INDIANA
TUBERCULOSIS ANNUAL REPORT 2010

Cases = 90

Crude Incidence Rate per 100,000 population = 1.4 (U.S. 2010 = 3.6)
U.S.-born = 0.9 (U.S. 2010 = 1.6)
Foreign-born = 14.1 (U.S. 2010 = 18.1)

Race and Ethnicity-specific Incidence Rates per 100,000 population[1]

White = 0.9
Black or African-American = 3.4
Asian = 19.2
Hawaiian Native or other Pacific Islander = N/A
American Indian or Alaska Native = N/A
Hispanic or Latino, all races = 6.3

Gender-specific Incidence Rates per 100,000 population
Male = 1.7
Female = 1.1

Executive Summary

The mission of the Tuberculosis and Refugee Health Division is to decrease tuberculosis incidence 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, health and 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 0.5/100,000 as the result of the initiative and collaboration of all local health departments, health care providers, Indiana State Department of Health (ISDH) and the CDC.

During 2010, there were 90 new cases of tuberculosis (TB) reported to the ISDH. This is a decrease of 29 counted cases from 2009, a decline of 24 percent. Figures 1a and 1b show long-term and 8-year trends, respectively. TB was reported by 27 of the 92 counties. According to the estimated 2009 census, the three most populous counties (Marion, Lake, and Allen) accounted for 49 percent of all new cases. Marion County's reported cases decreased in 2010 to 34 cases from 46 cases in 2009, a decrease of 26 percent. Fifty-three percent of the cases in Marion County were non-U.S. born, 45 percent from Central/South America and 30 percent from Southeast Asia. Lake and Allen Counties case counts also decreased in 2010. Allen County had six cases in 2010 and 12 cases in 2009, a decrease of 50 percent. Lake County reported four TB cases in 2010 and six cases in 2009, a 33 percent decrease. Elkhart County had seven active TB case in 2010 compared to five cases in 2009, a 40 percent increase.

[1] http://www.census.gov/popest/states/asrh/

High risk populations include children, persons with HIV infection and drug and alcohol abuse. The HIV status was known in 84 percent of the cases in 2010 for the 25 to 44 age group (Table 2), compared to 97 percent in 2009. Pediatric cases increased in 2010 to nine from seven cases in 2009 (Figure 9). Resistance to TB drugs decreased to nine cases in 2010 from 11 cases in 2009. Indiana had zero reports of multi-drug resistant cases in 2010. U.S. born individuals continue to make up the majority of TB cases diagnosed in Indiana (Figure 5). Of those non-U.S. born cases, 43 percent come from Southeast Asia and 38 percent come from Central/South America (Figure 6).

Indiana TB cases created eight new genotype clusters (two or more molecular matched isolates) in 2010, IN_0084 to IN_0091. Indiana had two TB outbreaks in 2010 along with an ongoing Marion County outbreak in the homeless. Elkhart County had four new cases within six months that matched genotype IN_0006 (PCR00874), a 2005 Kosciusko County Outbreak. Indiana's other 2010 TB outbreak was IN_0087 (PCR07836). Hamilton County had all four cases of IN_0087, two culture confirmed cases and two clinical cases. Marion County cluster IN_0074 (PCR12325), totaled 10 cases in 2009. Ten more Marion County cases have been added to this ongoing outbreak in 2010 creating a total of 20 cases in this cluster in two years. The two main epidemiological links to IN_0074 are chronic homelessness and residence in the same Indiana County.

INDIANA TUBERCULOSIS ANNUAL REPORT 2010

Tuberculosis (TB) 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, but can also affect other parts of the body like the brain, kidneys, or spine. TB bacteria are aerosolized when a person who has TB of the lungs or larynx coughs, sneezes, laughs, or sings. Another person 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 infected individuals will progress to active disease during their lifetime.

The introduction of anti-TB chemotherapy has led to a long-term decline in the number of deaths as well as the number of new cases. However, deaths still occur from the disease. The number of TB-related deaths is shown in Figure 2, with a total of four cases in 2010. Cases that died from other causes, verified by a death certificate, were excluded (two were excluded for 2010). One death was in a person less than or equal to 50 years of age.

Figure 1a.

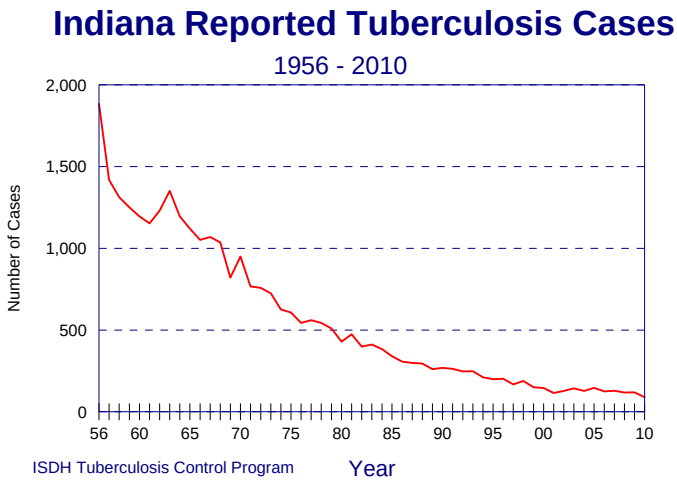


Figure 1b.

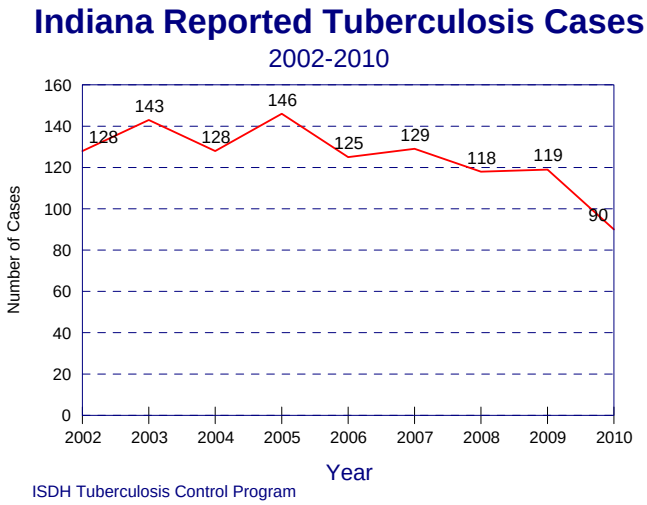
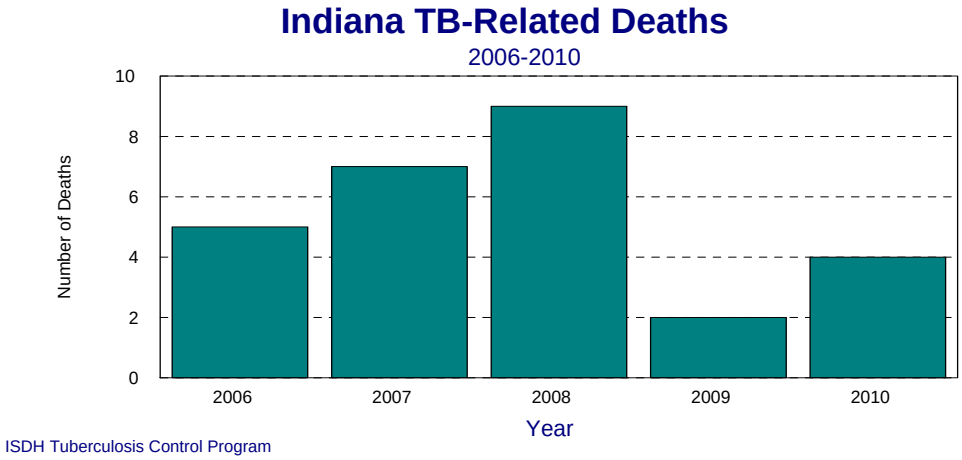


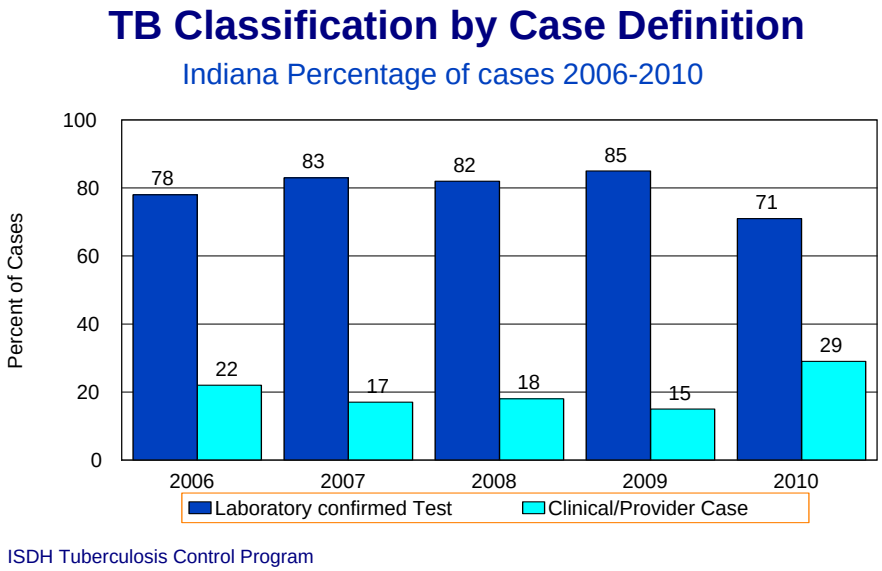
Figure 2.



A diagnosis of TB is verified using the CDC's "Case Definitions for Infectious Conditions under Public Health Surveillance." 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 after a completed 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 culture-negative pulmonary TB, extra-pulmonary TB where cultures would not grow or were not obtained, and children in whom obtaining specimens is difficult and invasive procedures are not warranted. Figure 3 shows the percentage of TB cases by case definition. Clinical cases increased 93 percent in 2010 (29 cases) from 2009 (15 cases).

Figure 3.

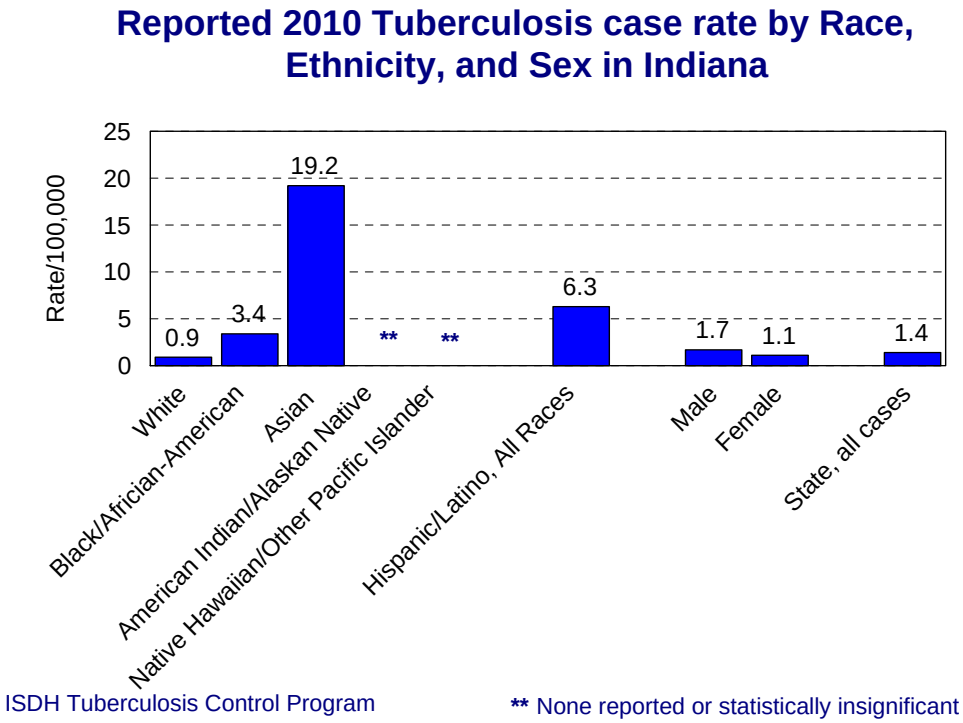


Indiana percentages of 2010 cases by sex, ethnicity, and race:

Category:	Percentage of 2010 cases:
Sex:	
Male	60
Female	40
Ethnicity:	
Hispanic or Latino	24
Race:	
White	58
Black or African-American	22
Asian	20
American Indian or Alaska Native	N/A
Hawaiian Native or other pacific islander	N/A

Figure 4 shows case rates per 100,000 population by race, ethnicity, and sex.

Figure 4.



U.S. born TB cases continues to outnumber foreign born cases in Indiana (Figure 5). Persons born in high-prevalence countries continue to make up a large proportion of TB cases. In 2010, 37 of the 90 reported TB patients (41%) were born in countries with a high burden of TB. Seven (18.9%) of the foreign born cases came to the United States as refugees. Figure 6 represents the distribution of TB cases in Indiana by world regions. Southeast Asia cases increased to 43 percent in 2010 from 39 percent in 2009. Central/South America cases increased to 38 percent in 2010 from 31 percent in 2009. Of the Southeast Asian cases, 31 percentwere refugees. In 2010 71 percent (980/1376) of Indiana's refugees arrived from Southeast Asia, and only 0.6% of those refugees became TB cases.

Figure 5.

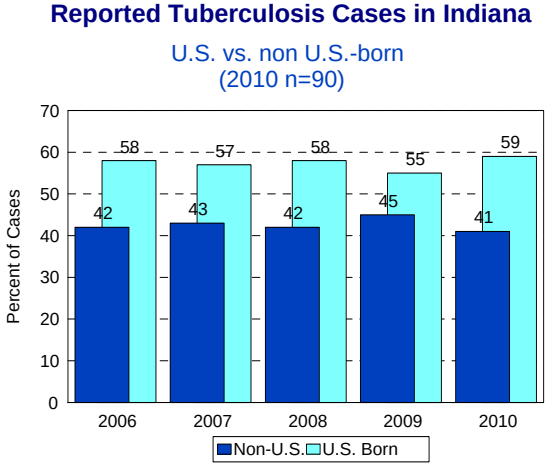


Figure 6.

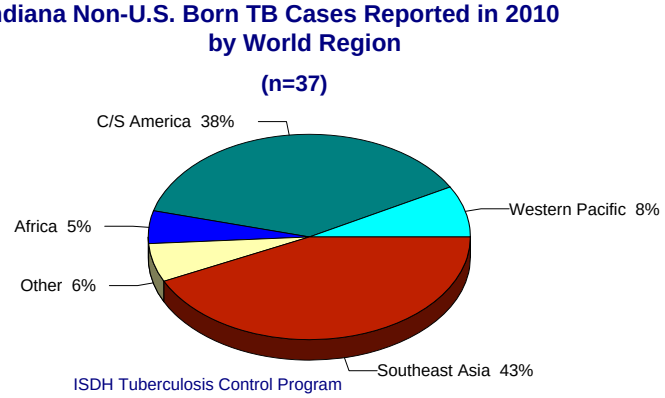


Figure 7 represents the length of time foreign born persons were living in the U.S. prior to TB diagnosis.

Figure 7.

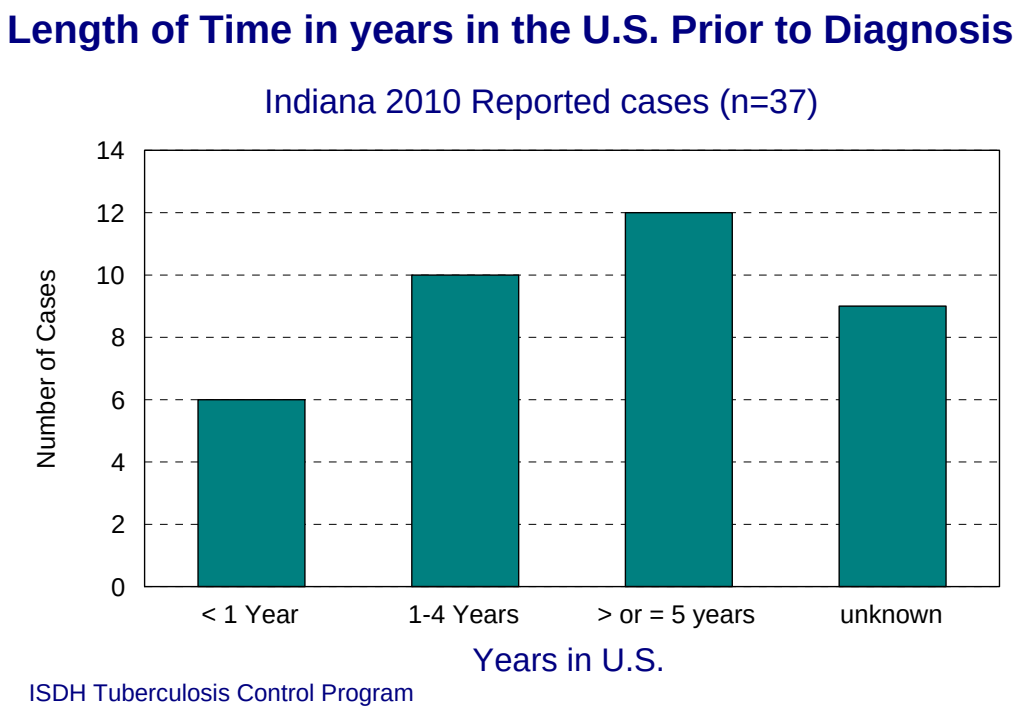
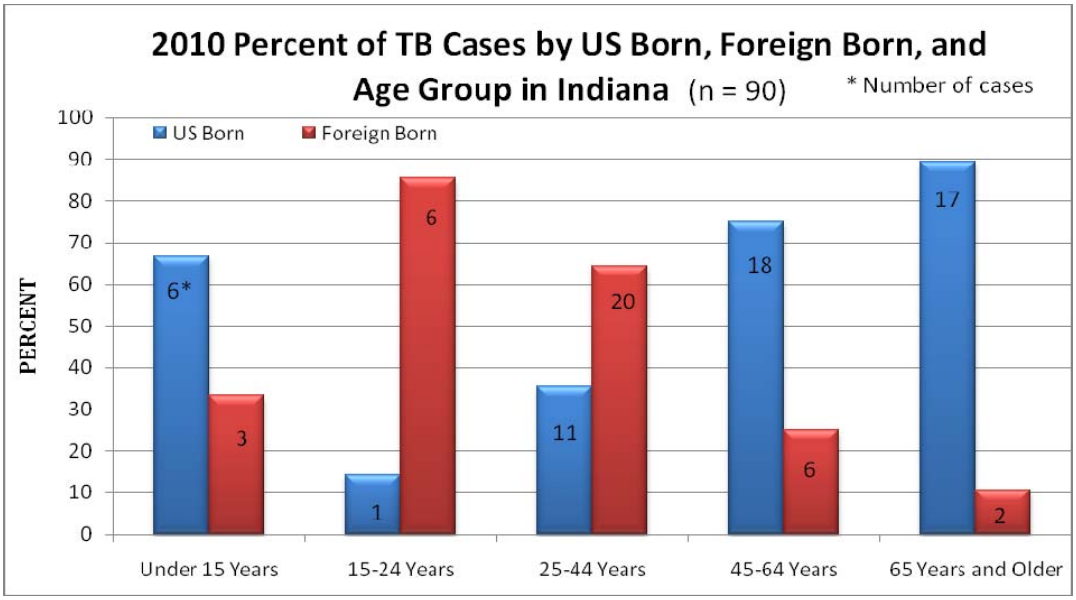


Table 1

2010 cases by US born, Foreign born, Age group, Sex, Percentage and Case rate in Indiana:

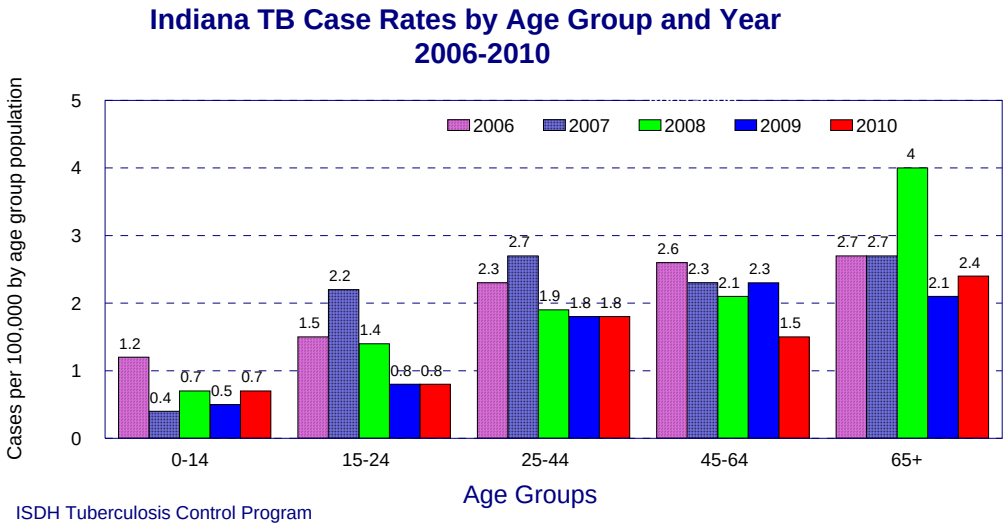
Age Group:	U.S. born		Foreign born		Total in Age groups	Percentage	Case Rate
	M	F	M	F			
< 15 years	2	4	2	1	9	10	0.7
15-24 years	0	1	1	5	7	8	0.8
25-44 years	7	4	12	8	31	34	1.8
45-64 years	12	6	4	2	24	27	1.5
≥ 65 years	13	4	0	2	19	21	2.4
Totals by Gender	**34**	**19**	**19**	**18**	**90**	**100**	**1.4**

Figure 8.



Case rates by age group are shown in Table 1. Figure 8 breaks down U.S. born and Foreign Born cases by age group. In the "Under 15 Year", 67 percent of the cases were U.S. born. Transmission from children aged <10 years is unusual[2]; this group indicates recent transmission. Sixty-six percent (6/9) of the source cases were known for these children. Eighty-six percent of the cases in the 15-24 age group and 64.5% of the 25-44 age group are foreign born cases. The age trend of our 2010 case rates (Figure 9) reveals a 35 percent decrease in the 45-64 years of age (2.3 in 2009 to 1.5 in 2010), while the greatest percentage of cases continues to be in the 25-64 years age brackets.

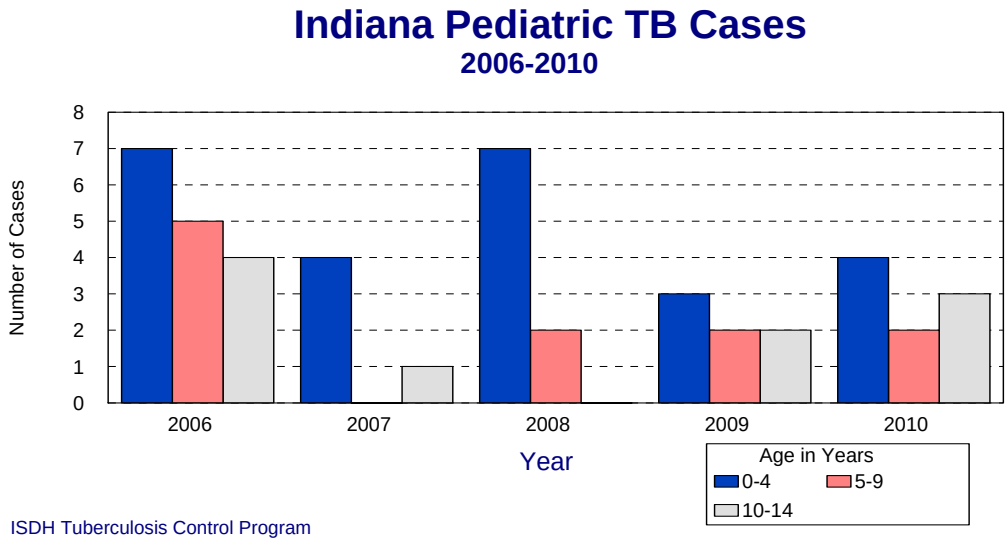
Figure 9.



[2] CDC. Guidelines for the Investigation of Contacts of Persons with Infectious Tuberculosis. MMWR 2005:54(No. RR-15):4

The numbers of pediatric cases by age group are shown in Figure 10. The new RVCT collects additional risk factor information for pediatric cases such as country of birth for the parents/guardians and "other countries lived" for the child. Data was complete 6/9 or 66 percent for these new variables.

Figure 10.



HIV disease is the most significant risk factor for progression to active disease. The percentage of patients with HIV Testing according to age is shown in Table 2. The percentage of "all adult cases" who were offered HIV testing increased in 2010 compared to 2009, 59 (73%) in 2010 and 81 (72%) in 2009. The HIV "all adult cases," who were reported to have refused testing decreased in 2010 to 5 (6%) from 10 (9%) in 2009. Of those individuals offered HIV testing in the 25-44 age group, 84.4% of the cases had the test performed, this is a 13% decrease from 2009 (97%). Overall, 21 percent of the TB cases in the "all adult cases" age group were not offered HIV testing. HIV counseling and testing is recommended for all adult patients with TB or suspected of having TB.

Table 2.

Indiana HIV Testing Status

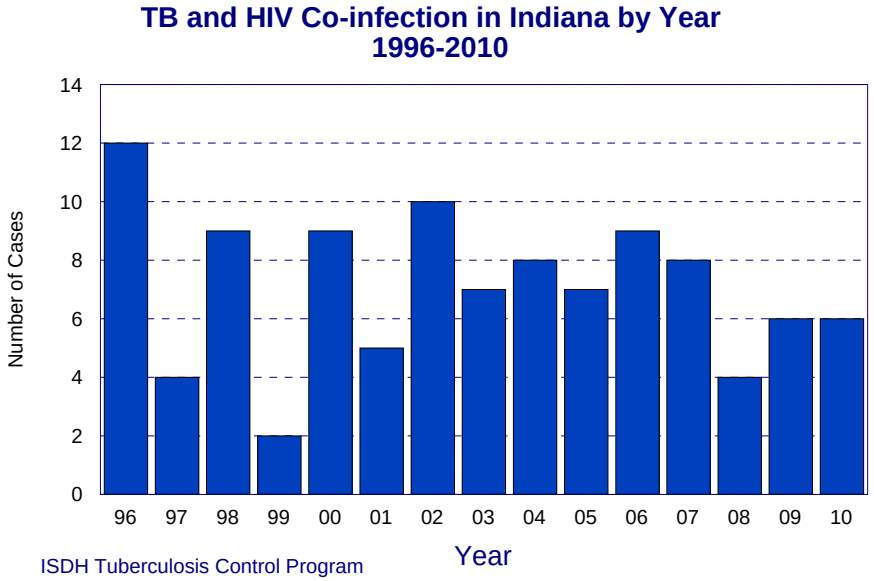
Number and percent of adult patients reported in 2010 offered counseling and testing

Status	Age group 25-44 (n=32)	All adult cases >=15 years of age (n=81)
Tested, results known or pending	27(84.4%)	59(73%)
Patient refused	3(9.4%)	5(6%)
Test not offered	2(6.2%)	17(21%)

ISDH Tuberculosis Control Program

The number of cases co-infected with TB and HIV is shown in Figure 11.

Figure 11.



Other risk factors for progression to active disease are excess alcohol use, homelessness, illicit drug use (injection and non-injection), and residence in a high-risk congregate setting. The numbers of persons reported with these risk factors at the time of diagnosis are shown in Table 3. A person may have multiple risk factors. Injection drug use rose to 6 percent in 2010 with five cases. This is a 150 percent increase in cases from 2009 which had two cases (2%).

Table 3.

Indiana Reported Tuberculosis Cases with Selected Exposure and Medical Risk Factors* in 2010
(n=90)

Risk Factor	Number of Cases	Percent of Cases
Excess alcohol use	20	22.22
Injection drug use	5	5.56
Non-injection drug use	9	10
Homelessness	13	14.44
Resident of long-term care facility	2	2.22
Resident of correctional facility	4	4.44

*at the time of diagnosis

Occupation is another variable used to detect trends. These data are shown in Table 4. The revised RVCT form changes "Not employed within 24 months" to "Unemployed" (which may include the homeless) and "Not Seeking Employment" (e.g. student, homemaker, and disabled). In 2010 unemployed and not seeking employment totaled 55 percent of the cases; in 2009 the total was 65 percent.

Table 4.

Indiana Reported Tuberculosis Cases by Selected Occupation* in 2010 (n=90)

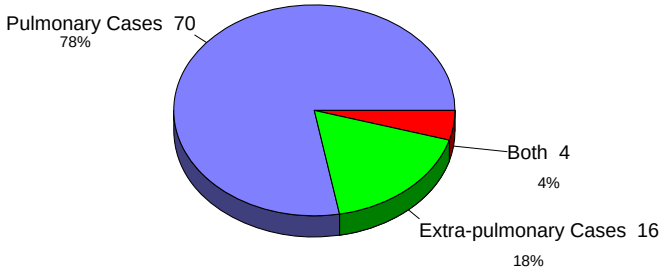
Occupation	Number of Cases	Percent of Cases
Unemployed	34	37.78
Other occupations	27	30
Migrant agricultural worker	0	0
Health care worker	1	1.11
Correctional facility employee	1	1.11
Retired	12	13.33
Not seeking employment (e.g. student, homemaker, disabled person)	15	16.67

* at the time of diagnosis

The number of cases and percentage of TB cases classified by the site of disease is shown in Figure 12. Pulmonary cases increased 6.8% in 2010 70 (78%) from 2009 with 87 (73%). There was a 50 percent decrease in cases that had both pulmonary and extra-pulmonary disease (8% in 2009 and 4% in 2010).

Figure 12.

Indiana Reported 2010 TB Cases by Site of Disease
Percentage of all cases reported
(n=90)

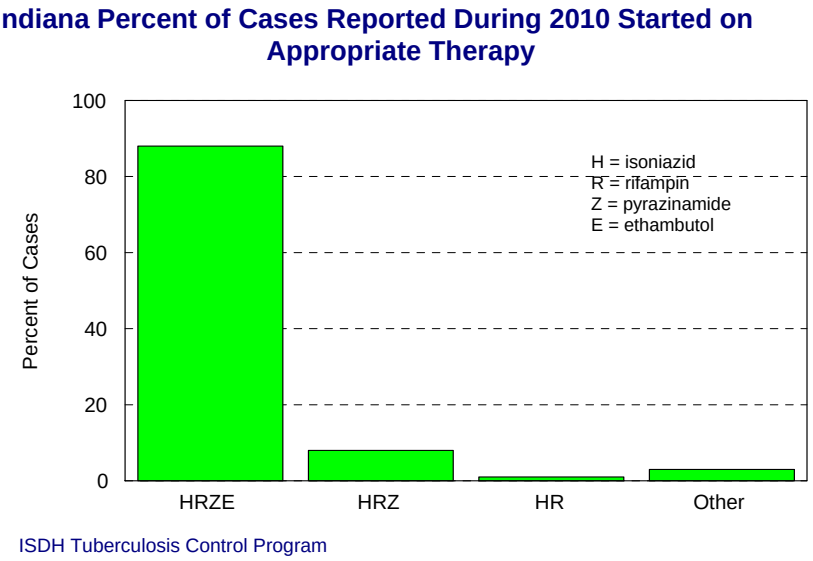


ISDH Tuberculosis Control Program

The ISDH recommends the treatment guidelines set by the American Thoracic Society and the CDC. Since 1991, these guidelines have recommended that four drugs be used in the initial treatment phase. Unless

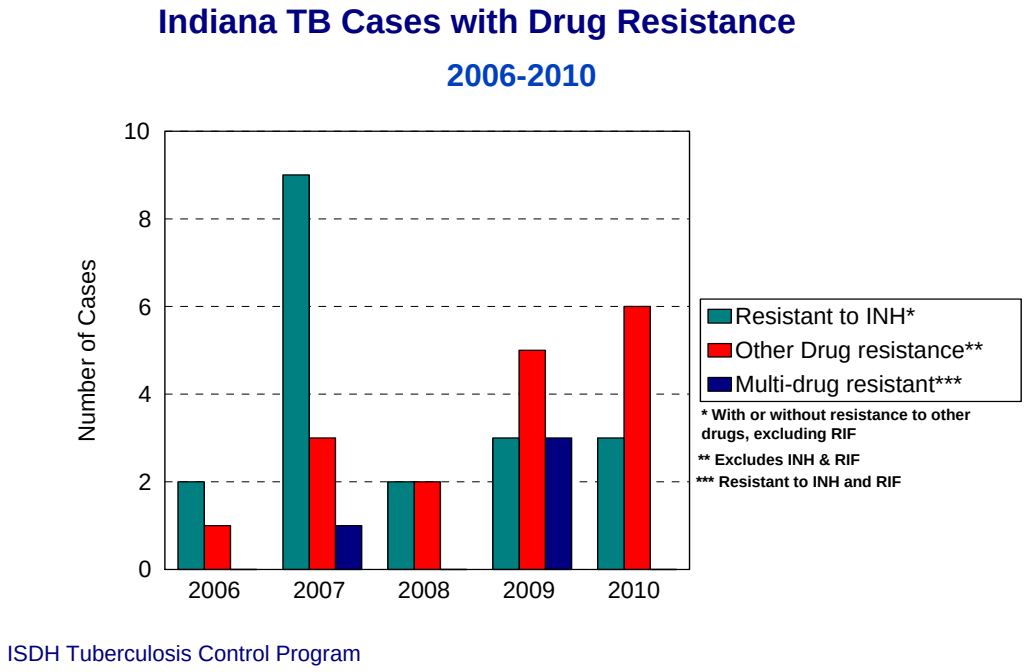
contraindicated, all patients should begin therapy on the preferred regimen containing Isoniazid (INH), Rifampin (RIF), Pyrazinamide (PZA), and Ethambutol (EMB). The percentage of patients who were started on the recommended four-drug regimen is shown in Figure 13.

Figure 13.



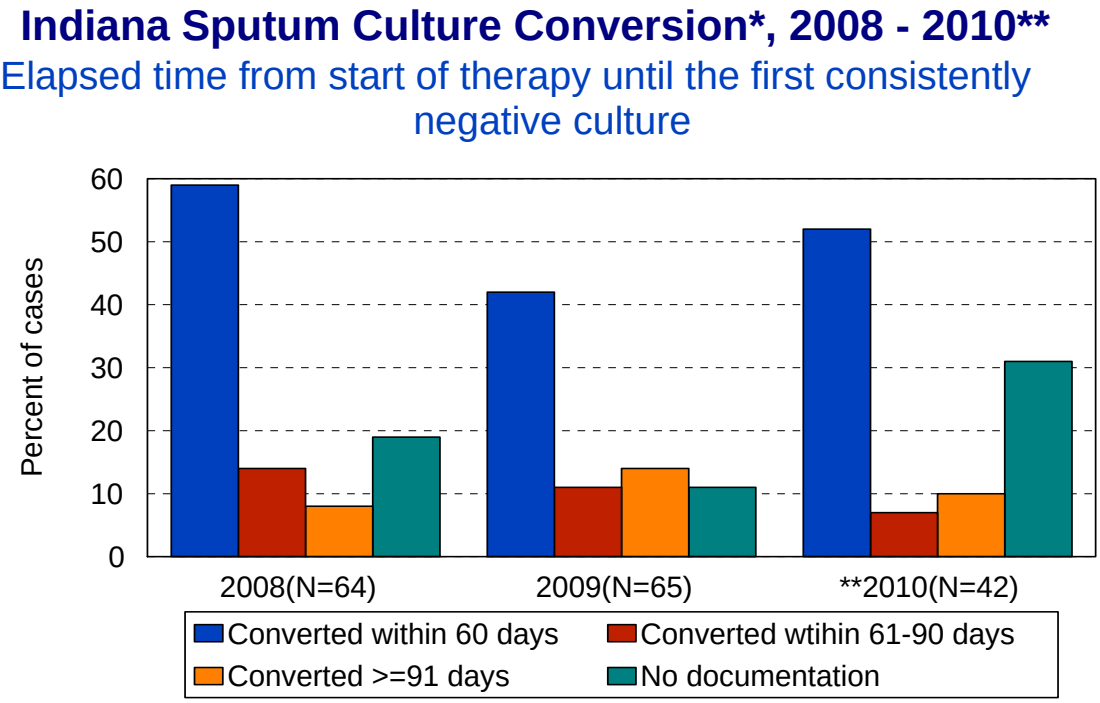
Drug susceptibility testing is routinely performed on all culture-positive isolates. Of the 63 culture positive cases reported during 2010, drug susceptibility testing was performed on 62 (98%) of the specimens submitted (one patient did not have a culture to perform susceptibilities; pure culture could not be obtained – overgrown with yeast). Nine cases had resistance to at least one drug: three cases were resistant to INH only, four resistant to pyrazinamide only, two resistant to streptomycin only and no cases were multi-drug resistant.

Figure 14.



Drug resistance, inadequate response to therapy and failure to follow the treatment regimen are the major reasons to extend the treatment period beyond 12 months. Sputum culture conversion (two consecutive negatives by culture) data are collected to measure response to therapy and to determine length of treatment. The absence of documentation of culture conversion at two months is most commonly due to inadequate patient follow-up or the inability of the patient to produce a sputum specimen and is addressed with the local health departments. Patients whose sputum cultures have not become negative after two months of treatment may require a longer course of therapy. Those whose symptoms have not improved or 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 failing to adhere to the treatment regimen if they are not on directly observed therapy. The proportion of patients who convert their sputum cultures to negative in two months or less is shown in Figure 15. It should be noted that data on sputum culture conversion is incomplete at this time.

Figure 15.



*sputum culture-positive, alive at the time of diagnosis, and began treatment; excludes those who died before completing 2 months of therapy and were still culture-positive
**Preliminary Data
ISDH Tuberculosis Control Program

Directly observed therapy (DOT) is the most effective way to assure that the patient is complying with the prescribed treatment regimen. DOT is a strategy proven to ensure completion of therapy, with the added benefit of preventing acquired drug resistance. DOT is the best practice and the standard of medical care in Indiana and should be used for all patients. Every effort must be made to initiate DOT when the patient is first started on therapy. Cohort year 2009 is the most recent period with complete DOT data and 2010 is a partial report of only those cases with completed treatment (Figure 16).

The first priority of TB elimination efforts is to ensure Completion of Therapy (COT). Indiana's goal is to have at least 90 percent of all patients' complete treatment within one year. 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 rate calculations are those who were dead at the time of diagnosis, patients who died before

completing therapy, patients who were never started on therapy, patients with multi-drug resistant disease, rifampin resistance, pediatric cases with miliary disease, all meningial cases and pediatric case with positive blood cultures. Therapy is considered to be incomplete for those patients who were reported as moved, uncooperative or refused, or lost to follow-up.

Figure 16.

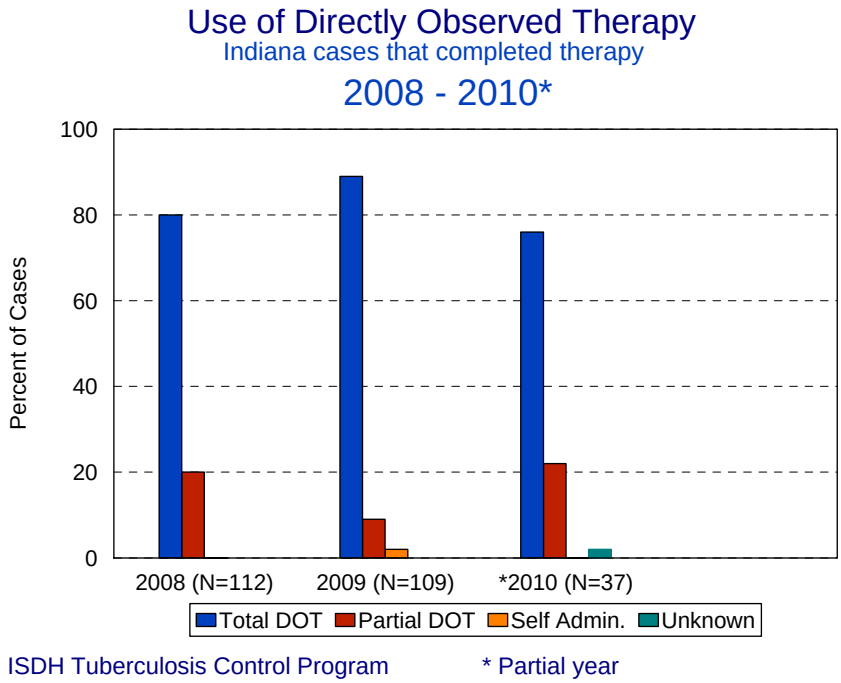


Figure 17 shows the percentage of patients who completed therapy in one year or less, and the total completion rate for all patients.

Figure 17.

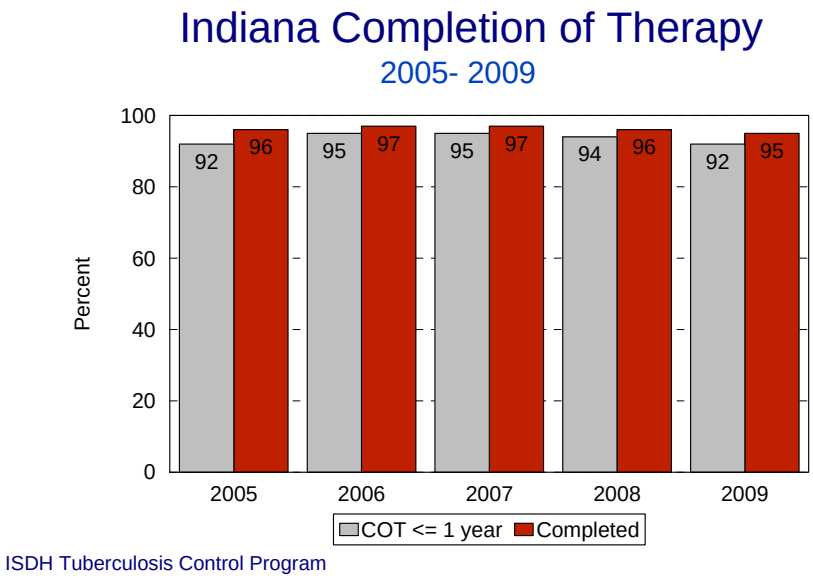


Figure 18 shows the case rate and number of cases in counties that reported five or more cases of TB in 2010. The total number for the state is based on persons whose primary residence was in Indiana at the time of diagnosis, and who were verified as having TB disease in a given year. Persons counted 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.

Figure 19 on page 16 shows the case rate and number of cases per county for a ten year period from 2001-2010. During the 10 years from 2001 through 2010, 12 counties did not have a reported case of TB. They were Newton, Benton, Warren, Pulaski, Jasper, Putnam, Brown, Hancock, Jennings, Ohio, Pike and Perry Counties. Only nine of the 92 counties had enough cases to give stable rates (>20 cases). This figure clearly illustrates the challenge of ensuring a knowledgeable public health workforce when doctors and nurses may only see several cases of TB every 10 years.

To eliminate the transmission of TB in Indiana, contact investigations must be focused on those at highest risk and the 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. Figure 20 shows the Contact Investigation Summary for the past six years. Beginning in 2010, CDC now asks for data on newly infected contacts. Recently infected contacts have a higher risk of breaking down to disease within the first two years of exposure[3]. This indicates that the contact investigation is very important for the prevention of disease. Indiana does a good job of identifying contacts to newly reported sputum acid fast bacillus (AFB) smear positive cases. Improvement is needed in getting those contacts evaluated and having those who start treatment complete treatment.

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 direct observed therapy and improve our contact investigation strategies and activities.

TB Elimination: Together We Can

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

Figure 18.

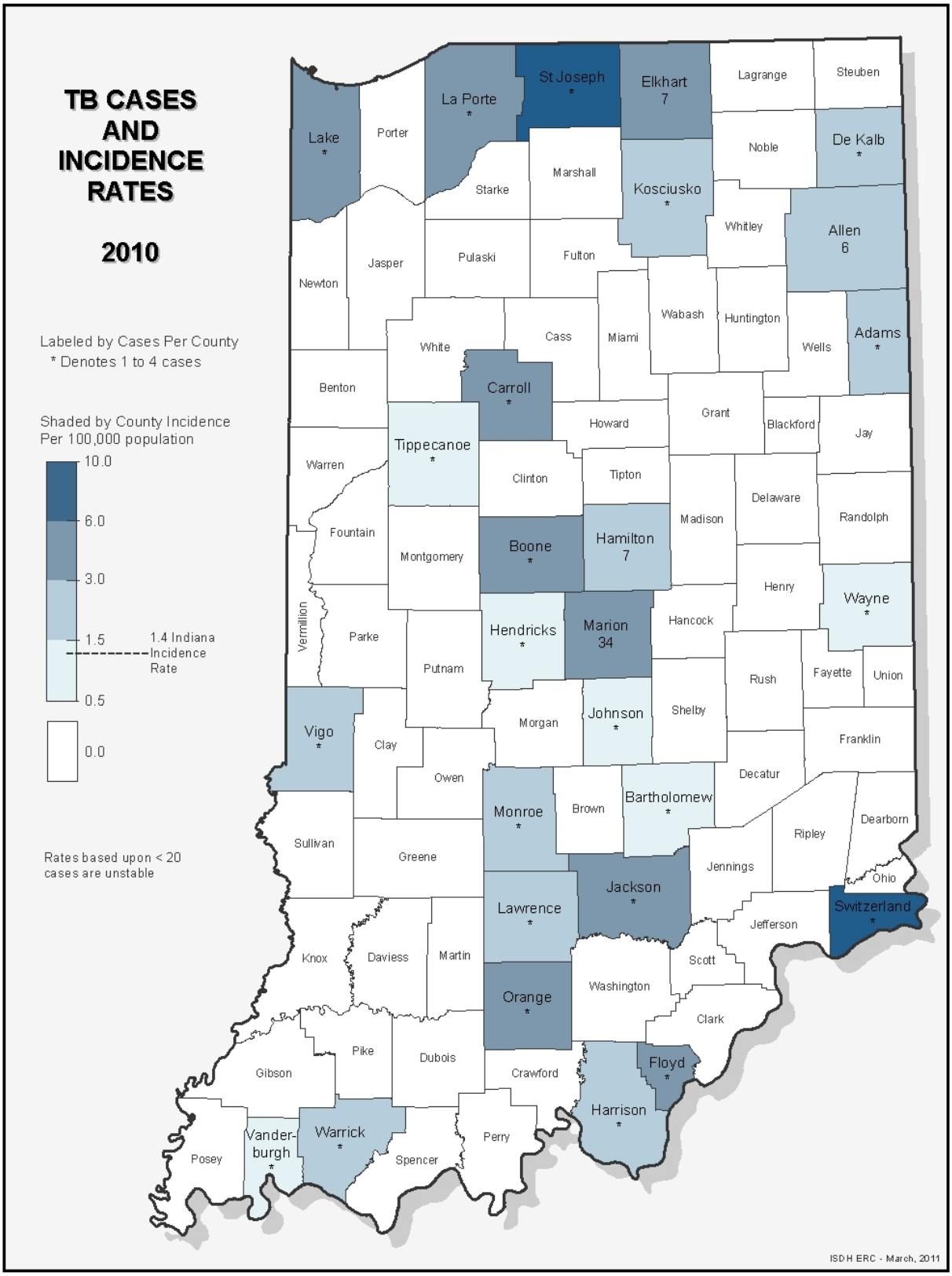

TB CASES AND INCIDENCE RATES
2010
Labeled by Cases Per County
* Denotes 1 to 4 cases
Shaded by County Incidence Per 100,000 population
10.0
6.0
3.0
1.5
1.4 Indiana Incidence Rate
0.5
0.0
Rates based upon < 20 cases are unstable
Lake *
Porter
La Porte *
St Joseph *
Elkhart 7
Lagrange
Steuben
De Kalb *
Noble
Kosciusko *
Marshall
Starke
Whitley
Allen 6
Jasper
Pulaski
Fulton
Newton
Wabash
Huntington
Wells
Adams *
White
Cass
Miami
Benton
Carroll *
Howard
Grant
Blackford
Jay
Tippecanoe *
Warren
Clinton
Tipton
Madison
Delaware
Randolph
Fountain
Montgomery
Boone *
Hamilton 7
Henry
Wayne *
Vermillion
Parke
Hendricks *
Marion 34
Hancock
Putnam
Rush
Fayette
Union
Vigo *
Clay
Morgan
Johnson *
Shelby
Franklin
Owen
Decatur
Monroe *
Brown
Bartholomew *
Sullivan
Greene
Ripley
Dearborn
Jennings
Ohio
Jackson *
Lawrence *
Switzerland *
Jefferson
Knox
Daviess
Martin
Scott
Washington
Orange *
Clark
Pike
Dubois
Gibson
Crawford
Floyd *
Harrison *
Vander-burgh *
Warrick *
Perry
Posey
Spencer
ISDH ERC - March, 2011

Figure 19.

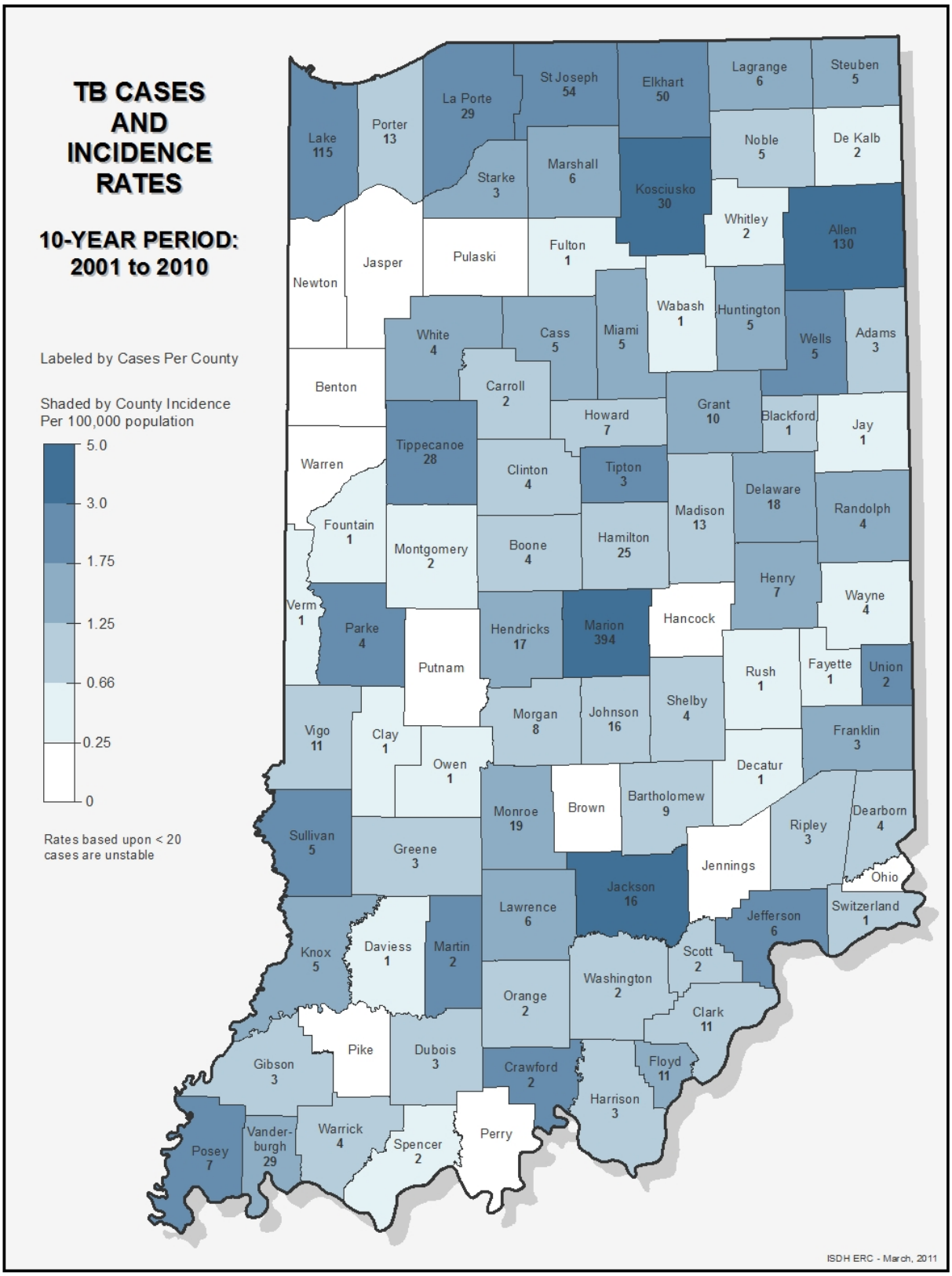

TB CASES AND INCIDENCE RATES
10-YEAR PERIOD: 2001 to 2010
Labeled by Cases Per County
Shaded by County Incidence Per 100,000 population
5.0
3.0
1.75
1.25
0.66
0.25
0
Rates based upon < 20 cases are unstable
Lake 115
Porter 13
La Porte 29
St Joseph 54
Elkhart 50
Lagrange 6
Steuben 5
Noble 5
De Kalb 2
Starke 3
Marshall 6
Kosciusko 30
Whitley 2
Allen 130
Newton
Jasper
Pulaski
Fulton 1
Wabash 1
Huntington 5
Wells 5
Adams 3
White 4
Cass 5
Miami 5
Benton
Carroll 2
Howard 7
Grant 10
Blackford 1
Jay 1
Warren
Tippecanoe 28
Clinton 4
Tipton 3
Madison 13
Delaware 18
Randolph 4
Fountain 1
Montgomery 2
Boone 4
Hamilton 25
Henry 7
Wayne 4
Verm 1
Parke 4
Putnam
Hendricks 17
Marion 394
Hancock
Rush 1
Fayette 1
Union 2
Vigo 11
Clay 1
Owen 1
Morgan 8
Johnson 16
Shelby 4
Franklin 3
Decatur 1
Monroe 19
Brown
Bartholomew 9
Ripley 3
Dearborn 4
Sullivan 5
Greene 3
Jennings
Ohio
Jackson 16
Lawrence 6
Jefferson 6
Switzerland 1
Knox 5
Daviess 1
Martin 2
Scott 2
Washington 2
Orange 2
Clark 11
Pike
Dubois 3
Gibson 3
Crawford 2
Floyd 11
Harrison 3
Vander-burgh 29
Warrick 4
Spencer 2
Perry
Posey 7
ISDH ERC - March, 2011

Figure 20.

Contact Investigation Summary

National Objective	2005	2006	2007	2008	2009	2010
Number of cases reported	146	125	129	118	119	90
Contact investigation: 1) Contacts will be identified for at least 90% of newly reported sputum AFB smear-positive TB cases.	93%	93%	98%	100%	100%	94%*
2) At least 95% of contacts to sputum AFB smear-positive TB cases will be evaluated for infection and disease.	54%	75%	60%	48%	54%*	N/A
3) At least 75% of infected contacts who are started on treatment for latent TB will complete therapy.	80%	70%	71%	69%	67%*	N/A
All newly diagnosed cases of TB will be reported to CDC using the electronic system developed by CDC. There will be at least 95% completeness for RVCT question numbers 7-15, 17-22, 25-28, 32-37 and 39. *Preliminary data	100%	100%	100%	100%	100%	100%