



Indiana State Department of Health

Tuberculosis Control Program

2018 Annual Report

April 29, 2019

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Executive Summary

The mission of the Tuberculosis Control, Prevention and Elimination Program is to oversee, manage and facilitate activities that ensure early identification and proper treatment of persons with tuberculosis; prevent transmission of *Mycobacterium tuberculosis* to others; increase the percentage of people with newly diagnosed infection who start and complete treatment; and provide education to both the public and health care workers.

In 2018, 116 new cases of tuberculosis (TB) were reported to the Indiana State Department of Health, a 16.0 percent increase since 2017. There has also been an overall 2.5 percent decrease in TB cases in Indiana over the last 10 years, which continues the trend seen since 1956. Marion County continued to have the most cases of any jurisdiction, with 38 cases reported in 2018 and a total of 408 cases over the past 10 years.

Disparities in TB continue to be seen among several populations, including by age group, race, ethnicity, gender, and foreign-born status. Hoosiers between 25 and 44 years, and 65 or older had the highest TB rates in 2018, with 2.3 cases per 100,000 population. More than half of the cases in 2018 in Indiana (56.9 percent) were among foreign-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 within a correctional facility. In 2018, HIV status was known among 89.9 percent of TB cases age 15 or older, and 6.0 percent of all TB cases were HIV-positive. Diabetes was the most common measured risk factor, reported in 15.5 percent 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 2018, 90.3 percent of TB cases were started on the recommended initial therapy and 98.8 percent of cases in 2017 completed their therapy. There were two cases of multi-drug-resistant TB in Indiana in 2018, a decrease from 2017.

TB genotyping and contact investigation are used in TB control to help prevent additional cases. Six genotype clusters with possible recent transmission were active in Indiana in 2018, with no clusters identified as outbreaks. In 2017, every case of infectious TB had contacts identified, and 83.5 percent of those contacts were fully evaluated for infection and disease.

The vision of the Indiana State Department of Health's TB Control, Prevention and Elimination 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 in Indiana.

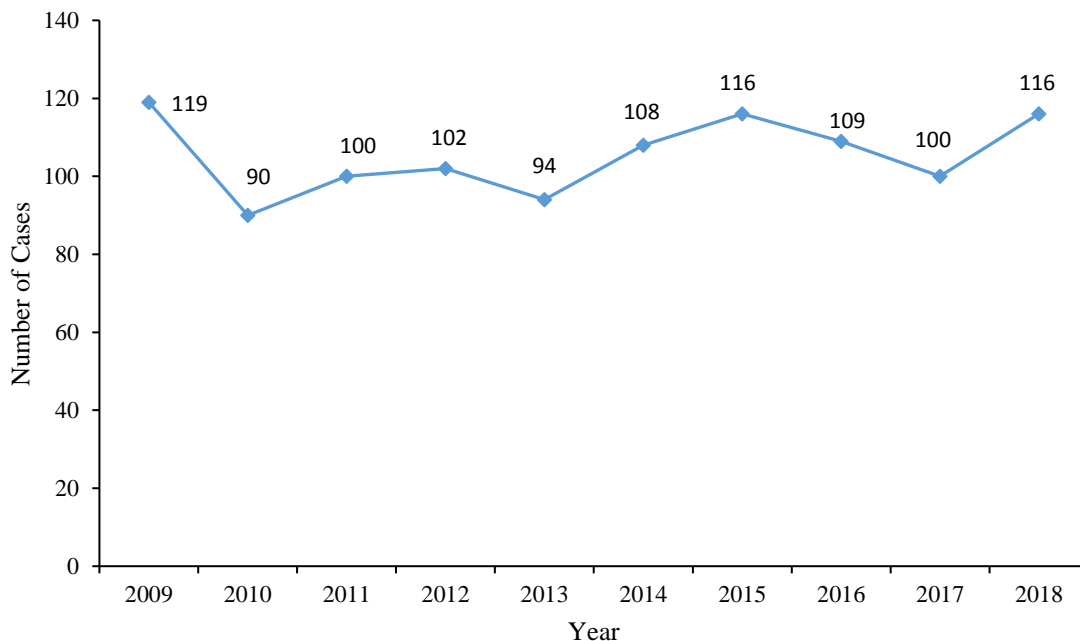
TB Indicators	Indiana		Program Goals
	2018	2017	2018
Number of Tuberculosis Cases	116	100	
Tuberculosis Case Rate per 100,000 Population	1.7	1.5	
Number of Tuberculosis Deaths	10	6	
Laboratory Confirmation	76.7%	72.0%	
Pulmonary Site of Disease	72.4%	72.0%	
U.S. Born Incidence Rate	0.8	0.4	0.6
Foreign-Born Incidence Rate	18.8	20.9	16.0
Non-Hispanic White Incidence Rate	0.7	0.4	
Non-Hispanic Black Incidence Rate	5.4	1.8	
Non-Hispanic Asian Incidence Rate	19.1	29.3	
Hispanic/Latino Incidence Rate	3.9	4.8	
Male Incidence Rate	2.0	1.9	
Female Incidence Rate	1.4	1.1	
Known HIV Status 25-44 Years of Age	97.4%	94.4%	88.7%
HIV Comorbidity	6.0%	6.0%	
Resident of Correctional Facility	3.5%	1.0%	
Homelessness	3.5%	4.0%	
Resident of Long-Term Care Facility	1.7%	2.0%	
Injecting Drug Use	2.6%	1.0%	
Non-Injecting Drug Use	8.6%	5.0%	
Excess Alcohol Use	9.5%	9.0%	
Initial Four Drug Therapy Regimen	90.3%	92.0%	94.0%
INH Resistance	2.6%	5.0%	
MDR	1.7%	3.0%	
Culture Conversion < 60 Days	71.1% (2017)	67.3% (2016)	72.0%
DOT Utilization	78.0% (2017)	85.2% (2016)	
Completion of Therapy <1 Year	96.4% (2017)	92.3% (2016)	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; another person may become infected if he or she inhales 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 percent of immunocompetent individuals with LTBI will progress to active disease at some point in their lives if they are not treated. Indiana requires reporting of all suspected cases and confirmed cases of TB. As of December 2015, LTBI is also a reportable disease at the state level in Indiana.

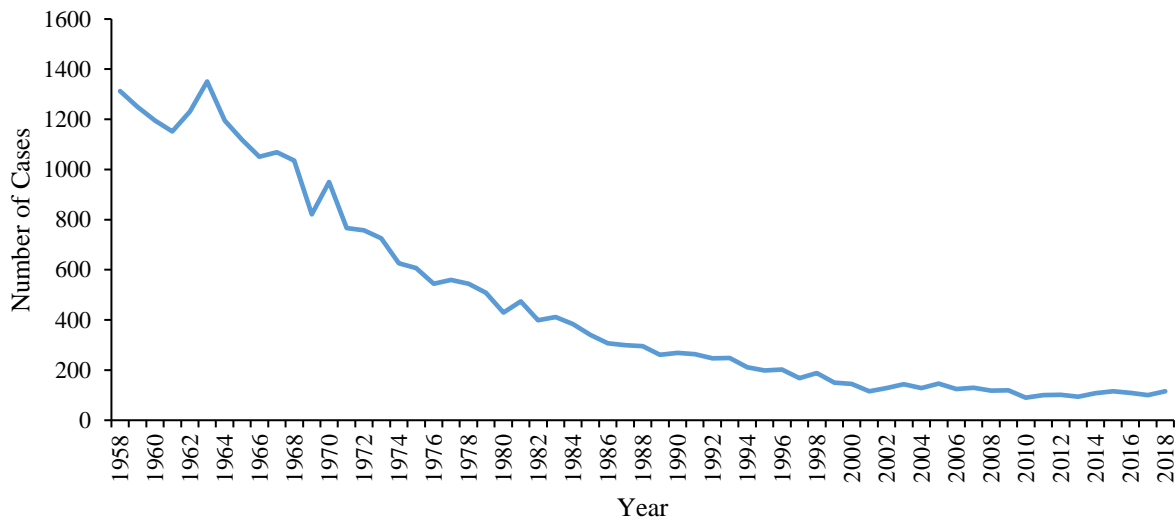
Burden & Trends

Figure 1. Tuberculosis Cases in Indiana, 2009 - 2018



In Indiana, there were 116 reported cases of TB in 2018, a 16.0 percent increase from 2017 and matching a 5-year high of reported cases. The incidence rate of TB also increased from 2017 to 2018, from 1.5 per 100,000 population to 1.7 per 100,000 population.

Figure 2. Historical Trend of Tuberculosis Cases in Indiana



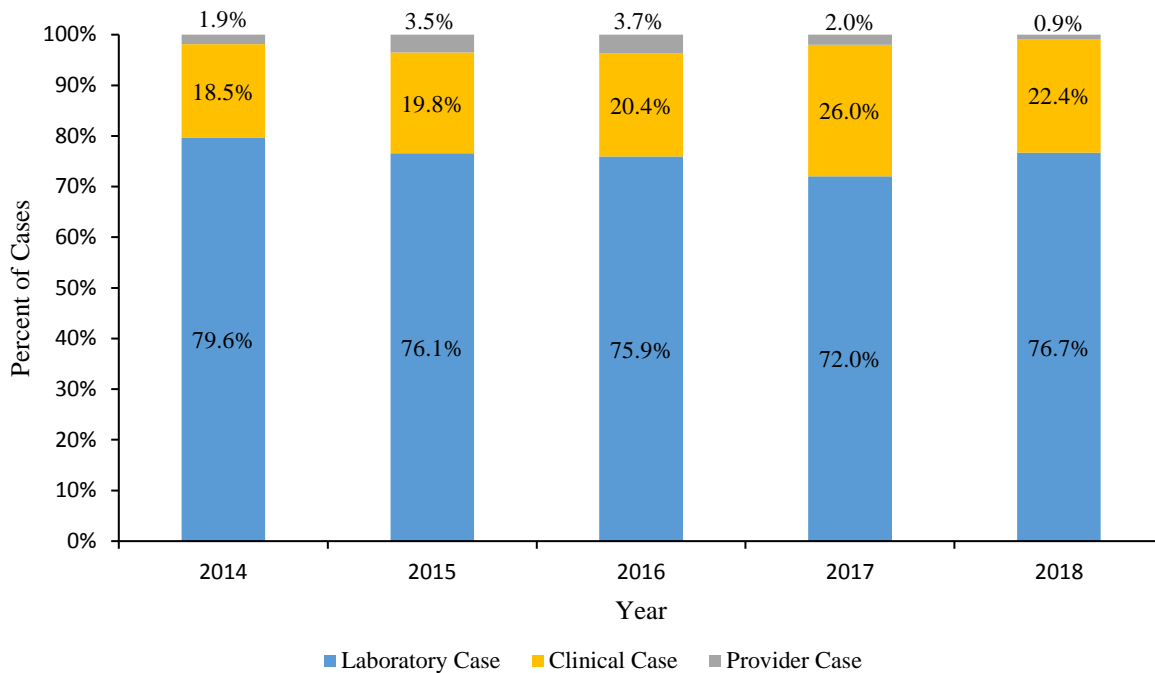
The decrease in TB seen in the last 10 years is in line with the downward historical trend seen in Indiana since the 1950’s. The latest national data from 2017 shows that Indiana ranked 32nd out of the 50 states in incidence rate but remains under the national incidence rate (2.8 per 100,000) for TB in the United States.

Diagnosis of Tuberculosis

A diagnosis of TB is categorized as either laboratory, clinical, or provider diagnosis according to established criteria by the CDC shown below¹. Provider diagnosis is defined as a case that does not meet either laboratory or clinical case definitions but in which the provider believes there is sufficient evidence for a diagnosis of TB based upon the clinical evaluation.

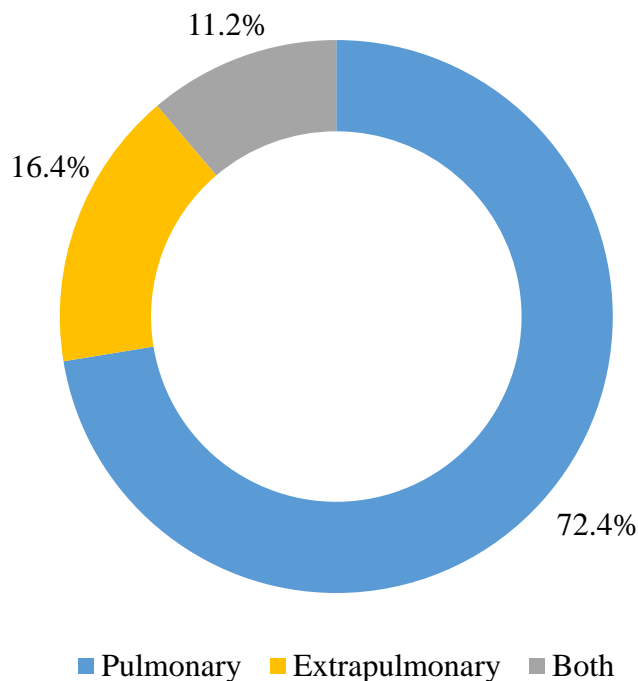
Laboratory Criteria	Clinical Criteria
<ul style="list-style-type: none"> ➤ Isolation of <i>M. tuberculosis</i> from a Clinical Specimen, OR ➤ Demonstration of <i>M. tuberculosis</i> complex from a clinical specimen by nucleic acid amplification test, OR ➤ Demonstration of acid-fast bacilli in a clinical specimen when a culture has not been or cannot be obtained or is falsely negative or contaminated. 	<ul style="list-style-type: none"> ➤ A positive tuberculin skin test or positive interferon gamma release assay for <i>M. tuberculosis</i> ➤ 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, 2014-2018



In 2018, 76.7 percent of cases were laboratory confirmed cases of TB. This is an increase from 72.0 percent in 2017.

Figure 4. Percentage of Tuberculosis Cases by Site of Disease, Indiana, 2018



In 2018, 72.4 percent of TB cases in Indiana were pulmonary (n=84). This proportion remained steady from 2017 which also reported 72.0 percent of TB cases as pulmonary.

Extrapulmonary sites included lymphatic, pleural, meningeal, peritoneal, genitourinary and ocular in 2018. Lymphatic system was the most commonly reported site for extrapulmonary disease, accounting for 42.0 percent of the extrapulmonary cases.

Geographic Distribution of TB

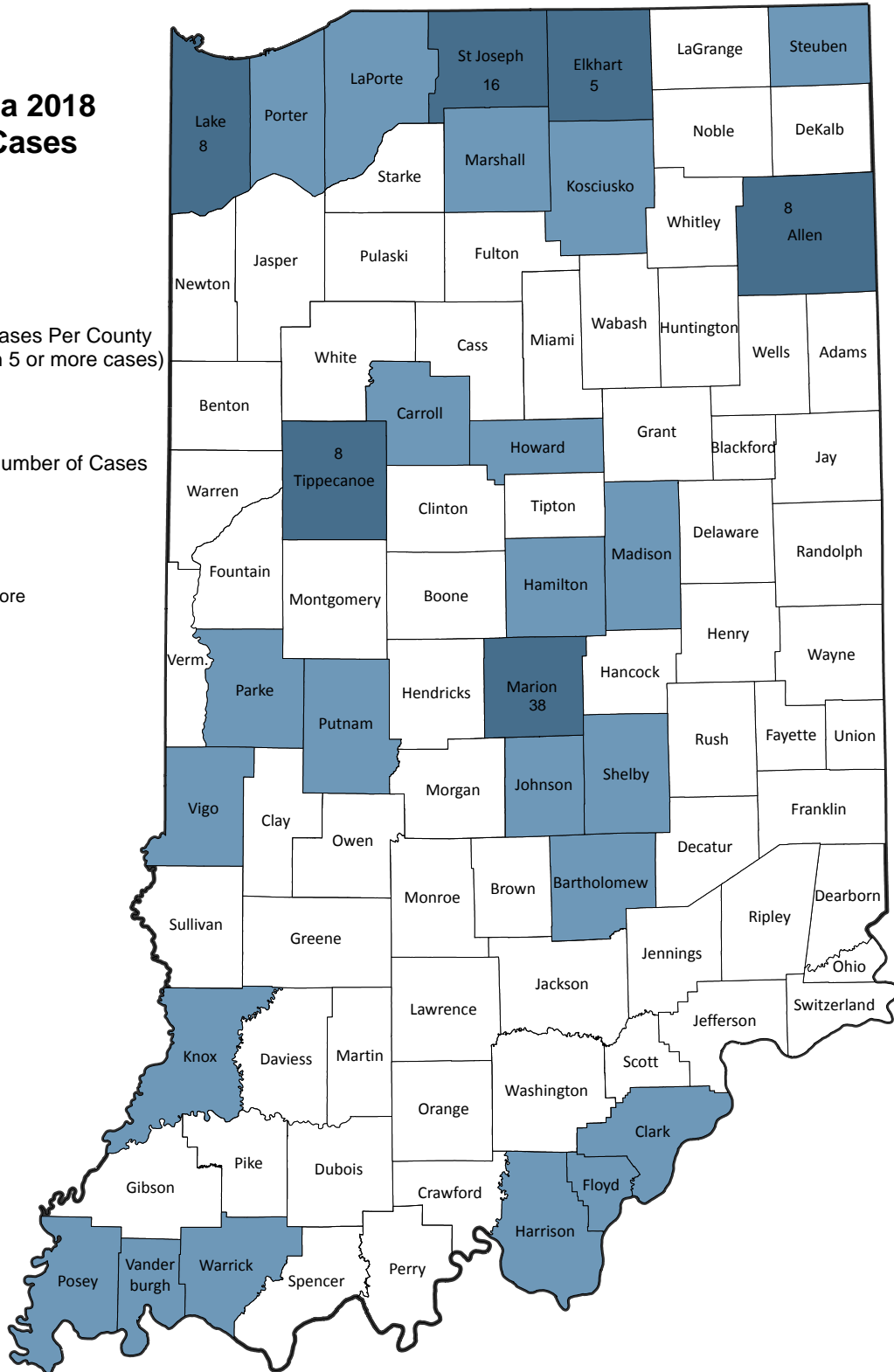
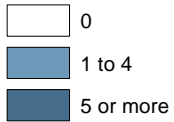
In total, 28 Indiana counties reported cases of TB in 2018. Of those counties, 18 reported increase in TB cases with four counties reporting increases of at least three or more cases compared to 2017. Marion County accounted for 32.8 percent of the total cases in 2018, while only having 14.3 percent of Indiana’s total population. Similarly, Marion County had the highest proportion of TB cases from 2009-2018, accounting for 38.8 percent of all cases in Indiana.

Top Indiana Counties by Number of TB Cases, 2018 (See Figure 5)	Top Indiana Counties by Number of TB Cases, 2009-2018 (See Figure 6)
<ul style="list-style-type: none"> ➤ Marion County: 38 cases ➤ St. Joseph County: 16 cases ➤ Allen County: 8 cases ➤ Lake County: 8 cases ➤ Tippecanoe County: 8 cases 	<ul style="list-style-type: none"> ➤ Marion County: 408 cases ➤ Allen County: 84 cases ➤ Lake County: 60 cases ➤ St. Joseph County: 46 cases ➤ Elkhart County: 39 cases

Indiana 2018 TB Cases

Labeled by Cases Per County
(counties with 5 or more cases)

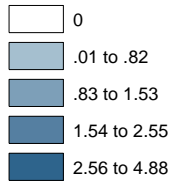
Shaded by Number of Cases
per County



TB Cases and Incidence Rates

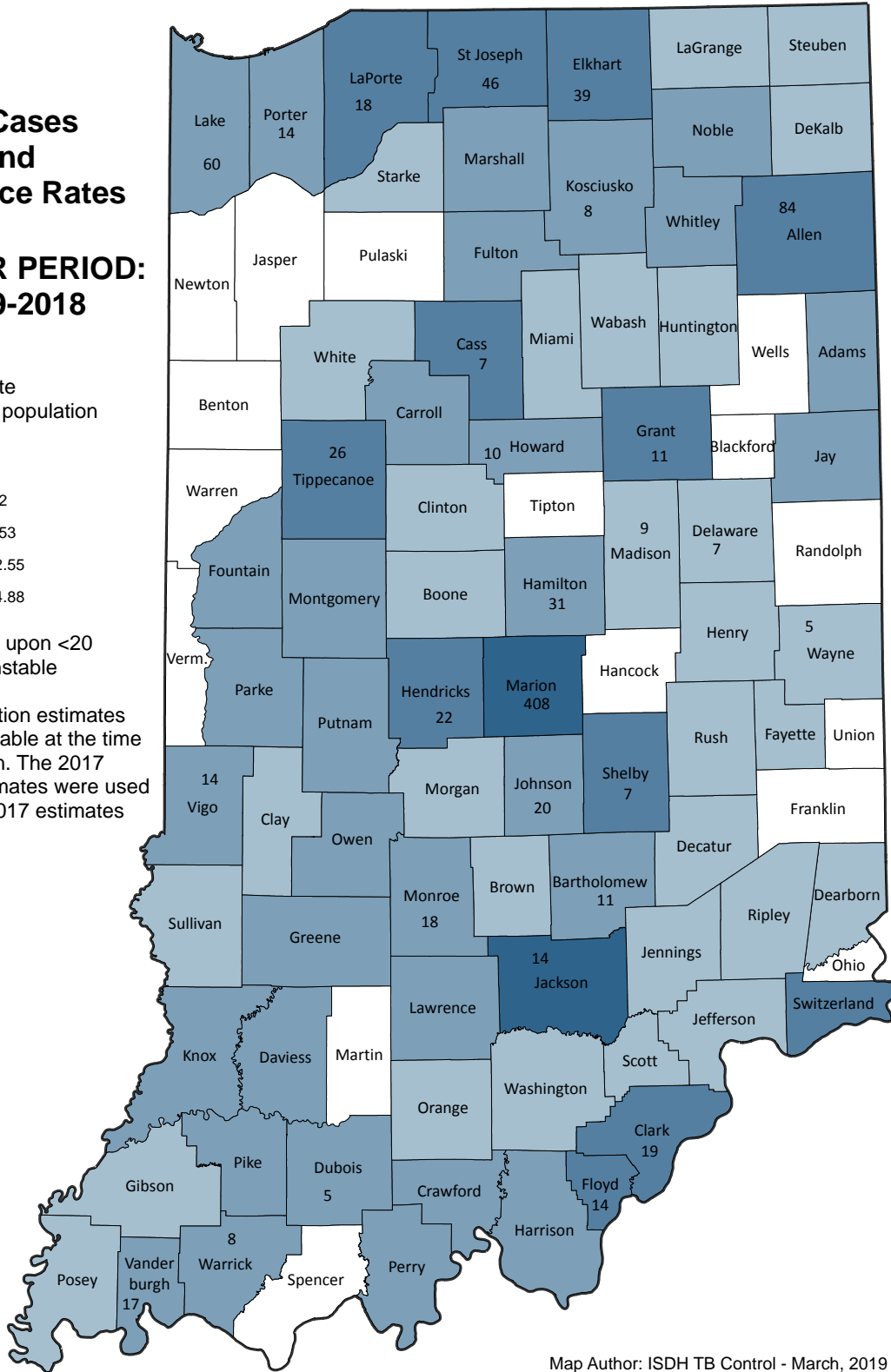
**10-YEAR PERIOD:
2009-2018**

Incidence rate per 100,000 population



Rates based upon <20 cases are unstable

2018 population estimates were unavailable at the time of publication. The 2017 Census estimates were used in place of 2017 estimates

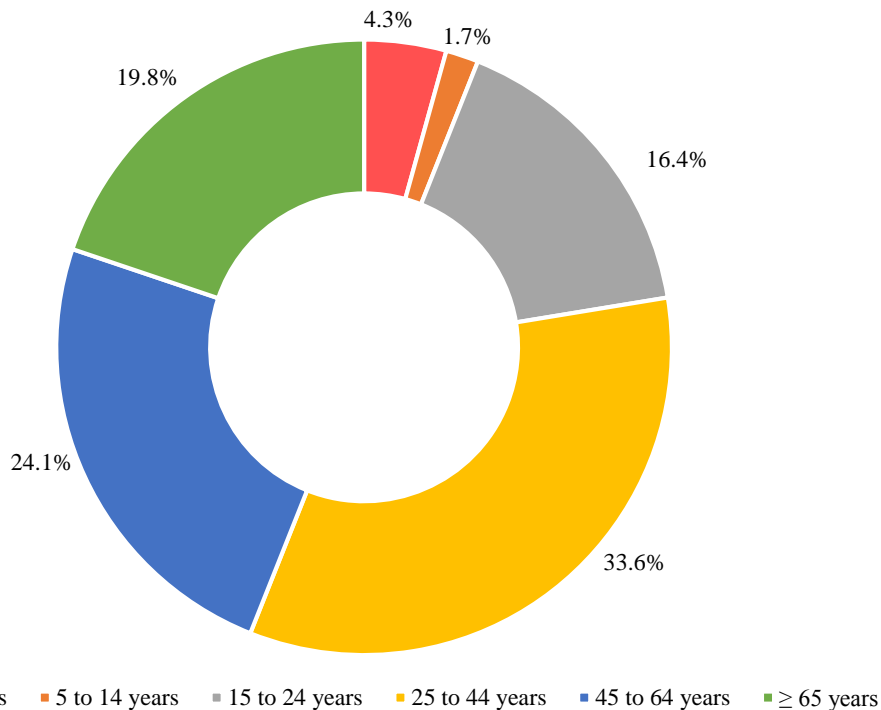


Map Author: ISDH TB Control - March, 2019

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 location².

Figure 7. Tuberculosis Cases by Age Group, Indiana, 2018



In 2018, 77.6 percent of Indiana’s TB cases occurred in adults aged 25 years or older (N = 90). 16.4 percent of cases were among those 15-24 years old, which is an increase from 2017 to 2018. The proportion of TB cases in adults age 65 and older decreased from 26.0 percent in 2017 to 19.8 percent in 2018.

The incidence of TB from the last five years remains high in persons in the 24 to 44 years age group (Figure 8) compared to other groups. Although the incidence rate in adults aged 65 years and older was declining from 2014 to 2016, rates have since elevated to 2014 levels.

There has also been an increasing trend of reported pediatric cases (<15 years of age) since 2014 but has remained stable from 2017 to 2018 (Figure 9). There were seven pediatric TB cases reported in 2018. Pediatric TB is a public health problem of special significance because it is a marker for recent transmission of TB and is more likely to be life-threatening³.

Figure 8. Tuberculosis Case Rates by Age Group and Year, Indiana, 2014-2018

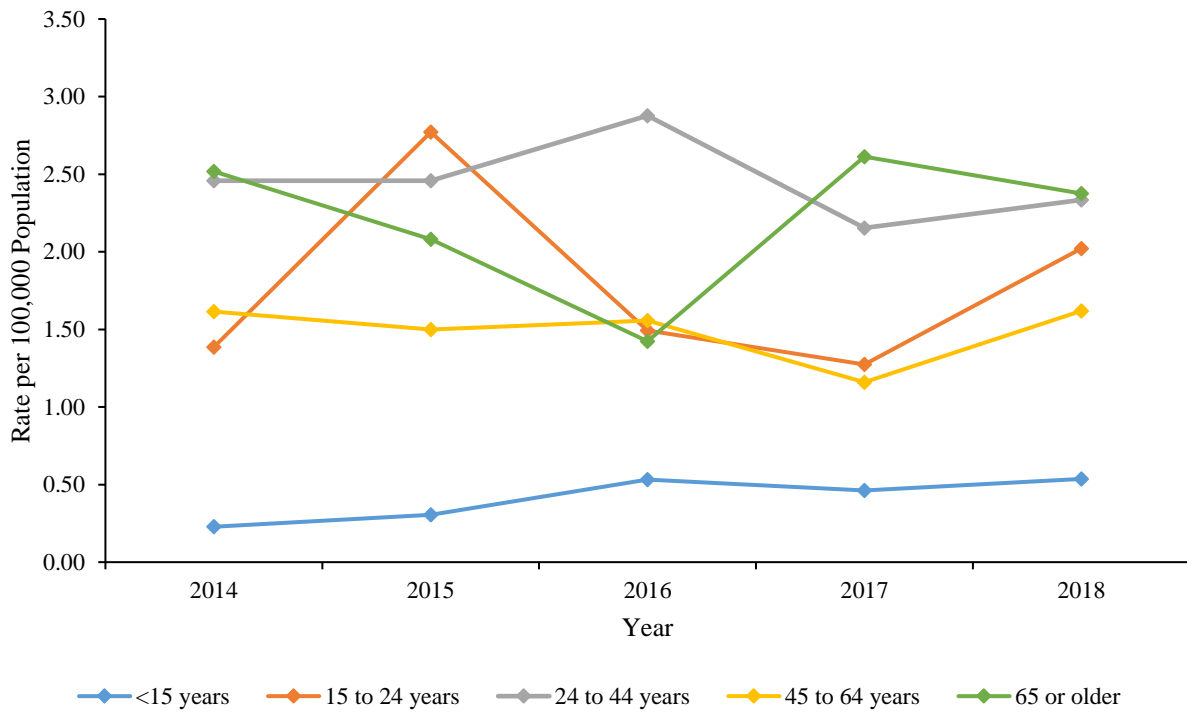


Figure 9. Pediatric TB Cases by Age Group, Indiana, 2014-2018

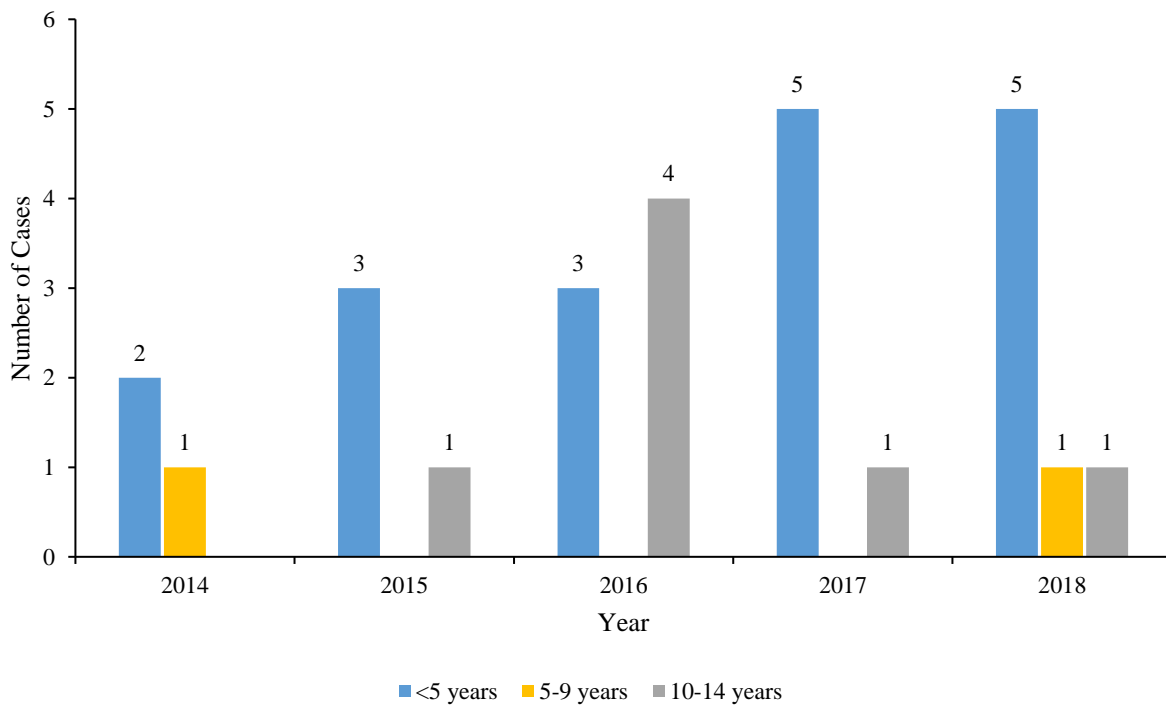
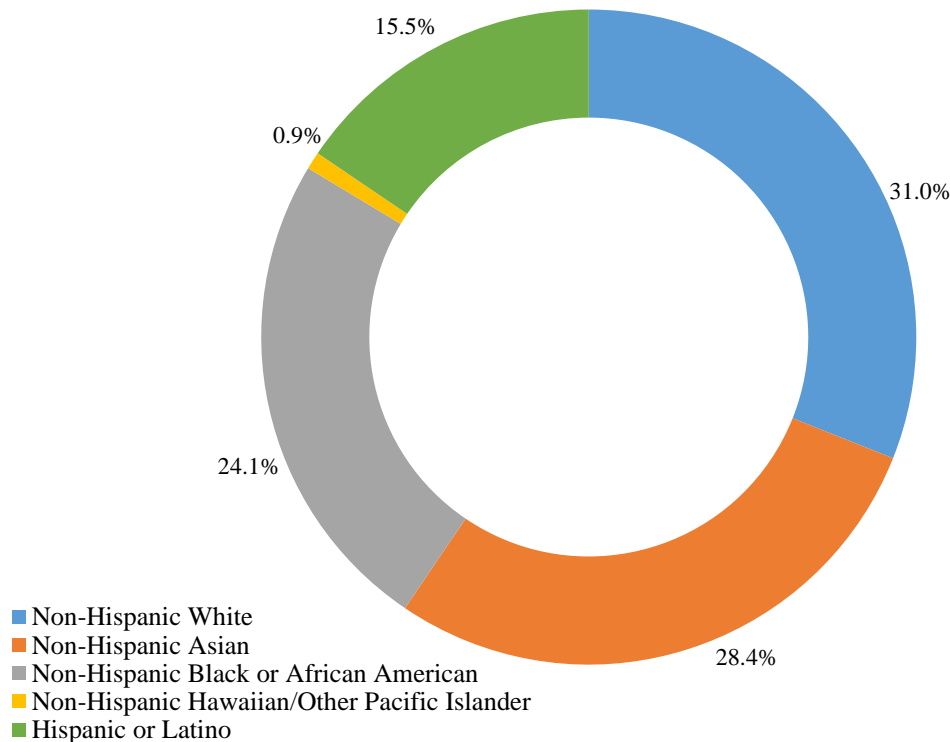


Figure 10. Percentage of TB Cases by Hispanic Ethnicity and Non-Hispanic Race, Indiana, 2018



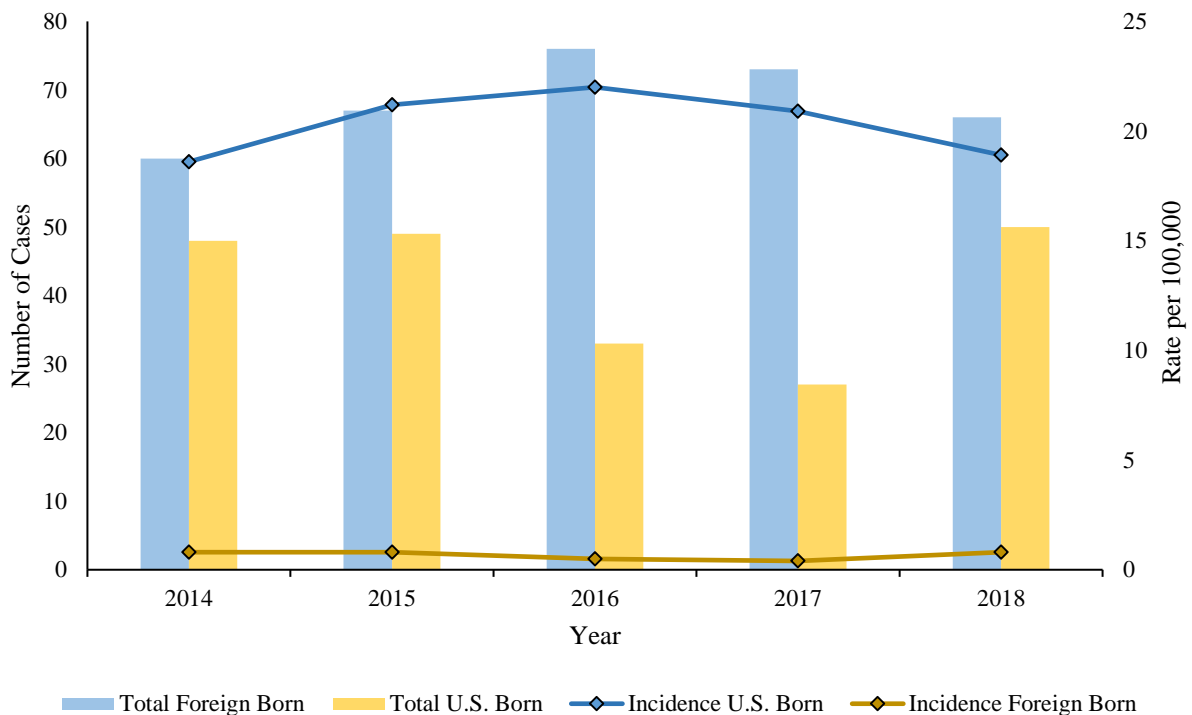
In 2018, Non-Hispanic Asians made up only 2.3 percent of Indiana’s total population but accounted for 28.4 percent of the cases, a decrease from 44.0 percent of cases in 2017. The proportion of Non-Hispanic Black or African Americans cases increased from 11.0 percent in 2017 to 24.1 percent in 2018. In Indiana, 3.7 percent of the population identified as Hispanic/Latino, yet 15.5 percent of TB cases in 2018 were seen in that population.

Incidence rates remain highest in Non-Hispanic Asians (19.1 per 100,000 population), Non-Hispanic Native Hawaiian/Other Pacific Islander (76.8 per 100,000 population), Non-Hispanic Black or African Americans (5.4 per 100,000 population) and Hispanic/Latinos (3.9 per 100,000 population) compared to Non-Hispanic Whites (0.7 per 100,000 population).

Geographic Risk Factors

Globally, those who are born in high-burden countries have higher risk of exposure to the tuberculosis bacteria. TB continues to disproportionately affect individuals in persons born in high-burden countries.⁵

Figure 11. TB Case Counts and Rates by Country of Birth, Indiana, 2014 -2018



The proportion of U.S.-born cases increased from 27.0 percent in 2017 to 43.1 percent in 2018. The incidence of TB cases remains high in persons born outside of the U.S. compared to those born in the United States for Indiana. Persons born in Burma, India, Mexico, Malawi and Nigeria accounted for 62.1 percent of the Indiana cases born outside of the United States in 2018.

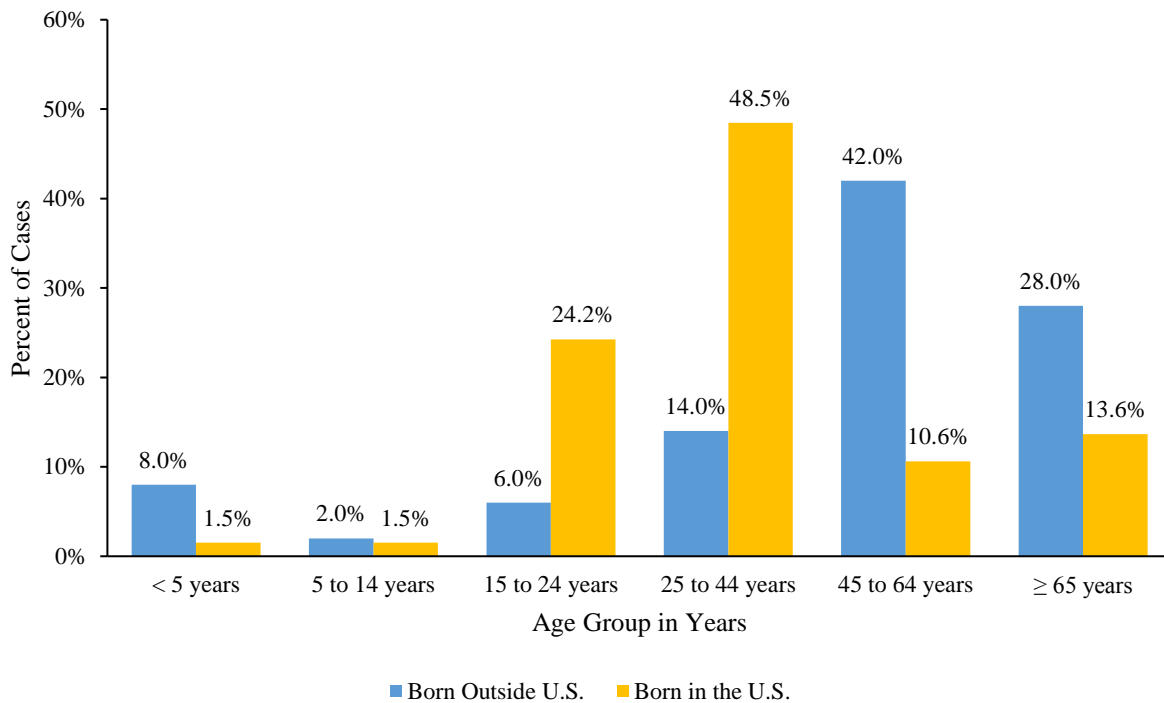
18.9
Per 100,000

Incidence rate in persons born outside of the U.S. compared to 0.8 per 100,000 population in persons born in the U.S.

56.9%

Proportion of cases occurring in persons born outside of the U.S. They account for only 5 percent of Indiana's total population in 2018.

Figure 12. Percentage of TB Cases by Country of Birth and Age Group, Indiana, 2018



Among those born outside of the U.S., 72.7 percent occurred in individuals between the ages of 15 to 44. Compared to persons born in the United States, 70.0 percent of the cases occurred in those older 45 or older. Among pediatric cases, there was a higher proportion of cases occurring among persons born in the U.S.

HIV Coinfection Risk Factor

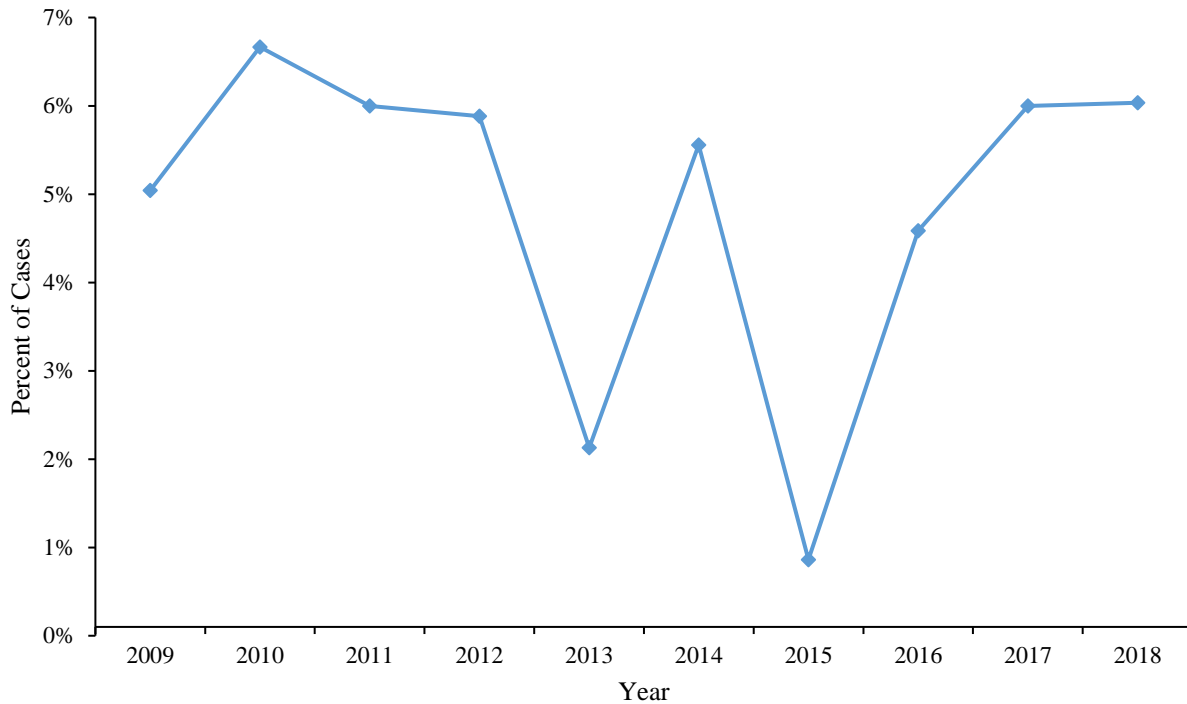
Someone with untreated latent TB infection and HIV infection is much more likely to develop TB disease during his or her lifetime than someone without HIV infection⁴. Among people with latent TB infection, HIV infection is the strongest known risk factor for progressing to TB disease⁴.

Figure 13. HIV Testing for Cases >15 Years and 25-44 Years of Age, Indiana, 2018

Age Group	Test Results Known	Testing Not Offered	Refused Testing
≥ 15 Years	89.9%	3.7%	5.5%
25-44 Years	97.4%	2.6%	0.0%

In 2018, 3.7 percent of TB patients’ ≥15 years old were not offered HIV testing and 5.5 percent refused testing. Among those 25-44 years old, no patients refused testing and only 2.6 percent were not offered an HIV test.

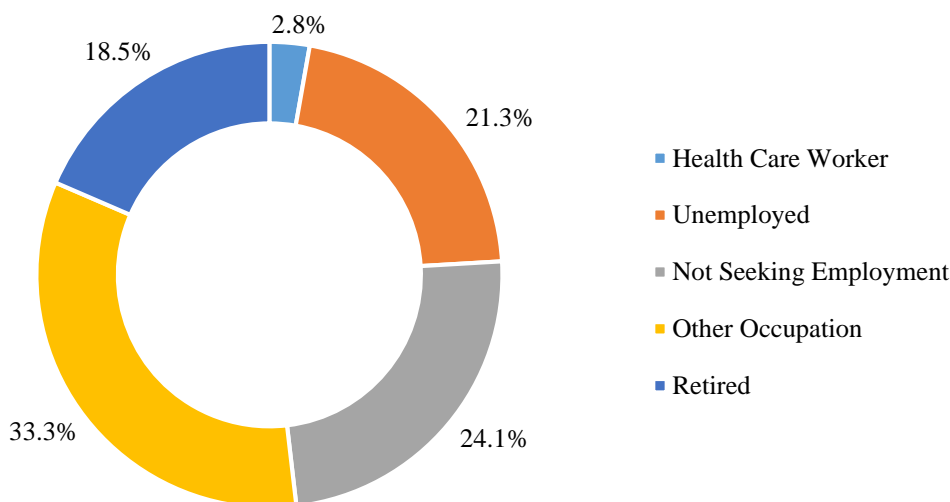
Figure 14. Percentage of Cases with HIV Comorbidity, Indiana, 2009 - 2018



The proportion of TB cases in Indiana with HIV comorbidity remained consistent from 2017 to 2018, with 6 percent of cases reporting HIV coinfection. Over the past 10 years, 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, 2018



The unemployment rate among persons 16 years and older in Indiana was 4.7 percent in 2018 yet 21.3 percent of TB cases were unemployed. This is an increase from 17.0 percent in 2017.

Figure 16. Most Common Reported Risk Factors, Indiana, 2018

Risk Factor	Percent
Diabetes	15.5%
Recent Contact to Infectious TB Case	10.3%
Alcohol Use	9.5%
Non Injection Drug Use	8.6%
Immunosuppression (not HIV/AIDS)	8.6%

In 2018, the five most common risk factors reported were diabetes, recent contact to an infectious TB case, alcohol use, non-injection drug use and immunosuppression (not HIV/AIDS). Similarly, these were also the most common risk factors reported in 2017. Diabetes continues to be the most common risk factor in Indiana from 2017 to 2018.

Other risk factors reported in 2018 include residence in a correctional facility within the past two years, residence in a long term care facility within the past two years, homelessness within the past year, contact to a TB case more than two years prior to diagnosis, prior history of incarceration, incomplete LTBI therapy, post-organ transplantation, end-stage renal disease and TNF-alpha therapy use.

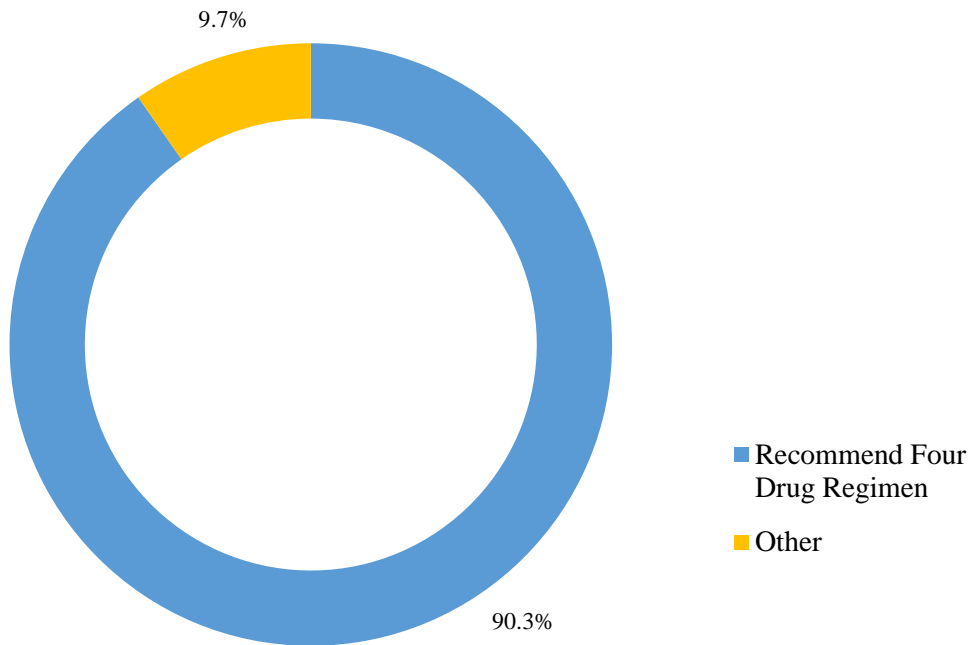
Treatment

TB disease can be treated by taking several medications for 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 very important that people 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 treat⁶.

Figure 17. Percentage of Cases with Recommend Initial Drug Regimen, Indiana, 2018



Of the 86 cases culture-positive TB cases in Indiana in 2018, drug susceptibility testing was performed on 97.7 percent of the isolates. Overall, the proportion of drug resistant strains declined from 2017 to 2018.

Figure 18. Percentage of Cases with Reported Drug Resistance, Indiana, 2014 - 2018

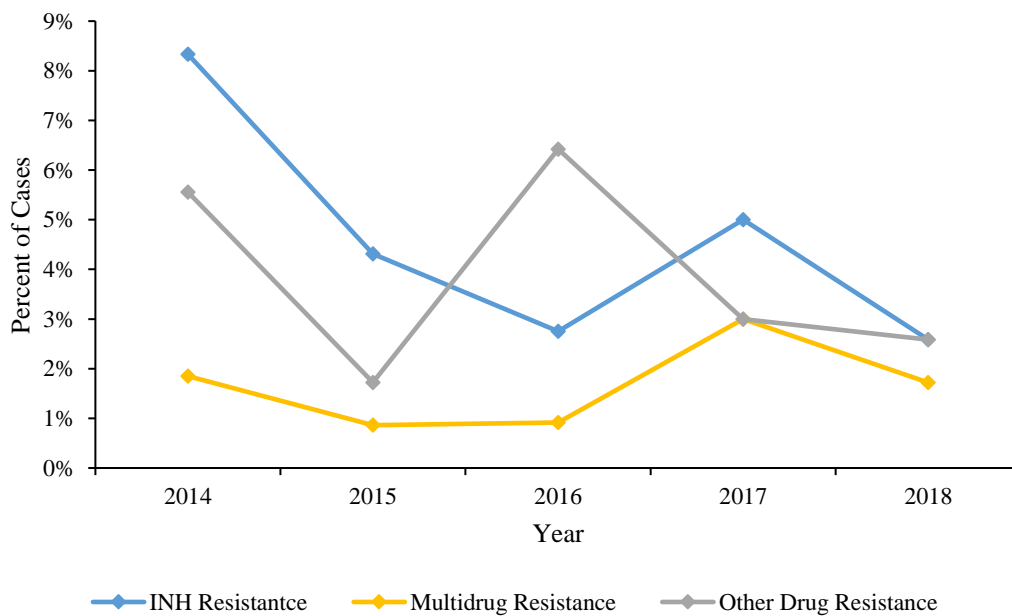
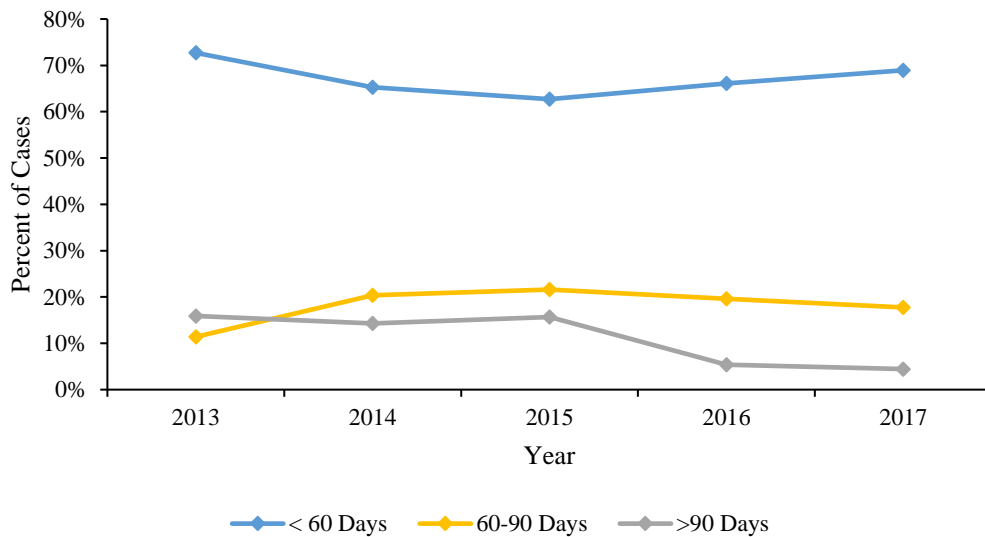
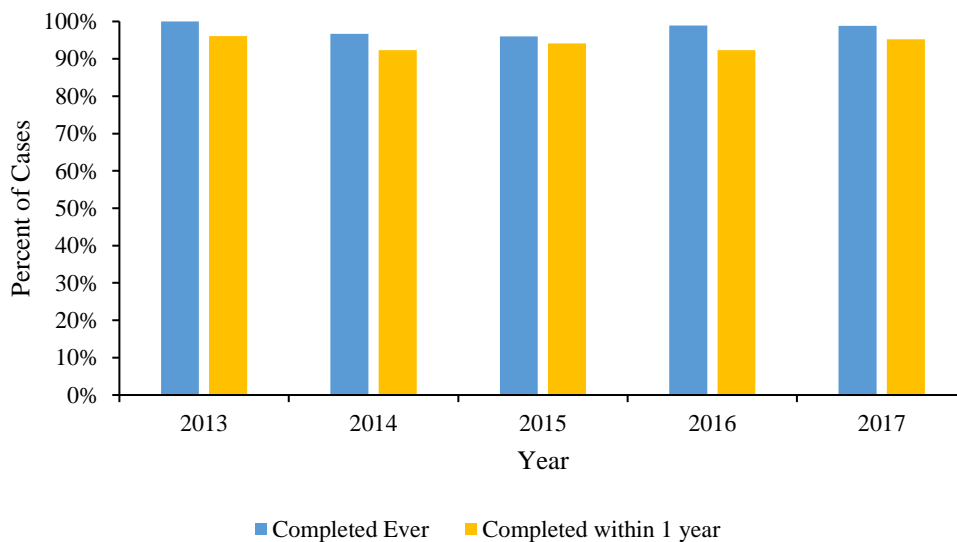


Figure 19. Percentage of Cases Culture Converted by Time to Conversion, Indiana, 2013 -2017



Among eligible cases, 91.1 percent of the cases reported sputum culture conversion in 2017. Of those cases, 71.1 percent 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, 2013-2017

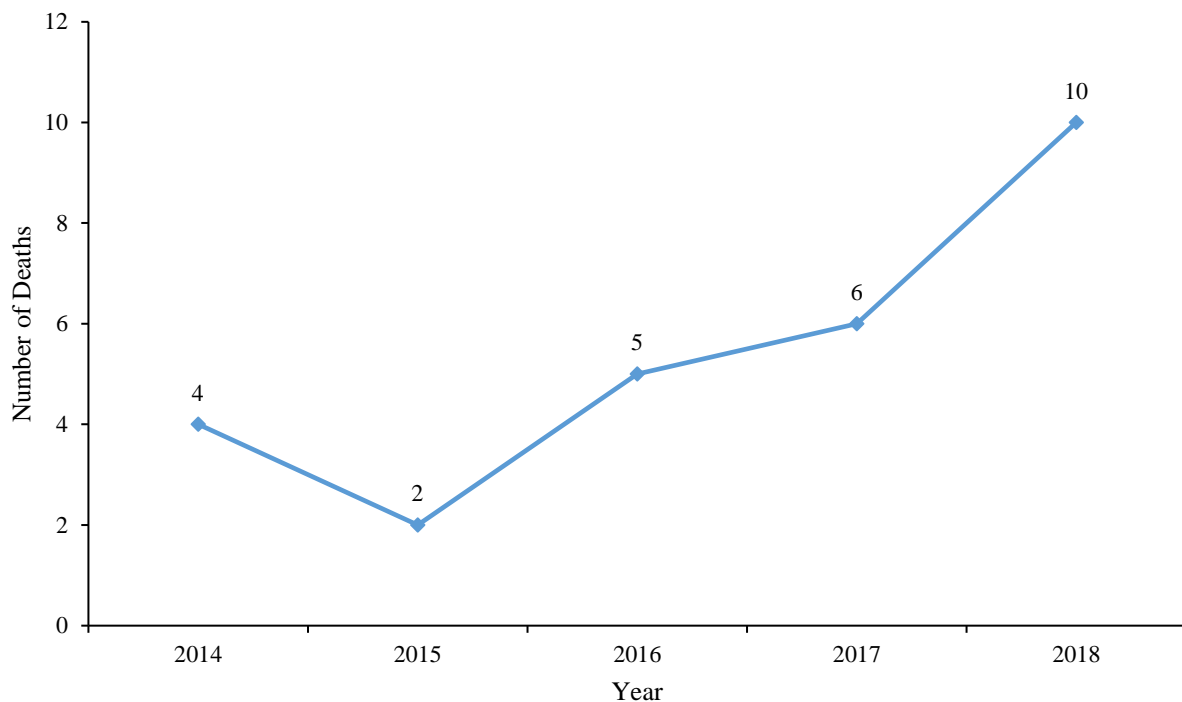


The proportion of eligible cases that completes treatment of therapy within one year remains steady in the five-year trend from 2013-2017. On average, 94.2 percent of eligible cases complete treatment within one year and 98.1 percent completed treatment ever within this five year period. Directly observed therapy (DOT) is the most effective way to ensure a patient is complying with the prescribed treatment regimen and preventing acquired drug resistance. In 2017, 78.0 percent of TB cases received all therapy via DOT with another 20.0 percent receiving at least part of their therapy via DOT.

TB Mortality

Deaths that are attributed to TB disease are also monitored as part of surveillance. Collecting data on deaths can help public health to understand risk factors associated with mortality from TB. Nationally, the number of TB-related deaths have been declining in the United States. The latest data shows that in 2016, the United States reported 528 deaths that were attributed to TB disease.⁷ ISDH uses data from death certificates to verify TB related deaths in Indiana.

Figure 21. TB Deaths, Indiana, 2014-2018



In the last five years, the number of TB related deaths has increased in Indiana. In 2018, 10 deaths were reported as related to TB disease. Of the 10 TB cases that died, eight were attributed to TB disease. There were two cases that were diagnosed after death. This is the most TB related deaths that have been reported in Indiana over this five year period.

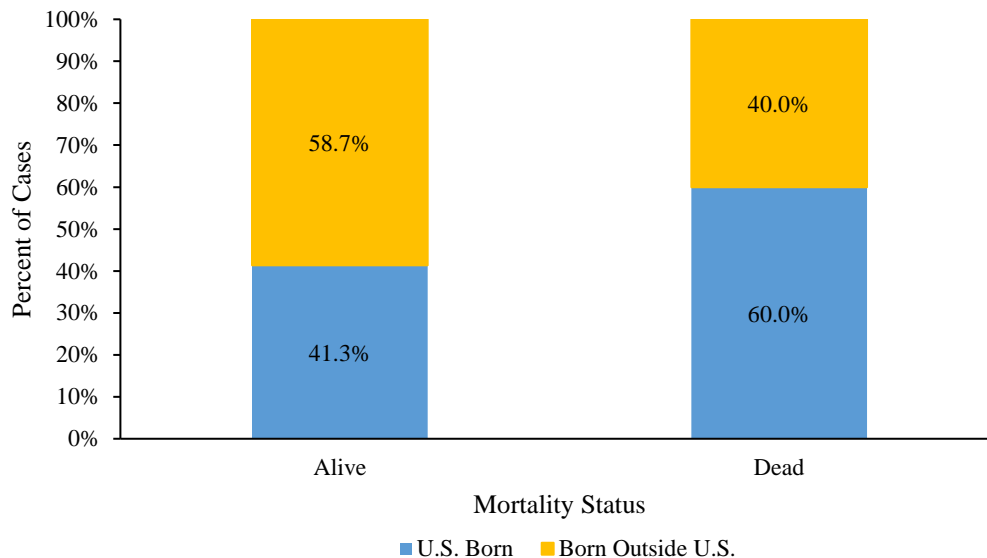
**21
Days**

Average length patients were on therapy among the TB related deaths in 2018. 215 days was the average length for a person who was alive at the end of treatment completion in 2018 (n=57).

**60
Years**

Is the average age of persons who died from TB in 2018. The average age of persons that did not die was 42 years.

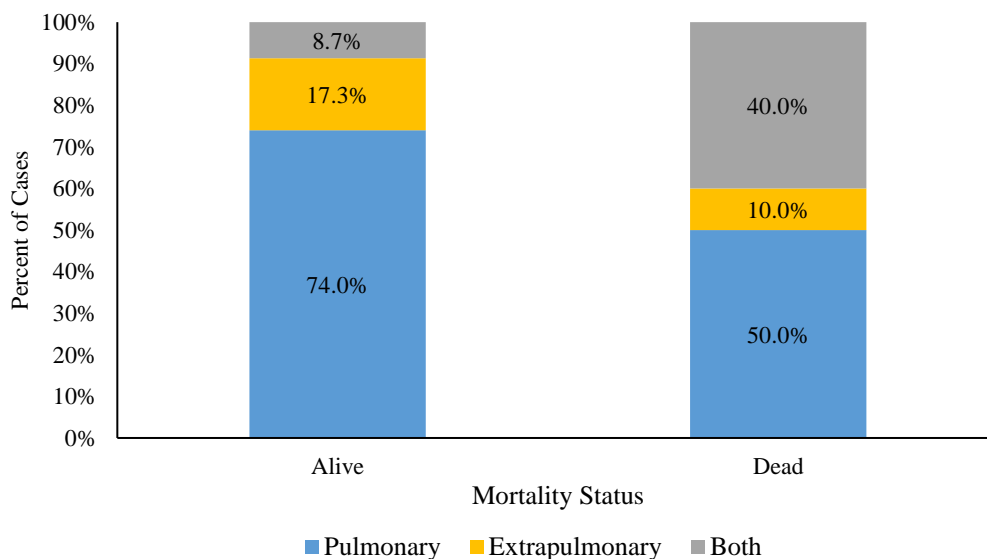
Figure 22. Percentage of TB Cases by Mortality Status and Country of Birth, Indiana, 2018



Excludes deaths unrelated to TB (n=10)

In 2018, 60.0 percent of TB deaths occurred in persons born in the U.S. compared to just 41.3 percent of the cases who are alive.

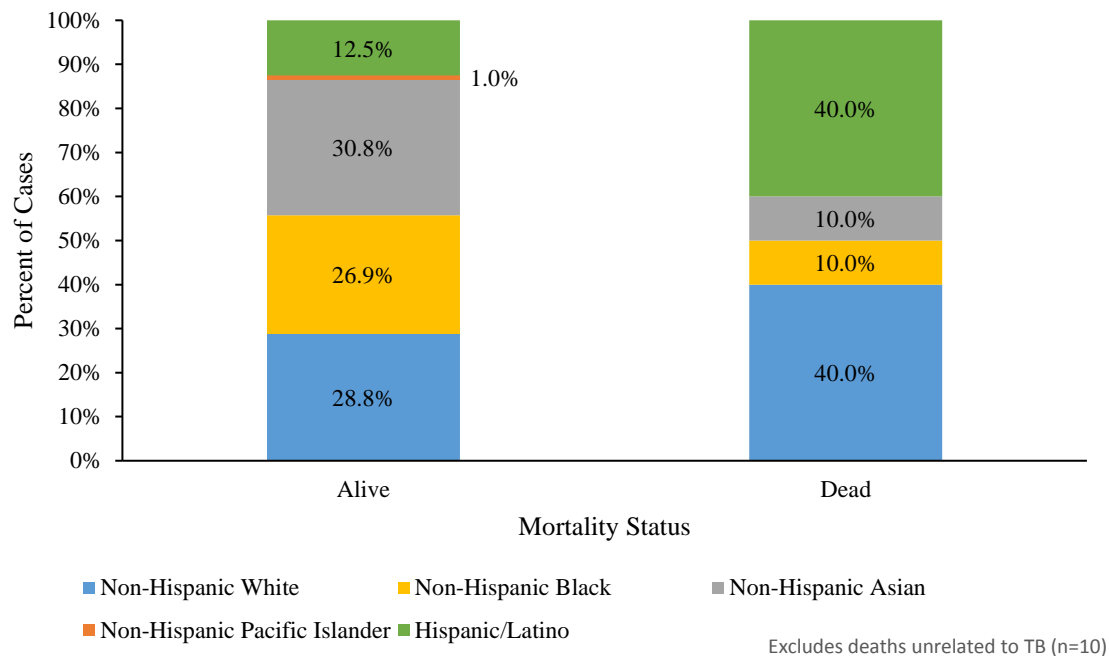
Figure 23. Percentage of TB Cases by Mortality Status and Site of Disease, Indiana, 2018



Excludes deaths unrelated to TB (n=10)

In 2018, cases that died from TB had a higher proportion of extrapulmonary site of disease compared to TB cases who survived. At least one extrapulmonary site of disease was diagnosed in 90.0 percent of TB deaths. Extrapulmonary sites among TB deaths included lymphatic, meningeal, spleen, rectum and small intestines.

Figure 24. Percentage of TB Cases by Mortality Status and Hispanic Ethnicity and Non-Hispanic Race, Indiana, 2018



The majority of TB related deaths occurred in Non-Hispanic Whites and Hispanic or Latinos in 2018. The two groups each accounted for 40.0 percent of the TB related deaths in 2018. Among TB cases that were alive in 2018, Non-Hispanic whites accounted only for 28.8 percent of those cases while Hispanic or Latinos accounted for only 12.5 percent 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 infection⁸.

52.4% of cases genotypes were identified as part of a cluster	97.7% of culture positive TB cases were genotyped	6 active clusters were identified as possible recent transmission	0 outbreaks reported in 2018.
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For this report, recent transmission is defined as cases with known epidemiologic links that were exposed within the two years prior to their diagnosis. Of the genotyped cases in 2018, six of those cases clustered and were identified to be part of possible recent transmission. In addition, seven clinical cases (no genotyping) were epidemiologically linked to a case of disease, with six of those exposures happening within the prior two years. Additionally, five genotyped cases were epidemiologically linked to a case with last exposure more than two years prior to diagnosis.

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 assess 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 TB⁹. 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 2013 - 2017						
Year	2013	2014	2015	2016	2017	2020 National Objective
Total Number of Cases	94	108	116	109	100	
Percentage of sputum AFB smear-positive TB cases with contacts identified	97%	97%	100%	100%	100%	100%
Percentage of contacts to sputum AFB smear-positive TB cases evaluated for infection and disease	60%	68%	60%	76%	83%	93%
Percentage of infected contacts who are started on treatment for latent TB that complete therapy	46%	82%	85%	91%	90%	91%

Appendices

A. Data Sources & Methods

All TB data for Indiana were pulled from the Indiana State Department of Health's online database Statewide Investigation, Monitoring and Surveillance System (SWIMSS) and analyzed using SAS version 9.4. Historical data pre-dating SWIMSS (prior to 2009) was pulled from the prior TB Information Management database. All local health departments in Indiana are required to enter information regarding TB cases and their contact investigations into the SWIMSS 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 2018 rates are based on 2017 American Community Survey 1-Year Estimates, as 2018 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 U.S. for less than 90 days of treatment are also excluded.

Cases counts less 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 department at ISDH. Any patient that dies during their course of their treatment has their death certificate reviewed by the TB 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 dead upon diagnosis. The completion of therapy measure only includes cases for whom 12 months of treatment or less 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 aged 14 or younger with disseminated TB. This also excludes cases who died or moved out of the U.S. 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 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 *Mycobacterium 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 reactivity 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* and *M. africanus*, *M. microti*, *M. canettii*, *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 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.

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