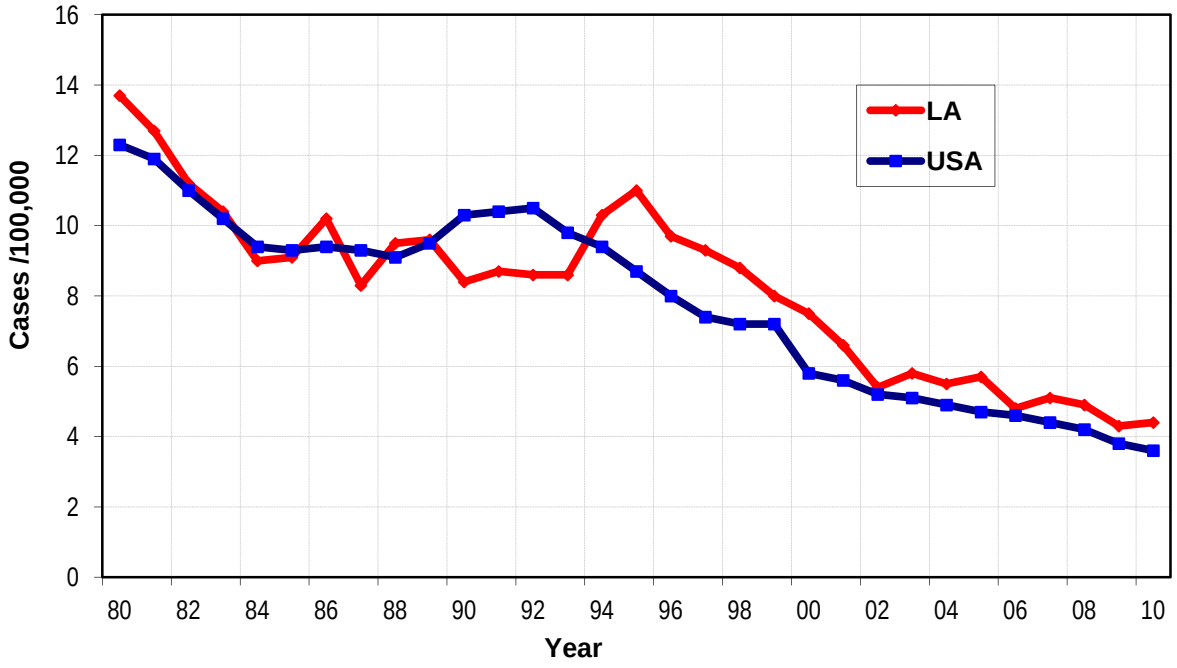
Tuberculosis

Tuberculosis is a Class B Disease and must be reported to the state within one business day.

Tuberculosis (TB), which is caused by infection with a member of the *Mycobacterium tuberculosis* complex, is a major cause of disability and death in many parts of the world. The incidence (newly reported cases) of tuberculosis in Louisiana is close to the average incidence in the United States. As in the U.S., incidence has decreased steadily, with a short interruption in the decrease between 1994 and 1996 and in 2005. (Figure 1)

Figure 1: Tuberculosis incidence rates - Louisiana and the U.S., 1980-2010

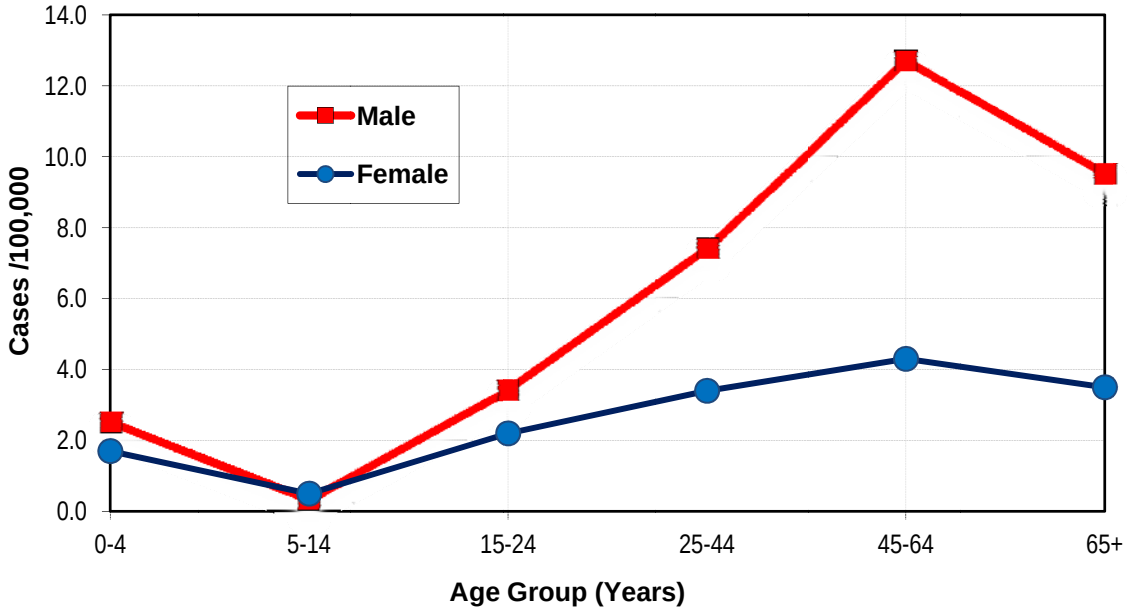


The most striking feature of tuberculosis epidemiology in Louisiana is the vast disparity in tuberculosis incidence within gender, ethnic group and geography.

Age and Sex

The incidence of TB is low until young adulthood and then it increases steeply. In older age groups the incidence of TB is much higher among males than among females (Figure 2). Such a pattern is found throughout the world. The disparity between males and females has been decreasing progressively in the past 20 years.

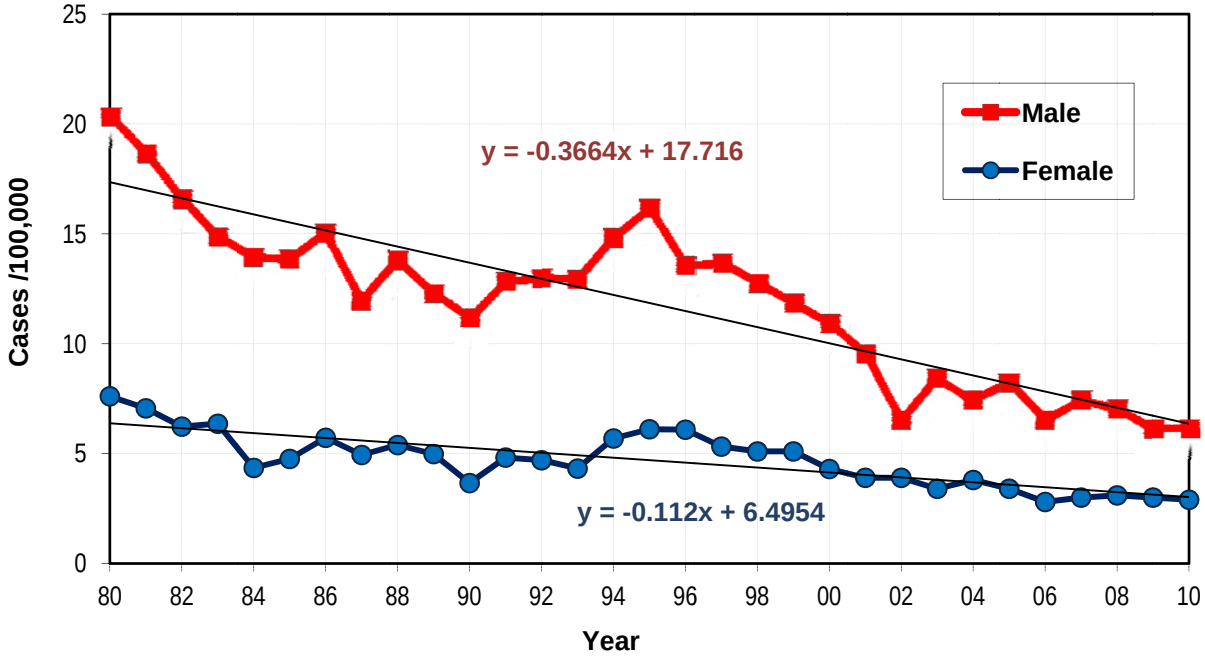
Figure 2: Tuberculosis average annual incidence rates by gender and age
Louisiana, 2006-2010



Trends by Sex

The decrease in incidence has been sharper in males than in females (Figure 3).

Figure 3: Tuberculosis average annual incidence rates by gender – Louisiana, 1980-2010



Trends by Age Group: The Cohort Effect

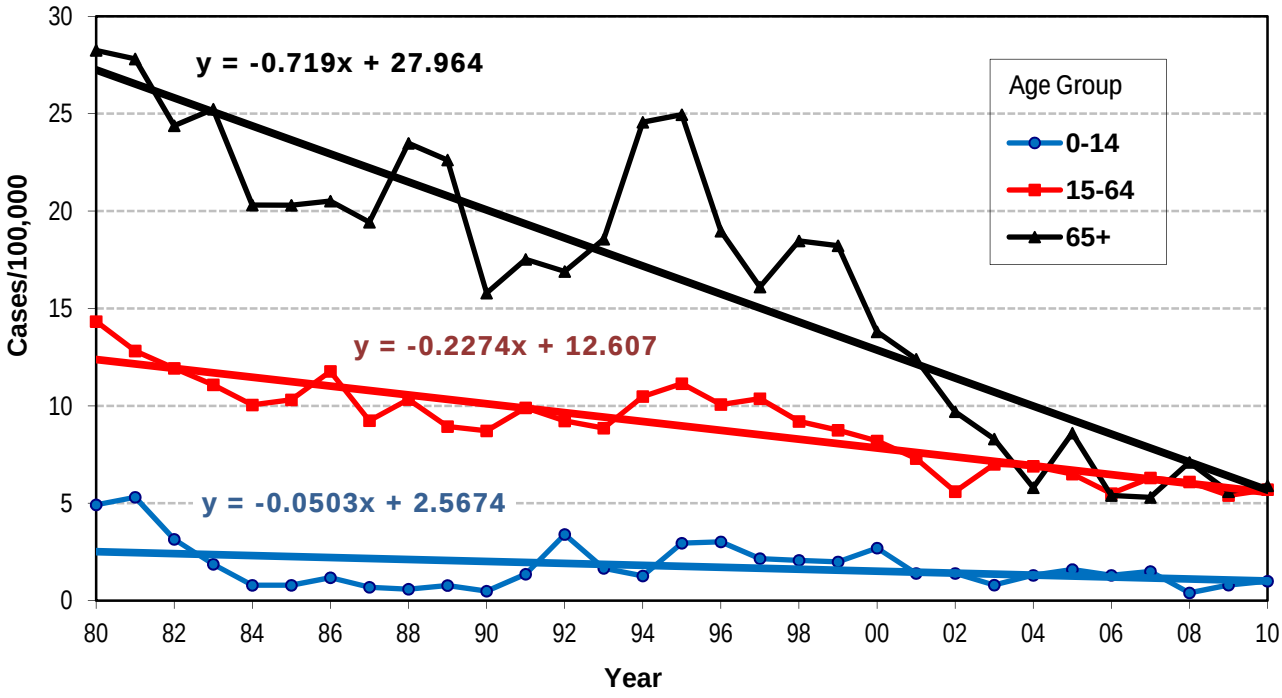
While the overall incidence of TB has been decreasing steadily, the decline can be seen more in the older age group (65 and older) for the following reason.

- From 1980 to 1989: the people in the age group 65+ were young adults during the 1920s, at a times when TB transmission was intense and when the proportion of TB infection was about 30% to 50%.

- On the other hand from 2000 to 2009, the people in the age group 65+ were young adults in the 1940s when the proportion of TB infection was about 20%.

-As these older generations pass away, newer generations of 65+ have lived at a time when TB infection was much less prevalent. Those that are 20 years old now have a proportion of TB infection of 5% or less. When they get older, they will not be a large reservoir of TB infections. (Figure 4)

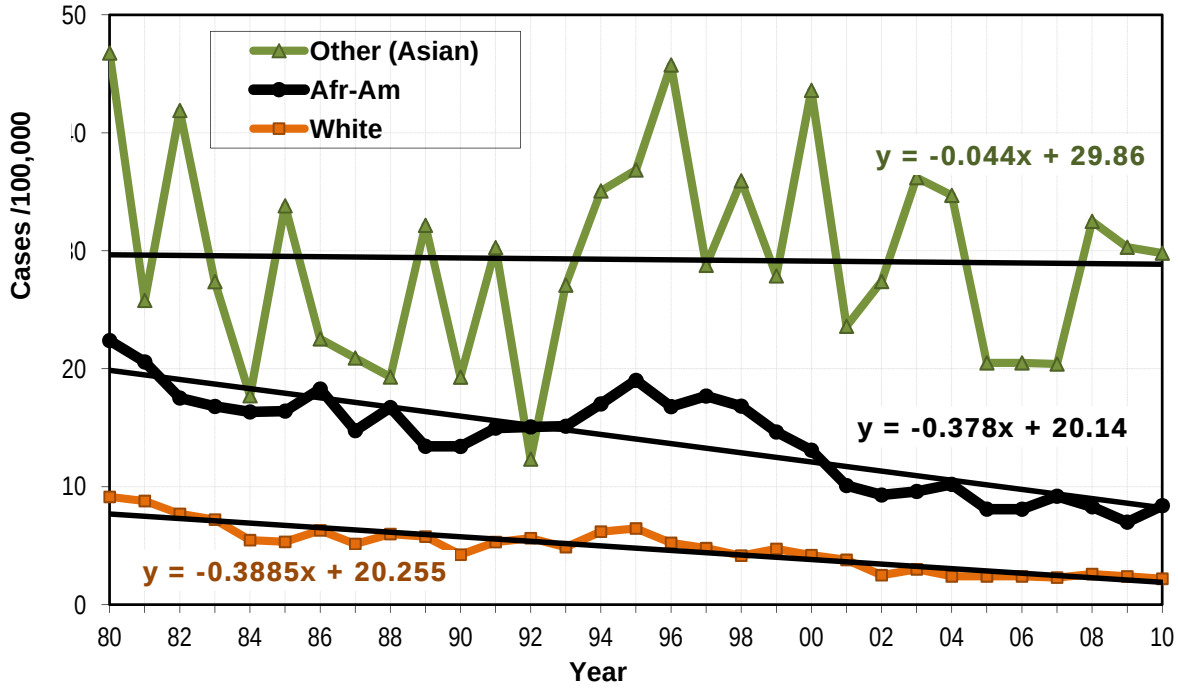
Figure 4: Tuberculosis annual incidence rates by age group by year – Louisiana, 1980-2009



Ethnic Group

The ethnic group distribution shows a decline in all age groups, particularly steeper among African-Americans. The incidence among Asians and other groups shows erratic fluctuations explained by a low population as a denominator in the rate calculation. (Figure 5)

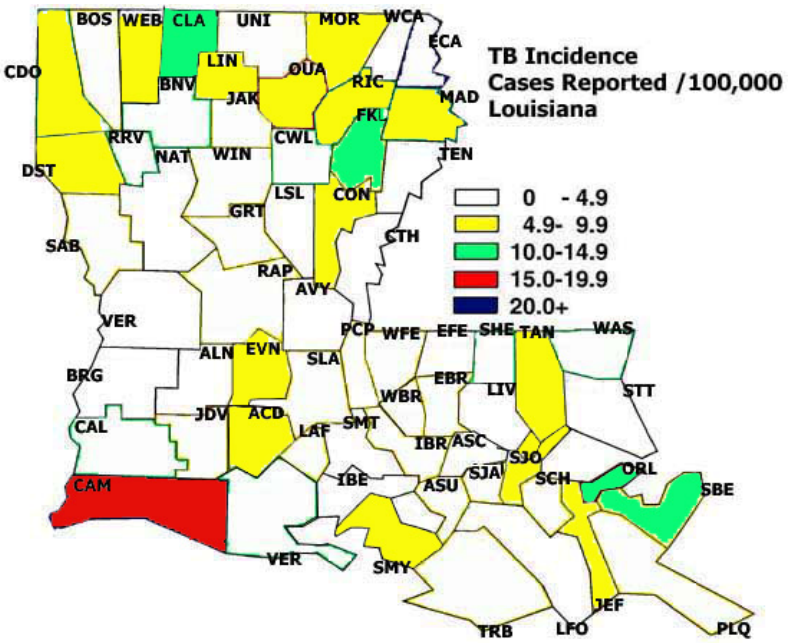
Figure 5: Tuberculosis annual incidence rates by ethnic group – Louisiana, 1980-2009



Geographical distribution

A geographical distribution of TB by parish shows low rates throughout the state in 2010. A few parishes show higher rates: these are parishes with very low population where just a case or two, create a high rate. For example, a single case in a parish of 6,000 persons shows as a rate of 16.7 /100,000 population (much higher than usually seen in Louisiana)(Figure 6).

Figure 6: Tuberculosis annual incidence rate – Louisiana, 2010



The map of five years averages 2000-2004 and 2005-2009 shows a decrease of rates throughout the entire state (Figure 7 and 8).

Figure 7: Tuberculosis annual incidence rates – Louisiana, 2000-2004

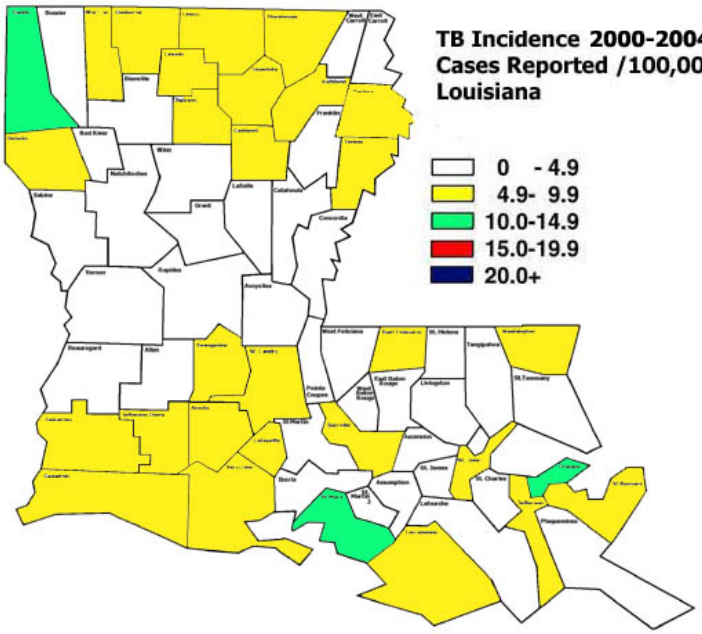
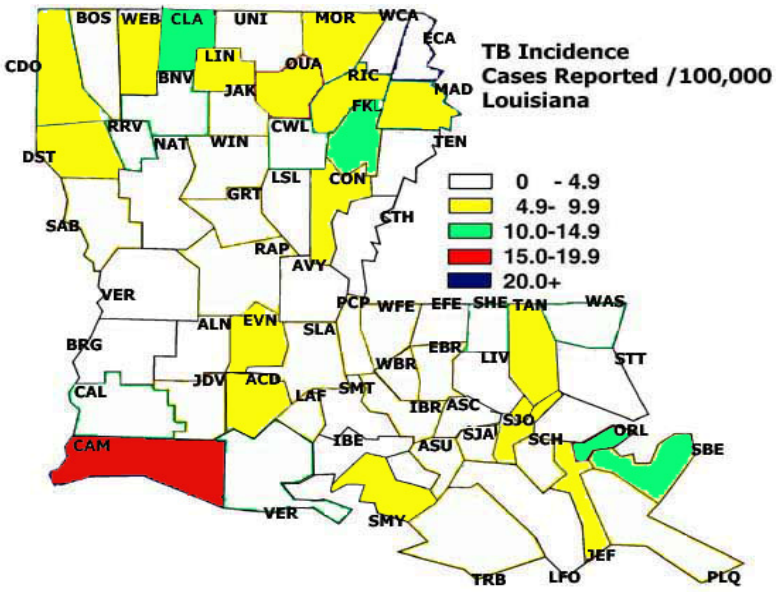


Figure 8: Tuberculosis annual incidence rates – Louisiana, 2005-2009



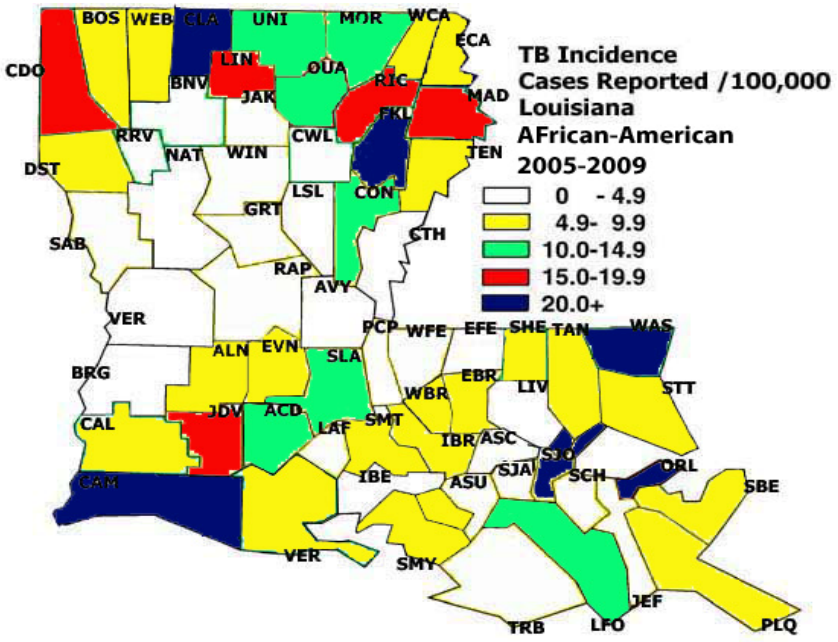
The distribution for Whites shows very low rates in most parishes except for:

- Higher rate in Orleans parish, partly due to a concentration of population with high risk factors (homeless, HIV infection, older adult alcoholic males, drug abuse)
- Higher rates in a few parishes, resulting from small clusters of cases - mostly family centered.

Race

The map for African-Americans shows a picture somewhat different than that for Whites, with higher rates in several parishes. High rates are seen in some small parishes with small populations. (Figure 9)

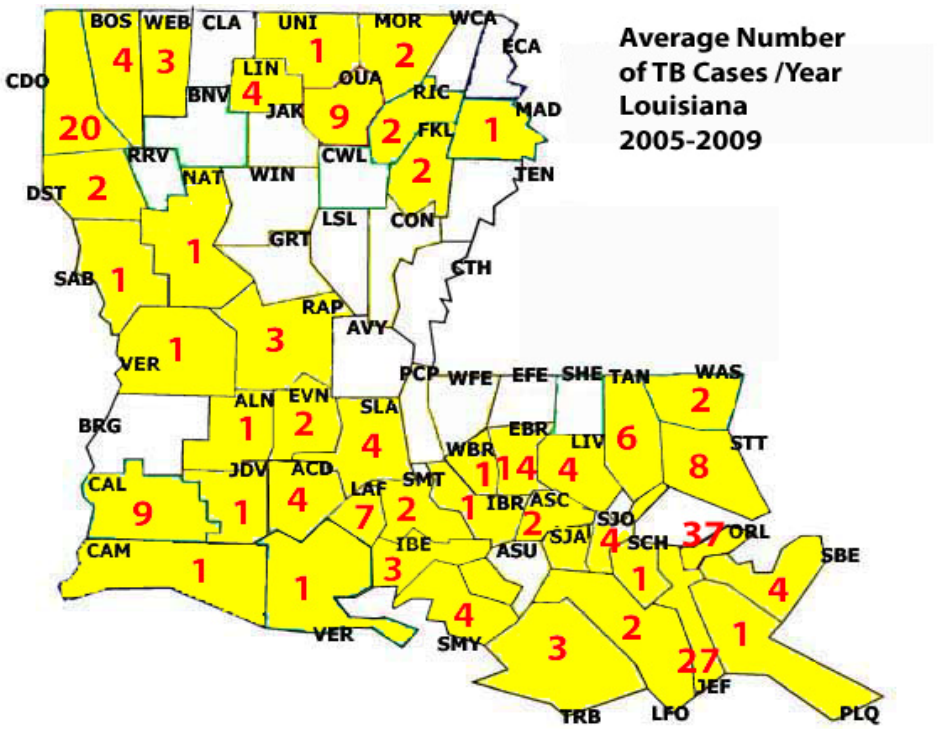
Figure 9: Tuberculosis annual incidence rates among African-Americans –Louisiana, 2005-2009



The incidence map for African-Americans shows some higher rates is specific parishes with high instability from year to year.

Incidence maps do not necessarily represent the case load carried by the TB Surveillance Program staff. Case loads are, in fact, more concentrated than is indicated by the incidence on the map because half of the cases come from six parishes (115 out of 218 cases for the period 2005-2009) (Figure 10). As expected, high case loads are found mostly in the cities, with 30% of cases in Orleans and Jefferson parishes.

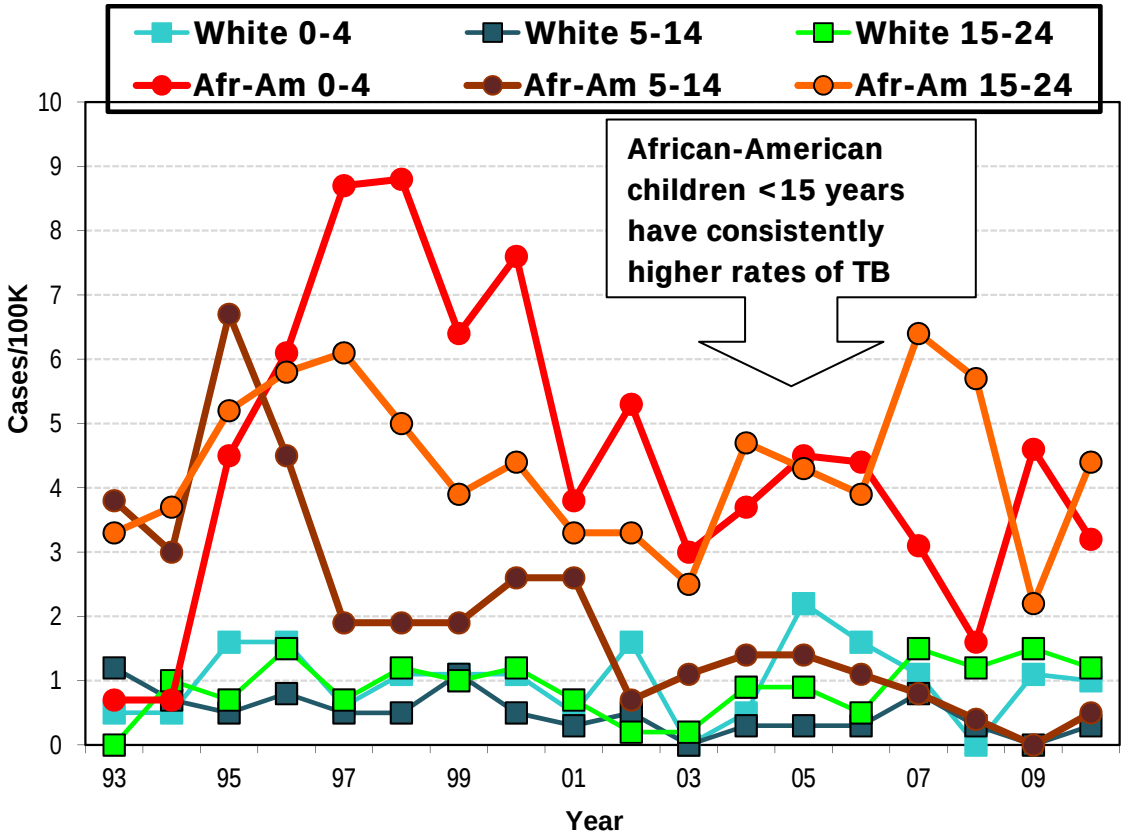
Figure 10: Average number of TB cases by Parish - Louisiana, 2005-2009



Ethnic Group and Age

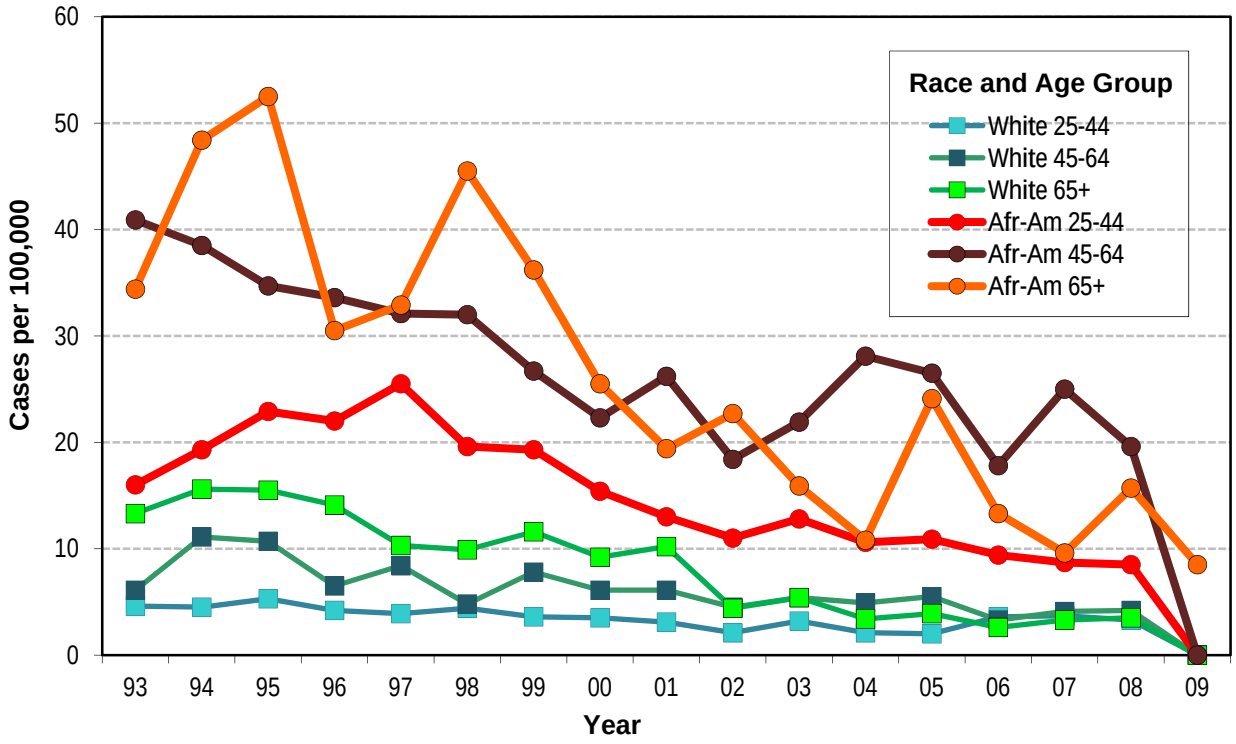
A comparison of incidence by age and ethnic groups shows even more important disparities between Whites and African-Americans, particularly for children less than 15 (Figure 11). Continuous efforts are necessary to prevent TB transmission in this age and ethnic group.

Figure 11: Tuberculosis annual incidence rates for African-American specific age groups (in years) - Louisiana, 1993-2010



Adult African-Americans also had higher rates in the past but in recent times their rates are decreasing to become similar to Whites. Transmission of TB has been decreasing since the late 1880s due to improvements in socio-economic conditions. The improvements in housing conditions, access to medical care and better alimentation were responsible for the early declines. In the 1950s, the first effective drugs against TB became available and thus incidence rates for TB were driven lower. The rates from African-Americans lagged behind for a while but are now catching up with the low rates observed in Whites (Figure12).

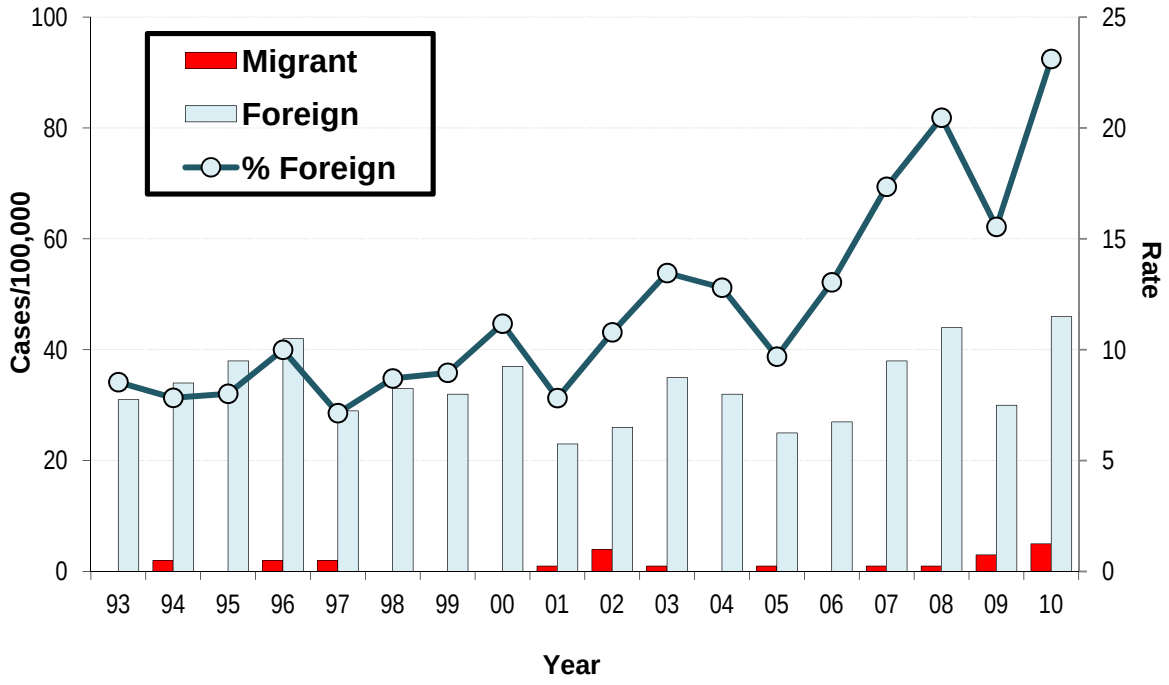
Figure 12: Tuberculosis annual incidence rates for African-American specific age groups (in years) - Louisiana, 1993-2009



Foreign-Born

Louisiana still has relatively high TB incidence rates among the indigenous population. Cases reported from people born outside of the U.S. represent only a small fraction (5% to 13%) of the total cases reported in the state. (Figure 13)

Figure 13: Tuberculosis cases and incidence rates for the foreign-born - Louisiana, 1993-2010

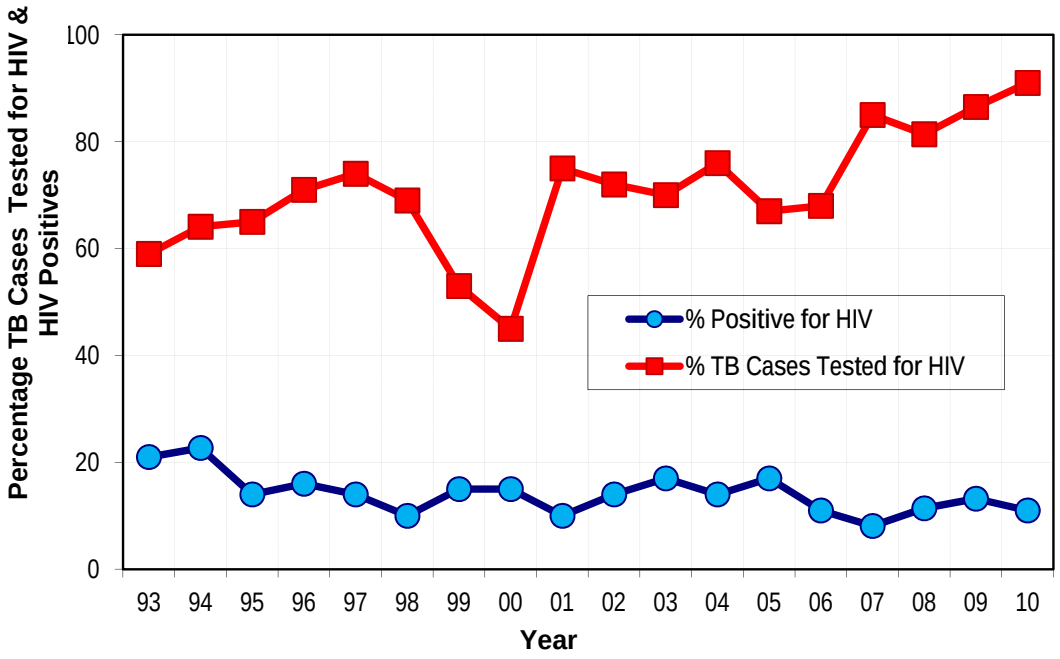


The largest group of foreign-born TB cases in Louisiana is among the Vietnamese population (32% since 1993). The second largest group is from Latin America: Mexicans 9.4%; Hondurenians 7.1%; other Latin Americans 5.7%. Indians, Pakistanis and Filipinos are among the other contributors. Most foreign-born cases reside in the large cities (New Orleans, Jefferson, Baton Rouge and Shreveport – 52%), and in the Lafayette area (11%) where large numbers of Vietnamese have settled.

Co-Infection

HIV infection is present among 15% of new TB cases. Most co-infected cases occur among men (83% of all cases), with males 25 to 44 years of age representing 56% of co-infection cases and males 45 to 64 years of age representing 26% (Figure 14)

Figure 14: Proportion of TB cases tested for HIV and proportion of HIV positives
Louisiana, 1993-2010

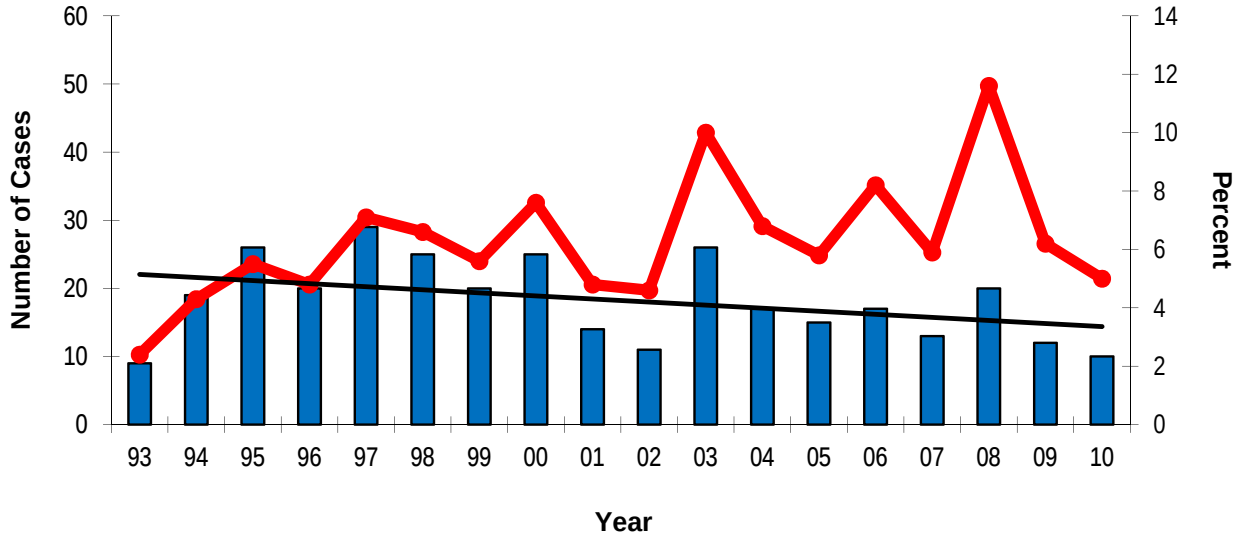


Most co-infection cases are concentrated in the New Orleans (50%) Jefferson, Baton Rouge, Monroe and Shreveport (25%). A few co-infections may have been missed, since testing among TB cases is not complete. Overall, 75% of TB cases are tested. The proportion of cases tested is 84% among males 15 to 44 years old, 85% among males 45years old and over, 100% among females 15 to 44 years old, and 61% among females 45 years old and over.

Other risk factors

The proportion of **homeless** cases ranged from two percent to eight percent from 1993 to the present with a slightly downward trend. Most homeless cases are in Orleans parish (53% of all cases) (Figure 15).

Figure 15: Proportion of Homeless among TB cases - Louisiana, 1993-2010



Other risk factors are:

- Incarceration (around 5%) with highest numbers in local jails followed by state prison
- Residence in long term care facilities (around 5%) with nursing homes being the most frequent
- Alcoholism 22%
- Injectable drug use 6%
- Non-injectable drug use 21%

Clinical picture (1993 to present)

The majority (85%) of cases are pulmonary. Among the extra pulmonary cases, the most common are pleural (3.6% of all TB cases), and lymphatic (4.0%), followed by other locations (genito-urinary, bone and joint, meningeal, peritoneal and miliary), each in the range of 1 to 2%.

About 50% of pulmonary cases are confirmed by a positive sputum smear and culture. These are the most infectious cases, responsible for the majority of tuberculosis transmission. An additional 20% of pulmonary cases have a negative sputum smear, but a positive culture. Finally, an additional 10% percent who do not produce sputum naturally, are culture positive on a specimen obtained from sputum induction or bronchial lavage. In total, 80% of all pulmonary tuberculosis cases are bacteriologically confirmed, which meets the accepted standard.

Some cases confirmed by bronchial lavage had no result for natural or induced sputum. (It is important to stress that the recommended approach to diagnose active pulmonary tuberculosis in

a patient who does not produce natural sputum is to perform sputum induction before bronchoscopy and bronchial lavage.)

Seventy percent of extra-pulmonary tuberculosis is confirmed bacteriologically.

Treatment Regimen, Sensitivity to Antibiotics and Response to Treatment

Almost 90% percent of cases now are started on the standard treatment regimen of INH, rifampin, PZA and ethambutol. An additional 3% percent are started on INH, rifampin and PZA, 2% do not get ethambutol, 2% do not get PZA and only 2% are treated with INH and rifampin only. Most of the cases that do not use ethambutol are among children because pediatricians are often reluctant to prescribe ethambutol for young children. Other regimens are only used when intolerance or resistance are present. Overall the treatment regimens are adequate.

Presently, primary resistance to anti-tuberculosis agents is not a major problem, but development of resistance needs to be monitored carefully. Primary resistance to INH is at 4%, (varying from year to year from 2% to 6%). Above the four percent threshold, the use of the four drugs (INH, RIF, PZA, EMB) is preferred over the use of only the first three drugs (INH, RIF, PZA). Resistance to INH and rifampin (commonly named MDR or multi-drug–resistant) is still rare (0 to 1 case per year).

Acquired resistance is rare: in Louisiana over the past eight years among patients who were sensitive to all drugs at onset of treatment, five cases acquired resistance to INH, two to rifampin, one to INH/rifampin and one to INH/rifampin/ PZA. Among those who were resistant to rifampin at onset of treatment, two developed INH resistance. This remarkably low development of resistance during treatment is probably the result of close monitoring of cases and directly observed therapy.

Reason to Stop Treatment

Reasons to stop treatment are displayed in Table 1. About 75% of cases complete their treatment. Only about 19% are not accounted for at the end of treatment. The data for 2010 is currently incomplete.

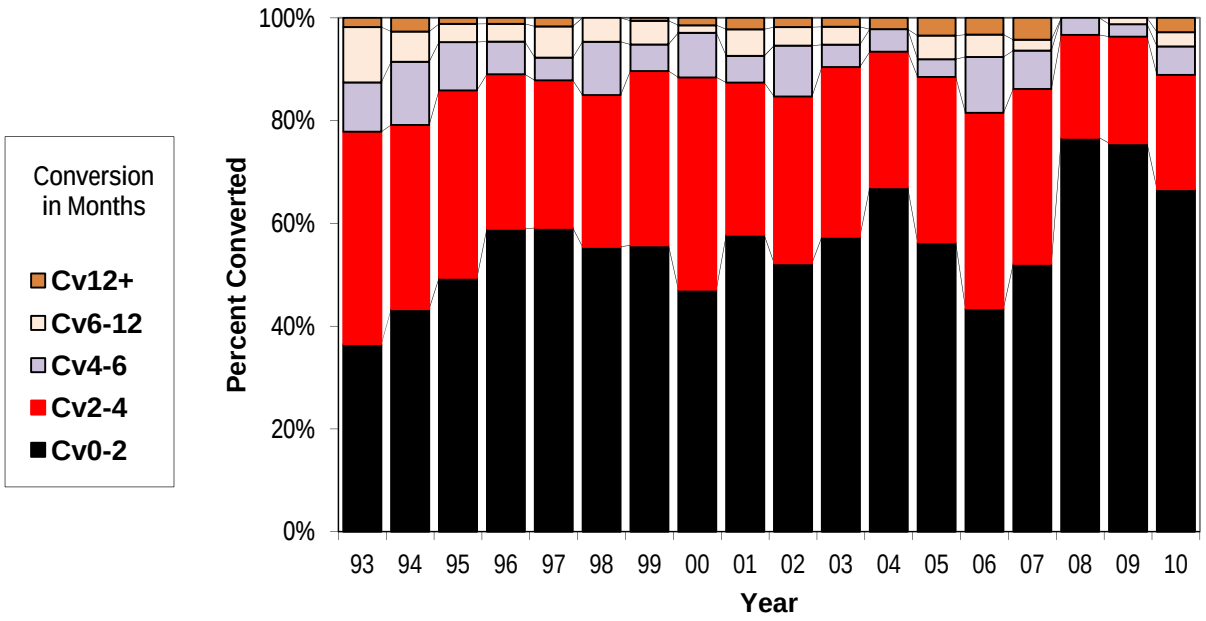
Table 1: Reasons to Stop Treatment – Louisiana, 1993-2010

Reason Stop	9399	0004	0509	10	9399	0004	0509	10
Cases	2850	1365	1092	199	Percent			
Completed	2013	1084	832	87	70.6	79.4	76.2	43.7
Died	270	91	77	10	9.5	6.7	7.1	5.0
Lost/Moved	196	71	57	5	6.9	5.2	5.2	2.5
Other	39	25	12	3	1.4	1.8	1.1	1.5
Refused	28	8	7	2	1.0	0.6	0.6	1.0
Unknown	304	86	107	92	10.7	6.3	9.8	46.2

Sputum conversion

Sputum conversion is the best indicator of the effectiveness of a TB control program since the main source of infection are those who have pulmonary TB and TB bacilli cultured from their sputum. Sputum conversion evaluates how well a program reduces the primary source of TB bacilli in the community. The ideal is a sputum conversion of 85% at two months of treatment. Since the conversion is sometimes documented a few weeks later than exactly two months, it is more accurate to estimate the sputum conversion at four months, when all of the follow-up cultures are done and the results are in. The four-month sputum conversion easily meets the criteria for an effective program (Figure 16).

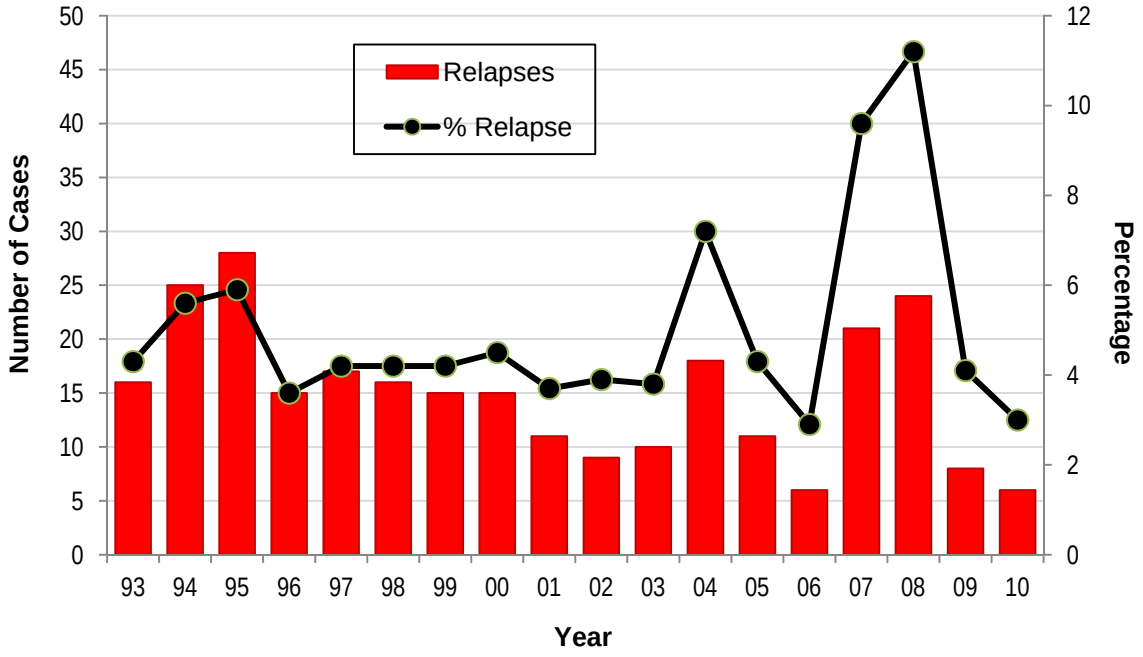
Figure 16: Sputum conversion - Louisiana, 1993-2010



Relapses

The number of relapses ranges from 10 to 25 per year with a mean of 16; the proportion is approximately 5% with some variations from year-to-year but no significant trend. The delay between relapse and original case ranges from one year to ten or more years without concentration in any year. Most relapses occur among U.S. born cases (mean number = 14/year) rather than among foreign-born (mean number = 1/year). Most TB bacilli-causing relapses are still sensitive to all standard anti-TB drugs with about one relapse per year due to resistant bacilli (Figure 17).

Figure 17: Proportion of relapses – Louisiana, 1993-2010

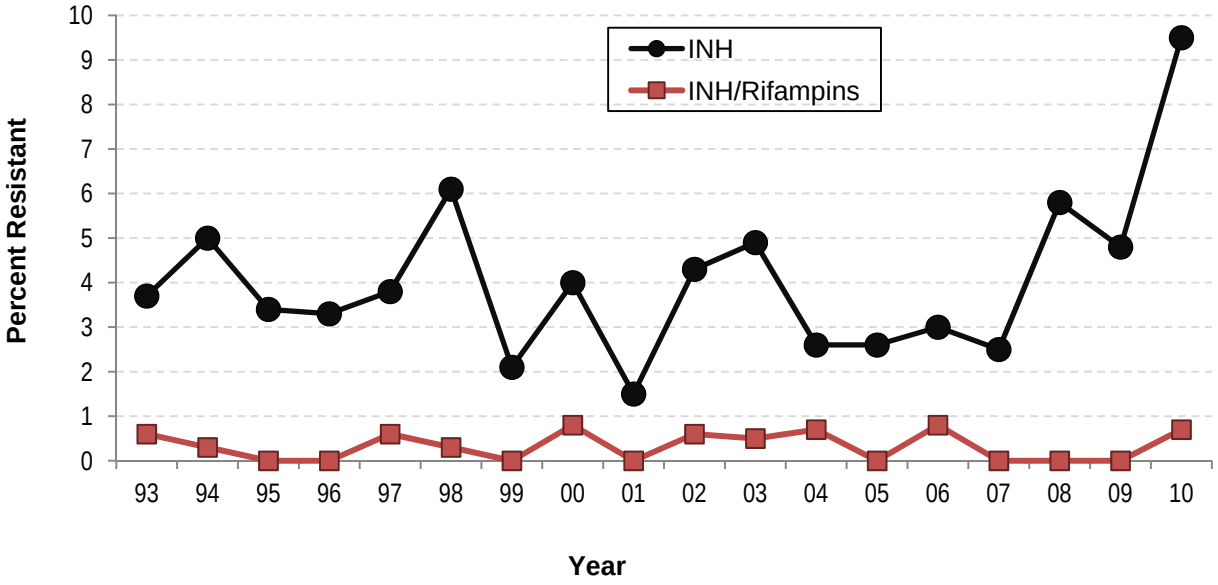


Resistance to Anti-TB Drugs

Acquired resistance to anti-TB drugs is rare: over the past 18 years, resistance has occurred only in nine years. There were ten cases of INH resistance and three cases of INH/Rifampin resistance.

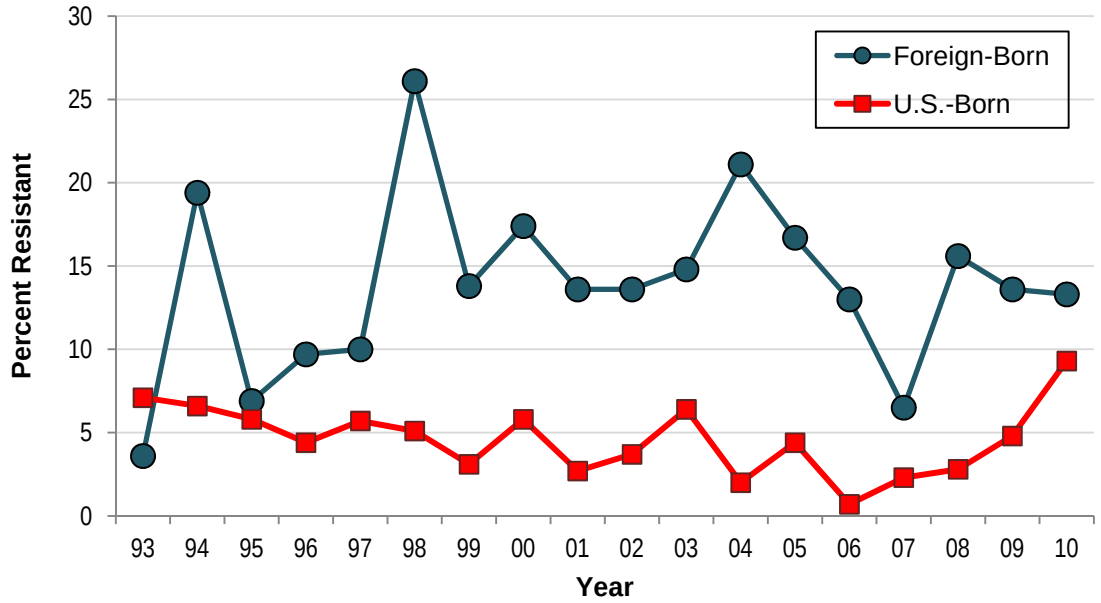
Overall resistance to INH seems to have increased in the past few years, starting in 2007. Since there has been some peaks and troughs in the past, a few more years of observation are necessary to decide whether this trend will prove real. Resistance to both INH and Rifampin is still sporadic (Figure 18).

Figure 18: Resistance to INH alone and INH/Rifampins – Louisiana, 1993-2010



Resistance among the foreign-born is consistently higher than in U.S. born cases. However, since 2006 the proportion of resistance among U.S. born cases has been increasing (Figure 19).

Figure 19: Resistance to INH among U.S. and foreign-born cases - Louisiana, 1993-2010



Detection of Infections

The TB control program has examined from 3,000 to 6,000 individuals per year to determine if they were infected with TB, the vast majority among contacts of active TB cases (Table 2).

Table 2: Number of individuals examined for TB infection - Louisiana, 1993-2010

Year	All	Administrative	Associate	Converter	Contact	Job	Medical Risk Factor	Population	Suspect	Volunteer	Unspecified
1998	5,343	98	0	5	1,343	0	4	22	108	0	3,763
1999	5,526	173	0	1	1,402	0	1	21	109	0	3,819
2000	4,708	210	2	12	1,106	3	2	55	203	0	3,115
2001	4,496	181	1	69	1,338	10	31	147	196	2	2,521
2002	5,504	446	7	93	1,981	24	67	268	305	14	2,299
2003	6,607	438	30	40	3,513	12	36	209	490	15	1,824
2004	5,414	419	21	11	2,581	16	20	241	560	18	1,527
2005	4,418	351	17	31	1,769	23	12	214	608	3	1,390
2006	4,238	325	17	54	1,634	0	15	284	583	1	1,325
2007	5,065	401	7	111	2,154	0	27	383	427	4	1,551
2008	5,002	462	16	132	2,159	0	46	292	374	5	1,516
2009	3,973	397	8	189	1,248	0	84	305	350	5	1,387
2010	4,631	741	14	212	1,349	0	96	571	406	0	1,242

Disposition of Contacts

The disposition of contacts is presented in Table 3.

Table 3: Disposition of Contacts - Louisiana, 1993-2010

Year	All TB	Pulm Smear/Culture Pos	Contact	Contact /Case	Not Evaluated	% Evaluated	Examined	Not Infected	% Not Infected	Converted	% Converted	Disease New	Disease Old	Infected	% Infected
1998	380	**170**	1,344	3.5	32	97.6	1,312	683	52.1	19	1.4	3	1	606	46.2
1999	357	**137**	1,402	3.9	33	97.6	1,369	686	50.1	13	0.9	0	1	669	48.9
2000	331	**129**	1,107	3.3	46	95.8	1,061	572	53.9	12	1.1	9	0	468	44.1
2001	294	**129**	1,339	4.6	113	91.6	1,226	652	53.2	35	2.9	6	2	531	43.3
2002	230	**102**	1,983	8.6	323	83.7	1,660	1,097	66.1	25	1.5	5	1	532	32.0
2003	260	**112**	3,515	13.5	346	90.2	3,169	1,913	60.4	85	2.7	11	9	1151	36.3
2004	250	**103**	2,587	10.3	234	91.0	2,353	1,550	65.9	37	1.6	5	8	753	32.0
2005	258	**122**	1,775	6.9	99	94.4	1,676	1,010	60.3	41	2.4	8	7	610	36.4
2006	207	**89**	1,645	7.9	122	92.6	1,523	1,066	70.0	38	2.5	10	5	404	26.5
2007	219	**99**	2,159	9.9	98	95.5	2,061	1,268	61.5	55	2.7	6	5	727	35.3
2008	215	**97**	2,159	10.0	88	95.9	2,071	1,551	74.9	84	4.1	12	5	419	20.2
2009	194	**72**	1,253	6.5	51	95.9	1,202	817	68.0	78	6.5	7	11	289	24.0
2010	199	**65**	1,353	6.8	41	97.0	1,312	989	75.4	19	1.4	9	8	287	21.9

The number of contacts examined has mostly been around 1,000 to 2,000 with a few exceptional years. The average number of contact per case has also varied according to the year. Lately it has been approximately six contacts per case. The great majority of contacts are examined (upwards of 90%). Recently, the proportion of contact-infected was at 25%, ranging from 300 to 400. The number of recent conversions observed among the contacts is very small (20 to 50). There are very few new cases identified among the contacts (less than ten).

Disposition of Infected Contacts

In recent years, about half (150) of the infected contacts (300) were placed on treatment for latent TB infection (LTBI), and one fourth completed or nearly completed the treatment. There were very few infected contacts who had been diagnosed as infected in prior years (Table 4).

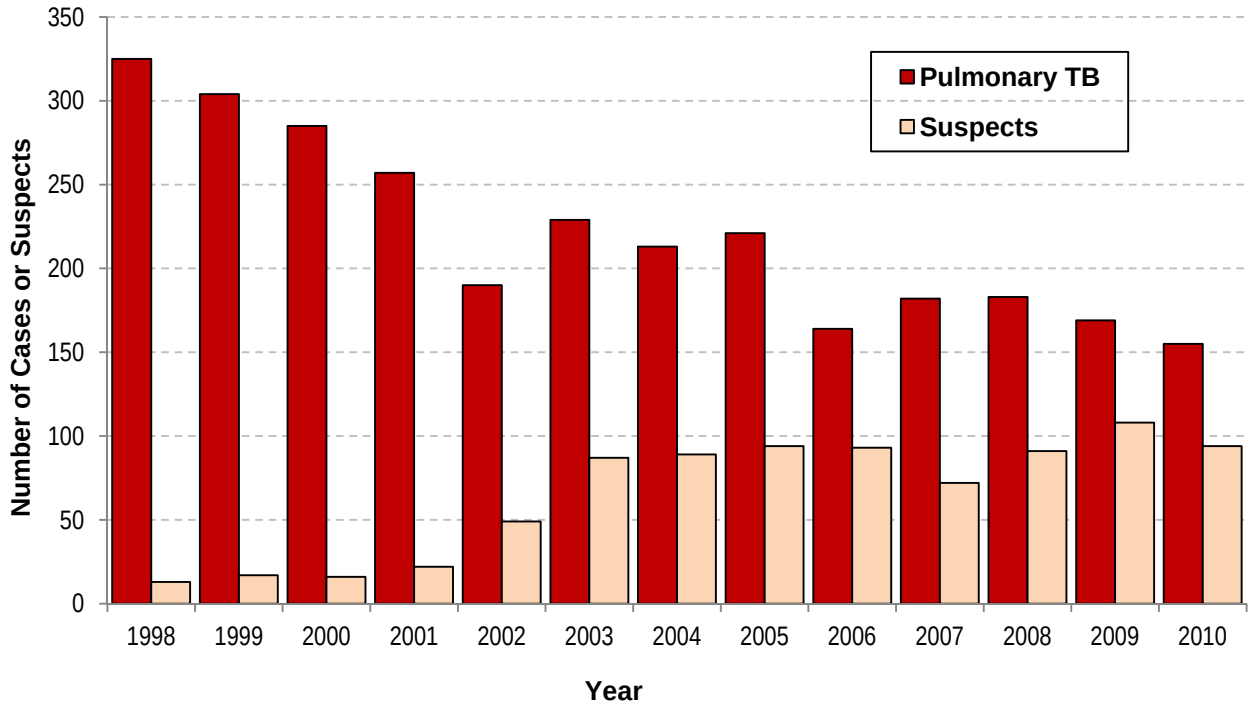
Table 4: Disposition of infected contacts - Louisiana, 1993-2010

Year	Infected	Infected No Treatment	Infected Treatment Completed	Infected Treatment Incomplete	Infected Prior No Treatment	Infected PriorTreatement Completed	Infected Prior Treatement Incomplete
1998	606	407	134	55	6	3	1
1999	669	456	146	61	4		2
2000	468	321	92	51	2	1	1
2001	531	345	103	66	7	8	2
2002	532	343	98	68	11	10	2
2003	1,151	551	247	273	43	30	7
2004	753	426	148	117	19	40	3
2005	610	306	130	115	40	17	2
2006	404	163	116	82	29	7	7
2007	727	359	143	174	29	18	4
2008	419	143	154	105	6	10	1
2009	289	127	76	47	8	28	3
2010	287	137	52	70	6	17	5

Suspects

The number of suspects of active pulmonary TB has been increasing drastically in recent years, to the point that the TB control program is treating 200 TB cases and 100 suspect cases (Figure 20).

Figure 20. Pulmonary TB and suspect cases – Louisiana, 1998-2010



The suspect cases are treated based on radiographic shadows, vague signs and symptoms and some negative bacteriological testing. The treatment includes four drugs (HRZE). Having such a high proportion of suspects is highly unusual. It often results from clinicians using a trial of TB treatment as a diagnostic tool, which is not a recommended course of action.