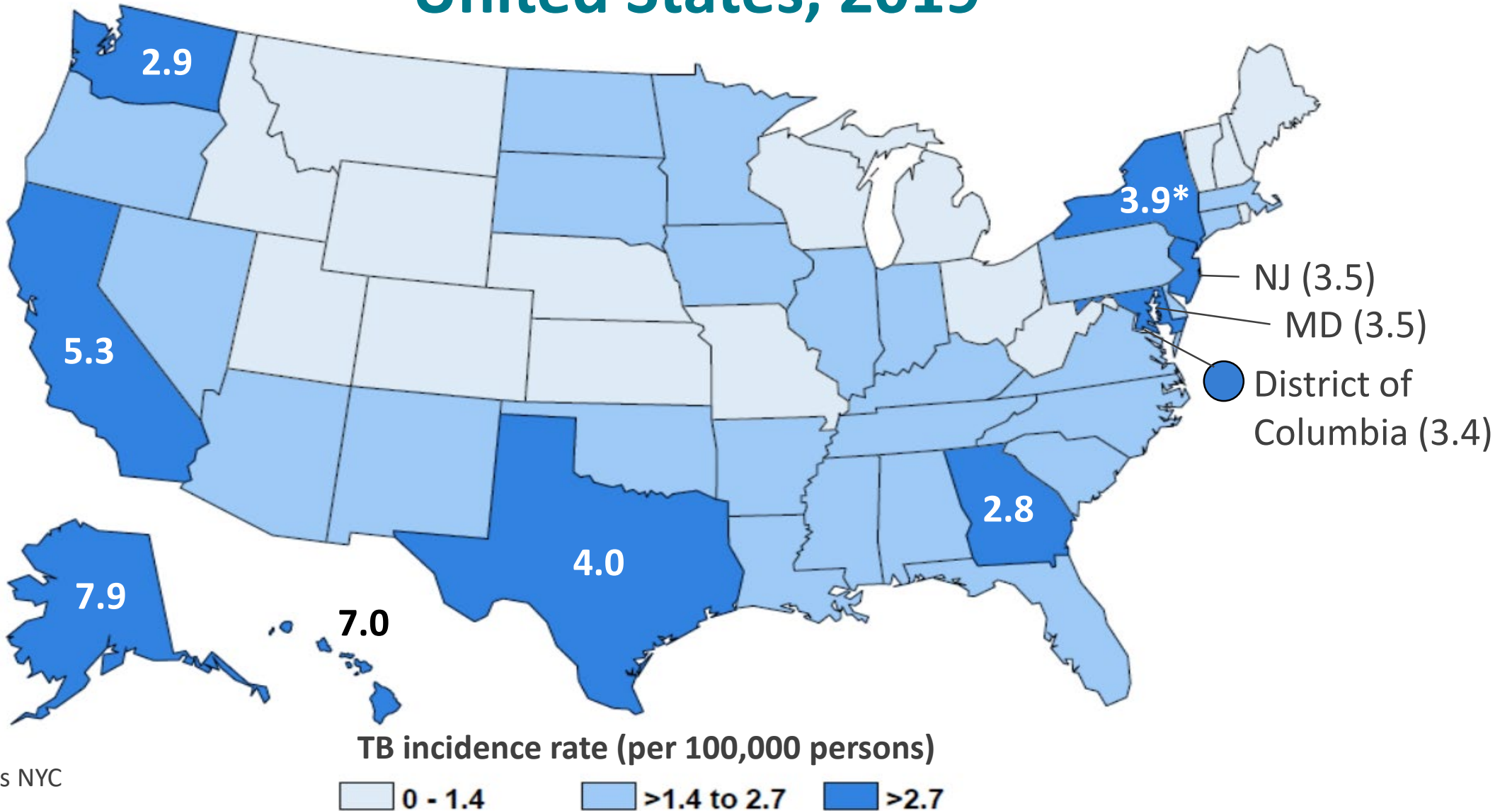
Reported TB Cases and Rates United States, 1993–2019



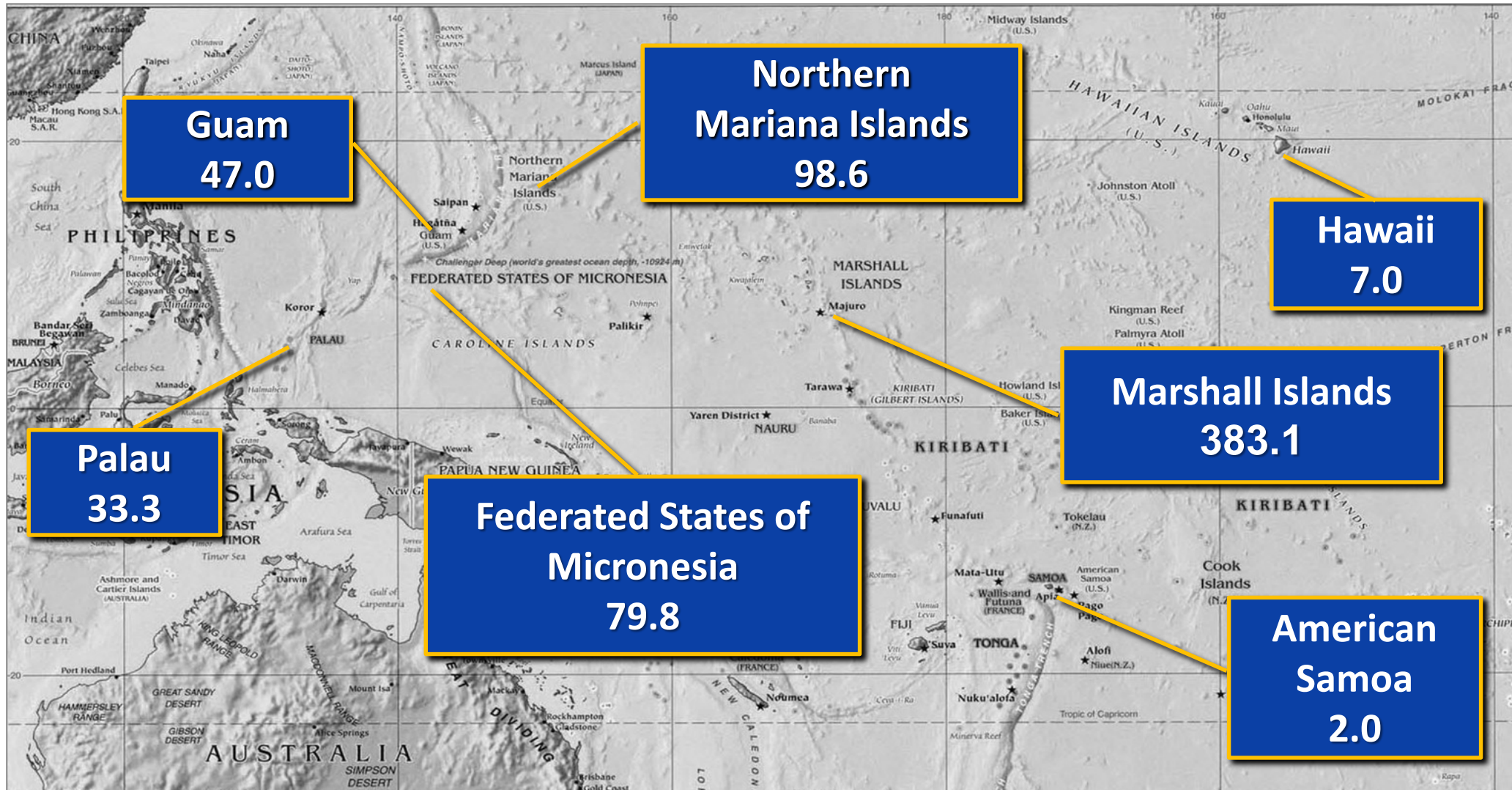
Majority of TB Cases Occur in Four States, United States, 2019



TB Case Rates by Reporting Area United States, 2019



Map of U.S.-Affiliated Pacific Islands and Hawaii by TB Case Rates*, 2019



*Cases per 100,000 persons

QUESTION 1

Q: What change did your program see in TB cases from 2019 to 2020?

- a. Increase
- b. No change
- c. Decrease

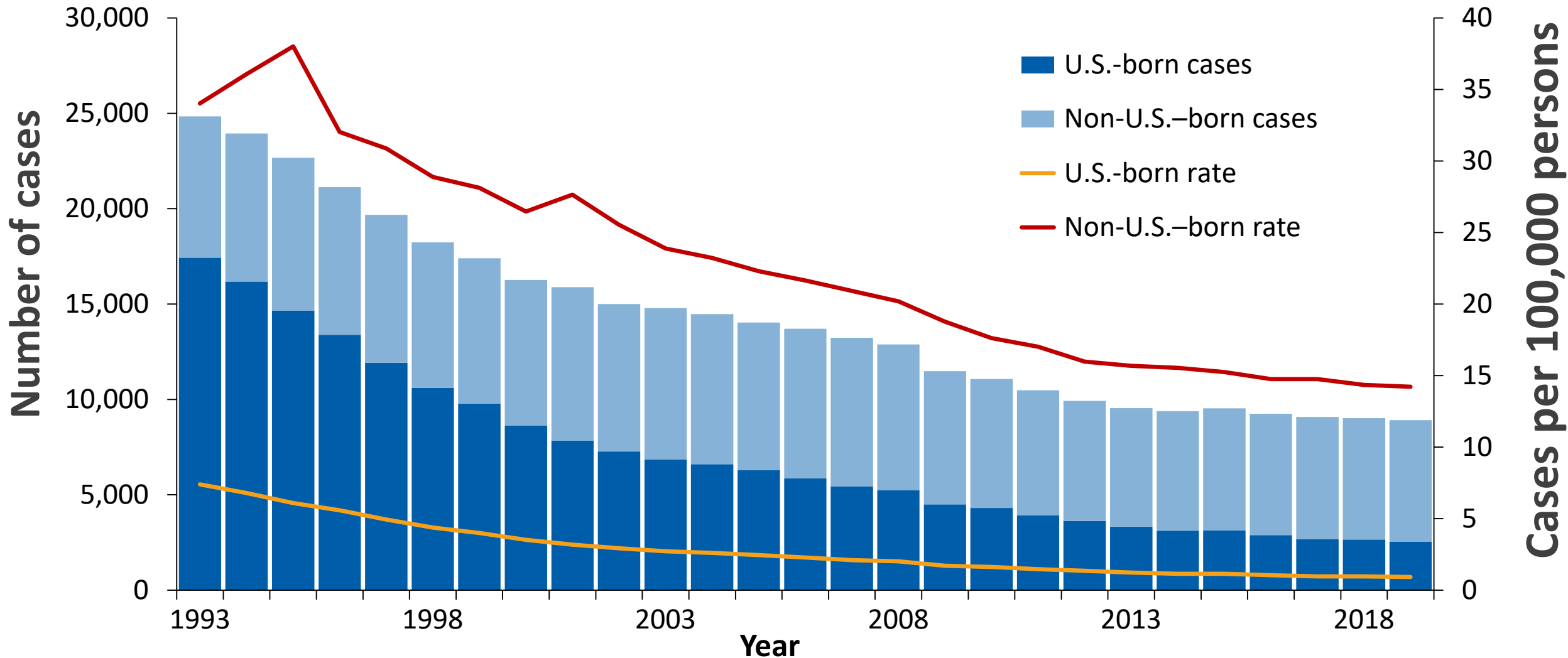
QUESTION 2

Q: Do you know what the case rate is for your state?

a. Yes

b. No

TB Cases and Rates Among U.S.-born versus Non-U.S.-born Persons, United States, 1993–2019

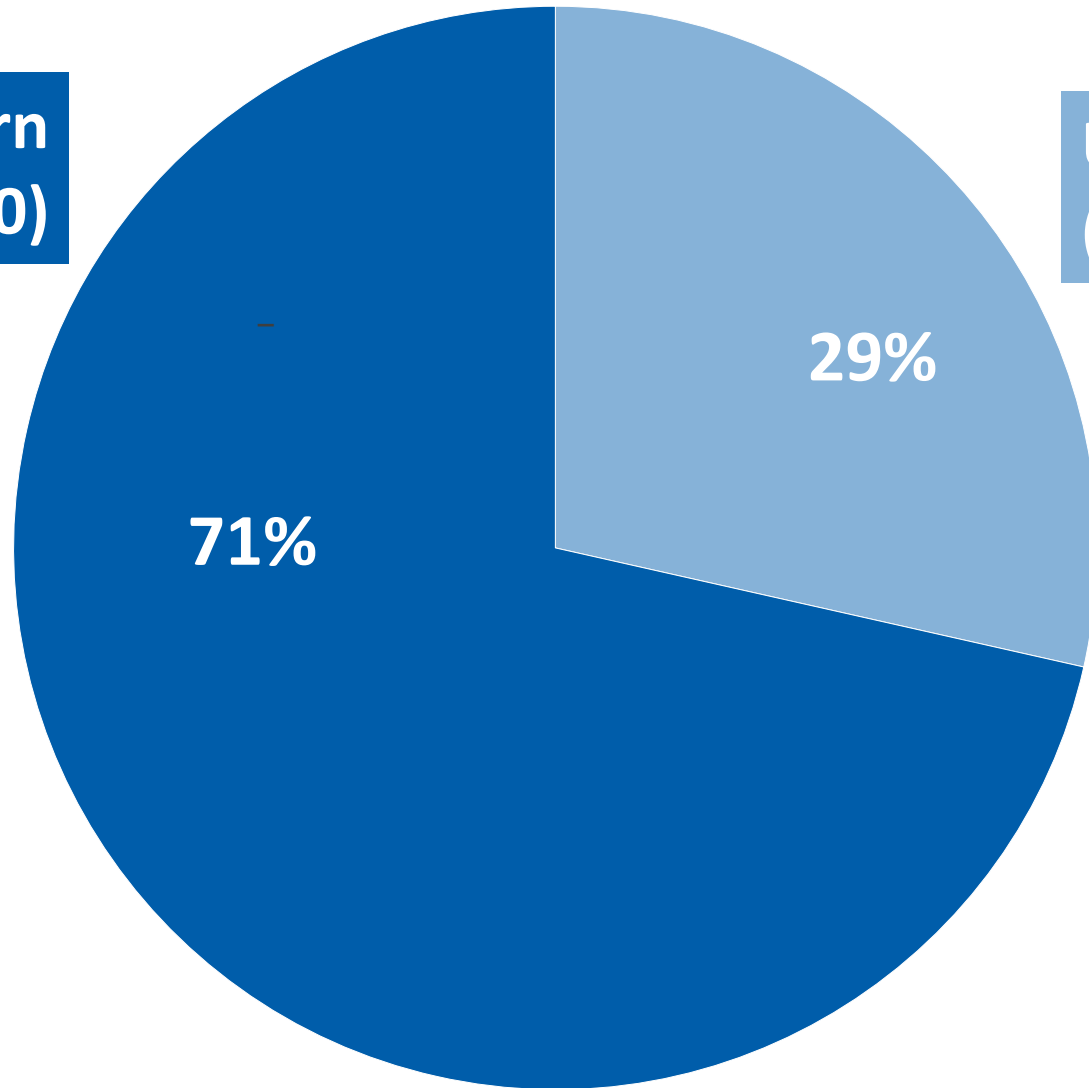


TB Cases by Origin of Birth, 2019

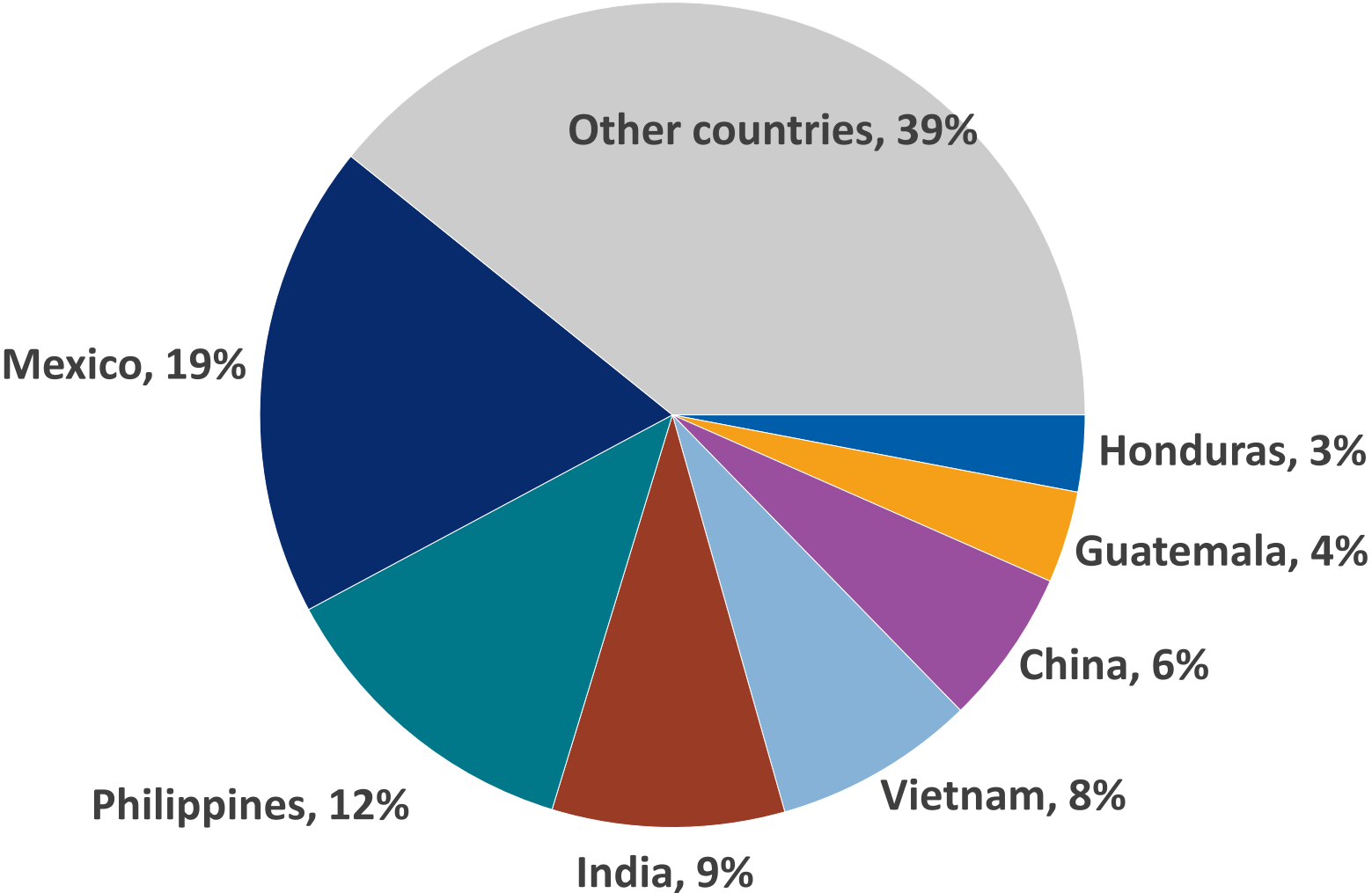
(N=8,905)

Non-U.S.-born
(Rate: 14.2 per 100,000)

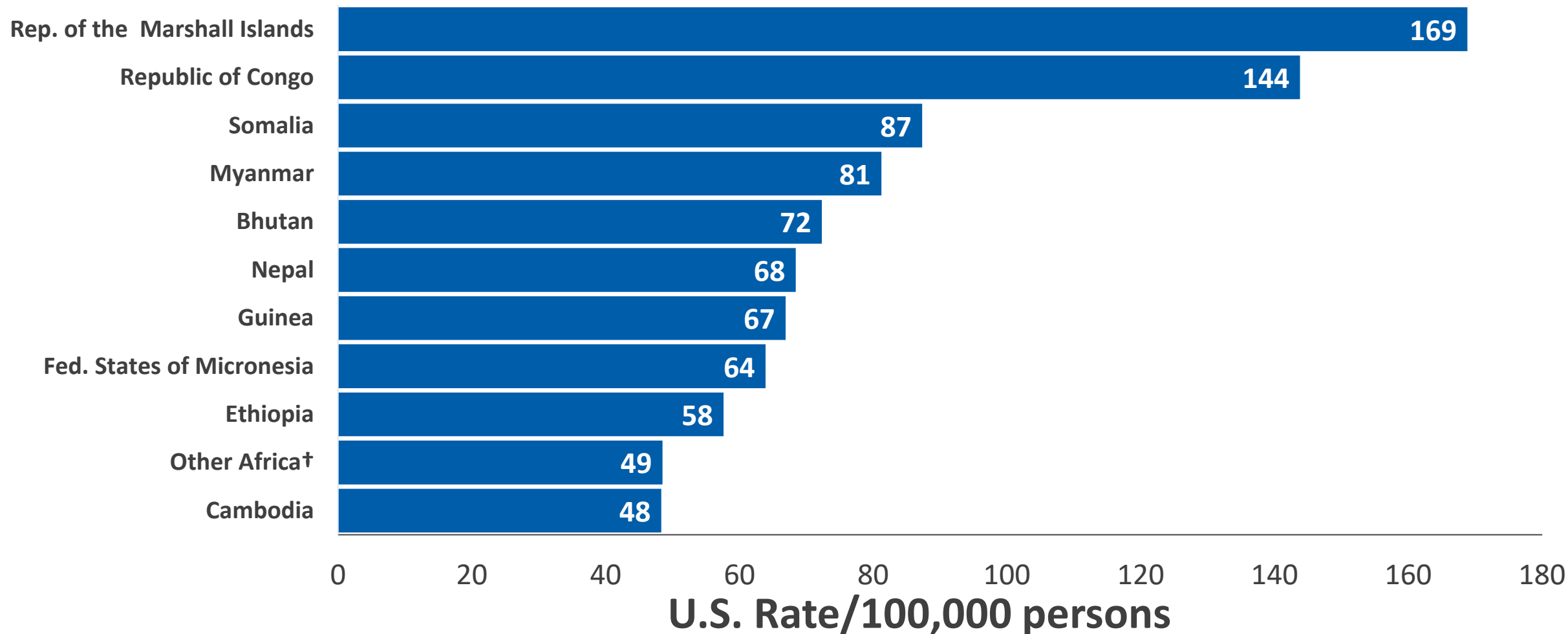
U.S.-born
(Rate: 0.9 per 100,000)



Countries of Birth Among Non-U.S.–born Persons Reported with TB, United States, 2019 (N=6,364)



TB Case Rates for Top 10 Countries of Birth* United States, 2015–2019

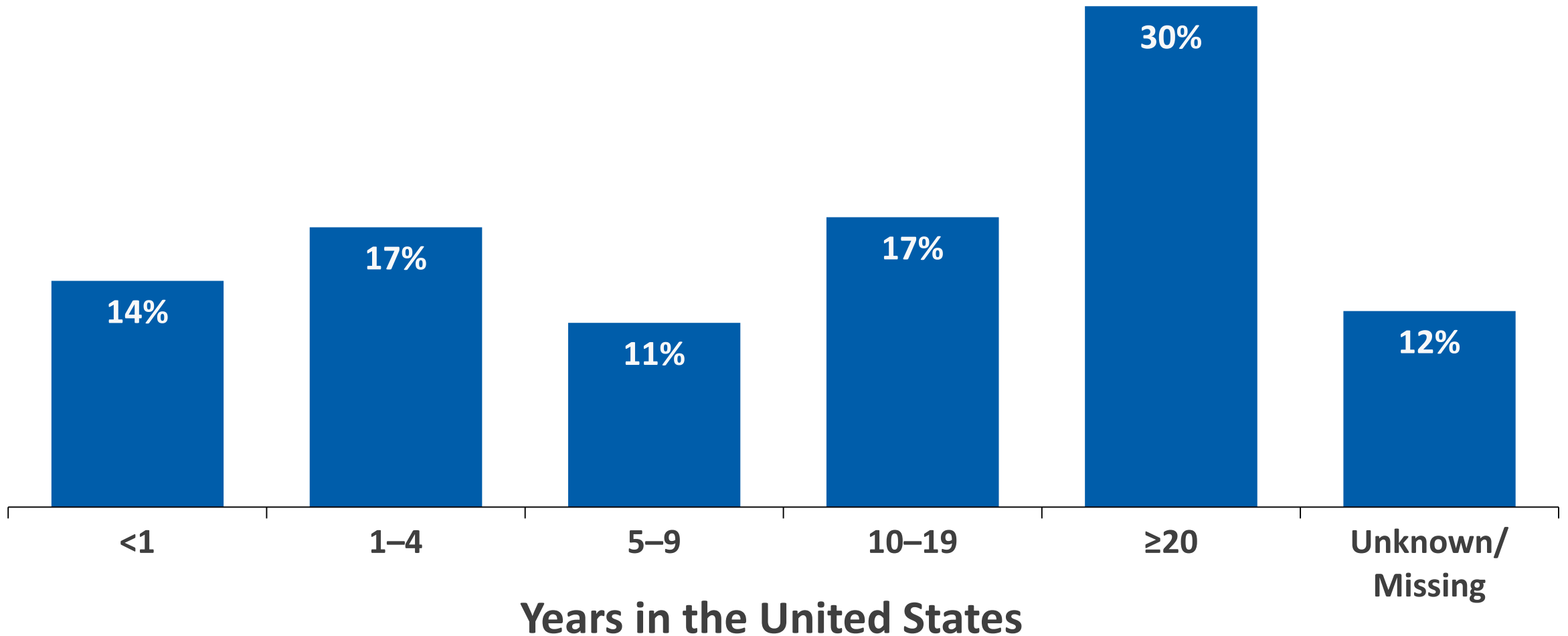


*The top 10 countries were selected based on their ranked 5-year rate of TB cases by country of birth in the United States. This list of top countries also includes the region of Other Africa.

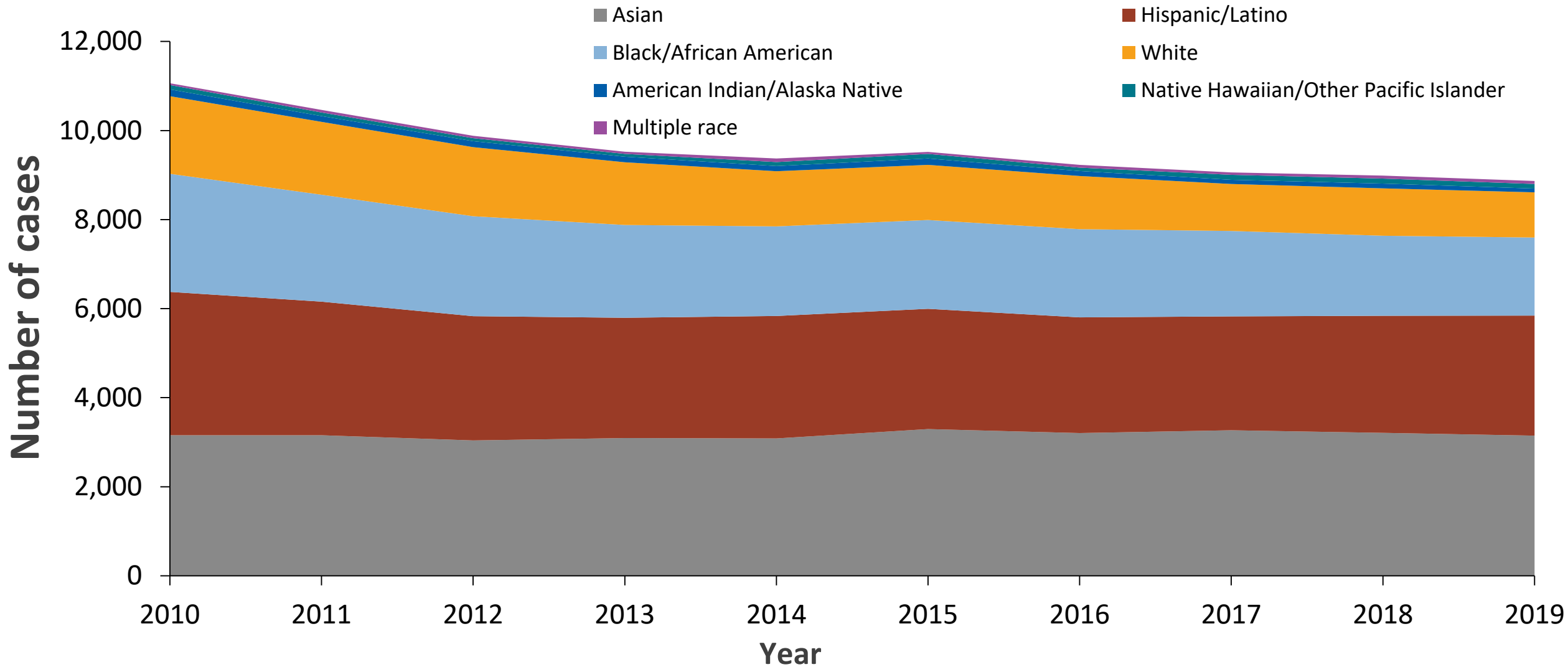
†The Other Africa region consists of Angola, Botswana, Central African Republic, Chad, Equatorial Guinea, Gabon, Lesotho, Namibia, Sao Tome & Principe, and Swaziland.

Percentage of TB Cases Among Non-U.S.–born Persons by Years Since Initial Arrival in the United States at Diagnosis, 2019 (N=6,364)

Percentage of TB cases



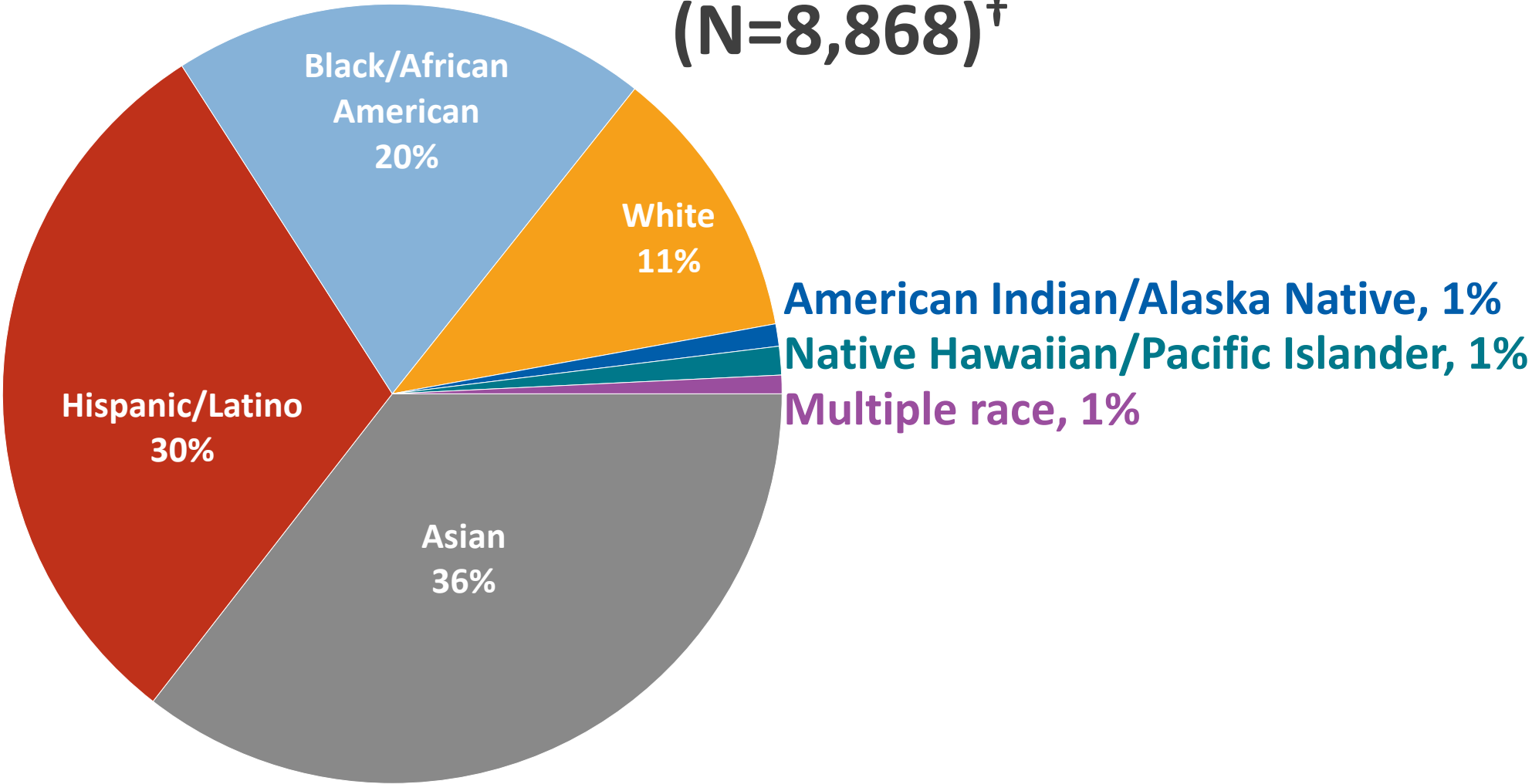
Reported TB Cases by Race/Ethnicity,* United States, 2010–2019



* All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

Reported TB Cases by Race/Ethnicity,* United States, 2019

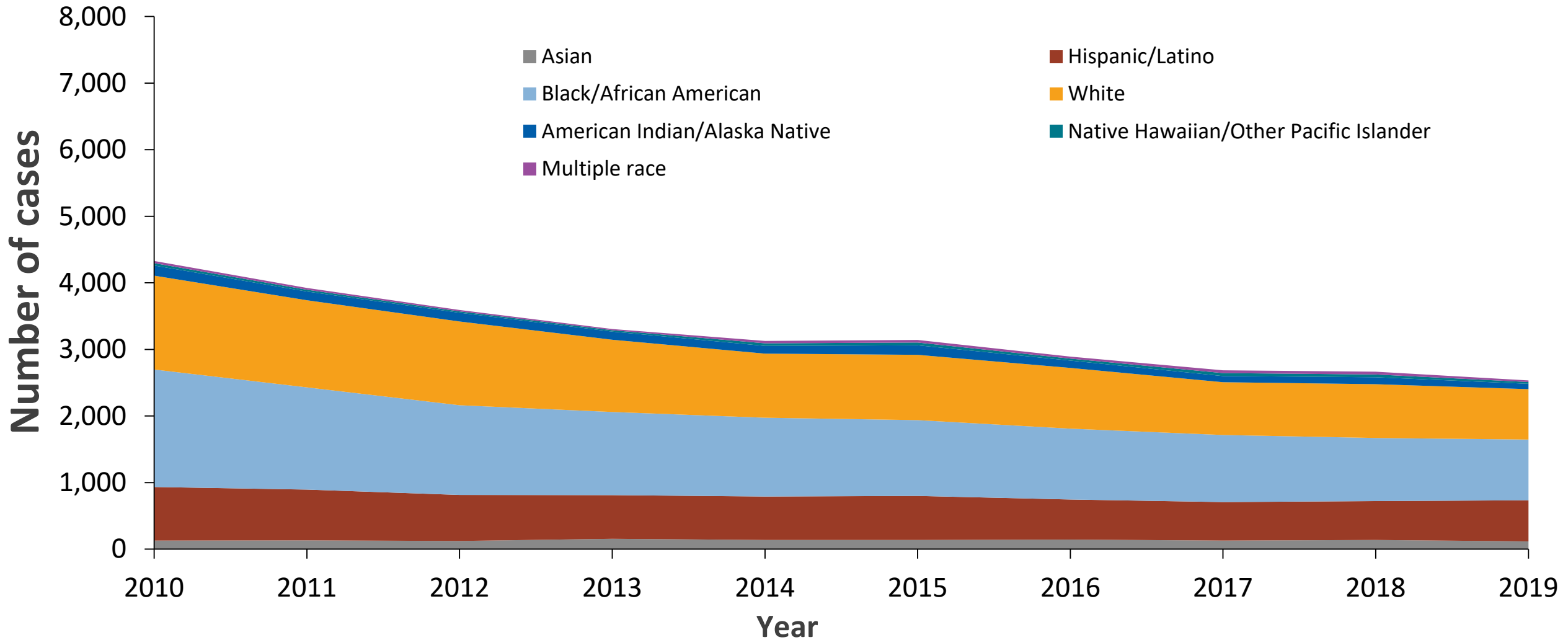
(N=8,868)[†]



* All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

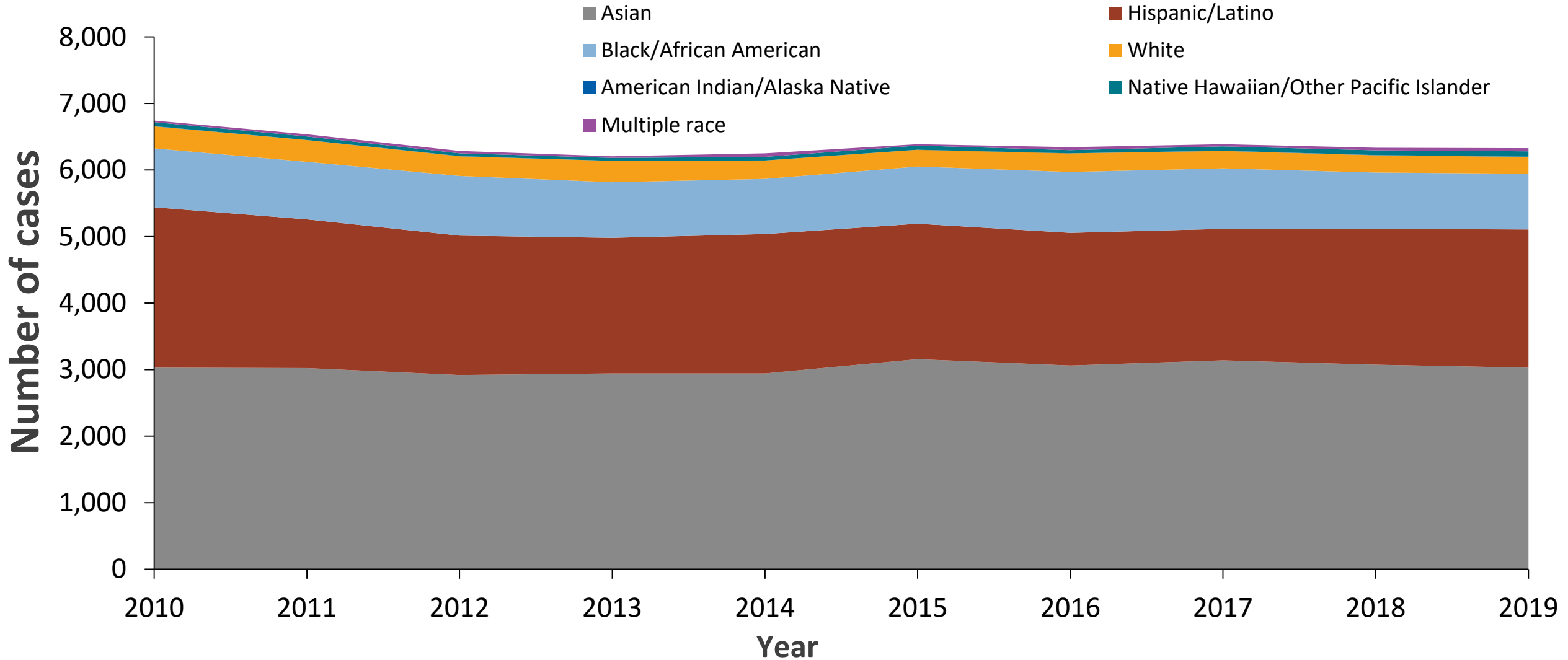
[†] Excludes unknown/missing values

Reported TB Cases Among U.S.-born Persons by Race/Ethnicity,* United States, 2010–2019



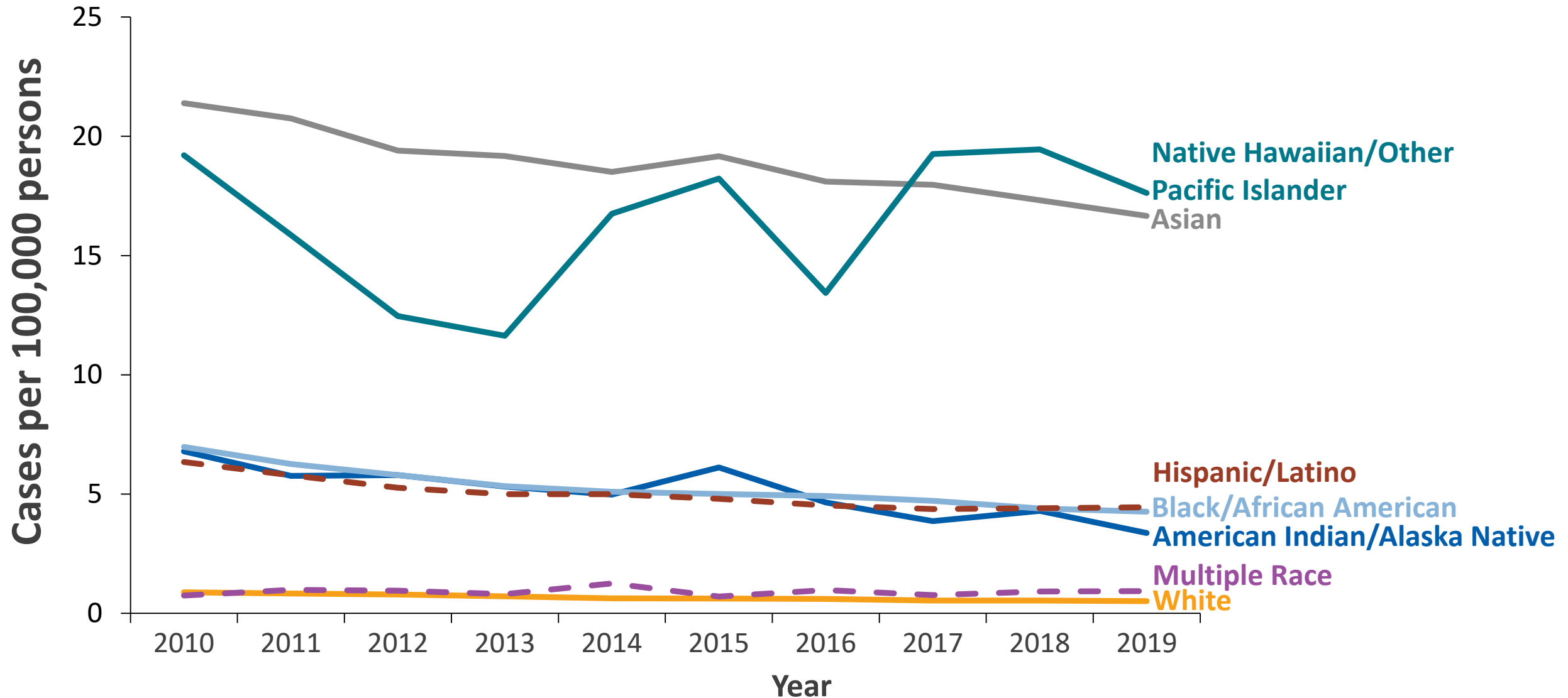
* All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

Reported TB Cases Among Non-U.S.–born Persons by Race/Ethnicity,* United States, 2010–2019



* All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

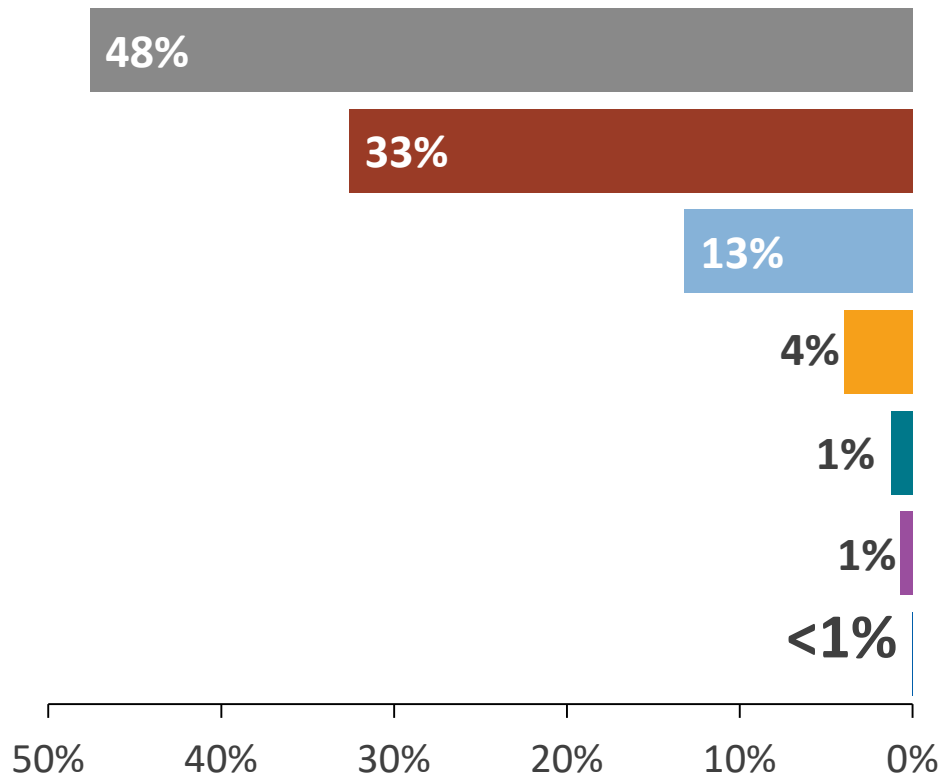
TB Case Rates by Race/Ethnicity*, United States, 2010–2019



*All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

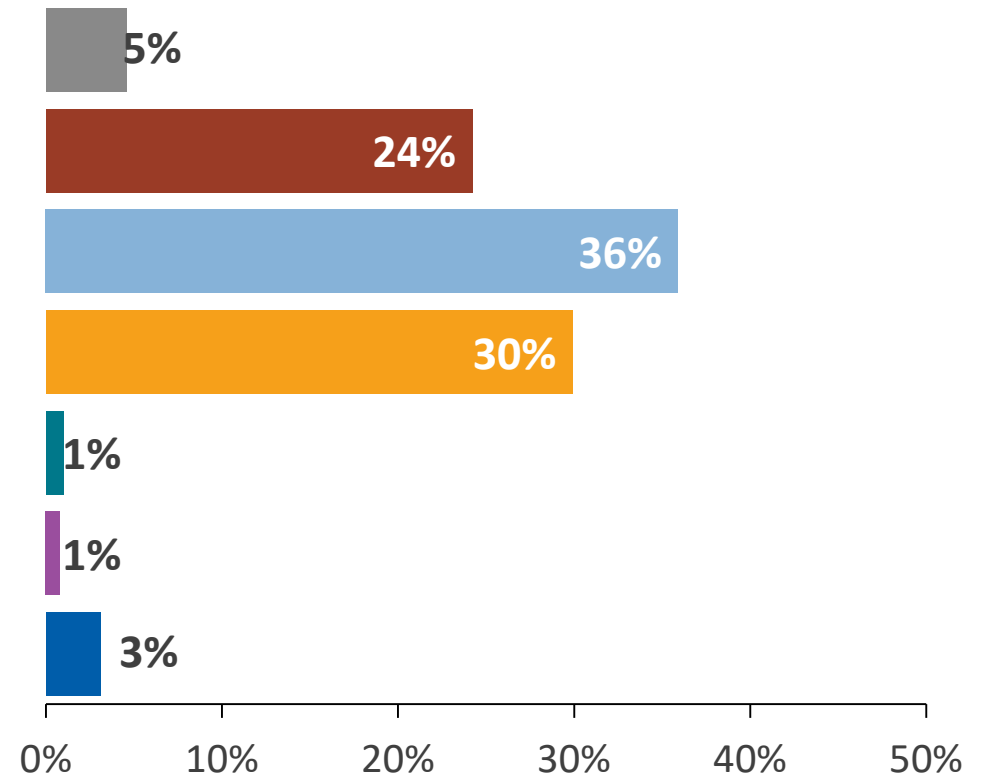
Reported TB Cases by Origin and Race/Ethnicity*, United States, 2019[†]

Non-U.S.–born persons[§]
(N=6,335)



Asian
Hispanic/Latino
Black/African American
White
Native Hawaiian/
Pacific Islander
Multiple Race
American Indian/
Alaska Native

U.S.-born persons
(N=2,541)

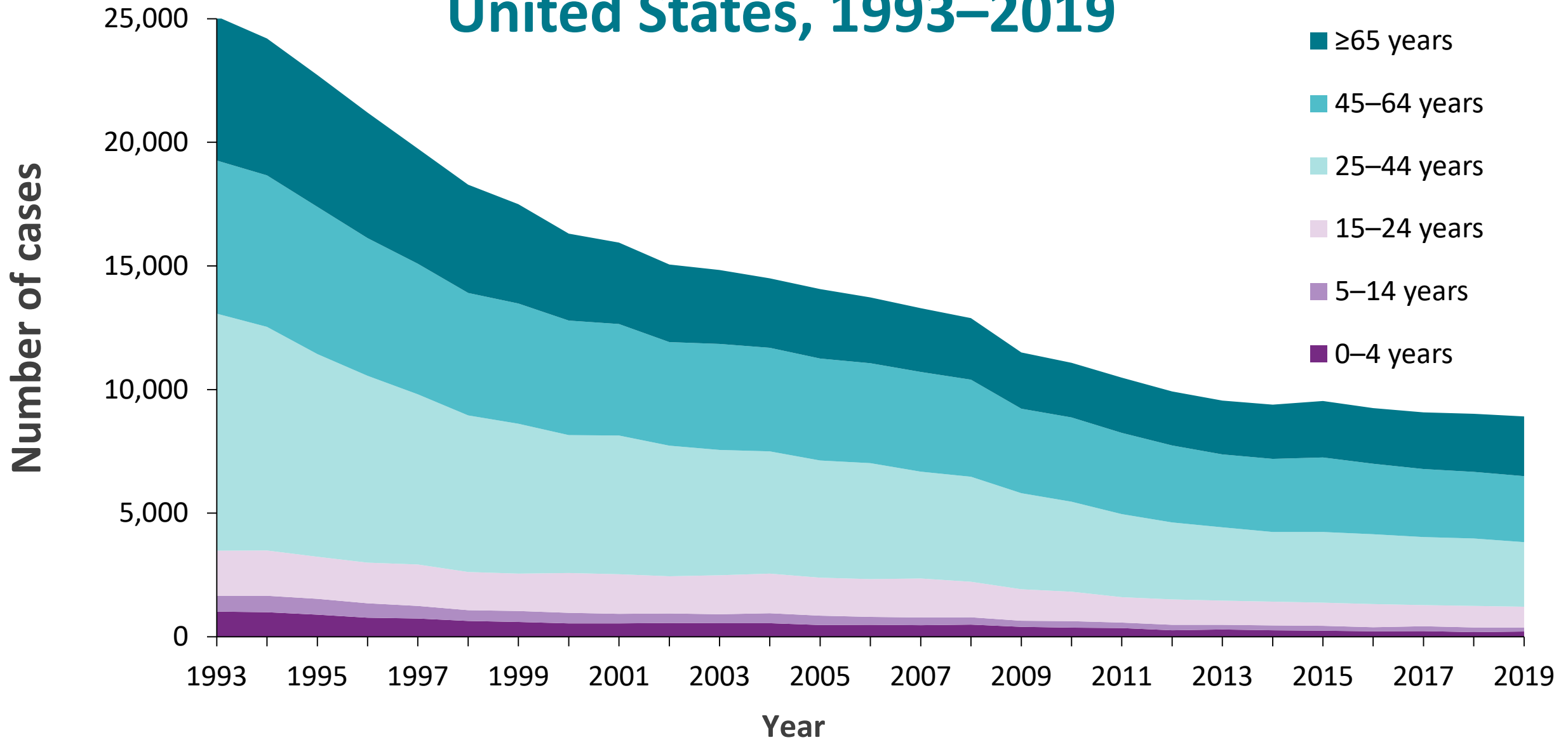


* All races are non-Hispanic; multiple race indicates two or more races reported for a person but does not include persons of Hispanic/Latino origin.

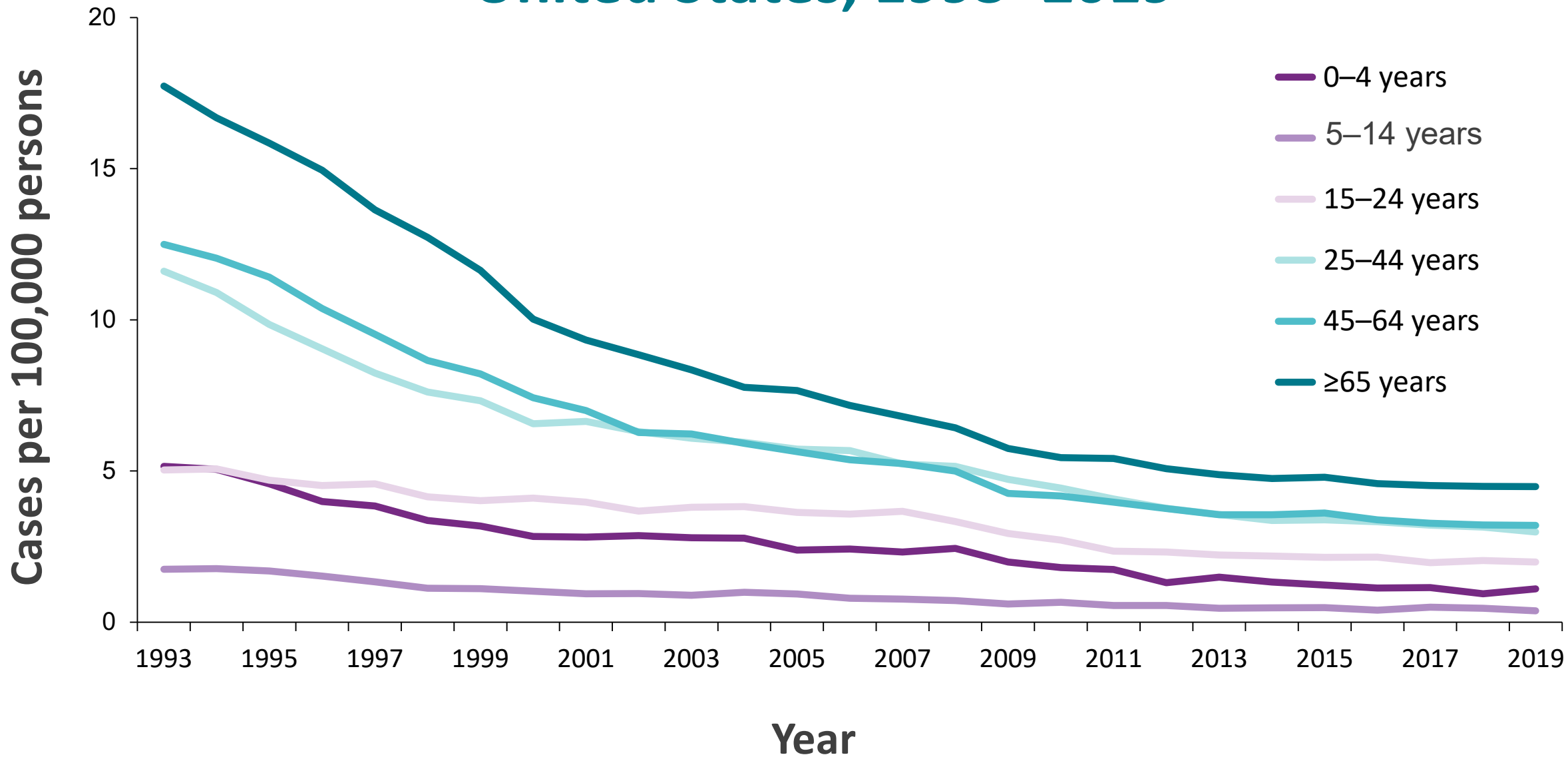
[†] Percentages are rounded.

[§] American Indian/Alaska Native accounted for <1% of cases among non-U.S.–born persons (not shown).

Reported TB Cases by Age Group, United States, 1993–2019



TB Case Rates by Age Group, United States, 1993–2019

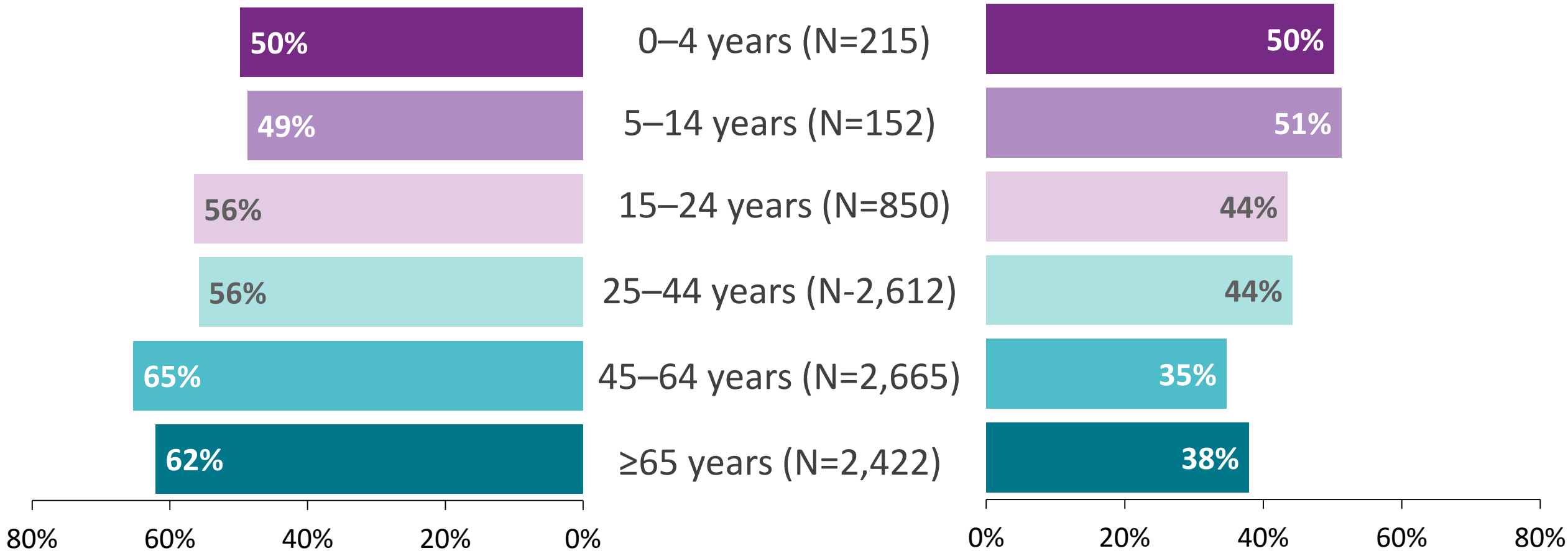


Distribution of Sex by Age Group, United States, 2019

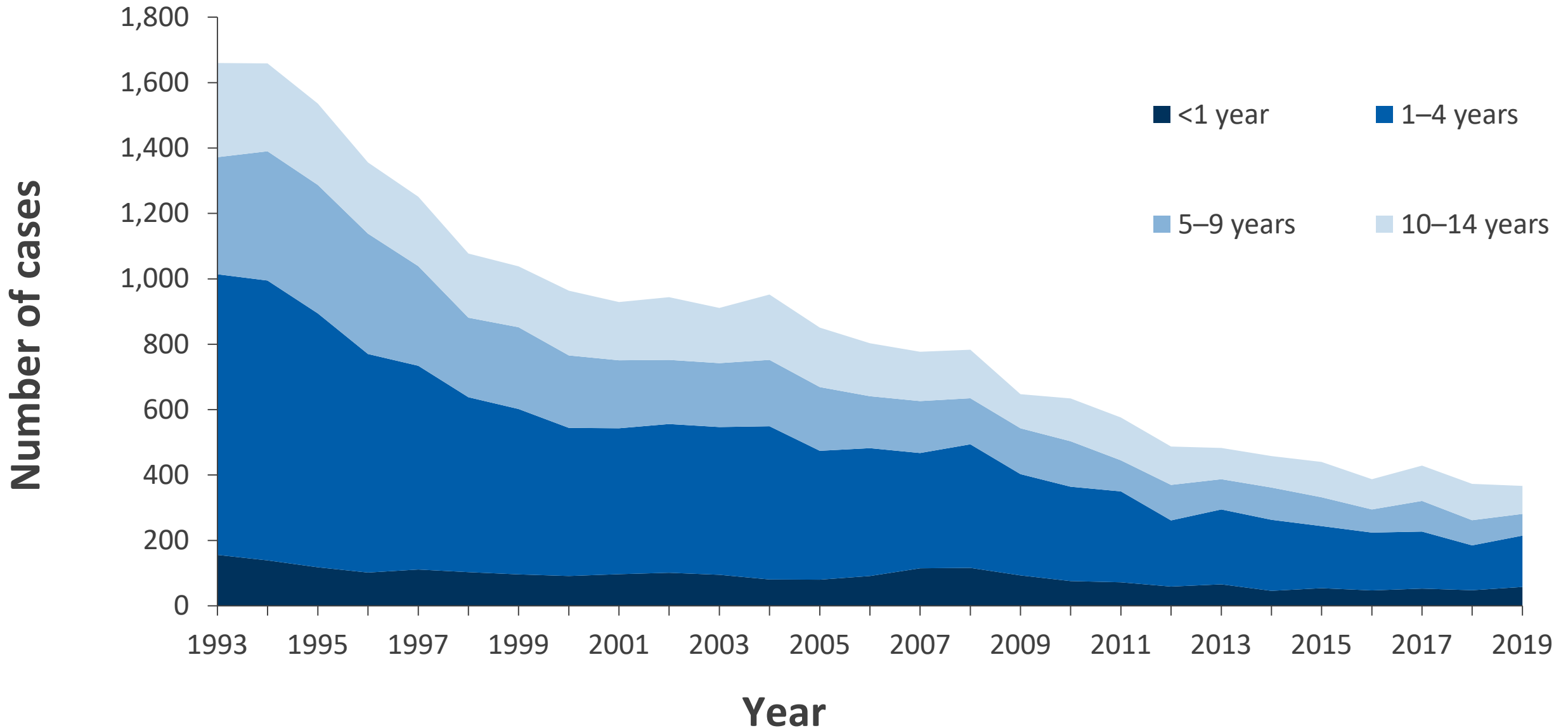
Males (N=5,361)

Females (N=3,555)

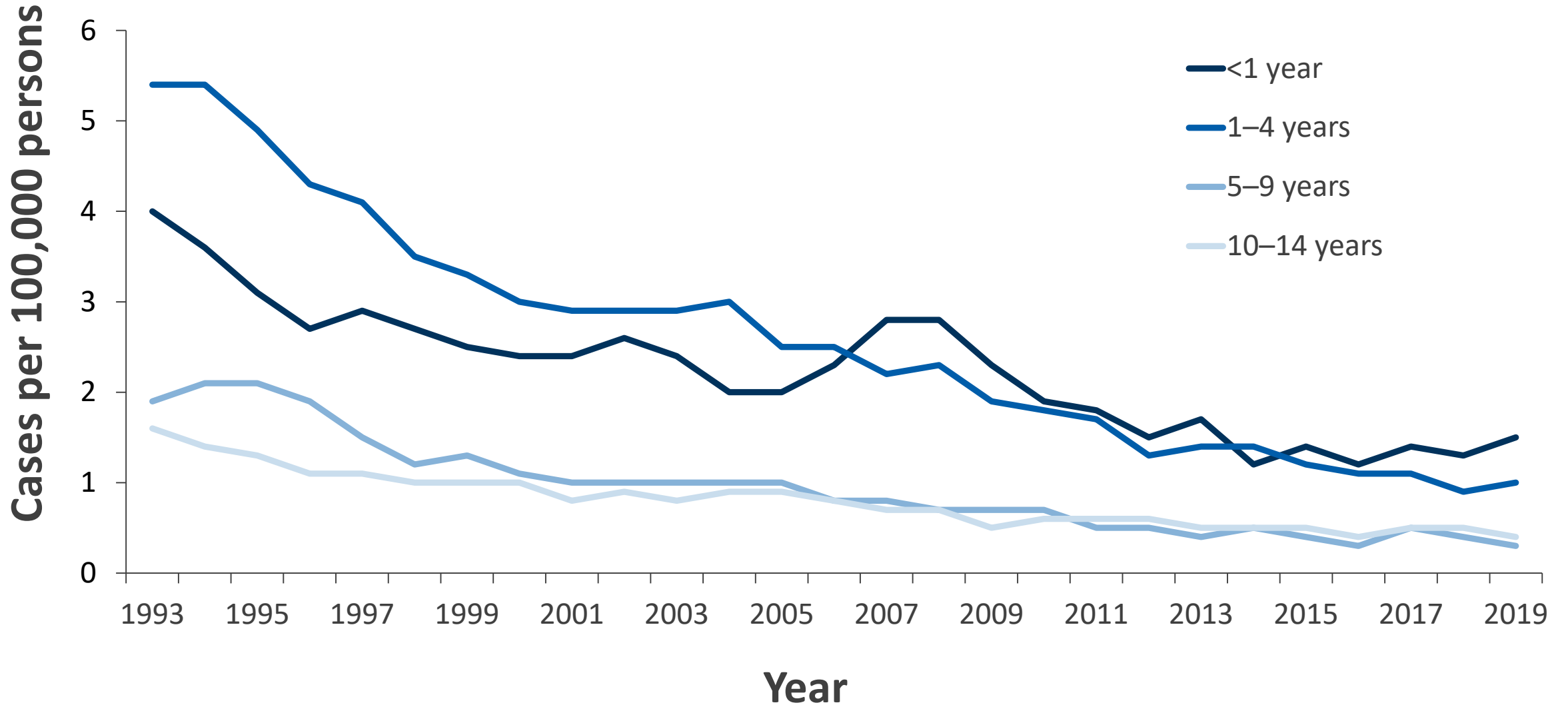
Age Group



Pediatric TB Cases by Age Group, 1993–2019

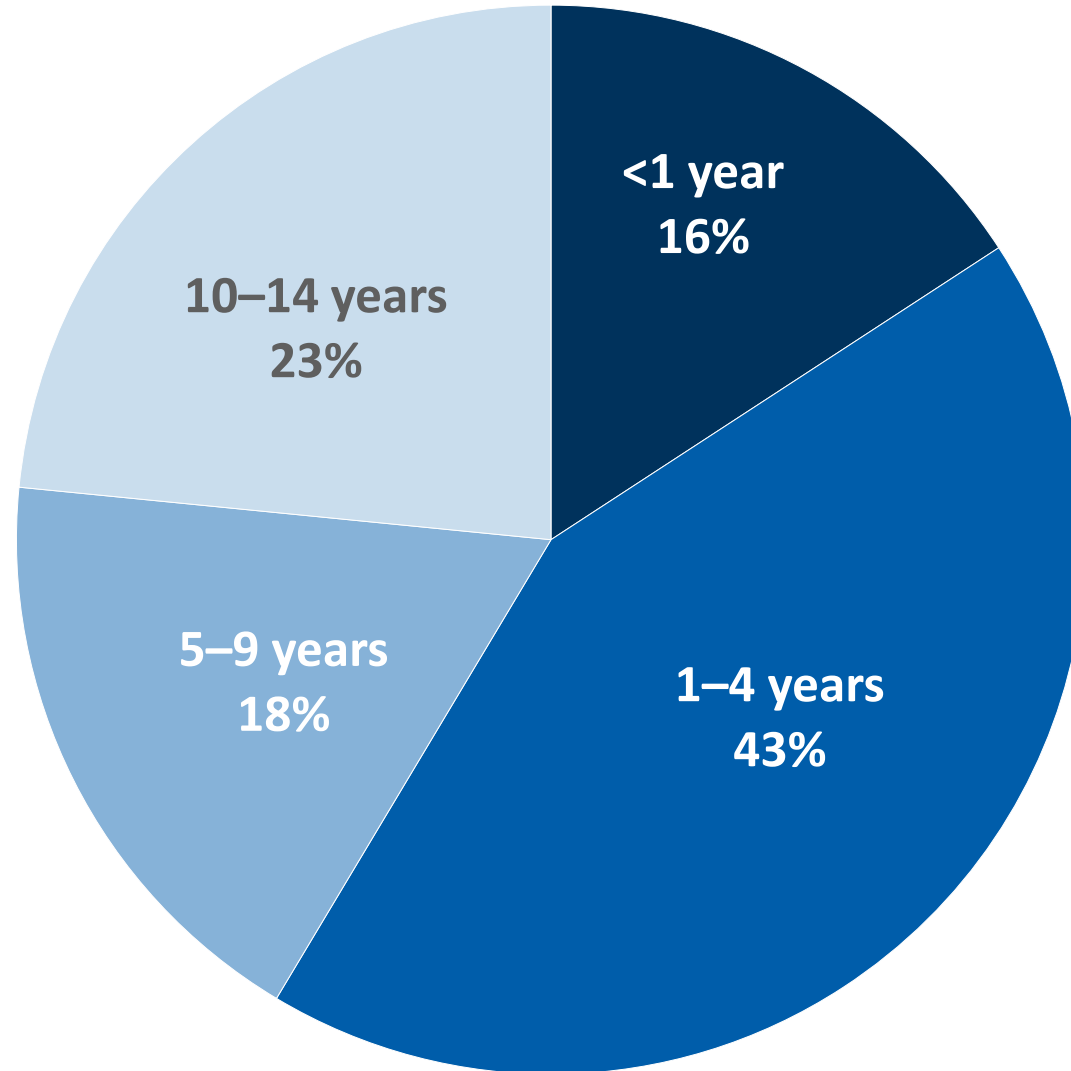


Pediatric TB Case Rates by Age Group, 1993–2019

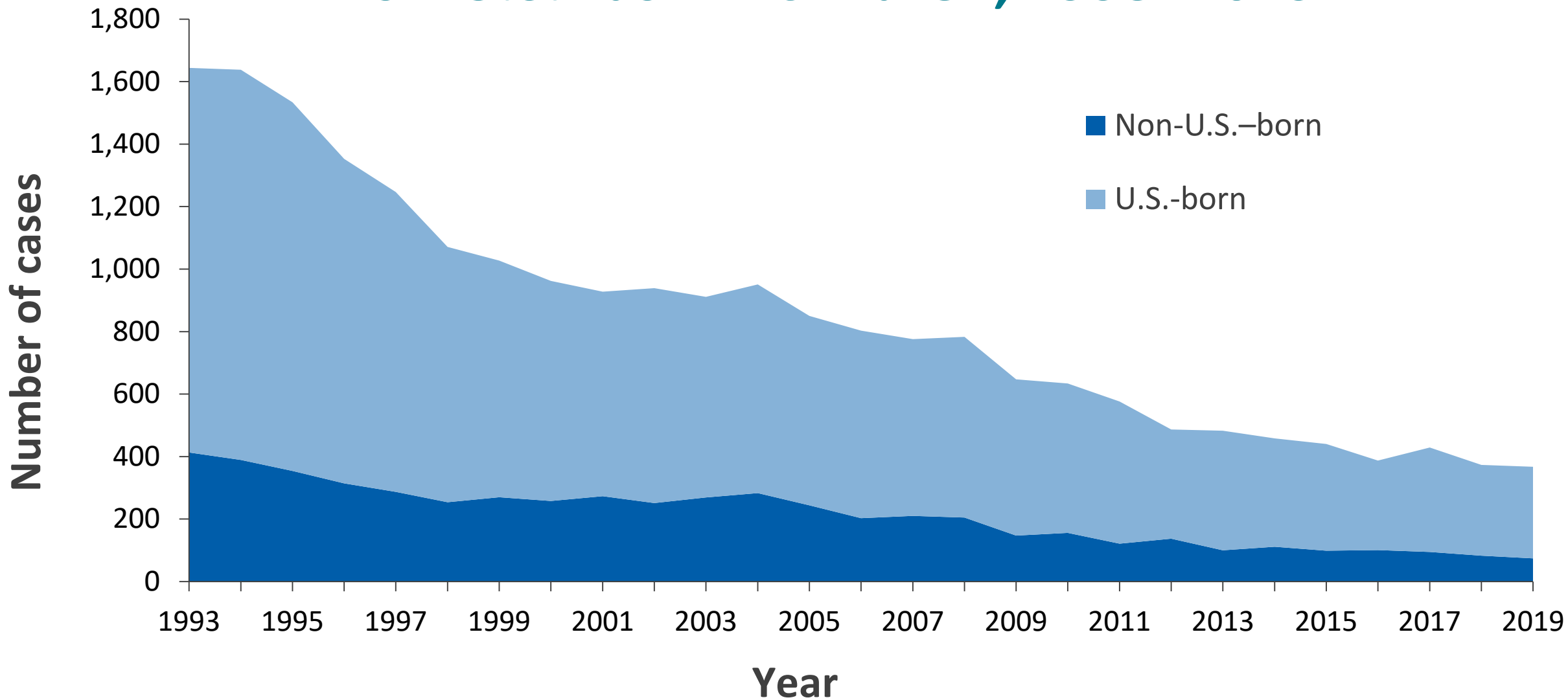


Pediatric TB Cases by Age Group, 2019

(N=367)

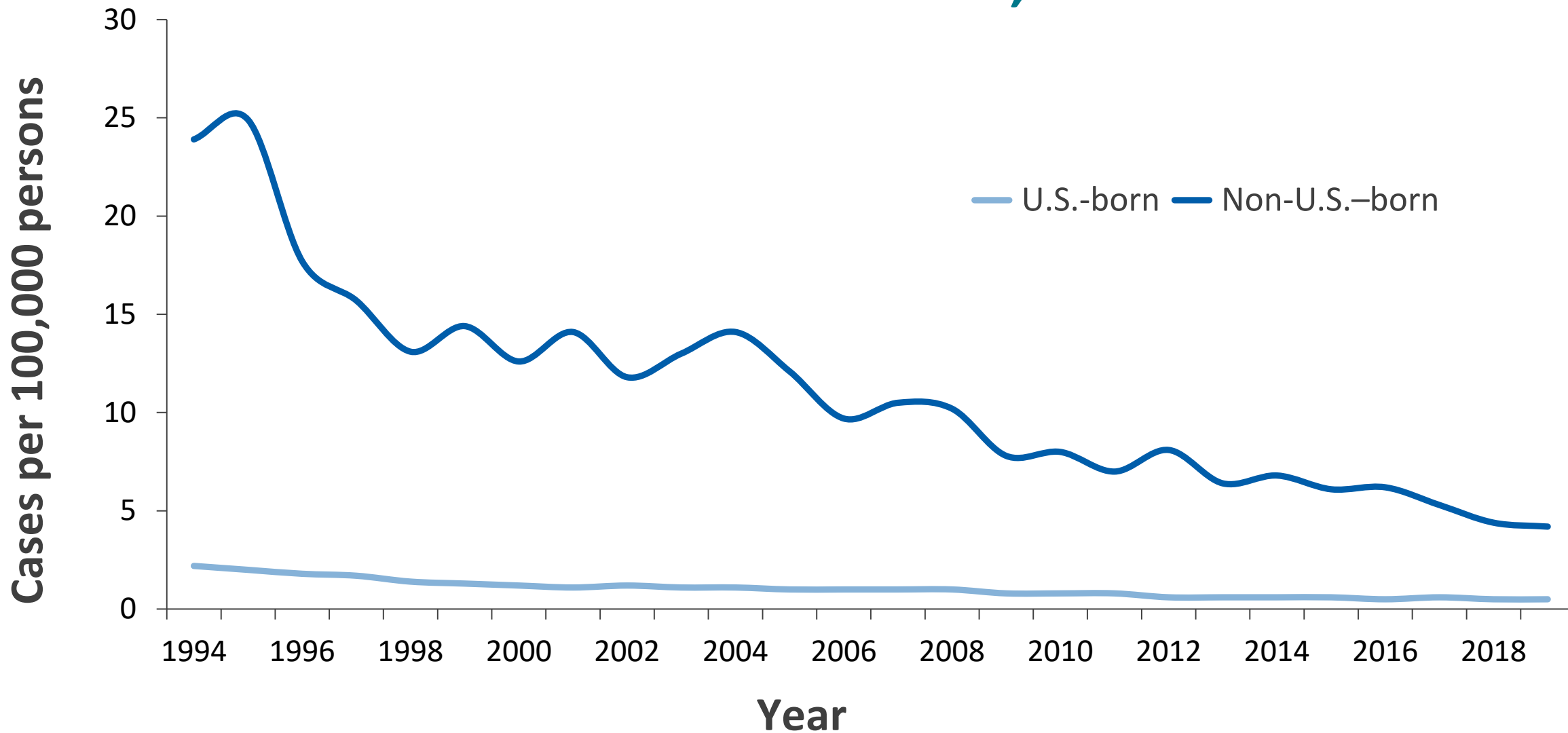


Number of Pediatric TB Cases among U.S.-born and Non-U.S.-born* Children, 1993–2019



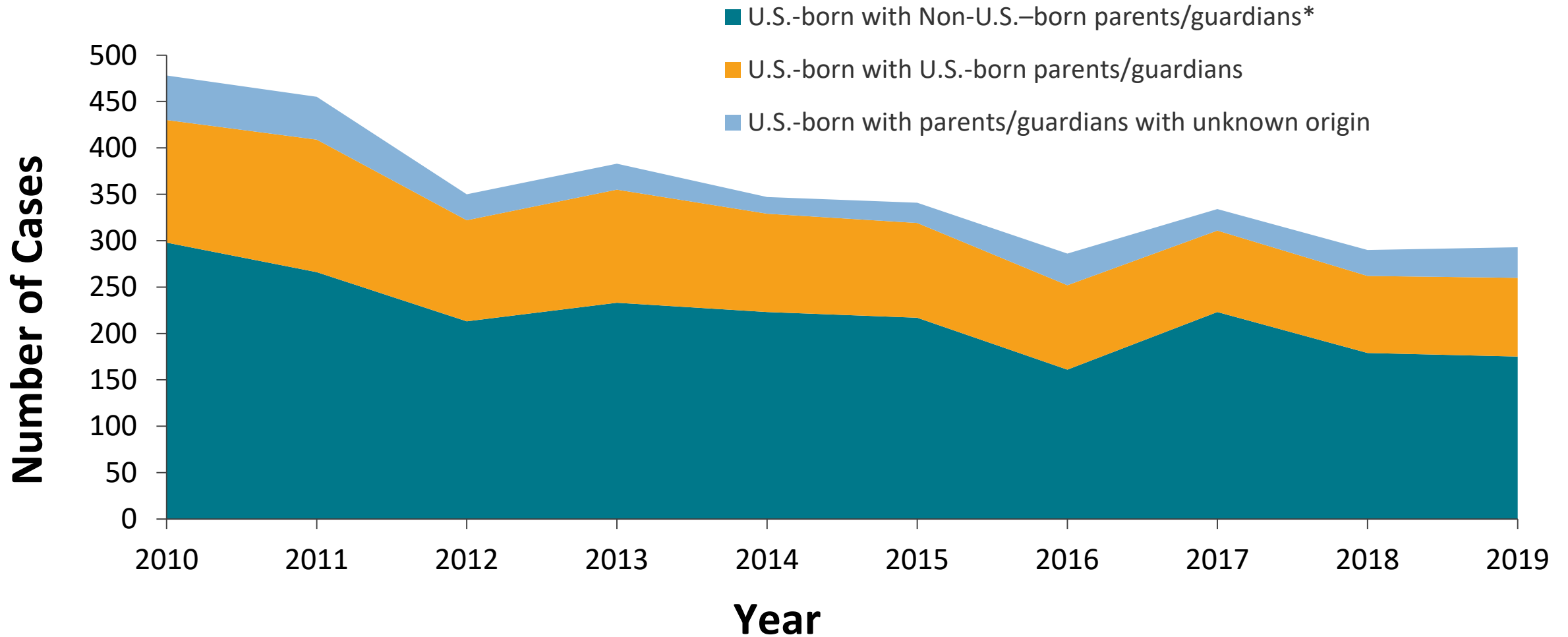
*Non-U.S.-born refers to persons born outside the United States or its territories or not born to a U.S. citizen

Pediatric TB Case Rates for U.S.-born and Non-U.S.-born* Children, 1993–2019



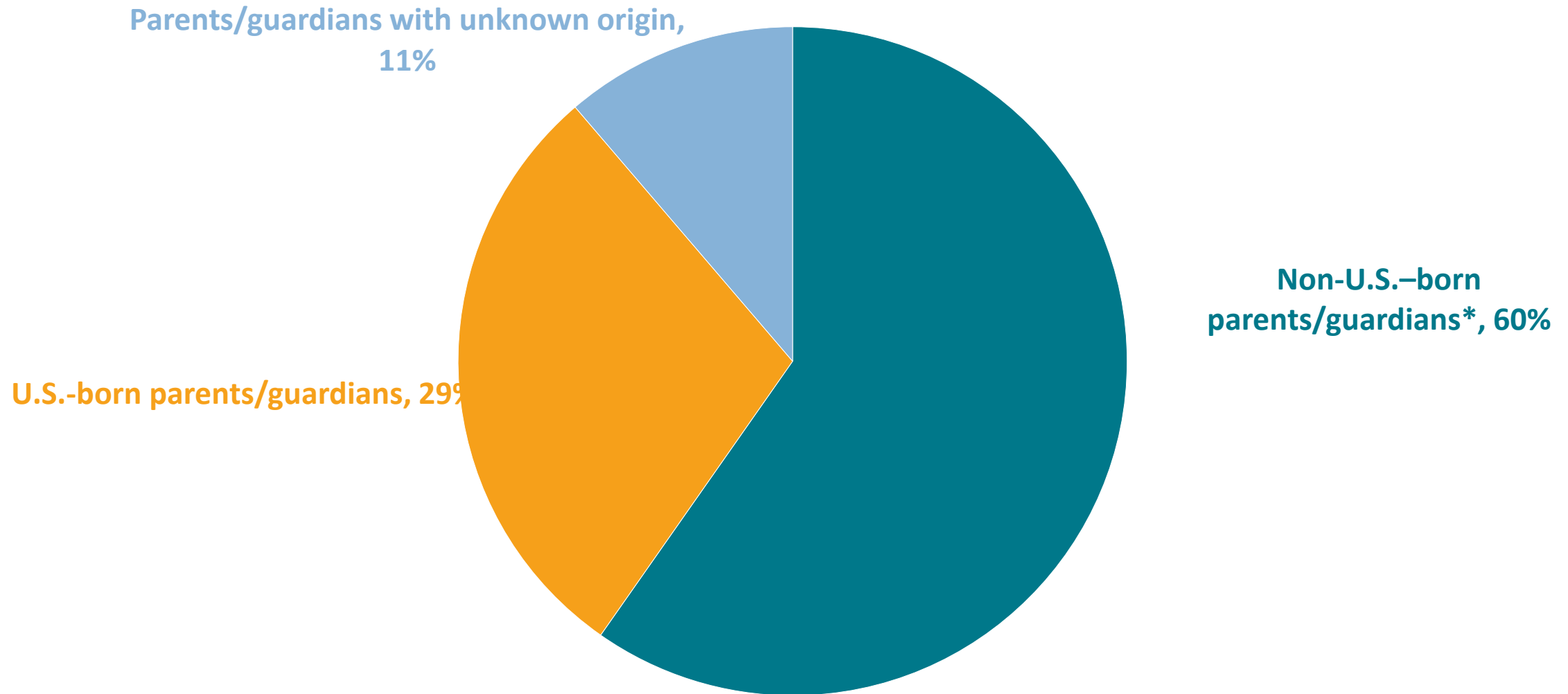
*Non-U.S.-born refers to persons born outside the United States or its territories or not born to a U.S. citizen

Number of U.S. Pediatric TB Cases among U.S.-Born Children by Parent/Guardian Status, 2010–2019



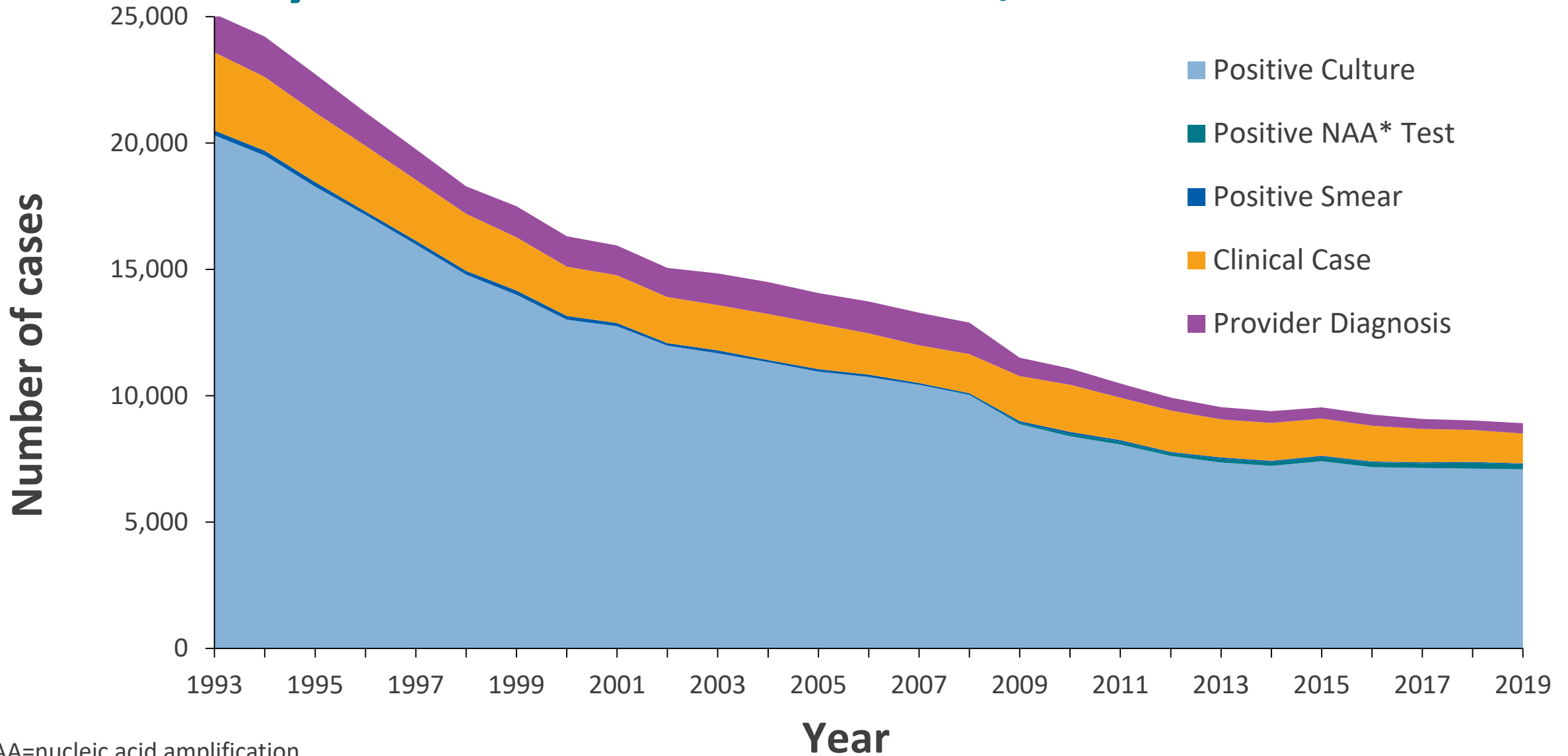
*At least one parent/guardian was non-U.S.-born

Number of Pediatric TB Cases among U.S.-born Children by Parent/Guardian Status, 2019 (N=293)



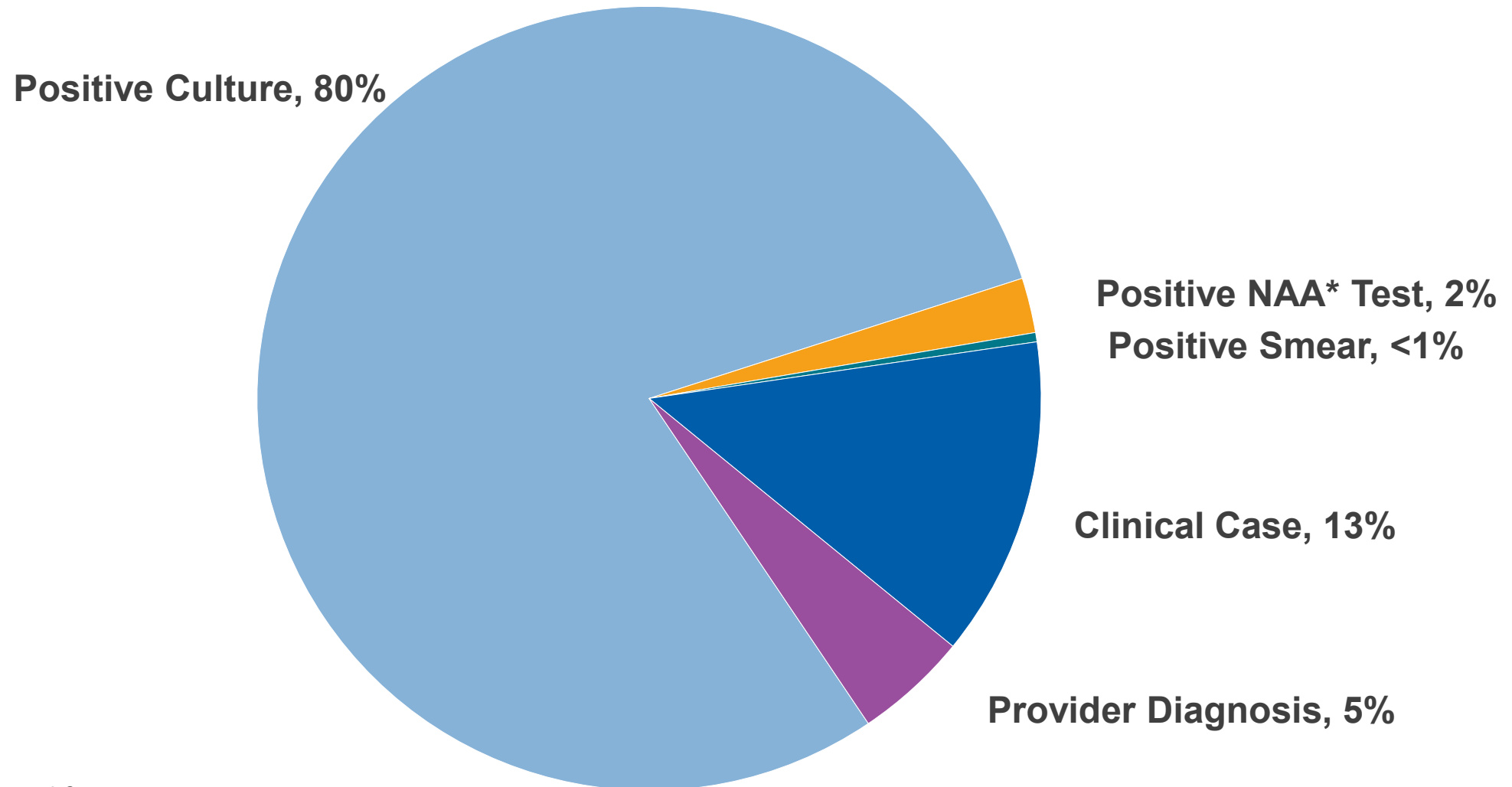
*At least one parent/guardian was non-U.S.-born.

Number of U.S. TB Cases by Case Verification Criteria, 1993–2019



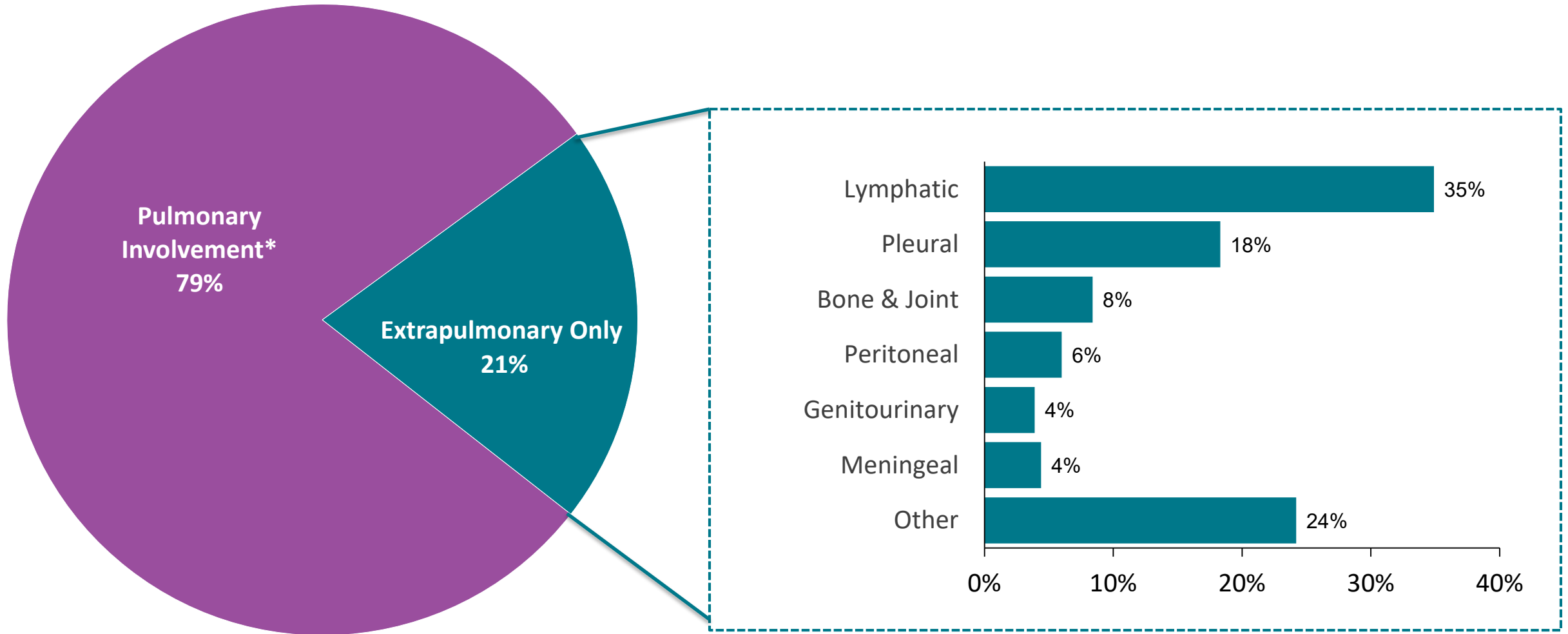
*NAA=nucleic acid amplification

Percentage of U.S. TB Cases by Case Verification Criteria, 2019 (N=8,916)



*NAA=nucleic acid amplification

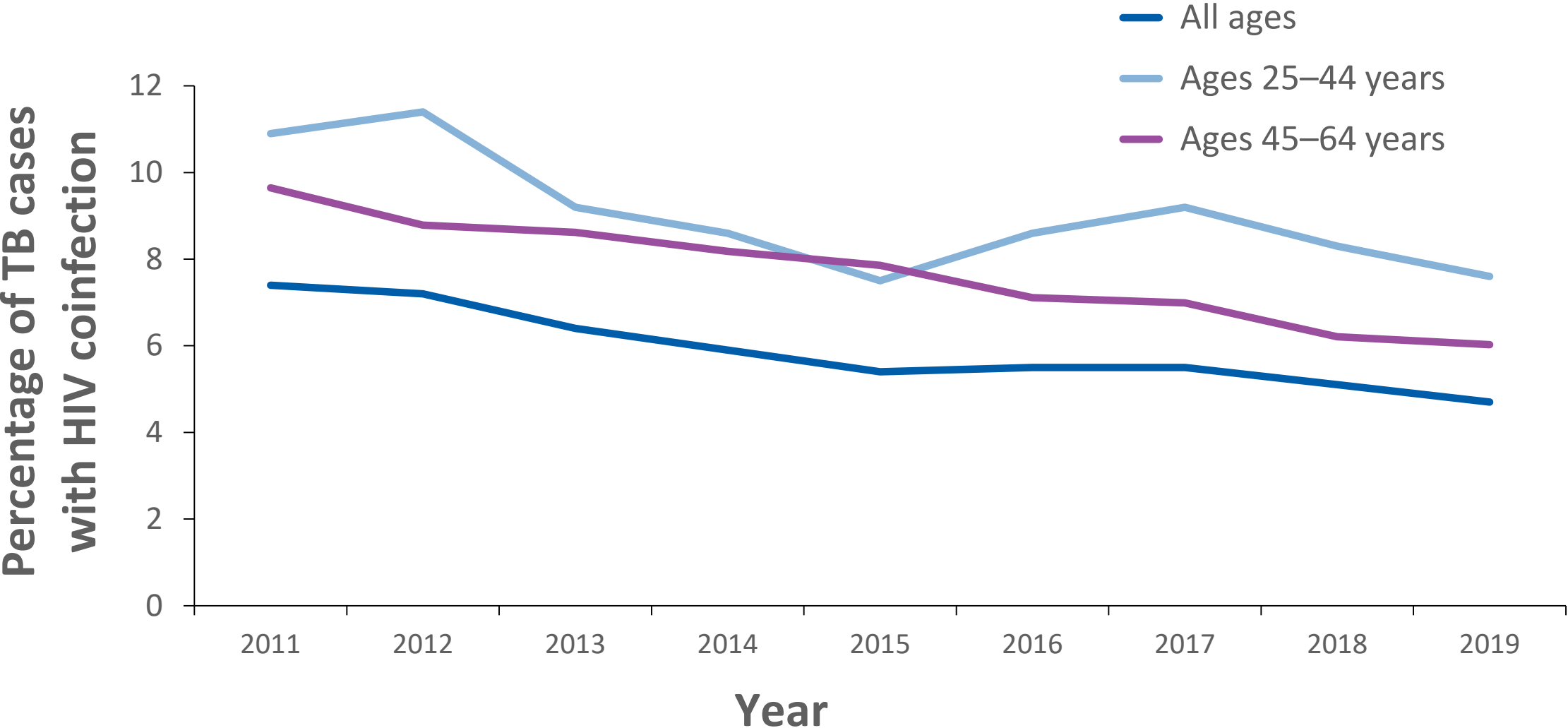
U.S. TB Cases by Site of Disease, 2019



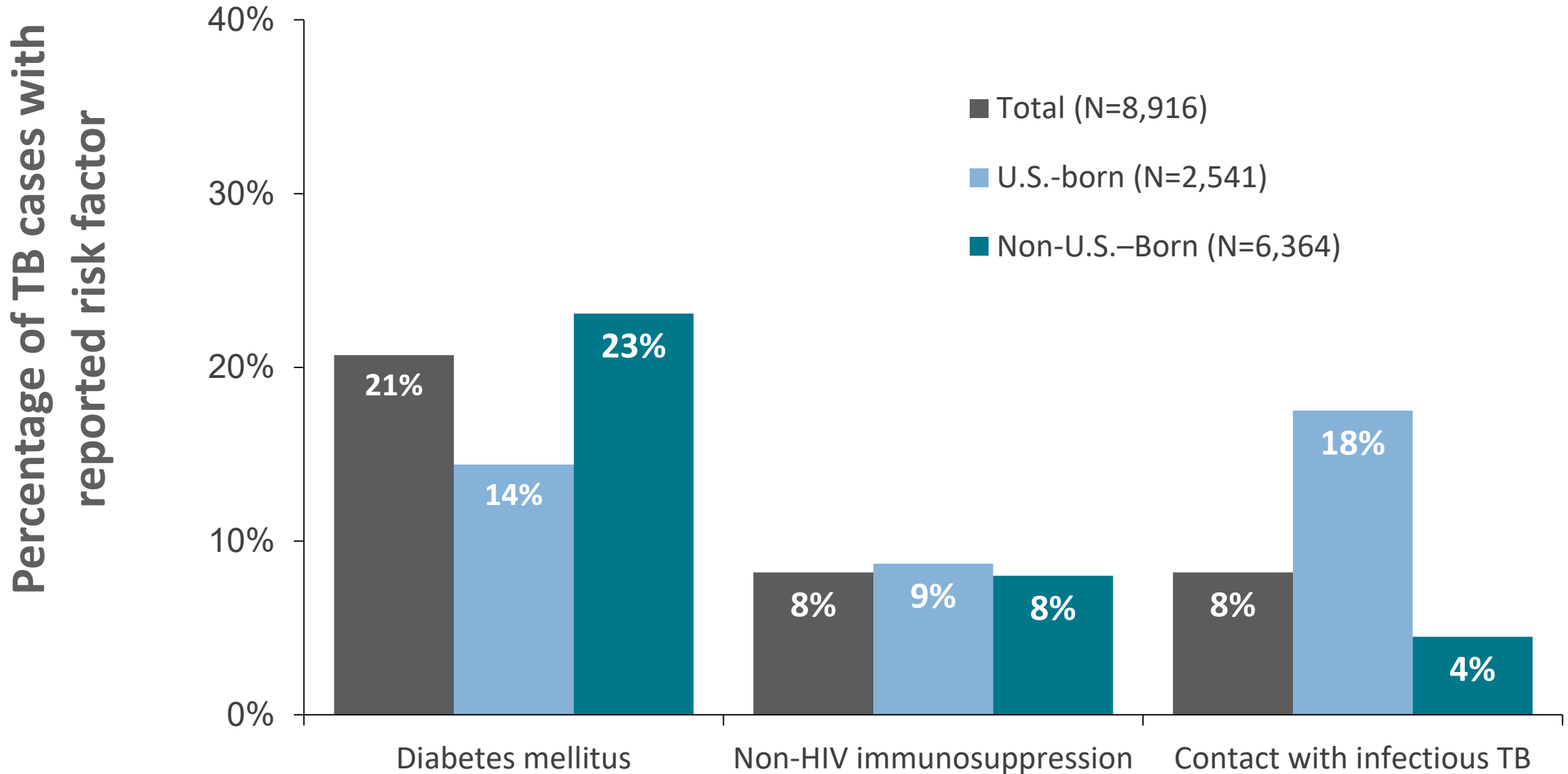
*Any pulmonary involvement which includes cases that are pulmonary only and both pulmonary and extrapulmonary.
Patients may have more than one disease site but are counted in mutually exclusive categories for surveillance purposes.

Note: Percentages are rounded.

HIV Coinfection by Age Among Persons Reported with TB, United States, 2011–2019

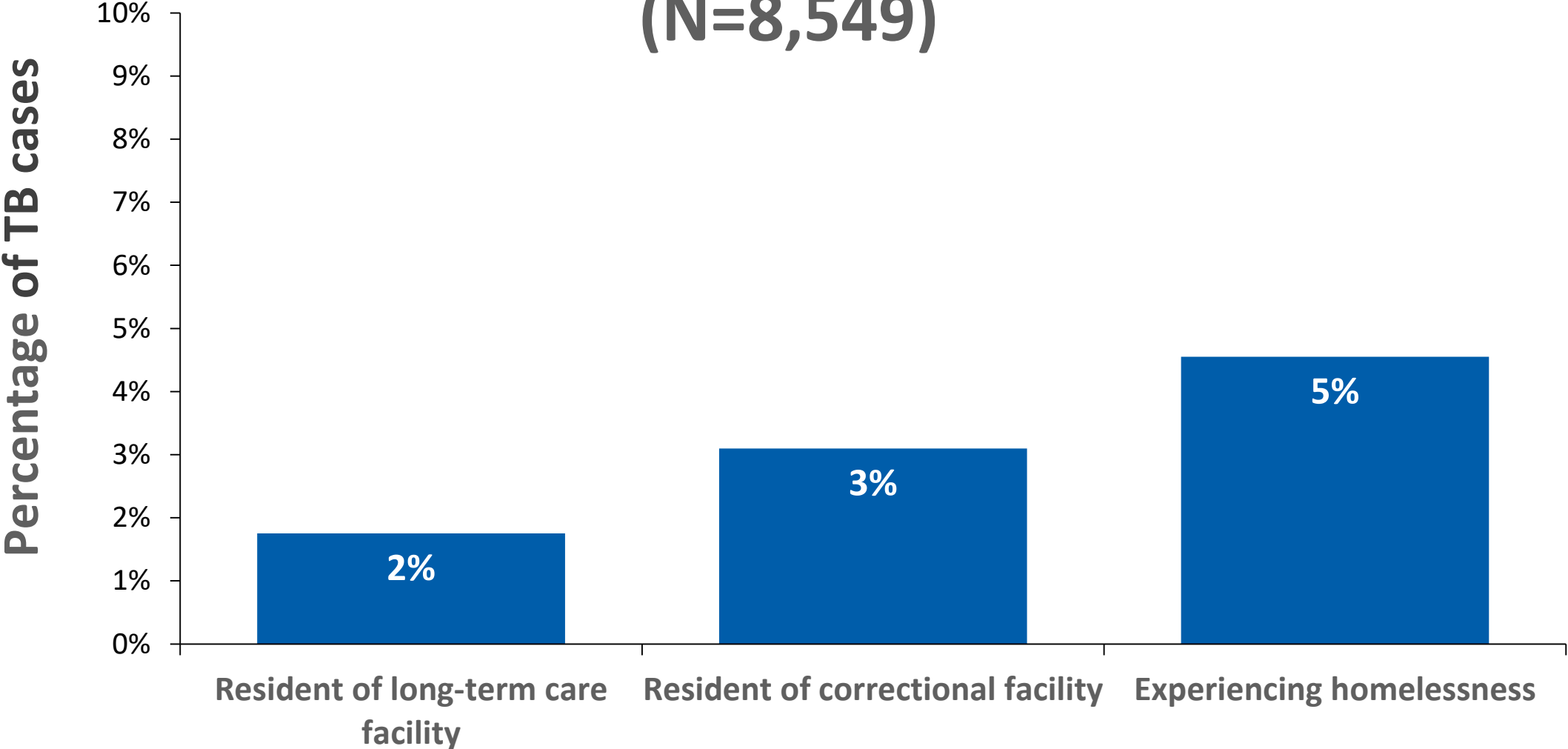


Selected Risk Factors by Origin of Birth, United States, 2019

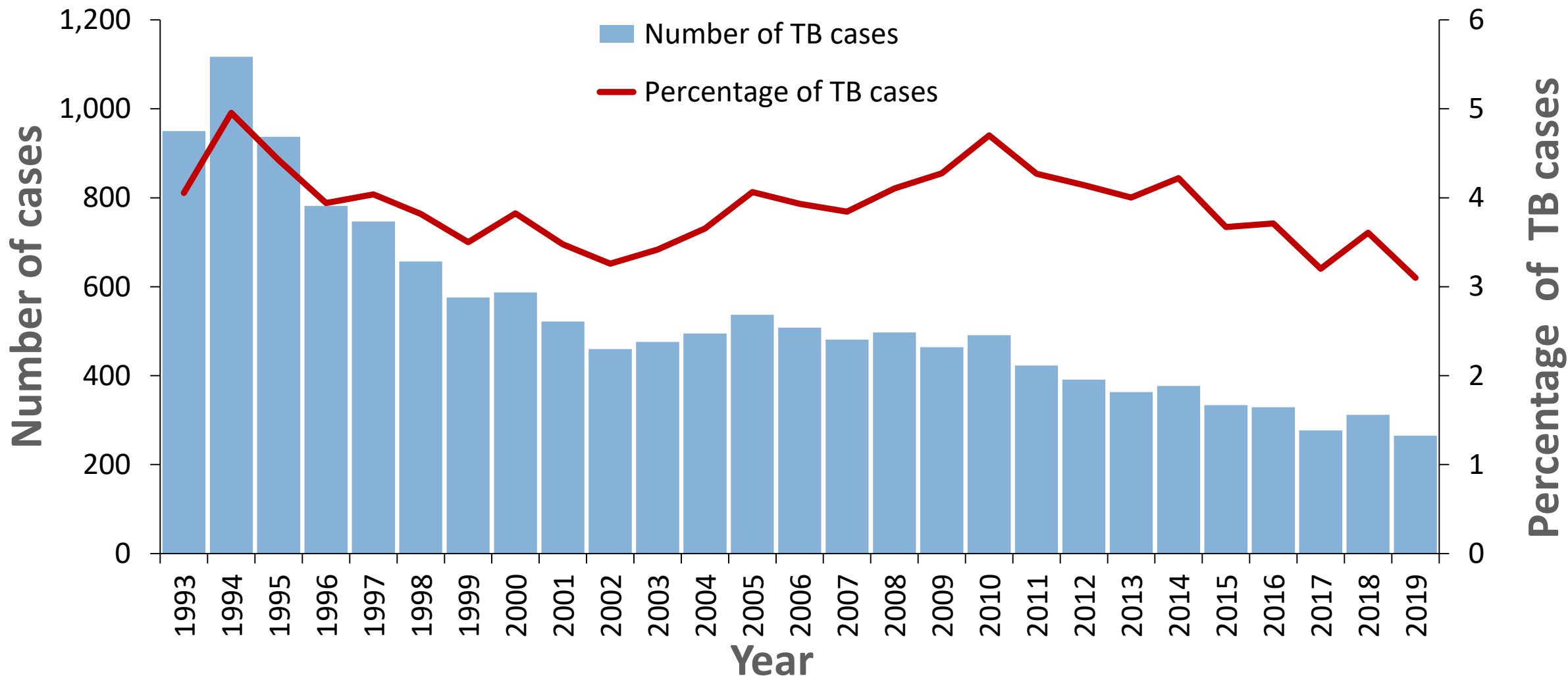


TB Cases Among Persons Aged ≥ 15 with Other Selected Risk Factors, 2019

(N=8,549)

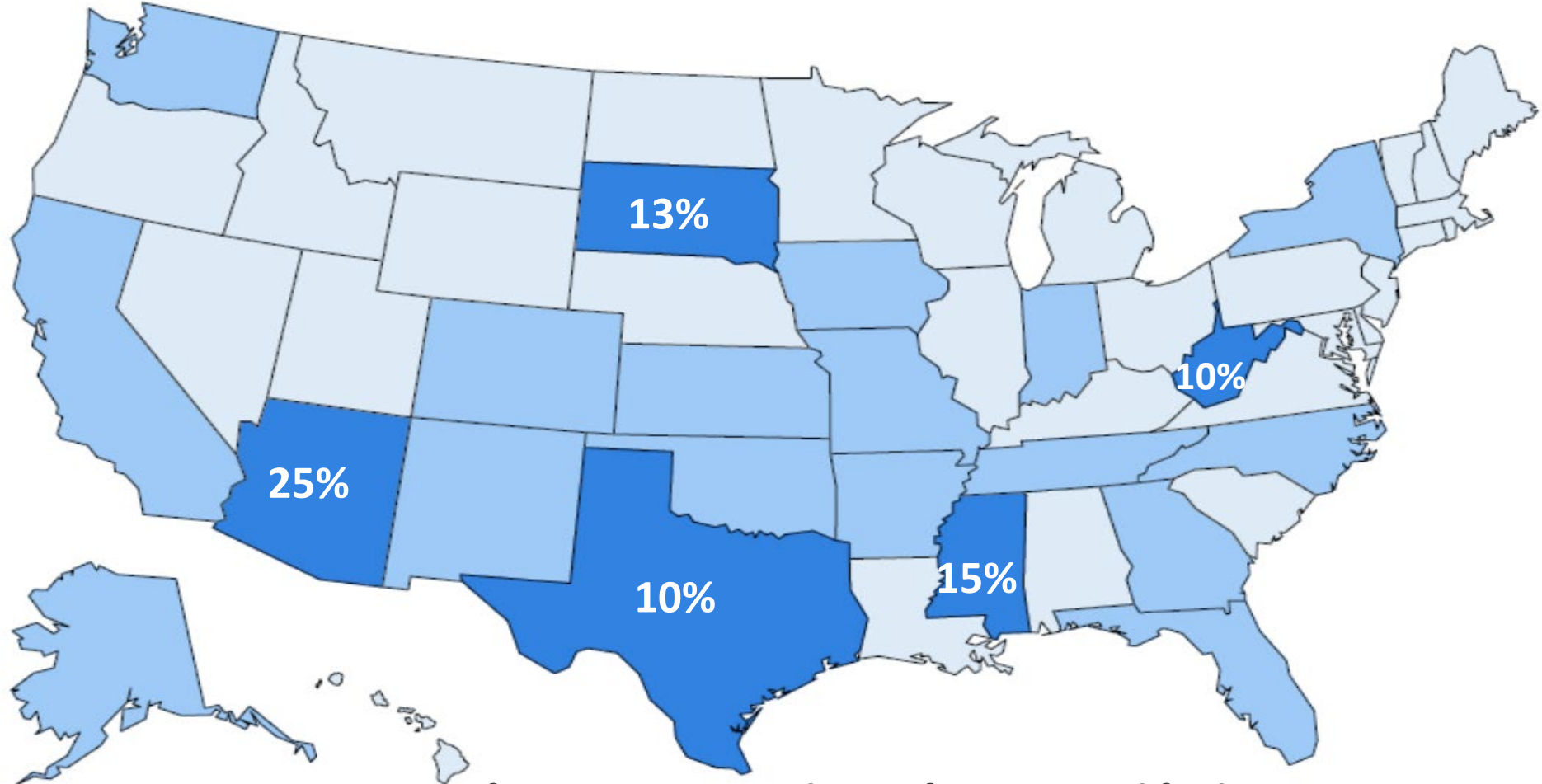


TB Cases among Residents of Correctional Facilities*, Aged ≥15, 1993–2019



*Correctional facilities include federal prisons, state prisons, local jails, juvenile correctional facilities, other correctional facilities, or unknown type of correctional facility.

Percentage of TB Cases among Residents of Correctional Facilities* by Reporting Area, Aged ≥ 15 , 2019

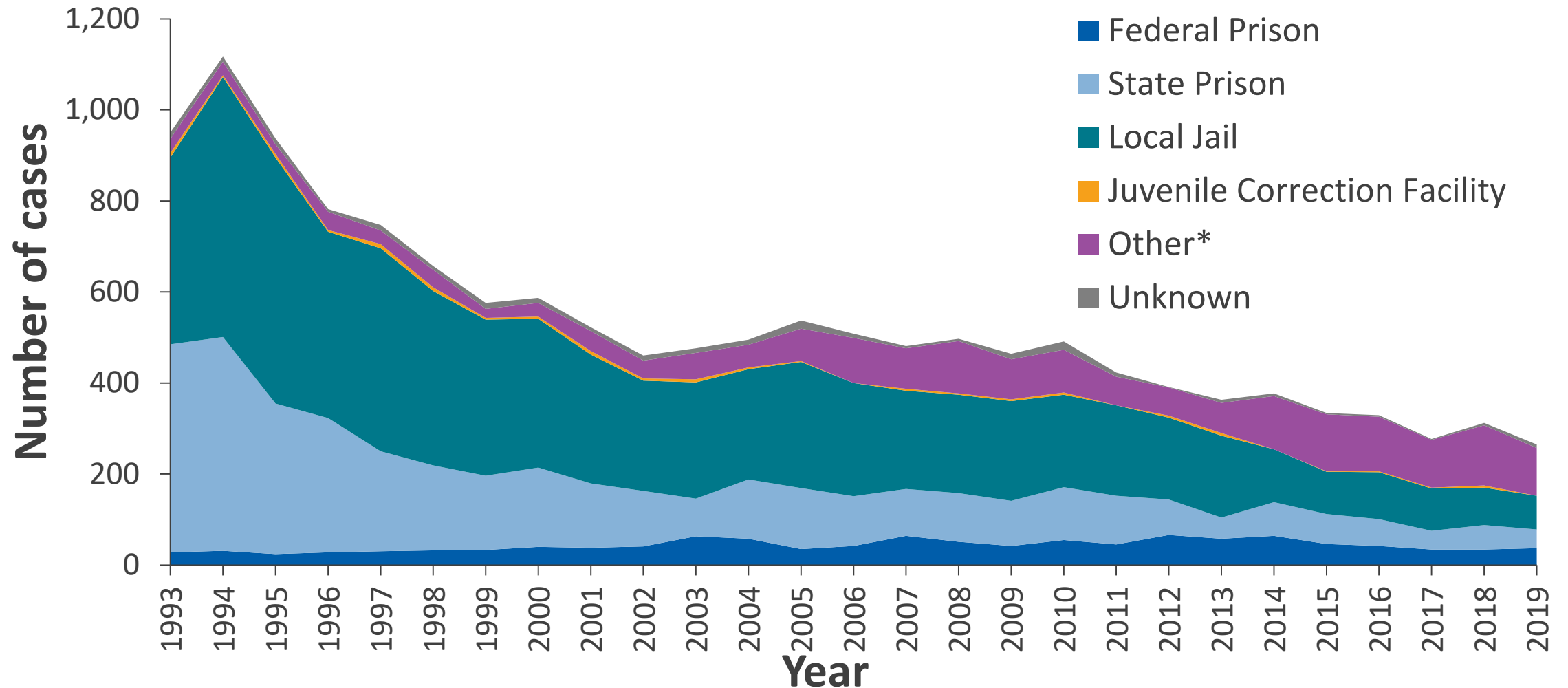


Percentage of cases among residents of correctional facilities

0 - 1.2 >1.2 to 4.2 >4.2

*Correctional facilities include federal prisons, state prisons, local jails, juvenile correctional facilities, other correctional facilities, or unknown type.

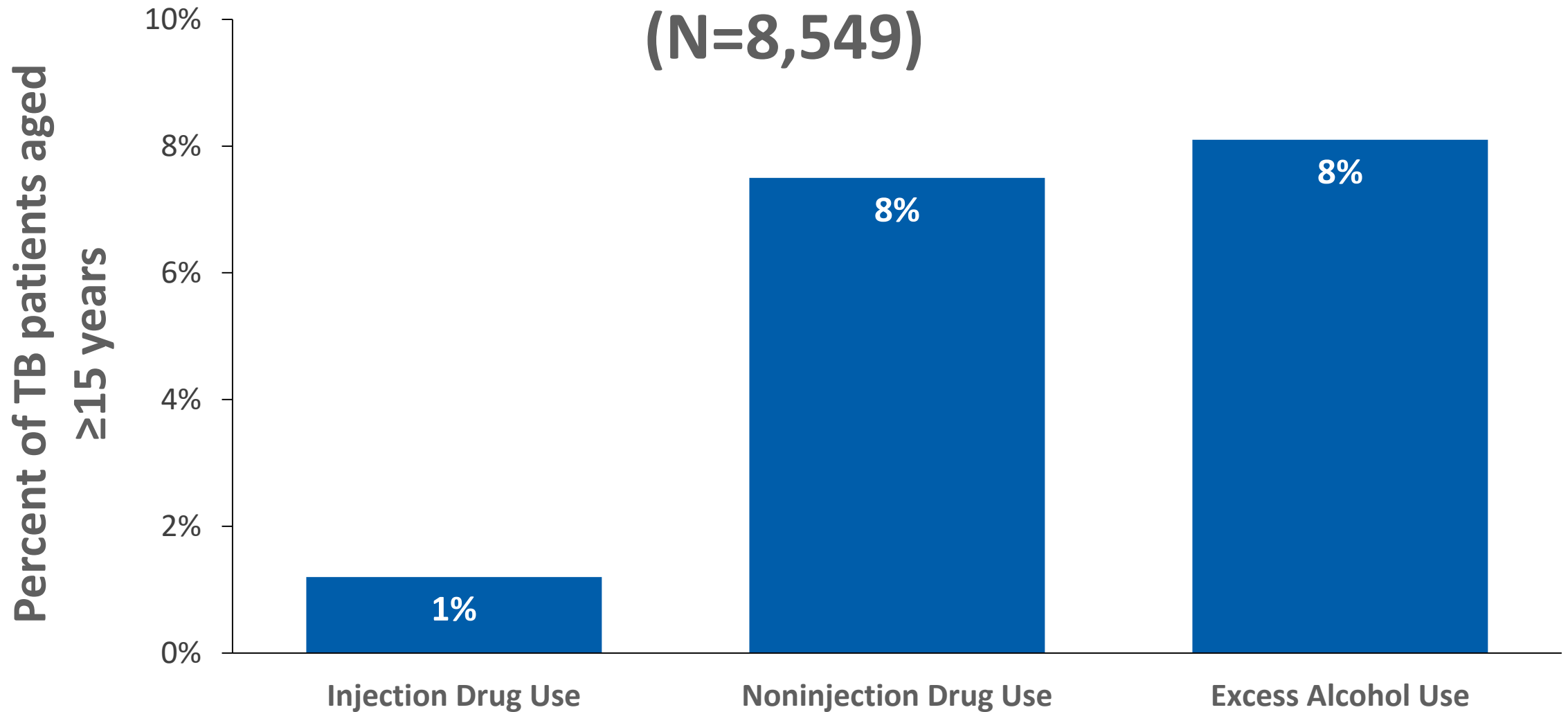
TB Cases among Residents of Correctional Facilities Aged ≥ 15 by Type of Facility, 1993–2019



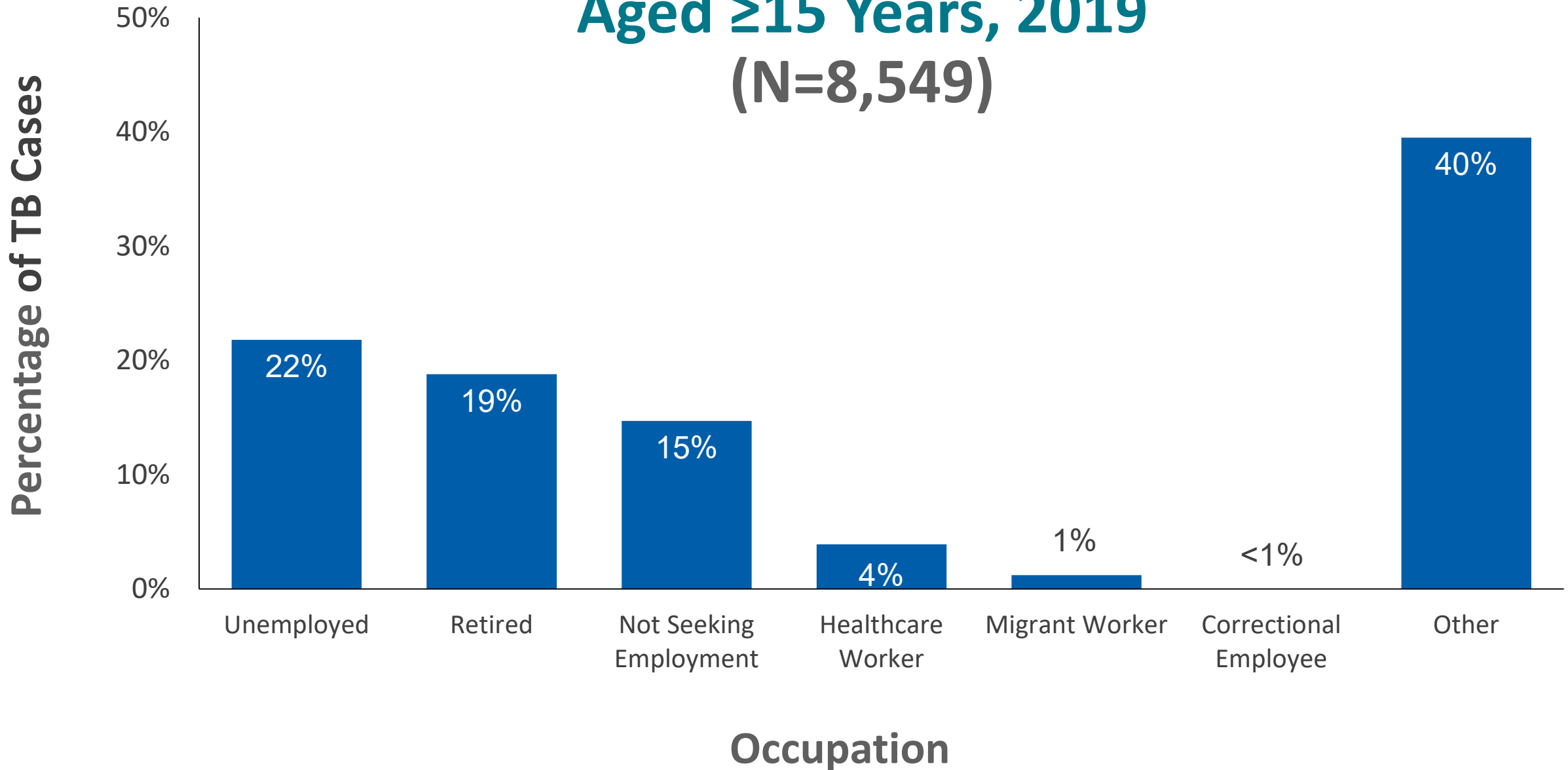
*Includes Immigration and Customs Enforcement (ICE) detention centers, tribal jails operated by Indian reservations, police lockups (temporary holding facilities for person who have not been formally charged in court), military stockades and jails, or federal park facilities

Substance Use Disorder Among TB Patients ≥ 15 Years, United States, 2019

(N=8,549)



Primary Occupation Among U.S. TB Patients Aged ≥ 15 Years, 2019 (N=8,549)



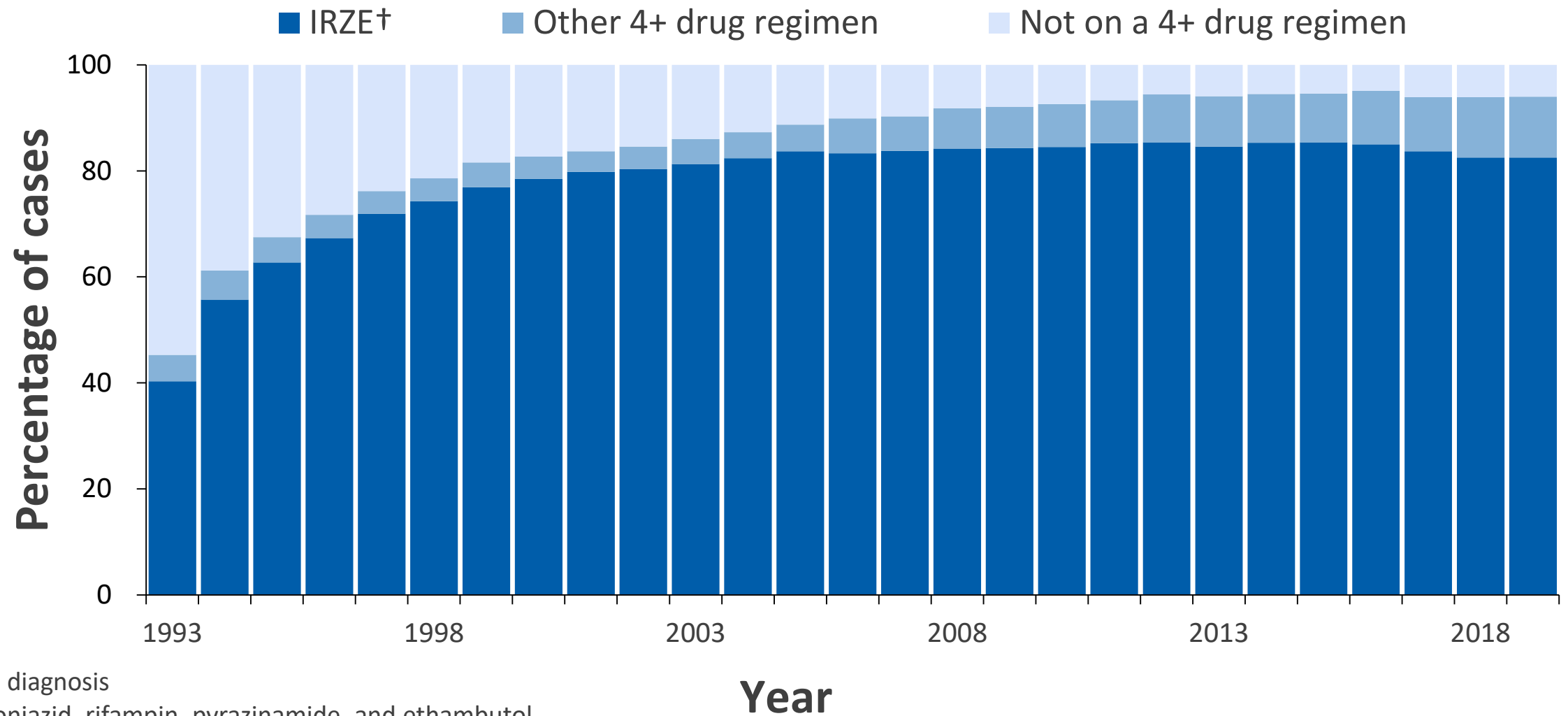
QUESTION 3

Q: Do you routinely review TB epidemiology when making program decisions or assessing patient risk?

a. Yes

b. No, but I will now

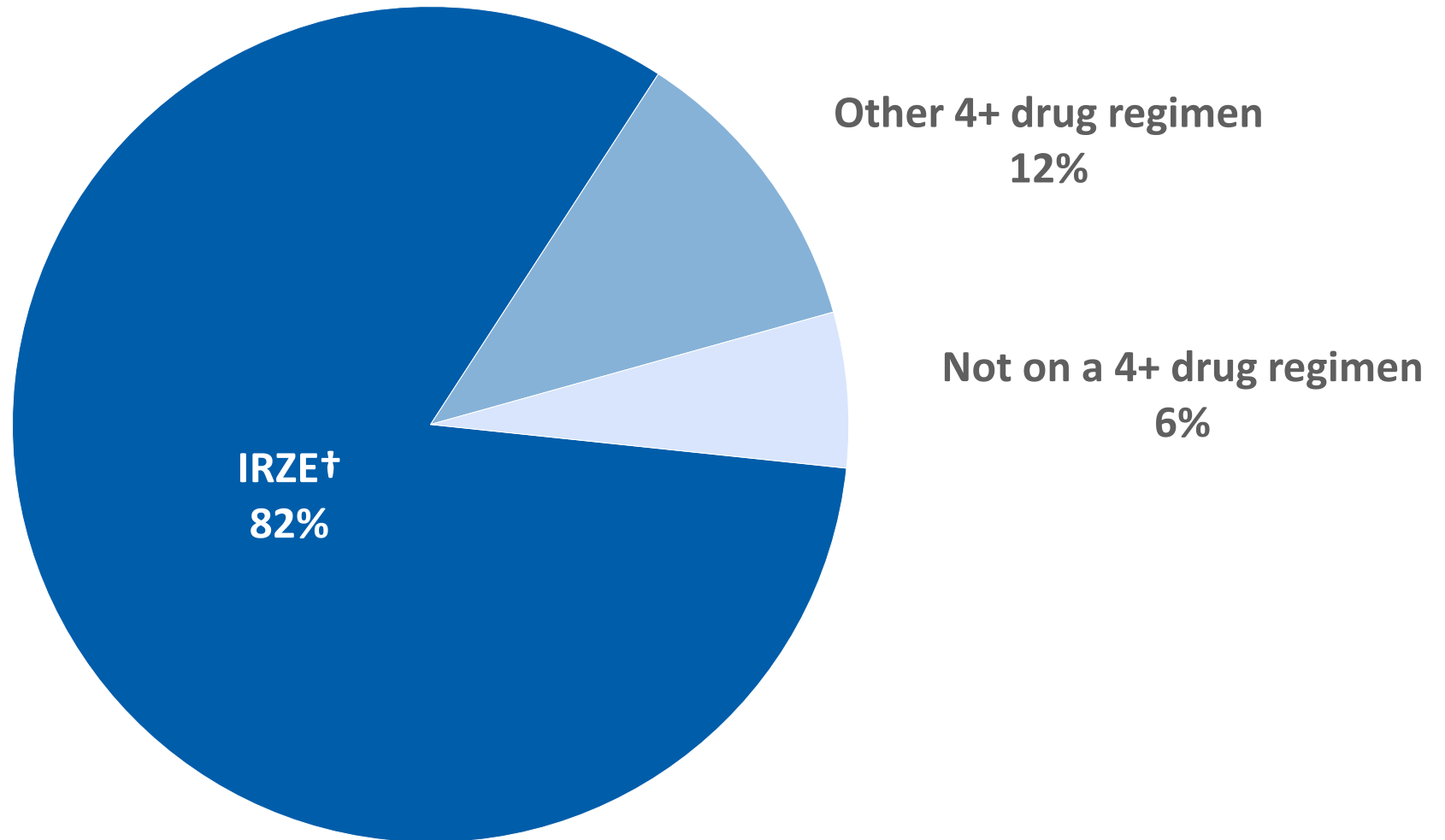
TB Cases* by Initial Drug Regimen, United States, 1993–2019



*Alive at diagnosis

†IRZE=isoniazid, rifampin, pyrazinamide, and ethambutol

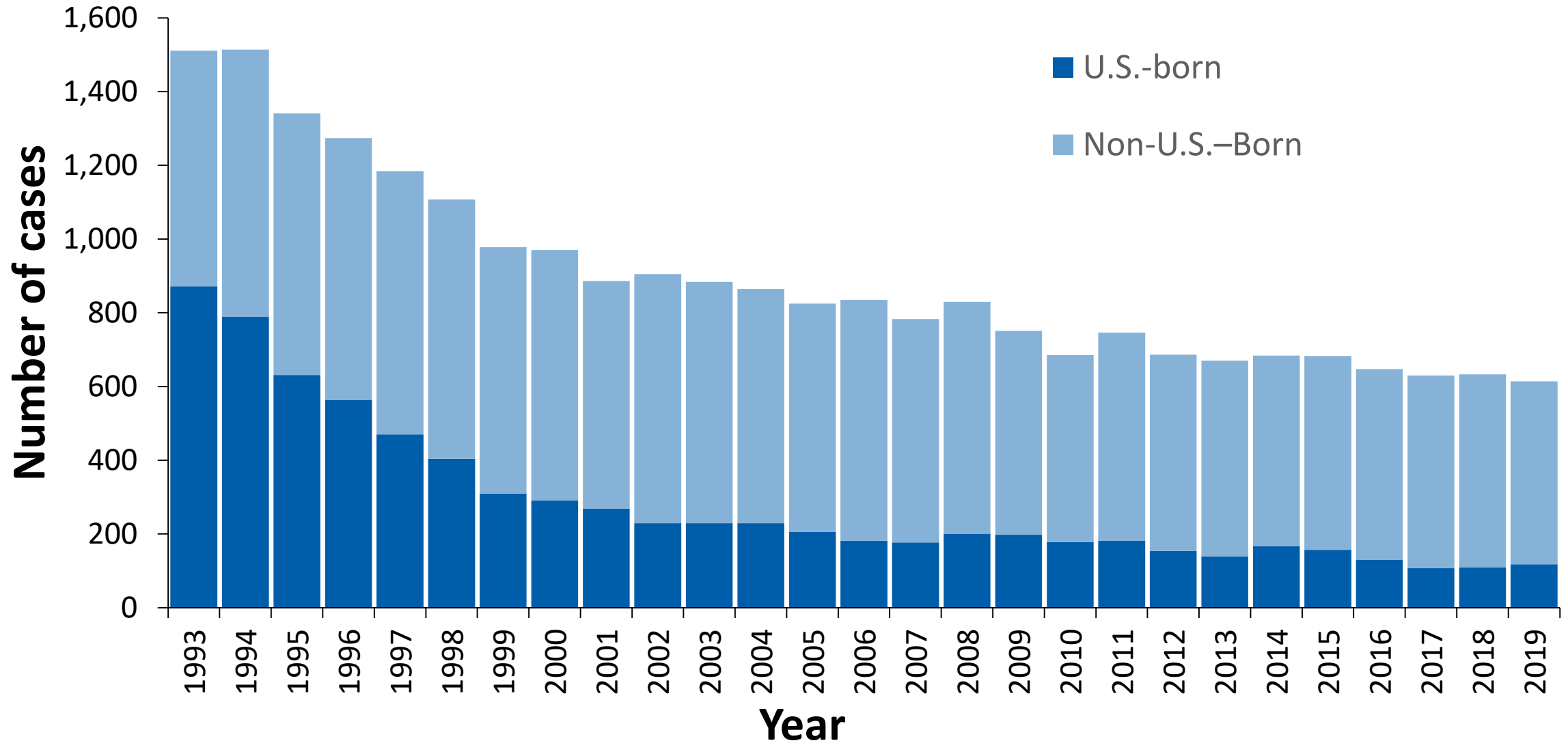
Percentage of TB Cases*, by Initial Drug Regimen, United States, 2019 (N=8,676)



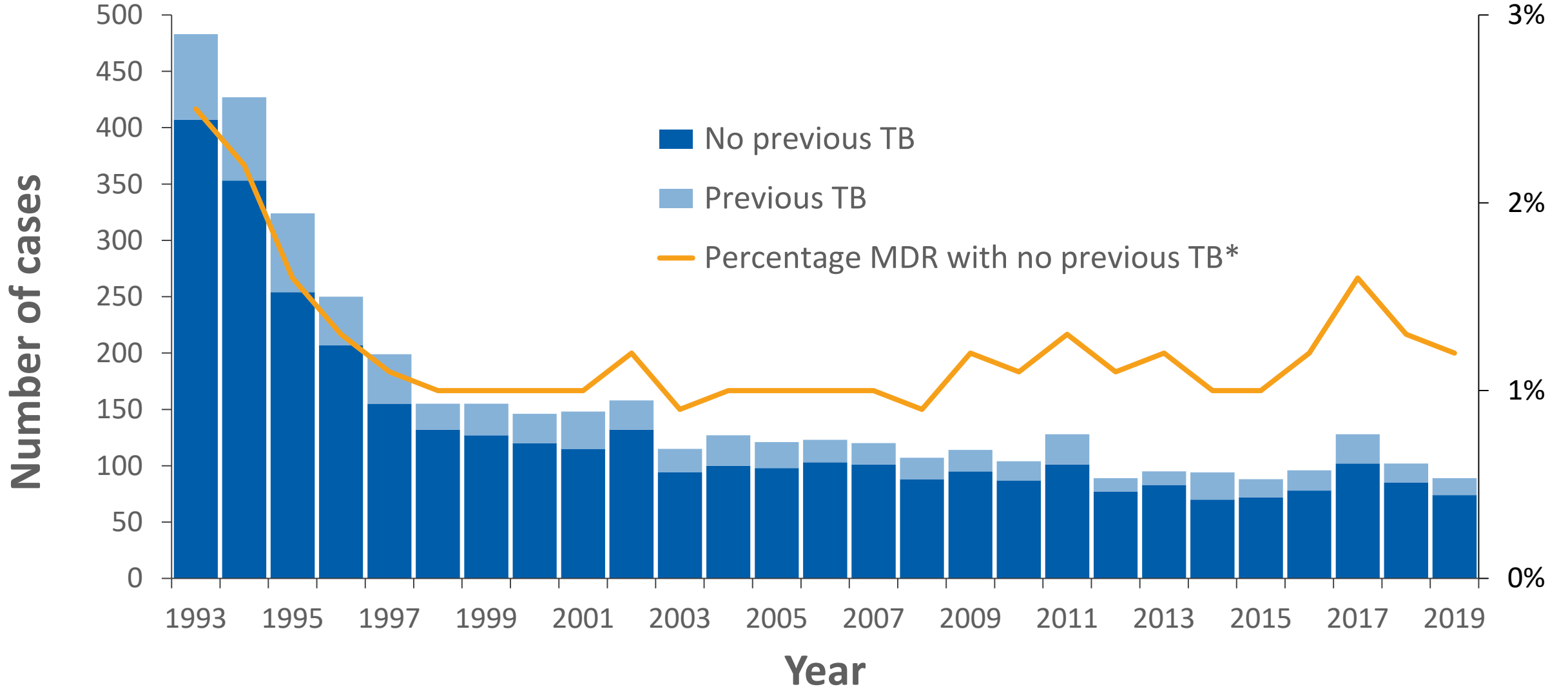
*Alive at diagnosis

[†]IRZE=isoniazid, rifampin, pyrazinamide, and ethambutol

Isoniazid Resistance Among U.S.-born versus Non-U.S.-born Persons, United States, 1993–2019

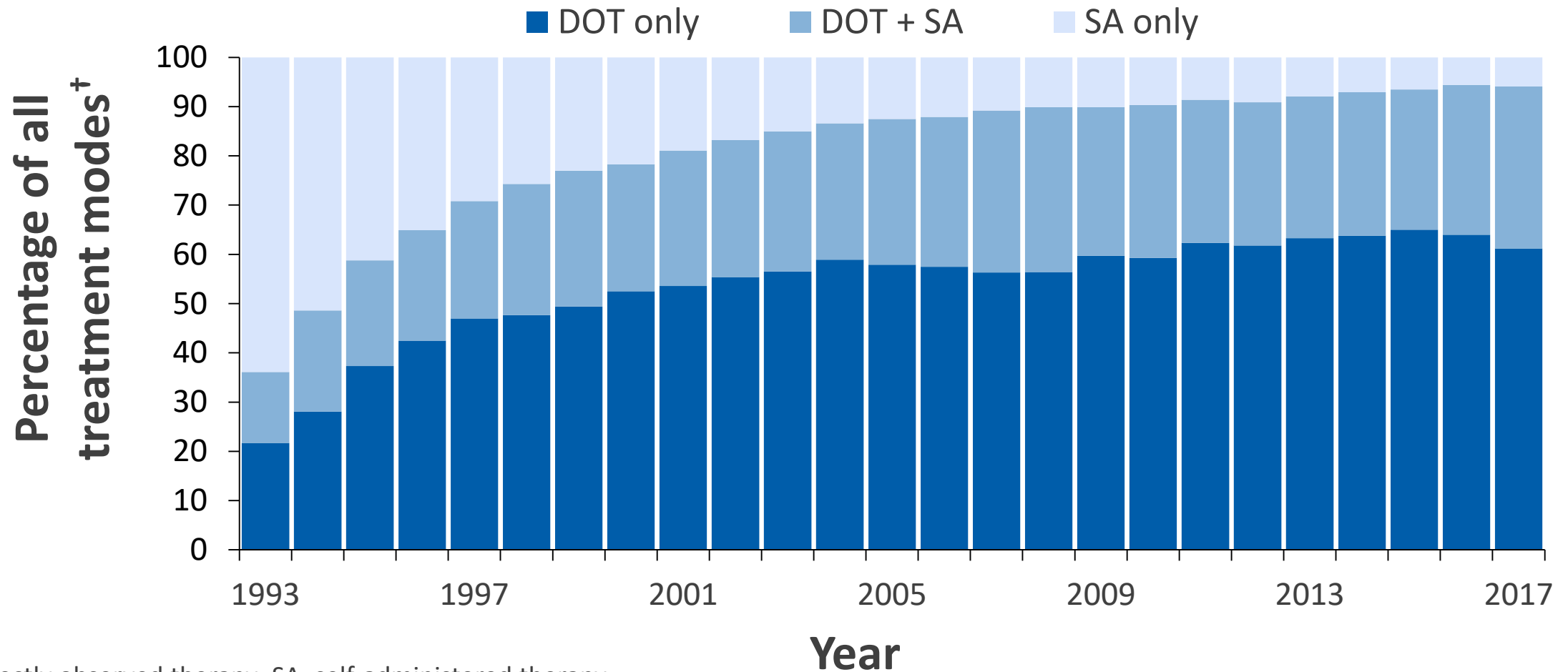


Cases of MDR TB by History of TB, United States, 1993–2019



*Based on initial isolates from persons with no prior history of TB; multidrug-resistant TB (MDR TB) is defined as resistance to at least isoniazid and rifampin.

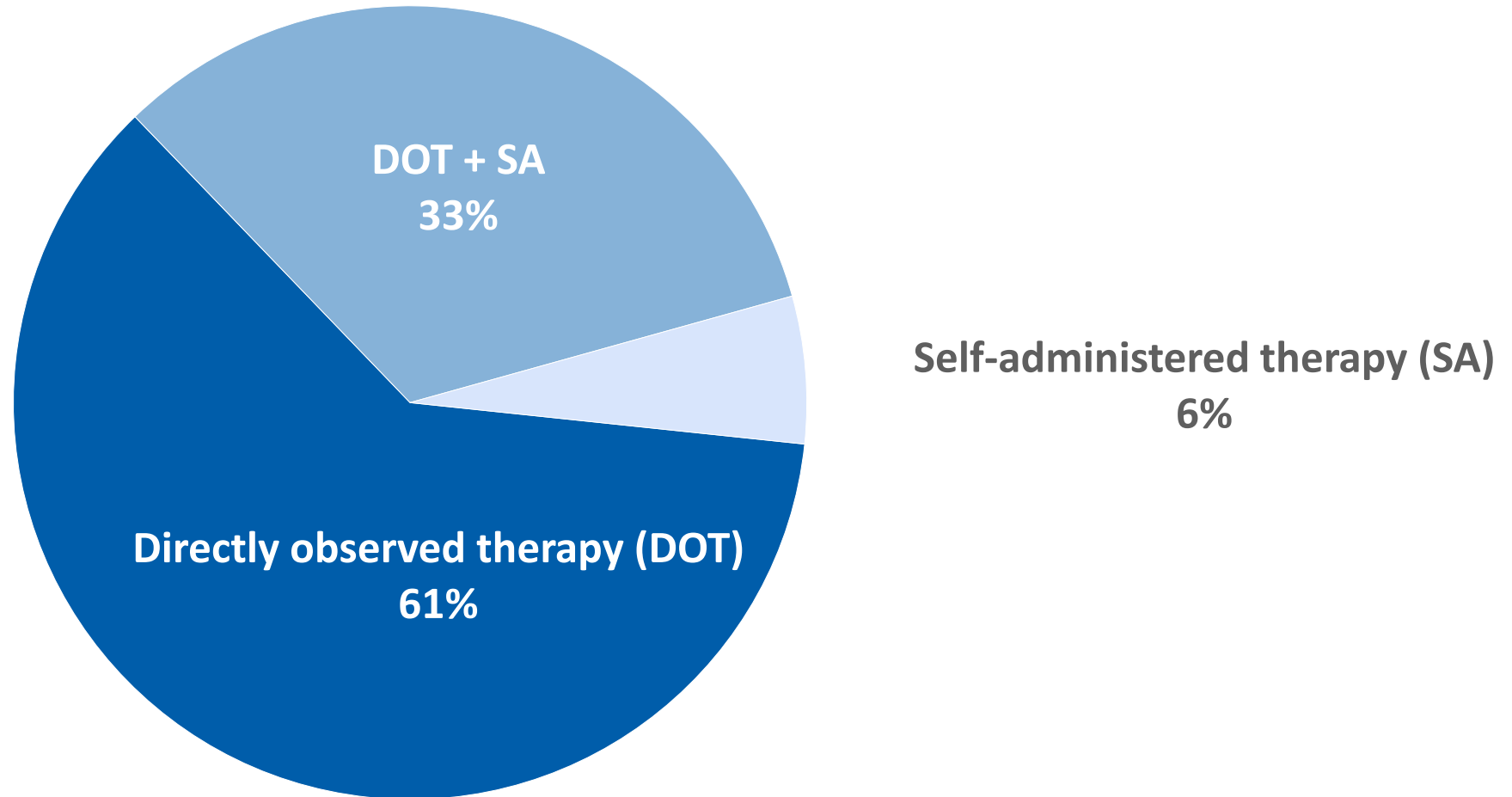
Mode of Treatment Administration Among Persons Reported with TB, United States, 1993–2017*



DOT=directly observed therapy; SA=self-administered therapy.

* Data available through 2017 only. †Percentage of total cases among persons alive at diagnosis, with an initial regimen of one or more drugs prescribed and excluding cases with unknown mode of treatment administration.

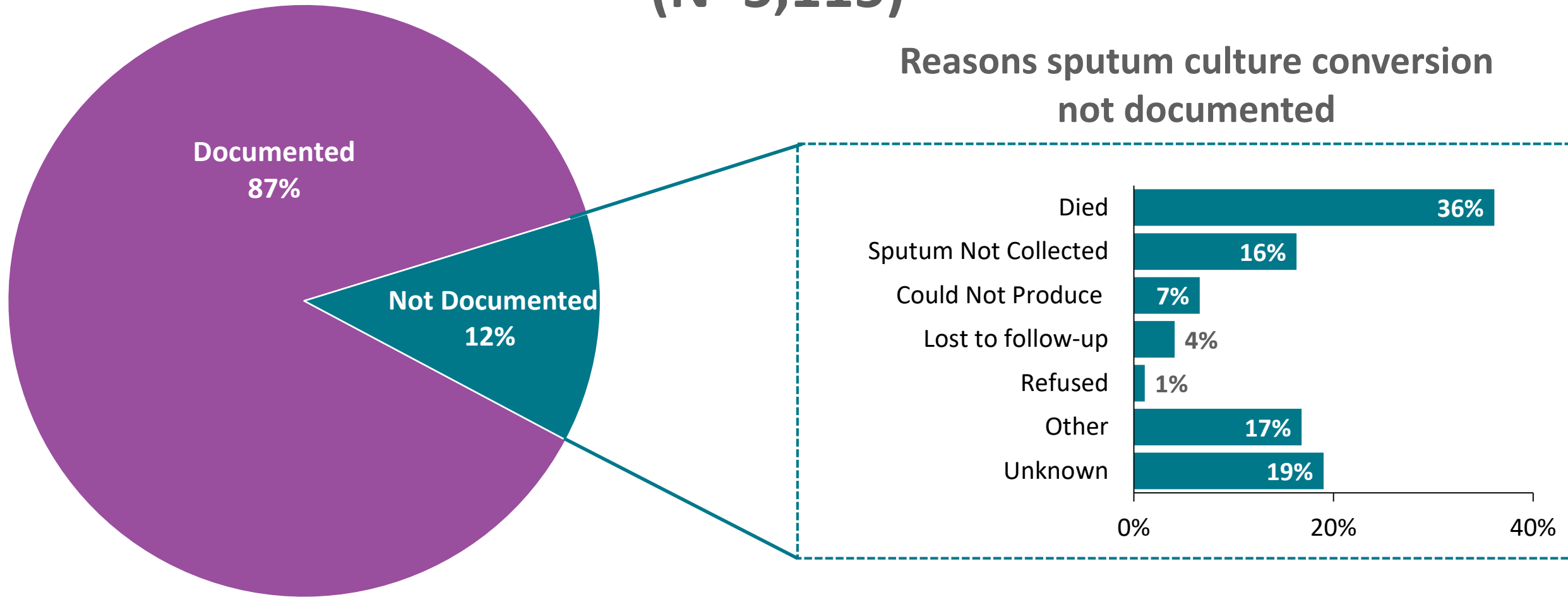
Mode of Treatment Administration Among Persons Reported with TB*, United States, 2017 (N=8,707)



*Percentage of total cases among persons alive at diagnosis, with an initial regimen of one or more drugs prescribed and excluding cases with unknown mode of treatment administration.

Sputum Culture Conversion, United States, 2017*

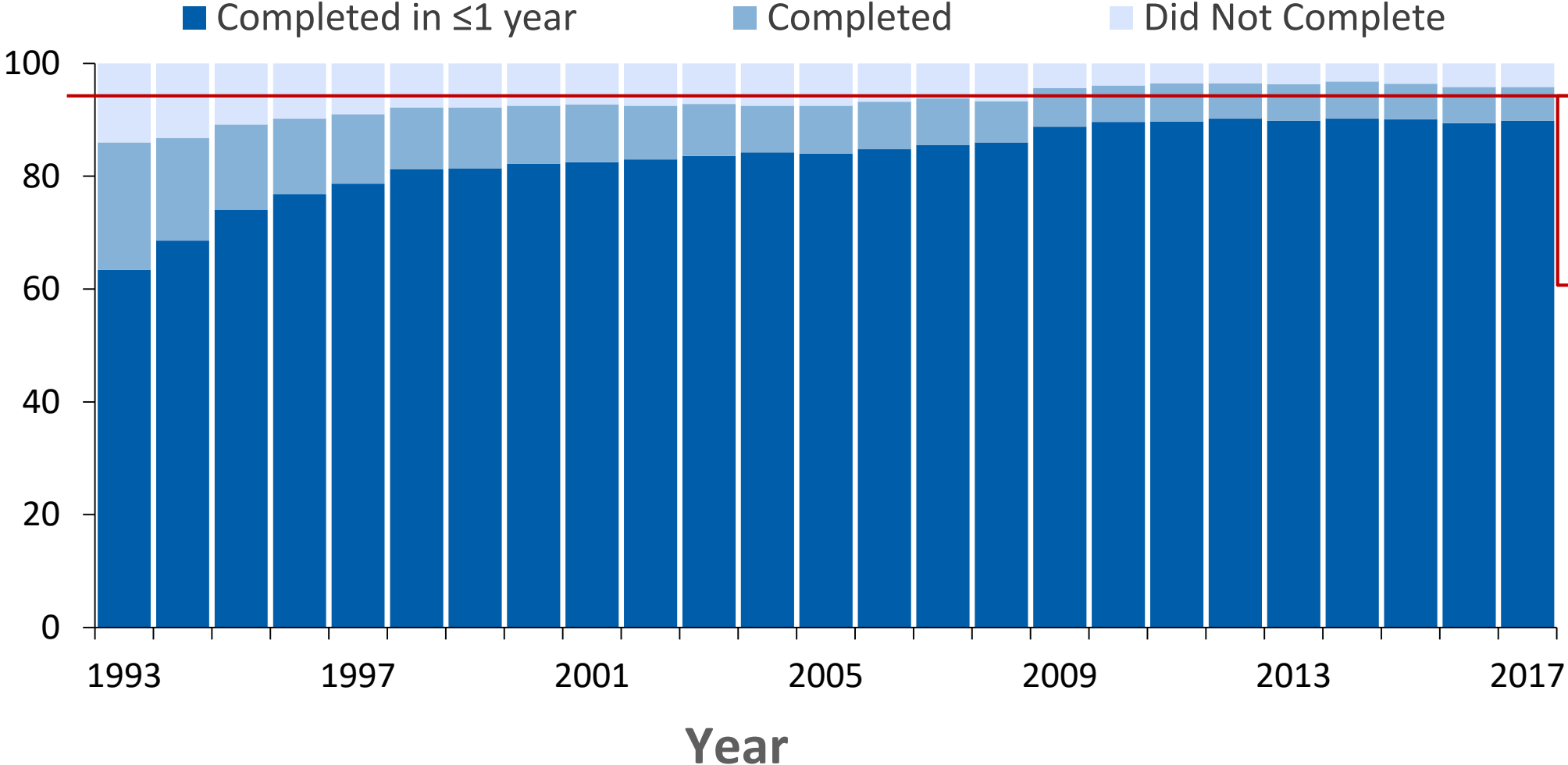
(N=5,115)



* Data available through 2017 only; among patients with a positive sputum culture.

Completion of TB Therapy, United States, 1993–2017*

Percentage completing therapy



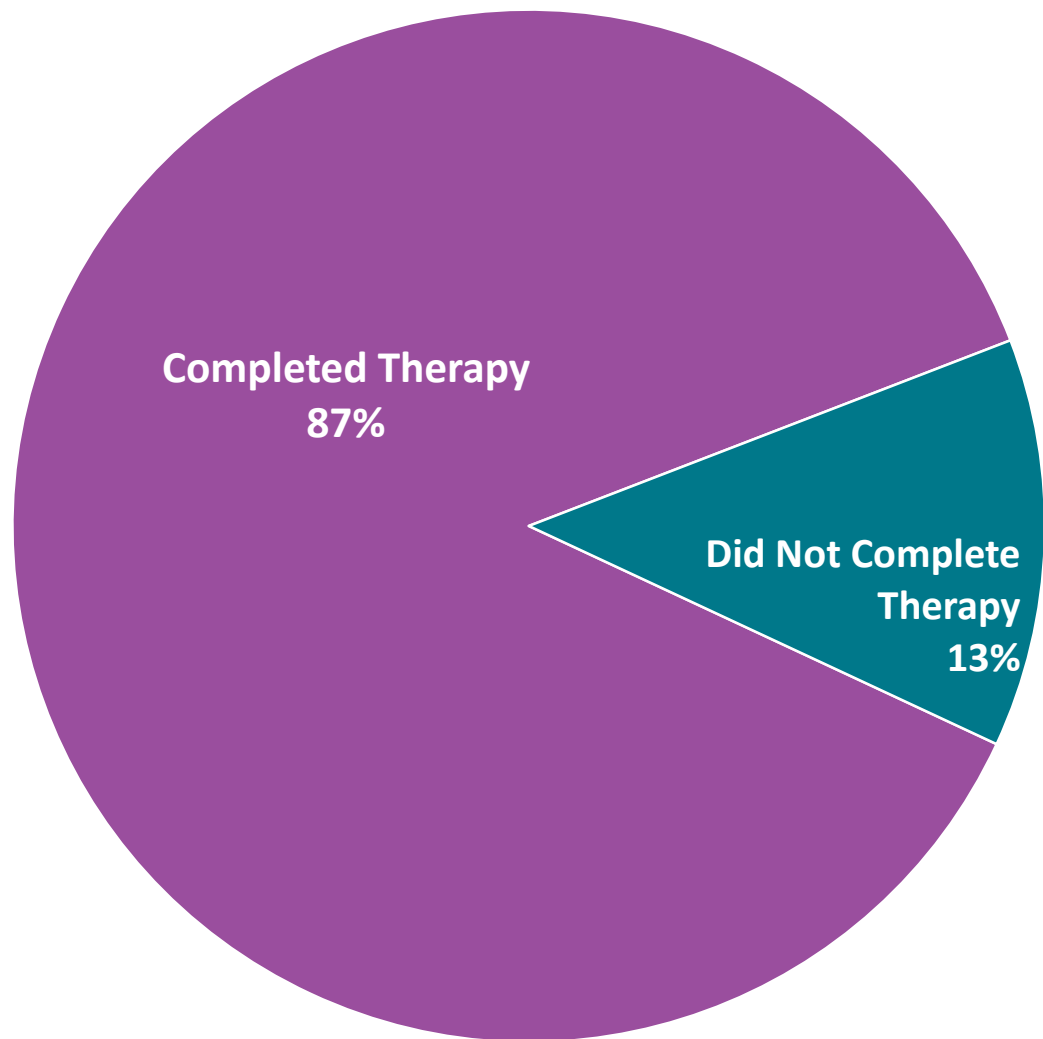
National Goal[†]: 95%

*Data available through 2017 only.

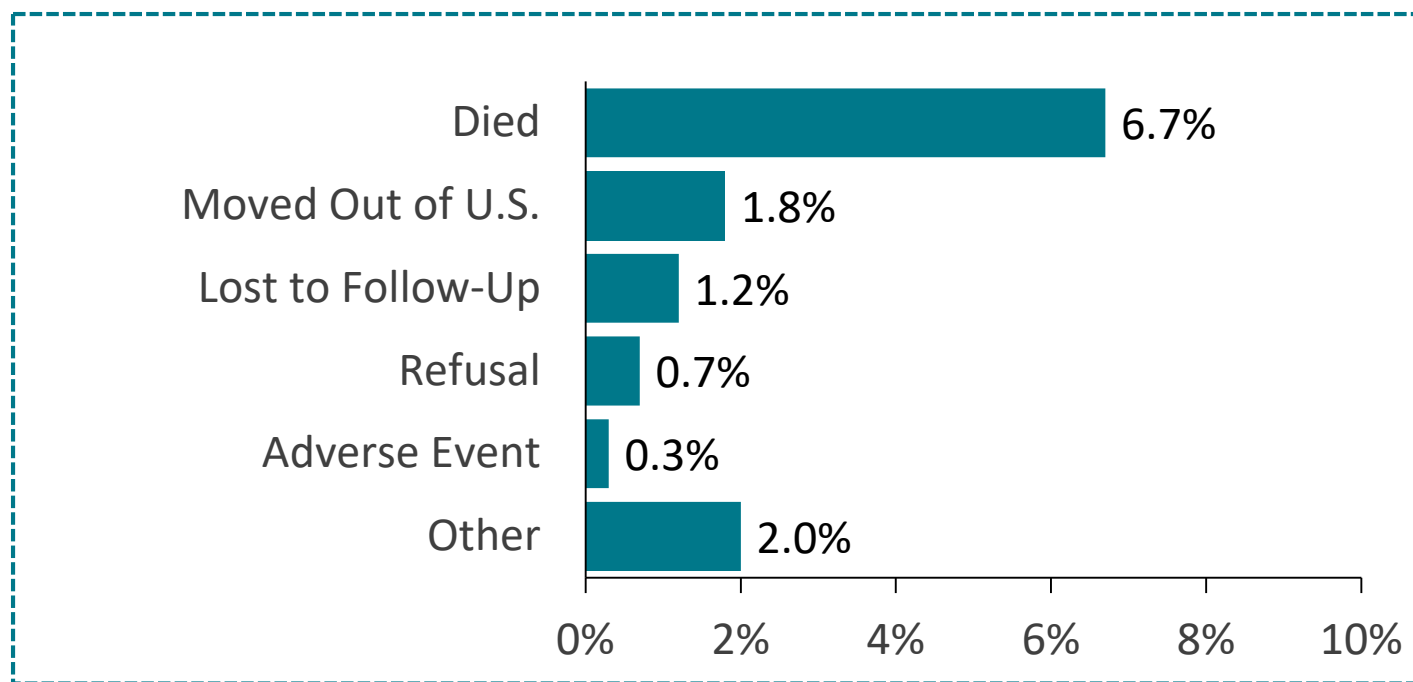
[†]National goal: for patients with newly diagnosed TB disease for whom ≤ 12 months of treatment is indicated, 95% complete treatment within 12 months.

TB Cases by Reason Therapy Stopped, 2017

(N=8,839)

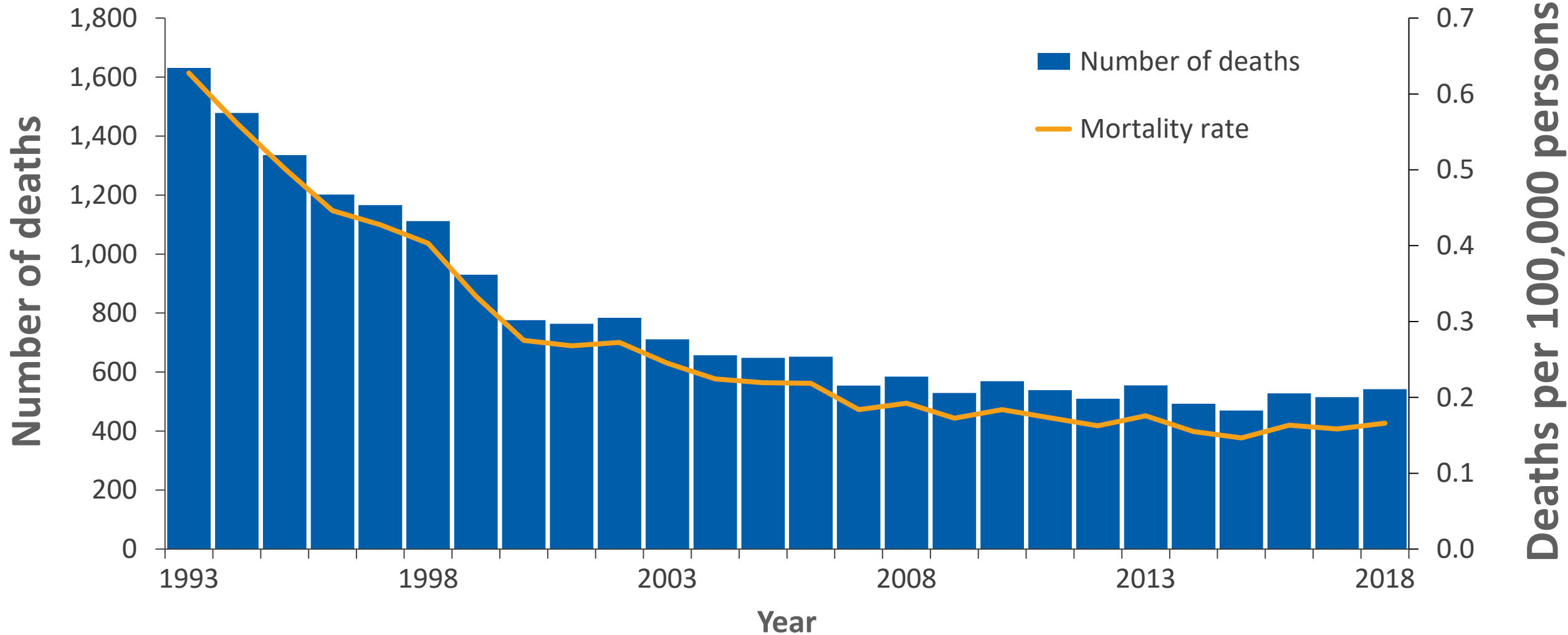


Outcomes for patients who did not complete treatment



*Data available through 2017 only. Among **all** patients who were alive at diagnosis and started on TB treatment.

Reported TB-Related Deaths* and Mortality Rates United States, 1993–2018



*National Vital Statistics System Underlying Cause of Death (based on deaths reported through 2018)

Deaths Attributed to TB, 2017*

Among TB patients
diagnosed in 2017,

9% died

before diagnosis or
during treatment



Of those deaths,

**1/3 attributed
to TB**

* Data available through 2017.

CONCLUSIONS

TB is still a leading cause of death globally

U.S. case counts and rates are declining slightly, but not enough to achieve elimination

Focus LTBI testing on those at increased risk for exposure and disease activation

Always consider population level and patient level risk factors

HIV co-infection is an important risk factor; the prevalence of other risk factors is increasing

Though less than other countries, drug-resistance in the U.S. is still a concern

REFERENCES AND RESOURCES

1. World Health Organization. Global tuberculosis report 2020. Geneva, Switzerland: World Health Organization; 2020.
https://www.who.int/tb/publications/global_report/en/
2. CDC. Tuberculosis in the United States 2019 Slide Set. Atlanta, GA: US Department of Health and Human Services, CDC; 2020.
<https://www.cdc.gov/tb/statistics/surv/surv2019/default.htm>
3. CDC. Reported tuberculosis in the United States, 2019. Atlanta, GA: US Department of Health and Human Services, CDC; 2020.
<https://www.cdc.gov/tb/statistics/reports/2019/default.htm>
4. Deutsch-Feldman M, Pratt RH, Price SF, Tsang CA, Self JL. Tuberculosis — United States, 2020. MMWR Morb Mortal Wkly Rep 2021;70:409–414. DOI:
<http://dx.doi.org/10.15585/mmwr.mm7012a1>

THANK
YOU!

Acknowledgements

MDHHS Tuberculosis Unit

CDC Division of Tuberculosis Elimination

Contact Information

smiths79@michigan.gov