

INDIANA TUBERCULOSIS ANNUAL SUMMARY 2009

Cases = 119

Crude Incidence Rate per 100,000 population = 1.9 (U.S. 2009 = 4.2)
U.S.-born = 1.1 (U.S. 2009 = 2.0)
Foreign-born = 21.0 (U.S. 2009 = 20.3)

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

White = 1.0
Black or African-American = 5.6
Asian = 27.5
Hawaiian Native or other Pacific Islander = N/A
American Indian or Alaska Native = N/A
Hispanic or Latino, all races = 7.9

Gender-specific Incidence Rates per 100,000 population

Male = 2.7
Female = 1.0

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 Center 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 2009, there were 119 new cases of tuberculosis (TB) reported to the Indiana State Department of Health. This is an increase of one counted cases from 2008. Figures 1a and 1b show long-term and 8-year trends, respectively. TB was reported by 34 of the 92 counties. According to the estimated 2009 census, the three most populous counties (Marion, Lake, and Allen counties) accounted for 54% of all new cases. Marion County's reported cases increased in 2009 to 46 cases from 33 cases in 2008, an increase of 39%. Lake and Allen Counties case counts decreased in 2009. Allen County had 12 cases in 2009 and 13 cases in 2008. Lake County reported six TB cases in 2009 and thirteen cases in 2008, a 54% decrease. Figure two illustrates TB related deaths decreased to a low of two cases in the last five years. The TB related deaths were verified by the death certificate.

High risk populations include: HIV infection, children, and drug and alcohol abuse. The HIV status was known in 97% of the cases in 2009 for the 25 to 44 age group, compared to 79% in 2008 (Table 1). Pediatric cases decreased in 2009 to seven from nine cases in 2008 (Figure 9). The percentage of cases

¹ <http://www.census.gov/popest/states/asrh/>

started on appropriate therapy increased from 84% in 2008 to 88% in 2009 (Figure 12). Isoniazid resistance increased in 2009 to three cases compared to two cases in 2008 (Figure 13). Resistance to other TB drugs increased to five cases in 2009, up from two cases in 2008. Indiana had three cases of multi-drug resistant cases in 2009. 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, 39% come from Southeast Asia and 31% come from Central/South America (Figure 6).

Indiana TB cases created ten new genotype clusters (two or more molecular matched isolates) in 2009, IN_0074 to IN_0083. Of interest is IN_0074 (PCR12325), a Marion County genotype cluster with active cases in the homeless population only. No other cases of PCR12325 have been identified outside of Indianapolis or in the U.S. at this time. Marion County has had ten cases in eight months; additional cases are expected to be identified. Marion County sent a notification to hospitals in regards to the outbreak. A CDC Technical Assistance Team was invited to help evaluate the situation at the onset of the outbreak. An Outbreak Response Team was created by Marion County. This outbreak attributes to the increase in homeless cases in 2009.

Beginning January 1st, 2009, CDC implemented a revised Report of Verified Case of Tuberculosis (RVCT) form. The additions and changes made to the variables of the RVCT will help programs capture data that are more inclusive to a variety of risk factors. New variables are:

- Count status
- Pediatric TB patients
- Nucleic acid amplification test
- Initial chest CT scan or other chest imaging study
- Primary reason evaluated for TB disease
- Additional TB risk factors
- Immigration status
- Genotype accession number
- Moved
- Reason therapy was extended for more than 12 months

CDC also introduced the National Tuberculosis Indicator Project (NTIP) in 2009. States were requested to set goals to be accomplished by 2015. These indicators focus on: Completion of Treatment, Contact Investigation, Aggregated Reports of Program Evaluation, Data Reporting, Drug Susceptibility results, Known HIV Status, Recommended Initial Therapy, Sputum Culture Conversion, Sputum culture reported, TB case rates and Universal Genotyping. To help achieve these projections CDC highly recommends that all states incorporate cohort reviews into their programs. Indiana began quarterly cohort reviews in November 2009.

All subsequent data and graphics represent Indiana

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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% of immunocompetent infected individuals will progress to active disease during their life time.

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 two cases in 2009. Patients who died after sputum culture conversion to negative and those who demonstrated significant clinical improvement but died from other causes which was verified by a death certificate were excluded (one was excluded for 2009). One death was in a person \leq 50 years of age.

Figure 1a.

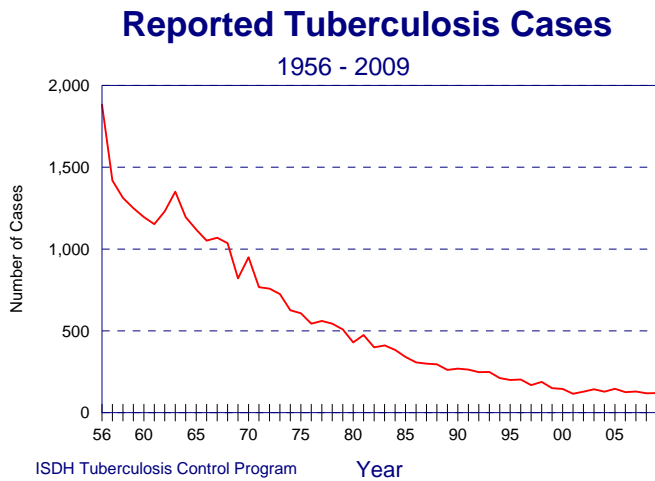


Figure 1b.

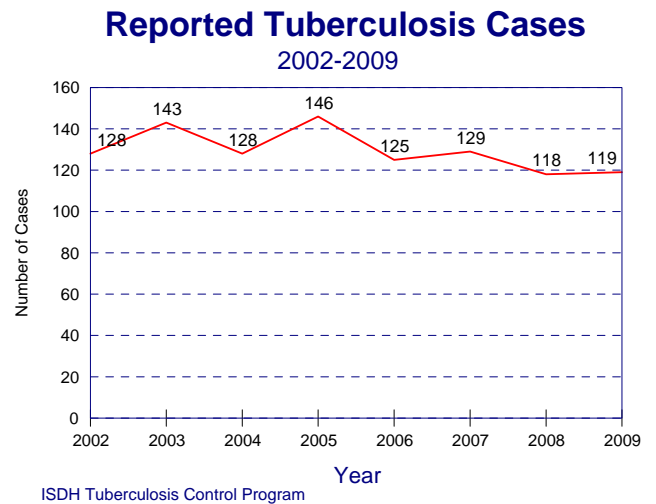
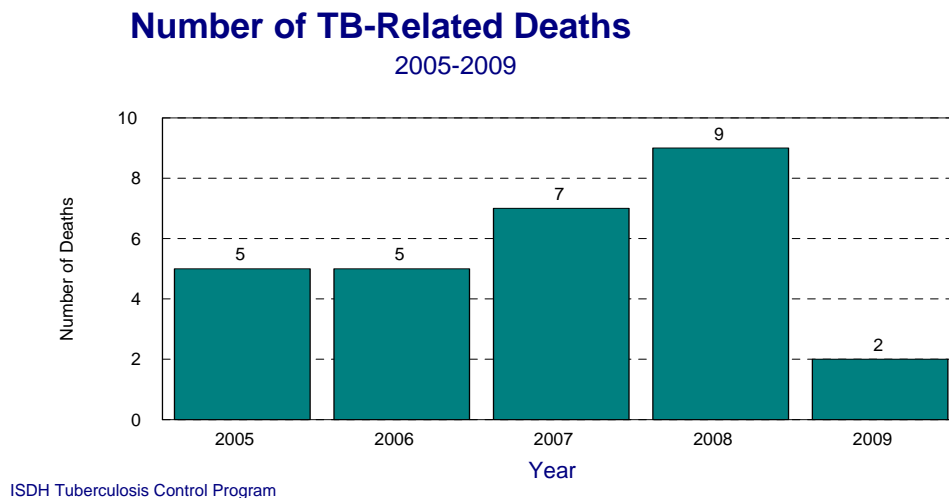


Figure 2.



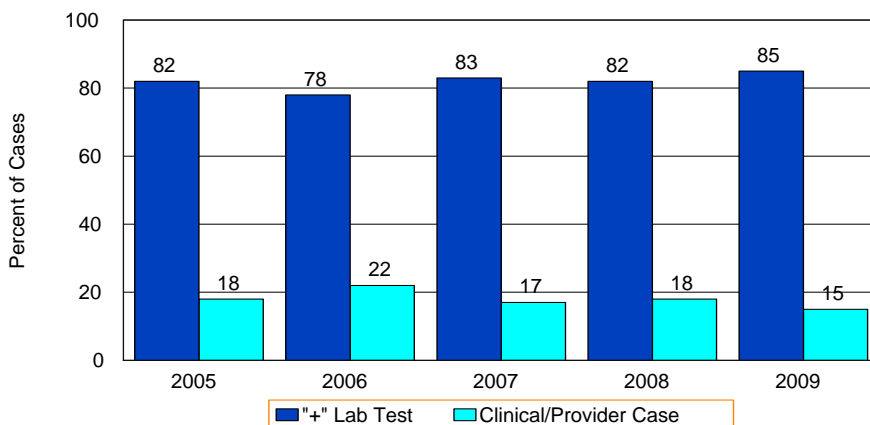
A diagnosis of TB is verified using the Centers for Disease Control and Prevention’s “Case Definitions for Infectious Conditions under Public Health Surveillance.” TB cases must meet the case definition for a laboratory, a clinical, or a provider diagnosis. A laboratory diagnosis is confirmed when: (1) *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. There has been a slight increase in lab confirmed cases of TB in 2009.

Figure 3.

TB Classification by Case Definition

2005-2009



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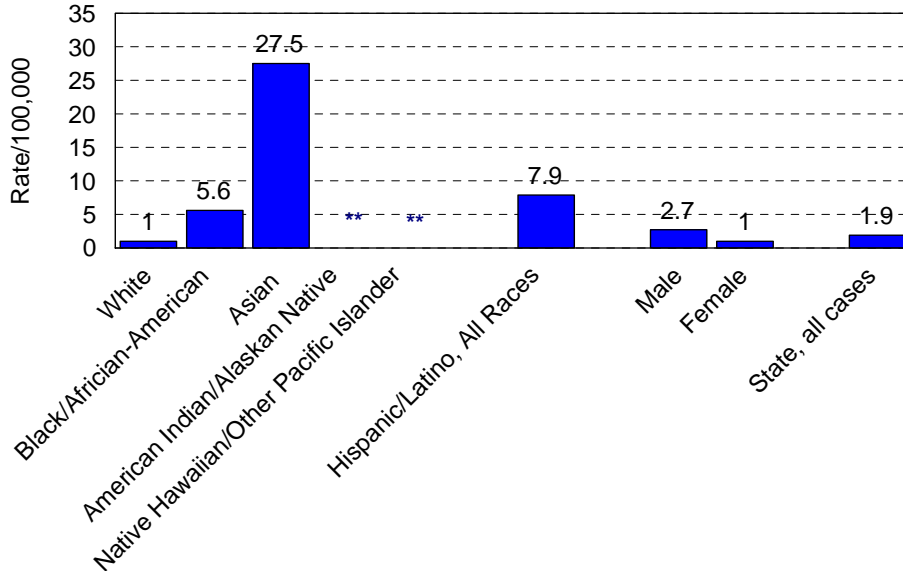
The percentages of 2009 cases by sex, ethnicity, and race are as follows:

Category:	Percentage of 2009 cases:
Sex:	
Male	71
Female	29
Ethnicity:	
Hispanic or Latino	22
Race:	
White	48
Black or African-American	28.5
Asian	23.5
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.

Reported 2009 Tuberculosis case rate by Race, Ethnicity, and Sex



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** None reported or statistically insignificant

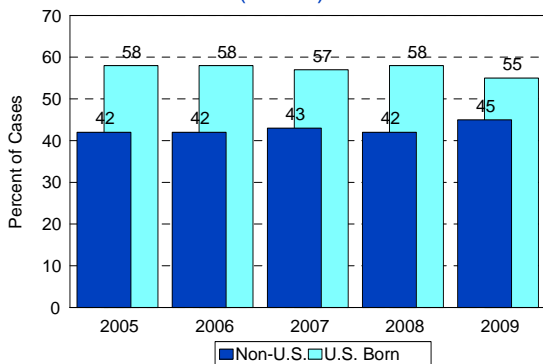
U.S. born TB cases continues to outnumber foreign born cases in Indiana (Figure 5). Persons born in high-prevalence countries continue to make up a large proportion of TB cases. In 2009, 54 of the 119 reported TB patients (45%) were born in countries with a high burden of TB. Five (9%) of the foreign born cases came to the United States as refugees. Figure 6 represents the distribution of TB cases in Indiana by world region as classified by CDC. Southeast Asia cases increased to 39% in 2009 from 35% in 2008. Central/South America cases decreased to 31% in 2009 from 37% in 2008. African cases increased to 13% in 2009 from 6% in 2008. Of the Southeast Asian cases, 24% were refugees. It is important to note that in 2009 nearly 90% (1072/1210) of Indiana's refugees arrived from Southeast Asia, and only 0.5% of those refugees became TB cases.

Figure 5.

Figure 6.

Reported Tuberculosis Cases

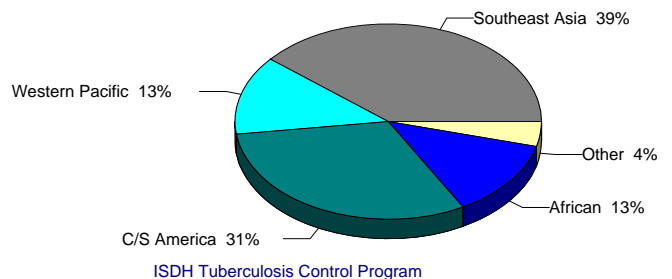
U.S. vs. non U.S.-born
(n=119)



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Non-U.S. Born TB Cases Reported in 2009 by World Region

(n=54)



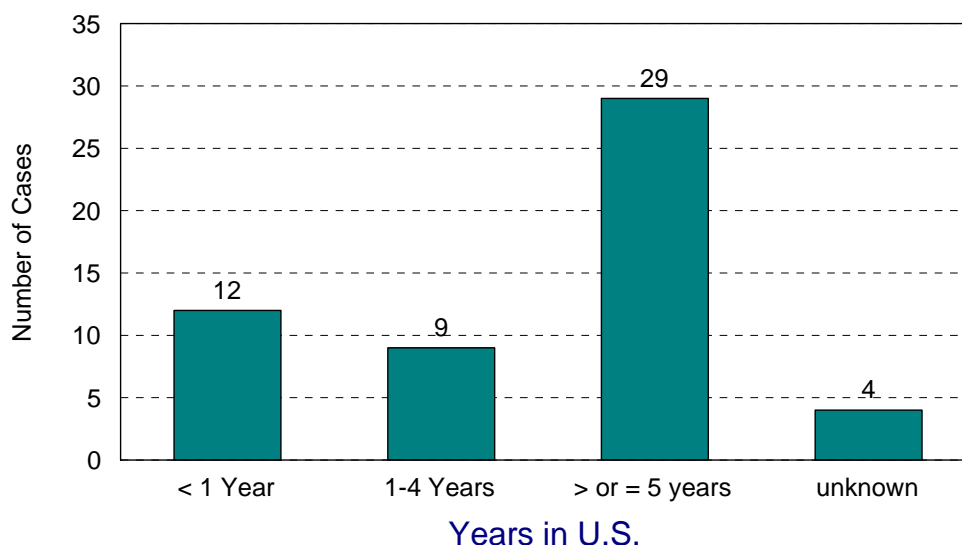
ISDH Tuberculosis Control Program

Figure 7 represents the length of time foreign born persons were living in the U.S. prior to TB diagnosis. The majority of the foreign born cases (53%) come from persons living in the U.S. greater than five years. Of those cases that have lived in the U.S. greater than five years, 28% come from Mexico, 14% come from Vietnam and 10% from India.

Figure 7.

Length of Time in the U.S. Prior to Diagnosis

2009 Reported cases (n=54)



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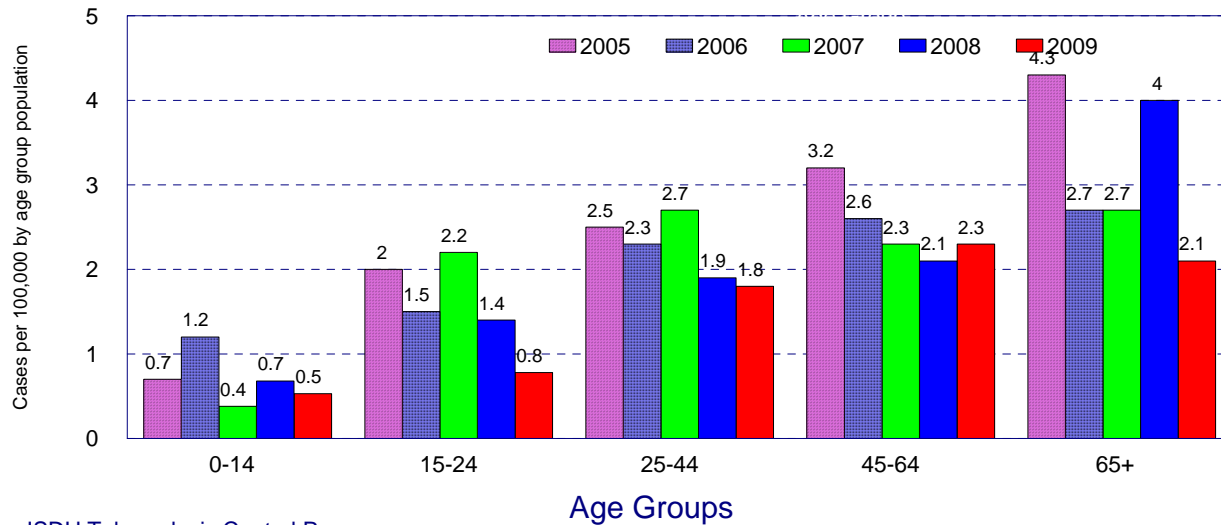
2009 cases by US born, Foreign born, Age group, Sex, Population and Case rate:

Age Group:	U.S. born		Foreign born		Total	Percentage	Case Rate
	M	F	M	F			
< 15 years	1	3	2	1	7	6	0.5
15-24 years	2	0	3	4	9	7.5	2
25-44 years	8	3	19	7	37	31	2.5
45-64 years	27	5	9	5	46	38.5	3.2
≥ 65 years	10	6	3	1	20	17	4.3

Case rates by age group are shown in Figure 8. The age trend of our 2009 case rates reveals a 43% decrease in the 15-24 years of age (1.4 in 2008 to 0.8 in 2009) and a 47% decrease in the ≥ 65 years of age (4 to 2.1 respectively.) Seventy seven percent of cases in the 15-24 age group are foreign born. Seventy percent of the cases in the 25-44 age group are in the foreign born population. The greatest percentage of cases continues to be in the 25-64 years age bracket.

Figure 8.

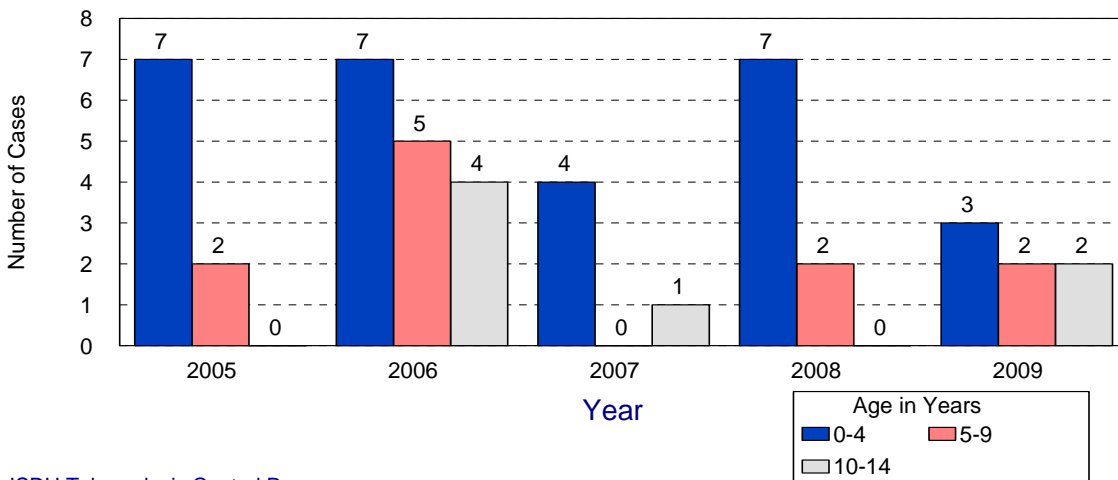
TB Case Rates by Age Group and Year 2005-2009



The numbers of pediatric cases by age group are shown in Figure 9. 2009 had a 57% decrease from seven cases in 2008 to three cases in 2009 for the 0-4 age group. The new RVCT collects additional risk factor information on pediatric cases such as country of birth for the guardians and countries lived for the child.

Figure 9.

Pediatric TB Cases 2005-2009



HIV disease is the most significant risk factor for progression to active disease. The percentage of patients' HIV Testing according to age is shown in Table 1. The percentage of adult patients who were offered HIV testing remained the same in 2009 compared to 2008, 81 (72%) in 2009 and 76 (72%) in 2008. The all adult percentage of patients who were reported to have refused testing also remained the same as the previous year. Of those individuals offered HIV testing in the 25-44 age group, 97% of the cases had the test performed. Overall, 19% of the TB cases in the All Adult cases >15 years of 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 1.

HIV Testing Status

Number and percent of adult patients reported in 2009 offered counseling and testing

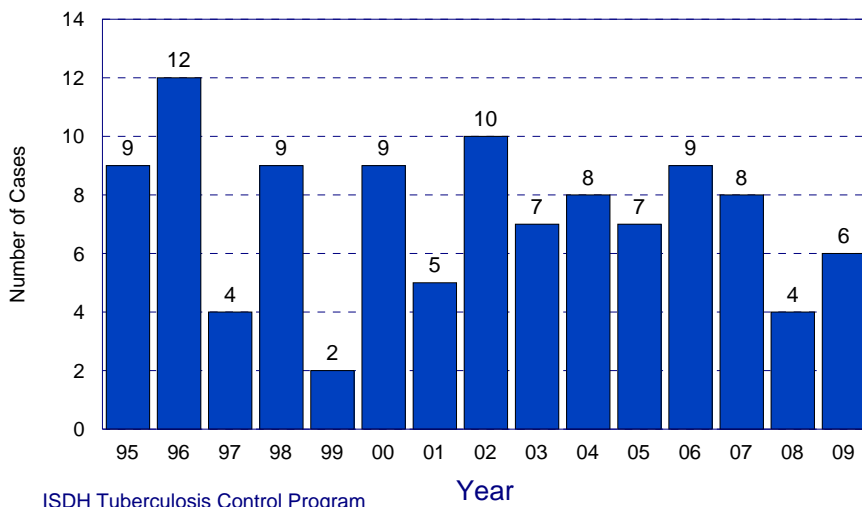
Status	Age group 25-44 (n=37)	All adult cases >=15 years of age (n=112)
Tested, results known or pending	36(97%)	81(72%)
Patient refused	0	10(9%)
Test not offered	1(3%)	21(19%)

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The number of cases co-infected with TB and HIV is shown in Figure 10.

Figure 10.

TB and HIV Co-infection 1995-2009



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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 2. A person may have multiple risk factors. There has been an 86% increase in the percentage of cases with homelessness (from 7% in 2008 to 13% in 2009). The Marion County Outbreak IN_0074 has homelessness as the main epidemiological factor in those cases. Another risk factor in Table 2 that increased in 2009 was resident of correctional facility at time of diagnosis (5% in 2009 and 2 % in 2008.)

Table 2.

Reported Tuberculosis Cases with Selected Exposure and Medical Risk Factors* in 2009
(n=119)

Risk Factor	Number of Cases	Percent of Cases
Excess alcohol use	29	24
Injection drug use	2	2
Non-injection drug use	13	11
Homelessness	16	13
Resident of long-term care facility	1	1
Resident of correctional facility	6	5

*at the time of diagnosis

Occupation is another variable used to detect trends. These data are shown in Table 3. 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, disabled). In 2011 we will be able to share the new information. Of the known and reported occupations, cases with occupations has decreased from 40 (34%) in 2008 to 34 (29%) in 2009.

Table 3.

Reported Tuberculosis Cases by Selected Occupation* in 2009

Occupation	Number of Cases	Percent of Cases
Not Employed In Last 24 months	77	65
Other occupations	34	29
Migrant agricultural worker	1	1
Health care worker	3	3
Correctional facility employee	0	0

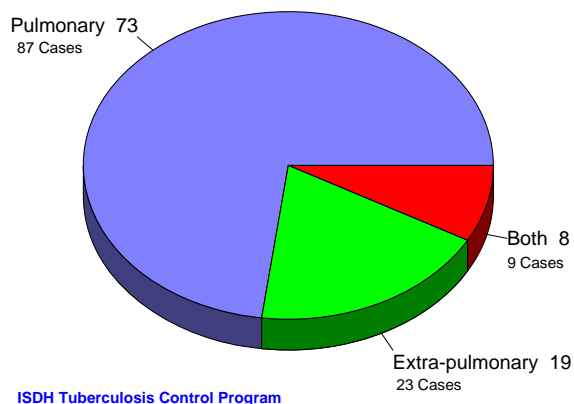
2009 (n=119)

* at the time of diagnosis

The number of cases and percentage of TB cases classified by the site of disease is shown in Figure 11. There was a slight decline in pulmonary (89 in 2008 to 87 in 2009), a slight increase in extra-pulmonary (21 in 2008 and 23 in 2009) and both sites of disease (8 in 2008 and 9 in 2009).

Figure 11.

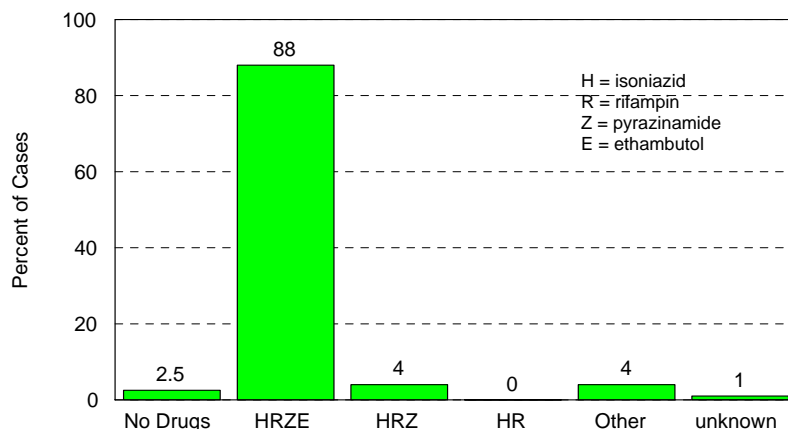
Reported 2009 TB Cases by Site of Disease
Percentage of all cases reported
 (n=119)



The Indiana State Department of Health recommends the treatment guidelines set by the American Thoracic Society and the Centers for Disease Control and Prevention. 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 12. Three cases did not start medications; two were dead at diagnosis and one refused medications and is lost to follow-up. One individual who moved to Georgia was lost to follow-up; the initial drug therapy is unknown.

Figure 12.

Percent of Cases Reported During 2009 Started on Appropriate Therapy

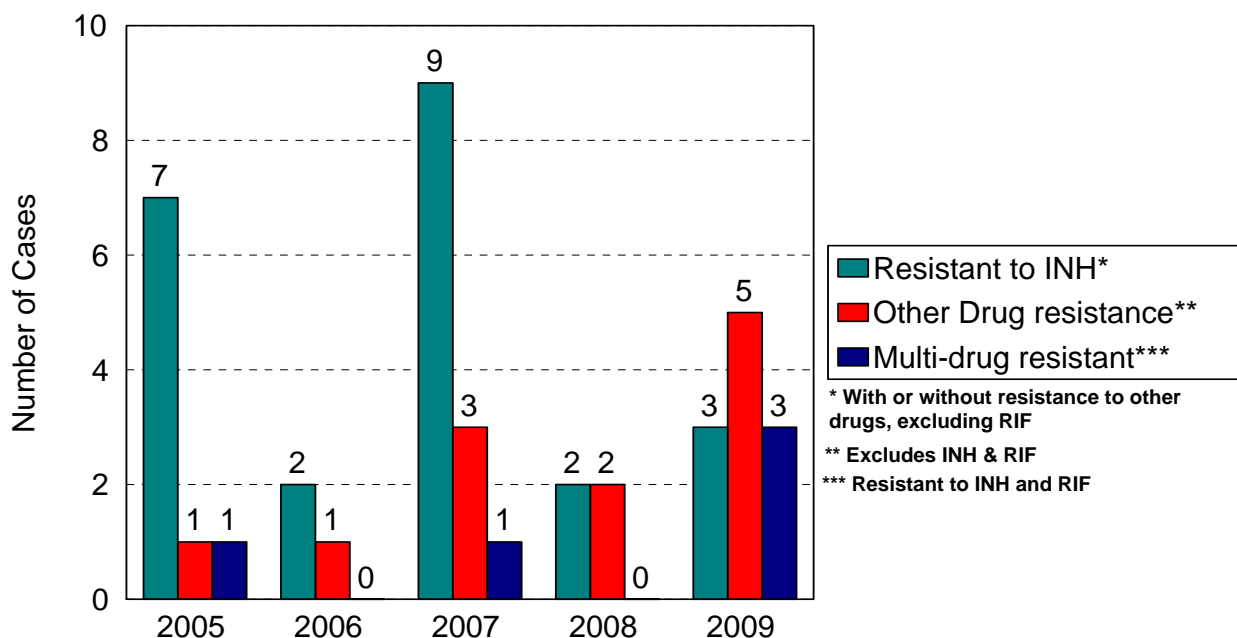


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Drug susceptibility testing is routinely performed on all culture-positive isolates. Of the 101 culture positive cases reported during 2009, drug susceptibility testing was performed on 97 (96%) of the specimens submitted (four patients did not have a culture to perform susceptibilities; they were polymerase chain reaction (PCR) positive, but no culture grew.) Of these, a total of 11 persons had resistance to at least one drug: almost triple the number of cases with drug resistance in 2008 (four cases). Three cases were resistant to at least INH; two of these were resistant to INH only; four cultures were resistant to streptomycin only and three cases were multi-drug resistant.

Figure 13.

TB Cases with Drug Resistance 2005-2009



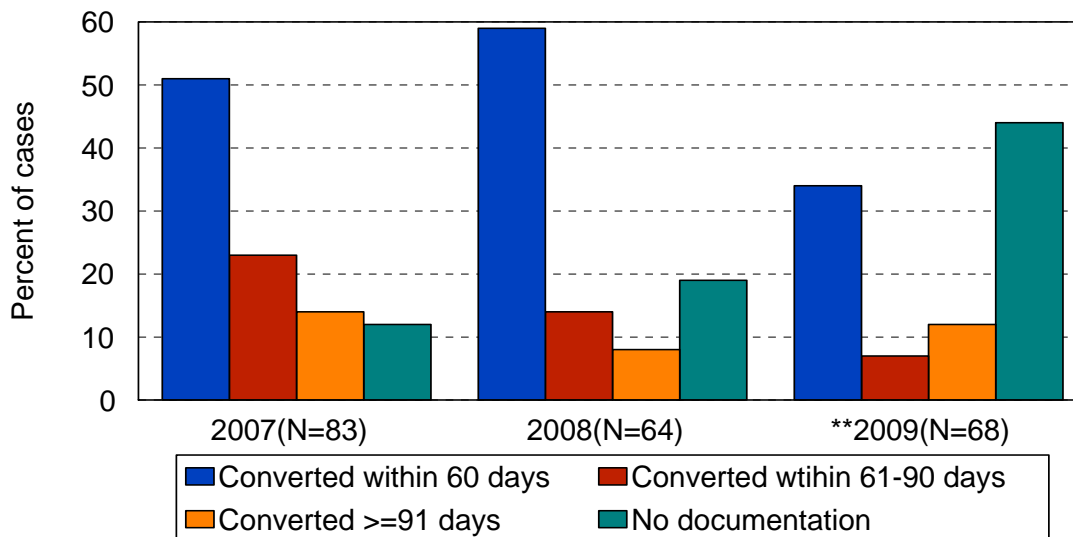
ISDH Tuberculosis Control Program

Drug resistance, inadequate response to therapy and failure to follow the treatment regimen are the major reasons for having to extend the treatment period. 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 14. It should be noted that data on sputum culture conversion is incomplete at this time.

Figure 14.

Sputum Culture Conversion*, 2007 - 2009**

Elapsed time from start of therapy until the first consistently negative culture



*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 2008 is the most recent period with complete DOT data and 2009 is a partial report of only those cases completed (Figure 15).

The first priority of TB elimination efforts is to ensure Completion of Therapy (COT). Indiana’s goal is to have at least 90% 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 15.

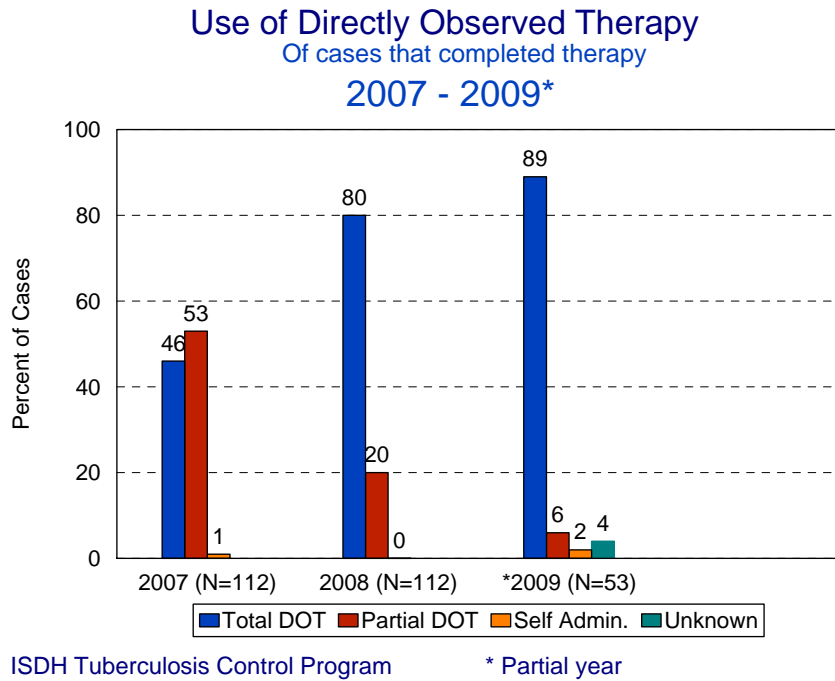


Figure 16 shows the percentage of patients who completed therapy in one year or less, and the total completion rate for all patients.

Figure 16.

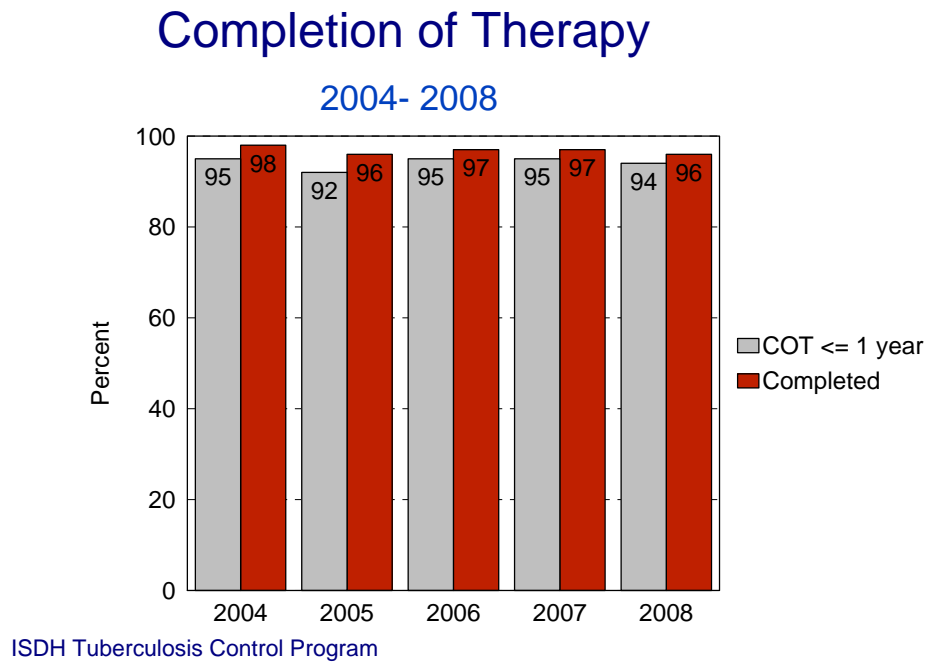


Figure 17 shows the case rate and number of cases in counties that reported 5 or more cases of TB in 2009. The total number for the state is based on persons whose primary residence was in Indiana at the time of diagnosis, and who were verified as having TB disease in a given year. Persons counted in 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.

The aggregate number of cases by the four regional nurse consultant regions is shown in Figure 18 on page 16. Figure 19 on page 17 shows the case rate and number of cases per county for a ten year period from 1999-2008. During the ten years from 1999 through 2008, eight counties did not have a reported case of TB. They were Newton, Benton, Warren, Pulaski, Brown, Hancock, Fayette and Perry Counties. Only 12 of the 92 counties had enough cases to give stable rates (>20 cases). Four of the five counties in the highest rate (3.0-5.0) category had outbreaks. 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 ten years.

To eliminate the transmission of TB in Indiana, contact investigations must be focused on those at the 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. The CDC, in its NTIP's has set the following goals:

- Contacts will be identified for at least 90% of newly reported sputum AFB (acid fast bacillus) smear positive TB cases.
- At least 95% of contacts to sputum AFB smear positive TB cases will be evaluated.
- At least 75% of infected contacts will complete treatment.

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

Figure 17.

Figure 19

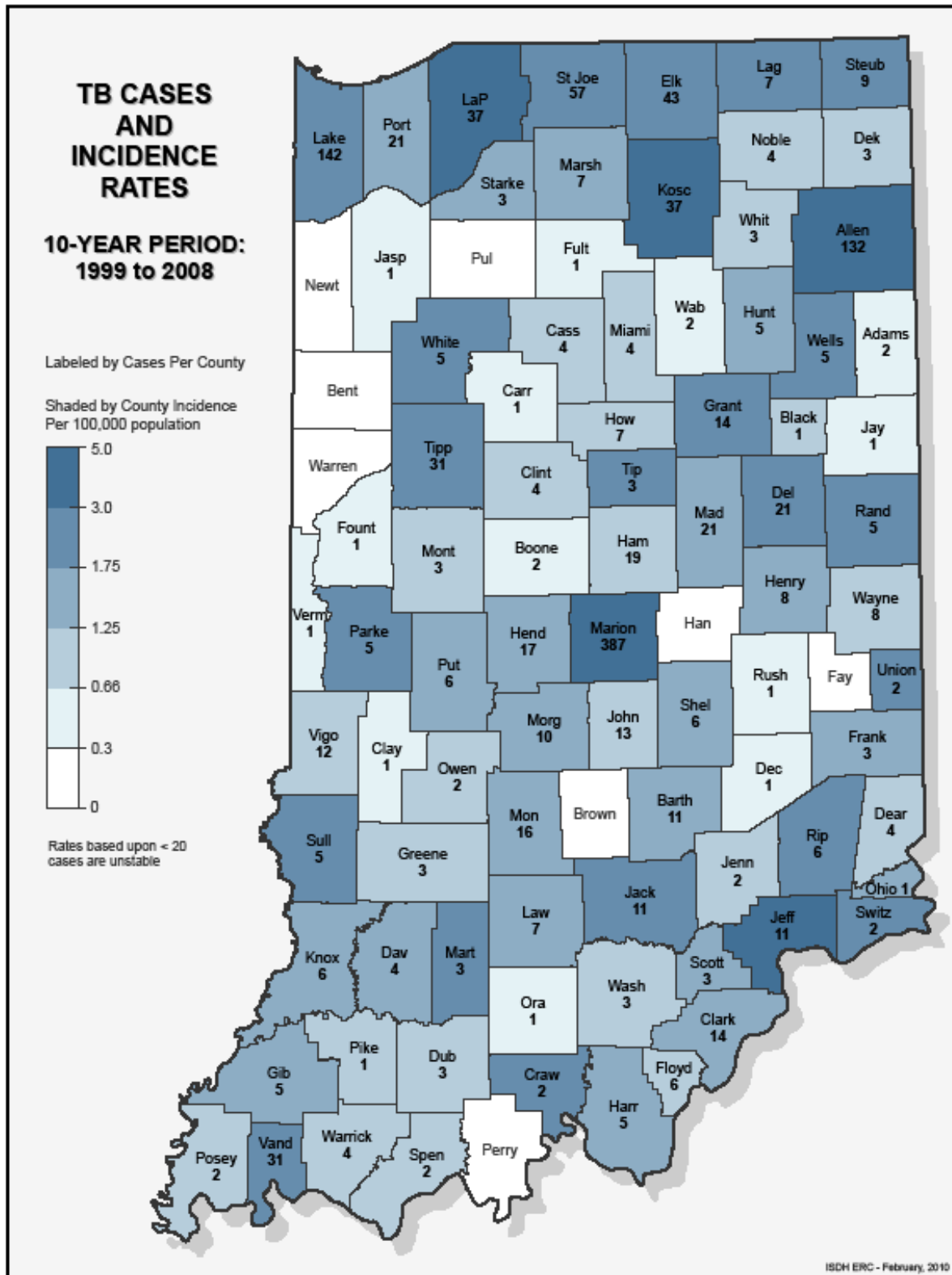


Figure 20**Contact Investigation Summary**

National Objective	2004	2005	2006	2007	2008	2009
Number of cases reported	128	146	125	129	118	119
Contact investigation:						
1) Contacts will be identified for at least 90% of newly reported sputum AFB smear-positive TB cases.	100%	93%	93%	98%	98%*	81%*
2) At least 95% of contacts to sputum AFB smear-positive TB cases will be evaluated for infection and disease.	79%	54%	75%	60%	40%*	N/A
3) At least 75% of infected contacts who are started on treatment for latent TB will complete therapy.	43%	80%	70%	71%	63%*	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%