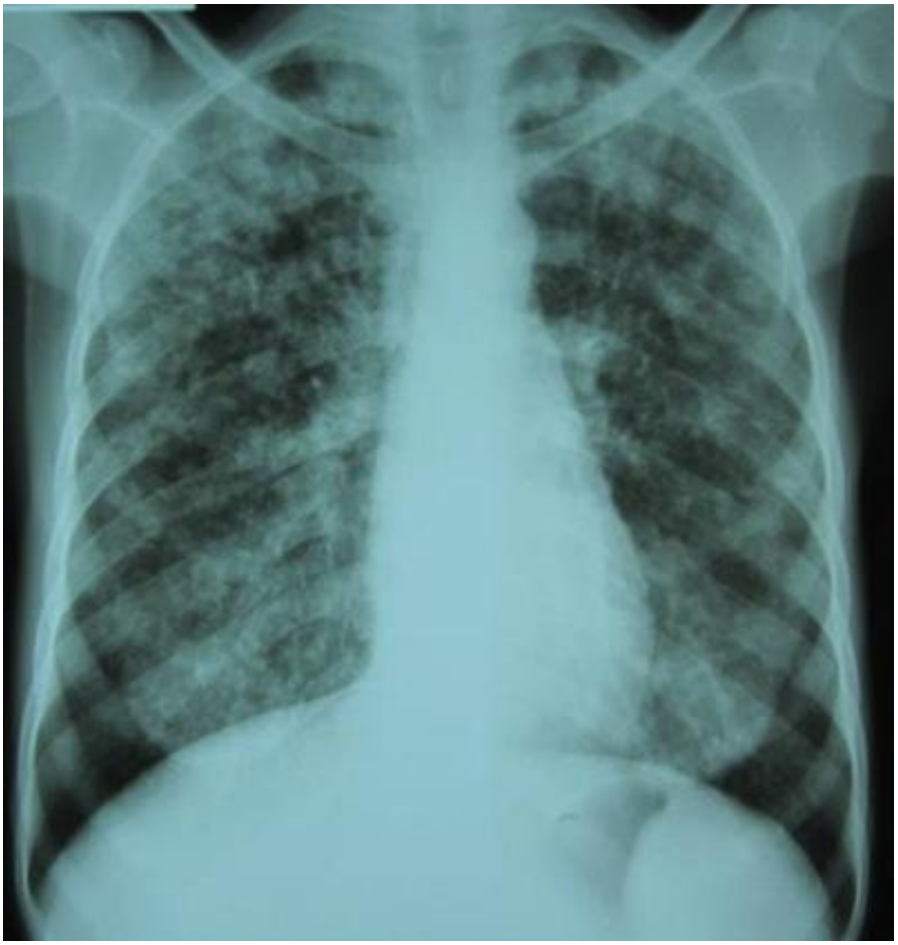
# INDIANA TUBERCULOSIS CONTROL PROGRAM
# 2013 ANNUAL REPORT



**Miliary Tuberculosis**
http://www.sharinginhealth.ca/pathogens/bacteria/mycobacterium_tuberculosis.html

Indiana State Department of Health

# Glossary

**Case fatality rate**: the ratio of the number of deaths caused by a specified disease to the number of diagnosed cases of that disease.

**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 interferon-gamma release assay (IGRA), (2) signs and symptoms compatible with current TB disease (e.g., an abnormal, unstable chest x-ray) or clinical evidence of current disease (e.g., cough, night sweats, weight loss, hemoptysis), and (3) current treatment with two or more anti-TB drugs.

**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.

**Culture:** Growth of microorganisms in the laboratory performed for detection and identification 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.

**Endemic**: present in a community at all times typically in relatively low frequency.

**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.

**Hemoptysis**: the coughing up of blood or bloody sputum from the lungs or airway.

**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.

**Isolate**: a population of microorganisms that has been obtained in pure culture.

**Laboratory case confirmation**: laboratory diagnosis is confirmed when: (1) *M. tuberculosis* complex has been isolated from a culture or has been demonstrated in a clinical specimen by a nucleic acid amplification (NAA) test approved by the FDA (must be accompanied by a culture for identification), or (2) acid fast bacilli (AFB) are seen when a culture has not or cannot be obtained (used primarily to aid in a post-mortem diagnosis).

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

**Lost to follow-up**: patients who at one point in time were actively participating in treatment but have become lost (either by error in a computer tracking system or by being unreachable) at the point of follow-up. These patients can become lost for many reasons: without properly informing the healthcare provider, they may have opted to withdraw from treatment; they may have moved away from the healthcare provider, or become ill and unable to communicate or are deceased.

**Miliary TB**: a serious form of TB disease sometimes referred to as disseminated TB. A dangerous and difficult form to diagnose of rapidly progressing TB disease that extends throughout the body. Uniformly fatal if untreated, and in certain instances it is diagnosed too late to save a life.

***Mycobacterium bovis***: see *Mycobacterium tuberculosis*.

***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. african*, *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.

**Outbreak**: unusually high occurrence of a disease or illness in a population or area. Three or more cases are required for an occurrence of tuberculosis 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.

**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.

## EXECUTIVE SUMMARY

The mission of the Indiana State Department of Health's Tuberculosis and Refugee Health Division is to decrease tuberculosis incidence and prevalence within the state of Indiana and to progress towards its elimination by providing technical assistance and support, education, policy development and surveillance in collaboration with local health departments, medical providers and the Centers for Disease Control and Prevention (CDC) in the care of those infected and affected by tuberculosis.

Our vision is that by 2015 the incidence rate of tuberculosis among U.S.-born residents of Indiana will not exceed 0.5 per 100,000 as the result of the initiative and collaboration of all local health departments, health care providers and the CDC. The incidence rate for 2013 was 1.4 per 100,000 for all persons in Indiana; however the U.S.-born incident rate in Indiana is 0.7 per 100,000.

During 2013, there were 94 new cases of tuberculosis (TB) reported to the Indiana State Department of Health – this represents a 7.8% decrease from the previous year. However, TB cases have declined from 1,883 reported in 1956 to an all-time low of 90 cases reported in 2010 Figure 1a shows data from the last 50 years and figure 1b reflects the past 10 years. In 2013, TB cases were reported in greater than one third of Indiana's 92 counties (n=30). Indiana's three most populous counties (Marion, Lake, and Allen) accounted for half (n=47, 50.0%) of all new cases. At 3.9 per 100,000, Marion County's incidence rate was nearly three times higher than the overall statewide rate (1.4 per 100,000); Marion County reported 36 cases in 2013 *vs*. 38 cases in 2012; Lake County reported four TB cases in 2013 *vs*. 7 in 2012; Allen County's caseload decreased from 15 cases in 2012 to 7 cases in 2013.

High risk populations for TB infection include children and persons with HIV comorbidity. Pediatric cases numbered seven in 2012 and four in 2013; six cases in 2012 and two cases in 2013 reported HIV as a comorbid condition.

Since TB is endemic in other parts of the world, being born outside the US is a risk factor for acquiring TB infection. In fact, 63% of all TB cases in the US in 2012 occurred among people born in other countries[1.] Until 2013 individuals born in the US made up a higher percentage of TB cases, however the 2013 trend in Indiana is now representative of the national trend with more cases of TB coming from foreign-born individuals(n=51, 54.3% foreign-born *vs*. n=43, 45.7% US-born). Of those non-U.S. born cases, over half (n=30, 58.8%) were born in Burma, India, Philippines, or Mexico. The highest incidence (28.4 per 100,000) of tuberculosis cases occurred among Indiana's population of Asian descent; the lowest incidence occurred among those who identified as White (0.7 per 100,000). Overall, resistance to TB drugs increased in 2013. Fortunately there were no multi-drug resistant cases in 2013.

One new genotype cluster with more than one case was confirmed in 2013. Indiana had two ongoing TB outbreaks in 2013, both (genotype cluster IN_0074 and IN_0069) associated with the homeless population. Cluster IN_0074 includes 31 cases from Indiana, with three added in 2013. Cluster IN_0069 includes 11 cases from Indiana, with four added in 2013.

Summary statistics listed in Table 1 illustrate 2013 data for Indiana in comparison to nationwide TB data (the most recent national data is from 2012 unless otherwise noted).

## SUMMARY STATISTICS

Table 1

| | Indiana (2013) | Indiana (2012) | United States (2012) |
|---|---|---|---|
| Number of tuberculosis cases | 94 | 102 | 9,945 |
| Tuberculosis deaths (per 100,000) | .03 | .06 | .2 (2010) |
| Laboratory case confirmation | 78% | 76% | 78% |
| Site of disease: pulmonary | 73% | 80% | 79% |
| Incidence rate (per 100,000) | 1.4 | 1.6 | 3.2 |
| US-born | 0.7 | 1.0 | 1.4 |
| Foreign-born | 16.9 | 15.1 | 15.9 |
| White | 0.7 | 0.8 | 0.8 |
| Black | 3.2 | 5.1 | 5.8 |
| Asian | 28.4 | 25.4 | 18.9 |
| Hispanic/Latino (all races) | 2.1 | 2.6 | 5.3 |
| Male | 2.0 | 1.9 | 3.9 |
| Female | 0.9 | 1.3 | 2.5 |
| Correctional facility resident * | 0% | 2.9% | 4.1% |
| Long-term care facility resident * | 3.2% | 3.9% | 2.2% |
| Excess alcohol use ** | 13.8% | 16.6% | 12.4% |
| Injecting drug use ** | 1.1% | 1.9% | 1.5% |
| Non-injecting drug use ** | 9.6% | 6.8% | 7.4% |
| Homeless ** | 10.6% | 8.8% | 5.7% |
| Known HIV test results 25-44 y/o | 83% | 93.0% | 92.0% |
| HIV positive – all ages | 2.0% | 6.0% | 7.5% |
| Isoniazid resistance with previous TB | 0.0% | 0.0% | 14.3% |
| Isoniazid resistance without previous TB | 8.5% | 8.1% | 8.9% |
| Multi-drug resistance with previous TB | 0.0% | 0.0% | 2.9% |
| Multi-drug resistance without previous TB | 0.0% | 0.0% | 1.1% |
| Initial drug regimen I, R, Z, E *** | 95.5% | 90.9% | 85.2% |
| Directly observed therapy | 80.8% (2012) | 85.0% (2011) | 59.1% (2010) |
| Therapy completed | 98.8% (2012) | 86.0% (2011) | 89.2% (2010) |
| Therapy completed ≤ 1 year | 92.9% (2012) | 99.0% (2011) | 89.2% (2010) |
| Therapy stopped: adverse event | 0.3% (2012) | 1.0% (2011) | 0.3% (2010) |
| Therapy stopped: moved | 0.0% (2012) | 0.0% (2011) | 0.8% (2009) |
| Therapy stopped: lost | 1.1% (2012) | 3.0% (2011) | 1.4% (2009) |
| Therapy stopped: refused | 0.5% (2012) | 1.0% (2011) | 0.7% (2009) |
| Therapy stopped: died | 4.0% (2012) | 6.1% (2011) | 5.9% (2010) |

* at time of diagnosis ** within the past year
*** I = isoniazid, R = rifampin, Z = pyrazinamide, E = ethambutol

Population data derived from 2010 US census data, except where noted[2]

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Tuberculosis is an airborne disease caused by a group of bacteria that is collectively referred to as the *Mycobacterium tuberculosis* (MTB) complex. 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 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. Latent infection may progress to a case of active tuberculosis disease; approximately 10% of immunocompetent individuals with latent infection will progress to active disease during their lifetime. Indiana requires reporting of all suspected cases and confirmed cases of TB; LTBI infection is not a reportable disease in Indiana at this time.

The introduction of anti-TB chemotherapy has led to a long-term decline in the number of new cases (Figures 1a and 1b) as well as a reduction in the TB case fatality rate. Indiana's number of deaths since 2009 is shown in Figure 2.

**Figure 1a**

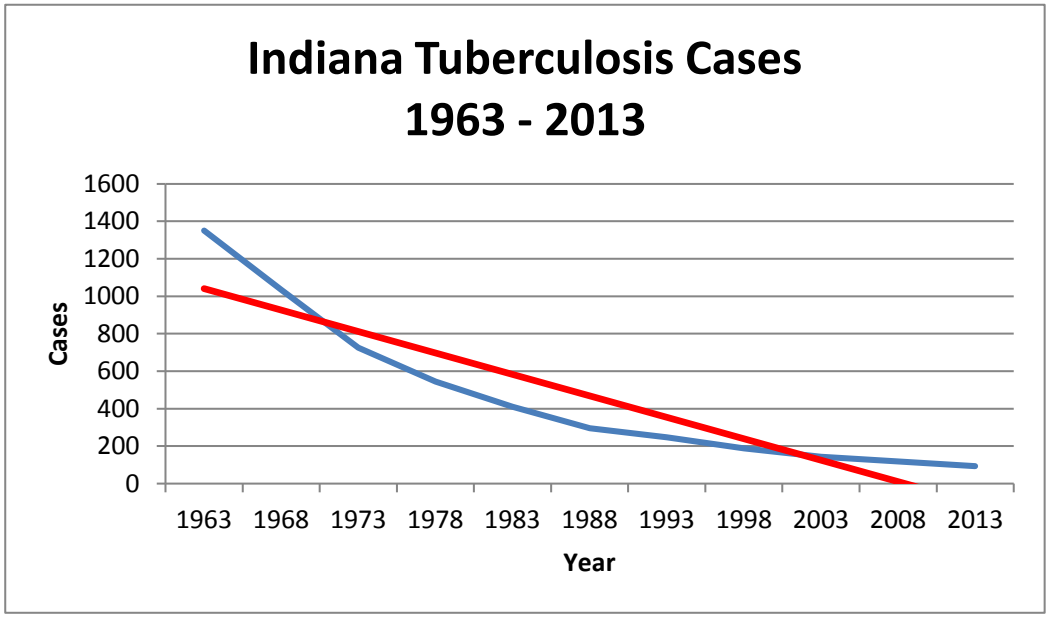


**Figure 1b**

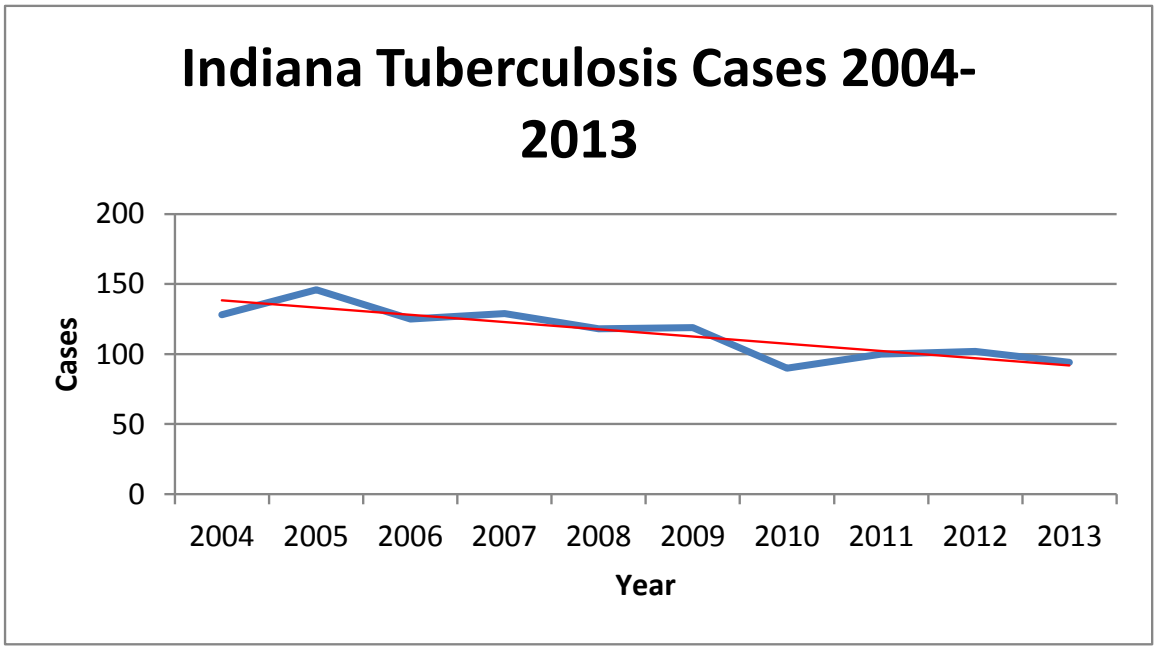
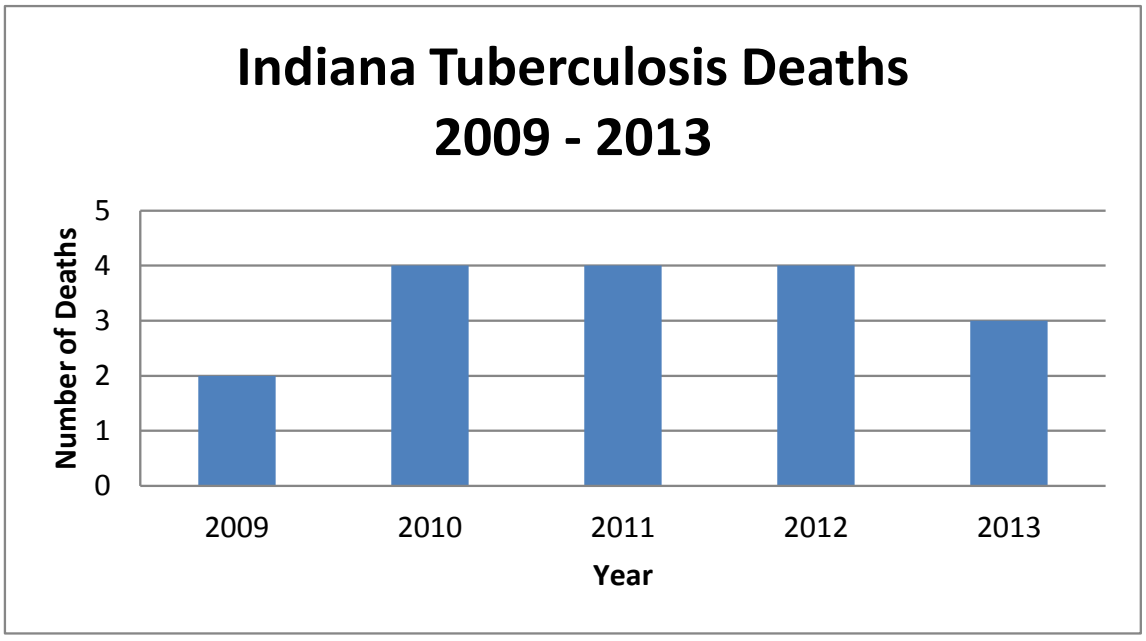


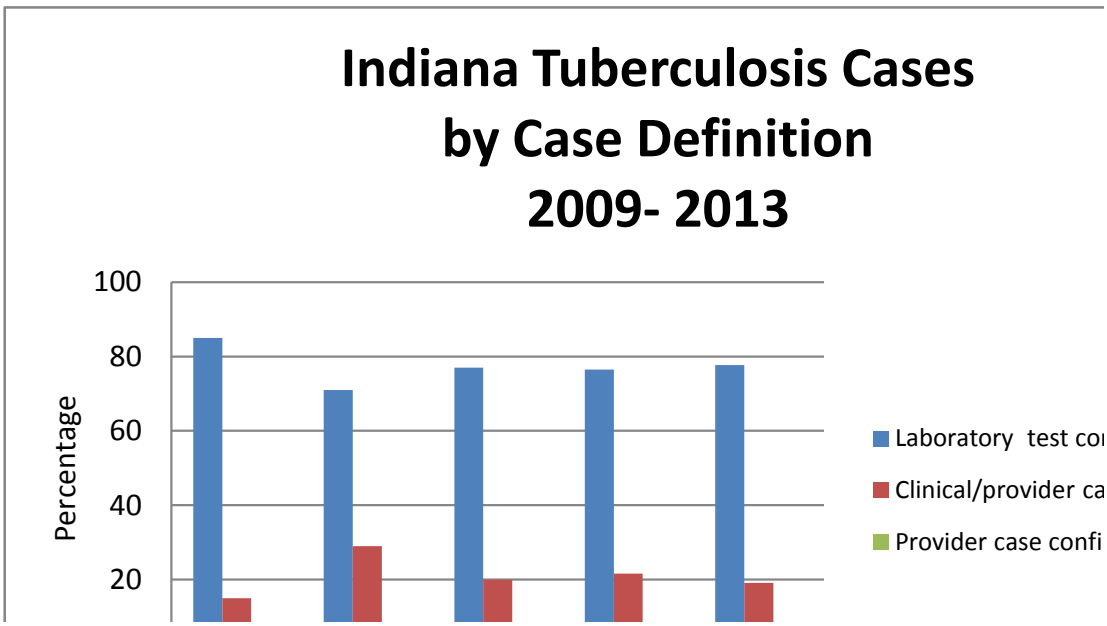

**Figure 2**



A diagnosis of TB is verified using the CDC's publication from 2007 entitled "Case Definitions for Infectious Conditions under Public Health Surveillance" publication[1]. TB cases must meet the case definition for a laboratory, clinical, or provider diagnosis. A laboratory diagnosis is confirmed when: (1) *M. tuberculosis* complex has been isolated from a culture or has been demonstrated in a clinical specimen by a nucleic acid amplification (NAA) test approved by the FDA (must be accompanied by a culture for identification), or (2) acid fast bacilli (AFB) are seen when a culture has not or cannot be obtained (used primarily to aid in a post-mortem diagnosis).

A clinical diagnosis is confirmed when **all** of the following criteria are met upon medical evaluation: (1) a positive tuberculin skin test (TST) or interferon-gamma release assay (IGRA), (2) signs and symptoms compatible with current TB disease (e.g., an abnormal, unstable chest x-ray) or clinical evidence of current disease (e.g., cough, night sweats, weight loss, hemoptysis), and (3) current treatment with two or more anti-TB drugs. This category includes cases of culture-negative pulmonary TB, extrapulmonary TB in which cultures did not grow or were not obtained, and in pediatric cases for whom obtaining specimens is difficult and invasive procedures are not warranted. In 2013 over three quarters (n=73, 77.7%) of TB cases were laboratory confirmed. Clinical case confirmation has risen from 15% in 2009 to 19.1% (n=18) in 2013. The third manner in which a TB case may be diagnosed is by provider diagnosis in which a medical provider diagnoses the case as TB based upon his or her clinical evaluation.

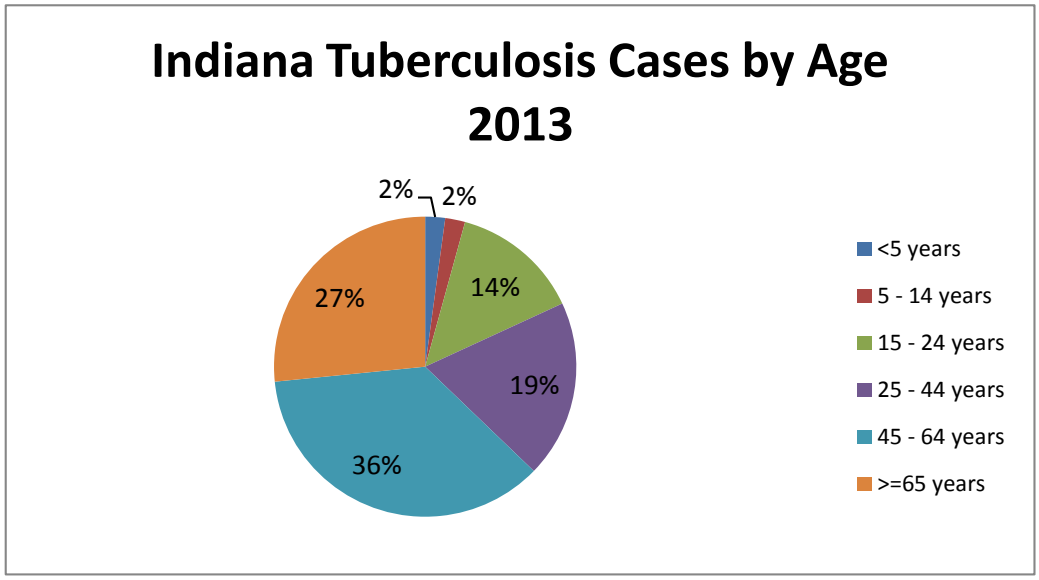
**Figure 3**



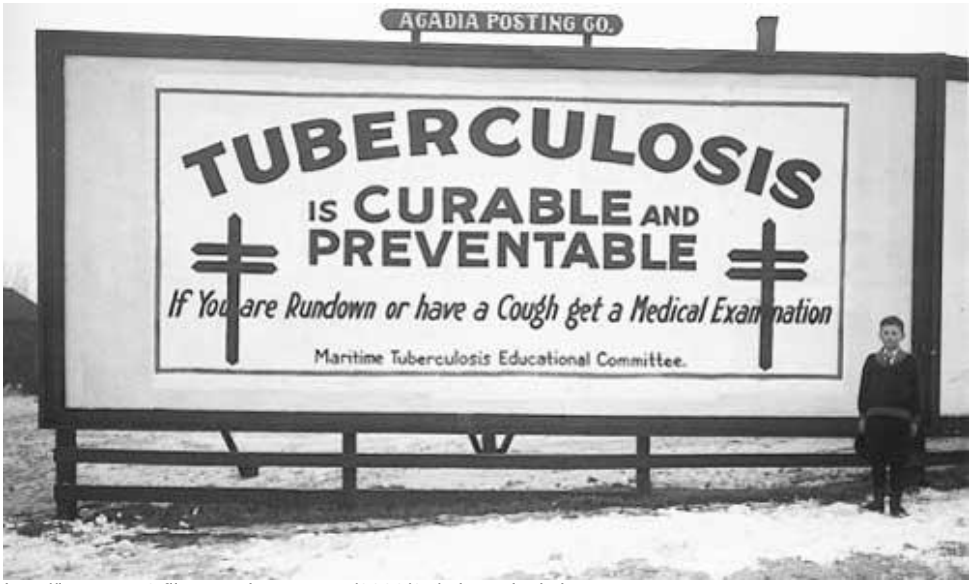

***** *Note:* provider case confirmation was not calculated as separate category until 2011.

In 2013, about 81% of diagnosed TB cases were adults aged 25 years or older (n=77). Figure 4 provides a breakdown by age group.

**Figure 4**

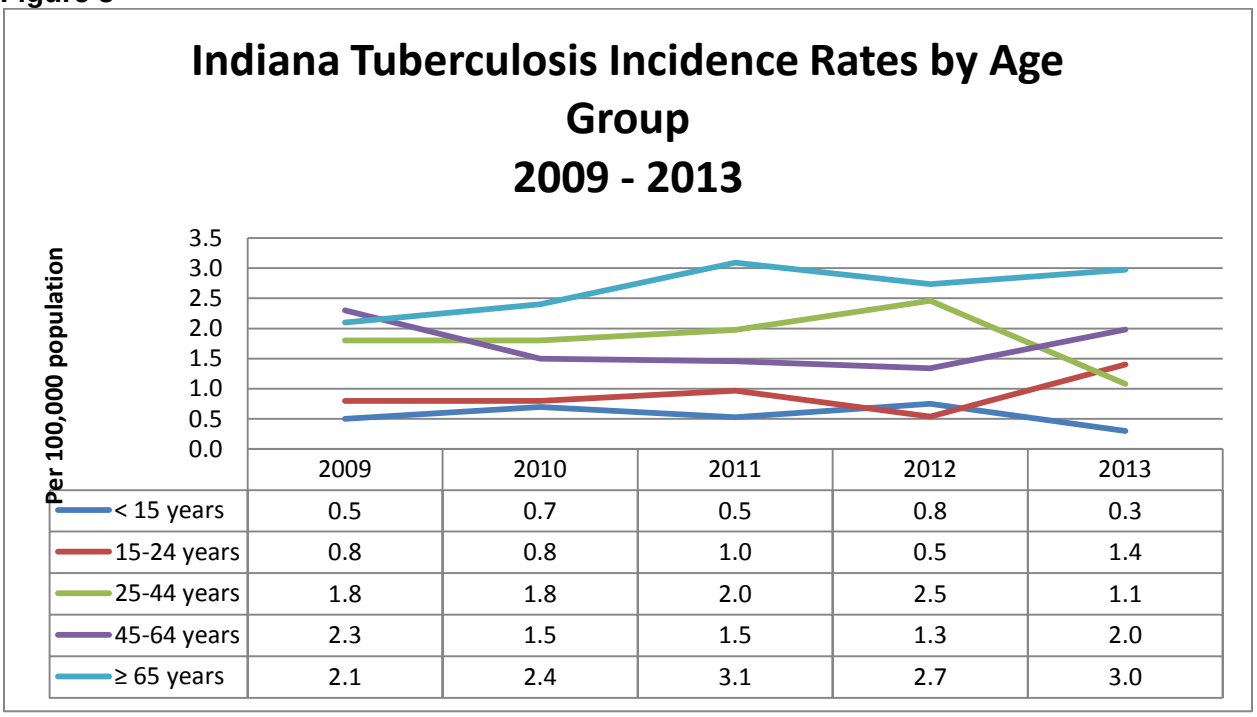



Age disparity is evident in the ≥65 year age group for 2013: 27% (n=25) of TB cases were reported in this age group, yet this group makes up only 13% of Indiana's total population (incidence rate = 3.0 per 100,000). In 2013, the incidence of tuberculosis decreased for the <15 years age group (0.3 per 100,000), declined for the 25-44 years age group (1.1 per 100,000), but increased almost twofold for the 15 – 24 years age group (1.4 per 100,000). The largest number and percentage of cases comes from the 45-64 age group (n=34, 36.2%) Figure 5 illustrates age group incidence trends for 2009 – 2013.




http://jmorrow50.files.wordpress.com/2008/05/tuberculosis.jpg

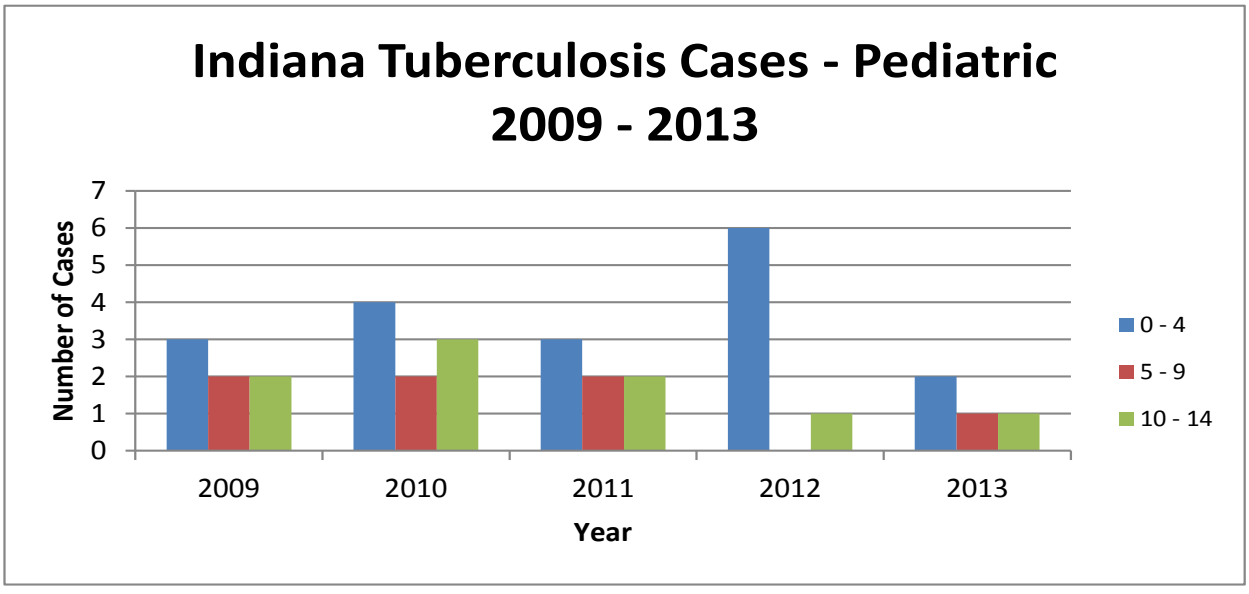
**Figure 5**




| | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|
| < 15 years | 0.5 | 0.7 | 0.5 | 0.8 | 0.3 |
| 15-24 years | 0.8 | 0.8 | 1.0 | 0.5 | 1.4 |
| 25-44 years | 1.8 | 1.8 | 2.0 | 2.5 | 1.1 |
| 45-64 years | 2.3 | 1.5 | 1.5 | 1.3 | 2.0 |
| ≥ 65 years | 2.1 | 2.4 | 3.1 | 2.7 | 3.0 |

The number of pediatric tuberculosis cases in Indiana in the 0 – 4 age group decreased by over half in 2013 (n=2); there was only 1 case each for the 5 – 9 year age group and the 10 – 14 year age group (Figure 6). The incidence rate for pediatric TB cases <5 years of age was 0.46 per 100,000, which meets Indiana's 2013 goal of 1.0 per 100,000 cases. Pediatric cases provide important information regarding ongoing transmission in a community because TB infection in children indicates that (1) TB was transmitted relatively recently, (2) the person who transmitted TB to the child may still be infectious, (3) other people in the household or community have likely been exposed to TB and could develop TB disease.

**Figure 6**



The distribution of TB among White, Black, and Asian persons of Indiana illustrates racial disparity. Forty-three percent (n=41) of the TB disease burden in 2013 was borne by White-identified persons yet census data show that 84% of the Hoosier population is White. While the disparity among Indiana's Black population remains, there has been improvement from 2012 (29% n=36). Black persons make up about 9% of Indiana's population but accounted for 21.3% (n=20) of TB disease, with a case rate of 2.3 per 100,000 this meets our program target for 2013 of 3.4 cases per 100,000. The most serious disparity is seen among Asian persons. Asian individuals made up 35% (n=33) of the TB disease burden yet account for only 2% of the overall Hoosier population (Figure 7); 100% (n=33) the Asian cases were born outside the US. (NOTE: Although American Indian/Alaska Native and Hawaiian Native/Other Pacific Islander are racial categories which are collected by the CDC and by Indiana TB Control Programs, in 2013 no TB case was classified in either of these categories.)

**Figure 7**

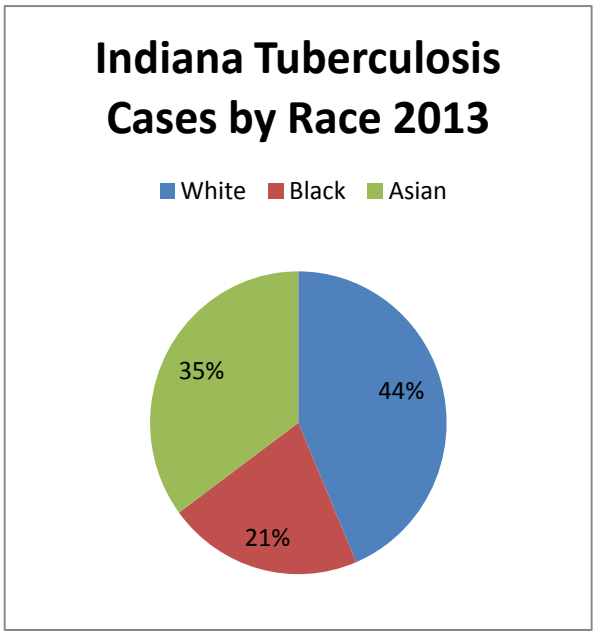
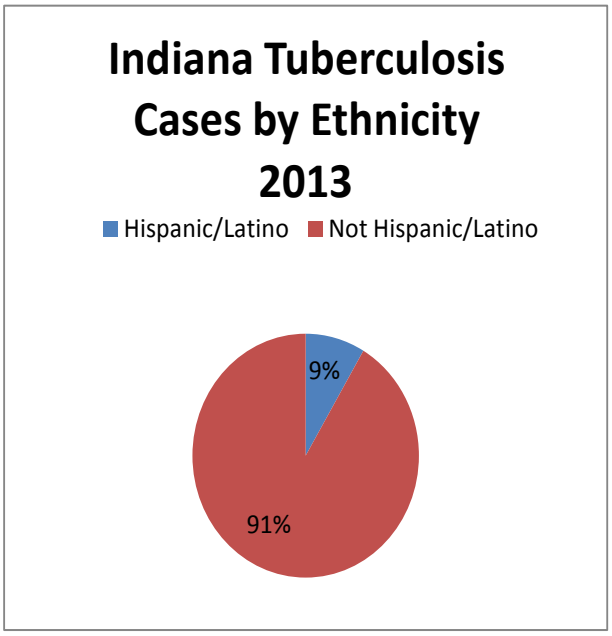


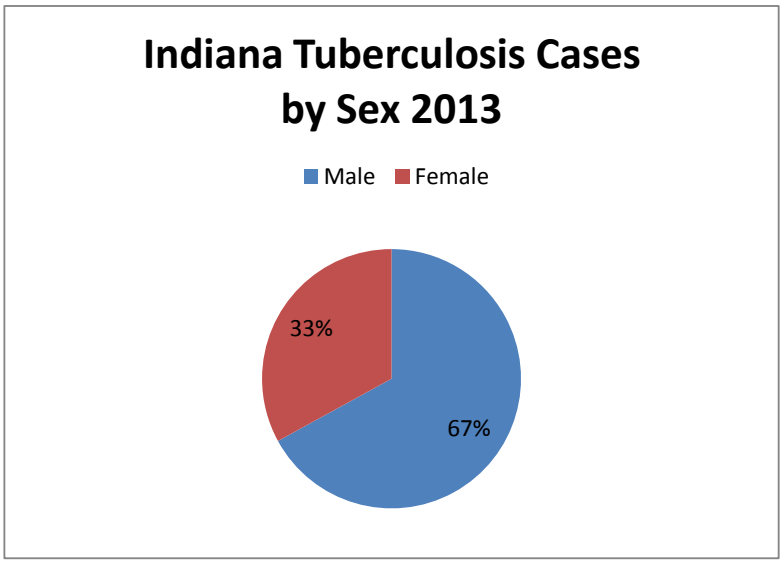

**Figure 8**




Disparity is also found in Indiana's Hispanic/Latino population. Although 6% of Indiana's population identifies as Hispanic/Latino, 9% (n=8) of 2013's cases were of Hispanic/Latino ethnicity (Figure 8). Of the Hispanic/Latino individuals, 100% (n=8) were foreign born.

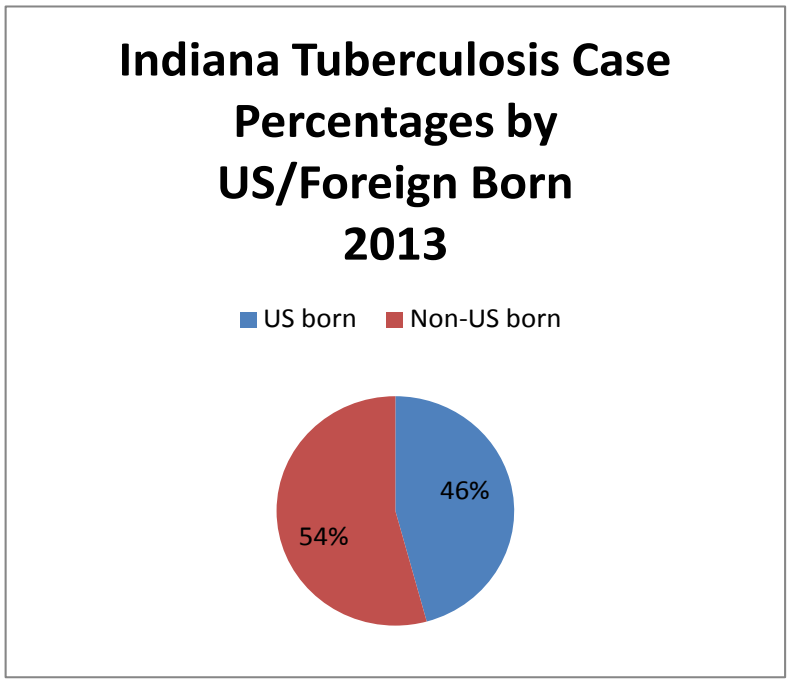
The split between male/female tuberculosis cases in Indiana in 2013 was more dramatic: males accounted for 67% of TB cases (n=63) while females accounted for 33% (n=31) (Figure 9).

**Figure 9**



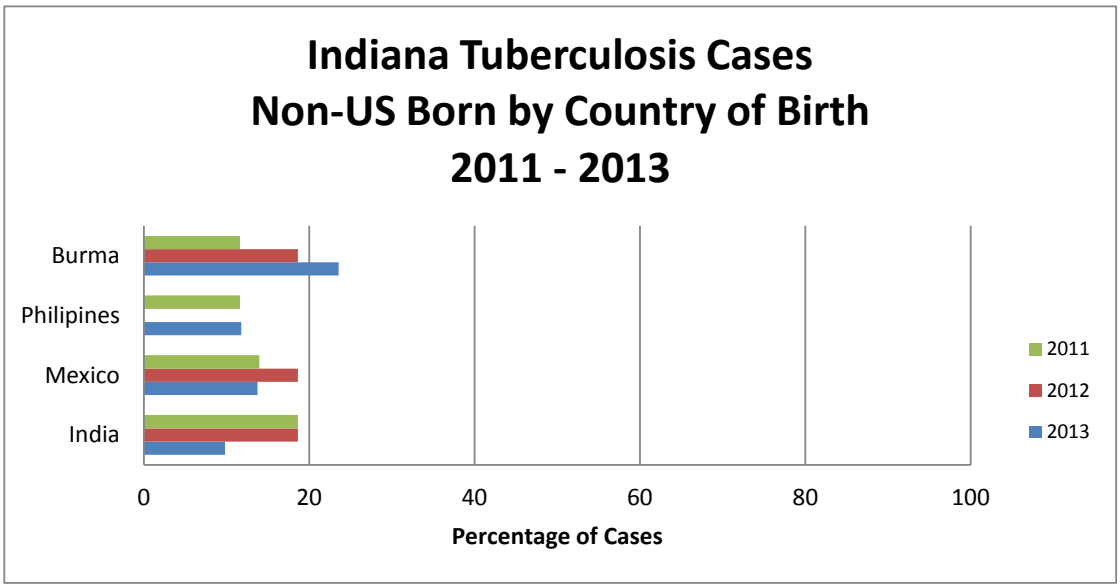

For the first time in Indiana, foreign born cases outnumbered U.S. Born cases, which follows the national trend. Nationally the TB case-rate disproportionally affects foreign born persons (15.9 per 100,000) which is 15 times higher than the rate for those born in the US (1.4 per 100,000). For 2013, Indiana's incidence rate goals for both US- born individuals (≤ 0.7per 100,000) and foreign-born individuals (≤ 17.5 per 100,000) were met. About forty-six percent of 2013 TB cases were US-born (n=43); 54% (n=51) of TB cases were born outside the US (Figure 10).

**Figure 10**



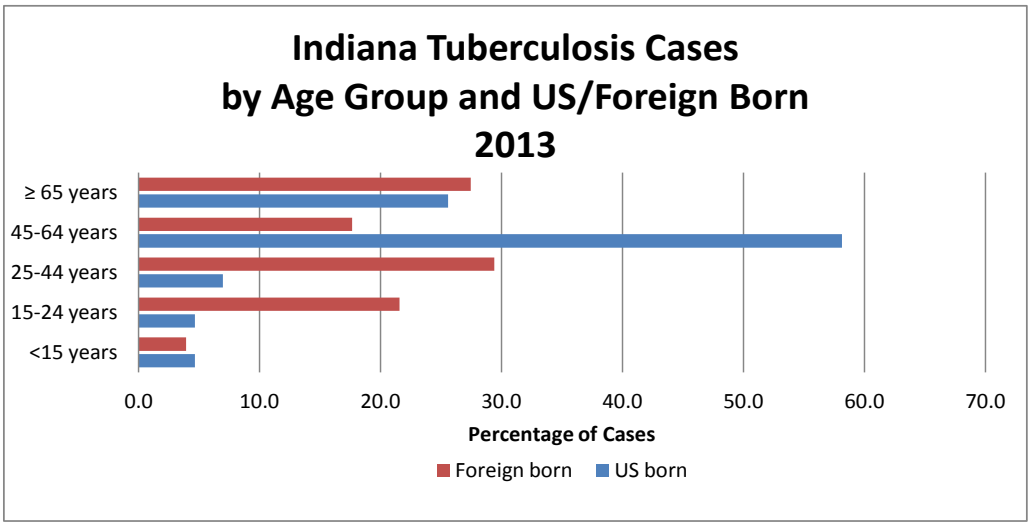
The countries with the highest percentages of 2013 TB cases are illustrated in Figure 11. Of the cases born outside the US, 9.8% (n=5) were from India; the percentage of cases (n=7) from Mexico is 13.7 percent. There were 6 cases (11.8%) from the Philippines, up from zero in 2012. Burmese cases increased by almost five percent (n= 12). (Note: only countries of origin with ≥5 cases are included in this analysis; 17 other countries of origin had one or two cases each.)

**Figure 11**




Distribution of TB cases by age group and US *vs*. foreign birth for 2013 is shown in Figure 12. TB disease was more common among US-born persons only in the 45-64 yrs age group (n=25, 74%). The percentage of foreign born cases aged 25 - 44 years (n=15, 83%) and 15-24 yrs (n=11, 85%) was more than double the percentage of US cases in the same age groups (n=3, 15%; and n=2, 15% respectively).

**Figure 12**



Burma, India, Mexico and the Philippines had the highest percentages of 2013 TB cases in Indiana among the foreign born. Cases of Indian, Mexican, and Philippino origin were all 15 years old or older (India: 25-44 years, n=1, 20.0%; 45-64, n=1, 20%, ≥65 years, n=3, 60%; Mexico: 15-24 yrs, n=1, 14.3%, 25-44 years, n=3, 42.9%; ≥65 years, n=3, 42.9%). In contrast, Burma had cases in all age groups (<15 years, n=1, 8.3%; 15-24 years, n=3; 25%; 25-44 years, n=4, 33.3%, 45-64 years n=1, 16.7%, ≥65 years n=1, 16.7%). (Figure 13)

**Figure 13**

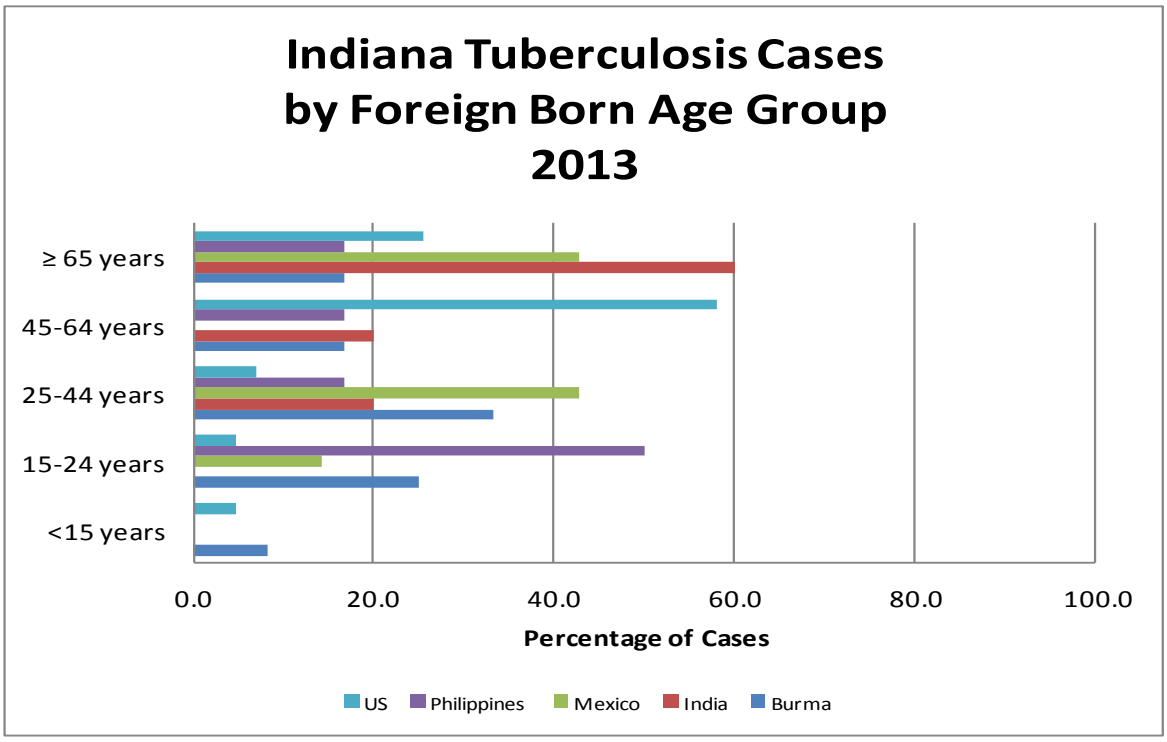



Figure 14 represents the length of time foreign-born persons were living in the U.S. prior to TB diagnosis; figure 15 illustrates the time in the U.S. prior to TB diagnosis for those cases born in countries with the highest percentage of 2013 foreign born TB cases: Burma, India Mexico, and the Philippines.

http://www.unrefugees.org.au/our-stories/stories-from-the-field/charity,-uganda

**Figure 14**

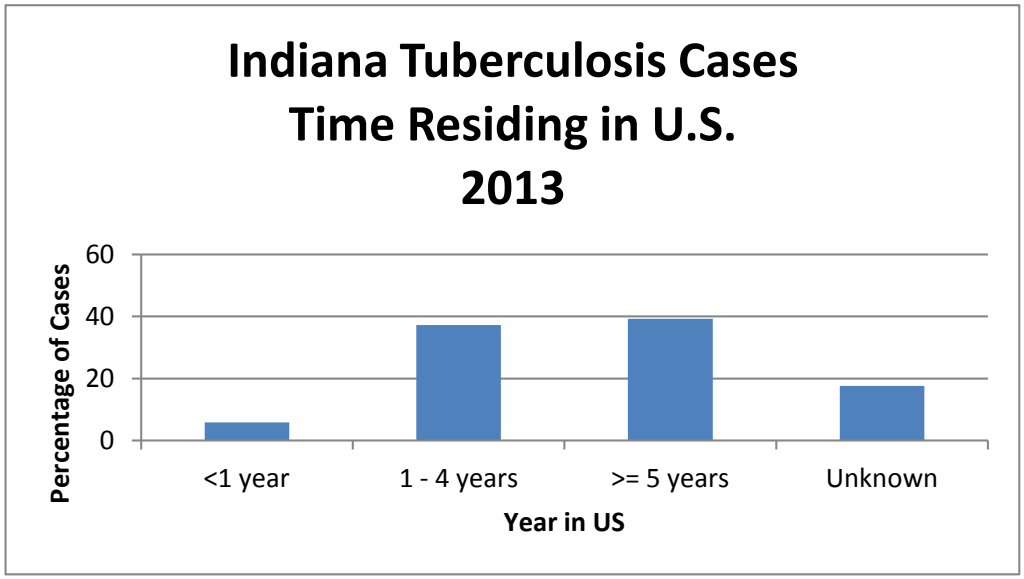
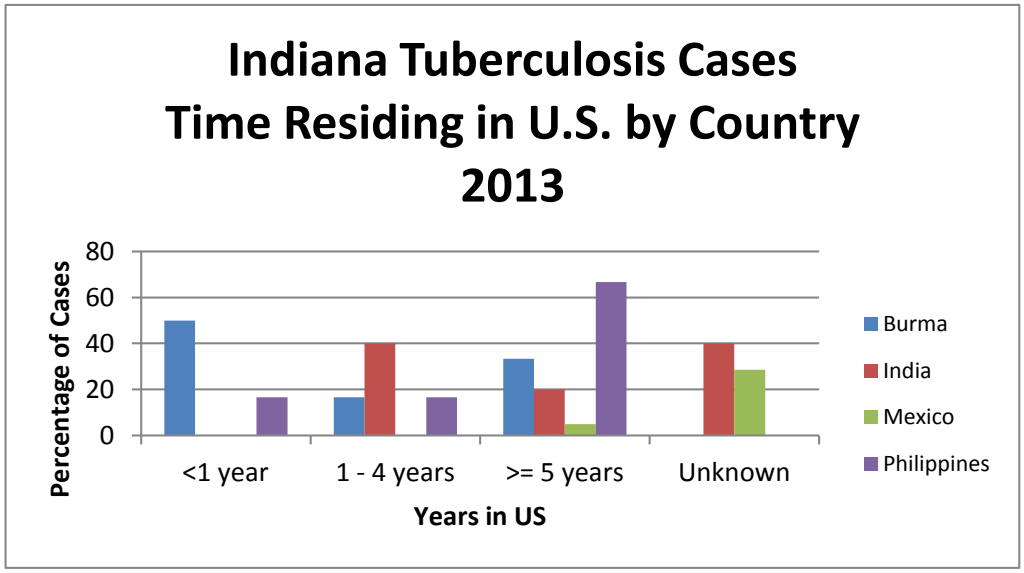



**Figure 15**




HIV status variables are shown in Figure 16a for the 25 – 44 years age group and in Figure 16b for all TB cases older than 15 years of age for 2013. Indiana's target for 2013 was 72.0% for "known HIV status"; this goal was achieved for both groups (n=15, 83% for the 25 – 44 year olds, n=66, 77% for all of those over age 15). For the 25 – 44 year age group, known HIV status decreased from 2012 (93%). In the 25 – 44 year age group two patients refused testing in 2013, and one patient was not offered testing.

The proportion of known HIV status for all cases older than 15 years of age decreased slightly to 77% (n=66) vs. 82% in 2012; the percentage of those who refused increased from 8% in 2012 to 15% (n=13) in 2013. Six percent of patients were not offered testing in 2013 (n=5). While it is a

guideline that TB patients are offered HIV testing, age and cultural factors have been noted as reasons why testing was not offered. Even though education and information has been provided to health care providers on the importance of HIV testing of TB patients, some providers indicate they are uncomfortable offering HIV testing due to cultural or age factors of their patients. While HIV remains a social stigma in some groups the importance of providing the highest standard of care to all patients outweighs the personal comfort of health care providers. HIV testing is vital to TB patients as treatment recommendations differ for those that are HIV positive.

**Figure 16a**

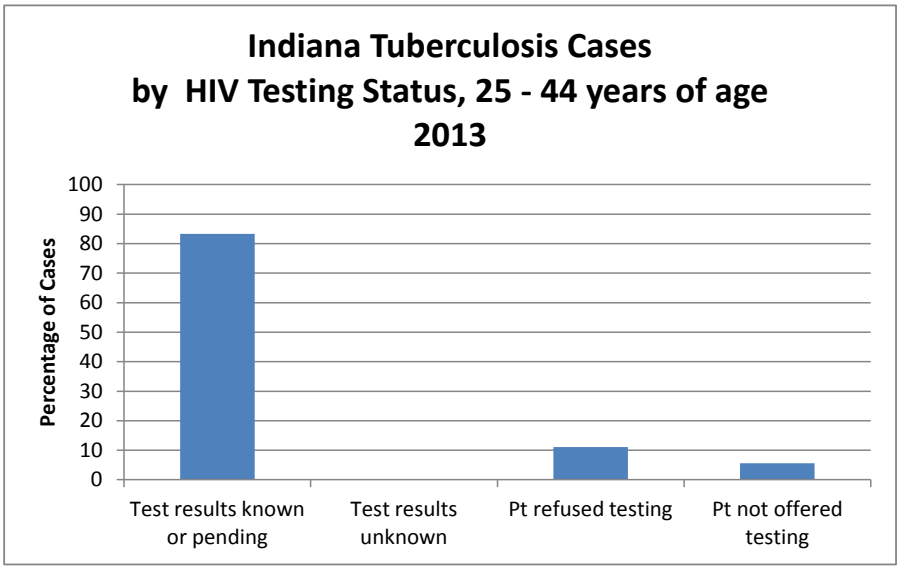
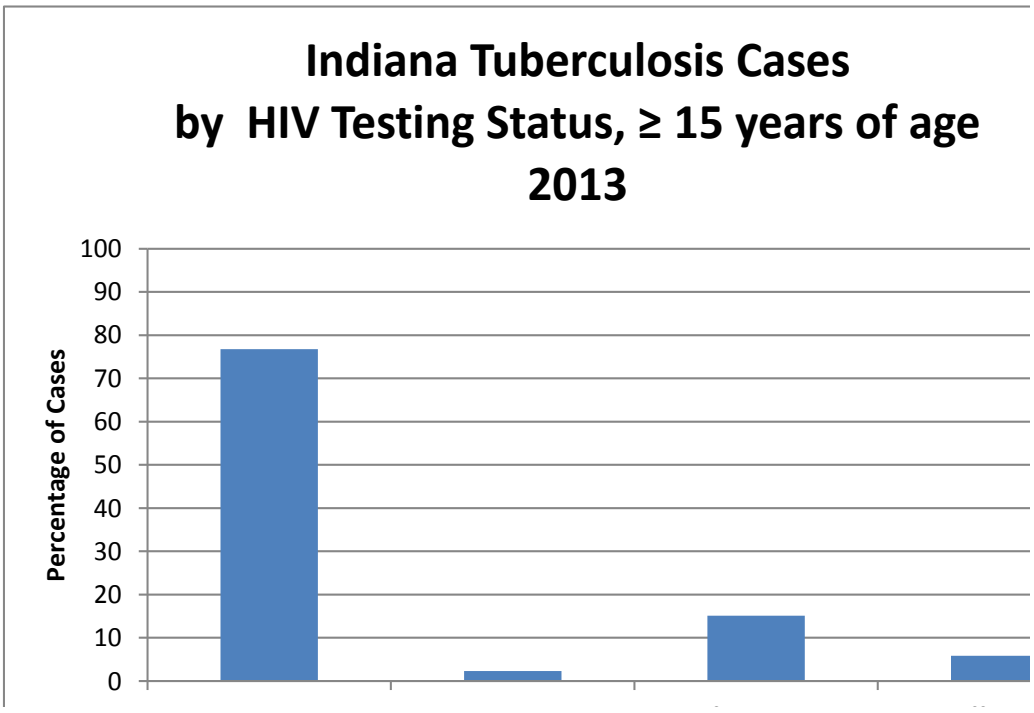
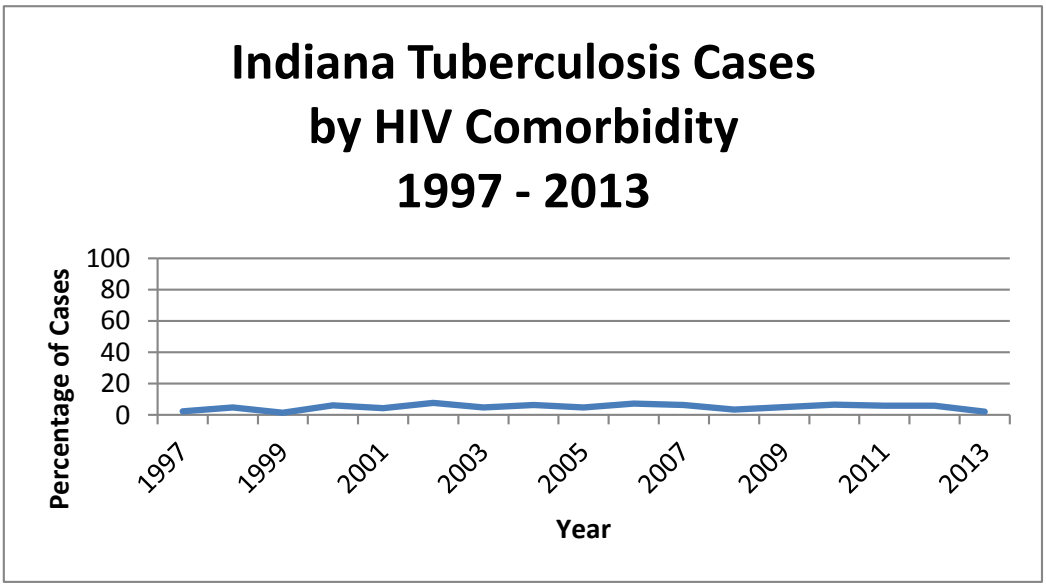



**Figure 16b**

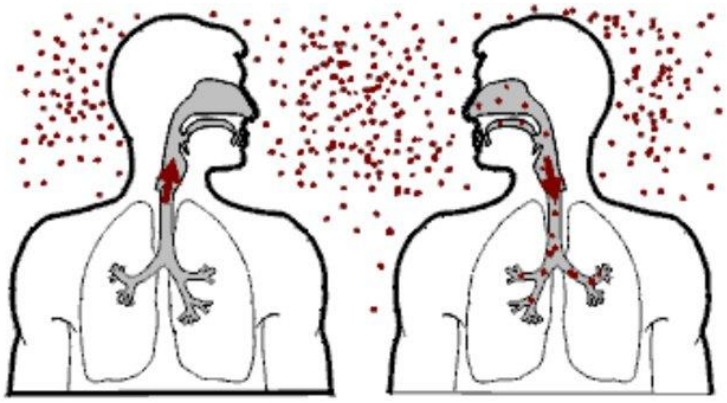


The percentage of people infected simultaneously with TB and HIV in 2013 (2%, n=6) is at its lowest point since 1999 (1%, n=2) (Figure 17). The highest number of TB cases with comorbid HIV infection occurred in 2002 (n=10, 8%). Comorbid TB infection and HIV infection is an AIDS-defining condition[3]. Even though TB is one of the leading causes of death for those infected with HIV, TB can be effectively treated even if HIV infection is present[4].

**Figure 17**

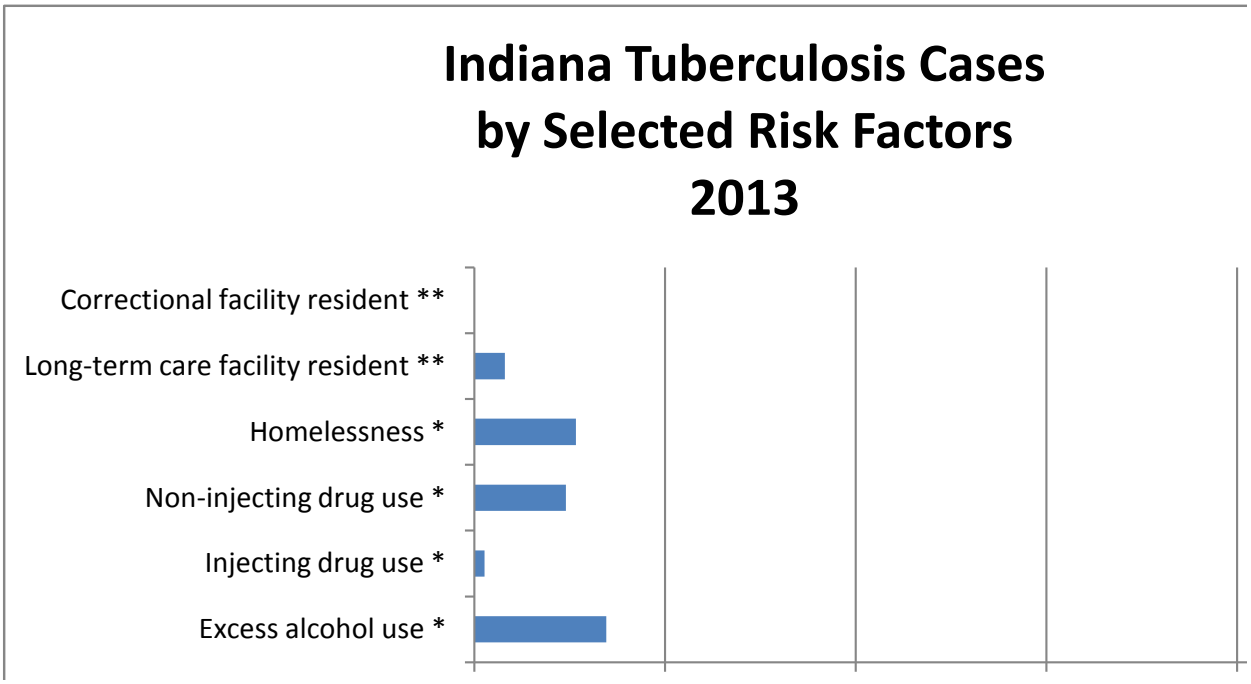



Other risk factors for progression to active disease include excessive alcohol use; illicit drug use (injection and non-injection), homelessness, and residence in a high-risk congregate setting (e.g., long-term care facilities and jails). Figure 18 illustrates the percentage of TB cases with selected risk factors for 2013. The most common risk factor present was excess alcohol use at 14% (n=13) which is a reduction from to 2012's 16% figure. Injecting drug use decreased from 1.9% in 2012 to 1.1% (n=1) in 2013; non-injecting drug increased slightly from 6.8% (n=7) in 2012 to 9.6% (n=9) for 2013. The percentage of those reporting a history of homelessness within the past year increased minimally from 8.8% (n=9) in 2012 to 10.6% (n=10) in 2013. The percentage of long-term care facility residents remained nearly static at 3.2% (n=3) compared to 3.9% in 2012. Those cases who were correctional facility residents at the time of diagnosis decreased from 2.9% in 2012 to zero in 2013.



http://www.franklinmo.org/Health%20Department/HealthDepartment_TB_Testing.htm

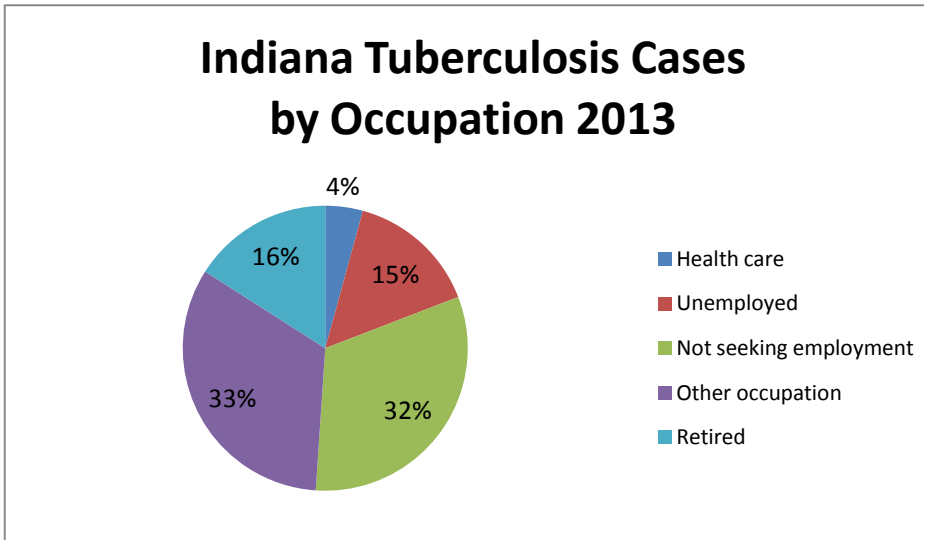
**Figure 18**




*within past year
**at time of diagnosis

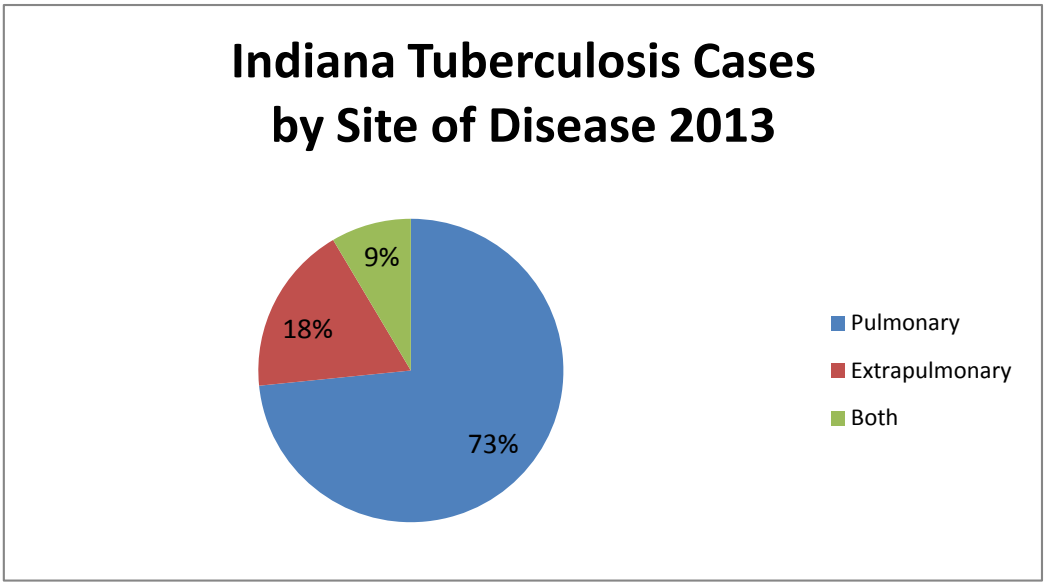
Indiana 2013 TB cases by employment category are shown in Figure 19 (n=94). Data show that the percentage of those unemployed in 2013 dropped by about 11 percent (n=14, 14.9%) from 26% in 2012; those not seeking employment (e.g., students, homemakers, disabled persons) represented just less than a third of those cases in this cohort (n=30, 31.9%) which is an increase from 25% in 2012. The proportion of retirees remained approximately the same with 16% (n=15) from 15% in 2012. The percentage of those employed in various occupations decreased minimally (n=31, 33%) in 2013 *vs.* 34% in 2012.

**Figure 19**



The percentage of TB cases classified by the site of disease is shown in Figure 20. Pulmonary site cases decreased by 5% while extrapulmonary remained the same from 2012 (pulmonary, n=69, 73% vs. 78% in 2012; extrapulmonary, n=17, 18% vs. 18% in 2012). Cases classified as having both pulmonary and extrapulmonary sites doubled in 2013 (n=8, 9% *vs.* 4% in 2012).

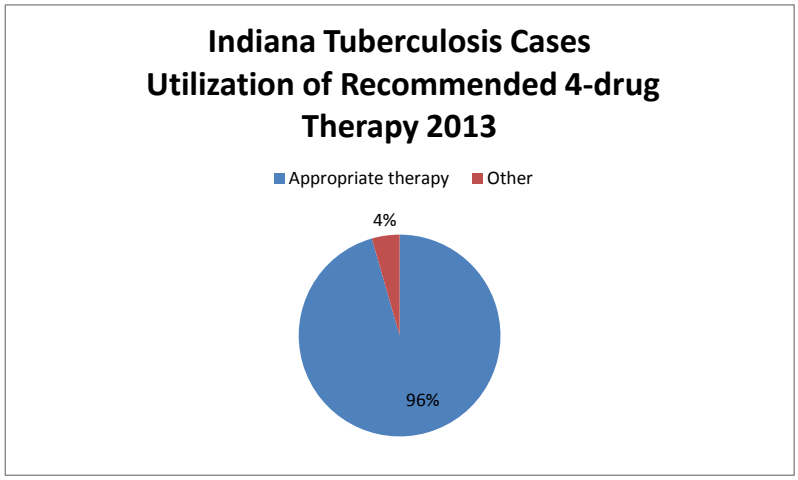
**Figure 20**




The Indiana State Department of Health endorses the treatment guidelines established by the American Thoracic Society and the CDC. Since 1991, these guidelines have recommended that four drugs be used in combination in the initial treatment phase. Unless contraindicated, all patients should begin therapy on the preferred regimen consisting of isoniazid (INH), rifampin (RIF), pyrazinamide (PZA), and ethambutol (EMB). In 2013, 96% (n=90) of patients began treatment on the recommended four-drug regimen; this meets the 2013 goal of 89.5% of patients beginning on this regimen and is a substantial increase from 84% of cases started on the recommended regimen in 2011. The percentage of patients who were started on the recommended four-drug regimen is shown in Figure 21.

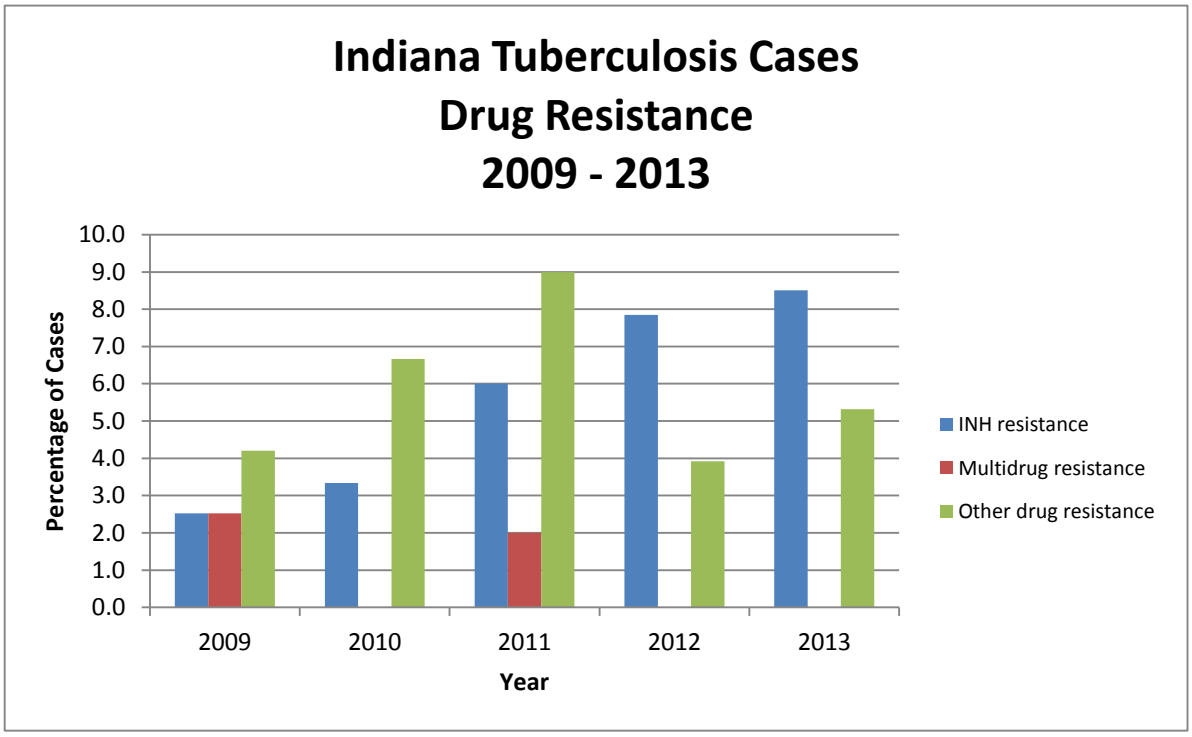
http://www.elpasocountyhealth.org/service/tuberculosis-screening

**Figure 21**



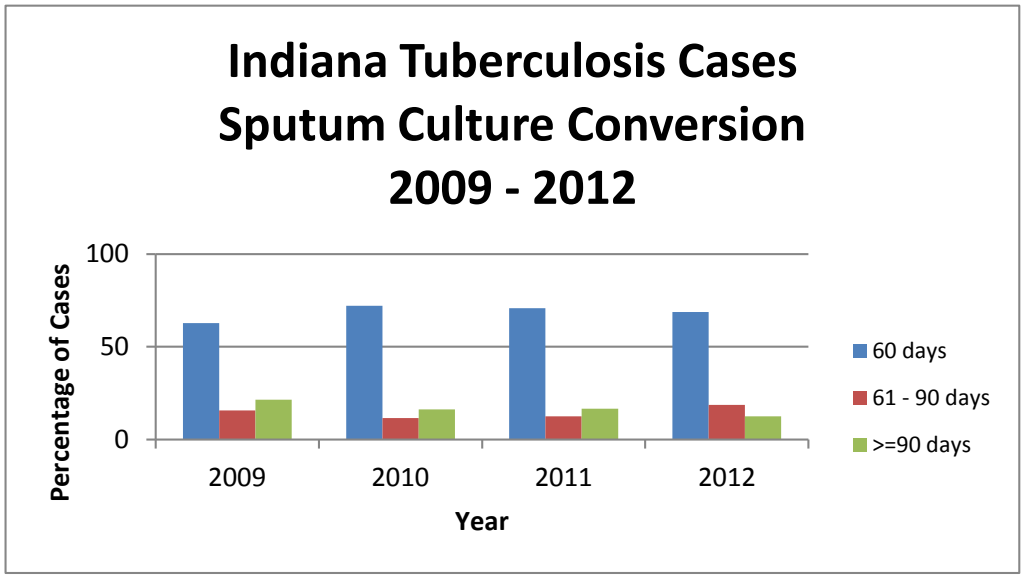

Drug susceptibility testing is routinely performed on all culture-positive isolates. Of the 73 culture-positive cases reported during 2013, drug susceptibility testing was performed on 72 (98.6%) of the specimens submitted; this proportion exceeds the 98.5% goal set by Indiana. In 2013, of all drug resistance metrics, drug resistance increased only in isoniazid resistance: 8.5% (n=8) resistant to INH *vs*. 7.8% in 2012; there were no new cases classified as multi-drug resistance (resistant to both INH and RIF) in 2013; 5.3% (n=5) were resistant to other drugs (excluding INH and RIF) *vs*. 3.9% in 2012 (Figure 22).

**Figure 22**



Drug resistance, inadequate response to therapy and failure to follow the treatment regimen are the most common reasons to extend the treatment period beyond 12 months. Culture conversion data are collected to measure response to therapy and to determine length of treatment. Patients whose cultures have not converted to negative after two months of treatment may require a longer course of therapy. Those whose symptoms have not improved or who are still culture-positive after four months of therapy are classified as treatment failures and should be re-evaluated for drug resistance as well as for failing to adhere to the treatment regimen if not on a directly observed therapy (DOT) regimen. In 2012, culture conversion was reported for 68.8% (n=48) of Indiana TB cases which exceeded the 2012 goal of 54.5% of patients undergoing culture conversion. Figure 23 illustrates culture conversion data for 2009, 2010, 2011, and 2012(; 2013 data is incomplete and will be reported in 2014).

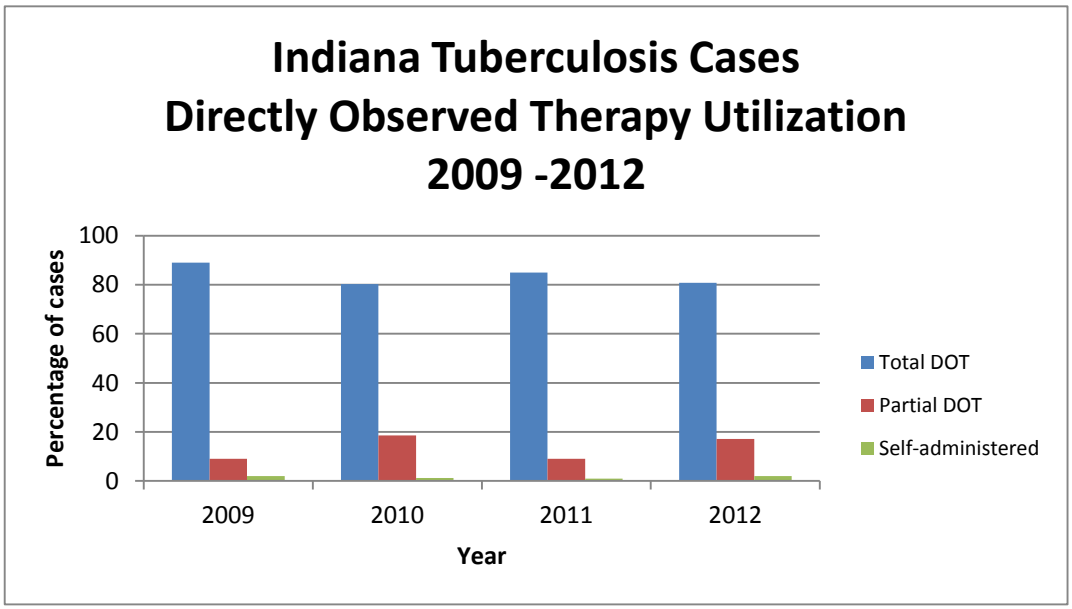
**Figure 23**




Directly observed therapy (DOT) is the most effective way to ensure that a patient is complying with the prescribed treatment regimen. Since DOT is a strategy proven to ensure completion of therapy with the added benefit of preventing acquired drug resistance, it is the standard of medical care in Indiana. Every effort must be made to incorporate DOT when therapy is initiated. DOT data for 2009 - 2012 are presented in Figure 24 (2012 is the most recent period for which complete DOT is available; 2013 data is incomplete and will be reported in 2014). For 2012, drug therapy utilizing total DOT decreased to 81% from 85% in 2011 while partial DOT increased a substantive amount from 9% in 2011 to 17% (n=17) in 2012; self-administered DOT went from 1% in 2011 to 2% in 2012 (n=2).

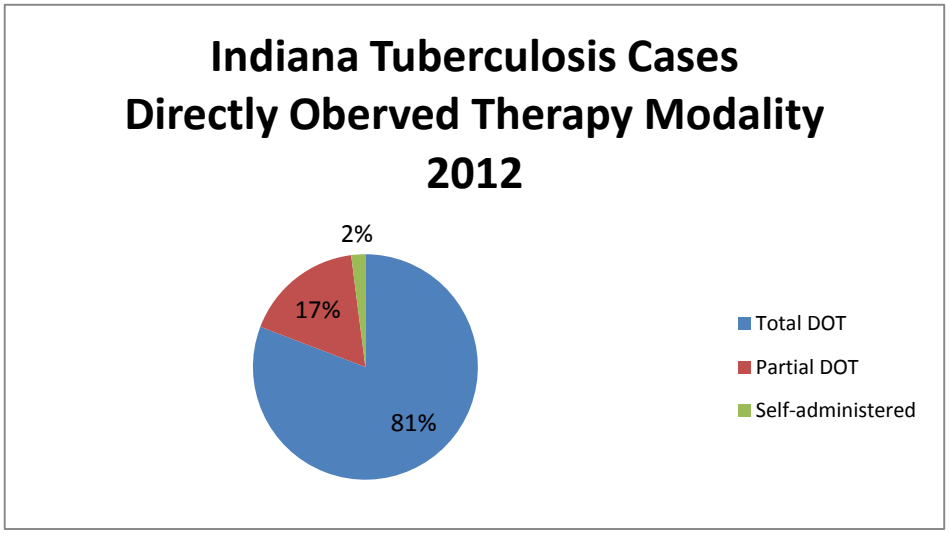
http://www.everydayhealth.com/tuberculosis/treatment.aspx

**Figure 24**




Directly observed therapy (DOT) is an intervention designed to ensure adequate treatment; figure 26 shows DOT utilization for 2012. Total DOT was utilized for 81% (n=80) of patients while 17% (n=17) were on partial DOT and only 2% (n=2) were on a self-administration regimen (figure 25).

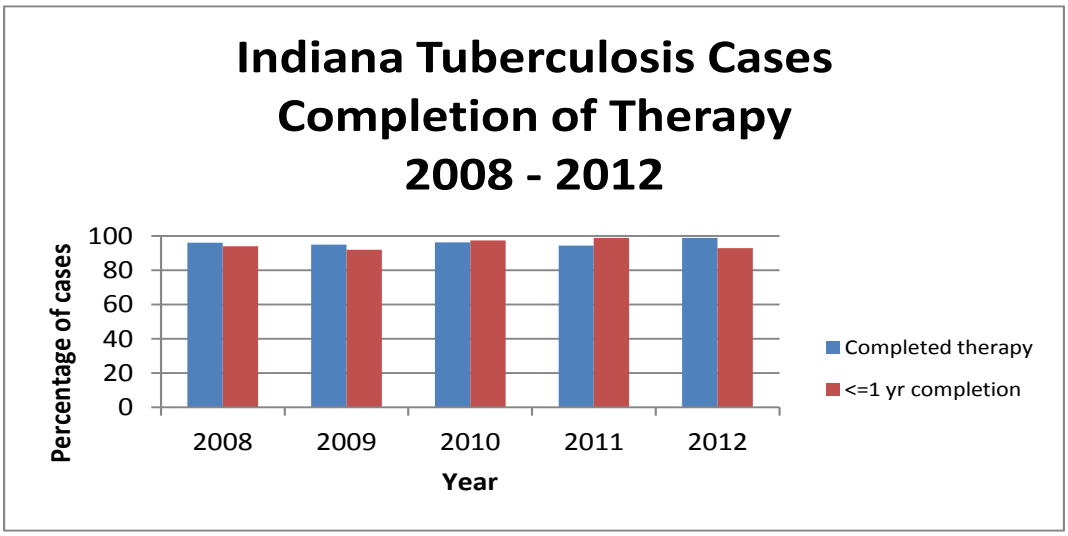
**Figure 25**




The first priority of TB elimination efforts is to ensure Completion of Therapy (COT). Indiana's goal of having at least 90.7% of all patients' complete treatment within one year was achieved in 2012 with 93% (n=79) completing therapy within one year's time. The completion of therapy index is based on the number of patients for whom treatment for one year or less is indicated. Exclusions from the calculations are those patients who were dead at the time of diagnosis, patients who died before completing therapy, patients who were never started on therapy, patients with rifampin resistance, patients with multi-drug resistance, pediatric cases with miliary disease, pediatric cases with positive blood cultures, and all meningeal cases. Therapy is considered to be incomplete for those patients who moved out of the United States during

treatment, those who are uncooperative or who refused therapy, or those who are lost to follow-up. Figure 26 shows the proportion of patients who completed therapy and those who completed therapy in one year or less.

**Figure 26**




To eliminate the transmission of TB in Indiana, contact investigations must focus on those at highest risk, and records of these investigations must be completed and returned to the TB program in a timely manner. Each contact with a positive TB screening test must be followed through medical evaluation, initiation of treatment and completion of treatment. In 2010 the CDC began soliciting data on newly infected contacts because recently infected contacts have a higher risk of developing active TB disease within the first two years of exposure[5]. This is one reason that completing a thorough contact investigation is crucial in the prevention of TB disease. A Contact Investigation Summary for 2008 through 2011 is presented in Table 2. Finalized data for 2012 will be available in August of 2014.

**Table 2**

| 2015 National Objective | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|
| Number of cases reported | 118 | 119 | 90 | 100 |
| Contact investigation: | | | | |
| 1) Contacts will be identified in 100% of newly reported sputum AFB smear-positive TB cases | 100% | 100% | 97% | 97% |
| 2) At least 93% of contacts to sputum AFB smear-positive TB cases will be evaluated for infection and disease | 48% | 54% | 66% | 83% |
| 3) At least 79% of infected contacts who are started on treatment for latent TB will complete therapy. | 69% | 67% | 70% | 63% |

Figure 27 (page 25) shows the incidence in counties that reported five or more cases of TB in 2013. The total number for the state is based on persons whose primary residence was in Indiana at the time of diagnosis and who were verified as having TB disease in a 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 who remain in the U.S. for less than 90 days of treatment are also excluded. In numeric terms, the four counties with the most cases included Marion (n=36), Allen (n=7), St. Joseph (n=6), and Lake (n=4).

Figure 28 (page 26) shows the incidence rate per county for the past 10 years in map format. During this time period, twelve counties did not have a reported case of TB: Newton, Benton, Warren, Pulaski, Jasper, Brown, Hancock, Jennings, Posey, Wells, Blackford, and Ohio. In fact, only eleven of the 92 counties experienced a sufficient number of cases to allow calculation of stable rates (>20 cases). These data clearly illustrate the challenge of ensuring a knowledgeable public health workforce when doctors and nurses in certain areas of the state may seldom see a TB case.

In order to reduce Indiana's U.S. born incidence rate to 0.5 per 100,000 by 2015, we must continue to include TB in diagnosis differentials, treat appropriately using directly observed therapy and improve our contact investigation strategies and activities.

**Figure 27**

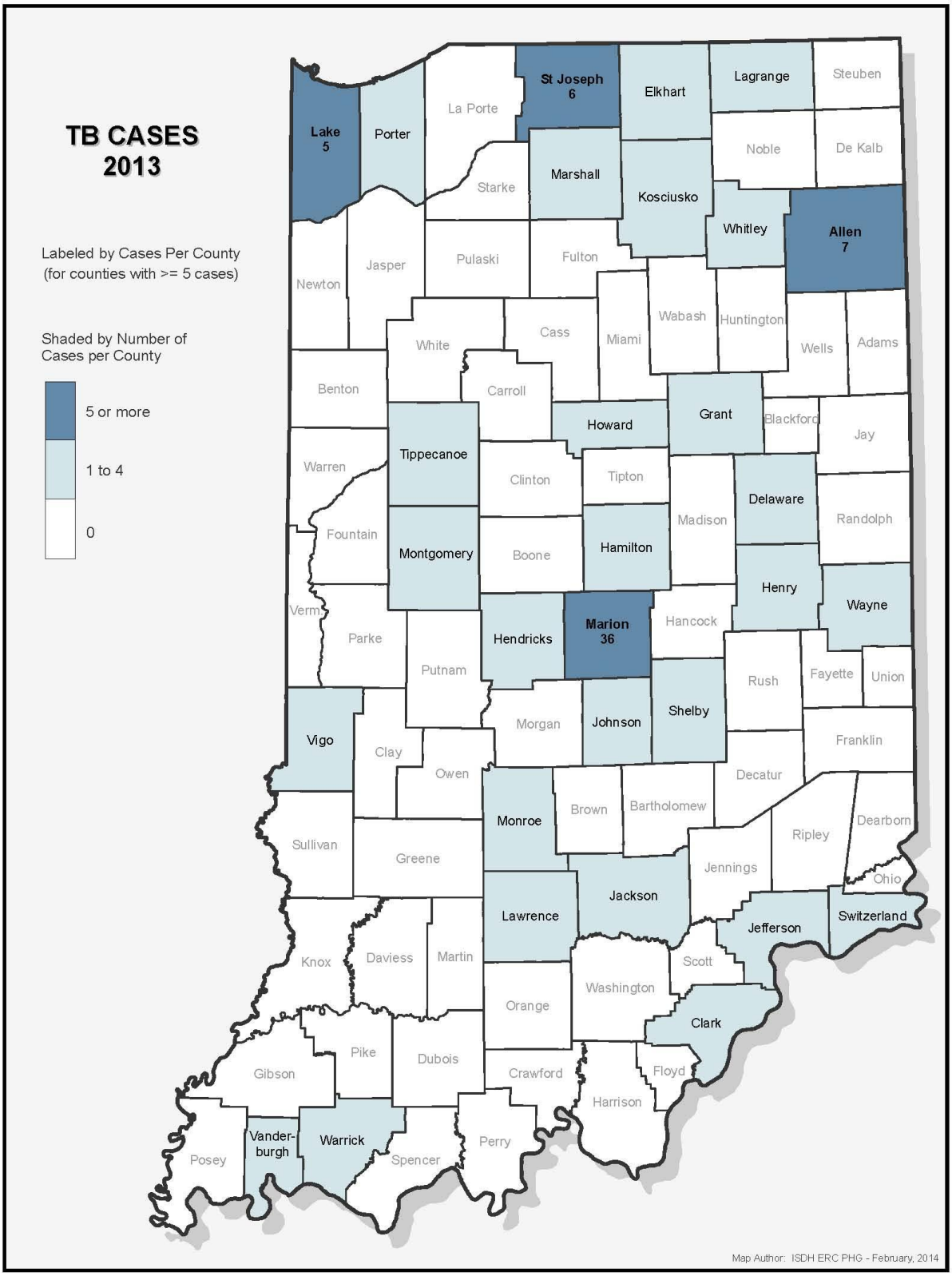
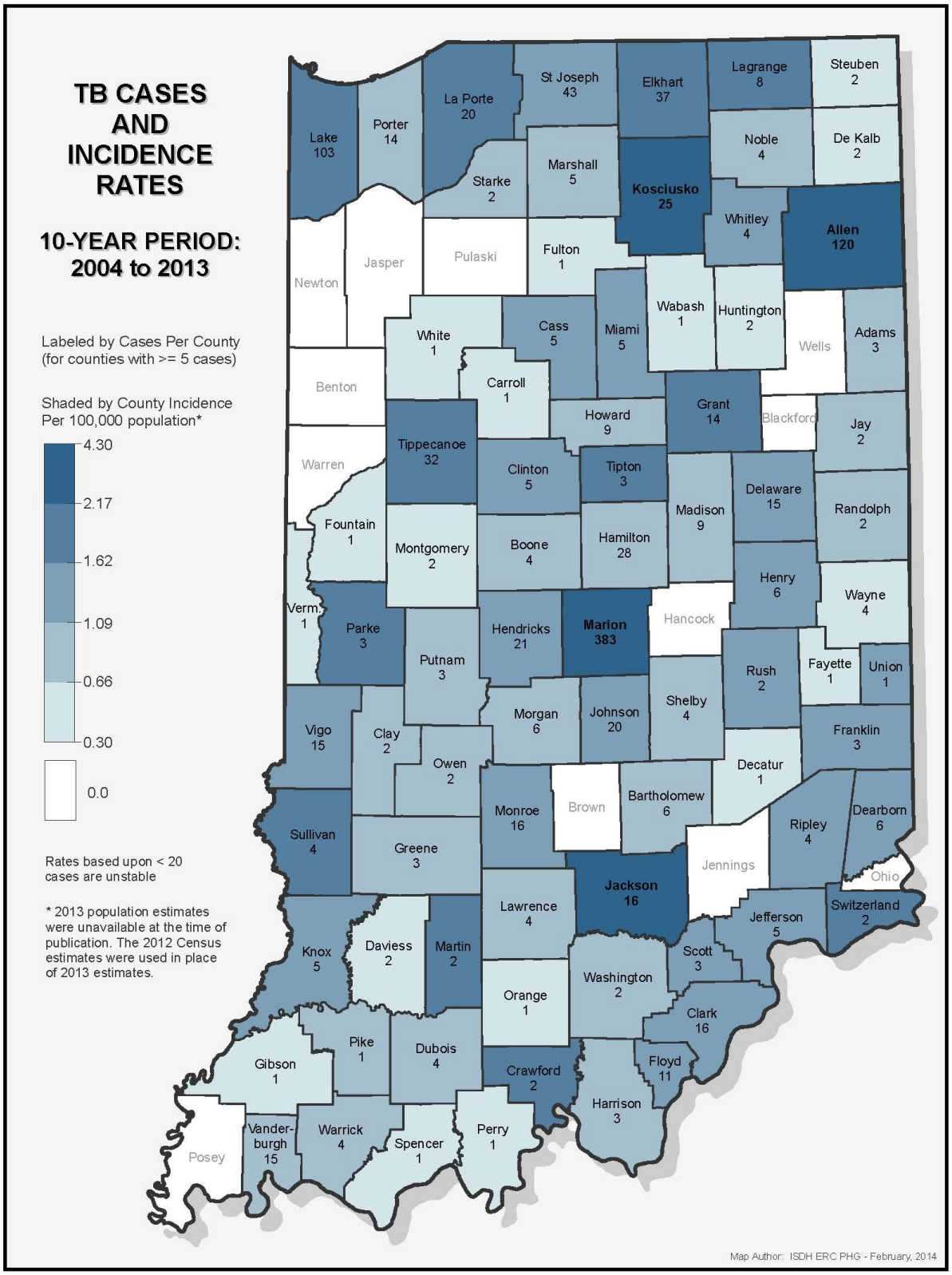

TB CASES
2013
Labeled by Cases Per County
(for counties with >= 5 cases)
Shaded by Number of
Cases per County
5 or more
1 to 4
0
Lake
5
Porter
La Porte
St Joseph
6
Elkhart
Lagrange
Steuben
Noble
De Kalb
Marshall
Starke
Kosciusko
Whitley
Allen
7
Newton
Jasper
Pulaski
Fulton
Wabash
Huntington
Wells
Adams
White
Cass
Miami
Benton
Carroll
Howard
Grant
Blackford
Jay
Warren
Tippecanoe
Clinton
Tipton
Madison
Delaware
Randolph
Fountain
Montgomery
Boone
Hamilton
Henry
Wayne
Verm
Parke
Putnam
Hendricks
Marion
36
Hancock
Rush
Fayette
Union
Vigo
Clay
Owen
Morgan
Johnson
Shelby
Franklin
Decatur
Monroe
Brown
Bartholomew
Dearborn
Ripley
Sullivan
Greene
Jennings
Ohio
Jackson
Lawrence
Jefferson
Switzerland
Knox
Daviess
Martin
Scott
Washington
Orange
Clark
Pike
Dubois
Floyd
Gibson
Crawford
Harrison
Vander-
burgh
Warrick
Perry
Posey
Spencer
Map Author: ISDH ERC PHG - February, 2014

**Figure 28**


TB CASES AND INCIDENCE RATES
10-YEAR PERIOD: 2004 to 2013
Labeled by Cases Per County (for counties with >= 5 cases)
Shaded by County Incidence Per 100,000 population*
4.30
2.17
1.62
1.09
0.66
0.30
0.0
Rates based upon < 20 cases are unstable
* 2013 population estimates were unavailable at the time of publication. The 2012 Census estimates were used in place of 2013 estimates.
Lake 103
Porter 14
La Porte 20
St Joseph 43
Elkhart 37
Lagrange 8
Steuben 2
Noble 4
De Kalb 2
Starke 2
Marshall 5
Kosciusko 25
Whitley 4
Allen 120
Newton
Jasper
Pulaski
Fulton 1
Wabash 1
Huntington 2
Wells
Adams 3
White 1
Cass 5
Miami 5
Benton
Carroll 1
Howard 9
Grant 14
Blackford
Jay 2
Warren
Tippecanoe 32
Clinton 5
Tipton 3
Madison 9
Delaware 15
Randolph 2
Fountain 1
Montgomery 2
Boone 4
Hamilton 28
Henry 6
Wayne 4
Verm. 1
Parke 3
Hendricks 21
Marion 383
Hancock
Putnam 3
Rush 2
Fayette 1
Union 1
Vigo 15
Clay 2
Morgan 6
Johnson 20
Shelby 4
Franklin 3
Owen 2
Decatur 1
Monroe 16
Brown
Bartholomew 6
Ripley 4
Dearborn 6
Sullivan 4
Greene 3
Jennings
Ohio
Jackson 16
Lawrence 4
Jefferson 5
Switzerland 2
Knox 5
Daviess 2
Martin 2
Scott 3
Washington 2
Orange 1
Clark 16
Pike 1
Dubois 4
Gibson 1
Crawford 2
Floyd 11
Harrison 3
Posey
Vander-burgh 15
Warrick 4
Spencer 1
Perry 1
Map Author: ISDH ERC PHG - February, 2014

# Notes

1 The Centers for Disease Control and Prevention, MMWR 46(RR10);1-55, May 02, 1997. Retrieved April 26, 2013 from http://www.cdc.gov/mmwr/preview/mmwrhtml/00047449.htm

2 The Centers for Disease Control and Prevention, Global Tuberculosis. Retrieved February 28, 2010 from http://www.cdc.gov/tb/topic/globaltb/default.htm

3 US Census Bureau, http://www.census.gov/

4 US Department of Health and Human Services. Centers for Disease Control and Prevention National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention Division of Tuberculosis Elimination. 2008. Self-study Modules on Tuberculosis: Epidemiology of Tuberculosis.

5US Department of Health and Human Services. Centers for Disease Control and Prevention National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention Division of Tuberculosis Elimination. 2012. TB and HIV Coinfection. Retrieved February 29, 2012 from http://www.cdc.gov/tb/topic/TBHIVcoinfection/default.htm

6 CDC. Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis. MMWR 2005:54(No. RR-15):11

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