INDIANA
TUBERCULOSIS ANNUAL SUMMARY 2008

2008 Cases = 118

Indiana 2008 Crude Incidence Rate per 100,000 population = 1.9 (U.S. 2007 = 4.4)
Indiana U.S.-born = 1.1 (U.S. 2007 = 2.1)
Indiana Foreign-born = 18.9 (U.S. 2007 = 20.7)

Indiana 2008 Race and Ethnicity-specific Incidence Rates per 100,000 population [1]
White = 1.3
Black or African-American = 4.2
Asian = 31
Hawaiian Native or other Pacific Islander = N/A
American Indian or Alaska Native = 8
Hispanic or Latino, all races = 7.7

Indiana 2008 Gender-specific Incidence Rates per 100,000 population
Male = 2.2
Female = 1.5

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 2008, there were 118 new cases of tuberculosis (TB) reported to the Indiana State Department of Health. This is a decrease of 11 counted cases from 2007, the lowest number of cases for Indiana in seven years. Figures 1a and 1b show long-term and 6-year trends, respectively. TB was reported by 37 of the 92 counties. According to the estimated 2008 census, the three most populous counties (Marion, Lake, and Allen counties) accounted for 50% of all new cases. Marion County's reported cases decreased in 2008 to 33 cases from 42 cases in 2007. Lake and Allen Counties both reported thirteen cases in 2008 which is a decrease for both counties (2007 numbers were 16 and 15 respectively). Twelve new Indiana genotype clusters (two or more molecular matched isolates), were identified in 2008. One new Indiana cluster is part of a homeless investigation that originated in Ohio.

High risk populations include: persons who have risk of HIV infection, children, and drug and alcohol abuse. Known HIV status decreased for 2008 cases, 79% for the 25 to 44 age group, compared to 87% in 2007 (Table 1). Pediatric cases increased in 2008 to seven from four cases in 2007 (Figure 9). Excess alcohol use

[1] http://www.census.gov/popest/states/tables/NST-EST2008-01.xls

decreased from 26% in 2007 to 23% in 2008 (Table 2). Non-injection drug use increased in 2008 to 11% compared to 9% in 2007. The percentage of cases started on appropriate therapy decreased from 88% in 2007 to 84% in 2008 (Figure 12). One active case returned to the country of origin before medications were started. Isoniazid resistance decreased to two cases in 2008 compared to nine cases in 2007 (Figure 13). Indiana had zero cases of multi drug resistant or extensively drug resistant counted cases for 2008.

U.S. born cases continue to make up the majority of TB cases diagnosed in Indiana (Figure 5). Of those non-U.S. born cases, 37% come from Central/South America and 35% come from Southeast Asia (Figure 6). National trends show most non-U.S. born cases are diagnosed within the first three years after entry into the U.S.

The most recent (2007) CDC aggregate reports for contact investigations of active cases reveal 46 contacts per case (average is 10)[2], 12% latent infection rate (average is 20-30%) and of those who started Latent TB treatment 69 % (75% is the CDC goal) completed the drug regimen.

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[2] http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5415a1.htm

Tuberculosis (TB) is an airborne disease caused by a group of bacteria that is collectively referred to as the *Mycobacterium tuberculosis* (MTB) complex. The five species in this complex are *M. tuberculosis, M. bovis, M. africanum, M. canettii, and M. microti*. 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 infected individuals who are not immuno-comprised will progress to active disease during their life time.

During 2008, there were 118 new cases of tuberculosis (TB) reported to the Indiana State Department of Health. This is a decrease of 11 counted cases from 2007, the lowest number of cases for Indiana in seven years. Figures 1a and 1b show long-term and 6-year trends, respectively. 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 nine cases. Patients who died after sputum culture conversion to negative and those who demonstrated significant clinical improvement but died from other causes were excluded (two were excluded for 2008). Of the nine TB related deaths, eight deaths were in persons ≥ 50 years of age.

Figure 1a.

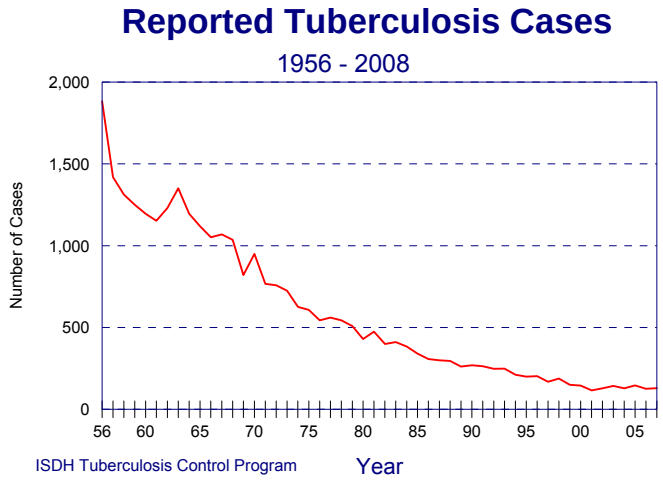


Figure 1b.

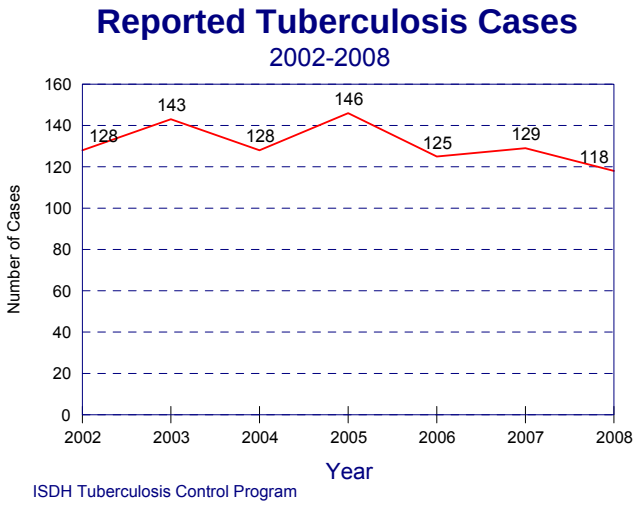
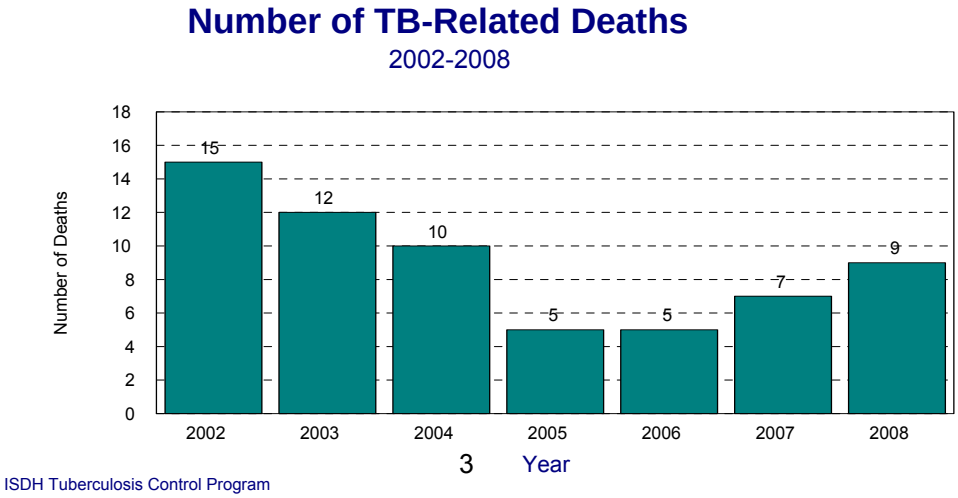


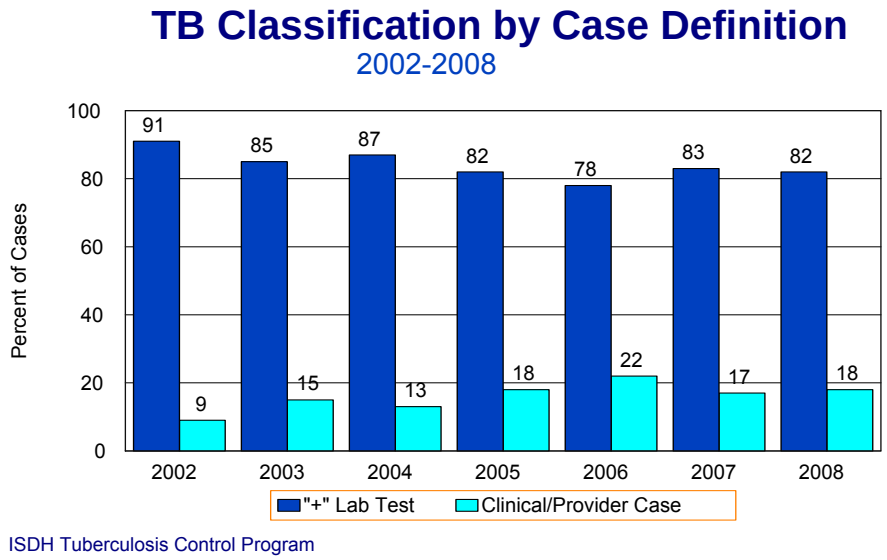
Figure 2.



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 *M. tuberculosis* complex has been: (1) 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.

Figure 3.

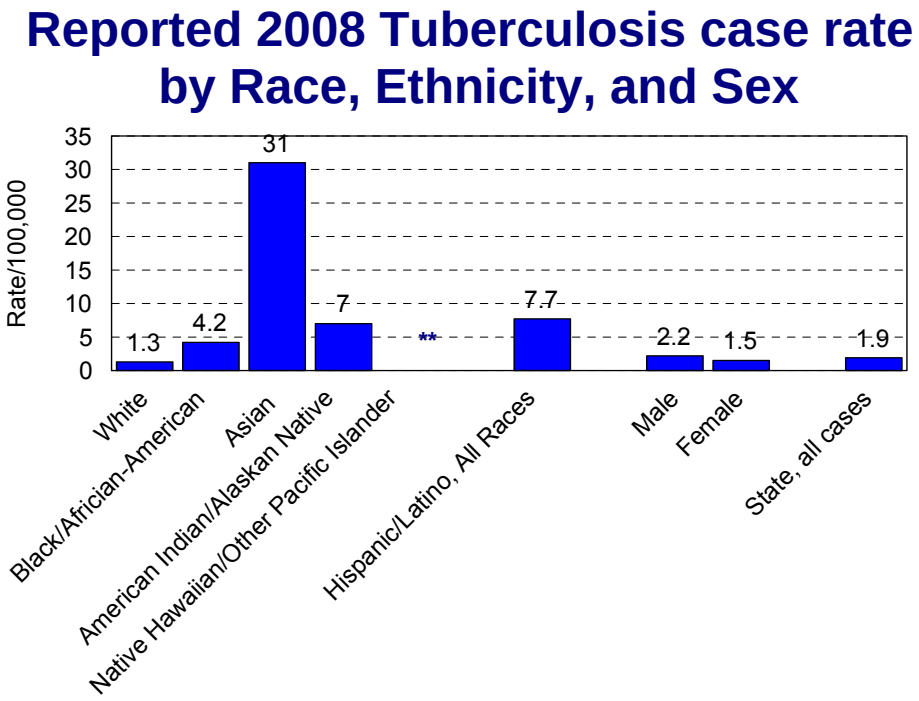


The percentages of new cases by sex, ethnicity, and race are as follows:

Category:	Number of Cases	Percent of Cases
Sex:		
Male	69	58
Female	49	42
Ethnicity:		
Hispanic or Latino	23	19
Race:		
White	69	58
Black or African-American	23	19
Asian	25	21
American Indian or Alaska Native	1	1
Hawaiian Native or other Pacific Islander	0	N/A

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

Figure 4.



Persons born in high-prevalence countries continue to make up a large proportion of TB cases. In 2008, 49 of the 118 reported TB patients (42%) were born in countries with a high burden of TB (Figure 5). U.S. born TB cases continue to out number foreign born cases in Indiana. Figure 6 represents the distribution of TB cases in Indiana by world region as classified by CDC. Central/South America cases decreased to 37% in 2008 from 53% of cases in 2007. Southeast Asia cases increased to 35% in 2008 from 16% of cases in 2007. Greater than 95% of Indiana's refugees come from Southeast Asia (2007 arrivals equaled 1,548). Of the 17 Southeast Asian TB cases 9 (53%) were refugees. African cases decreased to 6% in 2008 from 15% in 2007. Eastern Mediterranean and Western Pacific stayed relatively the same.

Figure 5.

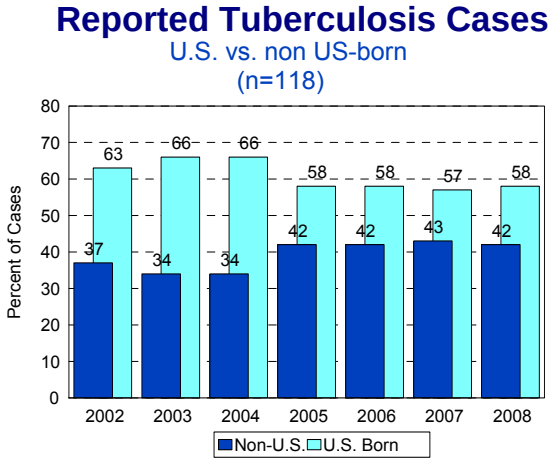


Figure 6.

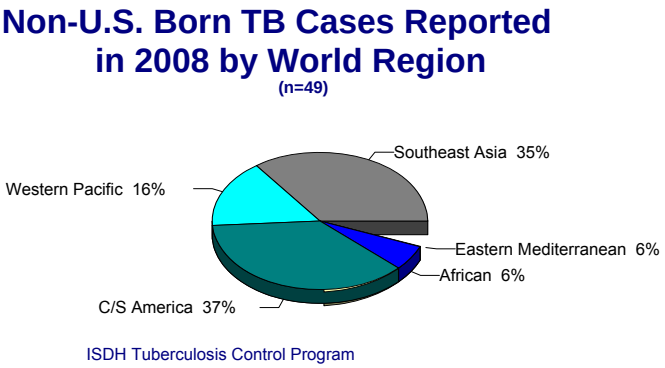
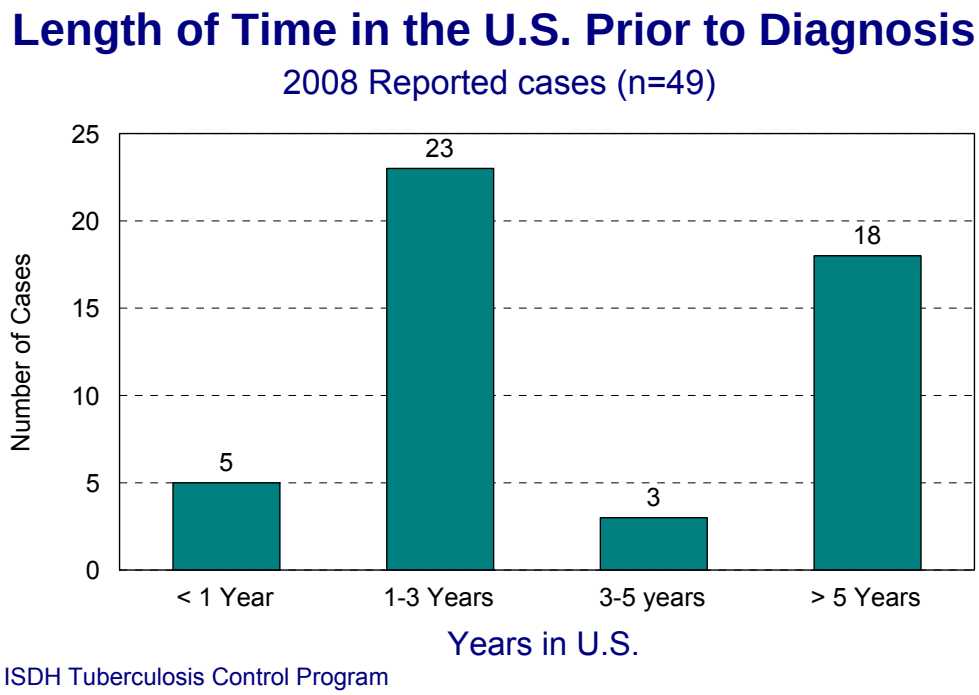


Figure 7 represents the length of time persons were living in the US prior to TB diagnosis. Forty-seven percent of non-U.S. born cases are diagnosed within the first three years of entry into the U.S.

Figure 7.



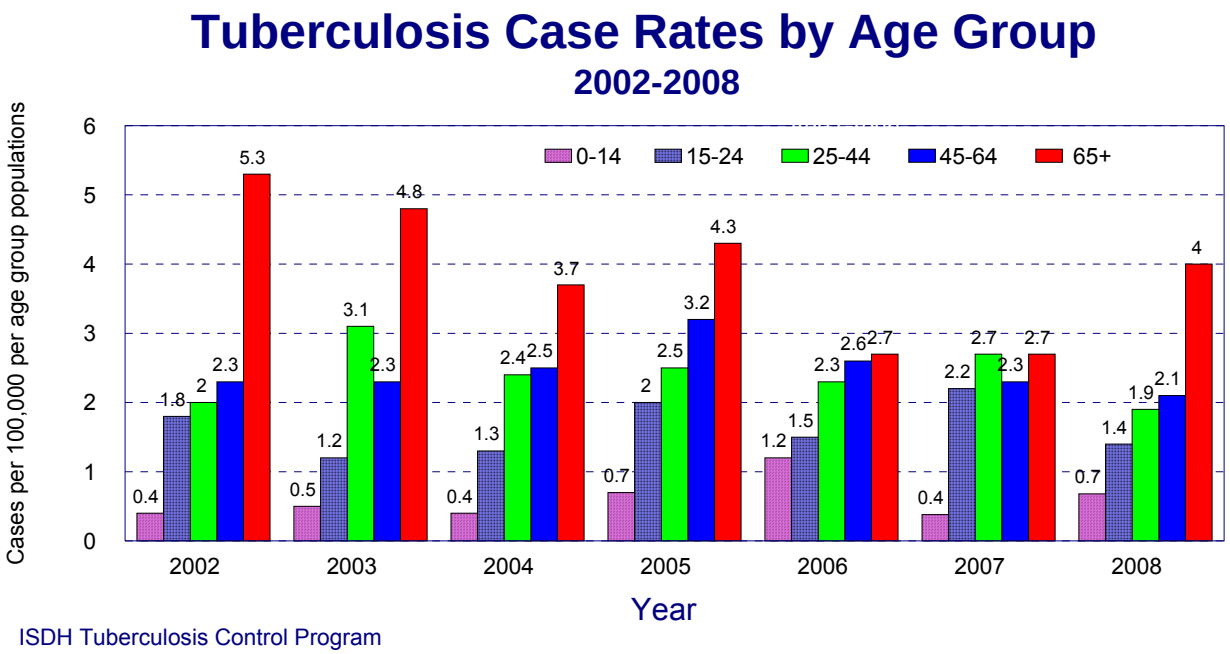
The number and percentages of 2008 reported cases by age group:

Age Group:	Numbers of new cases	Percentage of all new cases:
< 15 years	9	8
15-24 years	12	10
25-44 years	33	28
45-64 years	33	28
≥ 65 years	31	26

Case rates by age group are shown in Figure 8 on the next page.

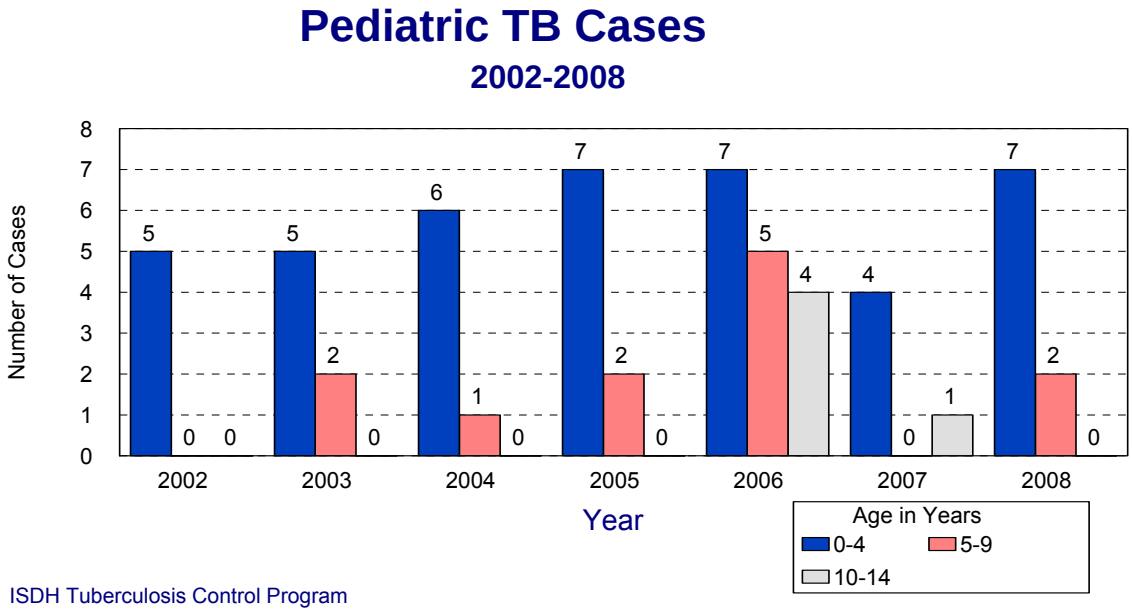
The age trend of our case rates revealed a decrease in the 15-24 years of age (23% in 2007 to 10% in 2008) and 45-64 years of age (34% to 28% respectively) with an increase in the ≥ 65 years (10% to 26% respectively.) The greatest percentage of cases continues to be in the 25-64 years age bracket.

Figure 8.



The numbers of pediatric cases by age group are shown in Figure 9. 2008 had an increase from four cases in 2007 to seven cases in 2008 for the 0-4 age group.

Figure 9.



HIV disease is the most significant risk factor for progression to active disease. The percentage of patients' who receive HIV Counseling and Testing according to age is shown in Table 1. The percentage of adult patients who were offered HIV testing remained the same, 89 (72%) in 2007 and 84 (72%) in 2008. The all adult percentage of patients who were reported to have refused testing also remained the same as the previous

year. The percentage of patients not offered HIV testing increased in 2008 to 15% from 13% in 2007 in the 25 – 44 year age group and from 22% to 23% in the all adult case category. HIV counseling and testing is recommended for all adult patients with TB or suspected of having TB.

Table 1.

HIV Counseling and Testing

Number and percent of adult patients reported in 2007 and 2008 offered HIV counseling and testing

Status	2007-Age Group 25-44 (N=47)	2007 All adult cases >=15 years of age (n=124)	2008-Age Group 25-44 (N=33)	2008 All adult cases >=15 years of age (n=109)
Tested, results known or pending	41 (87%)	89 (72%)	26 (79%)	79 (72%)
Patient refused	0	7 (6%)	2 (6%)	6 (6%)
Test not offered	6 (13%)	28 (22%)	5 (15%)	27 (23%)

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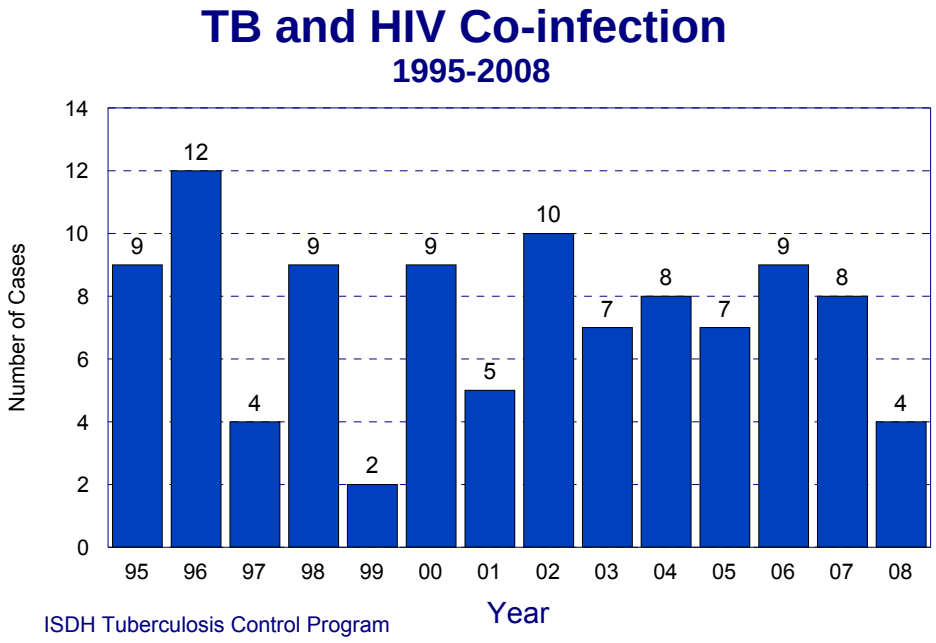
The number of cases co-infected with TB and HIV is shown in Figure 10.

Figure 10.



Other risk factors associated with TB exposure or 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 increase in the percentage of cases reporting non-injection drug use (from 9% in 2007 to 11% in 2008.). Other risk factors in Table 2 showed slight decreases over the previous year.

Table 2.

Reported Tuberculosis Cases in 2007 and 2008

with Selected Exposure and Medical Risk Factors*

(n=118)

Risk Factor	2008 Number of Cases	2008 Percent of Cases	2007 Number of Cases	2007 Percent of Cases
Excess alcohol use	27	23	34	26
Injection drug use	2	2	6	5
Non-injection drug use	13	11	12	9
Homelessness	8	7	10	8
Resident of long-term care facility	1	1	4	3
Resident of correctional facility	2	2	3	2

*at the time of diagnosis

Occupation is another variable tracked by the CDC. These data are shown in Table 3. The "not employed" category includes retired persons, children, and students. Not employed increased from 48% in 2007 to 61% in 2008. Of the known and reported occupations, cases with occupations has decreased from 65 (52%) in 2007 to 40 (34%) in 2008. This may also be reflective of the increase in cases age 65 and older.

Table 3.

Reported Tuberculosis Cases in 2008

by Selected Occupation*

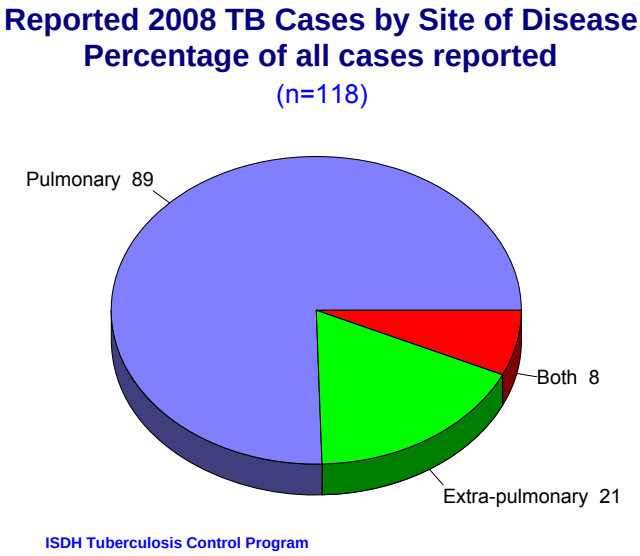
Occupation	Number of Cases	Percent of Cases
Not Employed In Last 2 Years	72	61
Other occupations	40	34
Migrant agricultural worker	0	0
Health care worker	4	4
Correctional facility employee	0	0

2008 (n=116)

* at the time of diagnosis

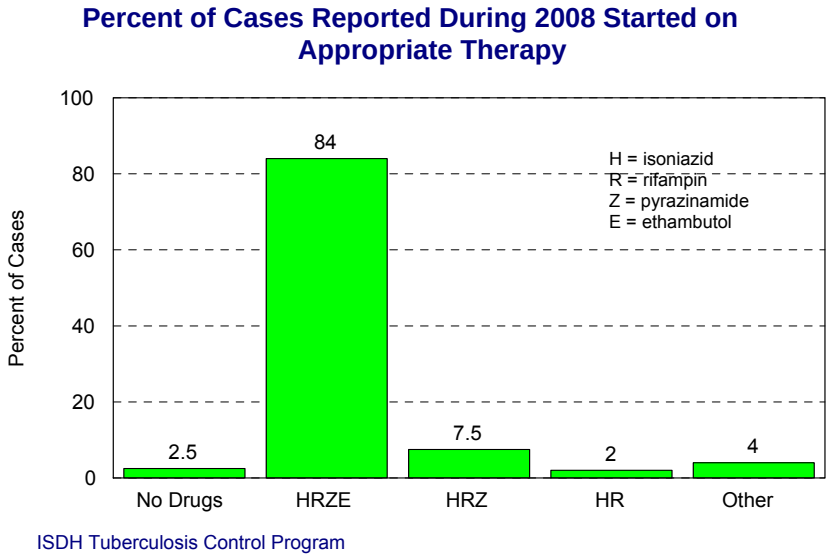
The number of TB cases classified by the site of disease is shown in Figure 11. An increase in both sites of disease was noticed in 2008 with an increase to 8% in 2008 from 3% in 2007.

Figure 11.



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 moved back to country of origin before treatment could be started.

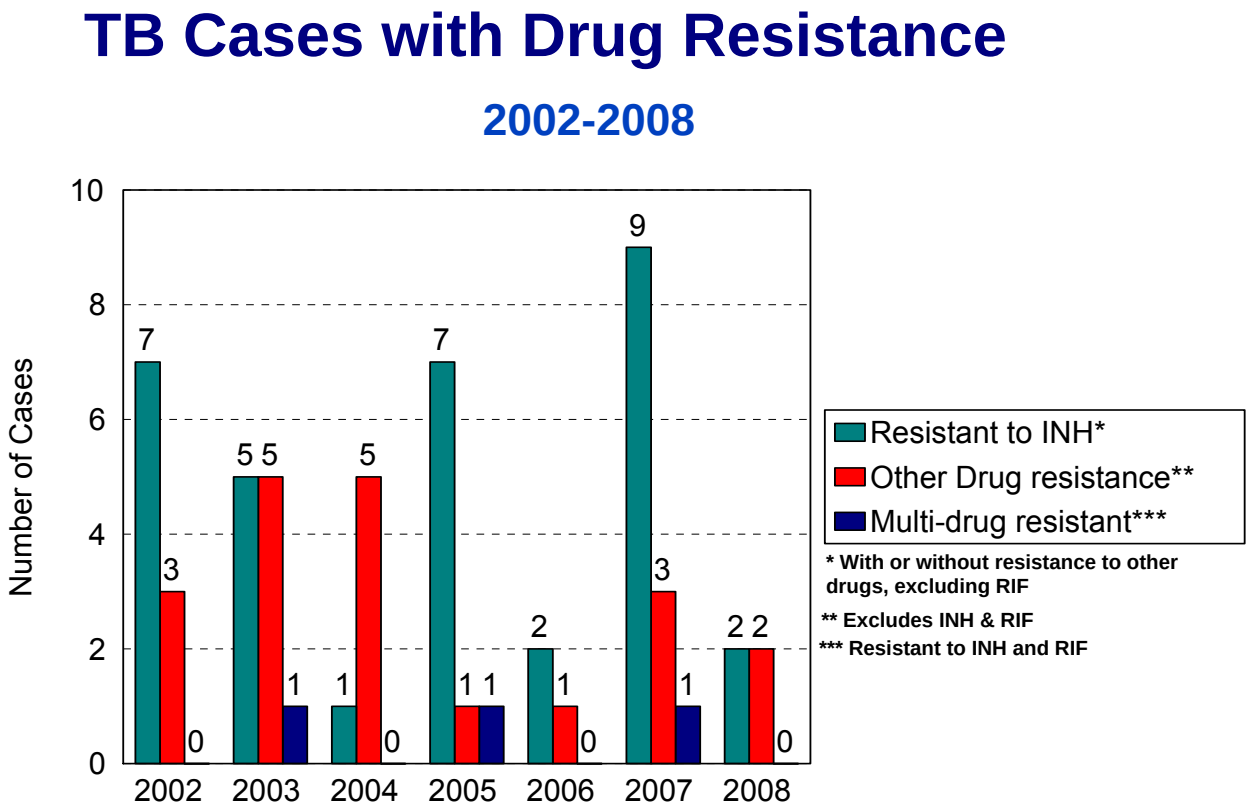
Figure 12.



Drug susceptibility testing is routinely performed on all culture-positive isolates. On rare occasions, such as with specimen contamination, drug susceptibility testing cannot always be performed.

Of the 97 culture positive cases reported during 2008, drug susceptibility testing was performed on 94 (97%) of the specimens submitted (three patients did not have a culture to perform susceptibilities.) Of these, a total of four persons were resistant to one, or more, of the four standard first line medications. This is a decrease over 2007 which had 13 resistant cases. Two cases were resistant to at least INH; one of these was resistant to INH only; two persons were resistant to streptomycin only.

Figure 13.



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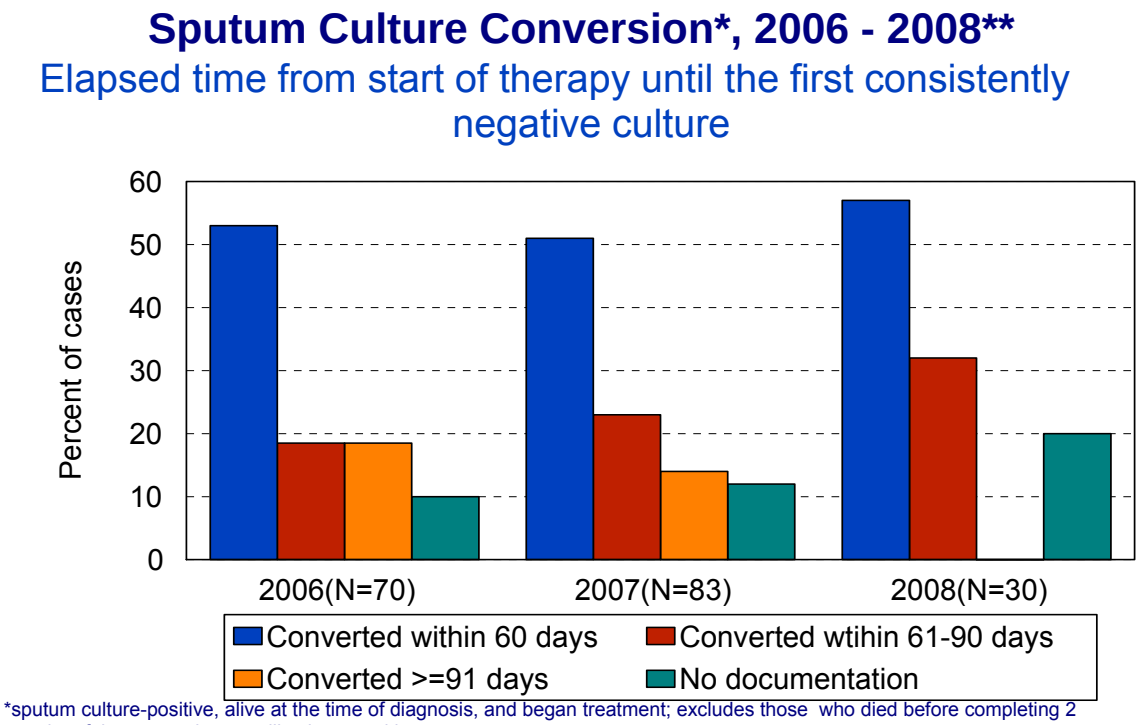
Besides drug resistance, inadequate response to therapy and failure to follow the treatment regimen are the major reasons for having to extend the treatment period. Sputum culture conversion data are collected to measure response to therapy. The absence of documentation of culture conversion is most 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.

Figure 14.



*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
**2008 only includes six months of data

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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 2007 is the most recent period with complete DOT data and 2008 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. 2007 denominator is a reflection of those exclusions. Previous year's denominator excluded cases that were dead at diagnosis, died before completing treatment, never started medications, had multi drug resistance and allergic reactions to the medications. Therapy is considered to be incomplete for those patients who were reported as moved, uncooperative or refused, or lost to follow-up. The current data are for those patients in cohort year 2007.

Figure 15.

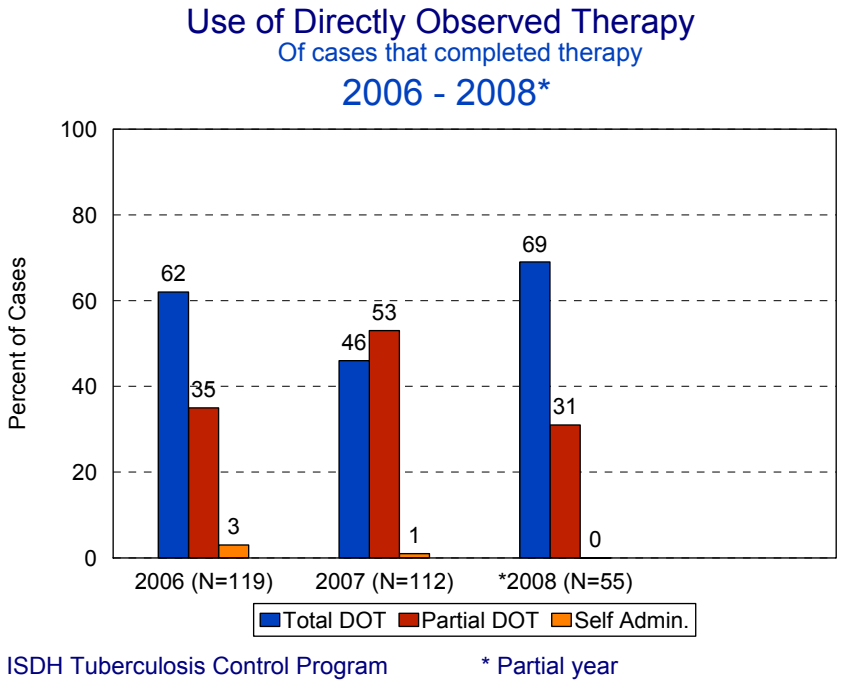


Figure 16 shows the percentage of patients who completed therapy in one year or less, and the total completion rate for all patients.

Figure 16.

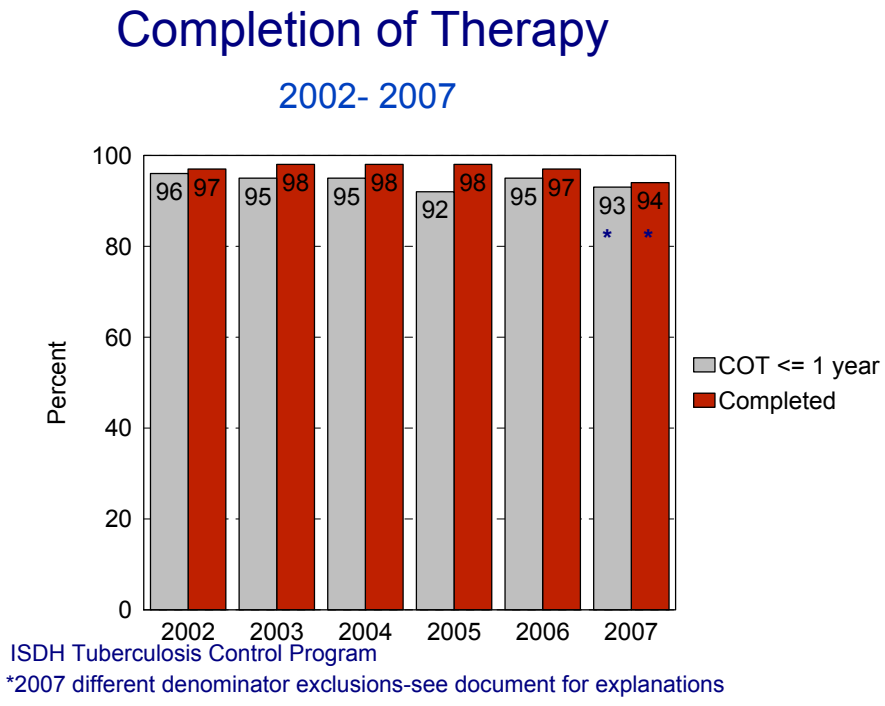


Figure 17 shows the counties that reported 5 or more cases of TB in 2008. The total number for the state is based on persons (1) whose primary residence was in Indiana at the time of diagnosis, and (2) who were verified as having TB disease in a given year. Persons counted in another state and immigrants 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 number of cases per county for a five year period from 2004-2008.

Figure 17.

2008 Indiana Reported TB Cases by County

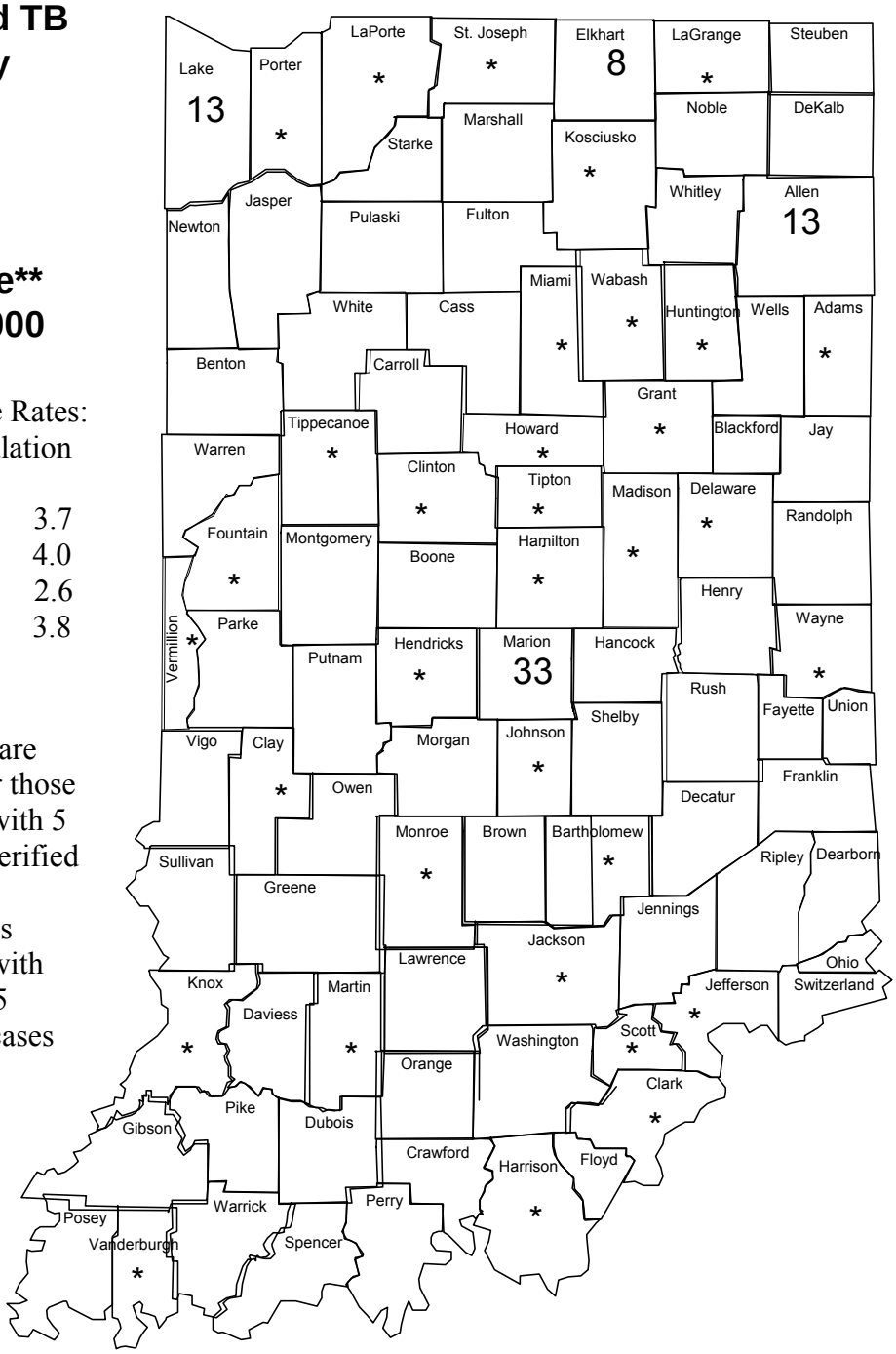
N=118

Case rate
1.9:100,000

Crude Case Rates:
(2007 population estimates)

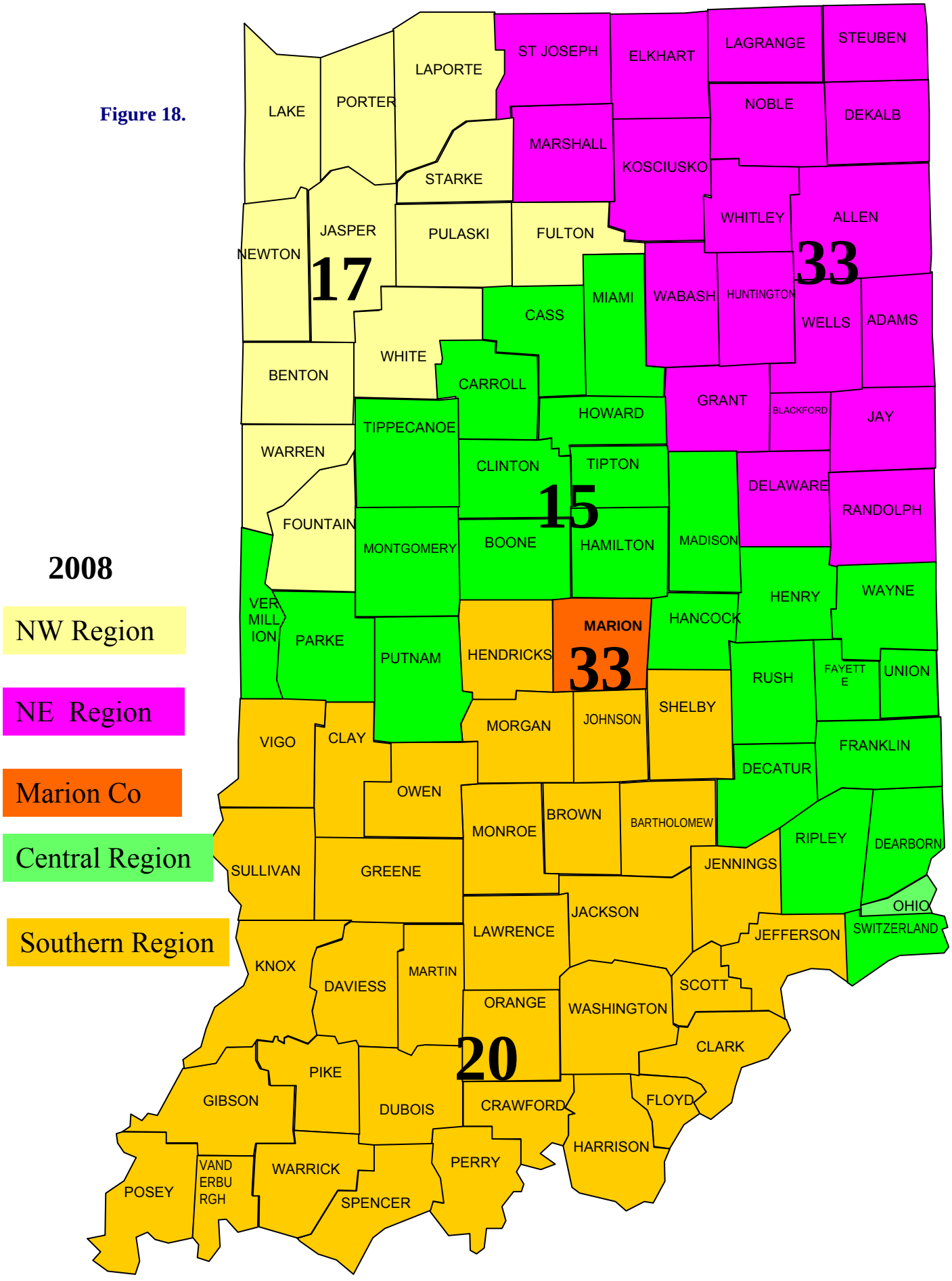
Allen Co	3.7
Elkhart Co	4.0
Lake Co	2.6
Marion Co	3.8

Numbers are shown for those counties with 5 or more verified cases.
* Indicates counties with less than 5 reported cases



** Case rate based on 2008 population

Figure 18.


2008
NW Region
NE Region
Marion Co
Central Region
Southern Region
LAKE
PORTER
LAPORTE
ST JOSEPH
ELKHART
LAGRANGE
STEUBEN
NOBLE
DEKALB
MARSHALL
KOSCIUSKO
STARKE
WHITLEY
ALLEN
JASPER
PULASKI
FULTON
NEWTON
17
33
MIAMI
WABASH
HUNTINGTON
WELLS
ADAMS
CASS
WHITE
BENTON
CARROLL
GRANT
BLACKFORD
JAY
HOWARD
TIPPECANOE
WARREN
CLINTON
TIPTON
DELAWARE
RANDOLPH
15
FOUNTAIN
MONTGOMERY
BOONE
HAMILTON
MADISON
HENRY
WAYNE
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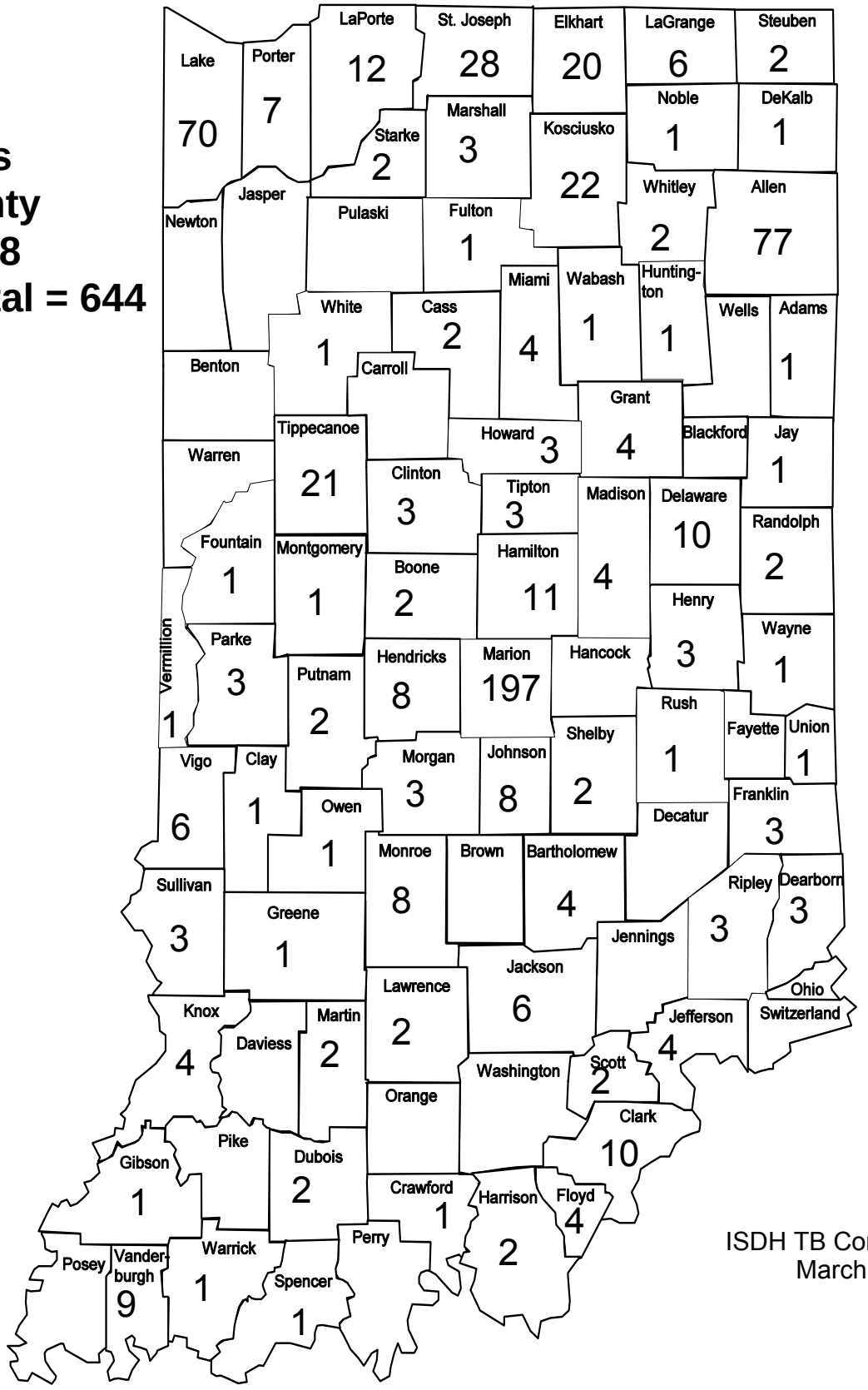
PARKE
PUTNAM
HENDRICKS
MARION
33
HANCOCK
RUSH
FAYETT
E
UNION
SHELBY
VIGO
CLAY
MORGAN
JOHNSON
FRANKLIN
DECATUR
OWEN
BROWN
BARTHOLOMEW
RIPLEY
DEARBORN
MONROE
JENNINGS
SULLIVAN
GREENE
JACKSON
OHIO
SWITZERLAND
LAWRENCE
JEFFERSON
KNOX
DAVIESS
MARTIN
SCOTT
ORANGE
WASHINGTON
CLARK
20
PIKE
GIBSON
DUBOIS
CRAWFORD
FLOYD
HARRISON
VAND
ERBU
RGH
WARRICK
PERRY
POSEY
SPENCER

Figure 19

TB Cases per County 2004-2008 State Total = 644



ISDH TB Control Program
March 2008