



Indiana State Department of Health

Tuberculosis Control Program

2017 Annual Report

April 9, 2018

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I. 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 2017, 100 new cases of tuberculosis (TB) were reported to the Indiana State Department of Health, an 8.3 percent decrease since 2016. There has also been an overall 15.3 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 37 cases reported in 2017 and a total of 403 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 2017, with 2.2 and 2.6 cases per 100,000 population, respectively. Almost three-quarters of the cases in 2017 in Indiana (73.0%) 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 2017, HIV status was known among 90.4 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 18.0 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 2017, 92.0 percent of TB cases were started on the recommended initial therapy and 98.9 percent of cases in 2016 completed their therapy. There were three cases of multi-drug-resistant TB in Indiana in 2017, an increase from 2016.

TB genotyping and contact investigation are used in TB control to help prevent additional cases. Thirteen genotype clusters with possible recent transmission were active in Indiana in 2017, with no clusters identified as outbreaks. In 2016, every case of infectious TB had contacts identified, and 76.0 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.

I. Summary Statistics

	Indiana		Program Goals
	2017	2016	2017
Number of Tuberculosis Cases	100	109	
Tuberculosis Case Rate per 100,000 Population	1.5	1.7	
Number of Tuberculosis Deaths	6	5	
Laboratory Confirmation	72.0%	76.1%	
Pulmonary Site of Disease	72.0%	71.6%	
U.S. born Incidence Rate	0.4	0.5	0.7
Foreign-born Incidence Rate	20.9	24.0	16.0
White Incidence Rate	0.8	0.8	
Black Incidence Rate	1.8	2.8	
Asian Incidence Rate	31.6	35.3	
Hispanic/Latino Incidence Rate	4.9	5.5	
Male Incidence Rate	1.9	2.0	
Female Incidence Rate	1.1	1.3	
Known HIV Status 25-44 Years of Age	90.4%	98.0%	88.7%
HIV Comorbidity	6.0%	4.6%	
Resident of Correctional Facility	1.0%	0.9%	
Homelessness	4.0%	0.0%	
Resident of Long-Term Care Facility	2.0%	1.8%	
Injecting Drug Use	1.0%	0.0%	
Non-Injecting Drug Use	5.0%	6.4%	
Excess Alcohol Use	9.0%	11.9%	
Initial Four Drug Therapy Regimen	92.0%	94.4%	94.0%
INH Resistance	5.0%	2.8%	
MDR	3.0%	0.9%	
Culture Conversion < 60 Days	67.3% (2016)	62.7% (2015)	72.0%
DOT Utilization	85.2% (2016)	90.3% (2015)	
Completion of Therapy <1 Year	92.3% (2016)	94.1% (2015)	95.0%

II. 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.

A. Burden & Trends

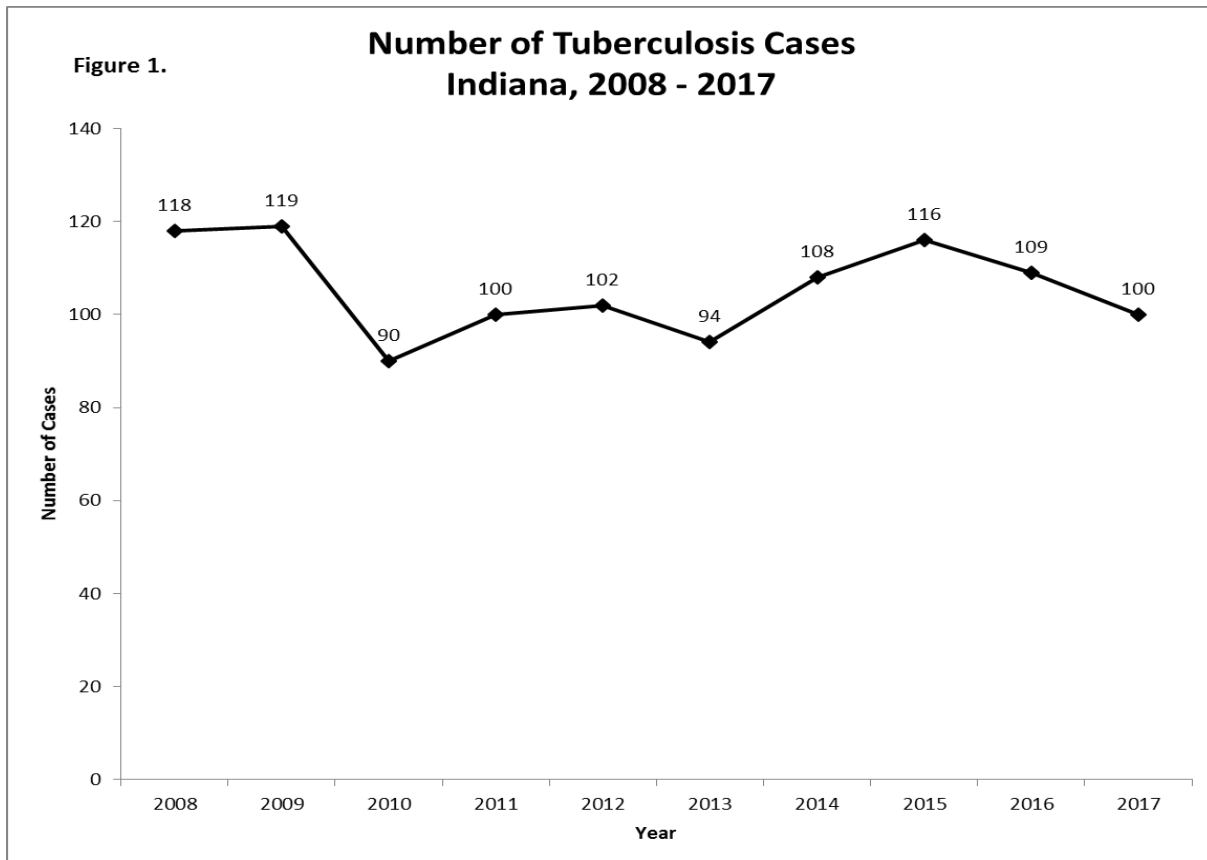


Figure 1. There were **100** reported cases of TB in Indiana in 2017 with an incidence rate of **1.5** per 100,000 population. Overall, there has been a **15.3%** decrease in TB cases in Indiana in the last 10 years but a **6.4%** increase during the last 5 years.

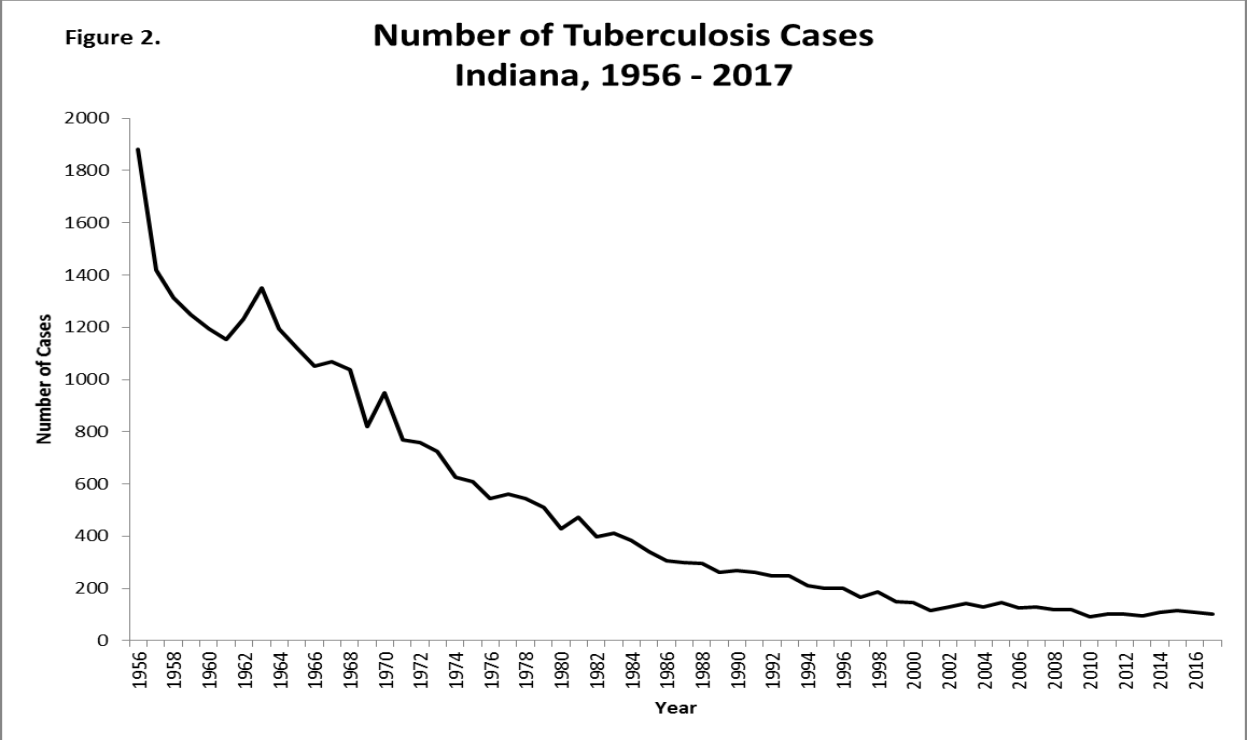


Figure 2. The decrease seen in TB cases in the last 10 years is in line with the downward historical trend seen in Indiana since 1956.

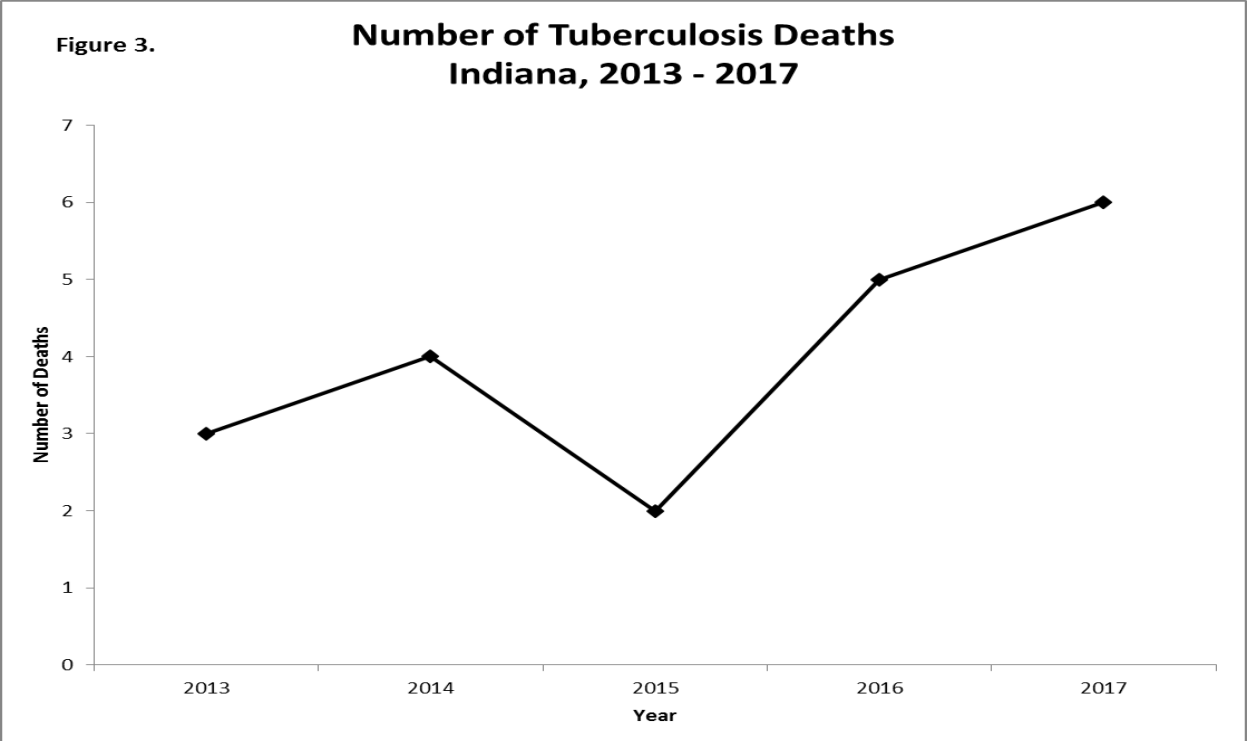


Figure 3. The number of TB-related deaths reached a five-year high, with six deaths reported in 2017. Overall there has been an increasing trend in deaths since 2015.

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

- 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.

Clinical Criteria

- 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

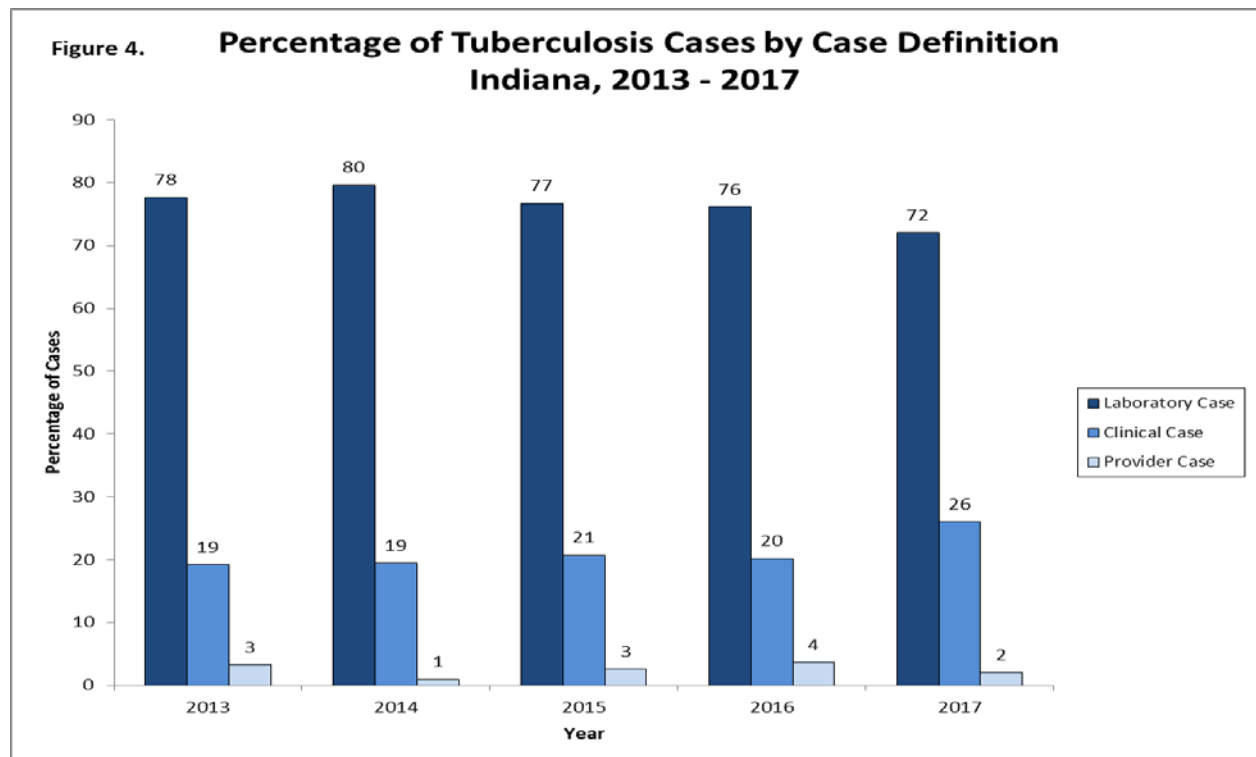


Figure 4. In 2017, 72.0% of TB cases in Indiana were laboratory confirmed (n = 72).

**Figure 5. Tuberculosis Cases by Site of Disease
Indiana, 2017**

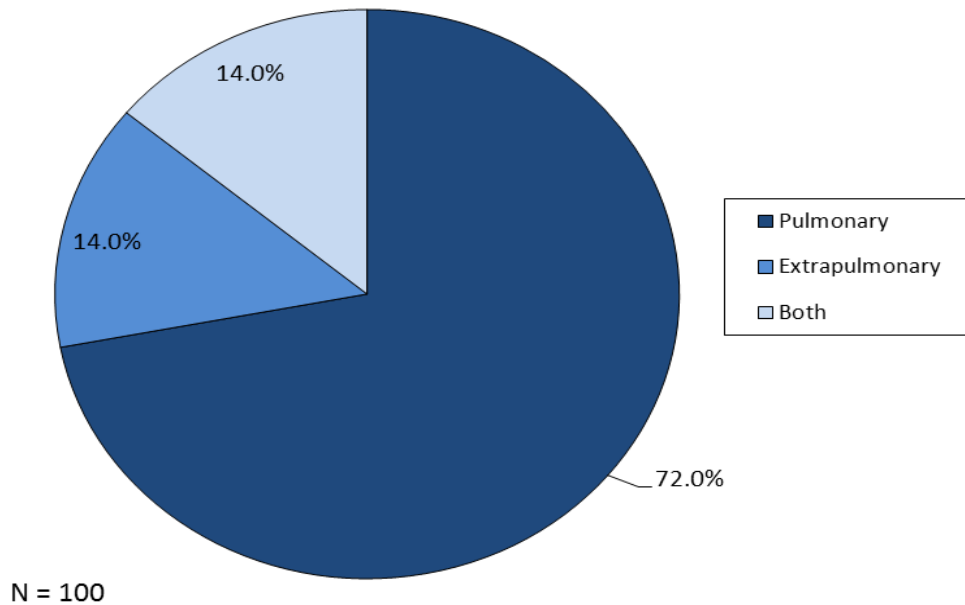


Figure 5. In 2017, **72.0%** of TB cases in Indiana were pulmonary (n = 72). This was a decrease from 2016 (76.1%). Extra pulmonary sites included lymphatic, pleural, meningeal, peritoneal, genitourinary, and others.

**Top Indiana Counties by Number of TB
Cases, 2017
(See Figure 6)**

- 1) Marion County – 37 Cases
- 2) Allen County – 8 Cases
- 3) Elkhart County – 8 Cases
- 4) Lake County – 5 Cases

**Top Indiana Counties by Number of TB
Cases, 2006-2017
(See Figure 7)**

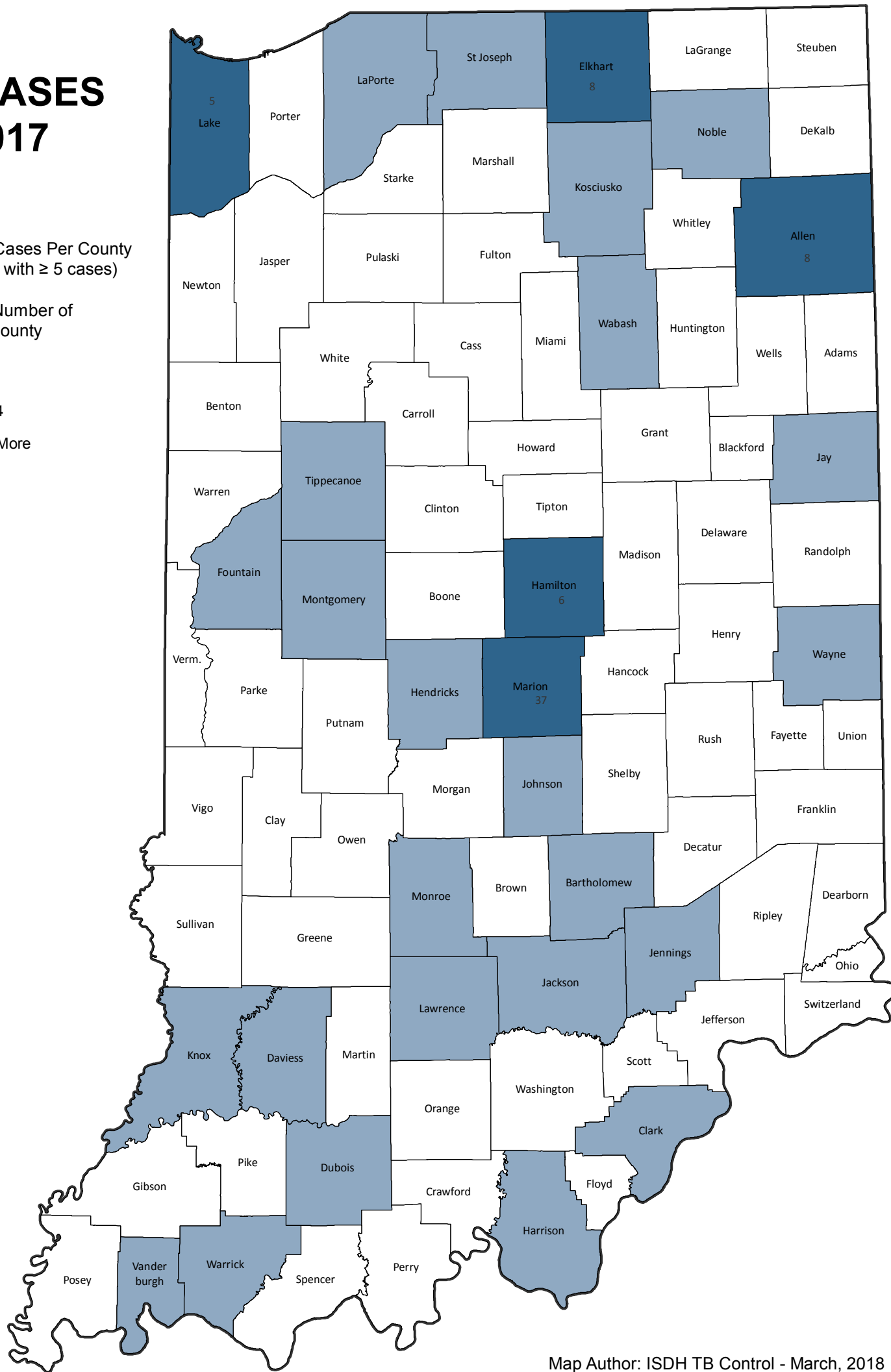
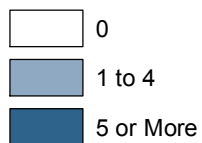
- 1) Marion County – 403 Cases
- 2) Allen County – 89 Cases
- 3) Lake County – 65 Cases
- 4) Elkhart County – 42 Cases
- 5) St. Joseph County – 32 Cases

In 2017, Marion County had the highest burden of TB cases. Marion County accounted for 37.0% of the total cases in 2017, while only having 14.0% of Indiana’s total population.

TB CASES 2017

Labeled by Cases Per County
(for counties with ≥ 5 cases)

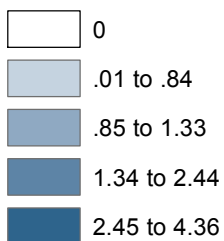
Shaded by Number of
Cases per County



TB CASES AND INCIDENCE RATES

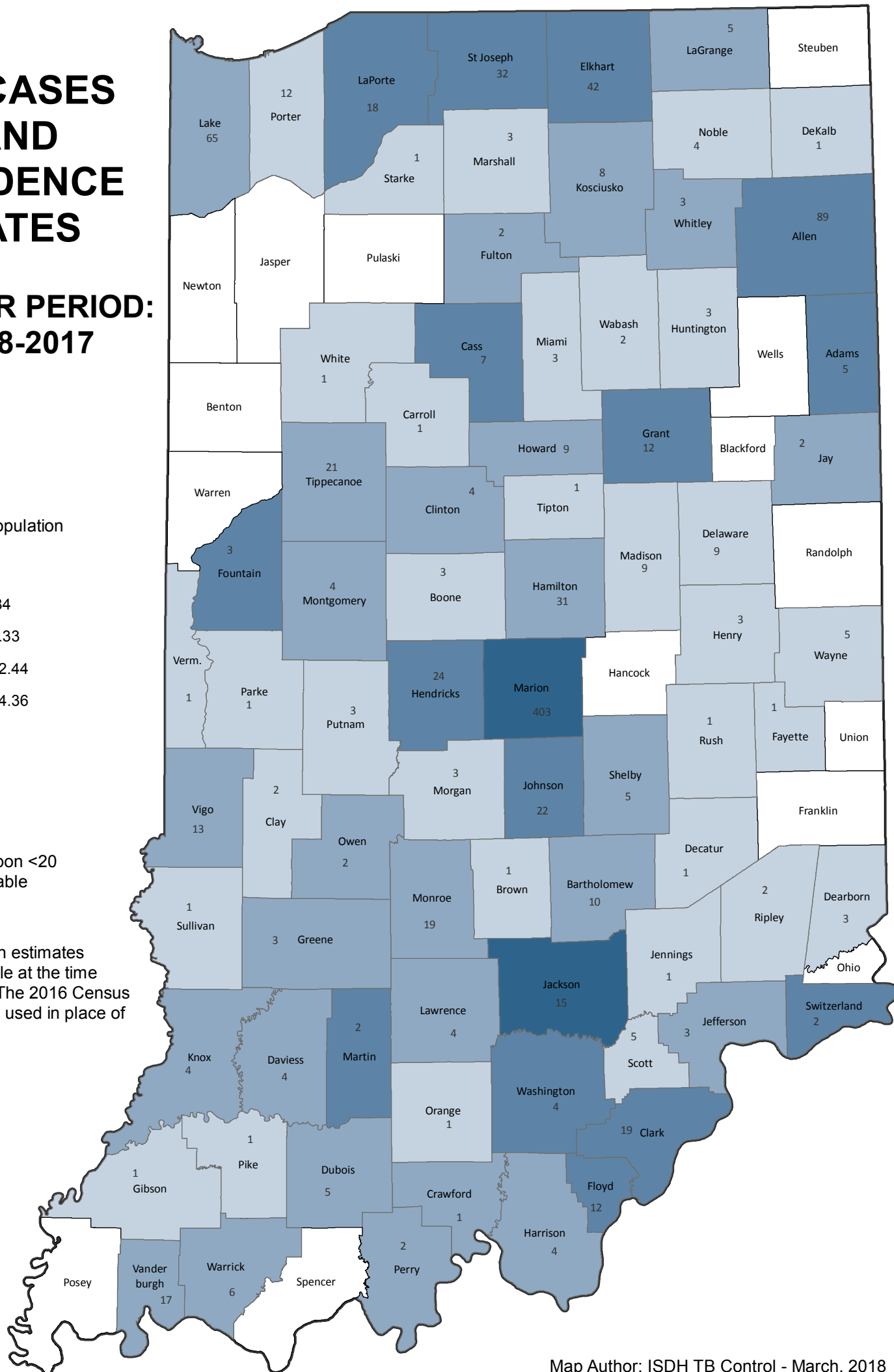
10-YEAR PERIOD: 2008-2017

Incidence Rate Per 100,000 population



Rates based upon <20 cases are unstable

2017 population estimates were unavailable at the time of publication. The 2016 Census estimates were used in place of 2017 estimates



B. Demographics & 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.

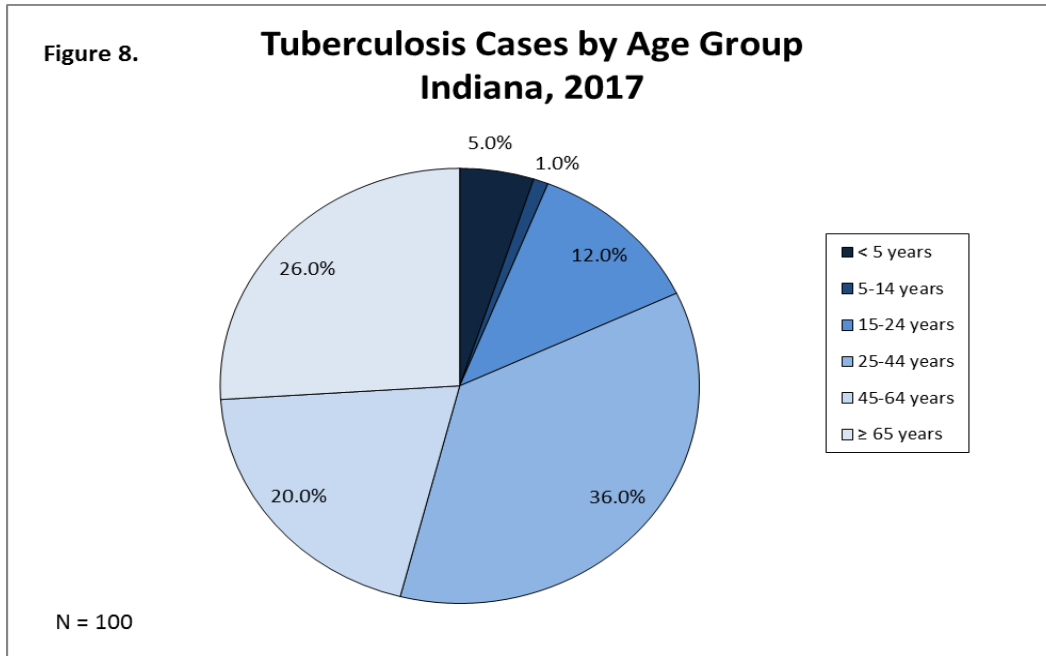


Figure 8. In 2017, **82.0%** of Indiana’s TB cases occurred in adults aged 25 years or older (N = 82). **12.0%** of cases were among those 15-24 years old, which remained stable from 2016 to 2017. The proportion of TB cases in adults age 65 and older increased from **11.9%** in 2016 to **26.0%** in 2017.

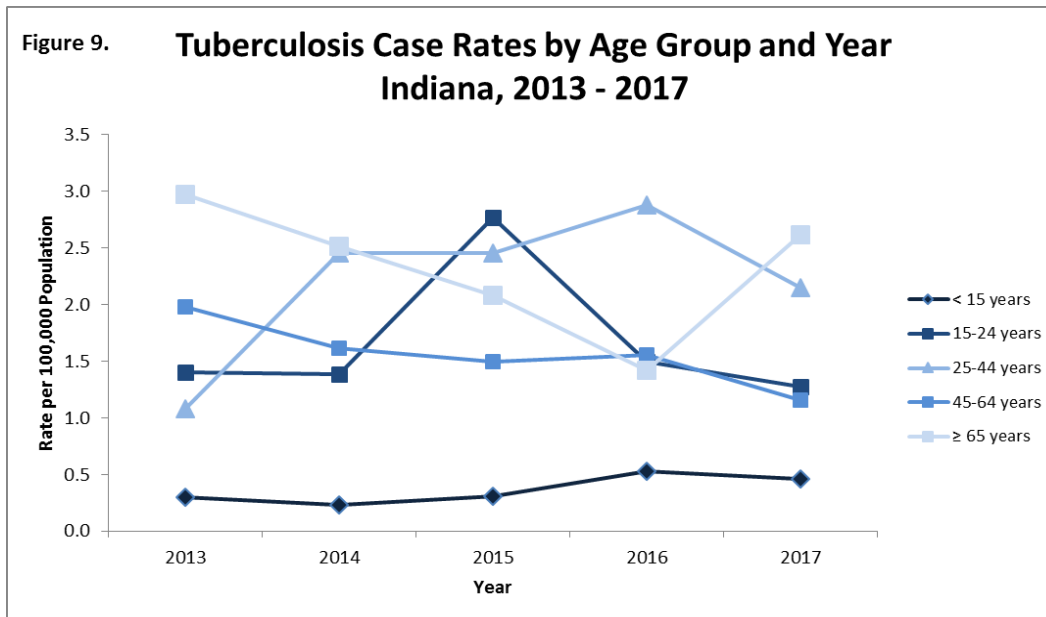


Figure 9. The 2017 TB incidence rate for adults aged 65 years and older increased to **2.6 per 100,000** population from **1.4 per 100,000** population in 2016.

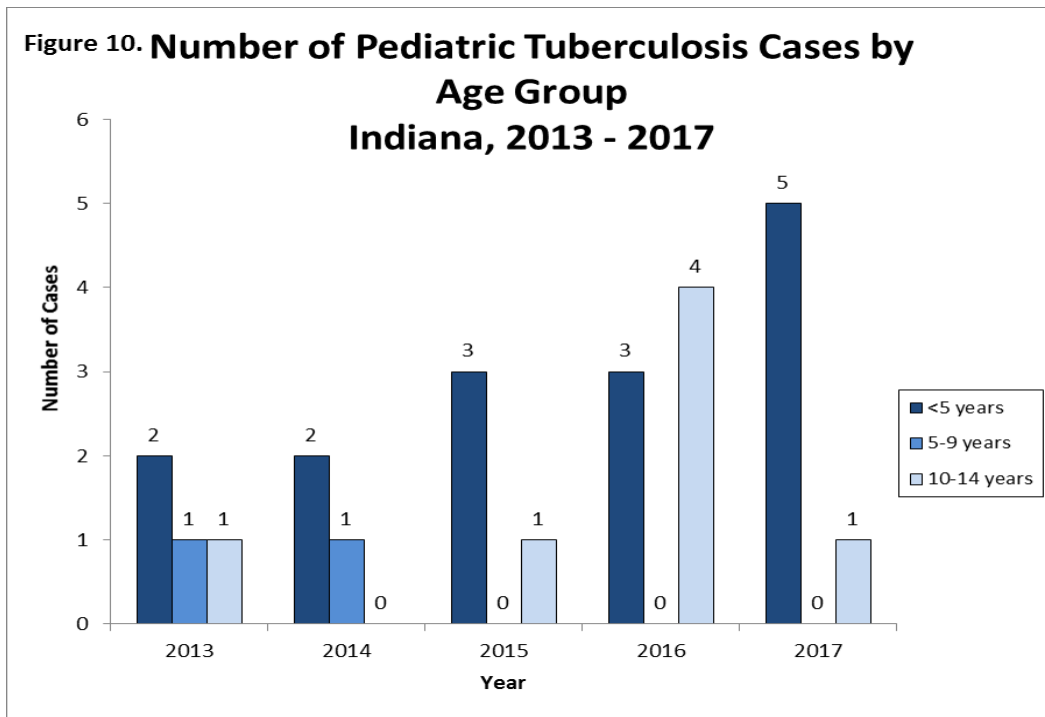


Figure 10. There were 6 pediatric TB cases (≤ 14 years) in Indiana in 2017, an increase from 2016. Pediatric TB is a public health problem of special significance because it is a marker for recent transmission of TB and is more likely to be life-threatening³.

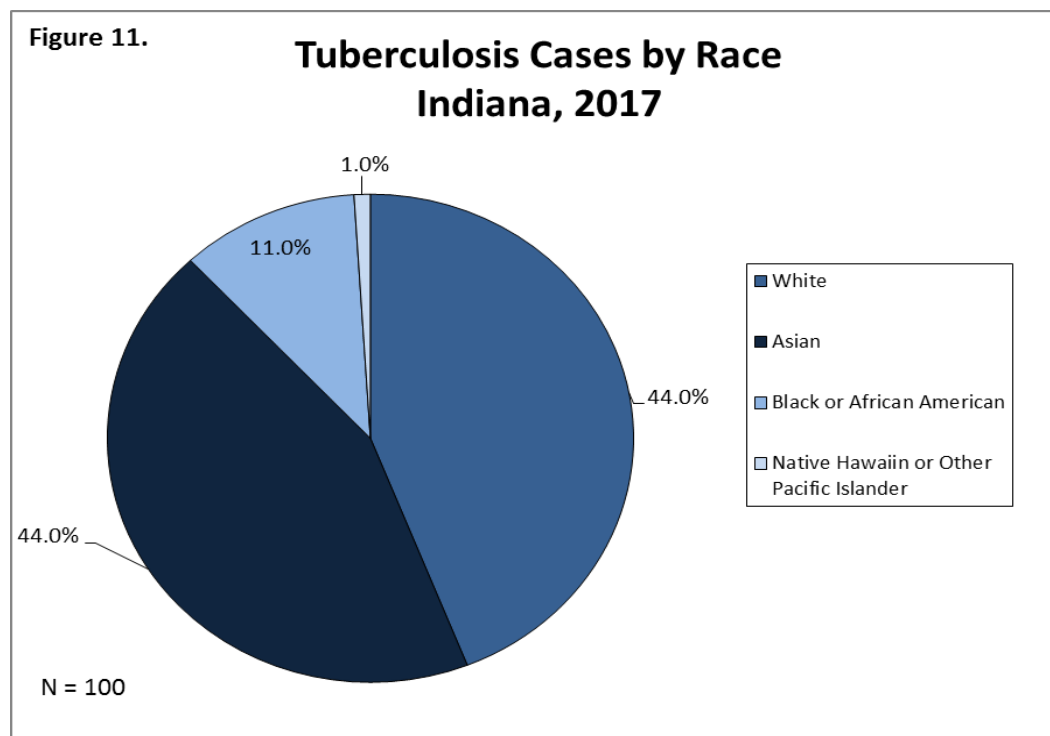


Figure 11. In 2017, Asians made up only 2.1% of Indiana’s total population but accounted for 44.0% of the cases. Incidence rates remain highest in Asians (31.6 per 100,000 population), Native Hawaiian/Other Pacific Islander (15.1 per 100,000 population) and Black or African Americans (1.8 per 100,000 population) compared to Whites (0.8 per 100,000 population).

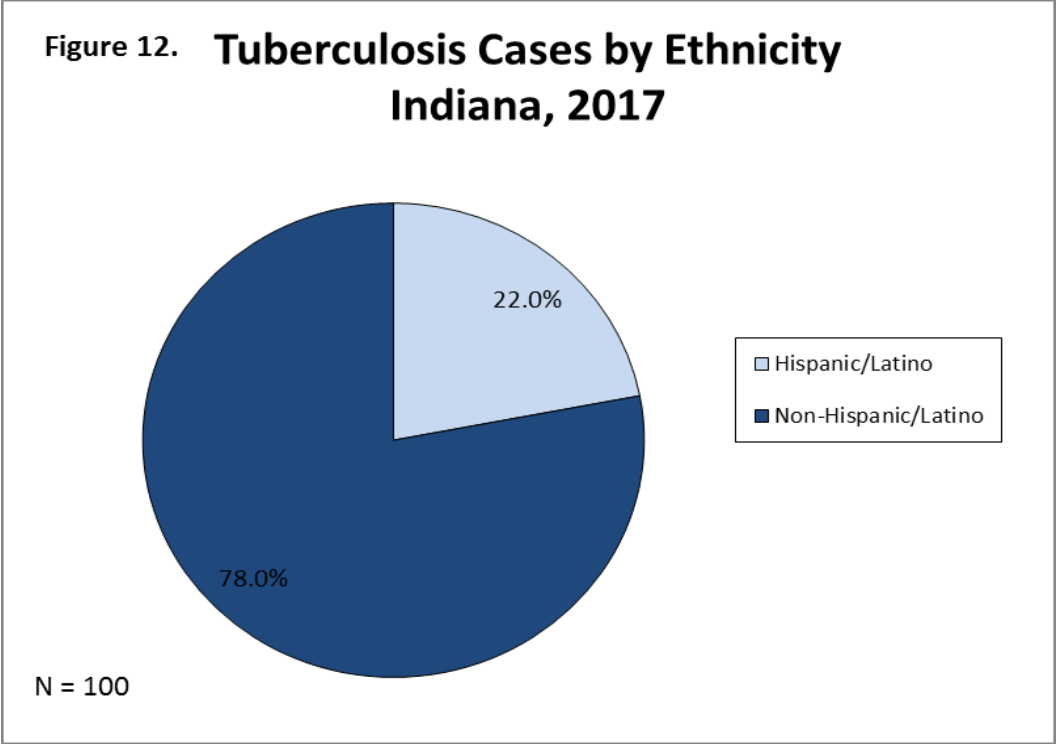


Figure 12. In Indiana, **6.8%** of the population identified as Hispanic/Latino, yet **22.0%** of TB cases in 2017 were seen in that population. This remains stable since 2016 (**21.1%**)

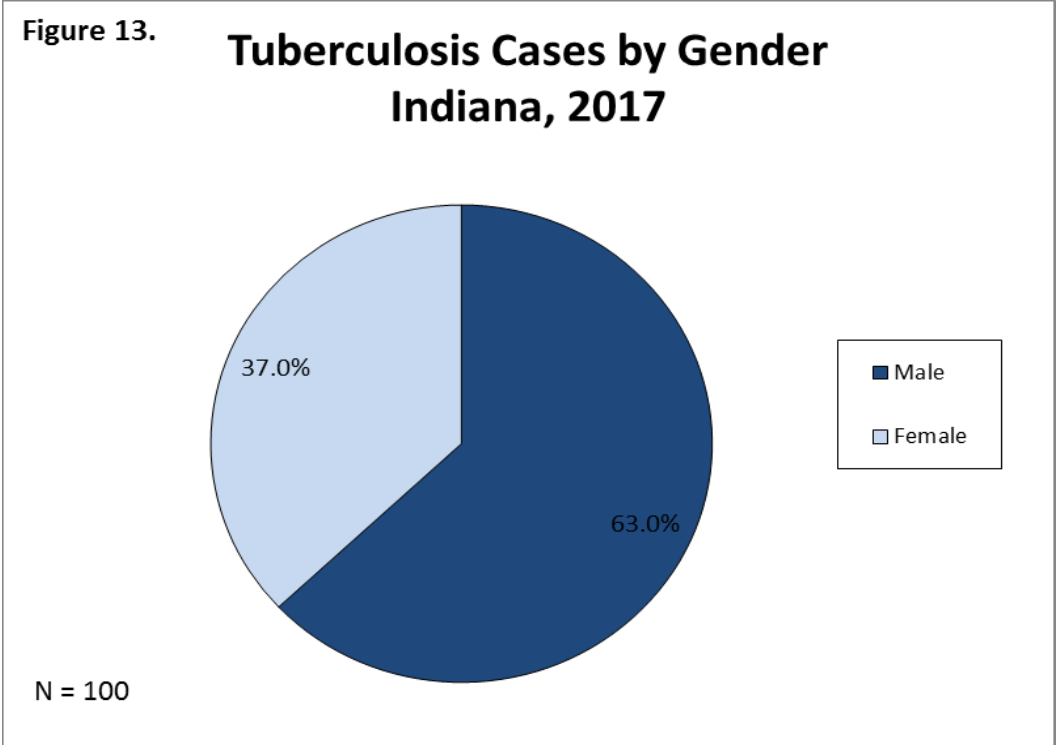


Figure 13. In 2017, males accounted for **63.0%** of TB cases in Indiana, a slight increase over 2016 (**60.6%**).

Figure 14.

Tuberculosis Cases by U.S./Foreign Birth Indiana, 2017

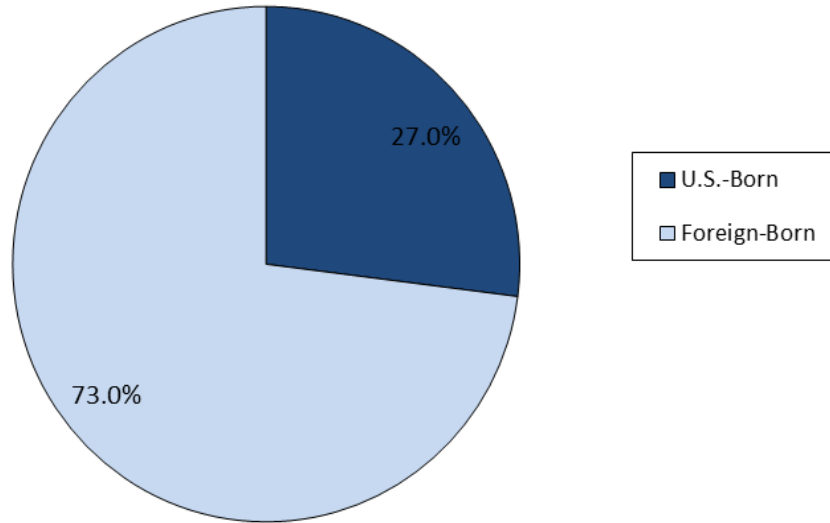


Figure 14. In 2017, 73.0% of TB cases in Indiana occurred among foreign-born individuals, an increase from 2016 (69.7%).

Figure 15.

Percentage of Foreign-Born Tuberculosis Cases by Country of Birth, Indiana, 2017

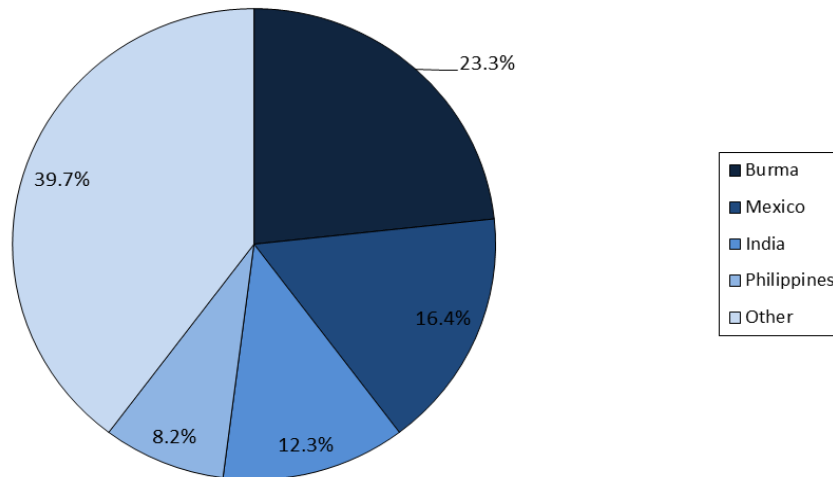


Figure 15. Among foreign-born cases in 2017, 23.3% of the cases were born in Burma (n=17). The proportion of foreign born cases from Burma, Mexico, India and Philippines account for about 60% of the cases, this remains stable from 2016.

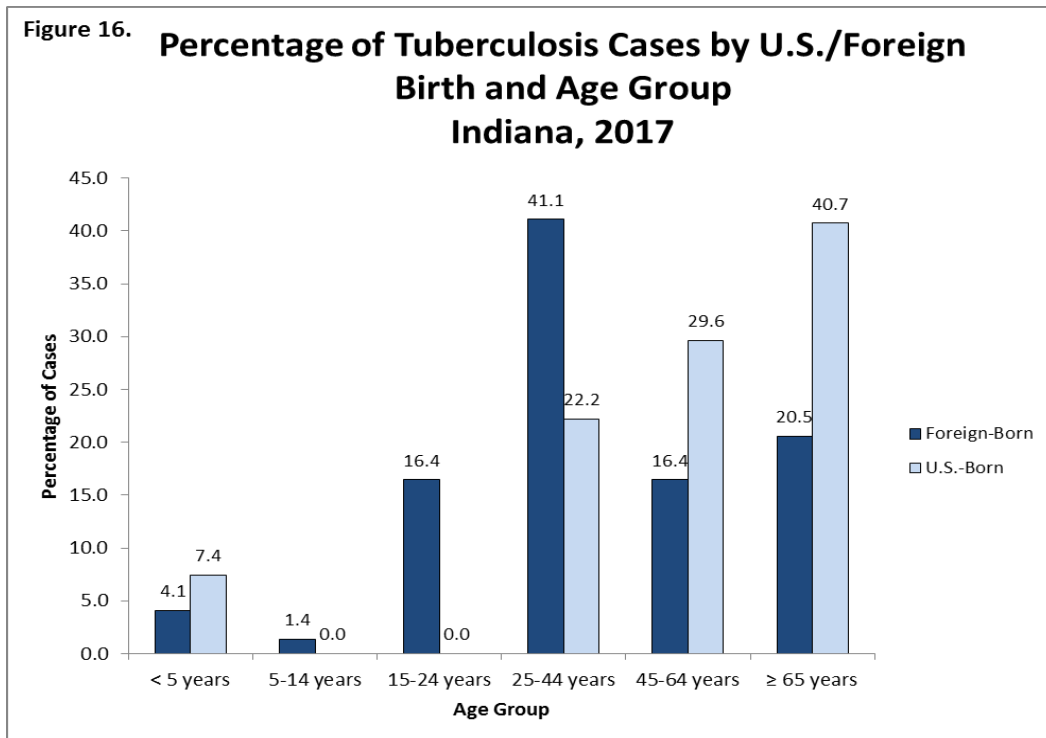


Figure 16. Foreign-born and U.S.-born cases of TB in Indiana differed in regards to age, with a higher proportion of U.S.-born cases falling in the <5 years and ≥ 65 years age groups than the foreign-born cases.

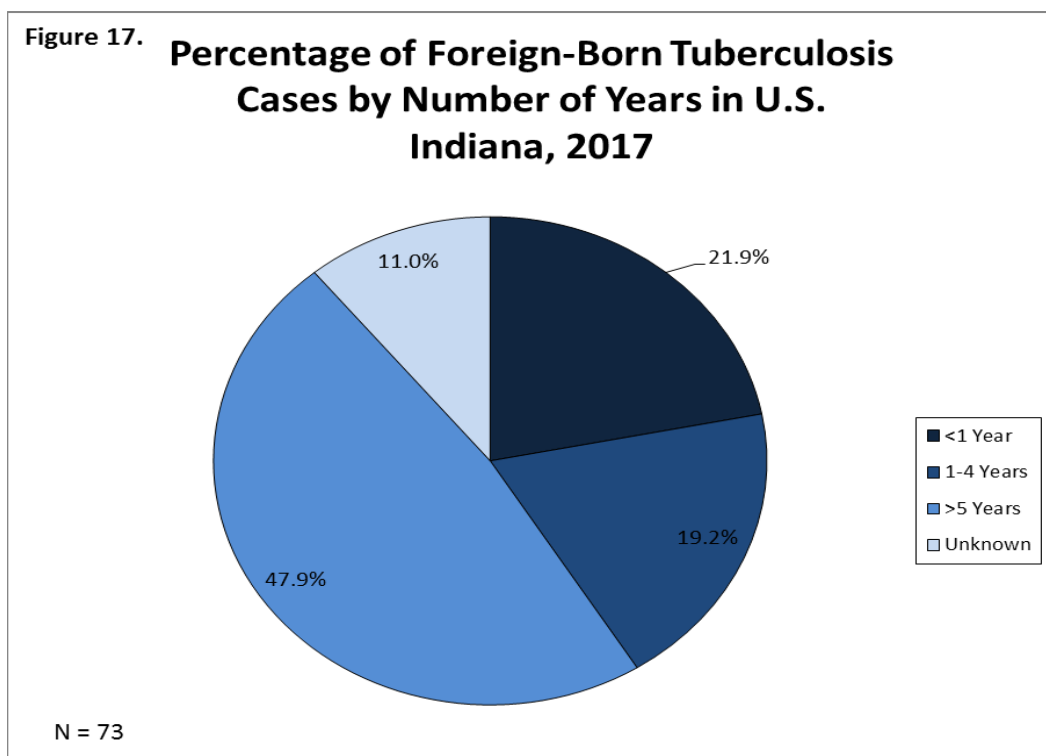


Figure 17. Among the 73 foreign-born cases of TB in Indiana in 2017, **47.9%** of them had been in the U.S. for more than five years.

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.

Percentage of TB Cases by HIV Testing Status & Age Group, Indiana, 2017		
HIV Testing Status	≥ 15 Years	25-44 Years
Test Results Known	90.4%	94.4%
Testing Not Offered	3.2%	0.0%
Refused Testing	6.4%	5.6%

In 2017, **3.2%** of TB patients' ≥15 years old were not offered HIV testing and **6.4%** refused testing. Among those 25-44 years old, only **5.6%** refused testing and all cases were offered testing.

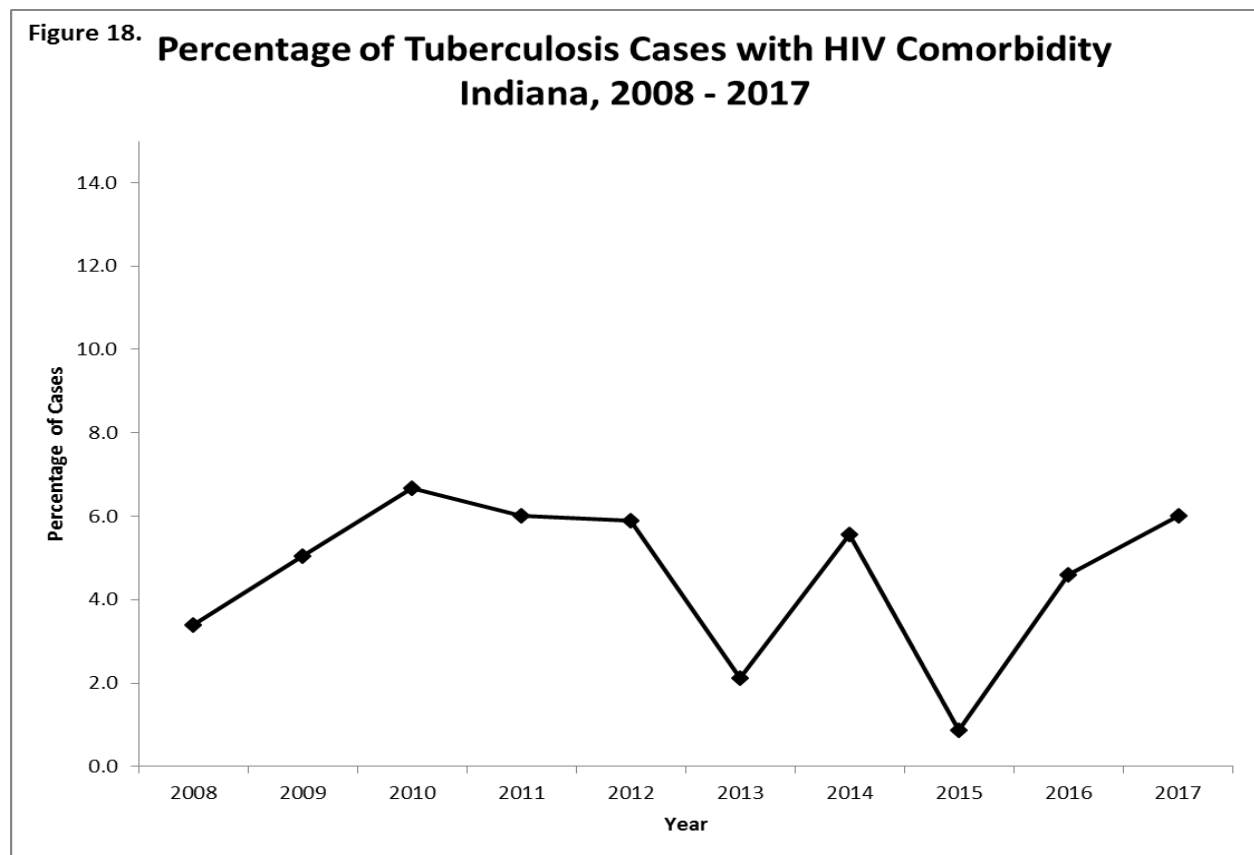


Figure 18. The proportion of TB cases in Indiana with HIV comorbidity increased in 2017 to **6.0%** from **4.6%** in 2016. Over the past 10 years, the proportion of TB cases with HIV co-infection in Indiana has not established a clear trend.

The most common reported risk factor among TB cases in Indiana in 2017 was diabetes mellitus reported in **18.0%** of cases. 2017 saw an increase in cases reporting homelessness compared to 2016.

Number & Percentage of TB Cases by Risk Factor Indiana, 2017		
Risk Factor	Number of Cases	Percent of Cases
Correctional Facility	1	1.0%
Homelessness	4	4.0%
Long-Term Care Facility	2	2.0%
Injecting Drug Use	1	1.0%
Non-Injecting Drug Use	5	5.0%
Excess Alcohol Use	9	9.0%
Contact of Infectious TB Patient	11	11.0%
Incomplete LTBI Therapy	5	5.0%
Diabetes Mellitus	18	18.0%
End-Stage Renal Disease	4	4.0%
Immunosuppression (Not HIV/AIDS)	6	6.0%

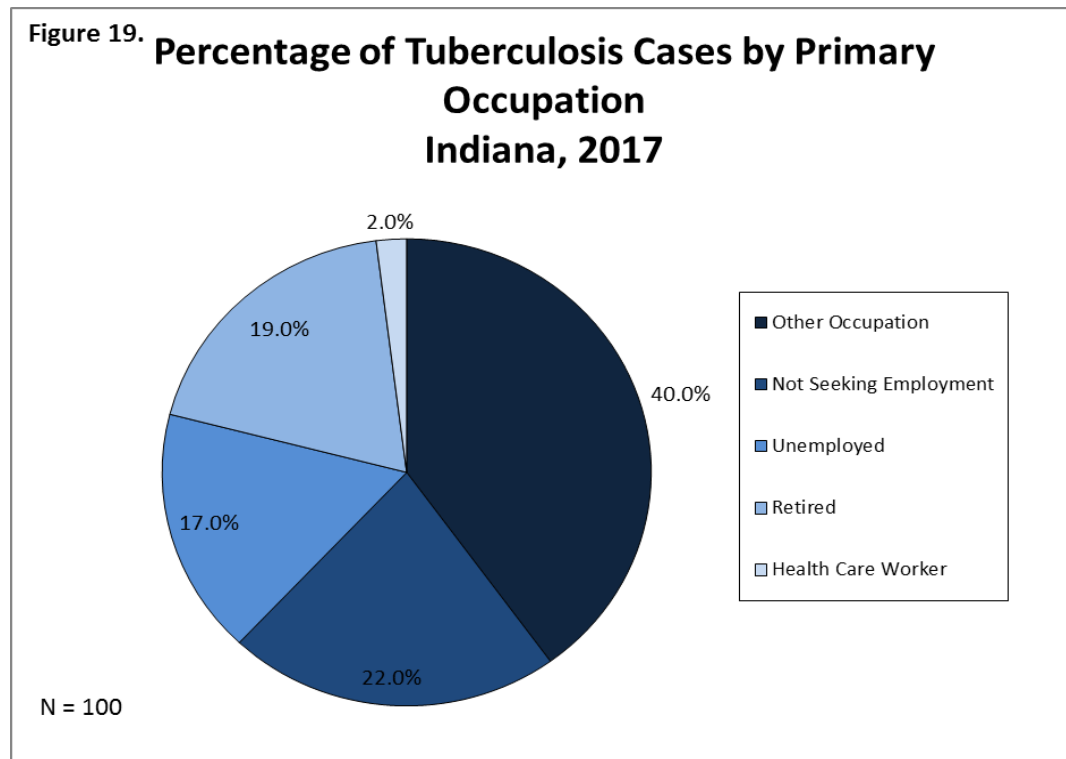


Figure 19. The unemployment rate in Indiana **3.8%** in 2017, yet **17.0%** of Indiana’s TB cases were unemployed.⁴ This remained stable from 2016.

C. 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.

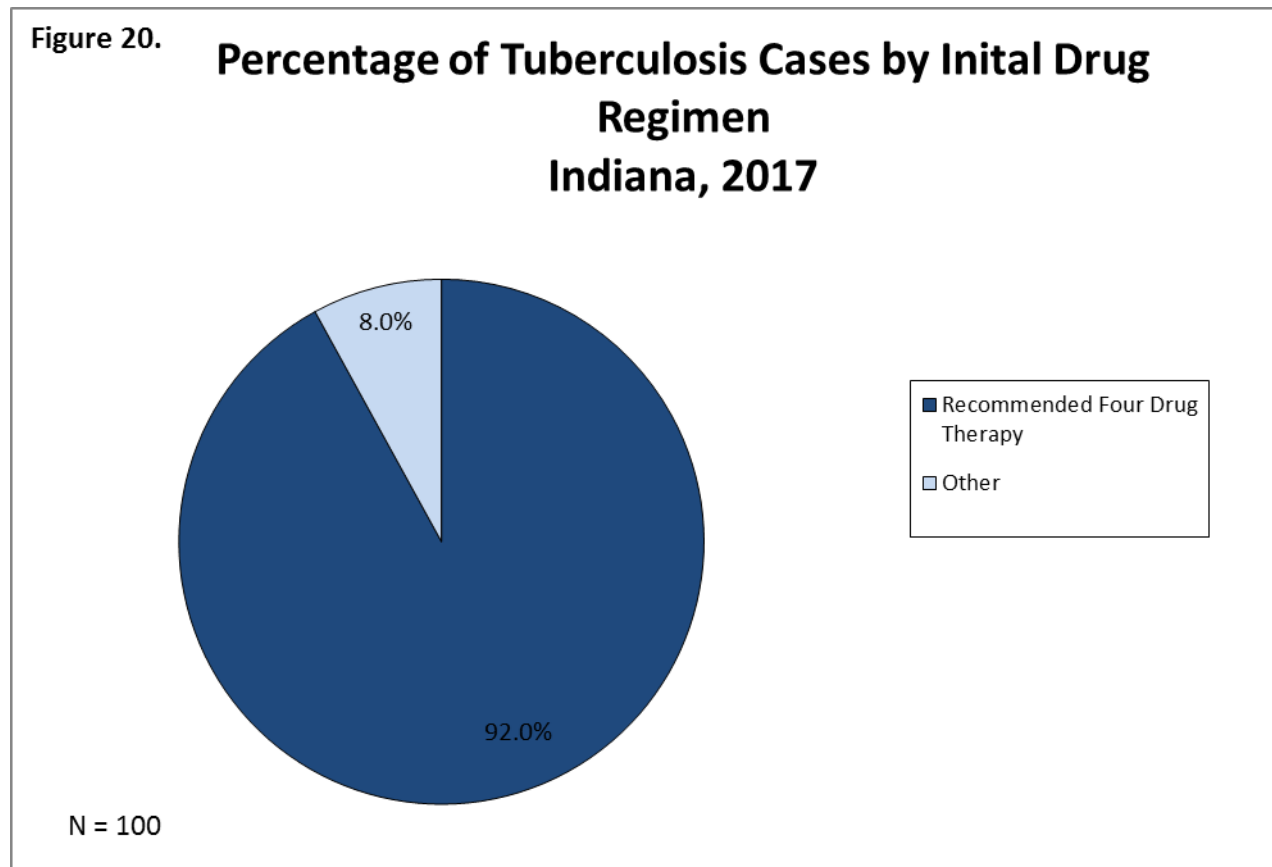


Figure 20. In 2017, **92.0%** of Indiana’s TB cases were started on the recommended four-drug initial therapy of INH, RIF, EMB, and PZA.

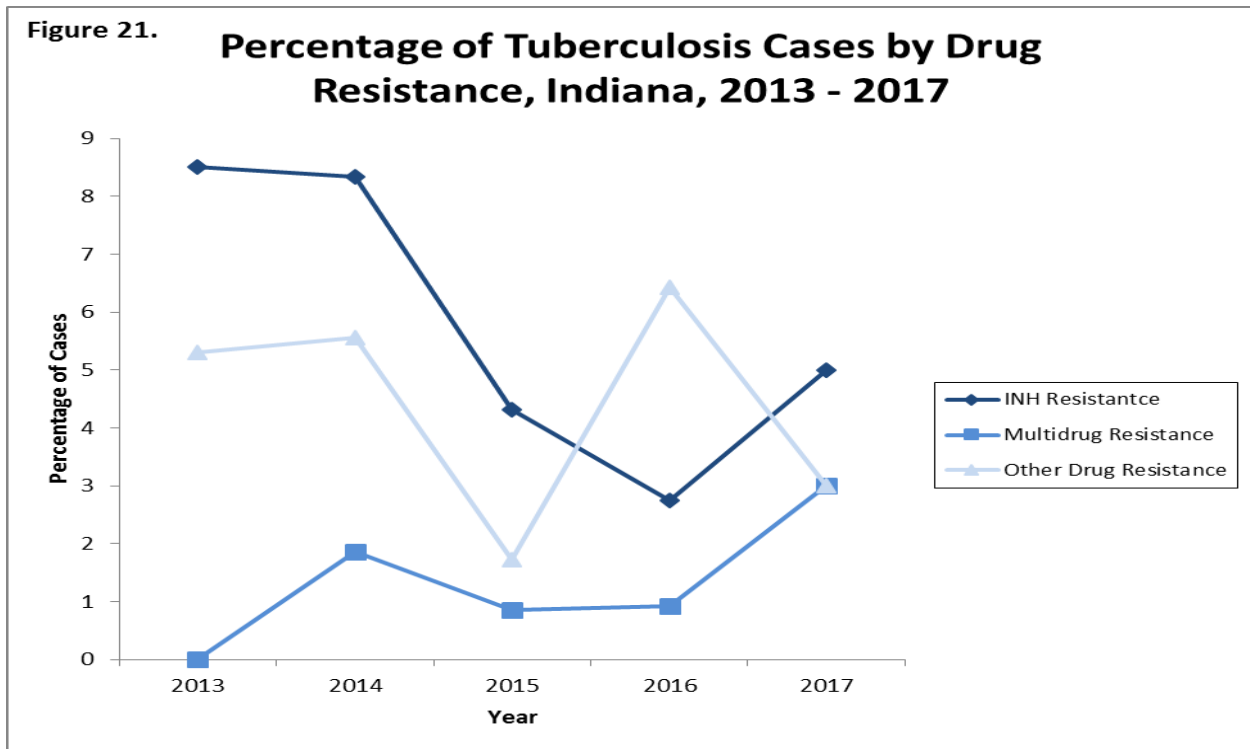


Figure 21. Of the 67 culture-positive TB cases in Indiana in 2017, drug susceptibility testing was performed on 98.5% of the isolates. There was an increase in the proportion of MDR and INH resistant TB while other drug resistance declined.

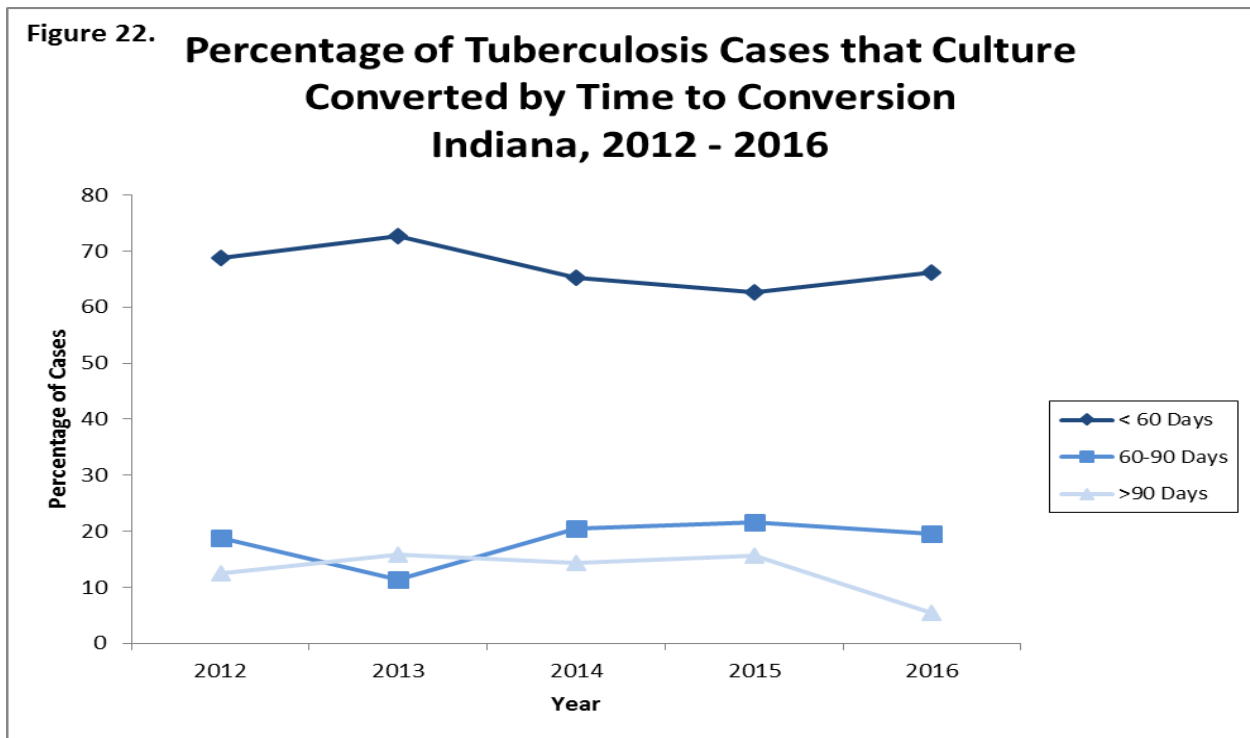


Figure 22. In 2016, culture conversion was reported for 92.7% of eligible TB cases, with 67.3% converting within the first 60 days of treatment. Sputum culture conversion (from positive to negative) data are collected to measure response to therapy and to determine length of treatment.

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.

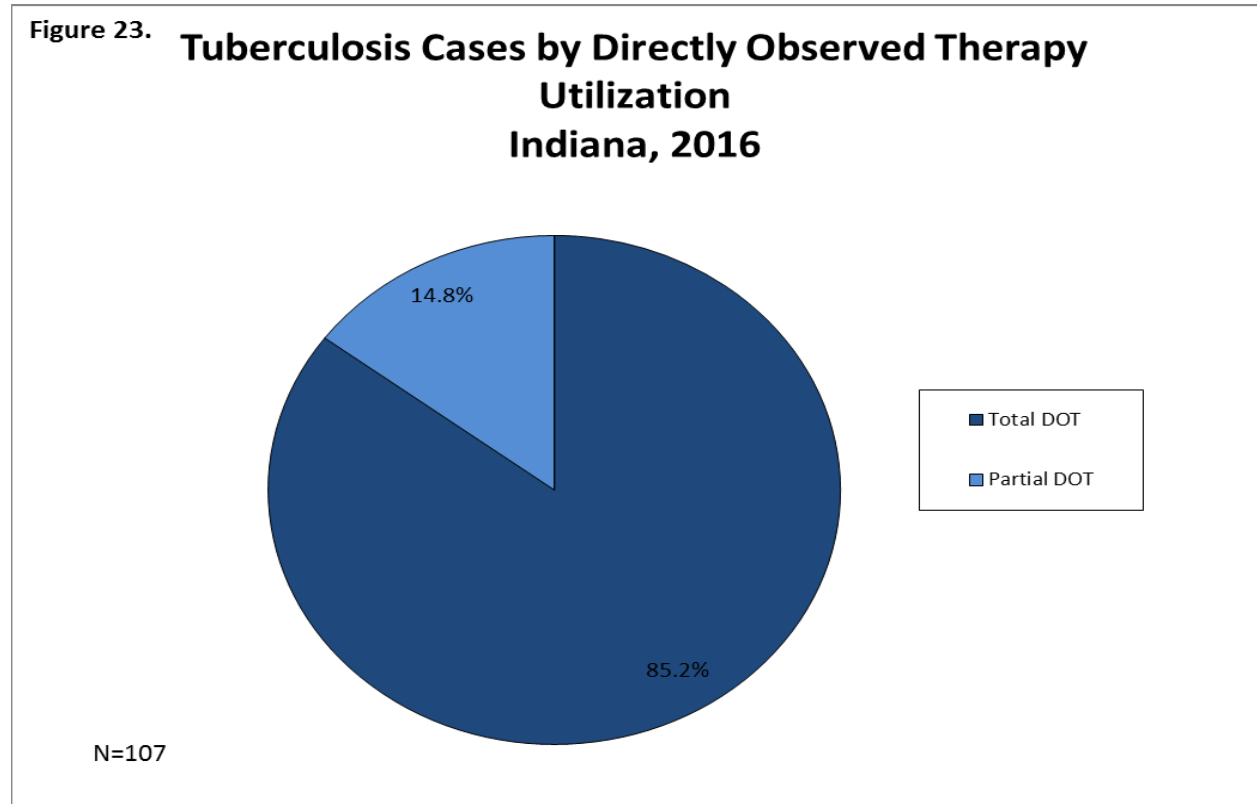


Figure 23. In 2016, 85.2% of Indiana TB Cases underwent total DOT, down from 90.1% in 2015.

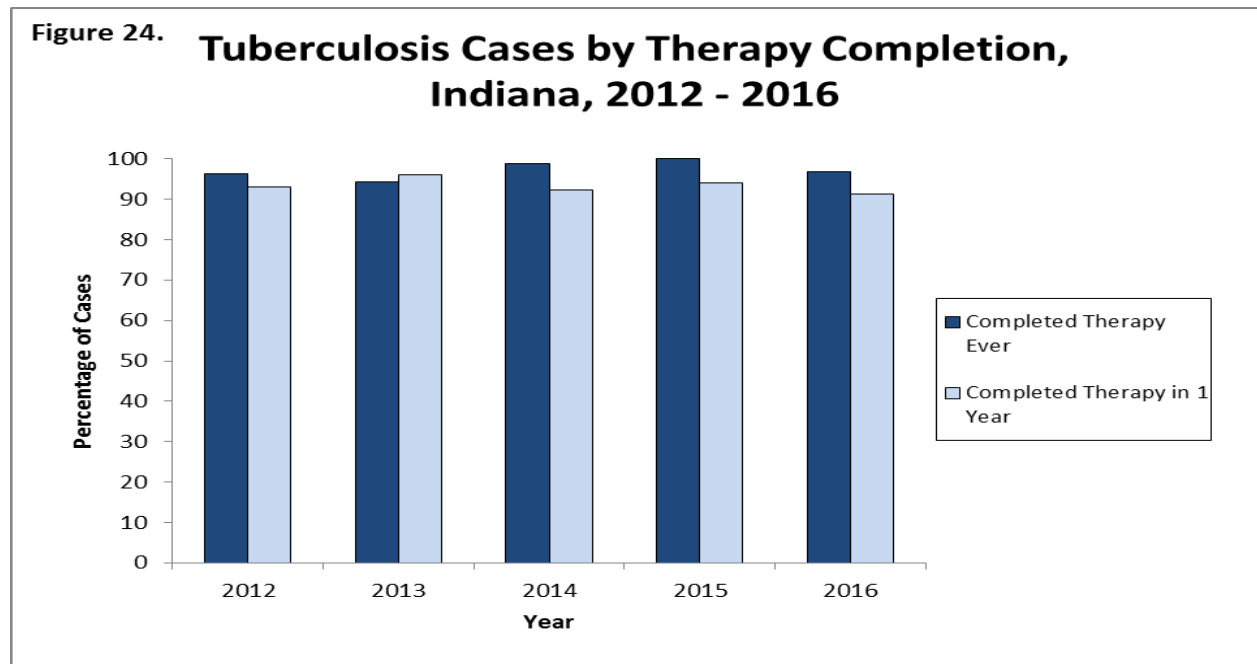


Figure 24. In 2016, 98.9% of eligible Indiana TB cases completed therapy, with 92.3% completing therapy within one year. This is a decrease from 2015, when 94.1% of eligible TB cases completed therapy within one year.

D. 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 infection⁷.

Of the cases genotyped in 2017, **53.7%** were identified as part of a cluster in Indiana.

In 2017, **100%** of culture-positive TB cases in Indiana were genotyped.

There were **13** active genotype clusters in 2017 indicating possible recent transmission.

There were **ZERO** ongoing outbreaks in 2017.

E. Contact Investigations

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 TB⁸. 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.

2016 National Objectives & Indiana Contact Investigation Measures by Year 2012 - 2016						
Year	2012	2013	2014	2015	2016	2020 National Objective
Total Number of Cases	102	94	108	116	109	
Percentage of sputum AFB smear-positive TB cases with contacts identified	90%	97%	97%	100%	100%	100%
Percentage of contacts to sputum AFB smear-positive TB cases evaluated for infection and disease	57%	60%	68%	60%	76%	93%
Percentage of infected contacts who are started on treatment for latent TB that complete therapy	52%	46%	82%	85%	91%	91%

III. 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 2017 rates are based on 2016 population estimates, as 2017 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 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.

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. africanum*, *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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