Tuberculosis Control Program

May 2021

2020 Annual Report

Indiana Department of Health

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Executive Summary

The mission of the Tuberculosis Control Program is to decrease tuberculosis incidence and progress toward its elimination by conducting surveillance activities and case management oversight, developing public health policies, providing technical assistance, networking with local health departments, and increasing the public's awareness of the disease.

In 2020, 92 new cases of tuberculosis (TB) were reported to the Indiana Department of Health, a 14.8% decrease from 2019. This decrease in reported TB cases may be attributed to the COVID-19 pandemic and should not be interpreted as a true decrease in TB burden. Marion County continued to have the most cases of any jurisdiction, with 34 cases reported in 2020 and a total of 411 cases over the past 10 years.

Disparities in TB continue to be seen among several populations, including by age group, race, ethnicity, gender, and U.S.-born status. Hoosiers ages 15 to 24 and ages 25 to 44 had the highest TB rates in 2020, with 1.6 cases per 100,000 population. More than half of Indiana cases in 2020 (57.6%) were among non-U.S.-born persons, which mirrors the disparity seen at the national level.

There are several established risk factors for TB, including HIV infection, homelessness, drug and alcohol use and residence in a correctional facility. In 2020, HIV status was known among 93.8% of TB cases age 15 or older, and 3.3% of all TB cases were HIV-positive. Diabetes was the most common measured risk factor, reported in 17.4% of all TB cases in Indiana.

Effective treatment of TB is essential to the control and elimination of the disease, and several treatment-related data measures are collected. In 2020, 96.7% of TB cases were started on the recommended initial therapy, and 94.4% of cases in 2019 completed their therapy within one year. One case of multi-drug-resistant TB was identified in 2020 in Indiana.

TB genotyping and contact investigation are used in TB control to help prevent additional cases. Five new genotype clusters were identified in 2020 in Indiana, with no clusters identified as outbreaks. In 2019, 92.7% of cases of infectious TB had contacts identified, and 77.1% of those contacts were fully evaluated for infection and disease.

The vision of the Indiana Department of Health's TB Control Program is: "A Tuberculosis-free Indiana." To achieve this vision, we will need continued collaboration between state and local health departments and continued efforts to find, diagnose, and effectively treat every case of TB and latent TB infection in Indiana.

Program Indicators

TB Indicators	Indiana		Program Goals
	2020	2019	2025
Number of Tuberculosis Cases	92	108	
Tuberculosis Case Rate per 100,000 Population	1.4	1.6	
Number of Tuberculosis Deaths	9	5	
Laboratory Confirmation	79.3%	70.4%	
Pulmonary Site of Disease	66.3%	60.2%	
U.S.-Born Incidence Rate	0.6	0.6	0.4
Non-U.S.-Born Incidence Rate	14.8	19.0	8.8
Non-Hispanic White Incidence Rate	0.5	0.6	
Non-Hispanic Black Incidence Rate	4.4	4.7	
Non-Hispanic Asian Incidence Rate	19.4	20.9	
Hispanic/Latino Incidence Rate	2.1	3.8	
Male Incidence Rate	1.8	2.0	
Female Incidence Rate	0.9	1.3	
Known HIV Status 25-44 Years of Age	96.3%	95.6%	99.0%
HIV Comorbidity	3.3%	6.5%	
Resident of Correctional Facility	3.3%	3.7%	
Homelessness	7.6%	9.3%	
Resident of Long-Term Care Facility	4.3%	1.9%	
Injecting Drug Use	2.2%	1.9%	
Non-Injecting Drug Use	4.3%	13.9%	
Excess Alcohol Use	6.5%	7.4%	
Initial Four Drug Therapy Regimen	96.7%	98.1%	97.0%
INH Resistance	4.3%	7.4%	
MDR	1.1%	0.9%	
Culture Conversion < 60 Days	68.1% (2019)	66.7% (2018)	73.0%
DOT Utilization	69.4% (2019)	74.0% (2018)	
Completion of Therapy <1 Year	94.4% (2019)	95.8% (2018)	95.0%

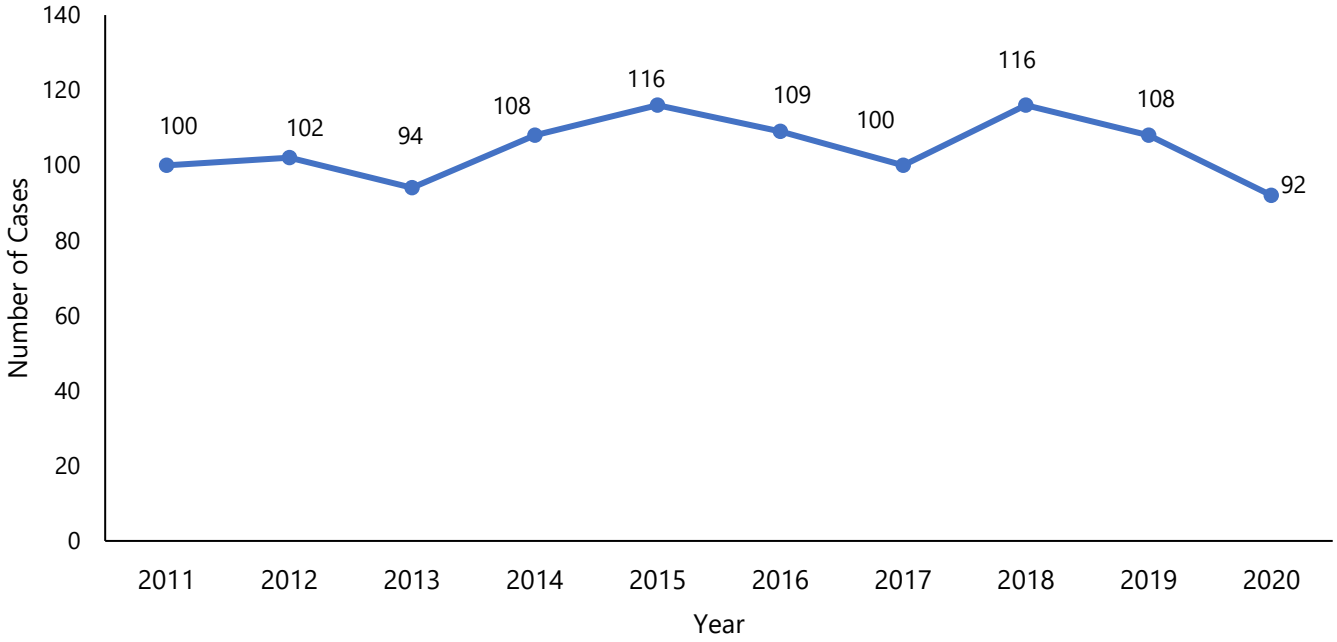
Tuberculosis in Indiana

Tuberculosis (TB) is an airborne disease caused by a group of bacteria called *Mycobacterium tuberculosis*. General symptoms may include a prolonged productive cough, blood-tinged sputum, night sweats, fever, fatigue, and weight loss. TB usually affects the lungs (pulmonary TB) but can also affect other parts of the body, such as the brain, kidneys, or spine (extrapulmonary TB).

TB bacteria are aerosolized when a person who has pulmonary TB or TB affecting the larynx coughs, sneezes, laughs, or sings; other people may become infected if they inhale the droplet nuclei that are formed. Individuals who become infected but do not become ill are considered to have latent TB infection (LTBI) and cannot transmit the infection to others. Approximately 10% of immunocompetent individuals with LTBI will progress to TB disease at some point in their lives if they are not treated. Indiana requires reporting of all suspected cases and confirmed cases of TB disease. As of December 2015, LTBI is also a state-level reportable condition.

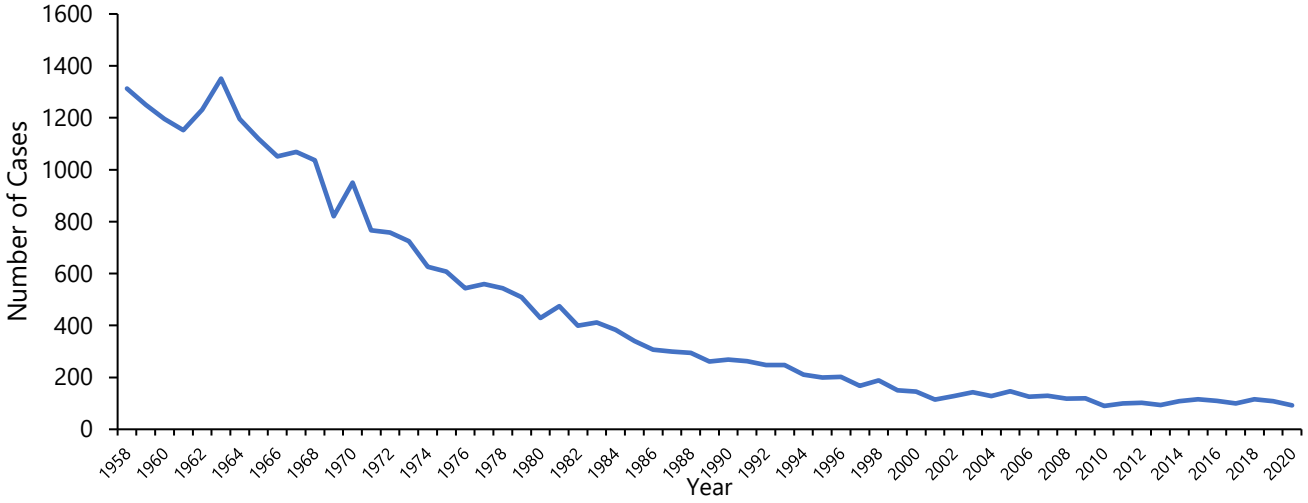
Burden & Trends

Figure 1. Tuberculosis Cases in Indiana, 2011 – 2020



In Indiana, 92 cases of TB were reported in 2020, a 14.8% decrease from 2019. Reported cases of TB in 2020 were affected nationally by the COVID-19 pandemic. The incidence rate of TB also decreased from 2019 to 2020, from 1.6 per 100,000 population to 1.4 per 100,000 population.

Figure 2. Historical Trend of Tuberculosis Cases in Indiana



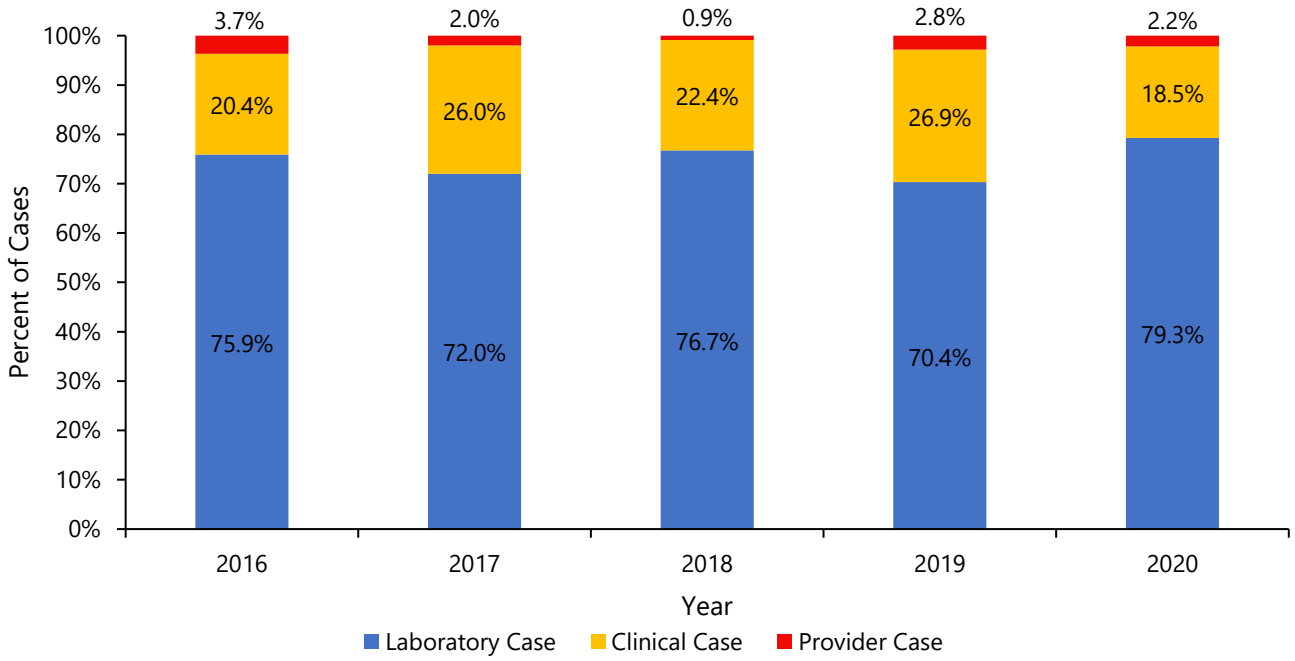
The decrease in TB seen in the last 10 years is in line with the downward historical trend seen in Indiana since the 1950s. The latest national data from 2019 shows that Indiana ranked 33rd out of the 50 states in incidence rate but remains under the national incidence rate (2.7 per 100,000) for TB in the United States.[1]

Diagnosis of Tuberculosis

A diagnosis of TB disease is categorized as either laboratory, clinical or provider diagnosis, according to the criteria established by the Centers for Disease Control and Prevention (CDC) shown below.[2] Provider diagnosis is defined as a case that does not meet either laboratory or clinical case definitions, but the healthcare provider believes there is sufficient evidence for a diagnosis of TB based upon the clinical evaluation.

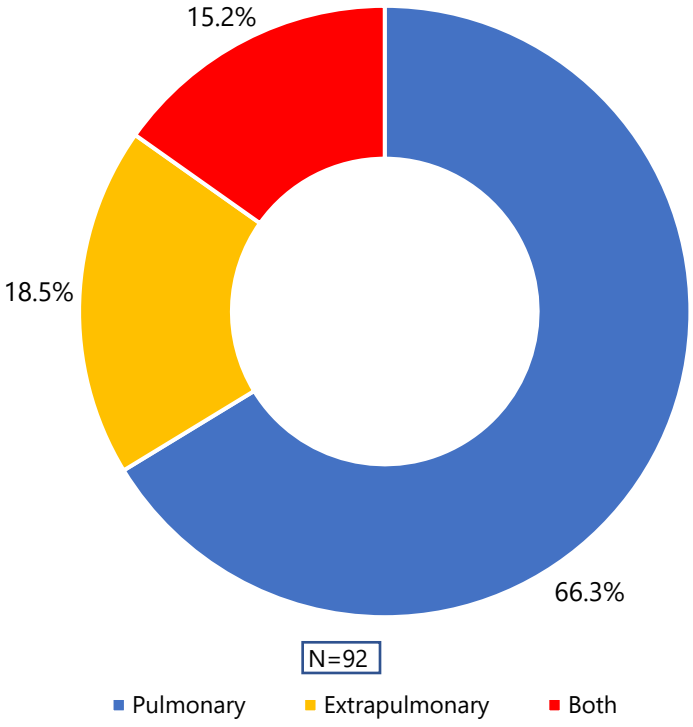
Laboratory Criteria	Clinical Criteria
➢ Isolation of M. tuberculosis from a Clinical Specimen, OR ➢ Demonstration of *M. tuberculosis* complex from a clinical specimen by nucleic acid amplification test, OR ➢ Demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated.	➢ A positive tuberculin skin test or positive interferon gamma release assay for *M. tuberculosis* ➢ Other signs and symptoms compatible with tuberculosis (TB) (e.g., abnormal chest radiograph, abnormal chest computerized tomography scan or other chest imaging study, or clinical evidence of current disease) ➢ Treatment with two or more anti-TB medications ➢ A completed diagnostic evaluation

Figure 3. Percentage of Tuberculosis Cases by Case Definition, Indiana, 2016-2020



In 2020, 79.3% of cases were laboratory-confirmed cases of TB. This is an increase from 70.4% in 2019.

Figure 4. Percentage of Tuberculosis Cases by Site of Disease, Indiana, 2020



In 2020, 66.3% of TB cases in Indiana were exclusively pulmonary (n=61). This proportion is an increase from 2019, which reported 60.2 percent of TB cases as pulmonary.

Extrapulmonary sites included lymphatic, bone and/or joint, eye and/or ear, genitourinary and other in 2020. Lymphatic system was the most reported site for extrapulmonary disease, accounting for 38.1% of extrapulmonary cases.

Geographic Distribution of TB

In total, 33 Indiana counties reported cases of TB in 2020. Of those counties, 20 reported an increase in TB cases, with two counties reporting increases of at least three or more cases compared to 2019. Marion County accounted for 37% of the total cases in 2020, while only having 14.3% of Indiana's total population. Similarly, Marion County had the highest proportion of TB cases from 2011-2020, accounting for 39.3% of all cases in Indiana.

Top Indiana Counties by Number of TB Cases, 2020 (See Figure 5)	Top Indiana Counties by Number of TB Cases, 2011-2020 (See Figure 6)
➢ Marion County: 34 cases ➢ Allen County: 5 cases ➢ St. Joseph: 5 cases	➢ Marion County: 411 cases ➢ Allen County: 80 cases ➢ Lake County: 55 cases ➢ St. Joseph County: 54 cases ➢ Elkhart County: 30 cases

Figure 5. Number of TB Cases by County, Indiana, 2020

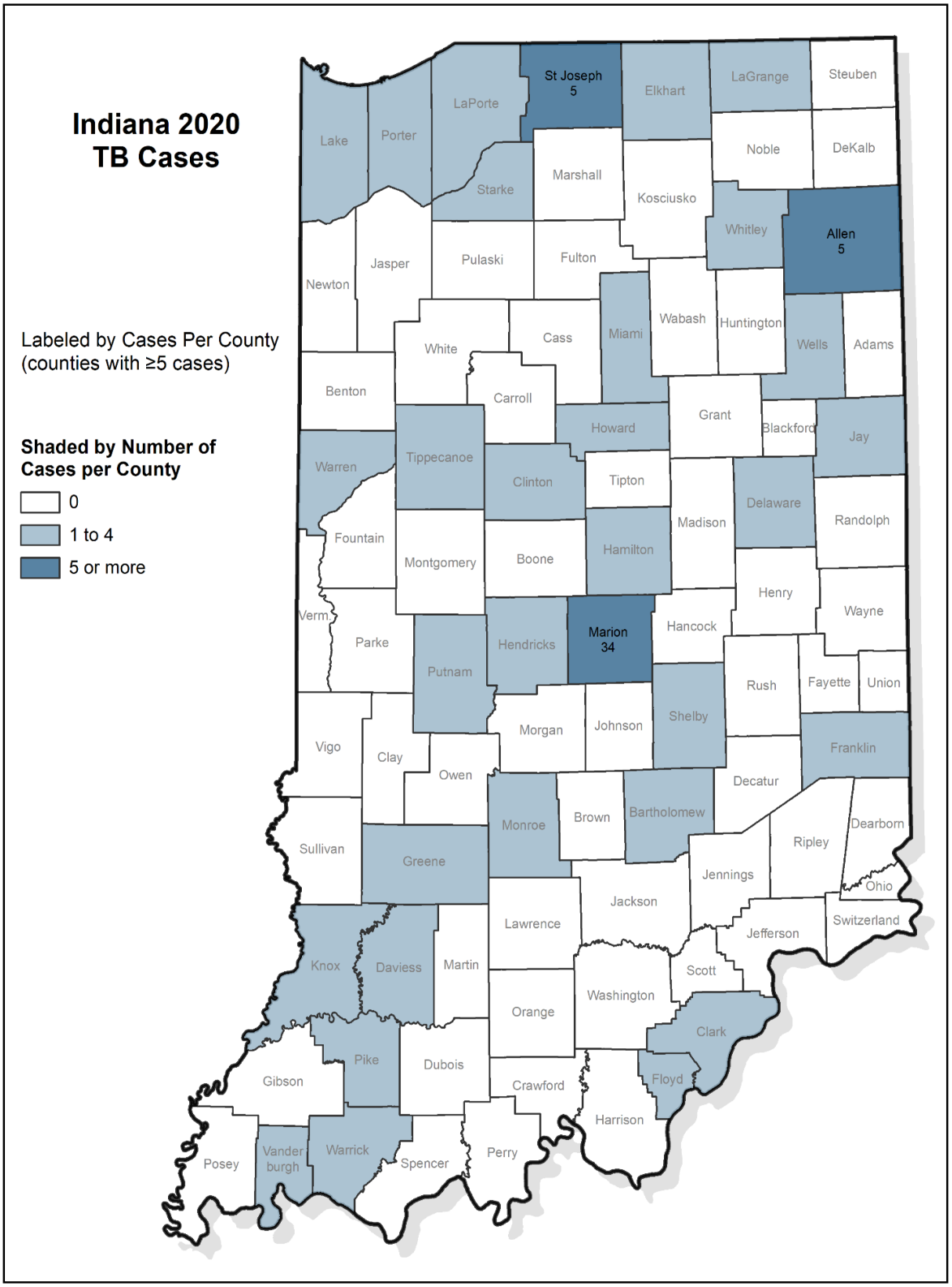
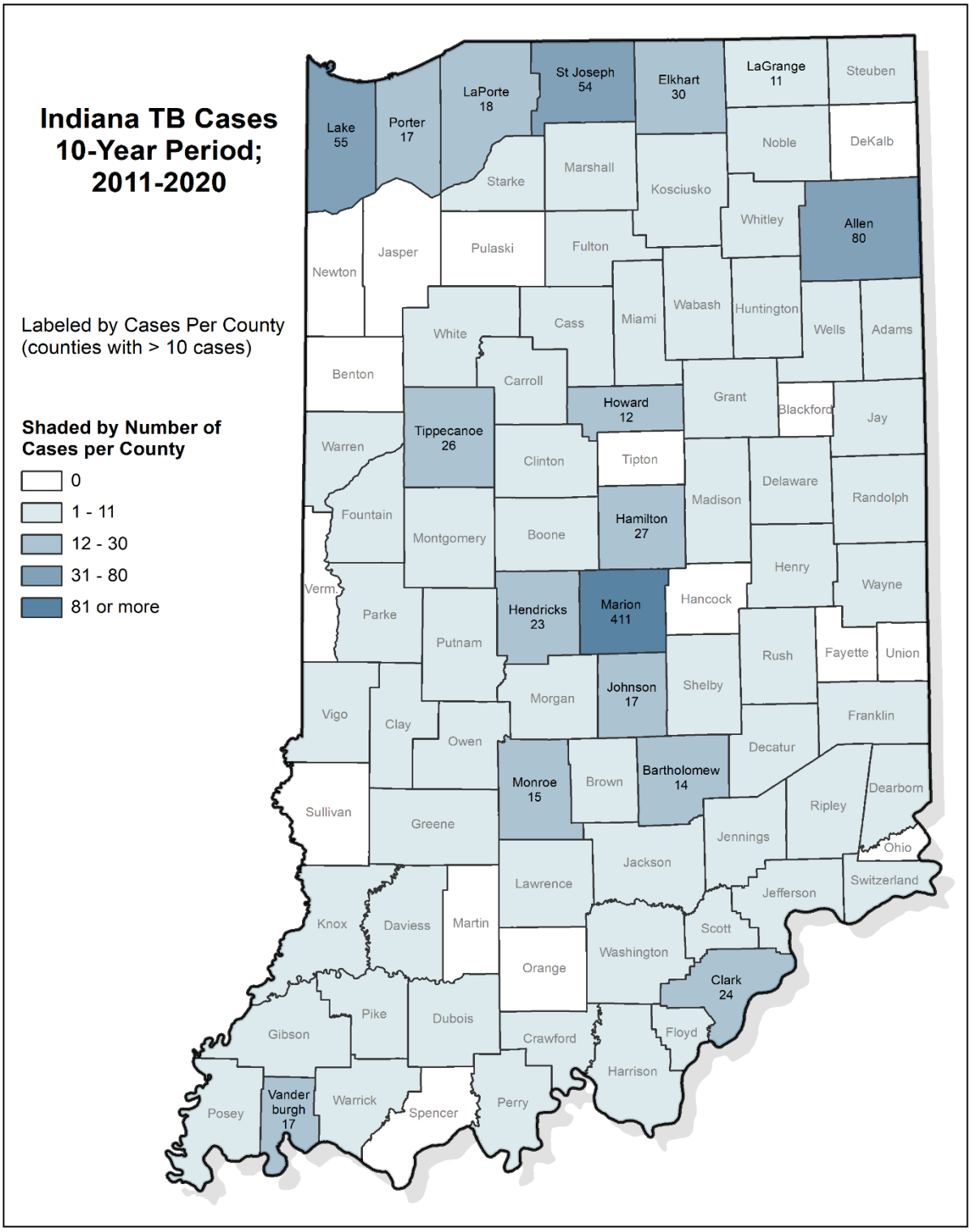


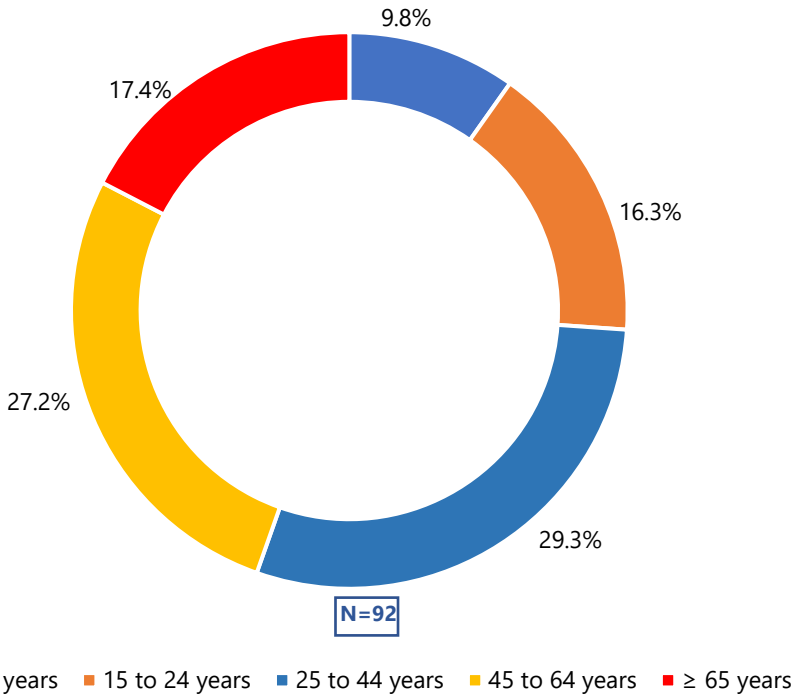
Figure 6. Total Number of TB Cases by County, Indiana, 2011-2020



Demographics and Risk Factors

Despite prevention efforts, some groups of people are affected by TB more than others. The occurrence of TB at greater levels among certain population groups is called a health disparity. Differences may occur by gender, race or ethnicity, income, comorbid medical conditions or geographic location.[3]

Figure 7. Tuberculosis Cases by Age Group, Indiana, 2020



In 2020, 74% of Indiana's TB cases occurred in adults aged 25 years or older (N = 68), and 29.3% were among those 25 to 44 years old, which is decreased from 2019 to 2020. The proportion of TB cases in those 15 to 24 years old increased from 12% in 2019 to 16.3% in 2020.

The incidence of TB from the last five years remains high in persons in the 25 to 44 years age group (Figure 8) compared to other groups. Although the incidence rate in adults aged 65 or older was slightly elevated in 2017, incidence rate has remained steady for this age group.

The trend of reported pediatric cases (<15 years of age) has stayed unstable since 2016 (Figure 9). In 2020, there were nine pediatric TB cases reported, which is the highest within the five-year period. Pediatric TB is a public health concern of special significance because it is a marker for recent transmission of TB and is more likely to be life-threatening.[4]

Figure 8. Tuberculosis Case Rates by Age Group and Year, Indiana, 2016-2020

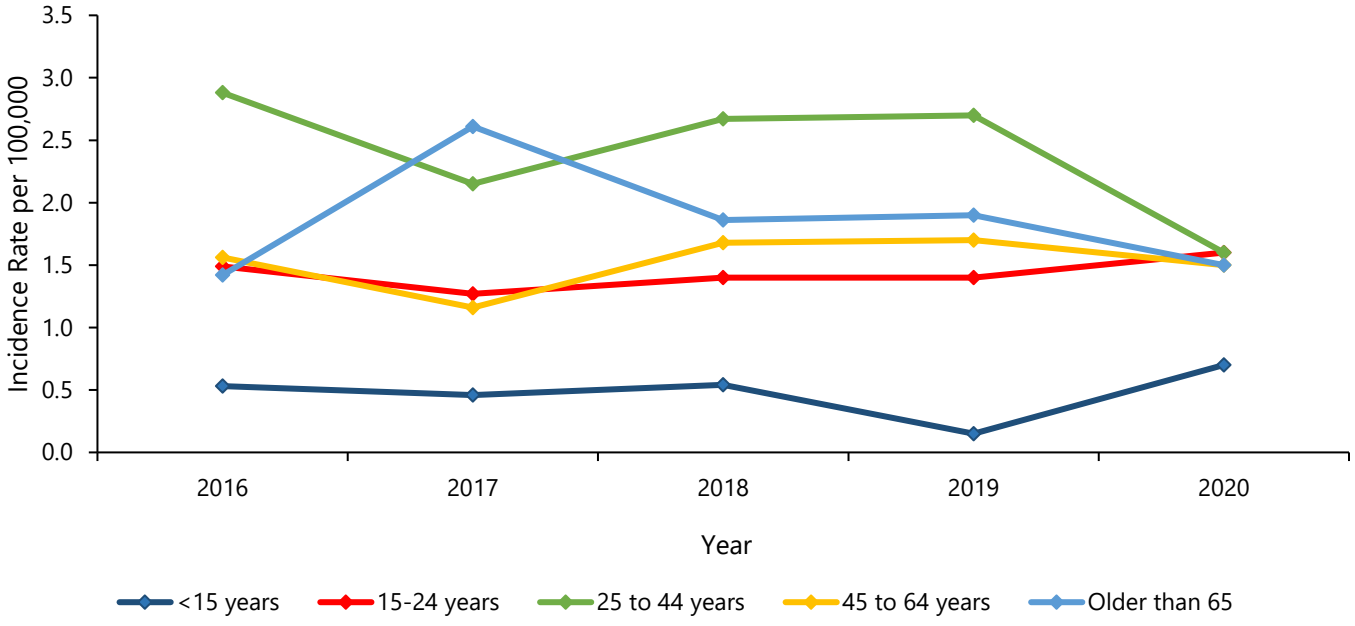


Figure 9. Pediatric TB Cases by Age Group, Indiana, 2016-2020

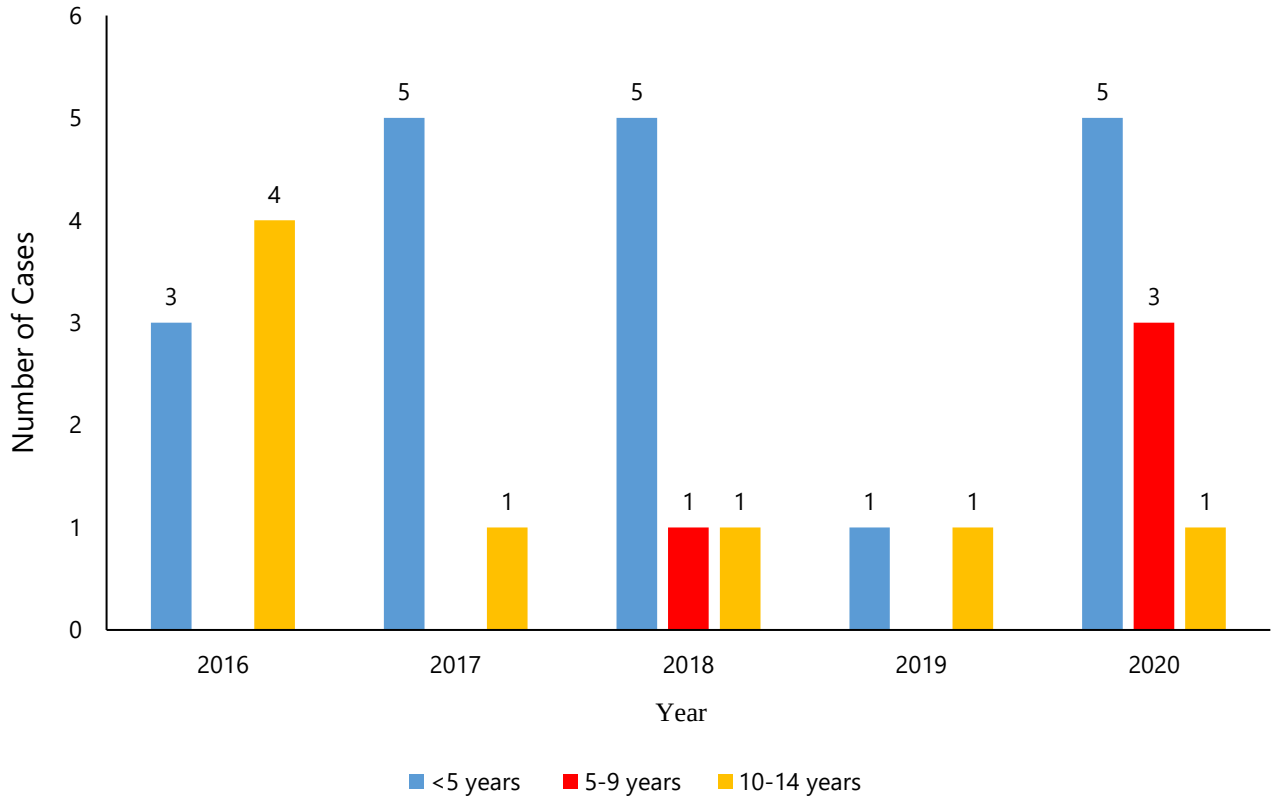
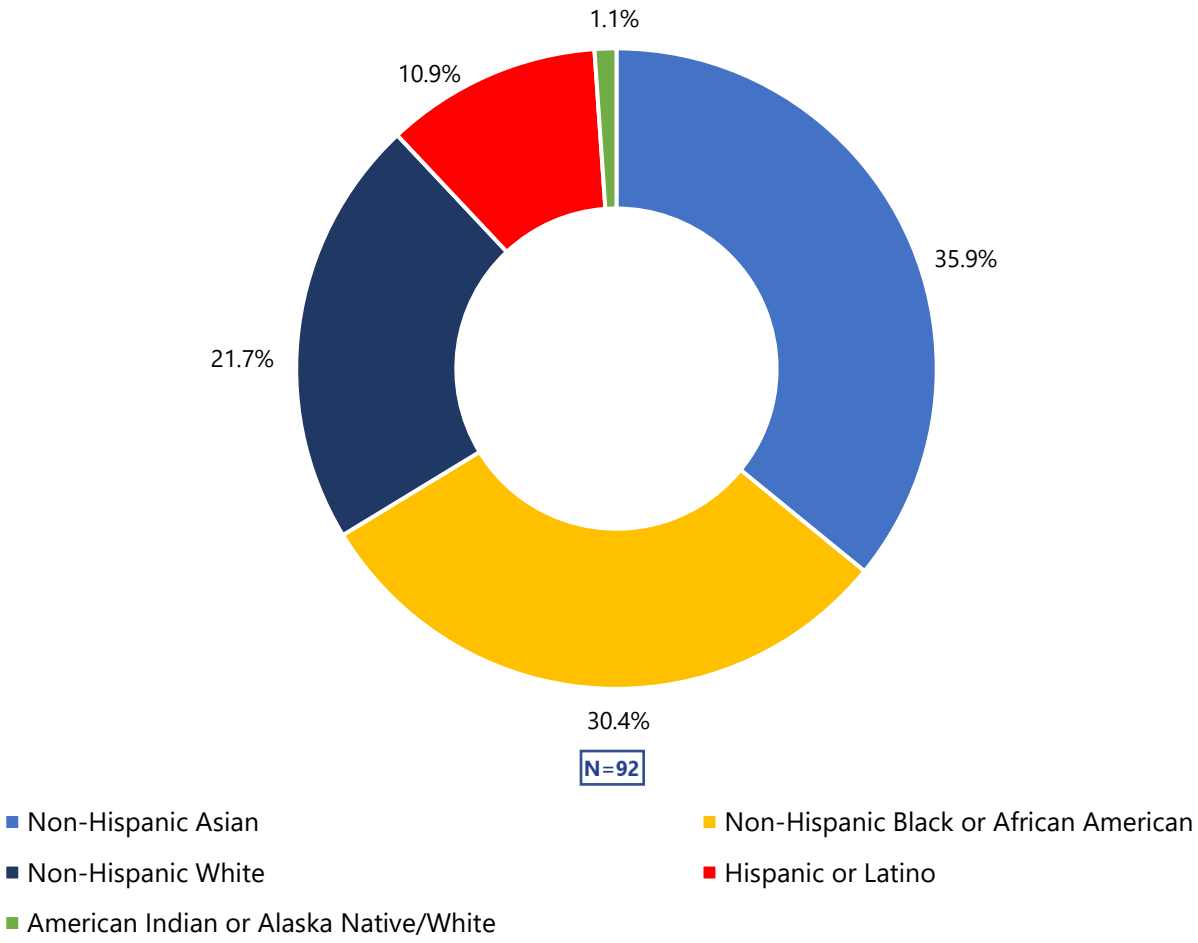


Figure 10. Percentage of TB Cases by Hispanic Ethnicity and Non-Hispanic Race, Indiana, 2020



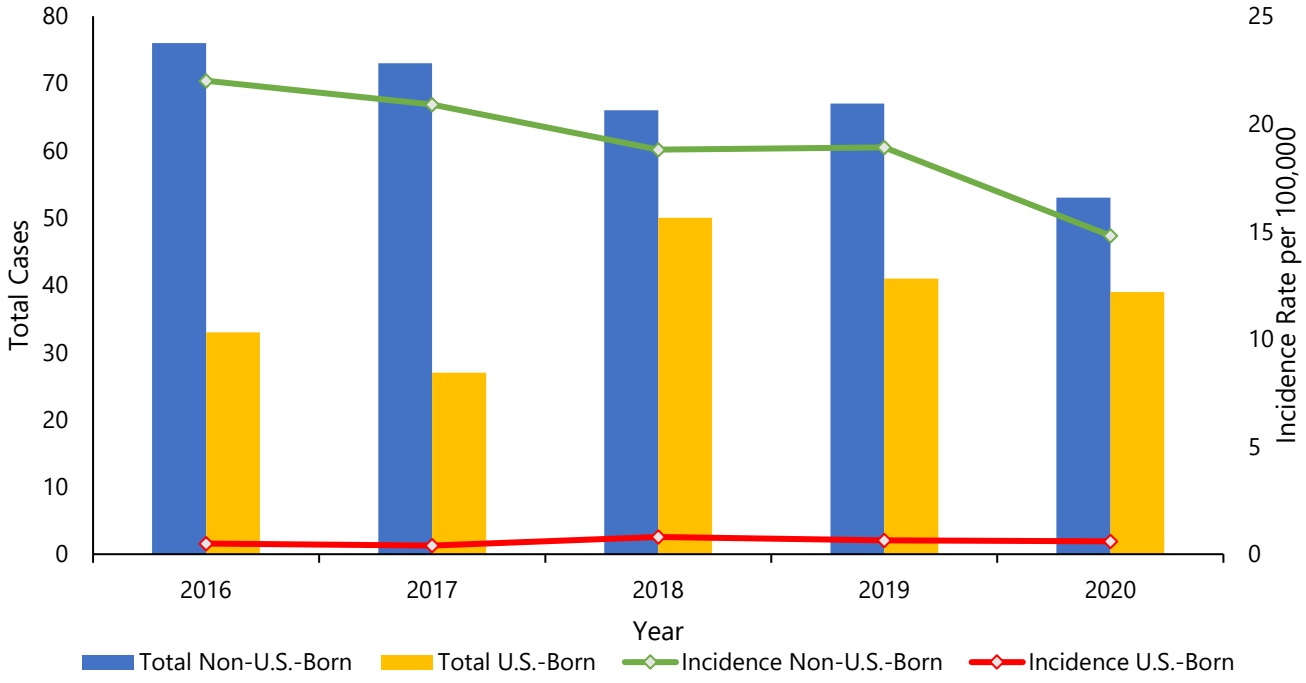
In 2019, Non-Hispanic Asians made up only 2.5% of Indiana's total population[5] but accounted for 35.9% of the cases, a slight increase from 34.3% of cases in 2019. Non-Hispanic Black or African American remain the second-highest proportion of cases by racial groups and compare to the low population of that racial group in Indiana. The proportion of Non-Hispanic White cases increased from 18.5% in 2019 to 21.7% in 2020. In Indiana, 7.2% of the population identified as Hispanic/Latino[5], yet 10.9% of TB cases in 2020 were seen in that population.

Incidence rates remain highest in Non-Hispanic Asians (19.4 per 100,000 population), American Indian or Alaska Native/White (8.4 per 100,000 population), Non-Hispanic Black or African Americans (4.4 per 100,000 population) and Hispanic/Latinos (2.1 per 100,000 population) compared to Non-Hispanic Whites (0.5 per 100,000 population).

Geographic Risk Factors

Globally, those who are born in high-burden countries have a higher risk of exposure to the tuberculosis bacteria. TB continues to disproportionately affect individuals born in high-burden countries.[6]

Figure 11. TB Case Counts and Rates by Country of Birth, Indiana, 2016-2020

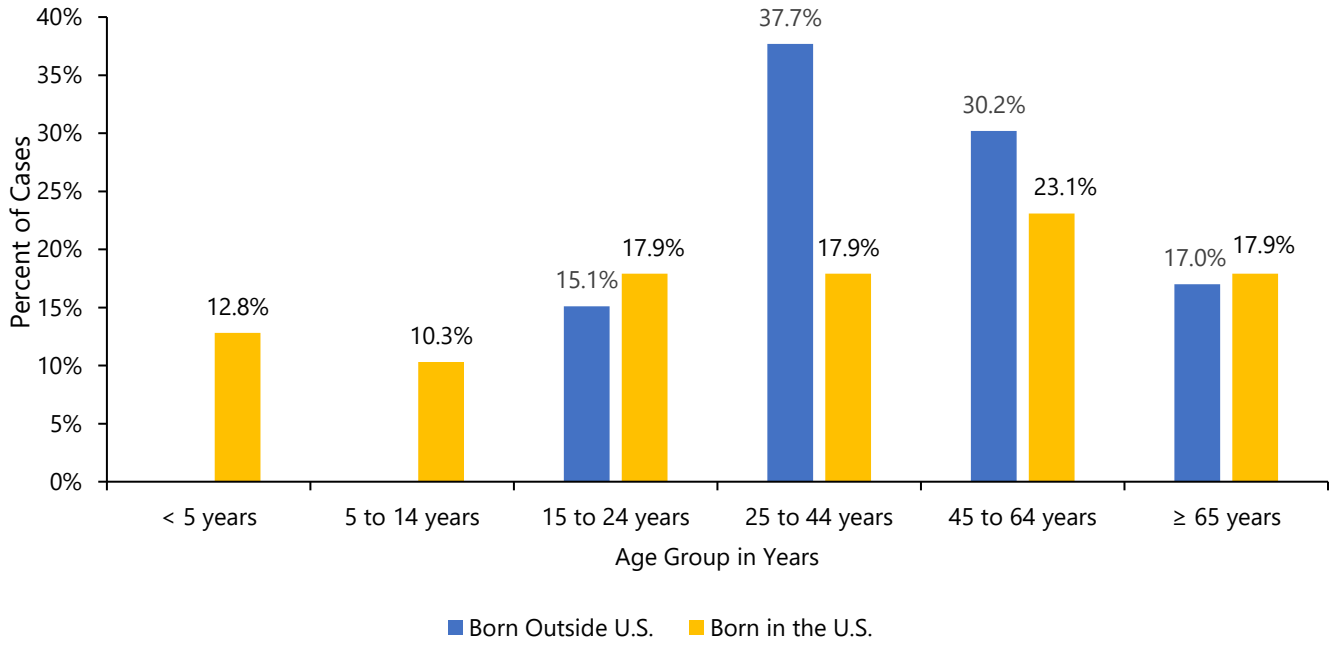


The proportion of U.S.-born cases increased from 38% in 2019 to 42.4% in 2020. The incidence of TB cases in Indiana remains high in persons born outside of the U.S. compared to those born in the United States. Persons born in Burma (aka Myanmar), Philippines, Mexico, India, and Nigeria accounted for 36.8% of the Indiana cases born outside of the United States in 2020.

14.8 Per 100,000 Incidence rate in persons born outside of the U.S. compared to 0.6 per 100,000 population in persons born in the U.S.

57.6% Proportion of cases occurring in persons born outside of the U.S. They accounted for only 5.3% of Indiana's total population in 2019.[5]

Figure 12. Percentage of TB Cases by Country of Birth and Age Group, Indiana, 2020



Among those born outside the U.S., 67.9% of TB cases occurred in individuals ages 25-64. Likewise, 41% of the cases occurred in persons born in the United States ages 25-64. Among pediatric cases, there were only cases among persons born in the United States.

HIV Coinfection Risk Factor

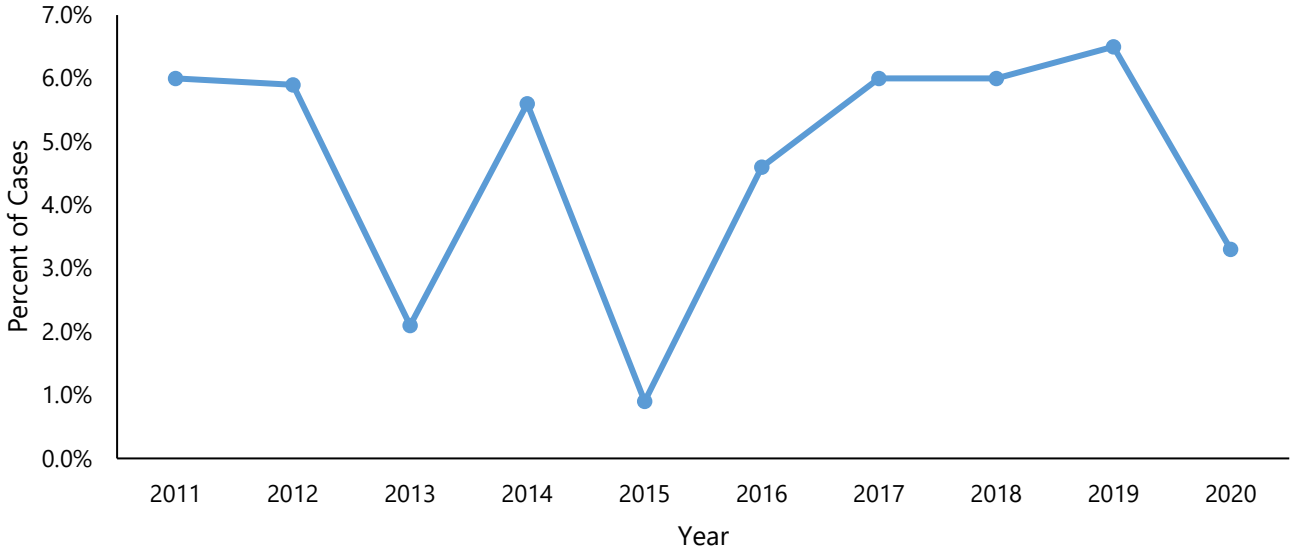
Someone with untreated latent TB infection and HIV infection is much more likely to develop TB disease during his or her lifetime than someone without HIV infection.[7] Among people with latent TB infection, HIV infection is the strongest known risk factor for progressing to TB disease.[7]

Figure 13. HIV Testing for Cases >15 Years and 25-44 Years of Age, Indiana, 2020

Age Group	Test Results Known	Testing Not Offered	Refused Testing
≥ 15 Years	93.8%	1.2%	4.8%
25-44 Years	96.3%	0%	3.7%

In 2020, 1.2% of TB patients ≥15 years old were not offered HIV testing and 4.8% refused testing. Among those 25-44 years old, only 3.7% of patients refused testing, and all patients were offered an HIV test.

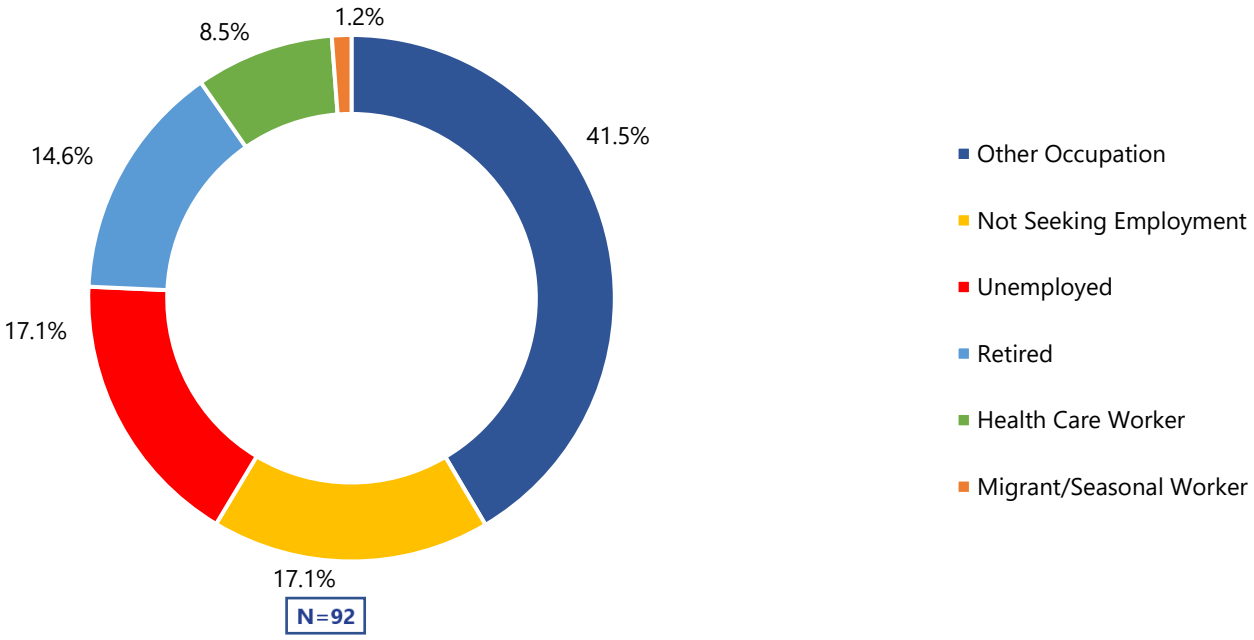
Figure 14. Percentage of Cases with HIV Comorbidity, Indiana, 2011 – 2020



The proportion of TB cases in Indiana with HIV comorbidity decreased from 2019 to 2020, with 3.3% of cases reporting HIV coinfection. Over the past 10 years, the proportion of TB cases with HIV coinfection in Indiana has not established a clear trend.

Occupational and Other Risk Factors

Figure 15. TB Cases by Occupation for Persons 16 Years or Older, Indiana, 2020



The unemployment rate among TB cases age 16 years and older was 17.1% in 2020. This has decreased from 2019, which was reported as 21.3%.

Figure 16. Most Common Reported Risk Factors, Indiana, 2020

Risk Factor	Percent
Diabetes Mellitus	17.4%
Non-injection Drug Use	10.9%
Excess Alcohol Use	8.7%
History of Homeless	7.6%
Immunosuppression (not HIV/AIDS)	5.4%

In 2020, the five most common risk factors reported were diabetes mellitus, non-injection drug use, excess alcohol use, history of homelessness, and immunosuppression (not HIV/AIDS). Similarly, these were also the most common risk factors reported in 2019 other than recent contact with infectious TB patient. Diabetes continued to be the most common risk factor in Indiana from 2016 to 2020.

Other risk factors reported in 2020 included contact with infectious TB patient, residence of long-time care facility within the past two years, residence in a correctional facility within the past two years, end-stage renal disease, injection drug use, incomplete LTBI therapy, TNF-α therapy and post-organ transplantation.

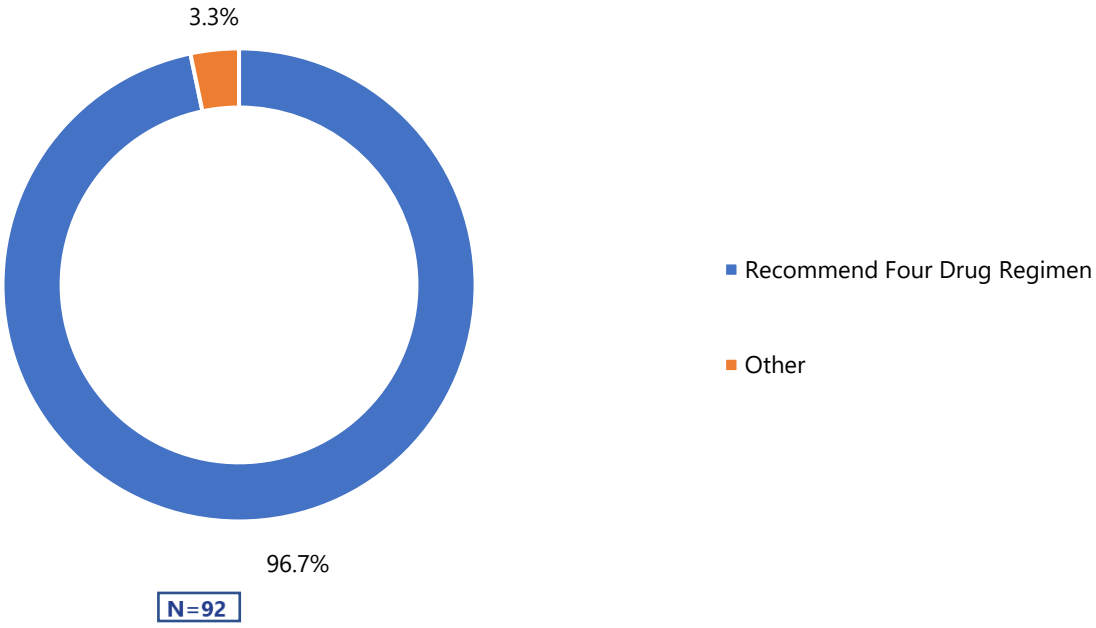
Treatment

TB disease can be treated by taking several medications for an average of six to nine months. There are 10 medications currently approved by the U.S. Food and Drug Administration (FDA) for treating TB. Of the approved medications, the first-line anti-TB agents that form the core of treatment regimens include:

- isoniazid (INH)
- rifampin (RIF)
- ethambutol (EMB)
- pyrazinamide (PZA)

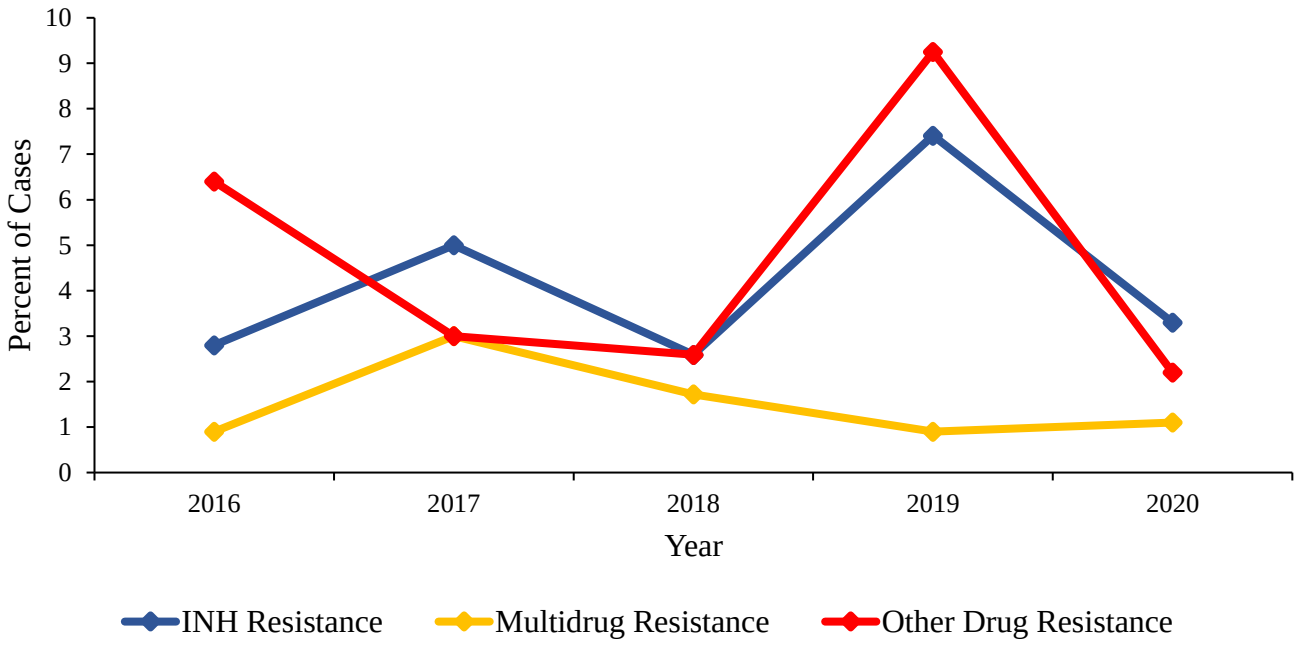
It is important that individuals who have TB disease finish the medicine, taking the drugs exactly as prescribed. If they stop taking the medication too soon, they can become sick again; if they do not take the medication correctly, the TB bacteria that are still alive may become resistant to those drugs. TB that is resistant to drugs is harder and more expensive to treat.[8]

Figure 17. Percentage of Cases with Recommended Initial Drug Regimen, Indiana, 2020



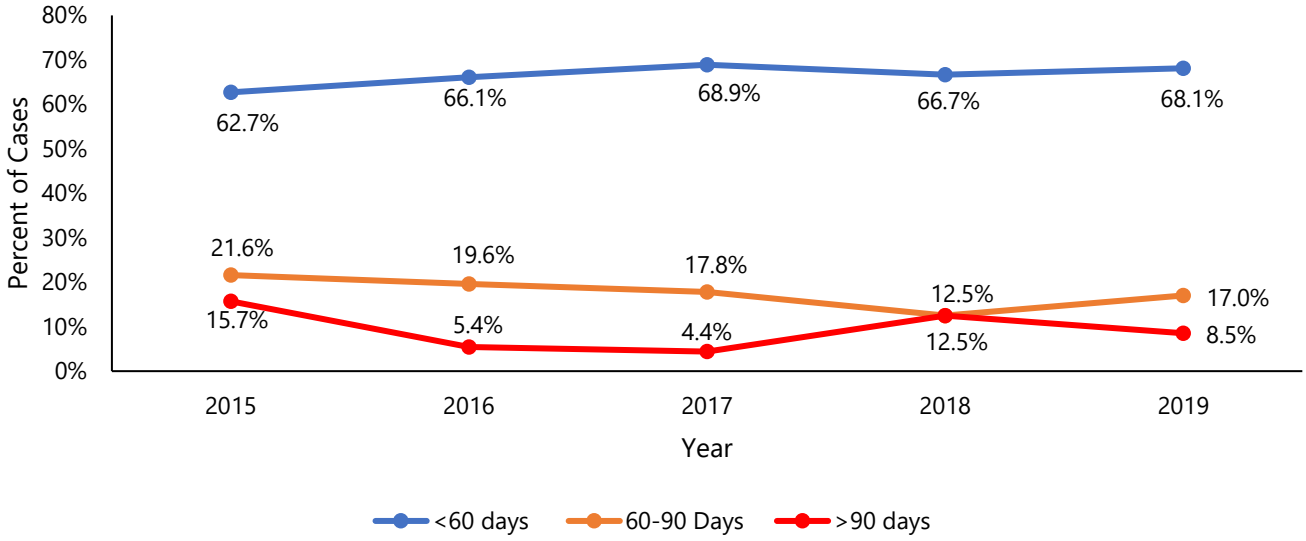
In 2020, 96.7% of TB cases were placed on the recommended initial four-drug therapy. That is lower than in 2019, with 98.1%.

Figure 18. Percentage of Cases with Reported Drug Resistance, Indiana, 2016 – 2020



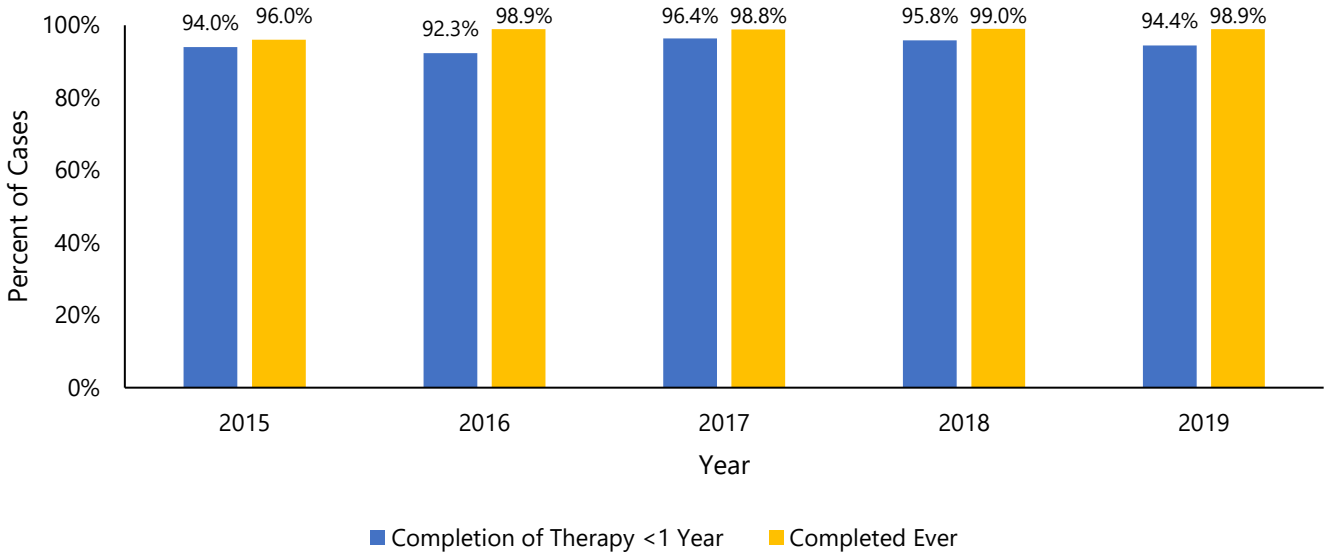
Of the 73 culture-positive TB cases in Indiana in 2020, drug susceptibility testing was performed on 96% of the isolates. INH and other drug resistance increased from 2018 to 2019, while multidrug resistance slightly decreased. In 2020, INH and other drug resistance decreased from 2019, while multidrug resistance remained unchanged.

Figure 19. Percentage of Cases Culture-Converted by Time to Conversion, Indiana, 2015 -2019



Among eligible cases, 93.6% of the cases reported sputum culture conversion in 2019. Of those cases, 68.1% had documented conversion within two months of treatment. Conversion (from positive to negative) data are collected to measure response to therapy and to determine length of treatment.

Figure 20. Percentage of Cases by Therapy Completion, Indiana, 2015-2019

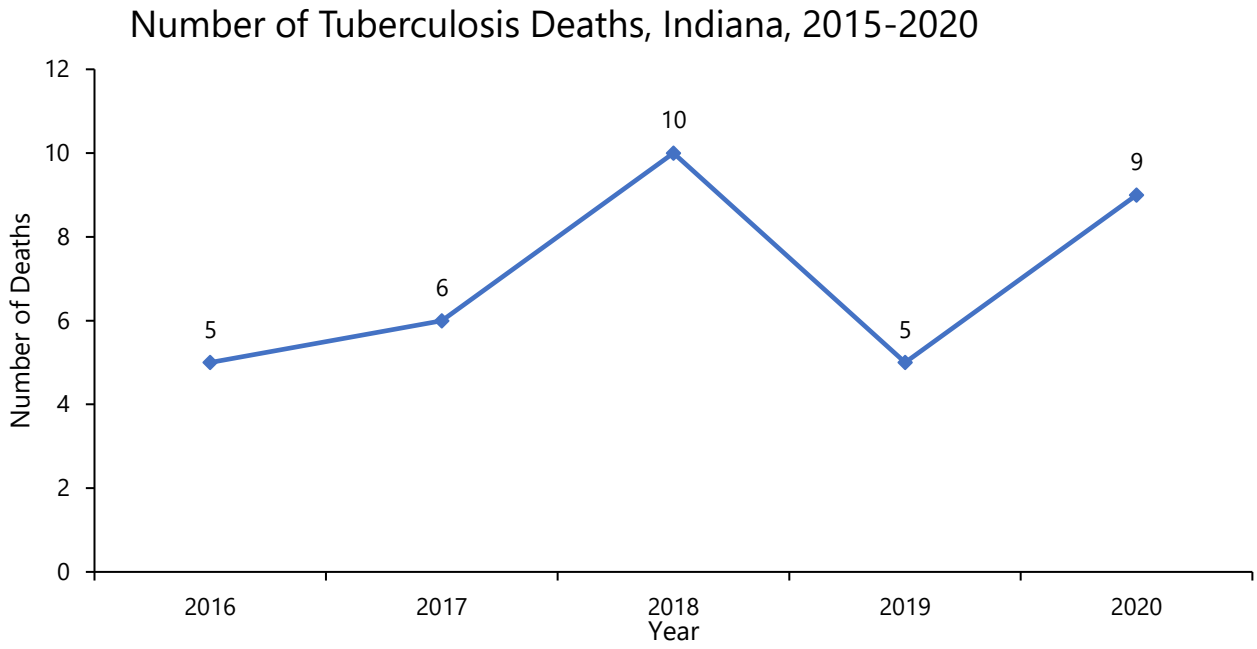


The proportion of eligible cases that completed treatment within one year remains steady in the five-year trend from 2015-2019. On average, 94.6% of eligible cases complete treatment within one year, and 98.3% completed treatment within this five-year period. Directly observed therapy (DOT) is the most effective way to ensure a patient complies with the prescribed treatment regimen and does not acquire drug resistance. In 2019, 69.4% of TB cases received all treatment via DOT.

TB Mortality

Deaths attributed to TB disease are also monitored as part of surveillance. Collecting data on deaths can help public health experts understand risk factors associated with TB mortality. Nationally, the number of TB-related deaths has been declining in the United States. The latest data show that in 2018, the United States reported 542 deaths that were attributed to TB disease.[9] The Indiana Department of Health uses data from death certificates to verify TB related deaths in Indiana.

Figure 21. TB Deaths, Indiana, 2016-2020



In the last five years, the number of TB-related deaths has varied in Indiana. In 2020, 9 deaths were reported as related to TB disease, which increased from 2019.

20 Days

Average length patients were on therapy among the TB-related deaths in Indiana in 2020.

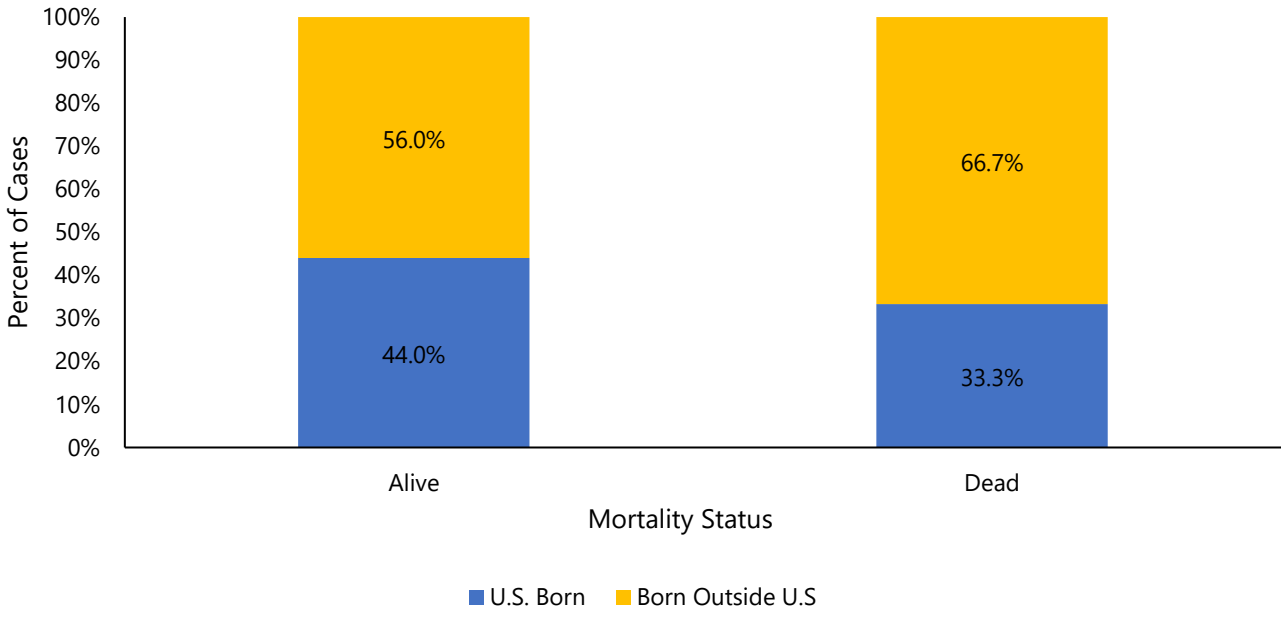
234 days was the average length for a person who was alive at the end of treatment completion in 2020 (n=48).

66 Years

Average age of persons who died from TB in Indiana in 2020.

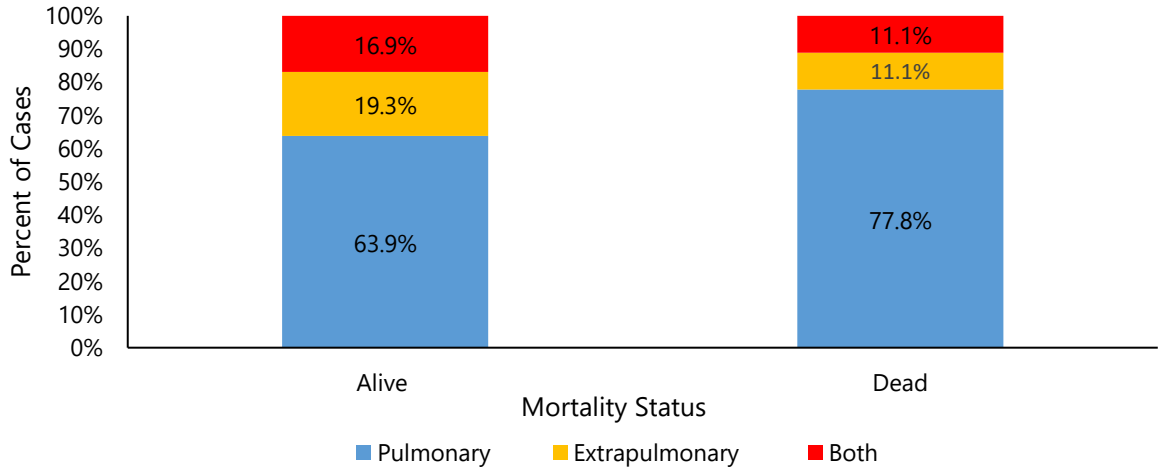
The average age of persons that did not die was 40 years.

Figure 22. Percentage of TB Cases by Mortality Status and Country of Birth, Indiana, 2020



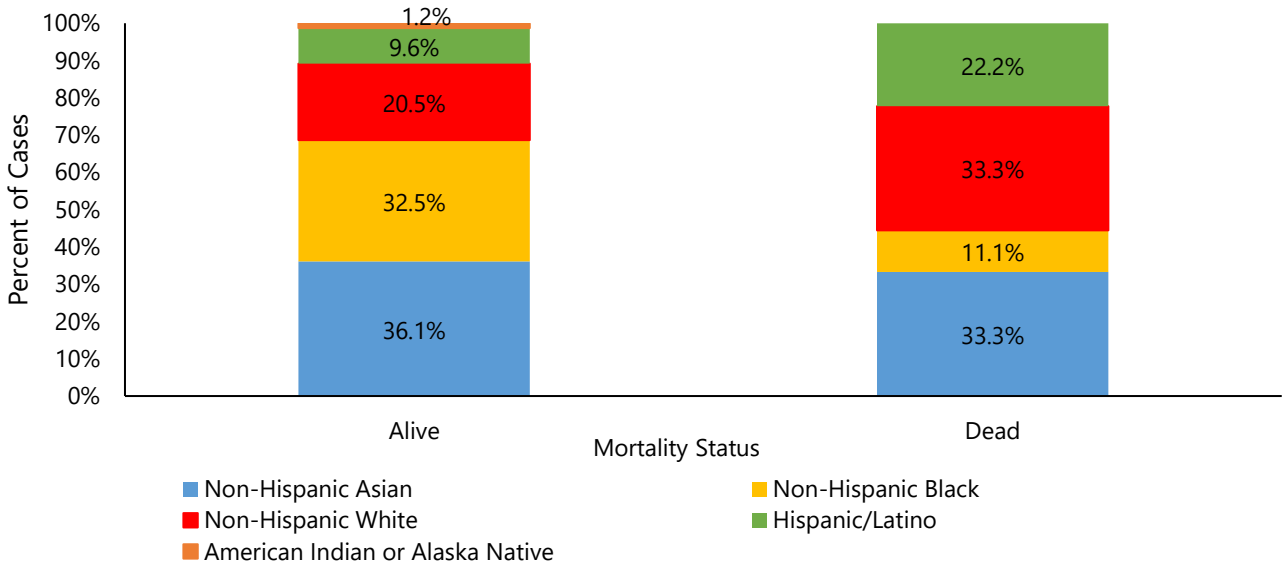
In 2020, 66.7% of TB deaths occurred in persons born outside of United States, compared to just 56% of the cases who survive. This is markedly different from 2019, when 100% of TB deaths occurred in persons born outside of United States.

Figure 23. Percentage of TB Cases by Mortality Status and Site of Disease, Indiana, 2020



In 2020, individuals who died from TB had a higher proportion of pulmonary site of disease in comparison to individuals who were alive at the end of treatment. A total of 11.1% of TB deaths came from patients who were diagnosed with both pulmonary and extrapulmonary sites of disease. The extrapulmonary sites were peritoneal and lymphatic intrathoracic.

Figure 24. Percentage of TB Cases by Mortality Status and Hispanic Ethnicity and Non-Hispanic Race, Indiana, 2020



The majority of TB-related deaths occurred in Non-Hispanic Asians and Non-Hispanic Whites in 2020. The two groups each accounted for 33.3% of the TB deaths in 2020. Among TB cases who were alive in 2020, Non-Hispanic Asian accounted for 36.1% those case while Non-Hispanic Whites accounted for only 20.5% of the cases.

Genotyping

TB genotyping is a laboratory-based approach used to analyze the genetic material (e.g., DNA) of *Mycobacterium tuberculosis*. Specific sections of the *M. tuberculosis* genome form distinct genetic patterns that help distinguish different strains of *M. tuberculosis*. TB genotyping results, when combined with epidemiologic data, help identify persons with TB disease involved in the same chain of recent transmission. In the same way, TB genotyping helps distinguish between persons whose TB disease is the result of TB infection that was acquired in the past, as compared to recently or newly acquired infection with development of TB disease.

When two or more *M. tuberculosis* isolates match by genotyping methods (i.e., same spoligotype and MIRU patterns), they are referred to as a genotype cluster. Patients who are members of the same genotype cluster are assumed to have the same strain, which may be a surrogate for recent transmission. However, genotyping information is only one piece of evidence used to determine transmission patterns. Genotyping information, epidemiologic linkages including spatial (geography) and temporal (time) associations, and drug susceptibility results (phenotype) can help distinguish recent transmission from activation of latent TB infection.[10]

100% of culture positive TB cases were genotyped	**61.1%** of cases genotypes were identified as part of a cluster	**5** New clusters were identified	**Zero** outbreaks reported in 2020.

In 2020, 44 out of the 72 genotyped cases were identified as part of a cluster. Five new genotype clusters were identified, with no outbreaks reported in 2020. There were several clusters with newly added cases indicating prior or continued transmission within Indiana. Risk factors associated with these ongoing clusters associated with transmission include history of homelessness, drug and alcohol use, and history of incarceration.

Contact Investigation

Persons who have been exposed to a case of infectious TB disease are known as TB contacts. A TB contact investigation is a TB control strategy used to identify, find, and assesses TB contacts and provide appropriate treatment for LTBI or TB disease, if needed. Effective contact investigations interrupt the spread of TB in communities and help prevent outbreaks of TB.[11] To help ensure contact investigations are being thoroughly completed, the Centers for Disease Control and Prevention (CDC) has set national objectives for contact investigation measures for programs to strive for.

2020 National Objectives & Indiana Contact Investigation Measures by Year 2015 - 2019

Year	2015	2016	2017	2018	2019	2025 National Objective
Total Number of Cases	116	109	100	100	108	
Percentage of sputum AFB smear-positive TB cases with contacts identified	100%	100%	100%	97.7%	92.7%	**100%**
Percentage of contacts to sputum AFB smear-positive TB cases evaluated for infection and disease	60%	76%	83%	66.8%	77.3%	**94%**
Percentage of infected contacts who are started on treatment for latent TB that complete therapy	85%	91%	90%	92.2%	81.6%	**93%**

Appendices

A. Data Sources and Methods

All TB data for Indiana were pulled from the Indiana Department of Health's online database National Electronic Disease Surveillance System Base System (NBS) and analyzed using SAS verison 9.4. Historical data pre-dating NBS (prior to 2019) was pulled from the Statewide Investigation, Monitoring, and Surveillance System (SWIMSS) and the TB Information Management database (prior to 2009). All local health departments in Indiana are required to enter information regarding TB cases and their contact investigations into the NBS database, which is then used to transmit required information to the CDC through the Report of Verified Case of Tuberculosis (RVCT).

All population data presented and used to calculate rates within this report were obtained from the U.S. Census Bureau's American Community Survey. Population estimates used in 2020 rates are based on 2019 American Community Survey 1-Year Estimates[5] as 2020 population had not been released at the time of publication.

The total number of TB cases is based on persons whose primary residence was in Indiana at the time of diagnosis and who were verified as having TB disease in the given year. Persons counted in another state and immigrants and refugees who are diagnosed and begin treatment abroad are excluded. Foreign visitors (i.e. students, tourists, etc.) and certain other categories of non-U.S. citizens who are diagnosed in Indiana but remain in the United States for fewer than 90 days of treatment are also excluded.

Cases counts fewer than five are suppressed at the county level to protect patient confidentiality.

Race is collected in five categories: American Indian or Alaskan Native, Asian, Black or African American, Native Hawaiian or Other Pacific Islander, and White. Only those racial groups with TB cases within the given time period are shown in this report.

Data for TB-related deaths are obtained from death certificates provided from the Vital Records Division at the Indiana Department of Health. The death certificate for any patient who dies during the course of treatment is reviewed by the TB Control Program. If it is determined that the cause of death is from TB disease or a complication from TB, the program will count the case as a death that is attributed to TB disease.

Data measures relating to treatment (initial drug regimen, culture conversion, DOT utilization, and therapy completion) exclude cases that were deceased upon diagnosis. The completion of therapy measure only includes cases for whom 12 months of treatment or fewer are recommended, who were alive at diagnosis, and who initiated treatment with one or more drugs. This excludes cases with any rifampin-resistant TB, meningeal TB, TB in bone or skeletal system, TB in the central nervous system, or children ages 14 and younger with disseminated TB. This also excludes cases who died or moved out of the United States within 366 days of initiating treatment.

B. Glossary

Acid-fast bacilli: Bacteria that retain certain dyes after being washed in an acid solution. *M. Tuberculosis* belongs to this group.

Clinical case confirmation: A clinical diagnosis is confirmed when all of the following criteria are met upon medical evaluation: (1) a positive tuberculin skin test (TST) or positive interferon-gamma release assay (IGRA) for *M. tuberculosis*; (2) other signs and symptoms compatible with TB (e.g., an abnormal chest X-ray or other clinical evidence of current disease); (3) current treatment with two or more anti-TB drugs, and (4) a completed diagnostic evaluation.

Cluster: A group of patients with LTBI or TB that is linked by epidemiologic, location, or genotyping data. A genotyping cluster is two or more cases with isolates that have an identical genotyping pattern.

Comorbid: The coexistence of two or more disease processes.

Contact: A person who has spent time with a person with infectious TB.

Culture: Growth of microorganisms in the laboratory performed for detection and identification of TB in sputum or other body fluids and tissues.

Culture conversion: Wherein sputum culture-positive results convert to sputum culture-negative.

Directly observed therapy (DOT): Adherence-enhancing strategy in which a health care worker or other trained person watches as a patient swallows each dose of medication. DOT is the standard care for all patients with TB disease and is a preferred option in certain circumstances for patients treated for LTBI.

Epidemiological Link: Method to connect cases using data about person, place and time in addition to genotypical data, if available. These cases are suspected as being part of shared transmission.

Extrapulmonary TB: TB disease in any part of the body other than the lungs. The presence of extrapulmonary disease does not exclude pulmonary TB disease.

Genotype: The DNA pattern of *M. tuberculosis* used to discriminate different strains.

Interferon Gamma Release Assay (IGRA): Whole-blood tests that can aid in diagnosing TB by measuring a person's immune reacitivity to *M. tuberculosis*.

Immunocompetent: Capable of developing an immune response; possessing a normal immune system.

Incidence: The extent or rate of occurrence, especially the number of new cases of a disease in a population over a period of time.

Laboratory case confirmation: Laboratory diagnosis is confirmed when: (1) isolation of *M. tuberculosis* from a clinical specimen, or, (2) demonstration of *M. tuberculosis* complex from a clinical

specimen by nucleic acid amplification test, or, (3) demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated.

Latent Tuberculosis infection (LTBI): Infection with *M. tuberculosis* in which symptoms or signs of disease have not manifested.

MIRU: Distinguishes the *M. tuberculosis* strains by the difference in the number of copies of tandem repeats at specific regions, or loci, of the *M. tuberculosis* genome.

***Mycobacterium tuberculosis*:** The namesake member organism of the *M. tuberculosis* complex and the most common causative agent of TB disease in humans. In certain instances, the species name refers to the entire *M. tuberculosis* complex, which includes *M. bovis, M. africanum*, *M. microti*, *M. canetii*, *M. caprae*, and *M. pinnipedii*.

Multi-drug resistance: Strains of *M. tuberculosis* that are resistant to at least isoniazid and rifampin.

Nucleic acid amplification test: A molecular technique used to detect a virus or bacterium, such as *M. tuberculosis***.**

Outbreak: Unusually high occurrence of a disease or illness in a population or area. Three or more cases are required for an occurrence of TB to be classified as an outbreak.

Pulmonary TB: TB disease that occurs in the lungs.

Provider diagnosis case confirmation: In which a case does not meet criteria for laboratory nor clinical confirmation but the TB Control Program counts as a TB case based upon physician assessment and as determined by TB Medical Consultant and TB Controller.

Resistance: The ability of certain strains of mycobacteria, including *M. tuberculosis*, to grow and multiply in the presence of drugs that ordinarily kill or suppress them. Such strains are referred to as drug-resistant strains and cause drug resistant-TB disease.

Smear-positive: A positive test indicating the presence of TB bacteria in sputum done by smearing the sputum on a glass slide, staining it, and looking for bacteria.

Spoligotyping: Identifies the *M. tuberculosis* genotype based on presence or absence of spacer sequences found in a direct-repeat region of the *M. tuberculosis* genome where 43 identical sequences and 36 base pairs are interspersed by spacer sequences.

Sputum: Mucus containing secretions coughed up from inside the lungs. Sputum is different from saliva or nasal secretions, which are unsatisfactory for detecting TB disease.

Tuberculin skin test: A test done to detect TB infection by injecting liquid tuberculin under the skin and measuring the immune reaction.

C. Sources

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