

# Annual Tuberculosis Surveillance Report Colorado 2010



---

Colorado Department  
of Public Health  
and Environment

**Colorado Department of Public Health and Environment  
Disease Control and Environmental Epidemiology Division  
Tuberculosis Program**

**4300 Cherry Creek Drive South  
DCEED-A3-TB  
Denver, Colorado 80246-1530  
(303) 692-2677**

<http://www.cdphe.state.co.us/dc/tb/tbhome.html>

## Summary

The state of Colorado documented 71 new cases of active tuberculosis disease during the 2010 calendar year. This represents a 16.5% decrease from the 85 cases reported in 2009. The largest decrease was seen among the Hispanic population (from 42 cases in 2009 down to 28 in 2010, a 33% decline). An increase in several demographic groups was observed, with the largest increase seen among Blacks (from 12 cases in 2009 to 16 in 2010, a 33% increase). Birth in one of the top 22 countries with highest TB burden (accounting for 80% of all TB cases worldwide) remains the strongest risk factor for developing active TB disease (23.9% of 2010 cases) followed by excess alcohol use and homelessness (4.2% each), being a healthcare worker (2.8%), and being a non-injection drug abuser (1.4%). See **Table 1** for a more detailed demographic analysis.

Fourteen of the state's 64 counties reported at least one new case of active TB disease in 2010. As in previous years, Denver reported the most cases (24) 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 (2001-2010)—see **Table 3**.

The overall case rate 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 3.6 per 100,000 according to the March, 2011 TB report from the US Centers for Disease Control and Prevention (CDC). The rate in the foreign-born population in Colorado (11.5 per 100,000) was over 28 times that of the U.S.-born population (0.4 per 100,000). Over 77% of reported cases were among foreign-born persons in 2010—see **Figure 8**.

The rate in the minority population (4.3 per 100,000) was approximately 14 times the rate among the majority (non-Hispanic white/Caucasian) population (0.3 per 100,000). While minorities made up approximately 27% of the state's total population in 2010, 87% of new TB cases occurred among these racial and ethnic minority groups—see **Table 7**.

The age of persons reported with active TB in 2010 ranged from 4 months to 87 years. In 2010, the majority of cases occurred in adults  $\geq 25$  years. The 35-44 year old group represented the largest percentage of cases (25%), and the 65-74 year old group ranked second with 15.5% of the cases—see **Figure 3** and **Table 5** for details.

Due to the length of time it takes to complete TB drug treatment, completion rates are incomplete for 2010. More complete 2010 data will be included in the 2011 Annual Surveillance Report. In 2009, the most current year for which robust treatment completion data are available, 79 of 85 cases were eligible to complete therapy (those not eligible were either dead at diagnosis or died during treatment). Among the 79 eligible cases, 70 (88.6%) completed therapy within 12 months, five (6.3%) completed therapy in > 12 months, three (3.8%) moved outside of the US during therapy, leaving completion data unknown, and one of 79 (1.3%) left the state and returned to her home country where she refused to continue anti-TB drug treatment.

In 2010, the CDPHE TB Program received 325 (preliminary data) notifications for immigrants and refugees designated as B1 (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* is diagnosed with TB and completes treatment overseas is classified as a Class B1) and B2 (an individual with a positive tuberculin skin test (TST) aged fifteen years or younger with a chest x-ray not suggestive of TB is classified as Class B2), of which 248 (81.6%) were evaluated. Of those evaluated, four immigrants or refugees were diagnosed with active TB disease. See **Table 12** for more details.

Of the 51 culture-positive TB cases in 2010, nine (17.6%) were resistant to at least one TB drug. Eight of the nine resistant cases were resistant to one or more of the four primary “first line” TB drugs: isoniazid, rifampin, pyrazinamide and ethambutol. Five of those cases were resistant to isoniazid alone, and two were resistant to pyrazinamide alone. One of the nine was resistant to streptomycin alone. There was one case of multi-drug resistant TB identified in 2010 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 2010 drug-resistance details.

In 2009, 41 sputum smear positive or sputum smear negative/culture positive cases yielded 489 contacts. As a result of these investigations, two active cases of TB and 176 cases of latent TB infection were identified. The 2010 data are incomplete and will not be available until August, 2011. **Table 1** shows demographic comparison between 2009 and 2010 active cases of TB disease.

**Table 1. Tuberculosis in Colorado: Demographic Comparison of 2009 and 2010 Cases**

|   | 2009      |            | 2010      |            |
|---|-----------|------------|-----------|------------|
|   | n         | % of cases | n         | % of cases |
| <b>Age Group (years)</b>  |           |            |           |            |
| <15   | 11        | 13.0       | 5         | 7.1        |
| 15-24   | 7         | 8.2        | 10        | 14.1       |
| 25-44   | 33        | 38.8       | 25        | 35.2       |
| 45-64   | 24        | 28.2       | 15        | 21.1       |
| 65+   | 10        | 11.8       | 16        | 22.5       |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>Gender</b>   |           |            |           |            |
| Male  | 44        | 51.8       | 42        | 59.2       |
| Female  | 41        | 48.2       | 29        | 40.8       |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>Race/Ethnicity</b>   |           |            |           |            |
| White   | 11        | 12.9       | 9         | 12.7       |
| Black   | 12        | 14.1       | 16        | 22.5       |
| Hispanic  | 42        | 49.4       | 28        | 39.4       |
| American Indian/Alaska native                                   | 1         | 1.2        | 1         | 1.4        |
| Asian/Pacific Islander  | 19        | 22.4       | 17        | 23.9       |
| Multiple race   | 0         | 0.0        | 0         | 0          |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>Region</b>   |           |            |           |            |
| Denver metro <sup>a</sup>                                       | 59        | 69.4       | 49        | 69.0       |
| Other than Denver metro   | 26        | 30.6       | 22        | 31.0       |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>Country of Origin (U.S.- vs. Foreign-born)</b>               |           |            |           |            |
| United States   | 25        | 30.6       | 16        | 22.5       |
| Mexico  | 26        | 29.4       | 22        | 31.0       |
| Other countries   | 34        | 40.0       | 33        | 46.5       |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>HIV Status</b>   |           |            |           |            |
| HIV Negative  | 69        | 81.2       | 62        | 87.3       |
| HIV Positive  | 4         | 4.7        | 6         | 8.5        |
| Testing done, results unknown                                   | 1         | 1.2        | 0         | 0          |
| Refused testing   | 1         | 1.2        | 0         | 0          |
| Not offered   | 10        | 11.7       | 3         | 4.2        |
| Unknown   | 0         | 0.0        | 0         | 0          |
| <b>TOTAL</b>  | <b>85</b> | <b>100</b> | <b>71</b> | <b>100</b> |
| <b>Risk factors<sup>b</sup></b>                                 |           |            |           |            |
| Birth in one of top 22 highest TB-burden countries <sup>c</sup> | 21        | 24.7       | 17        | 23.9       |
| Homeless within past year                                       | 5         | 5.9        | 3         | 4.2        |
| Resident of correctional facility at diagnosis                  | 2         | 2.4        | 0         | 0          |
| Resident of long-term care facility                             | 0         | 0.0        | 0         | 0          |
| Injected drug use within past year                              | 1         | 1.2        | 0         | 0          |
| Non-injected drug use within past year                          | 6         | 7.0        | 1         | 1.4        |
| Excess alcohol use within past year                             | 8         | 9.4        | 3         | 4.2        |
| Health care worker within past 2 years                          | 3         | 3.5        | 2         | 2.8        |

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](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 2010

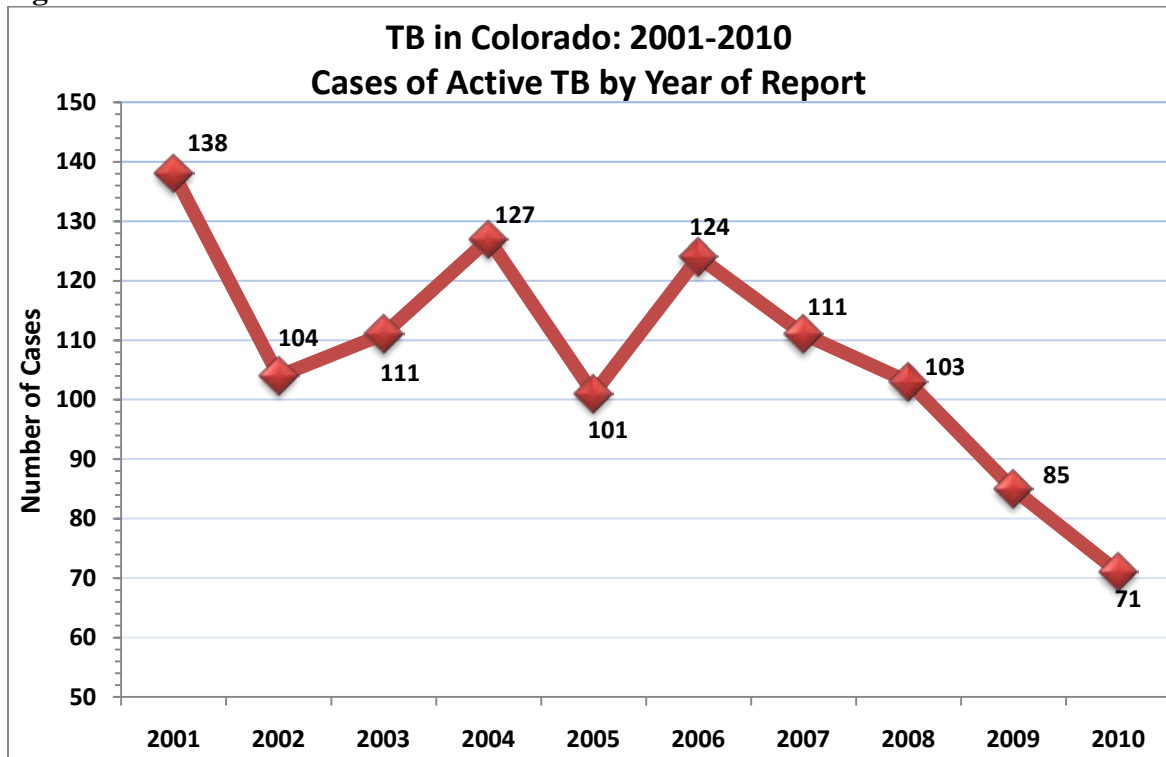
### Tuberculosis Incidence

In 2010, a total of 71 active tuberculosis disease (TB) cases were reported in Colorado. The United States has seen a slow decline in the number and rate of TB cases over the past 10 years (**Table 2**). Colorado has experienced a similar decline in the number and rate of cases over the past four years, from 2.6 cases per 100,000 in 2006 to 1.4 per 100,000 in 2010. **Table 2** and **Figure 1** reflect TB disease in Colorado and the United States over the past decade.

**Table 2.** Tuberculosis Cases and Case Rates per 100,000 Persons, Colorado and United States, 2001-2010

| Year | Colorado |      | United States |      |
|------|----------|------|---------------|------|
|      | Cases    | Rate | Cases         | Rate |
| 2001 | 138      | 3.1  | 15,989        | 5.6  |
| 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  |

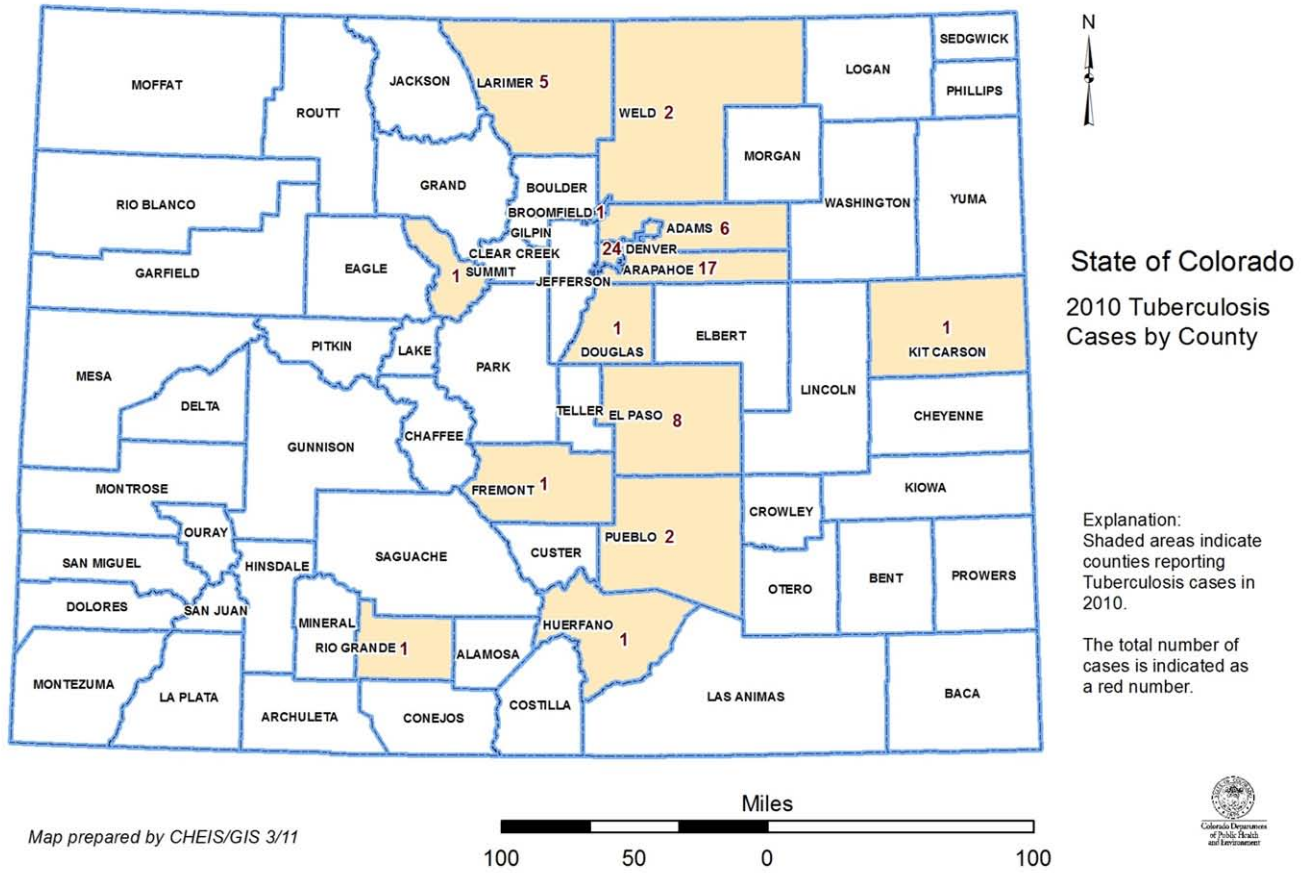
**Figure 1**



## Tuberculosis Cases by County

Fourteen of Colorado's 64 counties reported a new case of active TB disease in 2010. Denver had the most with 24 cases, followed by Arapahoe (17), El Paso (8), Adams (6) and Larimer (5) counties (**Figure 2, Table 3**).

**Figure 2.** TB in Colorado: 2010 TB Cases by County



**Table 3. TB in Colorado: Cases by County and Year of Report 2001-2010**

| County       | 2001       | 2002       | 2003       | 2004       | 2005      | 2006       | 2007       | 2008       | 2009      | 2010      |
|--------------|------------|------------|------------|------------|-----------|------------|------------|------------|-----------|-----------|
| Adams        | 15         | 11         | 9          | 13         | 6         | 17         | 14         | 14         | 4         | 6         |
| Alamosa      | 0          | 0          | 0          | 0          | 1         | 0          | 0          | 0          | 0         | 0         |
| Arapahoe     | 11         | 20         | 20         | 18         | 17        | 22         | 17         | 14         | 0         | 17        |
| Archuleta    | 0          | 0          | 1          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Bent         | 0          | 0          | 0          | 0          | 0         | 0          | 1          | 0          | 0         | 0         |
| Boulder      | 5          | 5          | 13         | 2          | 3         | 7          | 5          | 7          | 3         | 0         |
| Broomfield   | 1          | 0          | 0          | 0          | 1         | 0          | 0          | 0          | 0         | 1         |
| Chaffee      | 0          | 0          | 1          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Clear Creek  | 0          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 1         | 0         |
| Conejos      | 0          | 0          | 1          | 0          | 0         | 1          | 0          | 2          | 0         | 0         |
| Costilla     | 1          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Crowley      | 0          | 0          | 0          | 1          | 0         | 0          | 0          | 0          | 0         | 0         |
| Delta        | 1          | 0          | 0          | 0          | 0         | 0          | 1          | 0          | 1         | 0         |
| Denver       | 55         | 38         | 38         | 47         | 42        | 40         | 37         | 24         | 29        | 24        |
| Douglas      | 0          | 2          | 0          | 3          | 0         | 1          | 2          | 3          | 4         | 1         |
| Eagle        | 0          | 1          | 2          | 0          | 1         | 0          | 0          | 1          | 2         | 0         |
| El Paso      | 7          | 5          | 4          | 9          |           | 10         | 7          | 10         | 7         | 8         |
| Elbert       | 1          | 0          | 1          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Fremont      | 0          | 0          | 2          | 0          | 1         | 0          | 1          | 0          | 1         | 1         |
| Garfield     | 0          | 1          | 0          | 0          | 0         | 2          | 2          | 1          | 2         | 0         |
| Grand        | 0          | 0          | 0          | 2          | 1         | 2          | 0          | 0          | 0         | 0         |
| Gunnison     | 2          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 2         | 0         |
| Huerfano     | 0          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0         | 1         |
| Jefferson    | 9          | 4          | 7          | 10         | 5         | 5          | 9          | 12         | 8         | 0         |
| Kit Carson   | 0          | 0          | 0          | 0          | 0         |            | 0          | 0          | 0         | 1         |
| La Plata     | 1          | 1          | 0          | 1          | 0         | 0          | 0          | 0          | 0         | 0         |
| Lake         | 0          | 0          | 0          | 0          | 0         | 0          | 1          | 1          | 0         | 0         |
| Larimer      | 3          | 3          | 3          | 2          | 2         | 4          | 2          | 3          | 2         | 5         |
| Las Animas   | 1          | 0          | 0          | 0          | 0         | 0          | 2          | 1          | 2         | 0         |
| Lincoln      | 0          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Logan        | 0          | 0          | 0          | 0          | 1         | 0          | 0          | 1          | 0         | 0         |
| Mesa         | 4          | 2          | 2          | 0          | 0         | 0          | 0          | 0          | 1         | 0         |
| Moffat       | 0          | 0          | 0          | 0          | 1         | 0          | 0          | 0          | 0         | 0         |
| Montezuma    | 0          | 0          | 0          | 2          | 0         | 0          | 1          | 0          | 0         | 0         |
| Montrose     | 1          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Morgan       | 0          | 1          | 1          | 1          | 2         | 0          | 2          | 1          | 1         | 0         |
| Otero        | 3          | 0          | 0          | 0          | 0         | 1          | 0          | 1          | 0         | 0         |
| Phillips     | 0          | 0          | 0          | 0          | 1         | 0          | 0          | 0          | 0         | 0         |
| Pitkin       | 1          | 0          | 0          | 0          | 1         | 2          | 0          | 0          | 0         | 0         |
| Pueblo       | 3          | 6          | 2          | 3          | 3         | 2          | 4          | 3          | 1         | 2         |
| Rio Blanco   | 0          | 0          | 1          | 1          | 0         | 0          | 0          | 0          | 0         | 0         |
| Rio Grande   | 1          | 0          | 0          | 0          | 0         | 0          | 1          | 0          | 0         | 1         |
| Routt        | 0          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 0         | 0         |
| Saguache     | 2          | 0          | 0          | 0          | 0         | 0          | 0          | 1          | 0         | 0         |
| Sedgwick     | 0          | 0          | 0          | 1          | 0         | 0          | 0          | 0          | 0         | 0         |
| Summit       | 0          | 0          | 0          | 2          | 0         | 1          | 0          | 0          | 0         | 1         |
| Teller       | 0          | 0          | 0          | 0          | 0         | 0          | 0          | 0          | 1         | 0         |
| Weld         | 10         | 4          | 2          | 9          | 3         | 5          | 1          | 3          | 2         | 2         |
| Yuma         | 0          | 0          | 1          | 0          | 0         | 2          | 1          | 0          | 0         | 0         |
| <b>TOTAL</b> | <b>138</b> | <b>104</b> | <b>111</b> | <b>127</b> | <b>92</b> | <b>124</b> | <b>111</b> | <b>103</b> | <b>85</b> | <b>71</b> |

Note: Only counties reporting an active case of TB (2001-2010) are included.

Note2: Highlighted counties reported a case in 2010.

The county-specific five-year average TB incidence rates are provided in **Table 4**. Nineteen counties (29.2%) have an average case rate equal to or greater than the average state case rate of 2.0 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: 2006-2010 Mean Case Rates\* by County (Reporting at least one case)

| County          | 2006       | 2007       | 2008       | 2009       | 2010       | 5-Year Incidence Rates 2006-2010 |
|-----------------|------------|------------|------------|------------|------------|----------------------------------|
| Adams           | 4.1        | 3.3        | 3.2        | 0.9        | 1.3        | 2.5                              |
| Arapahoe        | 4.1        | 3.1        | 2.5        | 1.9        | 2.9        | 2.9                              |
| Bent            | 0.0        | 17.0       | 0.0        | 0.0        | 0.0        | 3.2                              |
| Boulder         | 2.4        | 1.7        | 2.3        | 1.0        | 0.0        | 1.5                              |
| Broomfield      | 0.0        | 0.0        | 0.0        | 0.0        | 1.8        | 0.4                              |
| Clear Creek     | 0.0        | 0.0        | 0.0        | 10.9       | 0.0        | 2.2                              |
| Conejos         | 11.9       | 0.0        | 24.0       | 0.0        | 0.0        | 7.2                              |
| Delta           | 0.0        | 3.2        | 0.0        | 3.1        | 0.0        | 1.3                              |
| Denver          | 6.9        | 6.3        | 4.0        | 4.7        | 3.8        | 5.1                              |
| Douglas         | 0.4        | 0.7        | 1.1        | 1.4        | 0.3        | 0.8                              |
| Eagle           | 0.0        | 0.0        | 1.9        | 3.7        | 0.0        | 1.1                              |
| El Paso         | 1.7        | 1.2        | 1.7        | 1.2        | 1.3        | 1.4                              |
| Fremont         | 0.0        | 2.1        | 0.0        | 2.1        | 2.0        | 1.2                              |
| Garfield        | 3.8        | 3.7        | 1.8        | 3.5        | 0.0        | 2.5                              |
| Grand           | 14.2       | 0.0        | 0.0        | 0.0        | 0.0        | 2.8                              |
| Gunnison        | 0.0        | 0.0        | 0.0        | 13.0       | 0.0        | 2.6                              |
| Huerfano        | 0.0        | 0.0        | 0.0        | 0.0        | 14.4       | 2.7                              |
| Jefferson       | 0.9        | 1.7        | 2.2        | 1.5        | 0.0        | 1.3                              |
| Kit Carson      | 0.0        | 0.0        | 0.0        | 0.0        | 11.5       | 2.4                              |
| Lake            | 0.0        | 12.3       | 12.1       | 0.0        | 0.0        | 4.8                              |
| Larimer         | 1.4        | 0.7        | 1.0        | 0.7        | 1.7        | 1.1                              |
| Las Animas      | 0.0        | 12.2       | 6.1        | 12.1       | 0.0        | 6.1                              |
| Logan           | 0.0        | 0.0        | 4.7        | 0.0        | 0.0        | 0.9                              |
| Mesa            | 0.0        | 0.0        | 0.0        | 0.7        | 0.0        | 0.1                              |
| Montezuma       | 0.0        | 3.9        | 0.0        | 0.0        | 0.0        | 0.8                              |
| Morgan          | 0.0        | 7.1        | 3.6        | 3.5        | 0.0        | 2.8                              |
| Otero           | 5.2        | 0.0        | 5.3        | 0.0        | 0.0        | 2.1                              |
| Pitkin          | 12.2       | 0.0        | 0.0        | 0.0        | 0.0        | 2.3                              |
| Pueblo          | 1.3        | 2.6        | 1.9        | 0.6        | 1.2        | 1.5                              |
| Rio Grande      | 0.0        | 7.9        | 0.0        | 0.0        | 7.9        | 3.2                              |
| Saguache        | 0.0        | 0.0        | 14.3       | 0.0        | 0.0        | 2.9                              |
| Summit          | 3.6        | 0.0        | 0.0        | 0.0        | 3.4        | 1.4                              |
| Teller          | 0.0        | 0.0        | 0.0        | 4.4        | 0.0        | 0.9                              |
| Weld            | 2.1        | 0.4        | 1.2        | 0.8        | 0.8        | 1.0                              |
| Yuma            | 20.2       | 10.1       | 0.0        | 0.0        | 0.0        | 6.0                              |
| <b>Colorado</b> | <b>2.6</b> | <b>2.3</b> | <b>2.1</b> | <b>1.7</b> | <b>1.4</b> | <b>2.0</b>                       |

\*TB disease per 100,000 persons

Note: Denominators for computing the rate of tuberculosis in Colorado are from the Colorado Division of Local Government, State Demography Office.

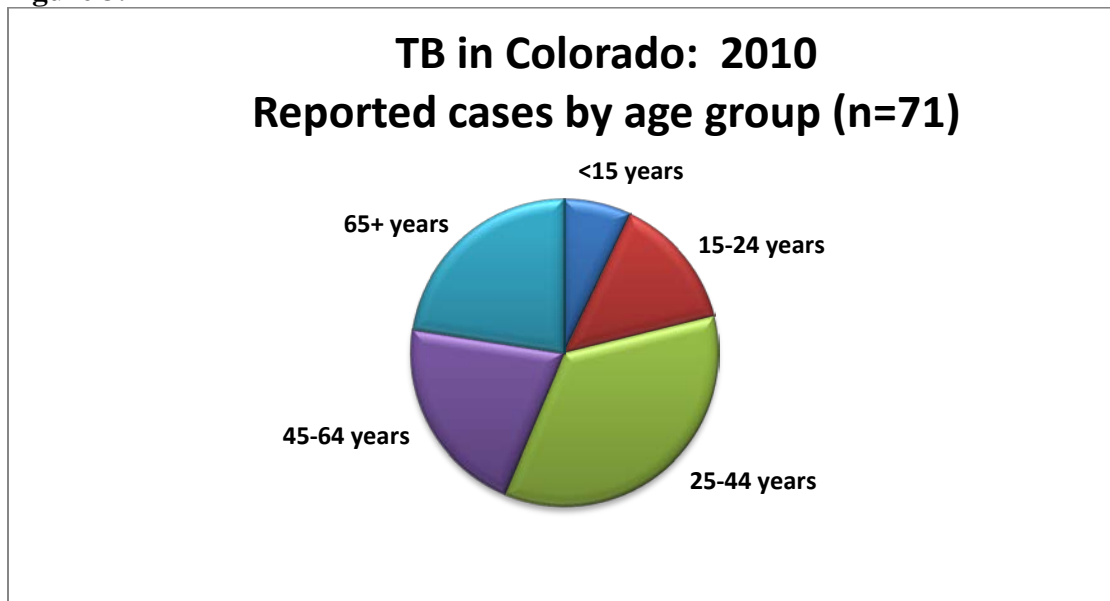
Note 2: Case rates based on fewer than five health events are likely to be unstable and imprecise.

### Tuberculosis by Age Group

In 2010, TB cases were reported among people ranging from 4 months to 87 years of age. Almost 39% of TB cases occurred among people ages 25-44 years, followed by those ages 45-64 years and <15 years (28% and 13%, respectively).

Five cases of pediatric TB (<15 years of age) were reported in 2010. Only two of the five pediatric cases were among foreign-born children. 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 the five cases, two were among children less than five years of age (**Figure 3**).

**Figure 3.**



**Table 5** shows that in 2009, the highest TB incidence was among persons 80-84 years of age (5.7 cases per 100,000) and lowest (0.3 cases per 100,000) among children ages 5-9 years. In 2010, the highest incidence rate was found in persons 70-74 years of age (7.1 per 100,000), with the lowest (among groups with at least one documented case) in the 25-29 age group (0.3 per 100,000) followed by the 0-4, 15-19, and 55-59 year old groups (all 0.6 cases per 100,000). Neither the 10-14 nor 75-79 year old cohorts had a case of active TB disease in 2010. **Table 6** shows the age groups relative to nativity (U.S.-born and foreign-born).

**Table 5. TB in Colorado: 2009 & 2010 Reported Cases by Gender and Age Group**

| Age Group    | 2009      |           |           |            | 2010      |           |           |            |
|--------------|-----------|-----------|-----------|------------|-----------|-----------|-----------|------------|
|              | Male      | Female    | Total     | Rate*      | Male      | Female    | Total     | Rate*      |
| 0 to 4       | 4         | 4         | 8         | 2.2        | 1         | 1         | 2         | 0.6        |
| 5 to 9       | 1         | 0         | 1         | 0.3        | 1         | 2         | 3         | 0.9        |
| 10 to 14     | 2         | 0         | 2         | 0.6        | 0         | 0         | 0         | 0          |
| 15 to 19     | 2         | 0         | 2         | 0.5        | 2         | 0         | 2         | 0.6        |
| 20 to 24     | 0         | 5         | 5         | 1.3        | 3         | 5         | 8         | 2.3        |
| 25 to 29     | 4         | 3         | 7         | 2.1        | 0         | 1         | 1         | 0.3        |
| 30 to 34     | 3         | 5         | 8         | 2.4        | 3         | 3         | 6         | 1.7        |
| 35 to 39     | 5         | 4         | 9         | 2.4        | 5         | 3         | 8         | 2.3        |
| 40 to 44     | 6         | 3         | 9         | 2.5        | 6         | 4         | 10        | 2.9        |
| 45 to 49     | 3         | 2         | 5         | 1.3        | 2         | 2         | 4         | 1.1        |
| 50 to 54     | 3         | 2         | 5         | 1.3        | 4         | 0         | 4         | 1.1        |
| 55 to 59     | 2         | 3         | 5         | 1.5        | 1         | 1         | 2         | 0.6        |
| 60 to 64     | 4         | 5         | 9         | 3.4        | 4         | 1         | 5         | 1.9        |
| 65 to 69     | 1         | 0         | 1         | 0.7        | 1         | 1         | 2         | 1.1        |
| 70 to 74     | 0         | 2         | 2         | 1.6        | 5         | 4         | 9         | 7.1        |
| 75 to 79     | 2         | 1         | 3         | 2.8        | 0         | 0         | 0         | 0          |
| 80 to 84     | 2         | 2         | 4         | 5.7        | 4         | 0         | 4         | 5.5        |
| 85+          | 0         | 0         | 0         | 0          | 0         | 1         | 1         | 1.4        |
| <b>TOTAL</b> | <b>44</b> | <b>41</b> | <b>85</b> | <b>1.7</b> | <b>42</b> | <b>29</b> | <b>71</b> | <b>1.4</b> |

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: 2009 & 2010 Comparison by Age Group and Patient Nativity**

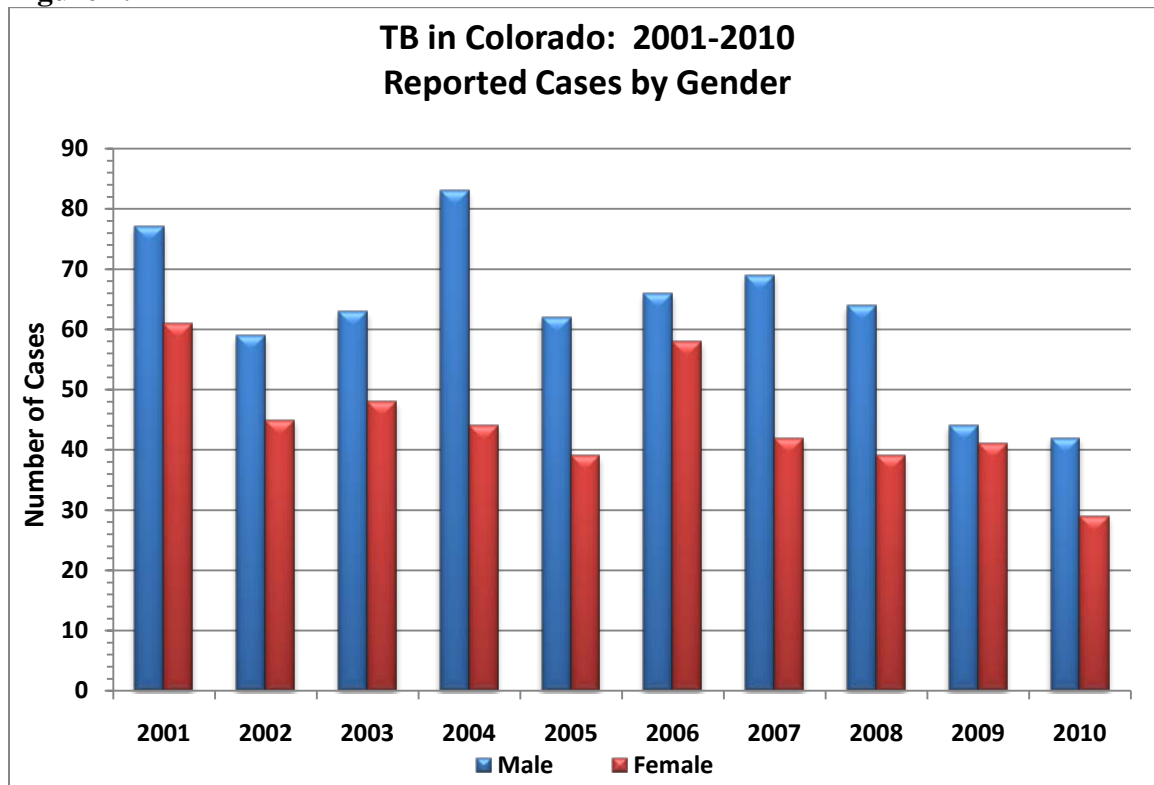
| Age Group    | 2009      |              |           | 2010      |              |           |
|--------------|-----------|--------------|-----------|-----------|--------------|-----------|
|              | U.S.-Born | Foreign-Born | Total     | U.S.-Born | Foreign-Born | Total     |
| 0-4          | 8         | 0            | 8         | 2         | 0            | 2         |
| 5-14         | 0         | 3            | 3         | 1         | 2            | 3         |
| 15-24        | 2         | 5            | 7         | 3         | 7            | 10        |
| 25-34        | 1         | 14           | 15        | 0         | 7            | 7         |
| 35-44        | 4         | 14           | 18        | 3         | 15           | 18        |
| 45-54        | 2         | 8            | 10        | 1         | 7            | 8         |
| 55-64        | 6         | 8            | 14        | 1         | 6            | 7         |
| 65-74        | 0         | 3            | 3         | 3         | 8            | 11        |
| 75-84        | 2         | 5            | 7         | 2         | 2            | 4         |
| 85+          | 0         | 0            | 0         | 0         | 1            | 1         |
| <b>TOTAL</b> | <b>25</b> | <b>60</b>    | <b>85</b> | <b>16</b> | <b>55</b>    | <b>71</b> |

### Tuberculosis by Gender

The predominance of TB among males has been observed and documented both in the United States and globally. This finding may be due to differences in access to care, 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 2009, the usual TB gender disparity was almost

nonexistent with 44 males and 41 females. In 2010, 42 males and 29 females were diagnosed and treated for active TB disease.

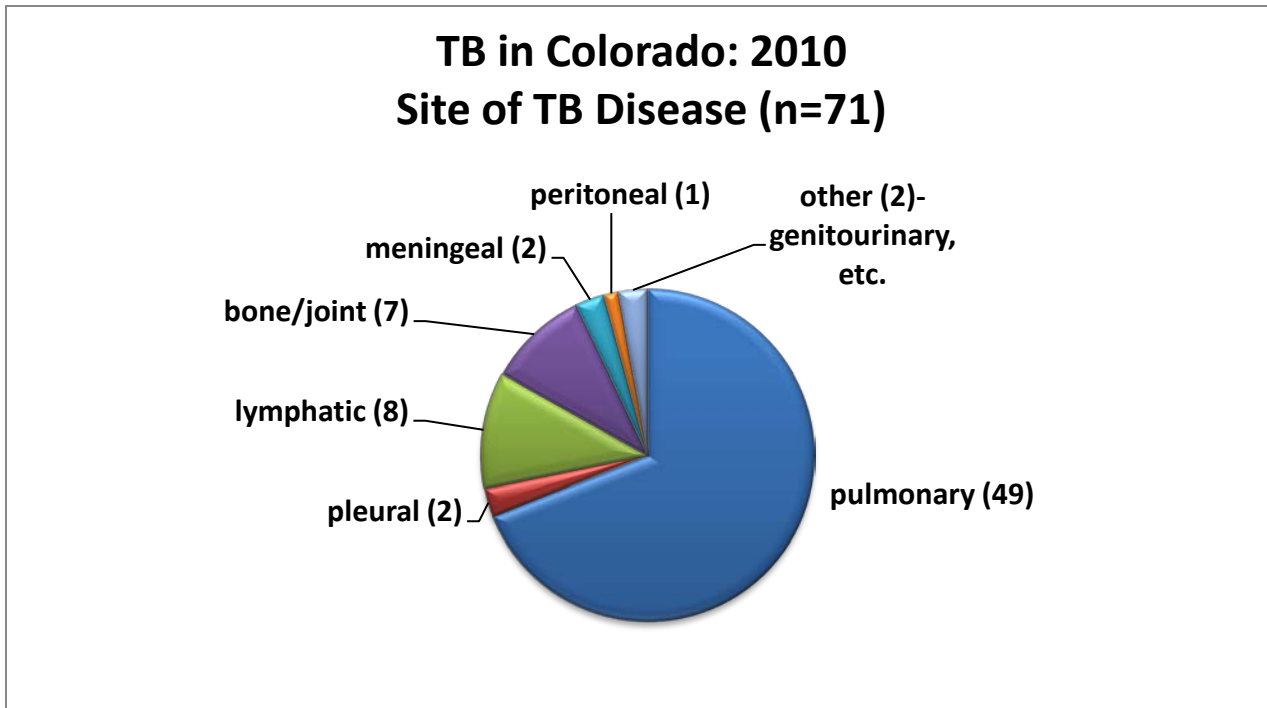
**Figure 4.**



**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 2010, 49 of the 71 (69%) cases were pulmonary, which is consistent with past surveillance. The second most common site of infection was the lymph system (cervical, intrathoracic or axillary) with 11 cases (15.5%). Several cases had multiple sites of disease e.g. a pulmonary case accompanied by lymphatic and peritoneal sites of infection. There were two cases of *Mycobacterium bovis* (*M. bovis*) infection in 2010 (both male— six and 62 years old); one with a lymphatic/cervical, the other with a pulmonary site of disease, and both with definitive resistance to pyrazinamide and a spoligotype consistent with *M. bovis* infection. **Figure 5** shows major sites of TB infection among 2010 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 2009 was similar to that seen in 2008, with persons identifying as Hispanic representing 49%; Black/African-Americans, 14%; Asian/Pacific Islanders, 22%; and American Indian/Alaska Natives, a little more than 1% (**Figure 6 and Figure 7**). This ethnic/racial disparity specific to the burden of TB disease remains a major concern to the state of Colorado's TB Program. In 2010, Black persons made up only 3.8% of the total population, yet represented 22.5% of all active TB cases. Persons of Hispanic origin made up 20.6% of the total Colorado population, yet they represented 39.4% of all active TB cases in 2010. Other racial and ethnic minorities include Asian and Pacific Islanders who made up only 2.9% of Colorado's total population, but almost 24% of all active TB cases in Colorado in 2010 were among that population. With a less-glaring disparity, American Indians and Native Alaskans (AI/AN) make up 1.1% of total population, but made up 1.4% of the active TB cases. The AI/AN and white/Caucasian populations were the only racial/ethnic groups to have lower disease burdens than representation in the general population. For instance, Whites make up 81.3% of Colorado's population, but only 12.7% of the cases of active TB disease.

Figure 6.

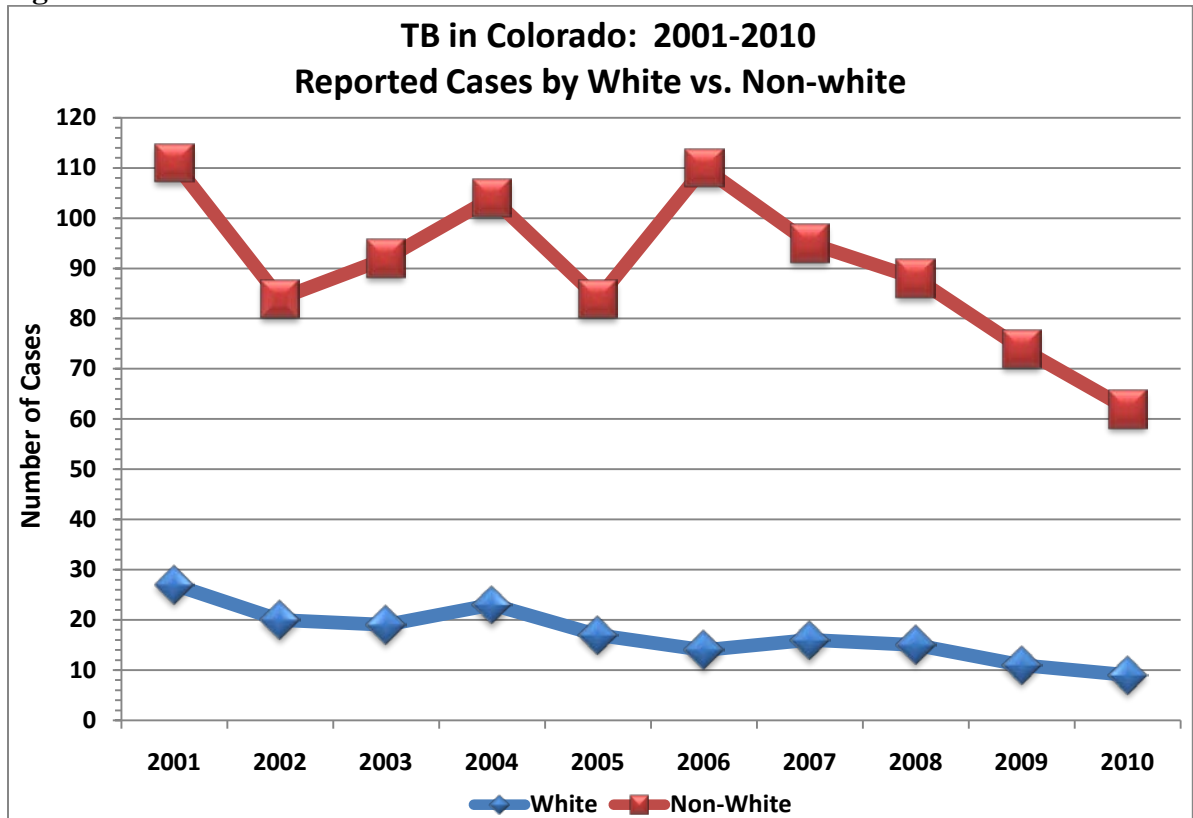
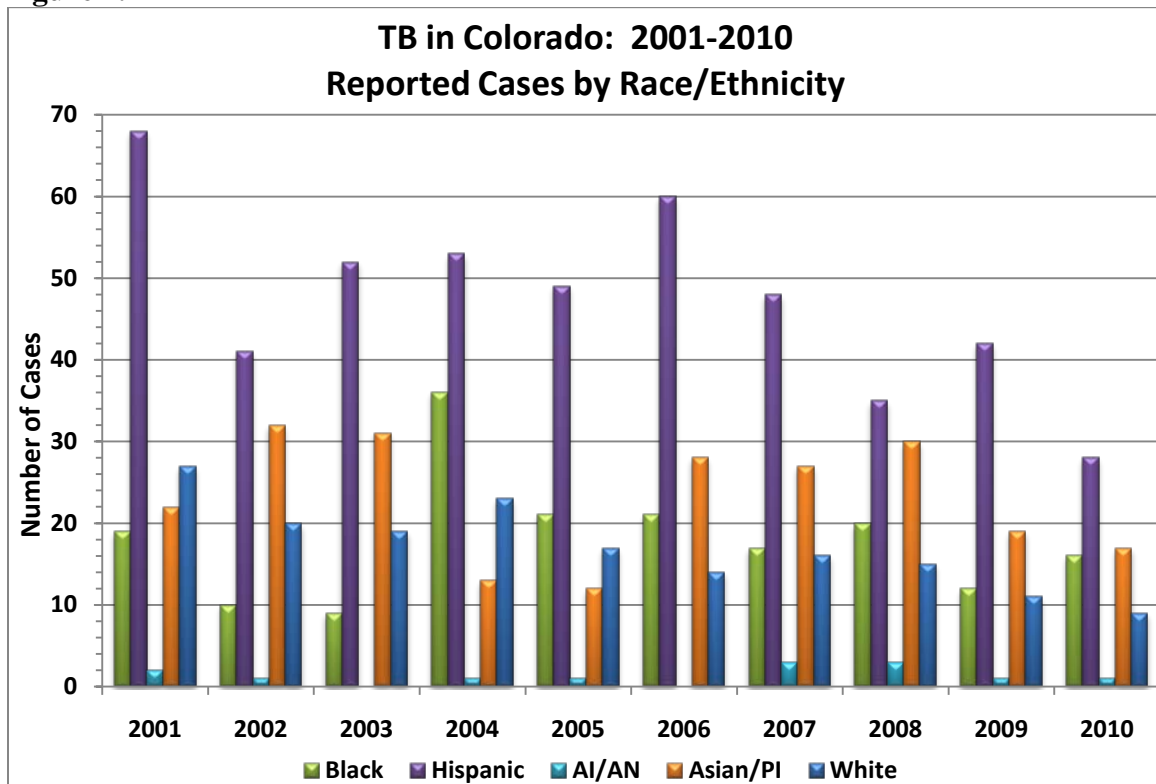


Figure 7.



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 2009 and 2010.

**Table 7. TB in Colorado: 2009 and 2010 by Race/Ethnicity**

| Race/ethnicity            | 2009                         |                 | 2010                         |                 |
|---------------------------|------------------------------|-----------------|------------------------------|-----------------|
|                           | Number of Cases (% of total) | Incidence Rate* | Number of Cases (% of total) | Incidence Rate* |
| White/Caucasian           | 11 (12.9)                    | 0.3             | 9 (12.7)                     | 0.3             |
| Black/African-American    | 12 (14.1)                    | 5.3             | 16 (22.5)                    | 7.9             |
| Hispanic                  | 42 (49.4)                    | 4.5             | 28 (39.4)                    | 2.7             |
| Asian/Pacific Islander    | 19 (22.3)                    | 12.2            | 17 (23.9)                    | 11.7            |
| American Indian/AK native | 1 (1.2)                      | 1.2             | 1 (1.4)                      | 1.8             |
| <b>TOTAL</b>              | <b>85 (100)</b>              | <b>1.7</b>      | <b>71 (100)</b>              | <b>1.4</b>      |

\*Per 100,000 persons

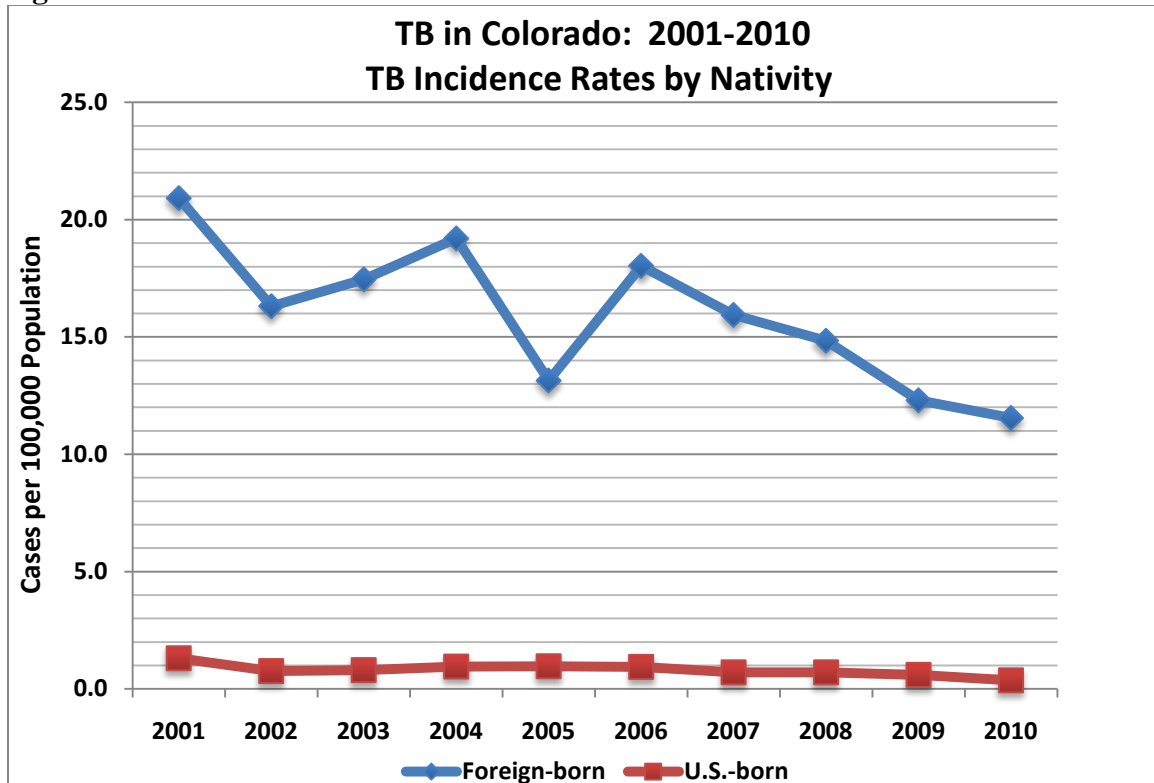
Note: Case rates based on fewer than five health events are likely to be unstable and imprecise.

Note2: percentages may not equal 100 due to rounding.

### TB Incidence Rates by Nativity

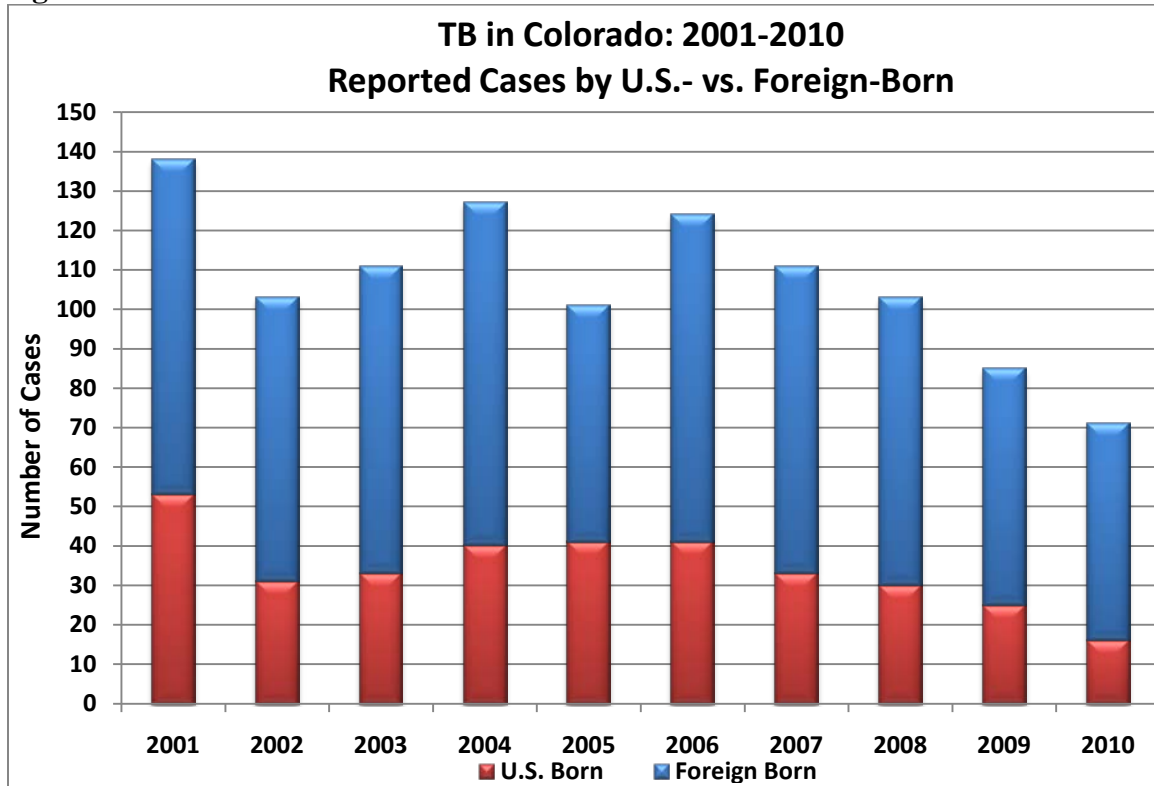
In 2009, the TB incidence in the foreign-born population living in Colorado was 12.3 per 100,000 persons, which is 20.5 times that of the U.S.-born population (0.6 per 100,000). Since 2000, more than two-thirds (69%) of the cases of TB reported in Colorado were among foreign-born individuals (**Figure 8** and **Figure 9**).

**Figure 8.**



In 2010, 55 foreign-born cases of TB were reported in Colorado, representing 77.5% of all cases that year. The largest single cohort came from Mexico with 22 cases. **Table 8** shows a breakdown of the countries of origin for all active cases of TB disease from 2008-2010. Of those foreign-born cases, 17 (23.9%) came from one of the top 22 highest-burdened countries that comprise 80% of all global cases of active TB disease.

**Figure 9.**



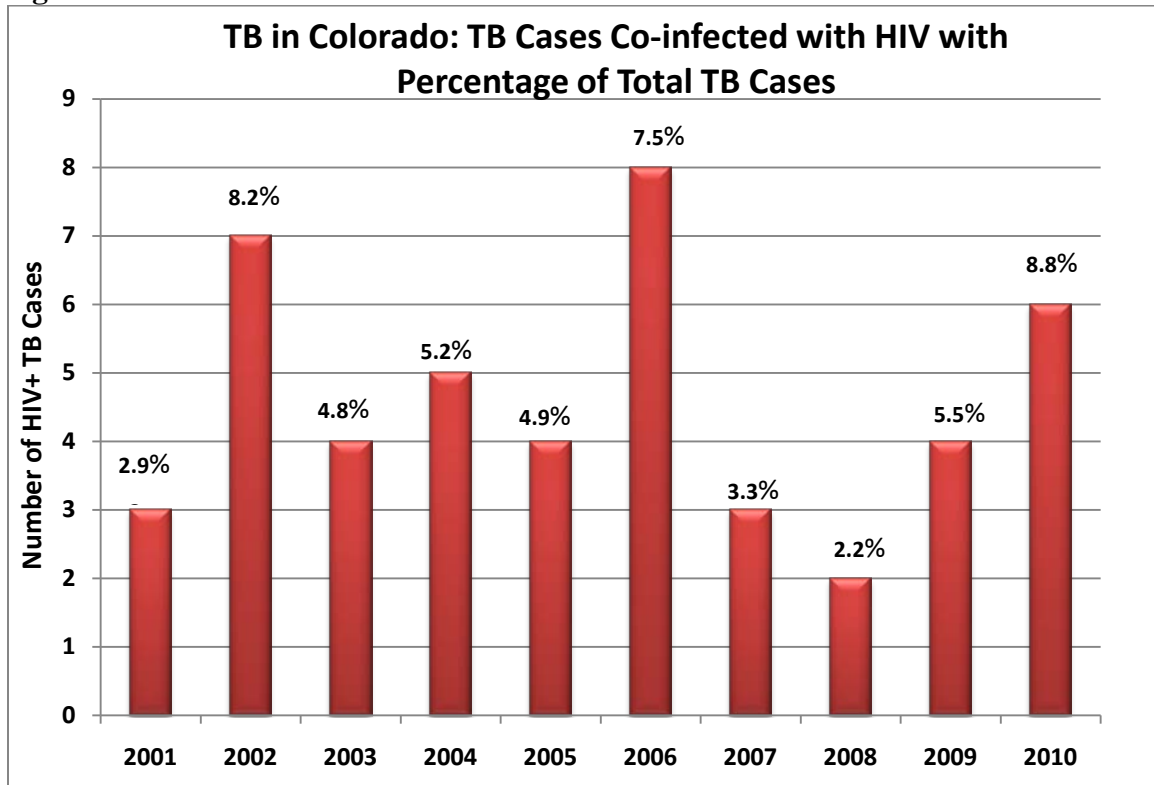
**Table 8.** Comparison of Colorado TB Cases by Country of Nativity, 2008-2010

| 2008              |                 | 2009              |                 | 2010              |                 |
|-------------------|-----------------|-------------------|-----------------|-------------------|-----------------|
| Country           | Number of Cases | Country           | Number of Cases | Country           | Number of Cases |
| Afghanistan       | 1               | Afghanistan       | 0               | Afghanistan       | 0               |
| Austria           | 0               | Austria           | 1               | Austria           | 0               |
| Bangladesh        | 0               | Bangladesh        | 0               | Bangladesh        | 2               |
| Bhutan            | 2               | Bhutan            | 2               | Bhutan            | 1               |
| Burma/<br>Myanmar | 2               | Burma/<br>Myanmar | 1               | Burma/<br>Myanmar | 2               |
| Cambodia          | 1               | Cambodia          | 0               | Cambodia          | 0               |
| Canada            | 0               | Canada            | 0               | Canada            | 1               |
| China             | 2               | China             | 0               | China             | 1               |
| Cuba              | 1               | Cuba              | 0               | Cuba              | 0               |
| El Salvador       | 2               | El Salvador       | 1               | El Salvador       | 0               |
| Eritrea           | 1               | Eritrea           | 0               | Eritrea           | 1               |
| Ethiopia          | 4               | Ethiopia          | 3               | Ethiopia          | 4               |
| Germany           | 0               | Germany           | 0               | Germany           | 1               |
| Guam              | 0               | Guam              | 0               | Guam              | 1               |
| Guatemala         | 0               | Guatemala         | 1               | Guatemala         | 0               |
| Honduras          | 1               | Honduras          | 1               | Honduras          | 0               |
| Hungary           | 1               | Hungary           | 0               | Hungary           | 0               |
| India             | 5               | India             | 5               | India             | 1               |
| Indonesia         | 0               | Indonesia         | 1               | Indonesia         | 2               |
| Jamaica           | 0               | Jamaica           | 0               | Jamaica           | 1               |
| Kenya             | 1               | Kenya             | 3               | Kenya             | 0               |
| Korea             | 1               | Korea             | 0               | Korea             | 1               |
| Laos              | 1               | Laos              | 0               | Laos              | 0               |
| Liberia           | 1               | Liberia           | 0               | Liberia           | 1               |
| Madagascar        | 1               | Madagascar        | 0               | Madagascar        | 0               |
| Mexico            | 22              | Mexico            | 26              | Mexico            | 22              |
| Mongolia          | 1               | Mongolia          | 1               | Mongolia          | 0               |
| Morocco           | 1               | Morocco           | 0               | Morocco           | 0               |
| Nepal             | 3               | Nepal             | 2               | Nepal             | 0               |
| Palau             | 0               | Palau             | 0               | Palau             | 1               |
| Peru              | 2               | Peru              | 1               | Peru              | 1               |
| Philippines       | 3               | Philippines       | 3               | Philippines       | 3               |
| Rwanda            | 1               | Rwanda            | 1               | Rwanda            | 1               |
| Senegal           | 0               | Senegal           | 0               | Senegal           | 1               |
| Somalia           | 5               | Somalia           | 2               | Somalia           | 4               |
| U.S.              | 30              | U.S.              | 25              | U.S.              | 16              |
| Viet Nam          | 7               | Viet Nam          | 5               | Viet Nam          | 2               |
| <b>Total</b>      | <b>103</b>      | <b>Total</b>      | <b>85</b>       | <b>Total</b>      | <b>71</b>       |

### HIV Co-infection

Worldwide, one in four people with HIV who die, 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 85 cases of TB in 2009, test results for HIV were available for 73 (86%) and, of those, four persons were found to be co-infected with HIV. One person refused an HIV test and one was tested but results were unavailable. Ten of the 85 patients were not offered an HIV test. In 2010, six (8.8%) of the 68 persons tested for HIV with active TB disease were co-infected with HIV. Three (4.2%) of the 71 cases were not offered an HIV test or were dead at the time of TB diagnosis. This is an improvement from past years when HIV testing of active TB patients was not a high priority. It is concerning to see that 8.8% of all cases in 2010 were HIV positive. This is the highest percentage of HIV-infected persons among active TB cases in the last 10 years. **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

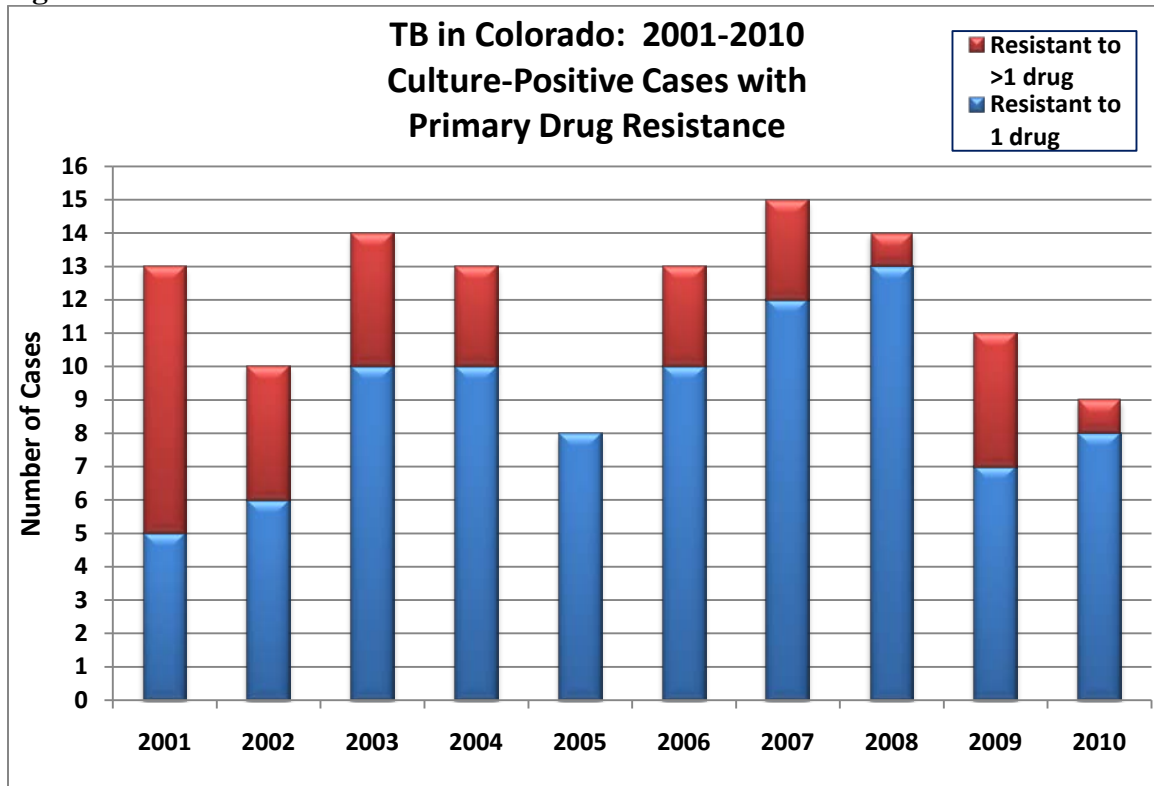
Of the 71 TB cases in 2010, nine were resistant to at least one TB drug. Eight of these nine (89%) cases were resistant to one or more of the four primary TB drugs: isoniazid, rifampin, pyrazinamide and ethambutol. Five of those cases were resistant to isoniazid alone, and two were resistant to pyrazinamide alone. One of the nine 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 2010. Since 2007, there has been a slight, but steady decline in cases of drug resistance that correlates with the annual drop in TB incidence. In 2010, Colorado reported the second case of MDR-TB (resistant to at least isoniazid and rifampin) in the past four years. See **Table 9** for a full break down of drug susceptibilities over the past four years.

**Table 9.** TB in Colorado: 2007-2010 Drug Susceptibilities

|  | <b>2007</b>             | <b>2008</b>             | <b>2009</b>             | <b>2010</b>             |
|--|-------------------------|-------------------------|-------------------------|-------------------------|
| <b>Drug(s)</b>   | <b>Number resistant</b> | <b>Number resistant</b> | <b>Number resistant</b> | <b>Number resistant</b> |
| isoniazid only   | 6                       | 7                       | 3                       | 5                       |
| pyrazinamide only  | 3                       | 4                       | 3                       | 2                       |
| ethambutol only  | 0                       | 1                       | 0                       | 0                       |
| isoniazid and streptomycin                                     | 2                       | 0                       | 3                       | 0                       |
| isoniazid and rifampin   | 1                       | 0                       | 0                       | 0                       |
| pyrazinamide and streptomycin                                  | 0                       | 0                       | 1                       | 0                       |
| streptomycin only  | 3                       | 2                       | 1                       | 1                       |
| streptomycin and ethionamide                                   | 0                       | 1                       | 0                       | 0                       |
| isoniazid, streptomycin and ethionamide                        | 0                       | 1                       | 0                       | 0                       |
| isoniazid, rifampin, ethambutol, pyrazinamide and streptomycin | 0                       | 0                       | 0                       | 1                       |
| <b>Total</b>   | <b>15</b>               | <b>16</b>               | <b>11</b>               | <b>9</b>                |

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 2008, there were 101 people who were treated for active TB disease. Two others were diagnosed after the time of death. Ninety-four of the 101 patients completed treatment through DOT, self-administered treatment or a combination of both. In 2009, 84 patients received treatment, 70 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 2008 and 2009 along with preliminary 2010 data.

**Table 10.** Number and Percentage of Patients Receiving DOT in Colorado 2008-2010

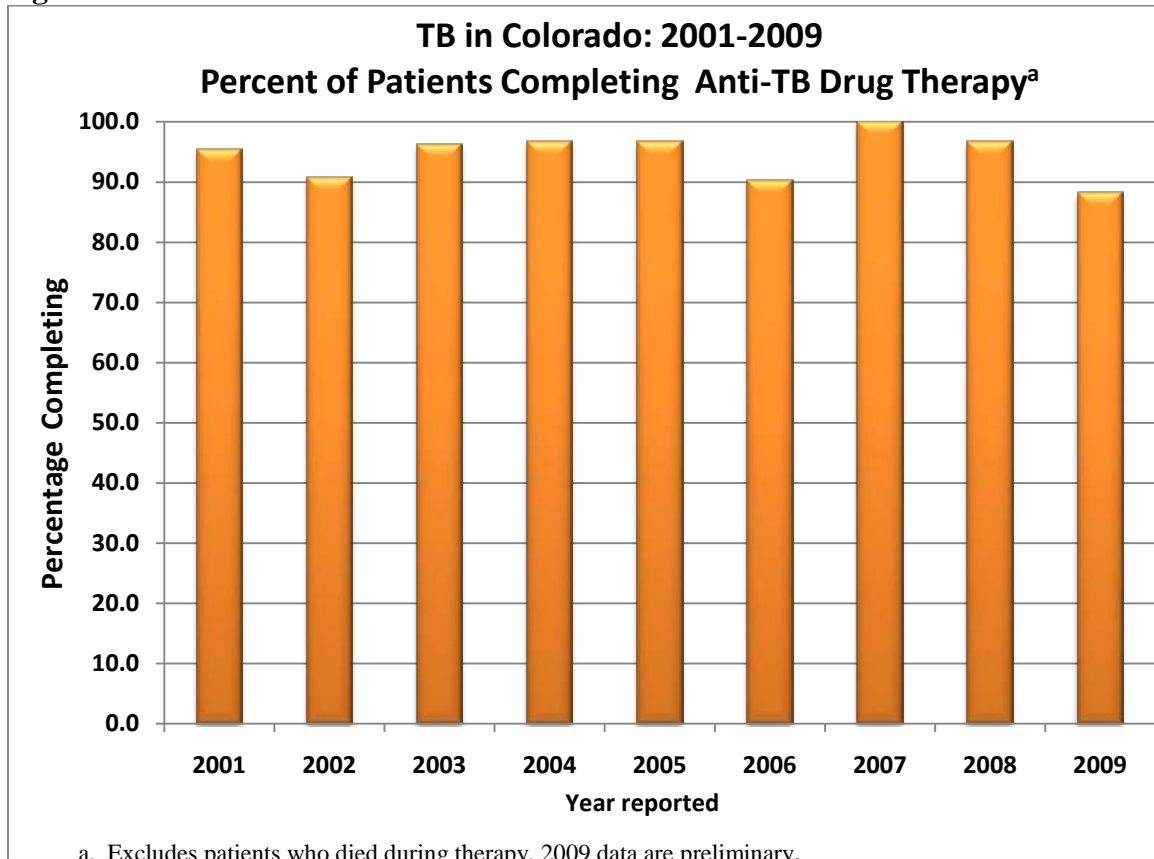
|                                | 2008       |            | 2009      |            | 2010*     |            |
|--------------------------------|------------|------------|-----------|------------|-----------|------------|
|                                | N          | %          | N         | %          | N         | %          |
| <b>DOT only</b>                | 88         | 85         | 69        | 81         | 21        | 81         |
| <b>DOT + self administered</b> | 11         | 11         | 12        | 14         | 5         | 19         |
| <b>Self administered only</b>  | 2          | 2          | 3         | 4          | 0         | 0          |
| <b>Dead at diagnosis</b>       | 2          | 2          | 1         | 1          | 0         | 0          |
| <b>TOTAL</b>                   | <b>103</b> | <b>100</b> | <b>85</b> | <b>100</b> | <b>26</b> | <b>100</b> |

\*2010 data are preliminary; 42 of 71 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 2009 (the most current year for which robust treatment completion data are available), 79 of 85 cases were eligible to complete therapy (those not eligible were either dead at diagnosis or died during treatment). Of the 79 eligible cases, 70 (88.6%) completed therapy within 12 months, five (6.3%) completed therapy in > 12 months, three (3.8%) moved outside of the US during therapy, leaving completion unknown, and one of 79 (1.3%) refused to continue treatment after leaving Colorado for her country of origin. Of 93 eligible cases reported in 2008, 86 patients (92.5%) completed treatment within 12 months. Another four cases completed therapy beyond the 12-month period for a total of 90 (96.7%), exceeding the national goal of 93%. Treatment completion data for 2009 and 2010 will be described in more detail in the 2011 surveillance report when these data will be more complete. **Figure 11** includes 2009 treatment completion data, along with complete data for the previous nine years.

**Figure 12.**



### Contact Investigations

The 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 2002-2009 (2009 data is preliminary, and preliminary data for 2010 will not be available until the 2011 report is published). In 2008, 44 sputum smear positive or sputum smear negative/culture positive cases yielded 998 contacts. As a result of these investigations, two active cases of TB disease and 160 cases of latent TB infection were identified. Of those 160 cases, 128 started LTBI treatment (80%) and 82 patients (63%) completed LTBI treatment. The 2009 data are preliminary, but the latest findings indicate 41 sputum smear-positive or sputum smear-negative/culture-positive cases were identified. These led to 489 contacts being identified. Of those, two cases of active TB disease were identified, and treatment was initiated. In addition, 174 cases of LTBI were identified, of which 141 (81%) started treatment.

**Table 11. TB in Colorado: Follow-up and Treatment for Contacts to Tuberculosis Cases, 2002-2009**

|  | 2002           | 2003         | 2004           | 2005           | 2006           | 2007         | 2008         | 2009*        |
|--|----------------|--------------|----------------|----------------|----------------|--------------|--------------|--------------|
| <b>Number of sputum smear- or culture-positive cases</b>                 | 60             | 45           | 48             | 44             | 64             | 40           | 44           | 41           |
| <b>Total contacts</b>  | 1,388          | 593          | 1,462          | 1,317          | 1,523          | 594          | 1,185        | 489          |
| <b>Average contacts per infectious case</b>                              | 23.1           | 13.1         | 30.5           | 29.9           | 23.7           | 14.8         | 26.9         | 11.9         |
| <b>Number (%) of contacts evaluated*</b>                                 | 1,017<br>(73%) | 489<br>(82%) | 1,170<br>(80%) | 1,113<br>(85%) | 1,290<br>(85%) | 432<br>(73%) | 998<br>(84%) | 445<br>(91%) |
| <b>Number (%) of contacts with latent TB infection</b>                   | 253<br>(25%)   | 111<br>(23%) | 351<br>(30%)   | 220<br>(20%)   | 274<br>(21%)   | 127<br>(29%) | 160<br>(16%) | 174<br>(39%) |
| <b>Number (%) of infected contacts starting treatment</b>                | 164<br>(65%)   | 89<br>(80%)  | 276<br>(79%)   | 179<br>(81%)   | 217<br>(79%)   | 101<br>(79%) | 128<br>(80%) | 141<br>(81%) |
| <b>Number (%) of contacts starting treatment who completed treatment</b> | 121<br>(74%)   | 63<br>(71%)  | 187<br>(68%)   | 129<br>(72%)   | 146<br>(67%)   | 83<br>(82%)  | 82<br>(63%)  | N/A          |
| <b>Number (%) of contacts with active TB disease</b>                     | 2<br>(<1%)     | 3<br>(<1%)   | 16<br>(1%)     | 7<br>(<1%)     | 9<br>(<1%)     | 3<br>(<1%)   | 2<br>(<1%)   | 2<br>(<1%)   |

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

\*2009 data are preliminary; preliminary 2010 data to follow in 2011 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 2010, there were 325 Class B notifications of which 304 were confirmed as arriving in Colorado. Of those 304 arrivals, 248 (81.6%) were evaluated. Four of those were found to have active TB disease. **Table 12** shows a breakdown of Class B data for 2005-2010 in Colorado.

**Table 12. TB in Colorado: Class B Data 2005-2010**

|                                     | 2005 |      | 2006 |      | 2007 |      | 2008 |      | 2009* |      | 2010* |      |
|-------------------------------------|------|------|------|------|------|------|------|------|-------|------|-------|------|
|                                     | n    | %    | n    | %    | n    | %    | n    | %    | n     | %    | n     | %    |
| <b>Class B notifications</b>        | 103  |      | 147  |      | 165  |      | 252  |      | 310   |      | 325   |      |
| <b>Moved prior to evaluation</b>    | 6    | 5.8  | 9    | 6.1  | 8    | 4.8  | 20   | 7.9  | 14    | 4.5  | 21    | 6.5  |
| <b>Confirmed Arrivals</b>           | 97   | 94.2 | 138  | 93.9 | 157  | 95.2 | 232  | 92.1 | 296   | 95.5 | 304   | 93.5 |
| <b>Evaluated</b>                    | 85   | 87.6 | 128  | 92.8 | 155  | 98.7 | 196  | 84.5 | 215   | 72.6 | 248   | 81.6 |
| <b>TB disease diagnosed</b>         | 4    | 4.7  | 3    | 2.3  | 7    | 4.5  | 5    | 2.6  | 2     | 0.9  | 4     | 1.6  |
| <b>Isoniazid recommended (LTBI)</b> | 43   | 50.6 | 63   | 49.2 | 72   | 46.5 | 105  | 53.6 | 118   | 55   | 91    | 36.7 |
| <b>Started treatment</b>            | 38   | 88.4 | 51   | 81.0 | 67   | 93.1 | 92   | 87.6 | 95    | 80.5 | 70    | 77.9 |
| <b>Completed treatment</b>          | 22   | 57.9 | 44   | 86.3 | 50   | 74.6 | 72   | 78.3 | 71    | 74.7 | 20    | 28.6 |
| <b>Currently on treatment</b>       |      |      |      |      |      |      |      |      | 11    | 11.6 | 47    | 67.1 |
| *2009 & 2010 data are preliminary   |      |      |      |      |      |      |      |      |       |      |       |      |

### Conclusion and Future Directions

The Colorado Department of Public Health and Environment's TB Control Program will continue its efforts to develop and maintain strong partnerships with local health departments (municipal and county), neighboring states' TB programs, and federal agencies in ongoing efforts to prevent, control, and ultimately, eliminate TB in Colorado. While the number of TB cases and corresponding incidence rates continue to decline, the number of TB cases reported among foreign-born persons continues to increase relative to U.S.-born cases. As cases drop, the importance of tracking and ensuring completion of treatment among active cases remains crucial. Emphasis on completion of treatment requires close collaboration with local health departments and other partners to prevent both further spread of the disease and the emergence of drug-resistant TB. In addition, as case numbers drop, efforts to ensure that clinicians continue to consider a TB diagnosis, especially in persons with risk factors and compatible symptoms, will be important. An emphasis on 100% HIV testing compliance among persons with active TB disease will continue considering the well-established role of TB as an opportunistic infection among HIV positive persons. Colorado's TB Program will actively seek out opportunities to collaborate with community stakeholders throughout the state as well as internally with other disease prevention programs, such as the HIV/STI and Viral Hepatitis programs

that share similar risk attributes among those infected and impacted by those diseases. Moving forward, the TB Program will be spearheading 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 compared to using traditional TST testing.