

Annual Tuberculosis Surveillance Report Colorado 2011



Colorado Department
of Public Health
and Environment

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Summary

The state of Colorado documented 70 new cases of active tuberculosis disease during the 2011 calendar year. This represents a 1.4% decrease from the 71 cases reported in 2010. The largest decline was among the Hispanic population (from 28 cases in 2010 down to 19 in 2011, a 32% decline). An increase was seen in the Asians and Pacific Islander (A/PI) demographic group (from 17 cases in 2010 to 24 in 2011, a 41% increase). Also an increase in U.S.-born cases was seen in 2011 (from 16 cases in 2010 to 21 cases in 2011; a 31% increase). Birth in one of the 22 countries with highest TB burden (accounting for 80% of all TB cases worldwide) remains the strongest risk factor for developing active TB disease (25.8% of all 2011 cases) followed by having diabetes (10%), then being a healthcare worker within past year (7.1%), homelessness within past year (5.7%), excess alcohol use (4.3%) and being a non-injection drug abuser (1.4%). See **Table 1** for a more detailed demographic analysis.

Twelve of the state's 64 counties reported at least one new case of active TB disease in 2011. As in previous years, Denver reported the most cases (23) of any Colorado county. Forty-nine of Colorado's 64 counties have reported at least one case of active TB in the past ten years (2002-2011)—see **Table 3**.

The overall case rate in 2011, as in 2010, for active TB disease in Colorado was 1.4 per 100,000 persons, as compared to the overall rate in the United States of 3.4 per 100,000 according to the March 2012 TB report from the US Centers for Disease Control and Prevention (CDC). The rate in the foreign-born population in Colorado (10.2 per 100,000) was more than 20 times that of the U.S.-born population (0.5 per 100,000). Seventy percent of reported cases of TB disease were among foreign-born persons in 2011—see **Figure 8**.

There exists an ethnic/racial disparity in Colorado specific to the distribution of TB disease among minority racial and ethnic populations. In 2011, for instance, Black persons made up only 3.7% of the total population, yet represented 22.9% of all active TB cases. Persons of Hispanic origin made up 20.1% of the total Colorado population, yet they represented 27.1% of all active TB cases in 2011—see **Table 7** for a more detailed analysis.

In 2011, TB cases were reported among people ranging from 5 months to 87 years of age. Almost 36% of TB cases occurred among people ages 25-44 years, followed by those ages 45-64 years (31%) and ≥ 65 years (13%)—see **Figure 3** and **Table 5** for details.

Due to the length of time it takes to complete TB drug treatment, completion rates are pending for 2011. Complete 2011 treatment completion data will be included in the 2012 Annual Surveillance Report. In 2010 (the most current year for which robust treatment completion data are available), 66 of 71 cases were eligible to complete therapy (those not eligible were either dead at diagnosis or died during treatment). Of the 66 eligible cases, 65 (98.5%) completed therapy and one is currently on course to complete therapy.

In 2011, there were 303 Class B notifications of which 279 were confirmed as arriving in Colorado. Of those 279 confirmed arrivals, 255 (91.4%) were evaluated. Two of those were found to have active TB disease. See **Table 12** for more details.

Of the 52 culture-positive TB cases in 2011, 13 (25.0%) were resistant to at least one TB drug. Nine of the 13 resistant cases were resistant to one or more of the four primary “first line” TB drugs: isoniazid, rifampin, pyrazinamide and ethambutol. Four of those cases were resistant to isoniazid alone, and four were resistant to pyrazinamide alone. One of the nine was resistant to ethambutol alone and another case was resistant to streptomycin alone. There was one case of multi-drug resistant TB identified in 2011 showing resistance to isoniazid, rifampin, ethambutol, pyrazinamide and streptomycin. There were no cases of extensively drug resistant-TB (XDR-TB). See **Table 9** and **Figure 11** for four-year drug-resistance trends along with 2011 drug-resistance details.

In 2010, the most recent year with complete data, 34 sputum smear positive or sputum smear negative/culture positive cases yielded 599 contacts. As a result of these investigations, six active cases of TB and 135 cases of latent TB infection were identified. The 2011 data are incomplete and will not be available until August, 2012. **Table 1** shows demographic comparison between 2010 and 2011 active cases of TB disease.

Table 1. Tuberculosis in Colorado: Demographic Comparison of 2010 and 2011 Cases

	2010		2011	
	n	% of cases	n	% of cases
Age Group (years)				
<15	5	7.1	8	11.4
15-24	10	14.1	6	8.6
25-44	25	35.2	25	35.7
45-64	15	21.1	22	31.4
65+	16	22.5	9	12.9
TOTAL	71	100	70	100
Gender				
Male	42	59.2	37	52.9
Female	29	40.8	33	47.1
TOTAL	71	100	70	100
Race/Ethnicity				
White	9	12.7	10	14.3
Black	16	22.5	16	22.9
Hispanic	28	39.4	19	27.1
American Indian/Alaska native	1	1.4	1	1.4
Asian/Pacific Islander	17	23.9	24	34.3
Multiple race	0	0	0	0
TOTAL	71	100	70	100
Region				
Denver metro ^a	49	69.0	53	75.7
Outside Denver metro	22	31.0	17	24.3
TOTAL	71	100	70	100
Country of Origin (U.S.- vs. Foreign-born)				
United States	16	22.5	21	30.0
Mexico	22	31.0	12	17.1
Other countries	33	46.5	37	52.9
TOTAL	71	100	70	100
HIV Status				
HIV Negative	62	87.3	61	87.1
HIV Positive	6	8.5	3	4.3
Testing done, results unknown	0	0	0	0
Refused testing	0	0	4	5.7
Not offered	3	4.2	2	2.9
Unknown	0	0	0	0
TOTAL	71	100	70	100
Risk factors^b				
Birth in one of top 22 highest TB-burden countries ^c	17	23.9	18	25.8
Homeless within past year	3	4.2	4	5.7
Diabetes	8	11.3	7	10.0
Resident of correctional facility at diagnosis	0	0	2	2.9
Resident of long-term care facility	0	0	0	0
Injected drug use within past year	0	0	0	0
Non-injected drug use within past year	1	1.4	1	1.4
Excess alcohol use within past year	3	4.2	3	4.3
Health care worker within past year	2	2.8	5	7.1

Note: percentages may not equal 100 due to rounding.

a. Denver metro includes: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas and Jefferson counties.

b. A case may have more than one risk factor indicated.

c. According to the World Health Organization's definition of 22 highest-burden countries

http://www.who.int/tb/publications/global_report/2007/annex_1_download/en/index.html

Tuberculosis in Colorado: A Summary of Active Cases Reported in 2011

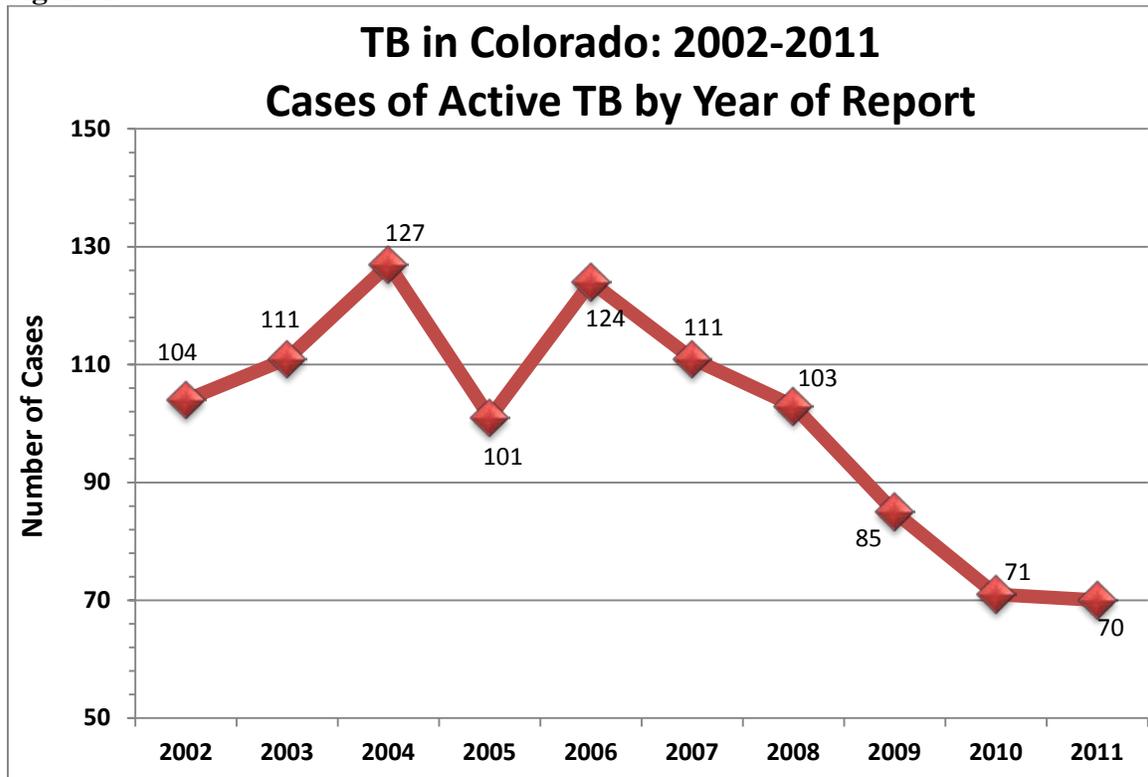
Tuberculosis Incidence

In 2011, a total of 70 active tuberculosis disease (TB) cases were reported in Colorado. As in the United States as a whole, Colorado has documented a slow decline in the number and case rate of TB cases over the past 10 years (**Table 2**). Colorado's case rate has dropped from 2.7 per 100,000 in 2004 to 1.4 during both 2010 and 2011. **Table 2** reflects active TB disease in Colorado and the United States over the past decade and **Figure 1** shows the 10 year trend in Colorado.

Table 2. Tuberculosis Cases and Case Rates per 100,000 Persons, Colorado and United States, 2002-2011

Year	Colorado		United States	
	Cases	Rate	Cases	Rate
2002	104	2.3	15,078	5.2
2003	111	2.4	14,871	5.1
2004	127	2.7	14,511	4.9
2005	101	2.1	14,093	4.8
2006	124	2.6	13,767	4.6
2007	111	2.3	13,293	4.4
2008	103	2.1	12,898	4.2
2009	85	1.7	11,483	3.8
2010	71	1.4	11,181	3.6
2011	70	1.4	10,465	3.4

Figure 1



Tuberculosis Cases by County

Twelve of Colorado's 64 counties reported a new case of active TB disease in 2011. Denver had the most with 23 cases, followed by Adams (10), Jefferson (8), El Paso (7), and Arapahoe and Boulder (5 each) counties (Figure 2, Table 3).

Figure 2. TB in Colorado: 2011 TB Cases by County

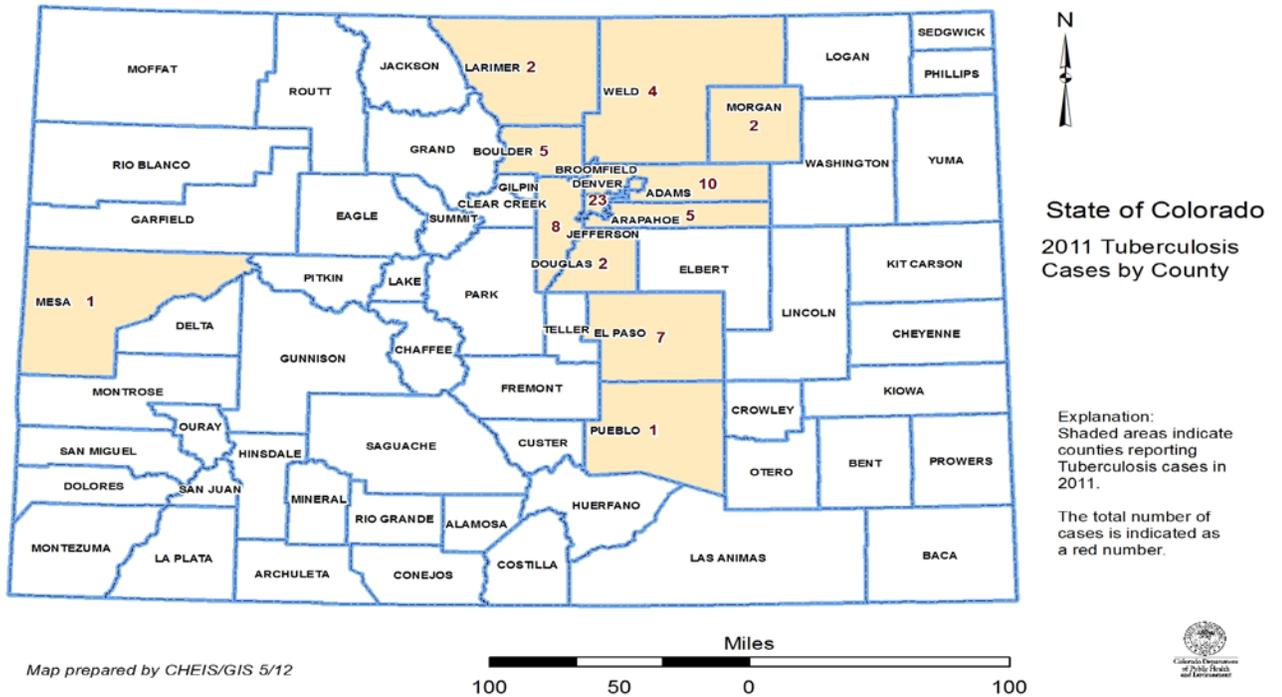


Table 3. TB in Colorado: Cases by County and Year of Report 2002-2011

County	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Adams	11	9	13	6	17	14	14	4	6	10
Alamosa	0	0	0	1	0	0	0	0	0	0
Arapahoe	20	20	18	17	22	17	14	11	17	5
Archuleta	0	1	0	0	0	0	0	0	0	0
Bent	0	0	0	0	0	1	0	0	0	0
Boulder	5	13	2	3	7	5	7	3	0	5
Broomfield	0	0	0	1	0	0	0	0	1	0
Chaffee	0	1	0	0	0	0	0	0	0	0
Clear Creek	0	0	0	0	0	0	0	1	0	0
Conejos	0	1	0	0	1	0	2	0	0	0
Costilla	0	0	0	0	0	0	0	0	0	0
Crowley	0	0	1	0	0	0	0	0	0	0
Delta	0	0	0	0	0	1	0	1	0	0
Denver	38	38	47	42	40	37	24	29	24	23
Douglas	2	0	3	0	1	2	3	4	1	2
Eagle	1	2	0	1	0	0	1	2	0	0
El Paso	5	4	9	9	10	7	10	7	8	7
Elbert	0	1	0	0	0	0	0	0	0	0
Fremont	0	2	0	1	0	1	0	1	1	0
Garfield	1	0	0	0	2	2	1	2	0	0
Grand	0	0	2	1	2	0	0	0	0	0
Gunnison	0	0	0	0	0	0	0	2	0	0
Huerfano	0	0	0	0	0	0	0	0	1	0
Jefferson	4	7	10	5	5	9	12	8	0	8
Kit Carson	0	0	0	0	0	0	0	0	1	0
La Plata	1	0	1	0	0	0	0	0	0	0
Lake	0	0	0	0	0	1	1	0	0	0
Larimer	3	3	2	2	4	2	3	2	5	2
Las Animas	0	0	0	0	0	2	1	2	0	0
Lincoln	0	0	0	0	0	0	0	0	0	0
Logan	0	0	0	1	0	0	1	0	0	0
Mesa	2	2	0	0	0	0	0	1	0	1
Moffat	0	0	0	1	0	0	0	0	0	0
Montezuma	0	0	2	0	0	1	0	0	0	0
Montrose	0	0	0	0	0	0	0	0	0	0
Morgan	1	1	1	2	0	2	1	1	0	2
Otero	0	0	0	0	1	0	1	0	0	0
Phillips	0	0	0	1	0	0	0	0	0	0
Pitkin	0	0	0	1	2	0	0	0	0	0
Pueblo	6	2	3	3	2	4	3	1	2	1
Rio Blanco	0	1	1	0	0	0	0	0	0	0
Rio Grande	0	0	0	0	0	1	0	0	1	0
Routt	0	0	0	0	0	0	0	0	0	0
Saguache	0	0	0	0	0	0	1	0	0	0
Sedgwick	0	0	1	0	0	0	0	0	0	0
Summit	0	0	2	0	1	0	0	0	1	0
Teller	0	0	0	0	0	0	0	1	0	0
Weld	4	2	9	3	5	1	3	2	2	4
Yuma	0	1	0	0	2	1	0	0	0	0
TOTAL	104	111	127	101	124	111	103	85	71	70

Note: Only counties reporting an active case of TB (2002-2011) are included.

Note2: Highlighted counties reported a case of active TB in 2011.

The county-specific five-year average TB incidence rates are provided in **Table 4**. Sixteen counties (25% of all counties) have an average case rate equal to or greater than

the average state case rate of 1.8 per 100,000 over the same five-year period, though several counties have too few cases for those incidence rates to be significant.

Table 4. TB in Colorado: 2007-2011 Mean Case Rates* by County (Reporting at least one case)

County	2007	2008	2009	2010	2011	5-Year Incidence Rates 2007-2011
Adams	3.3	3.2	0.9	1.3	2.2	2.2
Arapahoe	3.1	2.5	1.9	2.9	0.9	2.3
Bent	17.0	0.0	0.0	0.0	0.0	3.1
Boulder	1.7	2.3	1.0	0.0	1.7	1.3
Broomfield	0.0	0.0	0.0	1.8	0.0	0.4
Clear Creek	0.0	0.0	10.9	0.0	0.0	2.2
Conejos	0.0	24.0	0.0	0.0	0.0	4.8
Delta	3.2	0.0	3.1	0.0	0.0	1.3
Denver	6.3	4.0	4.7	3.8	3.8	4.5
Douglas	0.7	1.1	1.4	0.3	0.7	0.8
Eagle	0.0	1.9	3.7	0.0	0.0	1.1
El Paso	1.2	1.7	1.2	1.3	1.1	1.3
Fremont	2.1	0.0	2.1	2.0	0.0	1.2
Garfield	3.7	1.8	3.5	0.0	0.0	1.8
Gunnison	0.0	0.0	13.0	0.0	0.0	2.6
Huerfano	0.0	0.0	0.0	14.4	0.0	2.7
Jefferson	1.7	2.2	1.5	0.0	1.5	1.4
Kit Carson	0.0	0.0	0.0	11.5	0.0	2.4
Lake	12.3	12.1	0.0	0.0	0.0	4.9
Larimer	0.7	1.0	0.7	1.7	0.7	0.9
Las Animas	12.2	6.1	12.1	0.0	0.0	6.1
Logan	0.0	4.7	0.0	0.0	0.0	0.9
Mesa	0.0	0.0	0.7	0.0	0.7	0.3
Montezuma	3.9	0.0	0.0	0.0	0.0	0.8
Morgan	7.1	3.6	3.5	0.0	7.0	4.2
Otero	0.0	5.3	0.0	0.0	0.0	1.1
Pueblo	2.6	1.9	0.6	1.2	0.6	1.4
Rio Grande	7.9	0.0	0.0	7.9	0.0	3.2
Saguache	0.0	14.3	0.0	0.0	0.0	2.9
Summit	0.0	0.0	0.0	3.4	0.0	0.7
Teller	0.0	0.0	4.4	0.0	0.0	0.9
Weld	0.4	1.2	0.8	0.8	1.5	0.9
Yuma	10.1	0.0	0.0	0.0	0.0	2.0
Colorado	2.3	2.1	1.7	1.4	1.4	1.8

*TB disease per 100,000 persons

Note: Denominators for computing the rates of tuberculosis in Colorado on this and all remaining tables and graphs are supplied by the U.S. Census Bureau and the Colorado Division of Local Government, State Demography Office.

Note 2: Case rates based on fewer than five health events, as is the case with most of the above metrics, are likely to be unstable and imprecise.

Tuberculosis by Age Group

In 2011, TB cases were reported among people ranging from 5 months to 87 years of age. Almost 36% of TB cases occurred among people ages 25-44 years, followed by those ages 45-64 years and ≥ 65 years (31% and 13%, respectively).

Eight cases of pediatric TB (<15 years of age) were reported in 2011. Atypically, only two of the eight cases were among foreign-born children. This is a trend that will be watched closely and addressed if it continues. Active TB in young children is particularly concerning, as it is indicative of ongoing transmission in the community as well as missed opportunities for preventive therapy. Of those eight pediatric cases, five were among children less than five years of age and all five were female (Figure 3).

Figure 3.

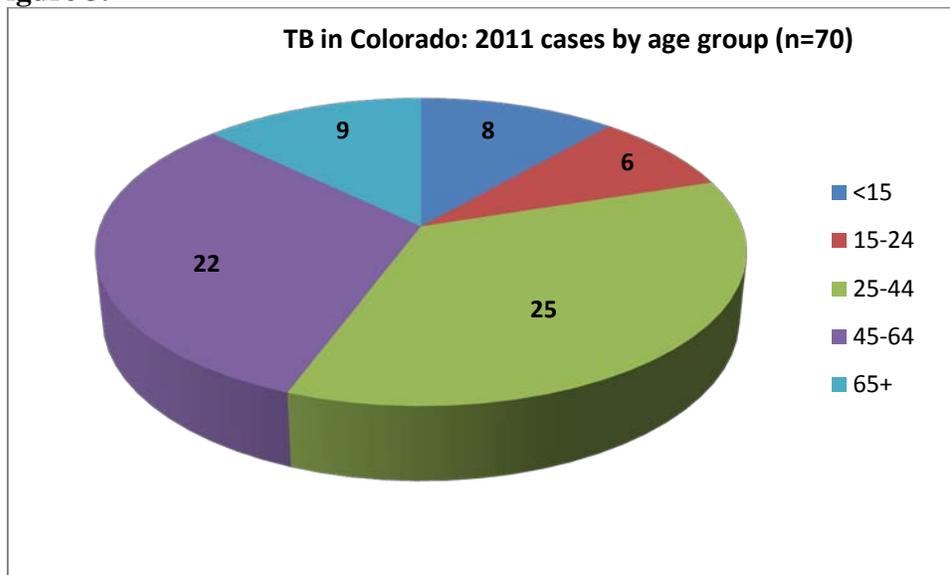


Table 5 shows that in 2011, the highest TB incidence was among persons 75-79 years of age (3.1 cases per 100,000) and lowest (among groups with at least one documented case) among children ages 5-9 years (0.3 cases per 100,000). There was a 142% increase in TB disease among 25-34 year olds in 2011 from 2010 (7 cases in 2010; 17 cases in 2011). In contrast, there was a 125% decline in TB disease among 35-44 year olds over the same period (18 in 2010; 8 in 2011). Table 6 shows the age groups relative to nativity (U.S.-born and foreign-born).

Table 5. TB in Colorado: 2010 & 2011 Reported Cases by Gender and Age Group

Age Group	2010				2011			
	Male	Female	Total	Rate*	Male	Female	Total	Rate*
0 to 4	1	1	2	0.6	0	5	5	1.4
5 to 9	1	2	3	0.9	0	1	1	0.3
10 to 14	0	0	0	0	1	1	2	0.6
15 to 19	2	0	2	0.6	0	2	2	0.6
20 to 24	3	5	8	2.3	1	3	4	1.1
25 to 29	0	1	1	0.3	4	4	8	2.1
30 to 34	3	3	6	1.7	3	6	9	2.5
35 to 39	5	3	8	2.3	2	1	3	0.8
40 to 44	6	4	10	2.9	4	1	5	1.4
45 to 49	2	2	4	1.1	4	0	4	1.1
50 to 54	4	0	4	1.1	8	2	10	2.7
55 to 59	1	1	2	0.6	5	2	7	2.1
60 to 64	4	1	5	1.9	1	0	1	0.4
65 to 69	1	1	2	1.1	0	3	3	1.6
70 to 74	5	4	9	7.1	1	1	2	1.6
75 to 79	0	0	0	0	2	1	3	3.1
80 to 84	4	0	4	5.5	1	0	1	1.4
85+	0	1	1	1.4	0	0	0	0
TOTAL	42	29	71	1.4	37	33	70	1.4

Note: Case rates based on fewer than five health events are likely to be unstable and imprecise.
*Rates are per 100,000 persons.

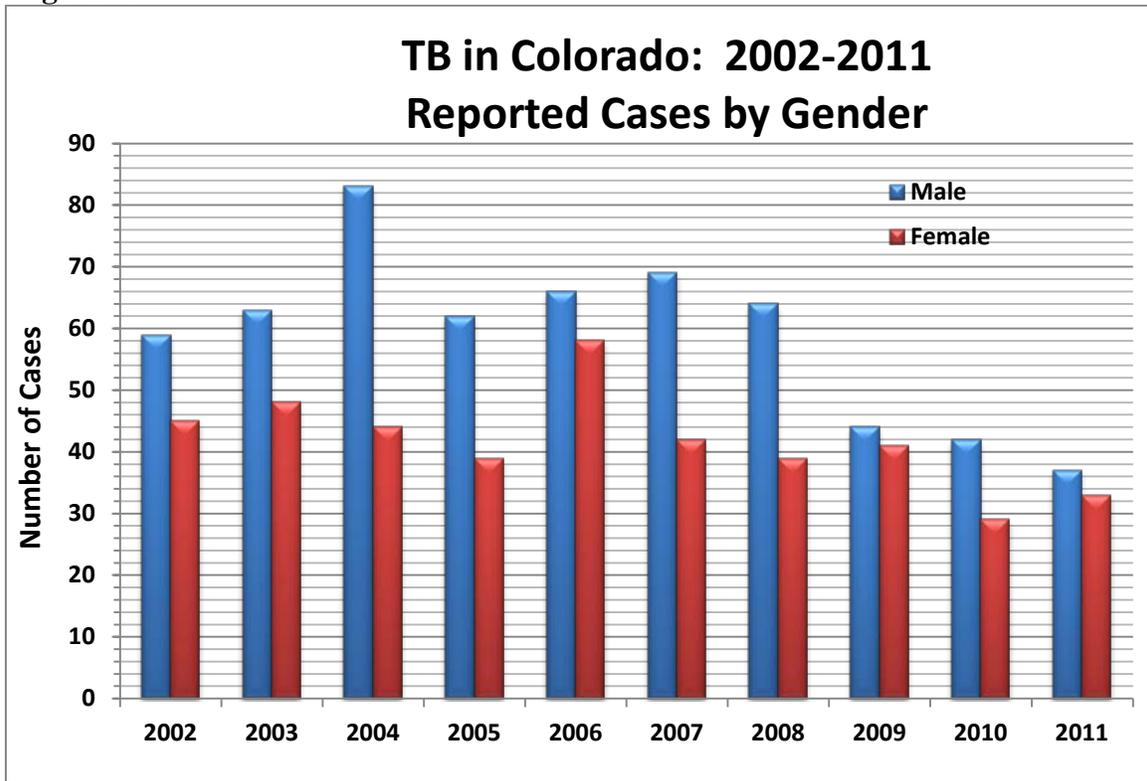
Table 6. TB in Colorado: 2010 & 2011 Comparison by Age Group and Patient Nativity

Age Group	2010			2011		
	U.S.-Born	Foreign-Born	Total	U.S.-Born	Foreign-Born	Total
0-4	2	0	2	5	0	5
5-14	1	2	3	1	2	3
15-24	3	7	10	1	5	6
25-34	0	7	7	3	14	17
35-44	3	15	18	0	8	8
45-54	1	7	8	4	10	14
55-64	1	6	7	4	4	8
65-74	3	8	11	1	4	5
75-84	2	2	4	2	2	4
85+	0	1	1	0	0	0
TOTAL	16	55	71	21	49	70

Tuberculosis by Gender

Tuberculosis tends to infect and lead to active TB disease in males more often than females. This finding may be due to disparities in access to care, differing health-seeking behaviors, underlying biological susceptibility to TB or the distribution of risk factors such as substance abuse and homelessness. Gender-specific cases over the last 10 years are found in **Figure 4**. In 2011, the usual TB gender disparity was less-pronounced than in some previous years with 37 males (52.8%) and 33 females. By comparison, 2010 saw 42 males (59.2%) and 29 females diagnosed and treated for active TB disease.

Figure 4.

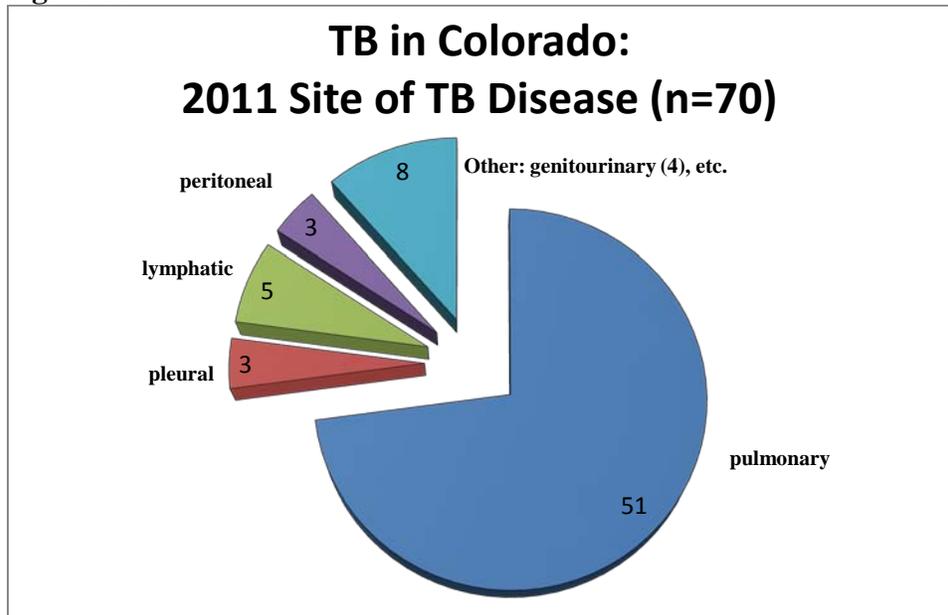


Tuberculosis Cases by Major Site of Disease

Tuberculosis most often attacks the lungs (pulmonary TB), but may affect any part of the body (extrapulmonary TB), including the kidneys, spine/brain, lymph nodes, bones/joints and genitourinary tract. In 2011, 51 of the 70 (72.9%) cases were pulmonary or had both a pulmonary/extrapulmonary site of disease, which is consistent with recent years' surveillance. The second most common site of infection in 2011 was the lymph system (cervical, intrathoracic or axillary) with 5 cases (7.1%). There were two cases of *M. bovis* infection in 2011; both were females; a 57 year old woman with genitourinary TB and a 34 year old woman with lymphatic-cervical and pulmonary TB. Both were PZA resistant by definition. Two other cases had PZA resistance, but without a *M. bovis* genotype.

Figure 5 shows the major anatomical sites of TB disease among 2011 cases.

Figure 5.



Tuberculosis by Race/Ethnicity

The number of reported cases of TB in Colorado for the last decade has been highest among racial and ethnic minorities. The distribution of cases in 2011 reflected some marked differences from the two previous years. The biggest changes of note were among Hispanics and Asian/Pacific Islanders (A/PI). In the former group, incidence was down from 42 cases in 2009 to only 19 cases in 2011; a decrease of 55%. Among the A/PI cohort, an increase in incidence was observed; from only 17 cases in 2010 to 24 cases in 2011; a jump of 41% (see **Figure 6** and **Figure 7** for a full breakdown). In fact, Asian/Pacific Islanders comprised the single largest racial/ethnic cohort in Colorado. As observed nationally, there also exists an ethnic/racial disparity in Colorado specific to the distribution of TB disease among racial and ethnic minorities. This is a major concern to the state of Colorado's TB Program. In 2011, Black persons comprised only 3.7% of the total population, yet represented 22.9% of all active TB cases. Persons of Hispanic origin made up 20.1% of the total Colorado population, yet they represented 27.1% of all active TB cases in 2011; a marked improvement from 2010, but disproportionate none-the-less. Asian and Pacific Islanders, who made up only 2.8% of Colorado's total population, comprised 34.3% of all active TB cases in Colorado in 2011. With a less-glaring disparity, American Indians and Native Alaskans (AI/AN) make up less than 1% of the state's total population, but comprised 3.4% of the active TB cases. The white/Caucasian population, in fact, was the only racial/ethnic group to have a lower disease burden than representation in the general population. Whites/Caucasians make up 70.6% of Colorado's population in 2011, but only 14.3% of the cases of active TB disease.

Figure 6.

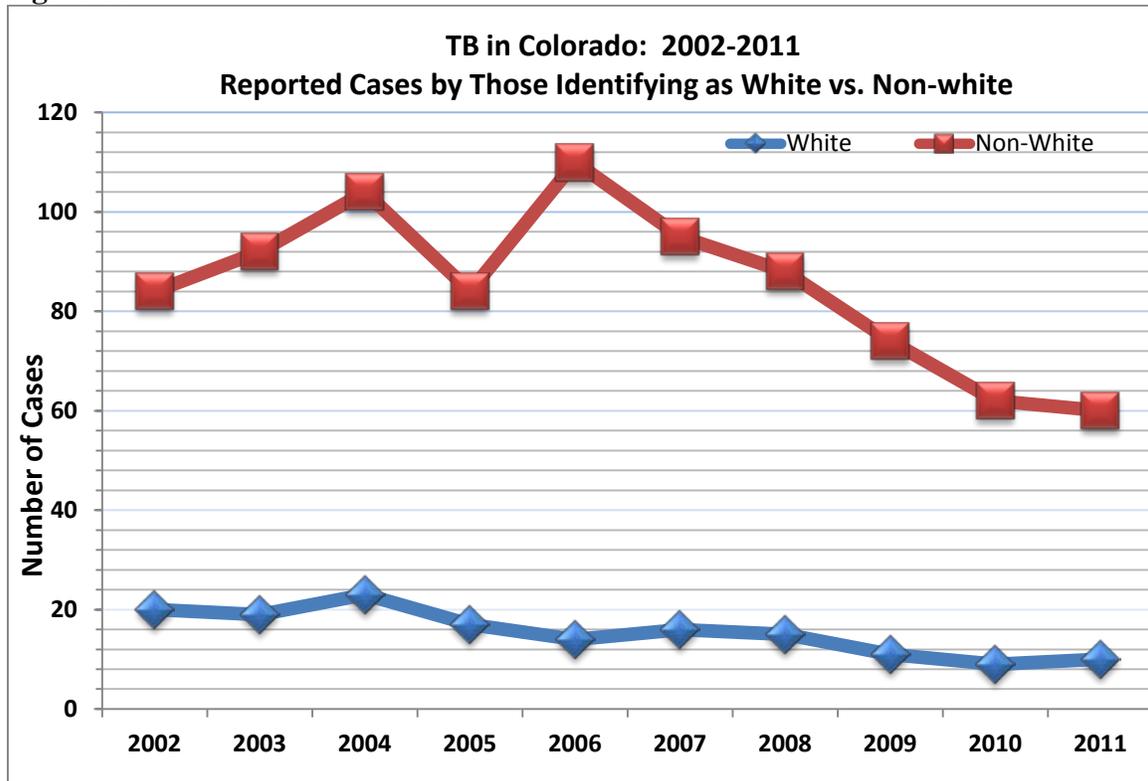
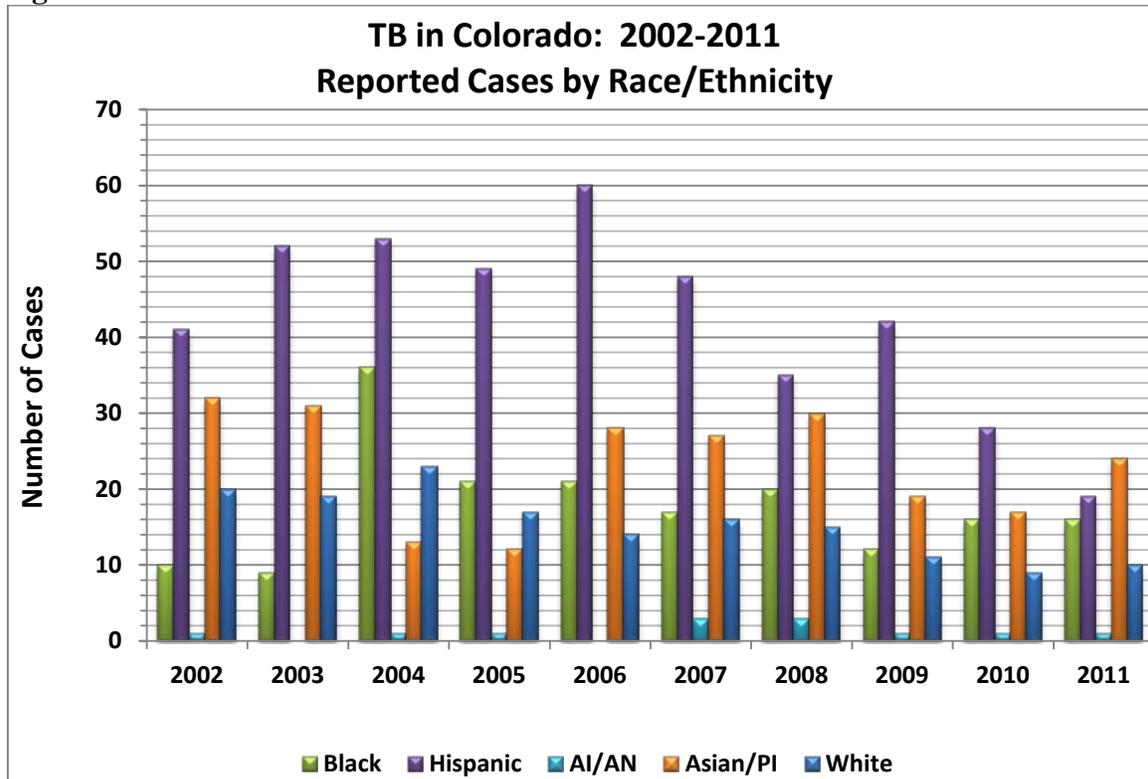


Figure 7.



The United States Centers for Disease Control and Prevention (CDC) considers Colorado a low-incidence state in relation to reportable TB disease (defined as a case rate less than

3.5 per 100,000 persons); however, case rates in most minority populations exceed the “low-incidence” threshold. **Table 7** compares race and ethnicity TB case rates from 2010 and 2011.

Table 7. TB in Colorado: 2010 and 2011 by Race/Ethnicity

Race/ethnicity	2010		2011	
	Number of Cases (% of total)	Incidence Rate*	Number of Cases (% of total)	Incidence Rate*
White/Caucasian	9 (12.7)	0.3	10 (14.3)	0.3
Black/African-American	16 (22.5)	7.9	16 (22.9)	8.8
Hispanic	28 (39.4)	2.7	19 (27.1)	1.9
Asian/Pacific Islander	17 (23.9)	11.7	24 (34.3)	17.7
American Indian/AK native	1 (1.4)	3.4	1 (1.4)	3.4
TOTAL	71 (100)	1.4	70 (100)	1.4

*Per 100,000 persons

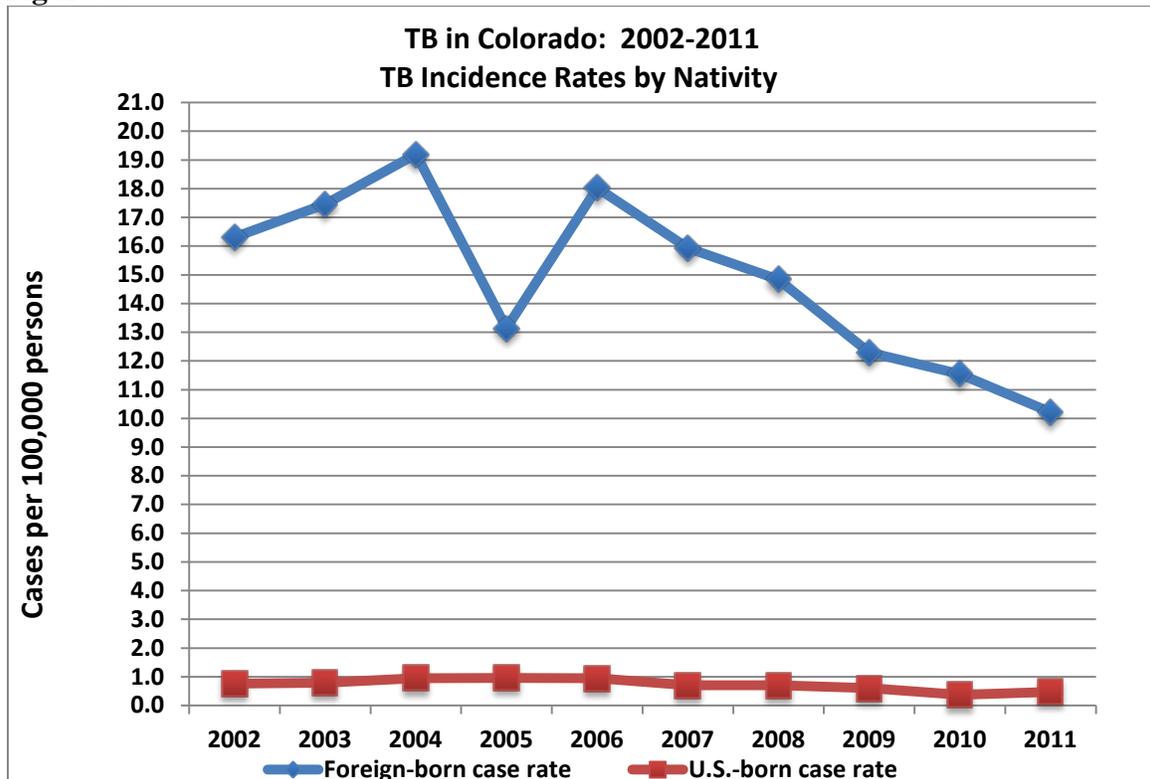
Note: Case rates based on fewer than five health events are likely to be unstable and imprecise.

Note2: percentages may not equal 100 due to rounding.

TB Incidence Rates by Nativity

In 2011, the TB incidence in the foreign-born population living in Colorado was 10.2 per 100,000 persons, which is over 20 times that of the U.S.-born population (0.5 per 100,000). Since 2000, more than two-thirds (69%) of the cases of TB disease reported in Colorado were among foreign-born individuals (**Figure 8 and Figure 9**), but this is trending down.

Figure 8.



In 2011, 49 foreign-born cases of TB were reported in Colorado, representing 70.0% of all cases that year. The largest single cohort came from Mexico with 12 cases, down from 22 in 2010, an 83% decline. As previously mentioned, one of the most striking surveillance trends was the increase in U.S.-born cases in 2011. In fact, the U.S.-born cohort was the largest from any single country. Twenty-one of 70 cases (30% of total) were born in the U.S. The next closest nativity cohort was Mexico with 12 cases (17.1%). **Table 8** shows a breakdown of the countries of origin for all active cases of TB disease from 2008-2011. 2011 cases are highlighted. Of those foreign-born cases, 18 (25.7%) came from one of the top 22 highest-burdened countries that comprise 80% of all global cases of active TB disease.

Figure 9.

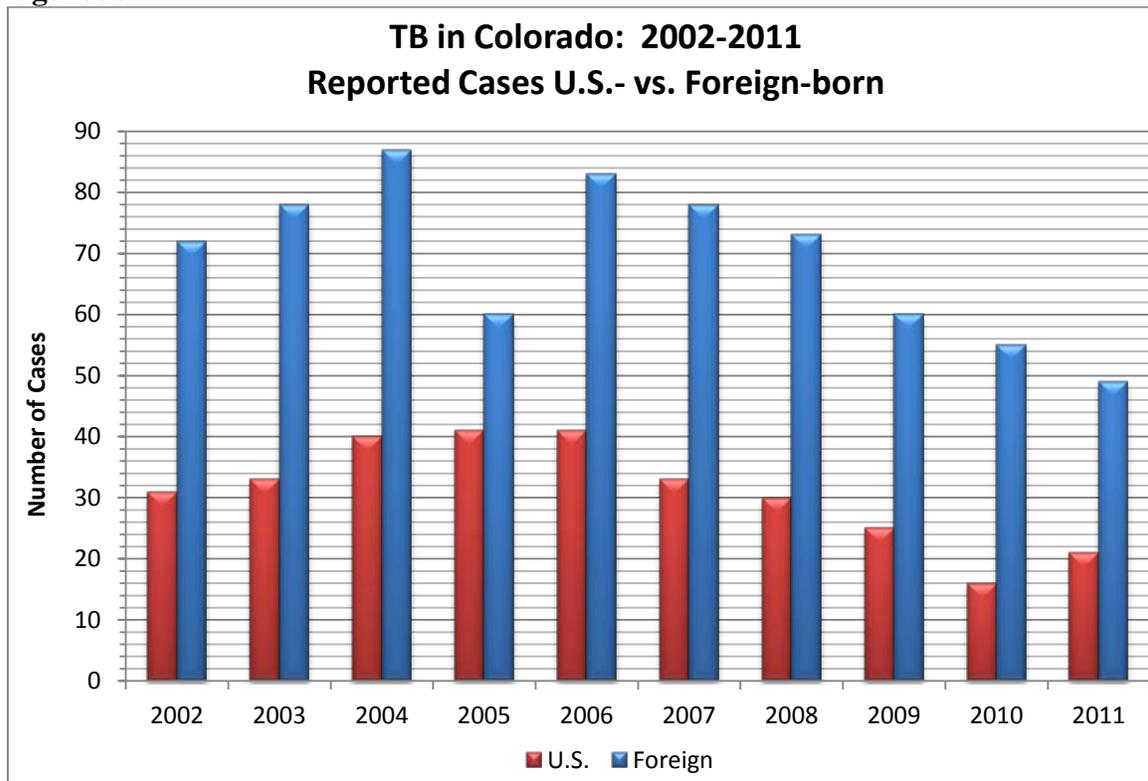


Table 8. Comparison of Colorado TB Cases by Country of Nativity, 2008-2011

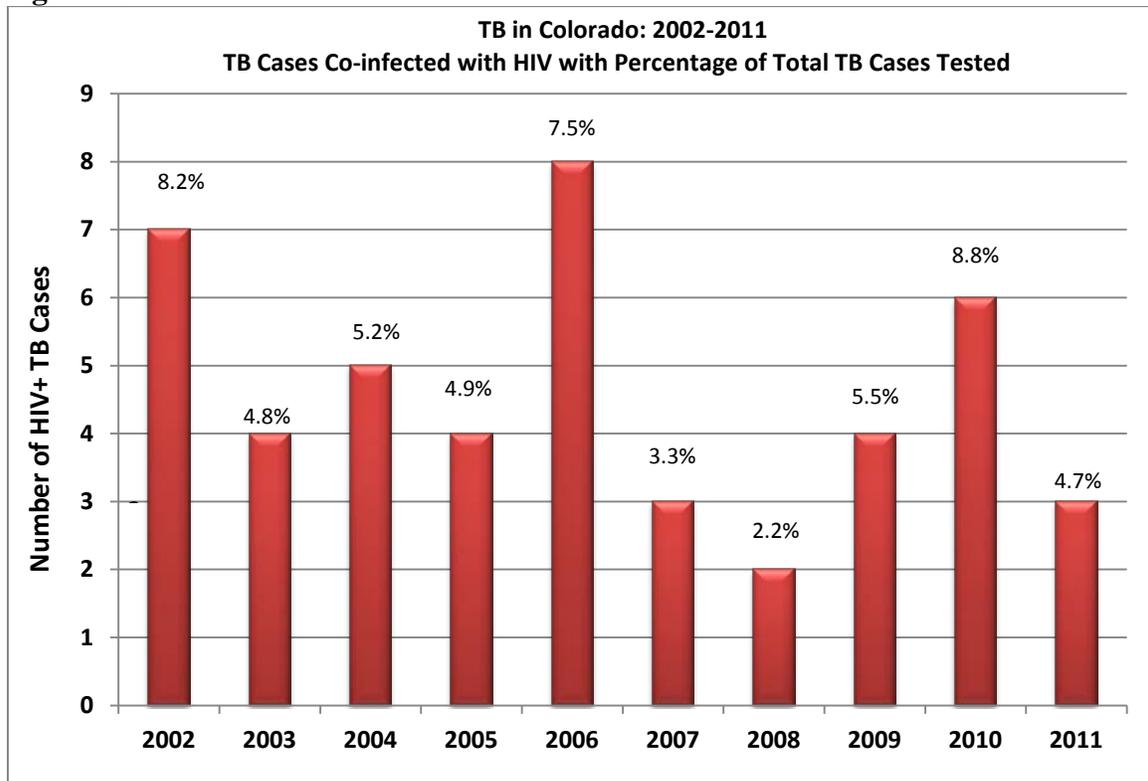
Country	2008 Cases	2009 Cases	2010 Cases	2011 Cases
Austria	0	1	0	0
Bangladesh*	0	0	2	0
Bhutan	2	2	1	1
Burma/ Myanmar*	2	1	2	1
Canada	0	0	1	0
China*	2	0	1	1
Cuba	1	0	0	0
DRC*	0	0	0	1
El Salvador	2	1	0	0
Eritrea	1	0	1	2
Ethiopia*	4	3	4	2
Fiji	0	0	0	1
Germany	0	0	1	0
Guam	0	0	1	0
Guatemala	0	1	0	0
Honduras	1	1	0	1
India*	5	5	1	4
Indonesia*	0	1	2	1
Italy	0	0	0	1
Jamaica	0	0	1	0
Kenya*	1	3	0	2
Korea	1	0	1	2
Laos	1	0	0	1
Liberia	1	0	1	0
Madagascar	1	0	0	0
Mexico	22	26	22	12
Mongolia	1	1	0	0
Morocco	1	0	0	0
Nepal	3	2	0	3
Pakistan*	0	0	0	1
Palau	0	0	1	0
Peru	2	1	1	0
Philippines*	3	3	3	2
Rwanda	1	1	1	0
Senegal	0	0	1	0
Somalia	5	2	4	5
Taiwan	0	0	0	1
Tonga	0	0	0	1
U.S.	30	25	16	21
Viet Nam*	7	5	2	3
Total cases	103	85	71	70

*One of the 22 highest-burden countries

HIV Co-infection

Worldwide, one in four people with HIV who die of AIDS-defining conditions, do so as a result of TB complications. HIV-infected people with latent TB infection (LTBI) are at higher risk of active TB because HIV weakens the immune system, greatly increasing the likelihood of progression from latent infection to active TB disease. Of the 70 cases of TB in 2011, test results for HIV were available for 64 (91% of total cases) and, of those, three persons were found to be co-infected with HIV. Four patients refused an HIV test. Two of the 70 total patients were not offered an HIV test and another two were dead at diagnosis. Until every person with active TB disease is offered an HIV test that includes an explanation of the medical necessities for such a test, this will remain an area for improvement. **Figure 10** shows the total number of HIV cases among TB patients over the last 10 years, as well as the percentage of co-infection each year.

Figure 10.



Drug Resistance and TB

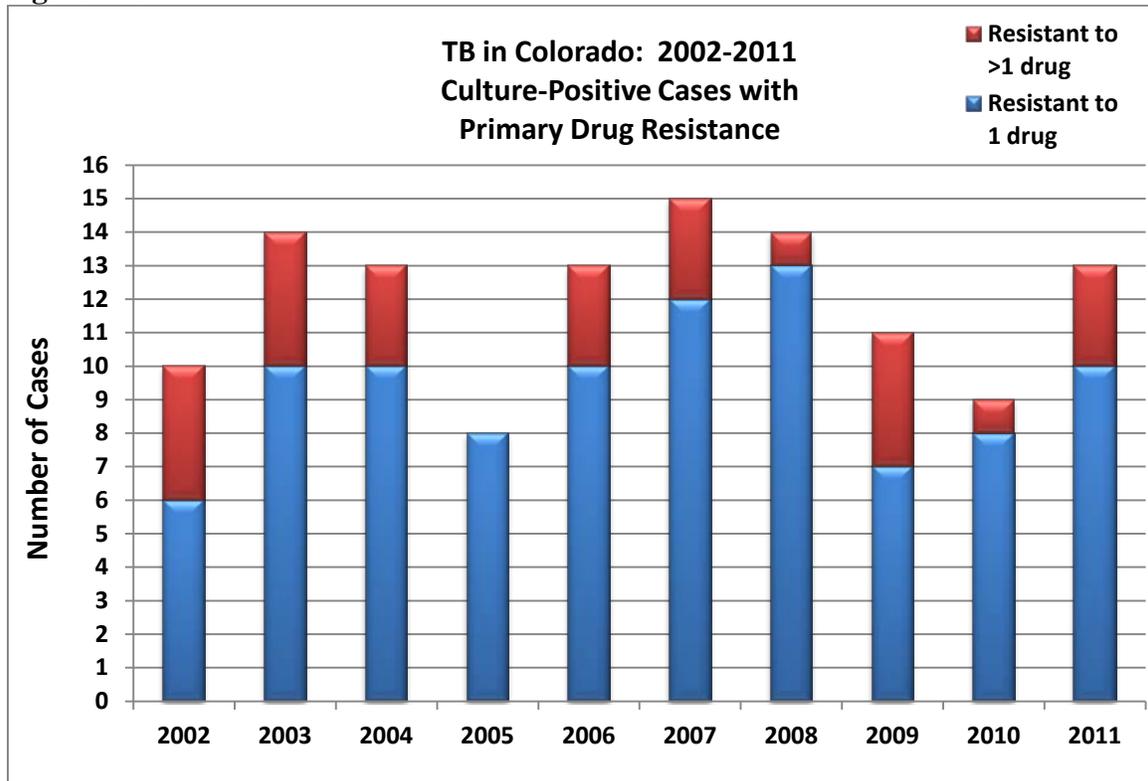
Of the 70 TB cases in 2011, 13 were resistant to at least one TB drug. Nine of these 13 (69%) cases were resistant to one or more of the four primary TB drugs: isoniazid, rifampin, pyrazinamide and ethambutol. Four of those cases were resistant to isoniazid alone along with another four resistant to only pyrazinamide. One of the 13 was resistant to streptomycin alone. One case was multi-drug resistant (MDR) showing resistance to all four first-line drugs as well as streptomycin. There were no cases of extensively-drug resistant TB (XDR-TB) identified in 2011. Since 2007, there had been a slight, but steady decline in cases of drug resistance that correlates with the annual drop in TB incidence

until 2011 when cases jumped from 9 in 2010 to 13; a 44% increase. See **Table 9** for a full break down of drug susceptibilities over the past four years.

Table 9. TB in Colorado: 2008-2011 Drug Susceptibilities

	2008	2009	2010	2011
Drug(s)	Number resistant	Number resistant	Number resistant	Number resistant
isoniazid only	7	3	5	4
pyrazinamide only	4	3	2	4
ethambutol only	1	0	0	1
isoniazid and streptomycin	0	3	0	1
isoniazid and rifampin	0	0	0	0
pyrazinamide and streptomycin	0	1	0	0
streptomycin only	2	1	1	1
streptomycin and ethionamide	1	0	0	0
isoniazid, streptomycin and ethambutol	0	0	0	1
isoniazid, streptomycin and ethionamide	1	0	0	0
isoniazid, rifampin, ethambutol, pyrazinamide and streptomycin	0	0	1	1
Total	16	11	9	13

Figure 11.



Directly Observed Therapy (DOT)

Directly observed therapy (DOT) is the standard of care for administering TB medications. Directly observed therapy is required for all pulmonary cases of TB and involves health care workers observing the patient taking his/her medications to ensure compliance with, and completion of, the treatment regimen. During 2010 (the most recent year with complete data), there were 71 people who were treated for active TB disease. All completed treatment through DOT, self-administered treatment or a combination of both. In 2011 to date, 46 patients have received treatment, all of whom have completed treatment via DOT or a combination of these modalities. **Table 10** presents the number and percentage of cases receiving DOT in 2009 and 2010 along with preliminary 2011 data.

Table 10. Number and Percentage of Patients Receiving DOT in Colorado 2009-2011

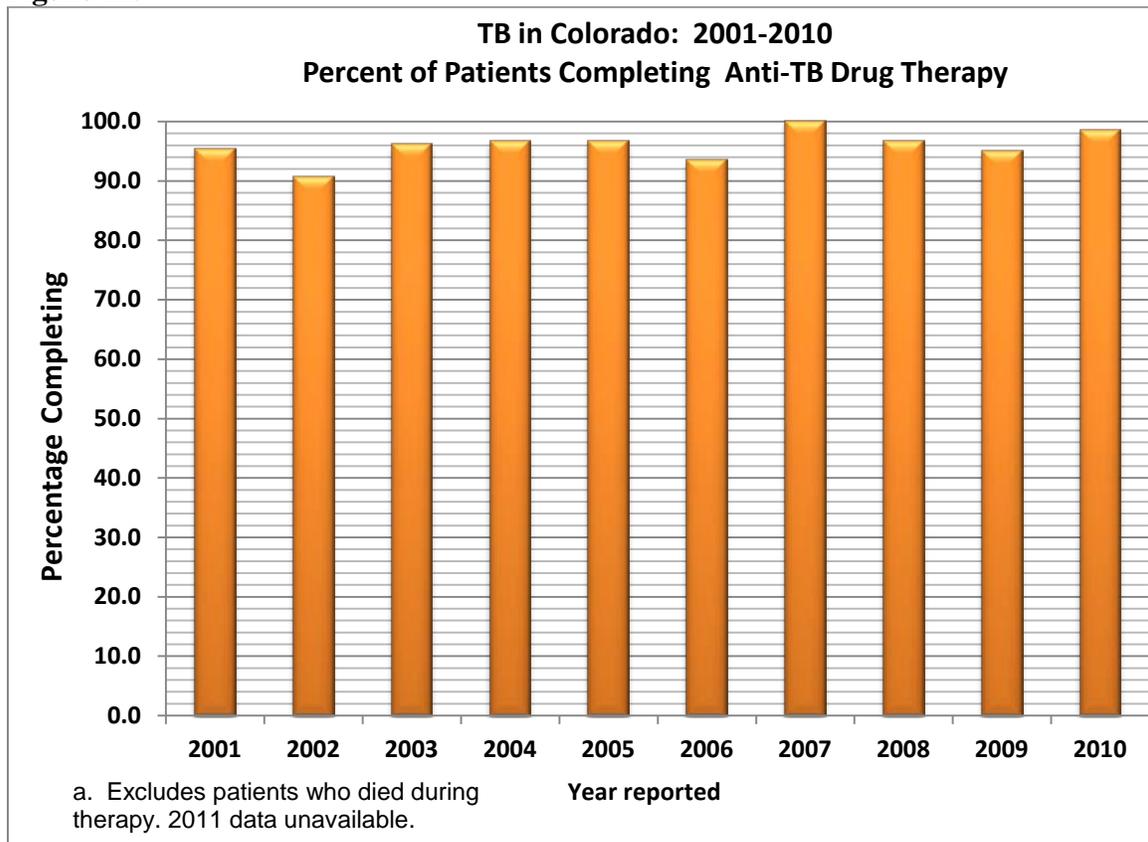
	2009		2010		2011*	
	N	%	N	%	N	%
DOT only	69	81.2	57	81.4	40	83.3
DOT + self administered	12	14.1	12	17.1	5	7.1
Self administered only	3	3.5	1	1.4	1	1.4
Dead at diagnosis	1	1.2	0	0	2	2.9
TOTAL	85	100	70	100	48	100

*2011 data are preliminary; 22 of 70 cases are pending

Completion of TB treatment

The standard treatment for active TB disease is six months in duration and utilizes the four “first-line” TB drugs: isoniazid, pyrazinamide, rifampin, and ethambutol. In 2010 (the most current year for which robust treatment completion data are available), 66 of 71 cases were eligible to complete therapy (those not eligible [5 cases] were either dead at diagnosis or died during treatment). Of the 66 eligible cases, 65 (98.5%) completed therapy and one (1.4%) is currently on treatment. Treatment completion data for 2011 will be described in more detail in the 2012 surveillance report when these data will be more complete. **Figure 11** includes updated 2010 treatment completion data, along with complete data for the previous nine years.

Figure 12.



Contact Investigations

The Colorado Department of Public Health and Environment’s TB Program is responsible for TB control throughout the state of Colorado, which includes the public health imperative to conduct contact investigations on all cases of infectious (pulmonary, pleural and laryngeal) TB. Contacts to infectious TB patients are 75 times more likely to be infected with TB than the general public, making it critical to locate, evaluate, and treat infected contacts. **Table 11** is a summary of contact investigations from 2002-2010 (2010 data is preliminary and preliminary data for 2011 will be available when the 2012 report is completed). In 2009, 41 sputum smear positive or sputum smear negative/culture positive cases yielded 490 contacts. As a result of these investigations, two active cases of TB disease and 176 cases of latent TB infection were identified. Of those 176 cases,

149 started LTBI treatment (85%) and 108 patients (72%) completed LTBI treatment. While 2010 data are preliminary, the latest findings indicate 34 sputum smear-positive or sputum smear-negative/culture-positive cases were identified. These led to 599 contacts being identified. Of those, six cases of active TB disease were identified and treatment initiated. In addition, 135 cases of LTBI were identified, of which 126 (93%) started treatment.

Table 11. TB in Colorado: Follow-up and Treatment for Contacts to Tuberculosis Cases, 2002-2010

	2002	2003	2004	2005	2006	2007	2008	2009	2010*
Number of sputum smear- or culture-positive cases	60	45	48	44	64	40	44	41	34
Total contacts	1,388	593	1,462	1,317	1,523	594	1,185	490	599
Average contacts per infectious case	23.1	13.1	30.5	29.9	23.7	14.8	26.9	11.9	17.6
Number (%) of contacts evaluated*	1,017 (73%)	489 (82%)	1,170 (80%)	1,113 (85%)	1,290 (85%)	432 (73%)	998 (84%)	447 (91%)	560 (93%)
Number (%) of contacts with latent TB infection	253 (25%)	111 (23%)	351 (30%)	220 (20%)	274 (21%)	127 (29%)	160 (16%)	176 (39%)	135 (24%)
Number (%) of infected contacts starting treatment	164 (65%)	89 (80%)	276 (79%)	179 (81%)	217 (79%)	101 (79%)	128 (80%)	149 (85%)	126 (93%)
Number (%) of contacts starting treatment who completed treatment	121 (74%)	63 (71%)	187 (68%)	129 (72%)	146 (67%)	83 (82%)	82 (63%)	108 (72%)	Not available yet
Number (%) of contacts with active TB disease	2 (<1%)	3 (<1%)	16 (1%)	7 (<1%)	9 (<1%)	3 (<1%)	2 (<1%)	2 (<1%)	6 (1.1%)

Note: Evaluated = symptom check and tuberculin skin test/IGRA, chest x-ray, sputum studies as indicated.

*2010 data are preliminary; preliminary 2011 data to follow in 2012 Surveillance Report.

Class B Evaluations

Immigrants and refugees who are traveling to the United States are evaluated for TB prior to arriving (as required by U.S. immigration law), and assigned a classification according to the status of their disease. An individual with a medical history, physical exam, or chest x-ray suggestive of pulmonary TB, but who has a negative acid-fast bacilli (AFB) smear and culture and not diagnosed with active TB *or* has been diagnosed with TB and completes treatment overseas is classified as a Class B1. Those with a positive tuberculin skin test (TST) aged fifteen years or younger, and those with a chest x-ray not suggestive of TB are classified as Class B2. The Division of Global Migration and Quarantine notifies CDPHE's TB Program of all class B1 and B2 individuals who are entering the state. The CDPHE TB Control Program forwards these referrals to the local health departments in the counties where the individual will reside. The local health departments provide medical evaluations and treatment for infection, whether active or latent. In 2011,

there were 303 Class B notifications of which 279 were confirmed as arriving in Colorado. Of those 279 arrivals, 255 (91.4%) were evaluated. Two of those were found to have active TB disease. **Table 12** shows a breakdown of Class B data for 2006-2011 in Colorado.

Table 12. TB in Colorado: Class B Data 2006-2011

	2006		2007		2008		2009		2010*		2011*	
	n	%	n	%	n	%	n	%	n	%	n	%
Class B notifications	147		165		252		322		325		303	
Moved prior to evaluation	9	6.1	8	4.8	20	7.9	16	5.1	25	7.7	24	7.9
Confirmed Arrivals	138	93.9	157	95.2	232	92.1	296	94.9	300	92.3	279	92.1
Evaluated	128	92.8	155	98.7	196	84.5	215	72.6	259	86.3	255	91.4
TB disease diagnosed	3	2.3	7	4.5	5	2.6	2	0.9	5	1.9	2	0.8
Isoniazid recommended (LTBI)	63	49.2	72	46.5	105	53.6	114	53.0	102	39.4	98	38.4
Started treatment	51	81.0	67	93.1	92	87.6	93	81.6	83	81.4	78	79.6
Completed treatment	44	86.3	50	74.6	72	78.3	74	79.6	71	85.5	46	59.0
Currently on treatment							0	0.0	4	4.8	30	38.5
*2010 & 2011 data are preliminary												

Moving Forward

The Colorado Department of Public Health and Environment's TB Program maintains strong partnerships with local health departments, regional states' TB programs, and federal agencies in ongoing efforts to prevent and control TB in Colorado. While the number of TB cases and corresponding incidence rates continue trending downward, the number of TB cases reported among foreign-born persons continues to increase relative to U.S.-born cases, despite 2011 surveillance data. As incidence declines, the importance of tracking and ensuring treatment completion will remain paramount. Emphasis on completion of treatment requires close collaboration with local health departments and other partners to prevent both further spread of the disease as well as the emergence of drug-resistant TB due to incomplete treatment regimens. An emphasis on 100% HIV testing compliance among persons with active TB disease will continue for well-documented reasons. Colorado's TB Program will continue to actively seek collaboration with community stakeholders throughout the state along with other CDPHE disease prevention programs including the HIV/STI and Viral Hepatitis. Moving forward, the TB Program will be promoting the increased use of interferon-gamma release assays (IGRAs) to test for LTBI and active TB disease among those populations CDC guidelines suggest will benefit most. Also the use of 12 doses of INH and Rifapentine (3HP) to treat LTBI will be scaled-up in efforts to both increase completion rates and reduce the adverse drug events documented using other treatment regimens.