



Trends in Tuberculosis Morbidity and Mortality

*Please note, this report is designed
for double-sided printing*

**American Lung Association
Research and Health Education
Epidemiology and Statistics Unit
April 2013**

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Introduction

The following document was written to provide the general public with information on the epidemiology (mortality, morbidity and burden) of tuberculosis in the United States and worldwide.

Despite popular misconceptions that tuberculosis (TB) is a disease of the past, it continues to pose a significant threat to public health. Worldwide, one-third of the total population is infected; 9 million are ill and nearly 1.5 million people die from TB each year.

In the United States, TB is much less common, with just over 10,500 people sick in 2011; however, it continues to cause disproportioned illness in certain populations such foreign-born persons and those with weak immune systems. Therefore, it remains imperative for the United States government and other agencies to maintain focus on eradicating TB through surveillance, treatment and prevention in the United States, as well as, worldwide.

In 1904, the American Lung Association began as an organization committed to eradicating TB, a contagious airborne infection caused by an organism called *Mycobacterium tuberculosis* and spread through the air from one person to another. More than a hundred years later, the American Lung Association continues to be at the forefront by supporting much needed research examining the links between the disease and other lung diseases and risk factors.

Tuberculosis In The United States

Table 1 documents the trends in TB morbidity and mortality between 1979 and 2011. In 1999, the tenth revision of the International Classification of Disease (ICD-10) replaced the ninth revision of the International Classification of Disease (ICD-9) leading to disruptions in the time series of mortality statistics. The codes for TB in the ICD-10 revision incorporate all of the same conditions seen in ICD-9 TB codes with two exceptions: lupus (not otherwise specified) and pneumoconiosis. Due to the coding change, the number of deaths classified as TB has decreased by 14% from 1,112 to 930. In 2009, there were 529 deaths attributed to TB and a death rate of 0.2 per 100,000 people.¹ This represents a 43% decrease since 1999 when the coding changed. **Figure 1** depicts this trend.

In 1953, the United States began collecting reports on newly diagnosed cases of TB disease. Over the next 32 years, the number of TB cases consistently decreased, dropping 74%, from 84,304 in 1953 to 22,201 in 1985 – an average annual decline of 2.3%. This led to a reduction of resources earmarked for TB surveillance, treatment and prevention due to the belief that TB had been eradicated. However, with the advent of HIV co-infection, TB rates began to increase, reversing the trend seen over the past thirty years. Between 1985 and 1992, the number of TB cases increased 20% to 26,673.² It has been estimated that approximately 64,000 excess cases of TB occurred in the U.S. during this time.³

Since the 1992 TB resurgence peaked, TB has once again been on a downward slope. Between 1992 and 2011, the number of reported TB cases have dropped 61% to a record low of 10,528 in 2011. Comparatively, TB case rates have decreased 67% over this time from 10.5 to 3.4 per 100,000 persons.⁴ In part, this decline reflects the impact of federal resources to assist state and local TB-control efforts, wider screening, preventive therapy for high-risk populations and growing support for TB prevention programs among HIV-infected persons.

Figure 1: TB Death Rates in the US, 1979-2009

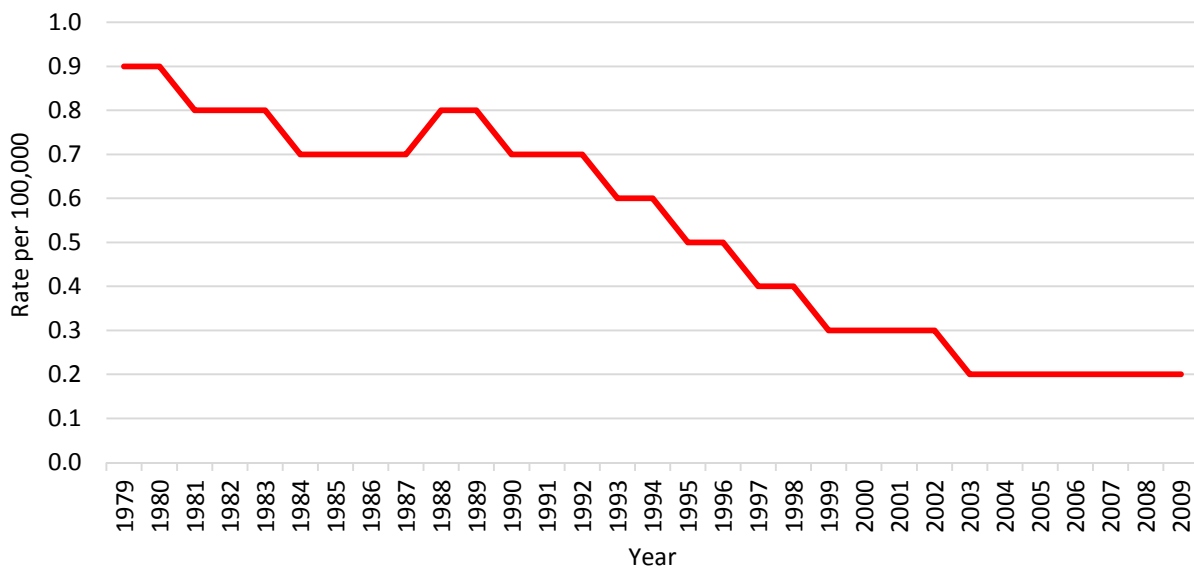


Table 1: Tuberculosis Deaths, Death Rates, Cases, Case Rates, and Percent Change in the US, 1979-2011 ⁽¹⁾

Year	Deaths				Cases			
	Number	Rate	% Change ⁽²⁾		Number	Rate	% Change ⁽²⁾	
			Number	Rate			Number	Rate
1979	2,007	0.9	-31.1	-30.8	27,669	12.6	-3.0	-3.8
1980	1,978	0.9	-1.4	0.0	27,749	12.3	0.3	-2.4
1981	1,937	0.8	-2.1	-11.1	27,373	11.9	-1.4	-3.3
1982	1,807	0.8	-6.7	0.0	25,520	11.0	-6.8	-7.6
1983	1,779	0.8	-1.5	0.0	23,846	10.2	-6.6	-7.3
1984	1,729	0.7	-2.8	-12.5	22,255	9.4	-6.7	-7.8
1985	1,752	0.7	1.3	0.0	22,201	9.3	-0.2	-1.1
1986	1,782	0.7	1.7	0.0	22,768	9.4	2.6	1.1
1987	1,755	0.7	-1.5	0.0	22,517	9.3	-1.1	-1.1
1988	1,921	0.8	9.5	14.3	22,436	9.1	-0.4	-2.2
1989	1,970	0.8	2.6	0.0	23,495	9.5	4.7	4.4
1990	1,810	0.7	-8.1	-12.5	25,701	10.3	9.4	8.4
1991	1,713	0.7	-5.4	0.0	26,283	10.4	2.3	1.0
1992	1,705	0.7	-0.5	0.0	26,673	10.5	1.5	1.0
1993	1,631	0.6	-4.3	-14.3	25,287	9.8	-5.2	-6.7
1994	1,478	0.6	-9.4	0.0	24,361	9.4	-3.7	-4.1
1995	1,336	0.5	-9.6	-16.7	22,860	8.7	-6.2	-7.4
1996	1,202	0.5	-10.0	0.0	21,337	8.0	-6.7	-8.0
1997	1,166	0.4	-3.0	-20.0	19,851	7.4	-7.0	-8.5
1998	1,112	0.4	-4.6	0.0	18,361	6.8	-7.5	-8.1
1999	930	0.3	-16.4	-25.0	17,531	6.4	-4.5	-5.9
2000	776	0.3	-16.6	0.0	16,377	5.8	-6.6	-9.4
2001	764	0.3	-1.5	0.0	15,989	5.6	-2.4	-3.4
2002	784	0.3	2.6	0.0	15,075	5.2	-5.7	-7.1
2003	711	0.2	-9.3	-33.3	14,874	5.1	-1.3	-1.9
2004	657	0.2	-7.6	0.0	14,517	4.9	-2.3	-3.2
2005	648	0.2	-1.4	0.0	14,097	4.8	-2.9	-3.8
2006	644	0.2	-0.6	0.0	13,779	4.6	-2.1	-3.1
2007	554	0.2	-14	0.0	13,278	4.4	-3.3	-4.2
2008	590	0.2	6.5	0.0	12,895	4.2	-2.9	-3.8
2009	529	0.2	-10.3	0.0	11,528	3.8	-10.6	-11.4
2010	...	...	...	...	11,171	3.6	-3.1	-3.8
2011	...	...	...	...	10,528	3.4	-5.8	-6.4

Source: Centers for Disease Control and Prevention. Reported TB in the U.S., 2011. October, 2013.

Notes:

(1) Rates are per 100,000 population.

(2) Percent change from previous year.

-- Data not available.

Demographics

Tuberculosis can affect anyone but certain subgroups, such as the foreign-born, are disproportionately affected. Data on TB cases and case rate by demographic factors such as sex, age, race/ethnicity, and country of origin are shown in **Table 2**. Current estimates are compared to those from 1993, the first year after which the TB resurgence began to subside and expanded TB surveillance was implemented. As such, it provides a useful benchmark against which to measure current progress on multiple indices.

Age

Between 1993 and 2011, TB case rates have decreased among all age groups with declines of 40 to 65%. TB case rates generally increased as age increases; the 0-14 age group had the lowest case rate at 0.9 per 100,000 in 2011 while those over the age of 65 had the highest at 5.4 per 100,000.⁵

Sex

Males were 62% more likely than females to have TB (4.2 vs. 2.6 per 100,000). Between 1993 and 2011, TB incidence decreased by more than 50% in both men and women; however, the decrease was greater among males than females.⁶ TB case rates by sex from 1982 through 2009 are displayed in **Figure 2**.

Figure 2: TB Case Rates in the US by Sex, Selected Years 1982-2011

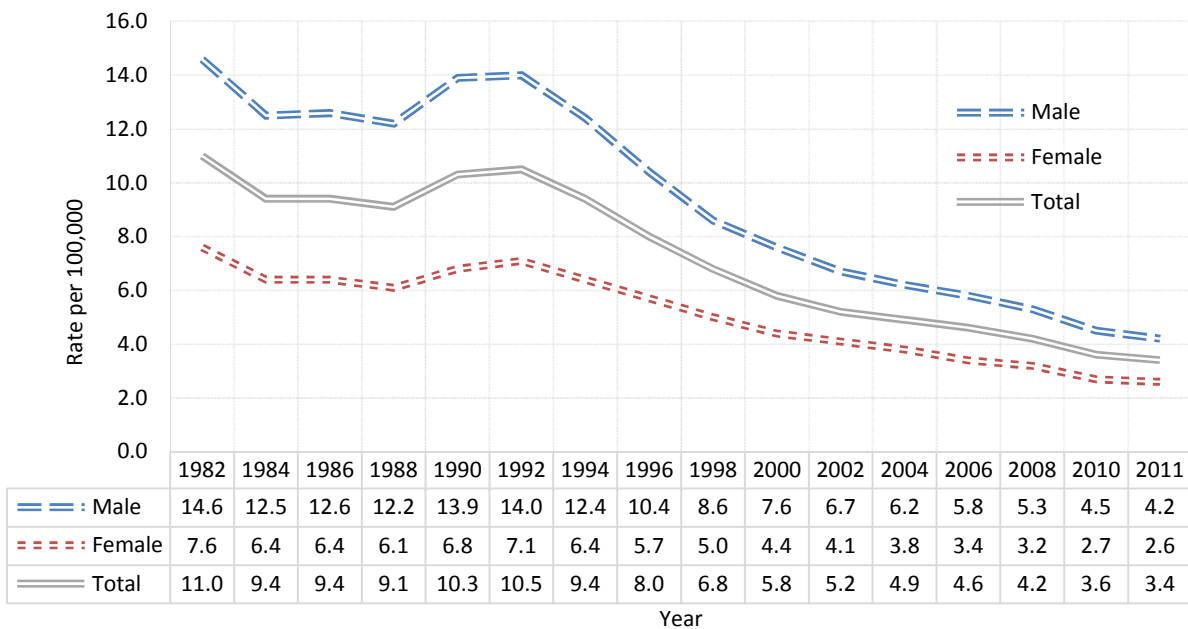


Table 2: Tuberculosis Cases and Case Rates in the US by Sex, Age, Race/Ethnicity and Country Of Origin, 1993 and 2011

Characteristic	Number of Cases			Case Rates ⁽¹⁾		
	1993	2011	Change (%)	1993	2011	Change (%)
Sex						
Male	17,433	6,413	-63.2	12.5	4.2	-66.4
Female	9,236	4,112	-55.5	6.3	2.6	-58.7
Age Group						
0-14	1,660	577	-61.1	2.9	0.9	-69.0
15-24	1,821	1,033	-43.3	5.0	2.4	-52.0
25-44	9,589	3,369	-64.9	11.5	4.1	-64.3
45-64	6,196	3,297	-46.8	12.4	4.0	-67.7
65+	5,820	2,247	-61.4	17.7	5.4	-69.5
Race/Ethnicity						
White, Non-Hispanic	6,903	1,664	-75.9	3.6	0.8	-77.8
Black, Non-Hispanic	8,947	2,408	-73.1	28.5	6.3	-77.9
Hispanic ⁽²⁾	5,138	3,008	-41.5	19.9	5.8	-70.9
American Indian/Alaska Native	272	129	-52.6	14.0	5.6	-60.0
Asian	3,454	3148	-8.9	41.2	20.9	-49.3
Native Hawaiian/Pacific Islander ⁽³⁾	N/A	81	N/A	N/A	15.9	N/A
Multiple Race ⁽³⁾	N/A	37	N/A	N/A	0.6	N/A
Country of Origin						
Foreign-Born ⁽⁵⁾	7,402	6,510	-12.1	34.0	17.2	-49.4
U.S.-Born	17,435	3,981	-77.2	7.4	1.5	-79.7
Unknown	266	37	N/A	N/A	N/A	N/A
Total	25,103	10,528	-58.1	9.7	3.4	-64.9

Sources: Centers for Disease Control and Prevention. Reported Tuberculosis in the U.S., 2011. October, 2013.

Notes:

N/A - Not Available

(1) Case rates are per 100,000 population.

(2) Persons of Hispanic ethnicity may be of any race.

(3) Category first reported in 2003. Multiple Race Indicates two or more races reported for a person but does not include information on Hispanic ethnicity.

(5) Persons born outside the United States and its territories.

Race/Ethnicity

In 2011, racial and ethnic groups, other than non-Hispanic whites, accounted for over 83% of TB cases. Asians accounted for 30% of TB cases, followed by Hispanics (29%), non-Hispanic Blacks (23%), and Whites (16%). Native Pacific Islanders, as well as, American Indians accounted for only 1% of cases. This was the first time, Asians accounted for the majority of TB cases surpassing Hispanics, who had the highest cases every year between 2004 and 2010. The percentage of TB cases by race/ethnicity in 2011 is displayed in **Figure 3**.

Since 1993, TB case rates have declined by 50% or more in all racial and ethnic groups except for Asians (49.3%).⁷ However compared to non-Hispanic Whites (0.8), the TB case rate per 100,000 is still 26 times greater in Asians (20.9), 20 times greater in non-Hispanic Native Hawaiians or other Pacific Islanders (15.9), 8 times greater in non-Hispanic Blacks (6.3), 7 times greater in Hispanics (5.8) and American Indians /Alaska Natives (5.6) than in non-Hispanic Whites (0.8) in 2011.⁸ **Figure 4** shows these trends.

Figure 3: TB Cases (%) in the US by Race/Ethnicity, 2011

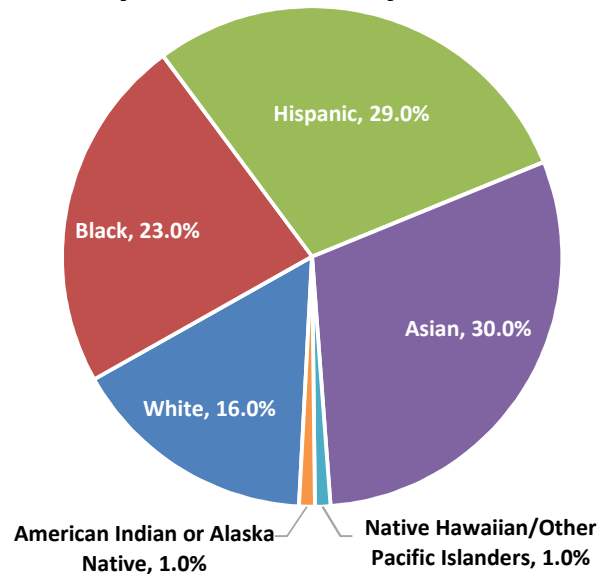
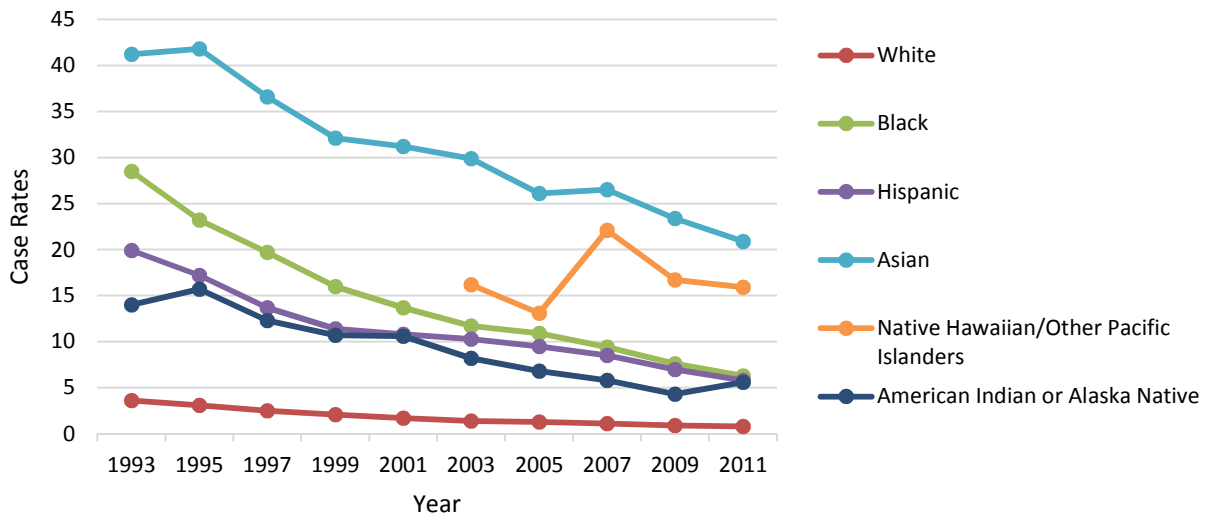


Figure 4: TB Case Rates in the US by Race/Ethnicity, Selected Years 1993-2011

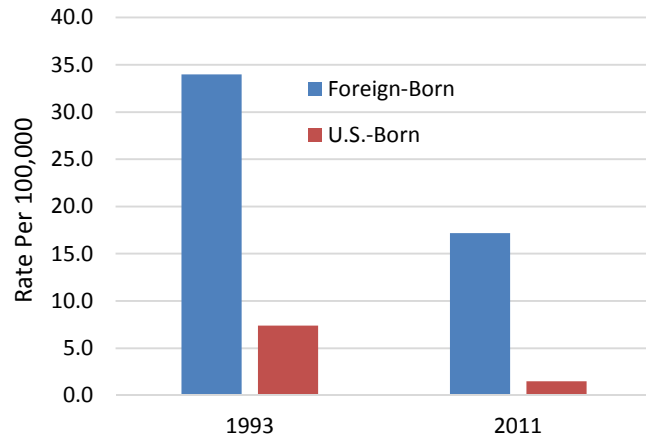


Foreign-Born Persons

According to 2011 data, 62% of TB cases occurred among foreign-born persons.⁹ This is the eleventh consecutive year in which foreign-born persons make up the lion's share of TB burden. Comparatively, in 1993, foreign-born persons accounted for less than 30% of TB cases.

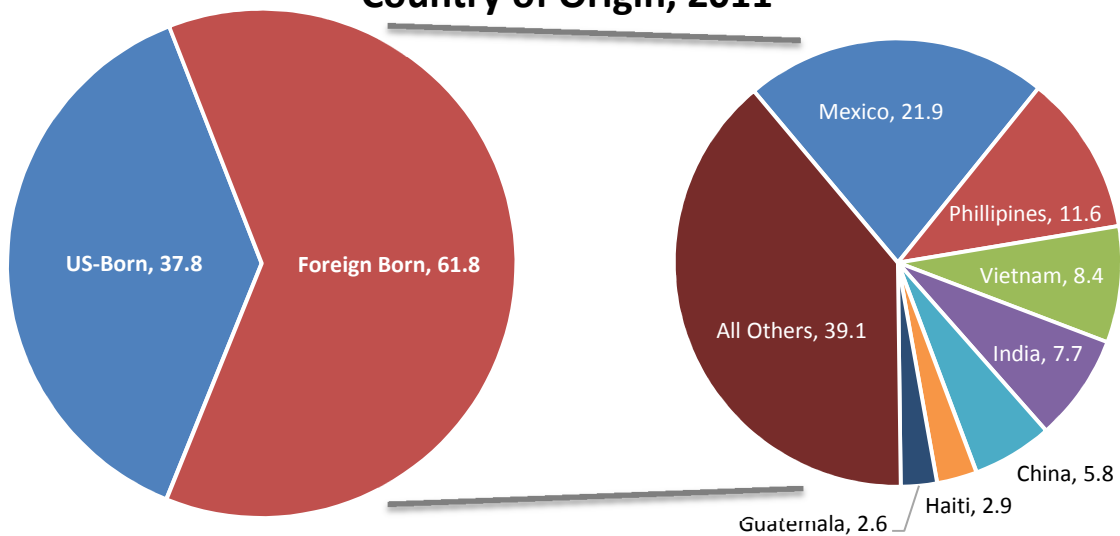
Since 1993, the TB case rate for both U.S.-born and foreign-born persons has declined annually but it has been less substantial among the latter (**Figure 5**). In 2011, the TB case rate among foreign-born persons was 11.5 times greater than that for U.S.-born persons (17.2 vs. 1.5 per 100,000, respectively).¹⁰

Figure 5: TB Case Rates in the US by Origin, 1993 and 2011



Foreign-born Hispanics and Asians together represented 80% of the foreign-born TB cases. Over 60% were reported in persons from the following countries: Mexico (1,432), Philippines (757), India (502), Vietnam (546), China (376), Haiti (187) and Guatemala (166).¹¹ The percentage of TB cases by country of origin in 2011 is displayed in **Figure 6**.

Figure 6: Percentage of all TB Cases in the US by Country of Origin, 2011



By State

Table 3 delineates TB case counts and rates by state for select years. In 2011, 29 states reported a decline in TB rates and 16 states and DC reported an increase in TB rates from 2010. **Figure 7** shows that 38 states had TB rates at or below the national average rate of 3.4 per 100,000. Twelve states and DC reported rates above the national average. Four states (CA, FL, NY and TX) reported more than 500 cases each in 2011 and when combined, accounted for just over 50% of the national case total.¹²

Figure 7: TB Case Rates by State, 2011

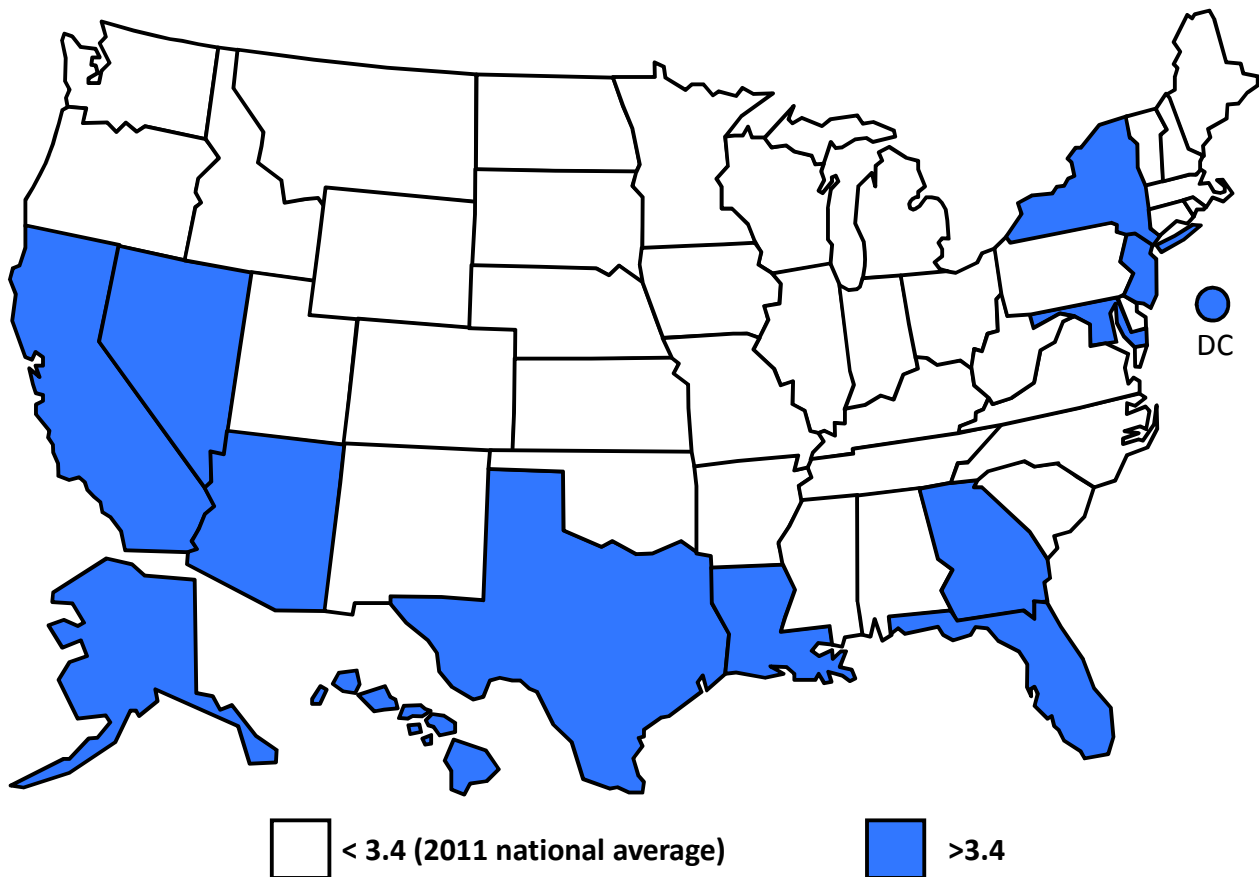


Table 3: Tuberculosis Cases and Case Rates ⁽¹⁾ by State, 1993-2011

State	1993		2000		2005		2010		2011		Change (%) 1993-2011	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
Alabama	487	11.6	310	7.0	216	4.7	146	3.1	161	3.4	10.3	9.7
Alaska	57	9.5	108	17.2	59	8.9	57	8.0	67	9.3	17.5	16.3
Arizona	231	5.9	261	5.1	281	4.7	282	4.4	255	3.9	-9.6	-11.4
Arkansas	209	8.6	199	7.4	114	4.1	78	2.7	85	2.9	9.0	7.4
California	5,170	16.6	3,297	9.7	2,904	8.0	2,324	6.2	2,323	6.2	0.0	0.0
Colorado	104	2.9	97	2.3	101	2.2	71	1.4	70	1.4	-1.4	0.0
Connecticut	155	4.7	105	3.1	95	2.7	85	2.4	83	2.3	-2.4	-4.2
Delaware	66	9.4	28	3.6	26	3.1	20	2.2	21	2.3	5.0	4.5
District of Columbia	161	27.9	85	14.9	56	10.2	43	7.1	56	9.1	30.2	28.2
Florida	1,655	12.1	1,171	7.3	1,094	6.1	834	4.4	754	4.0	-9.6	-9.1
Georgia	812	11.7	703	8.6	505	5.6	411	4.2	347	3.5	-15.6	-16.7
Hawaii	251	21.4	136	11.2	112	8.8	115	8.4	123	8.9	7.0	6.0
Idaho	11	1.0	16	1.2	23	1.6	15	1.0	12	0.8	-20.0	-20.0
Illinois	1,237	10.6	743	6.0	596	4.7	372	2.9	359	2.8	-3.5	-3.4
Indiana	248	4.3	145	2.4	146	2.3	90	1.4	100	1.5	11.1	7.1
Iowa	59	2.1	40	1.4	55	1.9	48	1.6	40	1.3	-16.7	-18.8
Kansas	80	3.2	77	2.9	60	2.2	46	1.6	36	1.3	-21.7	-18.8
Kentucky	404	10.7	147	3.6	124	3.0	90	2.1	71	1.6	-21.1	-23.8
Louisiana	367	8.5	331	7.4	257	5.7	200	4.4	167	3.7	-16.5	-15.9
Maine	28	2.3	24	1.9	17	1.3	8	0.6	9	0.7	12.5	16.7
Maryland	417	8.4	282	5.3	283	5.1	220	3.8	233	4.0	5.9	5.3
Massachusetts	370	6.2	285	4.5	265	4.1	222	3.4	196	3.0	-11.7	-11.8
Michigan	480	5.1	287	2.9	246	2.4	183	1.9	170	1.7	-7.1	-10.5
Minnesota	144	3.2	178	3.6	199	3.9	135	2.5	137	2.6	1.5	4.0
Mississippi	279	10.6	173	6.1	103	3.5	116	3.9	91	3.1	-21.6	-20.5
Missouri	257	4.9	211	3.8	108	1.9	107	1.8	98	1.6	-8.4	-11.1
Montana	22	2.6	21	2.3	10	1.1	6	0.6	8	0.8	33.3	33.3
Nebraska	23	1.4	24	1.4	35	2.0	27	1.5	23	1.2	-14.8	-20.0
Nevada	99	7.1	96	4.8	112	4.6	114	4.2	95	3.5	-16.7	-16.7
New Hampshire	26	2.3	22	1.8	4	0.3	10	0.8	11	0.8	10.0	0.0
New Jersey	912	11.6	565	6.7	485	5.6	405	4.6	331	3.8	-18.3	-17.4
New Mexico	74	4.6	46	2.5	39	2.0	50	2.4	49	2.4	-2.0	0.0
New York	3,953	21.7	1,744	9.2	1,289	6.7	954	4.9	910	4.7	-4.6	-4.1
North Carolina	594	8.6	447	5.6	329	3.8	296	3.1	244	2.5	-17.6	-19.4
North Dakota	7	1.1	5	0.8	6	0.9	9	1.3	7	1.0	-22.2	-23.1
Ohio	315	2.8	340	3.0	260	2.3	190	1.6	145	1.3	-23.7	-18.8
Oklahoma	209	6.5	154	4.5	144	4.1	86	2.3	94	2.5	9.3	8.7
Oregon	154	5.1	119	3.5	103	2.8	87	2.3	74	1.9	-14.9	-17.4
Pennsylvania	749	6.2	383	3.1	325	2.6	238	1.9	260	2.0	9.2	5.3
Rhode Island	64	6.4	49	4.7	47	4.4	26	2.5	27	2.6	3.8	4.0
South Carolina	401	11.0	286	7.1	261	6.1	153	3.3	140	3.0	-8.5	-9.1
South Dakota	16	2.2	16	2.1	16	2.1	15	1.8	15	1.8	0.0	0.0
Tennessee	556	10.9	383	6.7	298	5.0	193	3.0	156	2.4	-19.2	-20.0
Texas	2,396	13.3	1,506	7.2	1,535	6.7	1,385	5.5	1,325	5.2	-4.3	-5.5
Utah	46	2.5	49	2.2	29	1.2	20	0.7	34	1.2	70.0	71.4
Vermont	7	1.2	4	0.7	8	1.3	5	0.8	8	1.3	60.0	62.5
Virginia	458	7.1	292	4.1	355	4.7	268	3.3	221	2.7	-17.5	-18.2
Washington	285	5.4	258	4.4	256	4.1	239	3.5	200	2.9	-16.3	-17.1
West Virginia	75	4.1	33	1.8	28	1.5	15	0.8	13	0.7	-13.3	-12.5
Wisconsin	100	2.0	92	1.7	78	1.4	55	1.0	70	1.2	27.3	20.0
Wyoming	7	1.5	4	0.8	...	0.0	7	1.2	4	0.7	-42.9	-41.7
United States	25,287	9.8	16,377	5.8	14,097	4.8	11,171	3.6	10,528	3.4	-5.8	-5.6

Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the U.S., 1993-2011. October, 2013.

Notes:

(1) Rates are per 100,000 persons

Table 4 shows the percentage of TB cases that are either U.S.-born or foreign-born by state in 2011. Thirty-two states saw at least 50% of their TB cases in the foreign-born population, while seventeen states had 70% or more of their reported TB cases in the foreign-born population.¹³ In North Dakota, all seven cases reported were in foreign-born persons, followed by 85% in Minnesota and 84% in Massachusetts. Montana and Mississippi had the highest portion of U.S.-born cases at 88% and at 80%, respectively. **Figure 8** depicts the change in proportion of foreign-born cases by state from 2001 to 2011.

Figure 8: Percentage of TB Cases Among Foreign-born Persons by State, 2001 and 2011

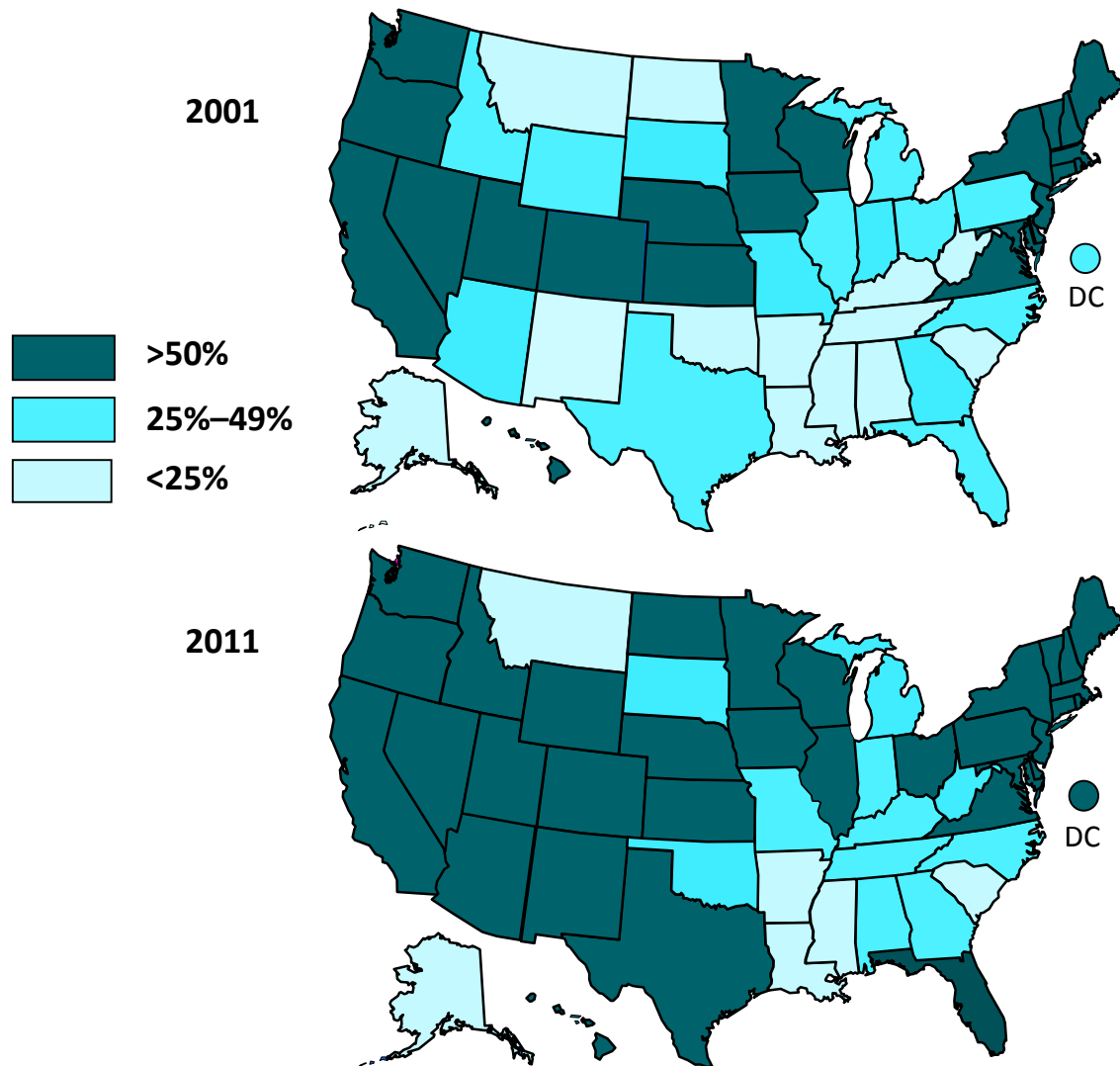


Table 4: Tuberculosis Cases, Case Rates and Percentages by Origin and State, 2011

State	Cases		U.S.-Born	Foreign-Born	Unknown Origin
	Number	Rate ⁽¹⁾	%	%	%
Alabama	161	3.4	70.2	29.8	0.0
Alaska	67	9.3	77.6	22.4	0.0
Arizona	255	3.9	33.3	66.7	0.0
Arkansas	85	2.9	77.6	22.4	0.0
California	2,323	6.2	22.1	76.7	1.2
Colorado	70	1.4	30.0	70.0	0.0
Connecticut	83	2.3	21.7	78.3	0.0
Delaware	21	2.3	23.8	76.2	0.0
District of Columbia	56	9.1	46.4	53.6	0.0
Florida	754	4.0	48.0	52.0	0.0
Georgia	347	3.5	54.2	45.8	0.0
Hawaii	123	8.9	26.0	74.0	0.0
Idaho	12	0.8	50.0	50.0	0.0
Illinois	359	2.8	37.0	63.0	0.0
Indiana	100	1.5	57.0	43.0	0.0
Iowa	40	1.3	27.5	72.5	0.0
Kansas	36	1.3	44.4	55.6	0.0
Kentucky	71	1.6	67.6	32.4	0.0
Louisiana	167	3.7	76.6	23.4	0.0
Maine	9	0.7	33.3	55.6	11.1
Maryland	233	4.0	28.3	71.7	0.0
Massachusetts	196	3.0	16.3	83.7	0.0
Michigan	170	1.7	48.2	48.8	2.9
Minnesota	137	2.6	15.3	84.7	0.0
Mississippi	91	3.1	80.2	19.8	0.0
Missouri	98	1.6	61.2	38.8	0.0
Montana	8	0.8	87.5	12.5	0.0
Nebraska	23	1.2	39.1	56.5	4.3
Nevada	95	3.5	27.4	72.6	0.0
New Hampshire	11	0.8	45.5	54.5	0.0
New Jersey	331	3.8	25.7	74.3	0.0
New Mexico	49	2.4	49.0	51.0	0.0
New York	910	4.7	22.3	77.6	0.1
North Carolina	244	2.5	56.1	43.9	0.0
North Dakota	7	1.0	0.0	100.0	0.0
Ohio	145	1.3	43.4	56.6	0.0
Oklahoma	94	2.5	74.5	25.5	0.0
Oregon	74	1.9	32.4	67.6	0.0
Pennsylvania	260	2.0	40.0	60.0	0.0
Rhode Island	27	2.6	22.2	77.8	0.0
South Carolina	140	3.0	76.4	23.6	0.0
South Dakota	15	1.8	60.0	40.0	0.0
Tennessee	156	2.4	64.7	35.3	0.0
Texas	1,325	5.2	47.2	52.8	0.0
Utah	34	1.2	29.4	70.6	0.0
Vermont	8	1.3	37.5	62.5	0.0
Virginia	221	2.7	31.2	68.8	0.0
Washington	200	2.9	22.5	77.5	0.0
West Virginia	13	0.7	61.5	38.5	0.0
Wisconsin	70	1.2	32.9	65.7	1.4
Wyoming	4	0.7	25.0	75.0	0.0
United States	10,528	3.4	37.8	61.8	0.4

Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the U.S., 2011. October, 2013.

Notes:

(1) Rates are per 100,000 persons

Expanded TB Surveillance

At the peak of TB's resurgence in 1993, the Centers for Disease Control expanded the TB information collected on each case. This included results of HIV virus antibody testing and drug susceptibility testing for both initial and final TB isolates inpatients with positive cultures, as well as, the administration of and completion of therapy. Information on occupation, history of substance abuse, homelessness was also collected and results are shown in **Table 5**.

In 2011, 86% of TB cases had been prescribed the initial four-drug regimen recommended by the American Thoracic Society and the Centers for Disease Control and Prevention of isoniazid [INH], rifampin [RIF], pyrazinamide [PZA], and either ethambutol or streptomycin. An additional 3% of patients were prescribed INH, RIF and PZA, while only 1 percent of TB patients had been given INH and RIF.

Over 12% of persons with TB were excessive alcohol drinkers, 7.6% were non-injecting drug users and 1.5% were injecting drug users. Approximately 30% of patients were unemployed, 5.8% were homeless, 4.3% resided in correctional institutions, and 2.3% resided in long-term care facilities.¹⁴

In 2009, over half of all TB cases (59.5%) participated in directly observed therapy (DOT) compared to 30% that combined directly observed therapy and self-administered therapy. In 2009, 93% of TB patients completed therapy, of which 95.3% completed observed therapy within one year.¹⁵

DRUG RESISTANCE

The first reports of drug resistance to TB medication in the United States began to appear in the mid-1970s. Resistance to one or several forms of treatment occurs when the bacteria develops the ability to withstand antibiotic attack and relays that ability to its offspring. Since that entire strain of bacteria inherits this capacity to resist the effects of the various treatments, resistance can spread from one person to another. Drug-resistant TB is difficult and costly to treat, extends the time a person needs to be in treatment and can be fatal. Inconsistent or partial treatment for a given individual remains the prominent cause of drug resistance.

Multidrug-resistant tuberculosis (MDR TB) is a form of tuberculosis that is resistant to two or more of the primary drugs (isoniazid and rifampin) used for the treatment of TB. Since 1993, at least 45 states and the District of Columbia have reported at least one instance of multiple drug resistance (MDR TB).¹⁶ In 2011, drug susceptibility results were reported for 95.7% of all culture positive TB cases in the 50 states, New York City, and the District of Columbia.¹⁷ Among those with no previous history of TB, 9.5% of TB cases were resistant to only INH and a further 1.6% of cases were considered to be primary MDR TB (resistant to INH and RIF; **Table 6**).¹⁸ **Table 6** displays the proportion of MDR TB by state.

Treatment for MDR-TB is expensive and involves drug therapy over many months or years. Even with the longer course of treatment, the cure rate for MDR-TB is approximately 50%, compared to over 90% for non-resistant strains of TB.

Instances of primary MDR TB among U.S.-born persons have decreased from 2.4% in 1993 to less than 1.0% in 2011. However, the proportion of MDR-TB cases among foreign-born persons has

Table 5: Tuberculosis Cases (%) in the US by Selected Characteristics, 2011

Characteristic	Percent of Cases with Characteristic ⁽¹⁾
Initial Drug Regimen	
Isoniazid And Rifampin	0.7
Isoniazid, Rifampin and Pyrazinamide	2.7
Isoniazid, Rifampin, Pyrazinamide and Ethambutol or Streptomycin	86.2
Substance Use Problems ⁽²⁾	
Injecting Drug Use	1.5
Noninjecting Drug Use	7.6
Excessive Alcohol Use	12.4
Residence at Time of Diagnosis	
Correctional Facility	4.3
Long-Term Care Facility	2.3
Homeless ⁽²⁾	5.8
Unemployed ⁽³⁾	
	30.4
Drug Resistance ⁽⁴⁾	
Isoniazid Resistant	9.5
Isoniazid and Rifampin Resistant	1.6
Treatment Type ⁽⁵⁾	
Directly Observed Therapy (DOT)	59.5
Combination (DOT and Self Administered)	30.3
Treatment Status ⁽⁵⁾	
Completed Observed Therapy	93.3
Completed Observed Therapy >1 Yr	63.0
Completed Observed Therapy < 1 Yr	95.3

Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the U.S., 2011. October, 2013.

Notes:

(1) Percentages based on data from 52 reporting areas (50 states, NYC, DC) and comprises reporting areas with information on characteristics reported for equal to or greater than 75% of cases.

(2) Within the 12 months preceding TB diagnosis.

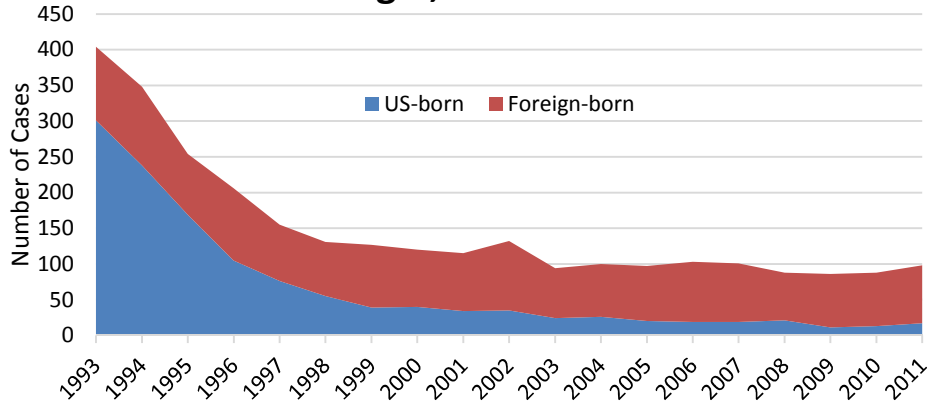
(3) During the preceding 24 months.

(4) Patients with no previous history of TB and tested for at least isoniazid and rifampin. Isolates may be resistant to other drugs.

(5) Latest information available is for 2009.

increased from 25.3% in 1993 to 82.7% in 2011.¹⁹ **Figure 9** displays MDR TB by country of origin from 1993 to 2011.

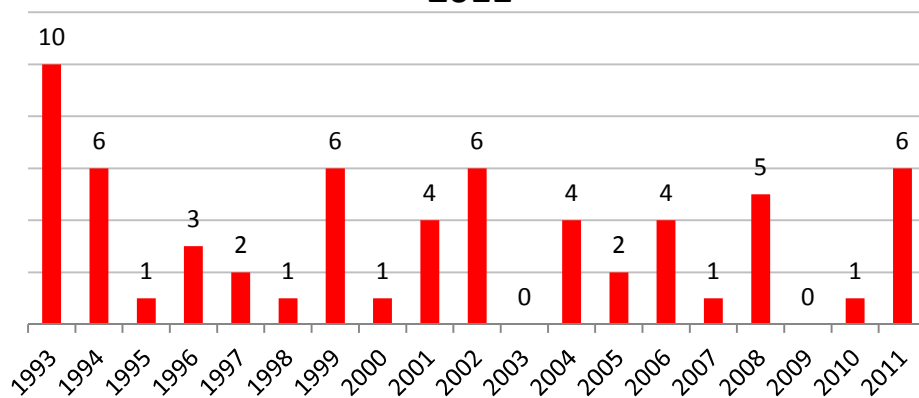
Figure 9: Number of MDR TB Cases in the US by Origin, 1993-2011



Extensively drug-resistant TB (XDR TB) is resistant to at least isoniazid and rifampin and to any fluoroquinolone and at least one of the three second-line injectable drugs: capreomycin, kanamycin, or amikan. XDR TB has emerged worldwide as a threat to public health and TB control, raising concerns of a future epidemic of virtually untreatable TB.

From 1993 to 2006, 49 cases of XDR-TB were reported in the US, spread across nine states and one city. New York City accounted for 19 of these cases, followed by California (11), New York (excluding New York City - 8), New Jersey (3), Nevada (2), Texas (2), and one case each in Illinois, Michigan, Ohio and Virginia.²⁰ **Figure 10** shows the trend of XDR TB cases reported by year in the United States, with the most in 1993 and between zero and six cases every year since.²¹

Figure 10: Number of XDR TB Cases in the US, 1993-2011



XDR-TB treatment is successful approximately 30% of the time for patients without compromised immune systems; it is even lower for those with compromised immune systems (such as those with HIV/AIDS).²²

Table 6: Tuberculosis Drug Resistance in the US By State, 2011

State	Total Culture Positive Cases	Cases with Initial Drug Susceptibility Testing ⁽¹⁾		Resistance ⁽²⁾			
		No.	(%)	Isoniazid ⁽¹⁾		Isoniazid and Rifampin ⁽¹⁾	
				No.	(%)	No.	(%)
Alabama	119	108	90.8	5	4.6	2	1.9
Alaska	60	59	98.3	14	23.7	4	6.8
Arizona	193	190	98.4	15	7.9	1	0.5
Arkansas	60	59	98.3	4	6.8	1	1.7
California	1,840	1,773	96.4	192	10.8	34	1.9
Colorado	52	52	100.0	7	13.5	1	1.9
Connecticut	69	66	95.7	6	9.1	0	0.0
Delaware	19	19	100.0	2	10.5	0	0.0
District of Columbia	46	46	100.0	3	6.5	0	0.0
Florida	604	567	93.9	42	7.4	6	1.1
Georgia	240	237	98.8	23	9.7	1	0.4
Hawaii	76	75	98.7	7	9.3	1	1.3
Idaho	10	9	90.0	2	22.2	0	0.0
Illinois	274	248	90.5	22	8.9	3	1.2
Indiana	74	73	98.6	8	11.0	2	2.7
Iowa	31	8	25.8	-	-	-	-
Kansas	36	35	97.2	4	11.4	0	0.0
Kentucky	53	53	100.0	5	9.4	2	3.8
Louisiana	137	128	93.4	10	7.8	0	0.0
Maine	8	8	100.0	0	0.0	0	0.0
Maryland	166	165	99.4	13	7.9	2	1.2
Massachusetts	144	137	95.1	14	10.2	0	0.0
Michigan	123	122	99.2	9	7.4	1	0.8
Minnesota	101	101	100.0	12	11.9	3	3.0
Mississippi	66	66	100.0	6	9.1	0	0.0
Missouri	75	34	45.3	-	-	-	-
Montana	5	5	100.0	0	0.0	0	0.0
Nebraska	18	18	100.0	0	0.0	0	0.0
Nevada	65	60	92.3	8	13.3	0	0.0
New Hampshire	10	10	100.0	1	10.0	0	0.0
New Jersey	267	262	98.1	34	13.0	8	3.1
New Mexico	43	43	100.0	0	0.0	0	0.0
New York ⁽³⁾	172	169	98.3	18	10.7	6	3.6
New York City	495	481	97.2	56	11.6	14	2.9
North Carolina	183	174	95.1	14	8.0	2	1.1
North Dakota	4	0	0.0	-	-	-	-
Ohio	112	110	98.2	7	6.4	2	1.8
Oklahoma	68	67	98.5	2	3.0	1	1.5
Oregon	59	59	100.0	5	8.5	1	1.7
Pennsylvania	199	177	88.9	22	12.4	4	2.3
Rhode Island	20	20	100.0	1	5.0	0	0.0
South Carolina	107	101	94.4	4	4.0	0	0.0
South Dakota	7	7	100.0	1	14.3	0	0.0
Tennessee	109	106	97.2	7	6.6	0	0.0
Texas	1,009	982	97.3	88	9.0	16	1.6
Utah	24	24	100.0	3	12.5	1	4.2
Vermont	6	6	100.0	0	0.0	0	0.0
Virginia	175	174	99.4	15	8.6	2	1.1
Washington	160	158	98.8	14	8.9	1	0.6
West Virginia	13	12	92.3	1	8.3	0	0.0
Wisconsin	60	60	100.0	6	10.0	2	3.3
Wyoming	4	4	100.0	0	0.0	0	0.0
United States	8,070	7,727	95.7	736	9.5	124	1.6

Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the U.S., 2011. October, 2013.

Notes:

1) Patients tested to at least isoniazid and rifampin

2) Isolates may be resistant to other drugs. Overall U.S. percentage based on 52 reporting areas (50 states, New York City, and the District of Columbia). Counts and percentages shown only for reporting areas with information reported for >75% of cases.

3) Excludes New York City

Tuberculosis Worldwide

Worldwide new cases of TB have been declining for the past several years and fell at a rate of 2.2% between 2010 and 2011. The TB mortality rate has decreased 41% since 1990 and the world is on track to achieve the global target of a 50% reduction by 2015. In 2011, there were 8.7 million new TB cases and approximately 1.4 million deaths. Worldwide, the total cost of TB control was \$4.8 billion in 2012.²³

Table 7 and **Figure 11** displays the trends in TB morbidity and mortality worldwide for 2011 by region. Africa and Southeast Asia are two regions that continue to be particularly hard hit with TB. Death, prevalence and incidence rates in these two regions are approximately two times higher than that of other world regions, with the exception of Eastern Mediterranean.

In 2011, there were an estimated 310,000 cases of MDR-TB among notified TB patients with pulmonary TB.²⁴ India, China, the Russian Federation and South Africa have almost 60% of the world's cases of MDR-TB. While drug-resistant TB is treatable, it requires extensive chemotherapy that is often prohibitively expensive (often more than 100 times more expensive than treatment for drug-susceptible TB). With such a hefty price tag, low and middle-income countries may have trouble treating those with TB, threatening global TB control efforts.

Figure 11: Burden of TB Worldwide, by Region, 2011

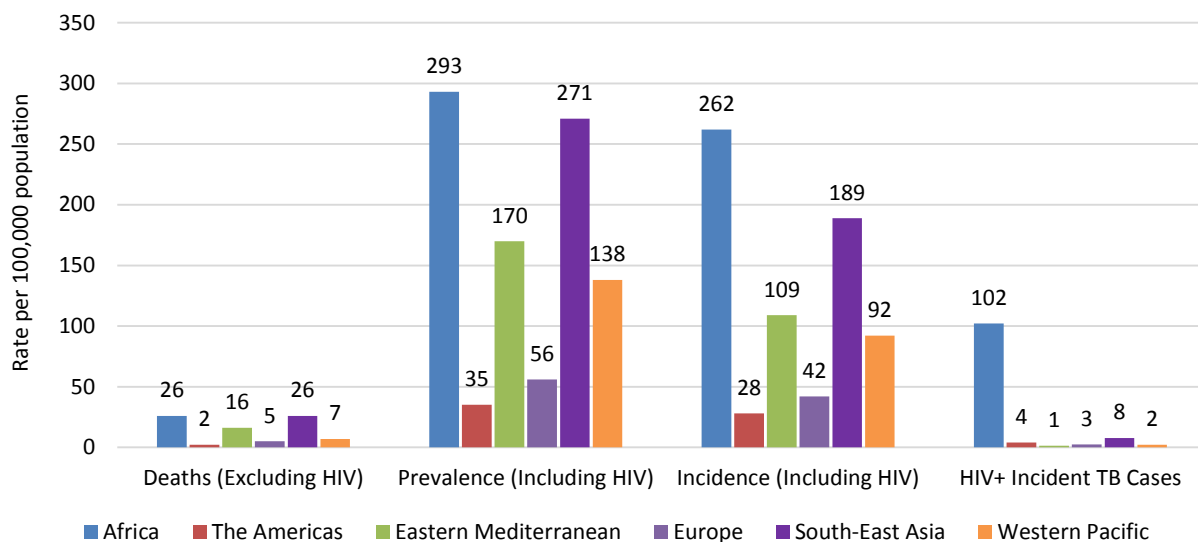


Table 7: Estimates of the Burden of TB by WHO Regions, Selected Years 1990-2011 ^(1,2,3)

Year	Region													
	Total		Africa		The Americas		Eastern Mediterranean		Europe		South-East Asia		Western Pacific	
	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate	#	Rate
Deaths (Excluding HIV)														
1990	1,300	24.0	200	40.0	41	5.7	120	32.0	37	4.4	570	43.0	310	21.0
1995	1,300	24.0	230	39.0	37	4.8	130	30.0	58	6.7	630	44.0	260	16.0
2000	1,400	22.0	240	37.0	30	3.6	140	29.0	69	8.0	680	43.0	200	12.0
2005	1,200	19.0	240	32.0	25	2.8	120	23.0	65	7.3	620	37.0	160	9.0
2010	1,000	15.0	220	27.0	21	2.3	99	17.0	49	5.4	500	28.0	130	7.2
2011	990	14.0	220	26.0	21	2.2	99	16.0	45	5.0	480	26.0	130	6.9
Prevalence (Including HIV)														
1990	14,000	268.0	1,900	372.0	680	94.0	1,000	269.0	580	68.0	6,100	465.0	3,900	255.0
1995	15,000	269.0	2,200	372.0	540	69.0	1,100	260.0	970	112.0	6,800	468.0	3,800	236.0
2000	16,000	257.0	2,500	374.0	460	55.0	1,200	245.0	1,100	123.0	7,000	445.0	3,500	209.0
2005	14,000	221.0	2,600	352.0	410	46.0	1,100	207.0	860	98.0	6,300	370.0	3,100	176.0
2010	12,000	177.0	2,500	303.0	340	36.0	1,000	173.0	560	63.0	5,200	285.0	2,600	143.0
2011	12,000	170.0	2,500	293.0	330	35.0	1,000	170.0	500	56.0	5,000	271.0	2,500	138.0
Incidence (Including HIV)														
1990	7,800	147.0	1,200	245.0	430	59.0	470	123.0	360	43.0	2,900	217.0	2,400	159.0
1995	8,400	148.0	1,600	276.0	380	49.0	530	123.0	560	65.0	3,100	217.0	2,200	137.0
2000	9,100	148.0	2,000	311.0	340	41.0	570	118.0	640	74.0	3,400	218.0	2,000	120.0
2005	9,200	142.0	2,300	310.0	310	34.0	610	113.0	560	64.0	3,600	212.0	1,800	106.0
2010	8,800	128.0	2,300	271.0	270	29.0	650	109.0	410	46.0	3,500	193.0	1,700	94.0
2011	8,700	125.0	2,300	262.0	260	28.0	660	109.0	380	42.0	3,500	189.0	1,700	92.0
HIV Positive Incident TB Cases														
1990	350	6.7	290	57.0	30	4.2	3	0.8	2.7	0.3	25	1.9	3.3	0.2
1995	710	12.0	560	96.0	44	5.6	4.9	1.1	4.6	0.5	90	6.2	14	0.9
2000	1,100	18.0	850	129.0	45	5.3	6.9	1.4	12	1.3	160	10.0	23	1.4
2005	1,200	19.0	960	130.0	33	3.8	8	1.5	21	2.4	170	10.0	32	1.8
2010	1,100	16.0	880	105.0	31	3.3	9.1	1.5	19	2.1	140	8.0	33	1.8
2011	1,100	16.0	870	102.0	37	3.9	8.7	1.4	23	2.5	140	7.7	36	2.0

Source: World Health Organization. Global Tuberculosis Control, 2012.

Notes:

(1) Numbers are in thousands.

(2) Rates are per 100,000 persons.

(3) Summing across rows may not equal total due to rounding.

The Connection between TB and HIV

The human immunodeficiency virus (HIV) is a major risk factor for the development of TB. HIV robs a person's body of its natural ability to fight infection, causing them to be more likely to be infected with TB. Furthermore, because HIV-infected individuals have weakened immune systems, they have a much greater chance of developing active TB disease.¹

TB is a leading cause of death among people who are HIV positive, accounting for 23% of HIV deaths worldwide.²⁵ Among people infected with TB, those who are also HIV positive are 21 to 34 times more likely to develop active TB in a given year compared to those who are HIV negative. In 2011, 1.1 million (13%) of the 8.7 million people who developed TB were HIV-positive. HIV is the single most important determinant of the increased incidence of TB in Africa, where close to 80% of HIV-positive TB cases reside.²⁶

In the United States, 6% of TB cases (672 cases) were also infected with HIV during 2011. Among 25-44 year olds, that percentage was almost doubled (10%, 342 cases). The percentage of co-infection has declined since 1993 overall and for 25-44 year olds.²⁷ **Table 8** displays the number and percentage of reported TB cases with HIV-positive test results in the U.S. from 1993 to 2011.

SUMMARY

Between 1985 and 1992, the number of TB cases reported annually in the United States increased 20%. Factors associated with the resurgence of TB include the HIV/AIDS epidemic, immigration of persons from countries where TB incidence rates are 10-30 times higher than in the U.S., transmission of TB among persons residing in congregate settings such as hospitals, prisons and homeless shelters, and a decline in resources for TB control.

From 1993 through 2011, the number of TB cases reported decreased 61%, in part reflecting the impact of federal resources to assist state and local TB-control efforts, including support for programs to prevent TB among HIV-infected persons, tuberculin screening, and preventive therapy for persons at high risk for TB infection.²⁸

In recent years, the number and proportion of foreign-born persons with TB have increased substantially. The case rate among foreign-born persons was approximately 12 times higher than among U.S.-born populations. Detection and treatment of TB among immigrants and refugees require improved screening efforts and prompt reporting to state and local public health authorities.

Maintaining the decline in TB morbidity and reaching the goal of eliminating TB in the U.S. will require sustained prevention and control efforts, especially rapid diagnosis, ensured completion of treatment, and prompt and complete reporting. In addition, tuberculin-screening programs that target persons at highest risk ensure the most effective use of resources and appropriate use of preventive therapy.²⁹

¹ Person has symptoms of TB and is infectious. Bacteria are active.

Table 8: Tuberculosis Cases with HIV Test Results ⁽¹⁾ and with HIV Coinfection by Age in the US, 1993-2011

Year	25-44 Years Old				All Ages			
	HIV Test Results		HIV Positive		HIV Test Results		HIV Positive	
	No.	%	No.	%	No.	%	No.	%
1993	4,377	46%	2,790	29%	7,455	30%	3,682	15%
1994	4,443	49%	2,669	30%	7,887	33%	3,601	15%
1995	4,277	52%	2,172	26%	8,179	36%	3,038	13%
1996	4,366	58%	1,856	25%	8,832	42%	2,615	12%
1997	4,142	60%	1,473	21%	8,771	44%	2,092	11%
1998	3,862	61%	1,240	20%	8,292	45%	1,831	10%
1999	3,811	63%	1,175	19%	8,420	48%	1,726	10%
2000	3,525	63%	955	17%	8,117	50%	1,464	9%
2001	3,576	64%	911	16%	8,095	51%	1,408	9%
2002	3,512	66%	845	16%	8,022	53%	1,390	9%
2003	3,424	68%	807	16%	8,118	55%	1,320	9%
2004	3,442	70%	682	14%	8,507	59%	1,194	8%
2005	3,273	69%	611	13%	8,226	58%	1,042	7%
2006	3,277	70%	557	12%	8,270	60%	961	7%
2007	3,147	73%	488	11%	8,302	62%	883	7%
2008	3,036	72%	411	10%	8,010	62%	820	6%
2009	2,754	71%	399	10%	7,051	61%	706	6%
2010	2,751	75%	324	9%	7,445	67%	627	6%
2011	3,042	90%	342	10%	8,683	82%	672	6%

Source: Centers for Disease Control and Prevention. Reported Tuberculosis in the US, 1993-2011. October, 2013.

Note:

(1) Includes persons with positive, negative, or indeterminate HIV test results and persons from California with co-diagnosis of TB and AIDS. Rhode Island did not report HIV test results for years 1993–1997. HIV test results for Vermont are not included for 2007-2010. California test results are not included from 2004-2010.

(2) California began reporting HIV test results to the CDC in 2011.

Sources

- ¹ Centers for Disease Control and Prevention. [Reported Tuberculosis in the United States, 2011](#). October 2012.
- ² Ibid.
- ³ Centers for Disease Control and Prevention. [Epidemiologic Notes and Reports Expanded Tuberculosis Surveillance and Tuberculosis Morbidity — United States, 1993](#). *Morbidity and Mortality Weekly Report*. May 27, 1994; 43(20):361–6.
- ⁴ Centers for Disease Control and Prevention. [Reported Tuberculosis in the United States, 2011](#). October 2012.
- ⁵ Ibid.
- ⁶ Ibid.
- ⁷ Ibid.
- ⁸ Ibid.
- ⁹ Ibid.
- ¹⁰ Ibid.
- ¹¹ Ibid.
- ¹² Ibid.
- ¹³ Ibid.
- ¹⁴ Ibid.
- ¹⁵ Ibid.
- ¹⁶ Centers for Disease Control and Prevention. [Progress Toward the Elimination of Tuberculosis — United States, 1998](#). *Morbidity and Mortality Weekly Report*. August 27, 1999; 48(33): 732–6.
- ¹⁷ Centers for Disease Control and Prevention. [Reported Tuberculosis in the United States, 2011](#). October 2012.
- ¹⁸ Ibid.
- ¹⁹ Ibid.
- ²⁰ Centers for Disease Control and Prevention. [Extensively Drug-Resistant Tuberculosis — United States, 1993–2006](#). *Morbidity and Mortality Weekly Report*. March 23, 2007; 56(11):250–3.
- ²¹ Centers for Disease Control and Prevention. [Tuberculosis in the United States: National Tuberculosis Surveillance System Highlights from 2011](#).
- ²² Castro, KC. Statement to Senate Committee on Health, Education, Labor and Pensions, October 30, 2007. Available at <http://www.hhs.gov/asl/testify/2007/10/t20071030a.html>.
- ²³ World Health Organization. [Global Tuberculosis Control Report, 2012](#).
- ²⁴ Ibid.
- ²⁵ Ibid.
- ²⁶ World Health Organization. [Tuberculosis Fact Sheet, No. 104](#); February 2013.
- ²⁷ Centers for Disease Control and Prevention. [Reported Tuberculosis in the United States, 2011](#). October 2012.
- ²⁸ Ibid.
- ²⁹ Ibid.