Tuberculosis in Colorado
A Summary of Cases Reported in 2003

A total of 111 new cases of active tuberculosis (TB) were reported in Colorado in 2003. With the exception of 2001 when 138 cases were reported, this is the largest number of cases reported in the past two decades. (**Figure 1**). **Table 1** shows a comparison between 2002 and 2003 cases.

Figure 1. TB in Colorado: 1984-2003
Cases of Active TB by Year of Report

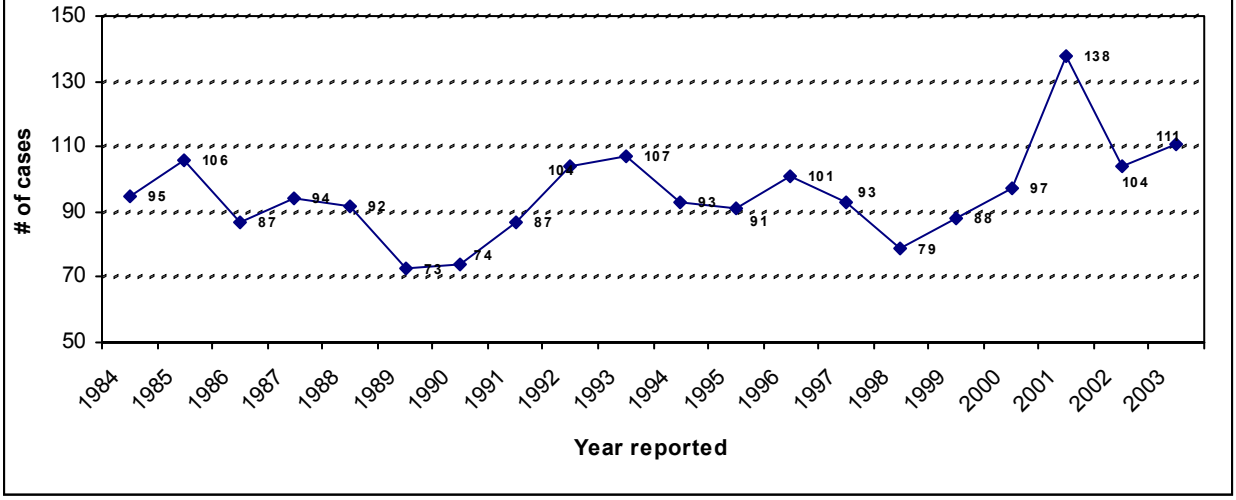


Table 1. TB in Colorado: Comparison of 2002 and 2003 Cases

	Year reported				
	2002		2003		
	n	%	n	%	% change
Age Group (years)					
<15	8	7.7	19	17.1	137.5
15-24	13	12.5	10	9.0	(23.1)
25-44	32	30.8	42	37.8	31.3
45-64	28	26.9	21	18.9	(25.0)
65+	23	22.1	19	17.1	(17.4)
TOTAL	104	100.0	111	100.0	6.7
Gender					
Male	59	56.7	63	56.8	6.8
Female	45	43.3	48	43.2	6.7
TOTAL	104	100.0	111	100.0	6.7
Race/Ethnicity					
White	20	19.2	19	17.1	(5.0)
Black	10	9.6	9	8.1	(10.0)
Hispanic	41	39.4	52	46.8	26.8
Amer Ind/AK native	1	1.0	0	0.0	(100.0)
Asian/Pacific Is	32	30.8	31	27.9	(3.1)
TOTAL	104	100.0	111	100.0	6.7
Region					
Denver metro[a]	80	76.9	87	78.4	8.7
Other than Denver metro	24	23.1	24	21.6	0.0
TOTAL	104	100.0	111	100.0	6.7
Country of Origin					
United States	31	29.8	33	29.7	6.5
Mexico	29	27.9	35	31.5	20.7
Vietnam	6	5.8	6	5.4	0.0
Other countries	38	36.5	37	33.3	(2.6)
TOTAL	104	100.0	111	100.0	6.7
HIV Status Among 25-44 Age Group					
Negative	28	87.5	35	83.3	25.0
Positive	4	12.5	4	9.5	0.0
Refused testing	0	0.0	1	2.4	-
Not offered	0	0.0	2	4.8	-
TOTAL	32	100.0	42	100.0	31.3
Risk factors[b]					
Birth in a high TB prevalence country	72	69.2	77	69.4	6.9
Homeless within past year	8	7.7	6	5.4	(25.0)
Resident of correctional facility at diagnosis	2	1.9	0	0.0	-
Resident of long-term care facility	4	3.8	3	2.7	(25.0)
Injected drug use within past year	1	1.0	1	0.9	0.0
Non-injected drug use within past year	6	5.8	2	1.8	(66.7)
Excess alcohol use within past year	13	12.5	10	9.0	(23.1)
Health care worker within past 2 years	4	3.8	5	4.5	25.0

a. Denver metro includes: Adams, Arapahoe, Denver, Douglas, and Jefferson counties.
Beginning in 2001, Boulder and Broomfield Counties are included as part of Denver metro.

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

Incidence

In 2003, the overall case rate for TB in Colorado was 2.4 per 100,000 population (**Figure 2**). Colorado continues to be categorized as a low incidence state (case rate of less than 3.5 per 100,000 population), though the case rates in Black, Hispanic, and Asian/Pacific Islander populations all exceed 'low incidence' threshold (**Table 2**). The incidence in the Asian/Pacific Islander population continues to be over 40 times the incidence in the majority population. Colorado will need to reduce the number of new cases of TB to less than 50 to meet the "Healthy People 2010" goal of 1.0 or fewer cases per 100,000 population.

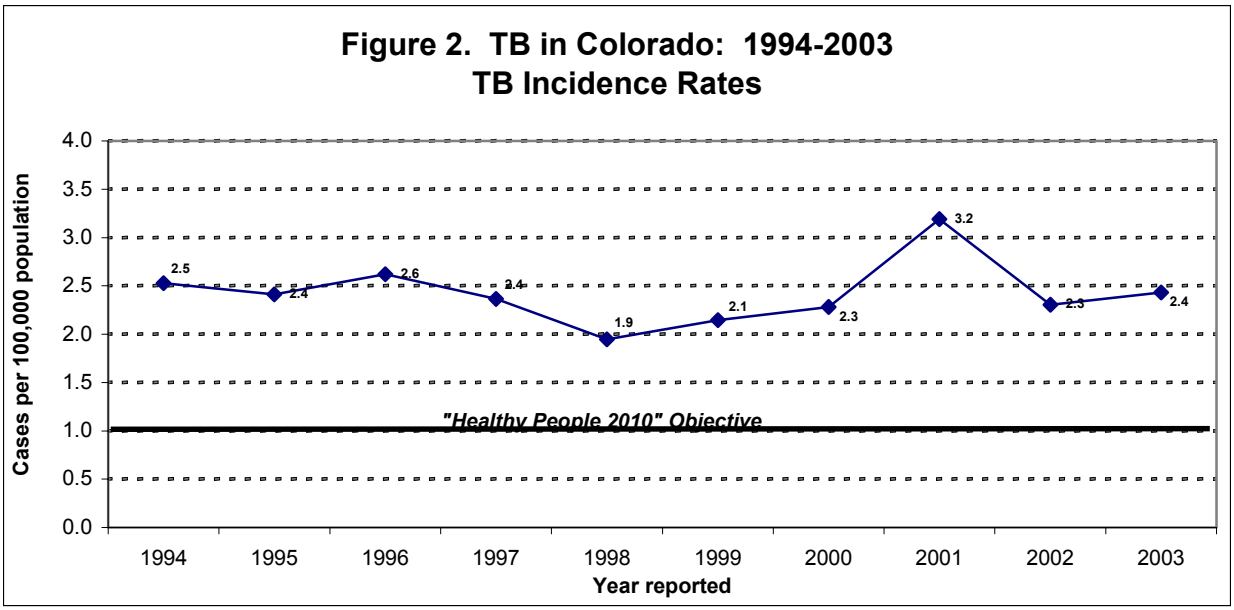


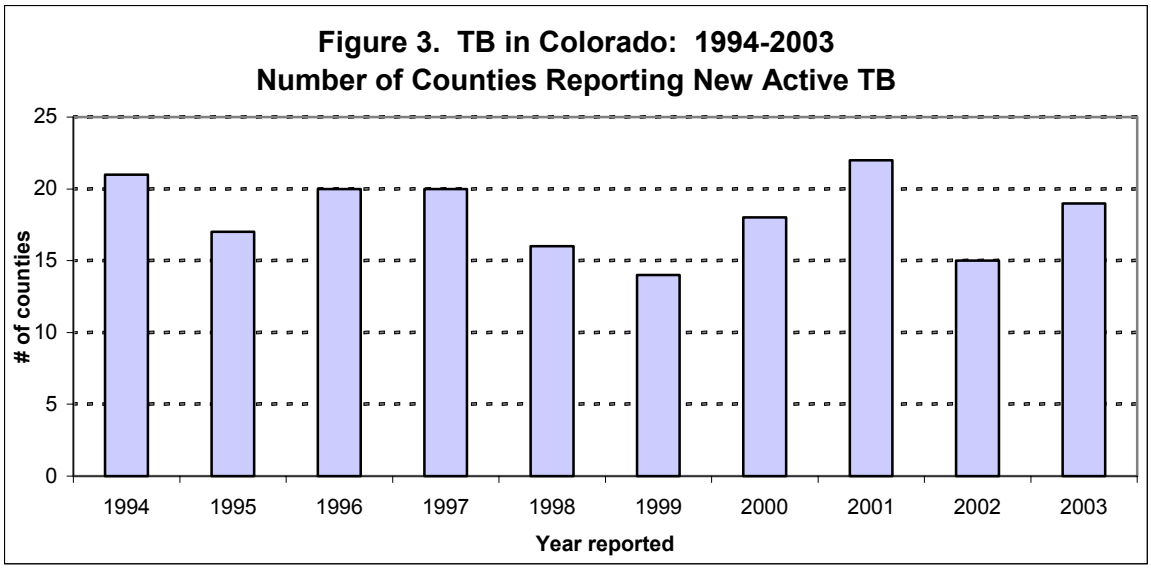
Table 2. TB in Colorado: 2003
Case Rates (per 100,000) by Race/Ethnicity

Race/ethnicity	2003 # cases	2003 Pop est.	2003 Rate
White	19	3,387,732	0.6
Black	9	183,738	4.9
Hispanic	52	828,573	6.3
Asian/Pacific Islander	31	113,558	27.3
Amer Ind/AK native	0	54,390	0.0
TOTAL	111	4,567,991	2.4

Year 2010 goal: <=1.0 cases per 100,000 population

Location

Nineteen of the state's 64 counties reported new cases of TB in 2003. Eighty-seven of the 111 cases (78%) were reported from the Denver metropolitan area. Boulder County had the largest increase from the previous year with five cases reported in 2002 and 13 reported in 2003. Four counties (Chaffee, Conejos, Rio Blanco, and Yuma) reported cases in 2003 after not reporting a case in a decade or more. Nineteen counties reporting at least one case during the previous five years did not report any new cases in 2003 (**Figure 3, Table 3**).



Approximately 56 percent of the state's population resides in the Denver metropolitan counties of Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, and Jefferson. However, 78 percent of all the cases of TB in Colorado are from those metropolitan counties (**Figure 4**).

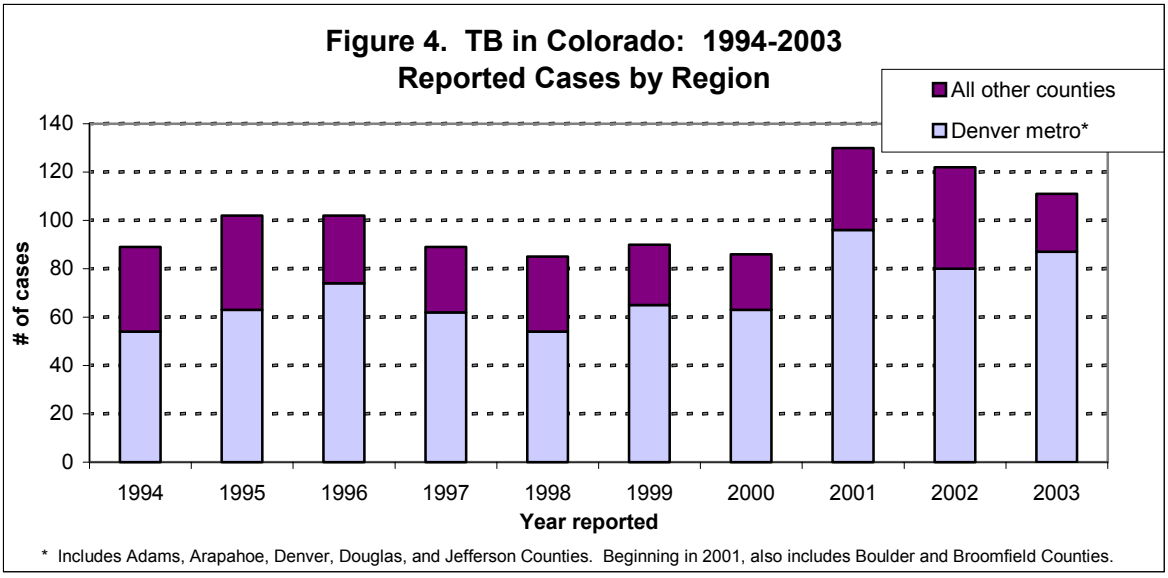


Table 3. TB in Colorado: 1998-2003
Cases by County and Year of Report

NOTE: Only counties reporting cases are listed.

County	1998	1999	2000	2001	2002	5-year mean	2003 cases
Adams	7	8	5	15	10	9.0	9
Arapahoe	6	12	10	11	20	11.8	20
Archuleta	0	0	0	0	0	0.0	1
Bent	1	0	0	0	0	0.2	0
Boulder	4	3	6	5	5	4.6	13
Broomfield	NA	NA	NA	1	0	0.5	0
Chaffee	0	0	0	0	0	0.0	1
Conejos	0	0	0	0	0	0.0	1
Costilla	0	0	0	1	0	0.2	0
Delta	0	0	2	1	0	0.6	0
Denver	34	39	42	55	38	41.6	38
Douglas	1	1	0	0	2	0.8	0
Eagle	0	0	2	0	1	0.6	2
El Paso	4	9	7	7	5	6.4	4
Elbert	0	0	0	1	0	0.2	1
Fremont	1	0	0	0	0	0.2	2
Garfield	1	0	0	0	1	0.4	0
Gunnison	0	0	0	2	0	0.4	0
Jefferson	6	5	6	9	5	6.2	7
La Plata	0	0	1	1	1	0.6	0
Larimer	1	0	2	3	3	1.8	3
Las Animas	0	1	0	1	0	0.4	0
Lincoln	1	0	0	0	0	0.2	0
Mesa	2	0	2	4	2	2.0	2
Moffat	0	1	0	0	0	0.2	0
Montezuma	0	0	1	0	0	0.2	0
Montrose	0	0	2	1	0	0.6	0
Morgan	0	0	1	0	1	0.4	1
Otero	2	1	1	3	0	1.4	0
Phillips	0	1	0	0	0	0.2	0
Pitkin	0	0	1	1	0	0.4	0
Pueblo	5	5	0	3	6	3.8	2
Rio Blanco	0	0	0	0	0	0.0	1
Rio Grande	0	1	0	1	0	0.4	0
Saguache	0	0	0	2	0	0.4	0
Summit	0	0	2	0	0	0.4	0
Weld	3	1	4	10	4	4.4	2
Yuma	0	0	0	0	0	0.0	1
TOTAL	79	88	97	138	104	101.2	111

The rates in counties with small populations may vary considerably from year to year although the frequency of reports may change by only one or two cases. In order to make a more realistic comparison, the average incidence for counties during the past five years is listed in **Table 4**. At 3.3 cases per 100,000 per year, the incidence for the metropolitan Denver counties combined is more than double the incidence in the rest of the state (1.4 per 100,000 per year).

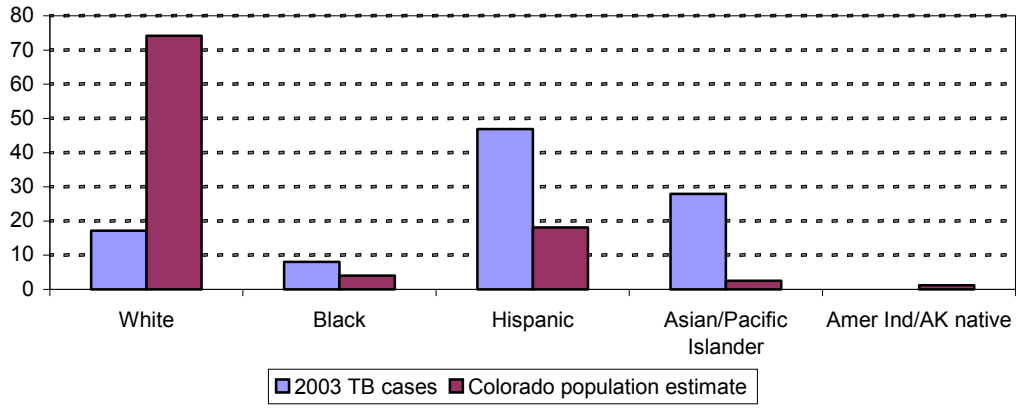
Table 4. Tuberculosis in Colorado: 1999-2003
Mean Case Rates by County

County	Mean cases 1999-2003	2001 population	Cases per 100,000 persons per year
Denver	42.4	560,365	7.6
Saguache	0.4	6,100	6.6
Costilla	0.2	3,723	5.4
Otero	1.0	19,976	5.0
Phillips	0.2	4,511	4.4
Rio Blanco	0.2	5,986	3.3
Rio Grande	0.4	12,518	3.2
Arapahoe	14.6	503,846	2.9
Gunnison	0.4	14,012	2.9
Adams	9.4	361,262	2.6
Las Animas	0.4	15,550	2.6
Pitkin	0.4	16,197	2.5
Boulder	6.6	275,809	2.4
Conejos	0.2	8,401	2.4
Eagle	1.0	44,824	2.2
Pueblo	3.2	144,383	2.2
Morgan	0.6	27,623	2.2
Weld	4.2	194,318	2.2
Delta	0.6	28,709	2.1
Yuma	0.2	9,900	2.0
Archuleta	0.2	10,548	1.9
Elbert	0.4	21,453	1.9
Montrose	0.6	34,601	1.7
Mesa	2.0	119,961	1.7
Summit	0.4	26,355	1.5
Moffat	0.2	13,190	1.5
La Plata	0.6	45,616	1.3
Chaffee	0.2	16,522	1.2
Jefferson	6.4	529,404	1.2
El Paso	6.4	533,526	1.2
Fremont	0.4	47,209	0.8
Larimer	2.2	259,707	0.8
Montezuma	0.2	23,999	0.8
Broomfield	0.3	40,621	0.8
Garfield	0.2	46,173	0.4
Douglas	0.6	200,385	0.3
Alamosa	0.0	15,282	0.0
Baca	0.0	4,514	0.0
Bent	0.0	5,865	0.0
Cheyenne	0.0	2,228	0.0
Clear Creek	0.0	9,485	0.0
Crowley	0.0	5,491	0.0
Custer	0.0	3,686	0.0
Dolores	0.0	1,844	0.0
Gilpin	0.0	4,845	0.0
Grand	0.0	13,253	0.0
Hinsdale	0.0	794	0.0
Huerfano	0.0	7,857	0.0
Jackson	0.0	1,620	0.0
Kiowa	0.0	1,598	0.0
Kit Carson	0.0	8,007	0.0
Lake	0.0	7,878	0.0
Lincoln	0.0	6,117	0.0
Logan	0.0	21,920	0.0
Mineral	0.0	843	0.0
Ouray	0.0	3,888	0.0
Park	0.0	15,325	0.0
Prowers	0.0	14,240	0.0
Routt	0.0	20,551	0.0
San Juan	0.0	560	0.0
San Miguel	0.0	6,956	0.0
Sedgwick	0.0	2,722	0.0
Teller	0.0	21,827	0.0
Washington	0.0	4,898	0.0

Race/Ethnicity

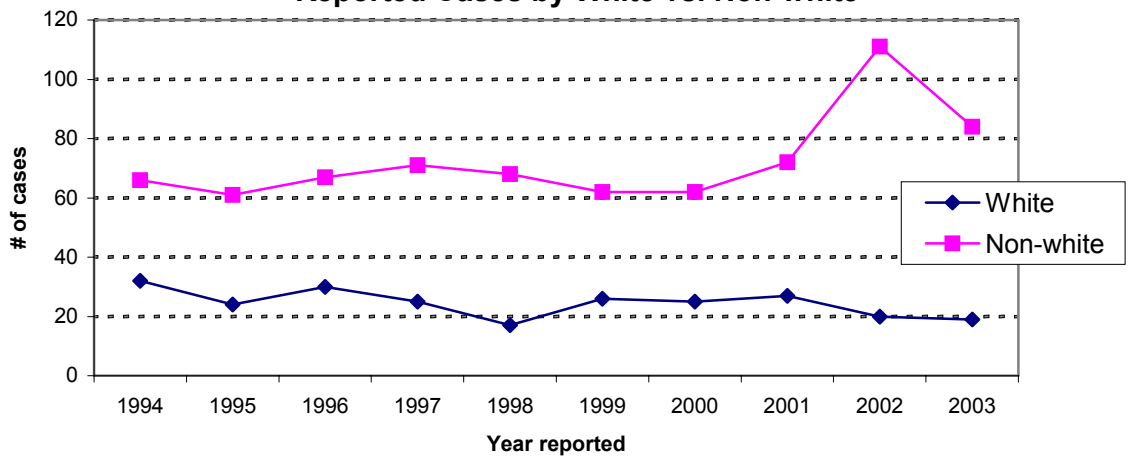
Of the 111 cases reported in 2003, approximately 83 percent were of non-white race/ethnicity. The cases were classified as follows: 52 (47 percent) non-white Hispanic, 31 (28 percent) Asian/Pacific Islander, 19 (17 percent) non-Hispanic white, and nine (eight percent) Black. As compared to Colorado's population, which is approximately 74 percent non-Hispanic white, minorities are over-represented among TB cases (**Figure 5**).

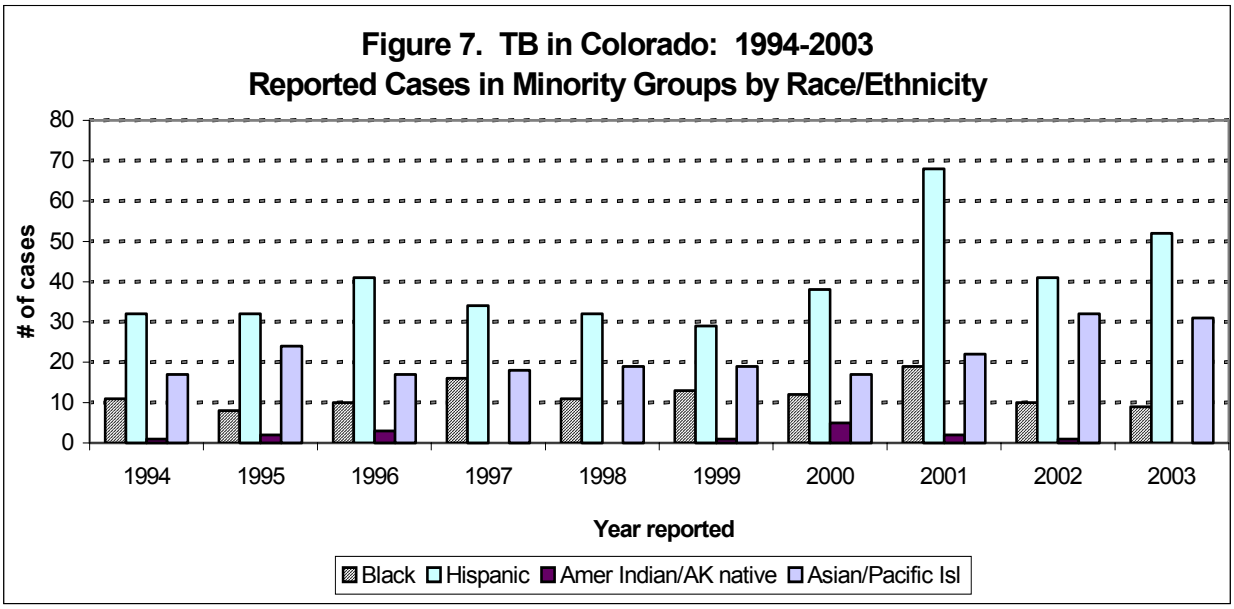
Figure 5. TB in Colorado: 2003
Percent of TB Cases Compared to the Percent Population by Race/Ethnicity



Since 1991, there has been an overall decrease in cases among the white race/ethnicity group, while cases among the non-white race/ethnicity groups have increased (**Figure 6**). The number of cases by race/ethnicity among minority groups since 1994 is shown in **Figure 7**.

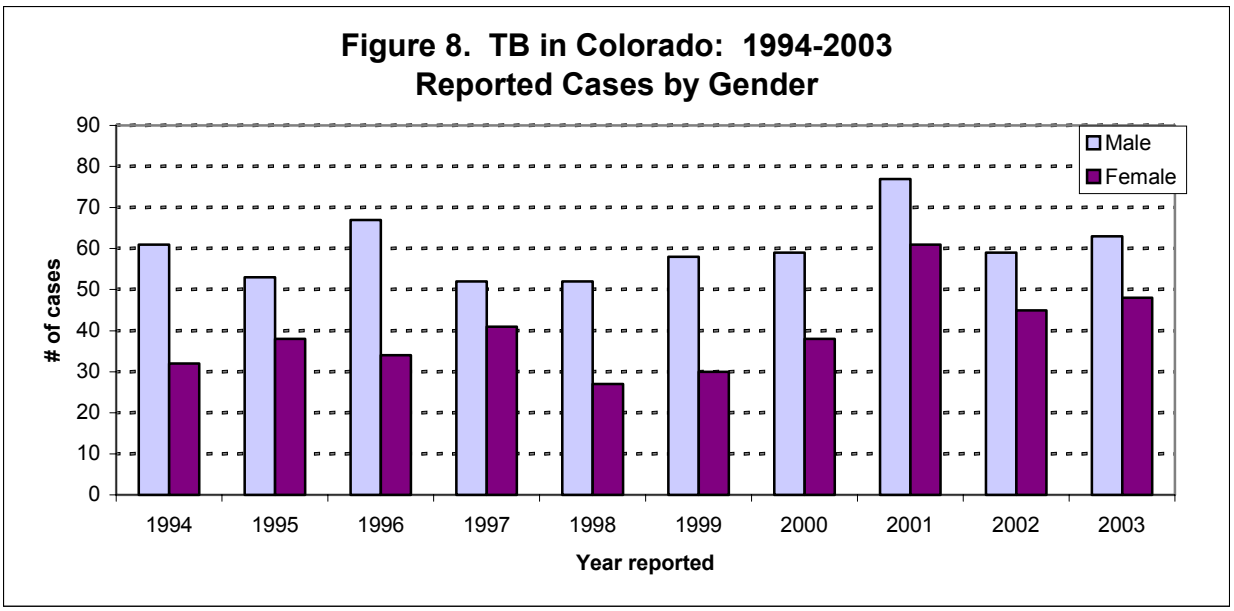
Figure 6. TB in Colorado: 1994-2003
Reported Cases by White vs. Non-white





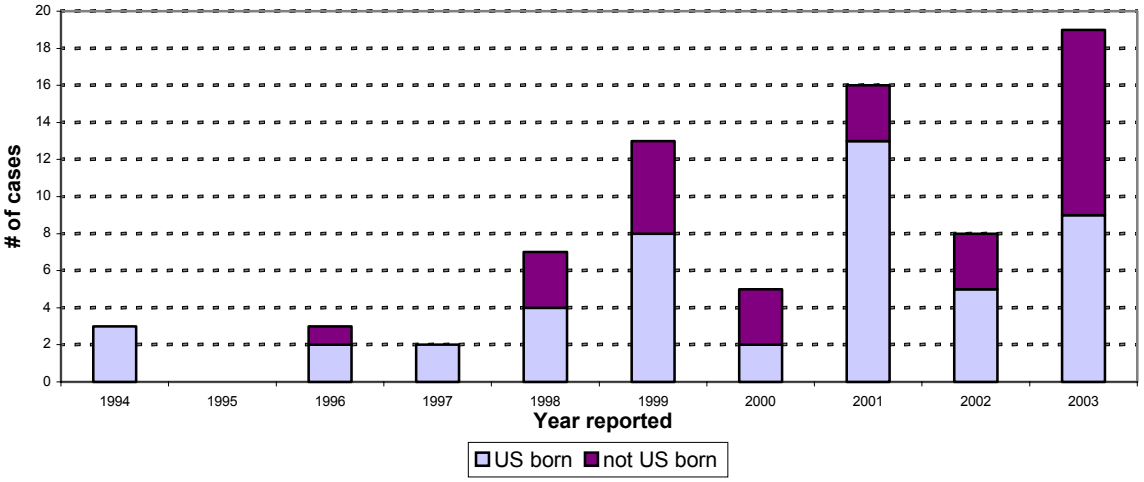
Gender/Age

The number of cases of TB occurring among males is 1.3 times that occurring among females (**Figure 8**).



The ages of persons reported with TB in 2003 ranged from less than one year to 91 years with an average of 39 years. Nineteen cases were in children less than 15 years, and 11 of those were children less than five years (**Figure 9**). Of the cases in children less than five years, seven were US-born, and four were foreign-born (two from China, one from Italy, one from Pakistan). Three of the US-born children were discovered through contact investigations.

Figure 9. TB in Colorado: 1994-2003
Reported Cases in Children < 15 Years by Country of Origin



Twenty-three (21 percent) of cases were in the 25-34 years age group. The 85+ years age group had the highest incidence with 8.0 cases per 100,000 population (**Table 5**).

Table 5. TB in Colorado: 2003
Cases and Case Rates by Age Group and Gender

Age group	2003 Male	Female	Total	Pop.est.	Rate*
0-14	14	5	19	963,373	2.0
15-24	6	4	10	660,634	1.5
25-34	11	12	23	680,732	3.4
35-44	9	10	19	730,676	2.6
45-54	8	4	12	683,264	1.8
55-64	6	3	9	415,075	2.2
65-74	8	1	9	235,783	3.8
75-84	1	5	6	148,318	4.0
85+	0	4	4	50,137	8.0
TOTAL	63	48	111	4,567,991	2.4

* Cases per 100,000 persons.

Foreign-born

Approximately 70 percent of the cases reported in 2003 were foreign-born with Mexico being the predominant country of origin (**Figure 10**). Foreign-born cases were from 23 different countries (**Table 6**).

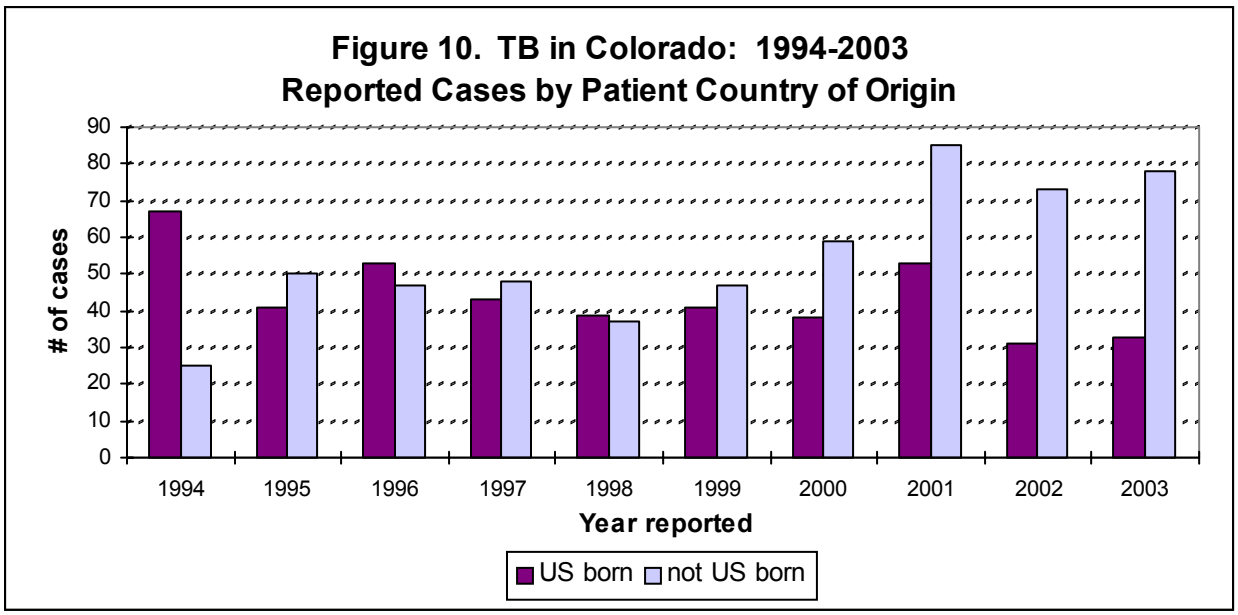


Table 6. TB in Colorado: 2003
Patient Country of Origin

Country	# of cases	Country	# of cases
Cambodia	1	Mali	1
China	4	Mexico	35
Ethiopia	2	Mongolia	1
Guam	1	Niger	1
Honduras	1	Pakistan	1
India	6	Peru	1
Indonesia	1	Philippines	5
Italy	1	Poland	1
Japan	1	Somalia	2
Korea	3	Thailand	1
Laos	1	Vietnam	6
Liberia	1	TOTAL	78

There are several notable differences between the characteristics of U.S.-born and foreign-born TB cases. In 2003:

- Thirty-eight (49 percent) of foreign-born cases were in the 25-34 year age group. Only four (12 percent) of the U.S.-born cases were in that same age group.

- Eighty-six percent of the foreign-born cases were reported from the Denver-metro area as compared to 60 percent of the U.S.-born cases.

- Seven (21 percent) of the U.S.-born cases had excessive alcohol use compared to three (four percent) of the foreign-born cases.

- None of the U.S.-born cases were health care workers as compared to five of the foreign-born cases.

Table 7 shows the number of cases by age group for those born in the United States and those born outside the United States.

Table 7. TB in Colorado: 2003
Reported Cases by Age Group and Patient Country of Origin

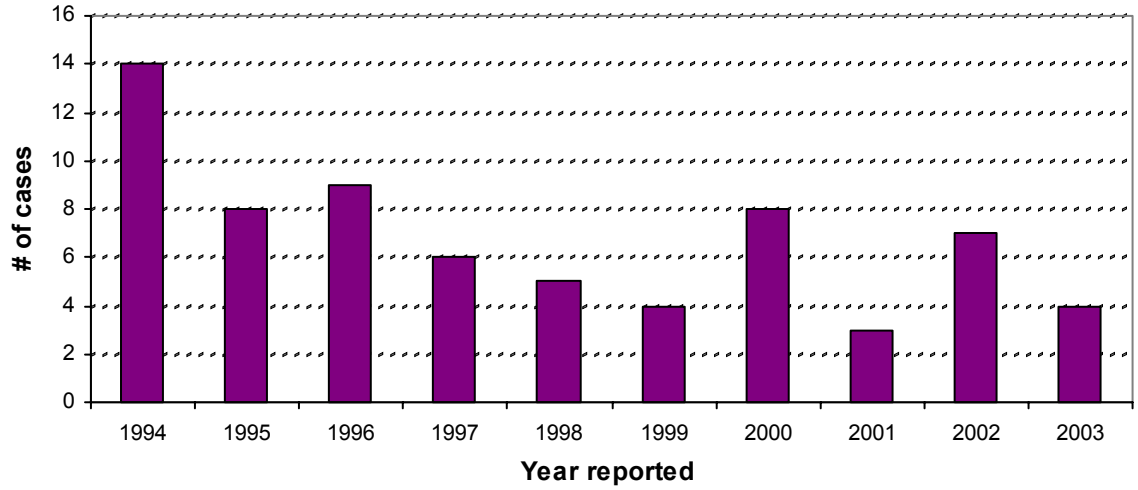
Age Group	USA	Foreign	Total
0-4	7	4	11
5-14	2	6	8
15-24	1	9	10
25-34	0	23	23
35-44	4	15	19
45-54	3	9	12
55-64	4	5	9
65-74	6	3	9
75-84	3	3	6
85+	3	1	4
TOTAL	33	78	111

Elapsed time since entry into the U.S. was available for all 78 foreign-born cases reported in 2003. Nineteen (25 percent) were in the U.S. less than six months prior to diagnosis; one (one percent) had been in the U.S. six to 12 months; 25 (32 percent) had been in the U.S. more than one year and less than five years; and 33 (42 percent) had been in the U.S. for more than five years. Foreign-born cases were in the U.S. an average of eight years prior to diagnosis.

HIV/TB Co-infection

The number of cases of TB among persons who are at highest risk of developing active disease – those infected with HIV as well as TB – has declined since 1994 when there were 14 co-infected cases (**Figure 11**). In 2003, HIV testing was done in 76 percent of the cases (84 of 111). The goal is to have HIV status reported for at least 75 percent of all newly reported cases age 25-44. Colorado exceeded this goal by reporting HIV status for 93 percent of cases age 25-44.

Figure 11. TB in Colorado: 1994-2003
Reported Cases known to be co-infected with HIV



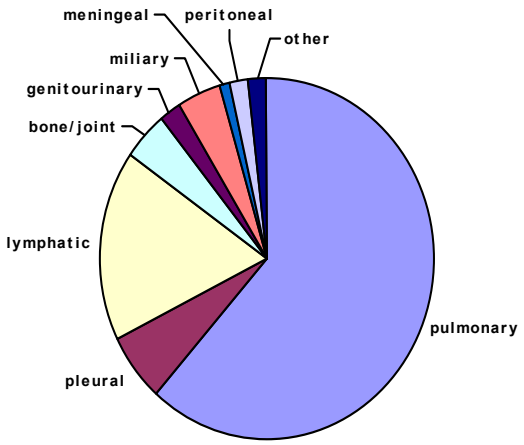
Occupation

The occupational status is known for all cases reported in 2003. Five cases were health care workers (currently or within the past two years); one case was a migrant farm worker (currently or within the past two years); 58 were unemployed (including children and retired persons); and 47 worked at a variety of jobs not known to present a high risk for TB.

Site of Disease

Though the majority of TB cases (61 percent) were pulmonary, TB caused disease in many other sites (**Figure 12**).

Figure 12. TB in Colorado: 2003
Site of disease



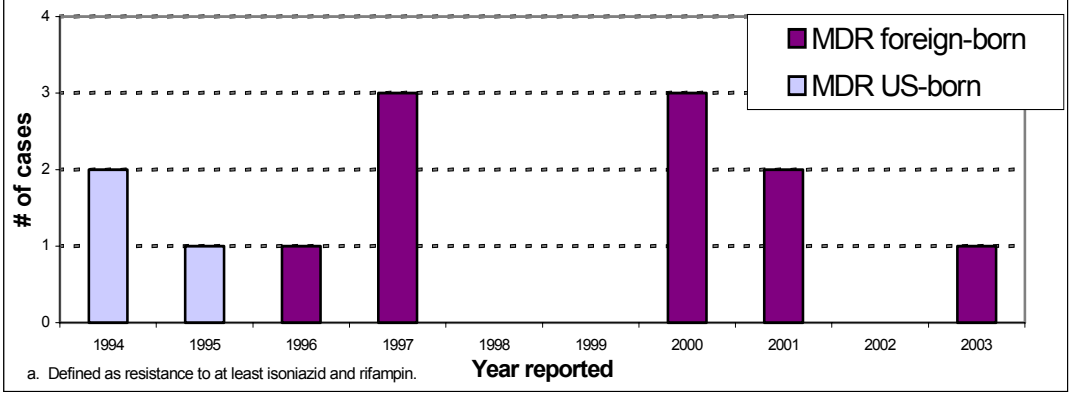
Drug Susceptibilities

Drug susceptibility results were available for all culture-positive TB cases in 2003. Fourteen (19 percent) of the 72 culture-positive cases were resistant to one or more primary drugs. Eleven of the 14 cases with drug resistance were foreign-born, and the other three were U.S.-born. The primary resistance patterns were as follows:

5 isoniazid (INH) only
2 pyrazinamide (PZA) only—(NOTE: both were strains of *M. bovis*)
3 streptomycin (SM) only
1 rifampin (RIF) and PZA
1 INH and SM
1 RIF and SM
1 INH, RIF, PZA, ethambutol (EMB), SM

There was one new case of multi-drug resistant TB -- defined as being resistant to at least INH and RIF **(Figure 13**).

Figure 13. TB in Colorado: 1994-2003
Multi-drug Resistant (MDR)[a] Cases
by Patient Country of Origin



a. Defined as resistance to at least isoniazid and rifampin.

Table 8 describes the 16 cases of multi-drug resistant TB in Colorado from 1994 to 2003. Thirteen of the cases were diagnosed in Colorado and three were diagnosed in other countries.

Table 8. TB in Colorado: 1994-2003
Cases of Multi-drug Resistance (MDR)[a]

Report year	Age at diagnosis	Sex	County	Country of origin	Resistant to[b]	Completion of therapy
1994	38 years	F	Jefferson	US	IRPES	completed (31 months)
1994	37 years	M	Jefferson	US	IRPES	died after 18 months of therapy
1995	63 years	M	Denver	US	IRS	completed (26 months)
1996	51 years	F	Arapahoe	Mexico	IRPE	died after 20 months of therapy
transfer[c] 1996	30 years	F	Boulder	China	IR	completed (22 months)
1997	24 years	F	Boulder	India	IRP	moved after 6 months of therapy outcome unknown
1997	48 years	M	Denver	Viet Nam	IRPES	completed (26 months)
1997	28 years	F	Adams	Mexico	IRPE	died after 11 months of therapy
2000	20 years	F	Boulder	Mexico	IRP	completed (26 months)
transfer[c] 2000	31 years	F	Larimer	Mexico	IR	completed (25 months)
2000	39 years	F	Adams	Mexico	IRPES	completed (26 months)
2000	36 years	M	Denver	Mexico	IR	completed (28 months)
2001	64 years	F	Denver	China	IRP	moved after 6 months of therapy outcome unknown
transfer[c] 2001	41 years	M	El Paso	Korea	IRPES	completed (18 months)
2001	65 years	M	Adams	Peru	IRS	completed (18 months)
2003	26 years	F	Boulder	China	IRPES	currently on therapy[d]

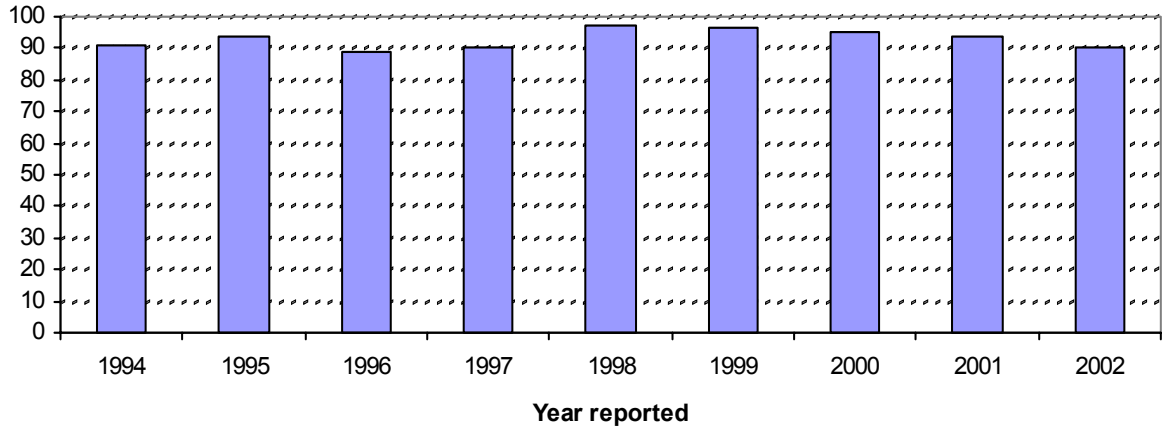
a. Defined as resistance to at least isoniazid and rifampin.
b. I=isoniazid, R=rifampin, P=pyrazinamide, E=ethambutol, S=streptomycin
c. Cases not included on graphs of MDR. Cases are counted in the reporting area where they are diagnosed.
d. As of 4/2004.

Completion of Therapy

The usual treatment for TB is six months using INH, RIF, PZA, and EMB. The Colorado Board of Health requires directly-observed therapy for pulmonary TB. As shown in **Figure 14**, over 90 percent of patients reported in 2002 completed an appropriate course of therapy. All new cases reported in 2003, who were alive at diagnosis, have started therapy.

Figure 14. TB in Colorado: 1994-2002

Percent completing therapy[a]



a. Excludes patients who died during therapy.

Contact Investigations

It is a public health responsibility to conduct contact investigations on all cases of infectious (pulmonary and laryngeal) TB. Contacts to infectious cases are evaluated for the presence of latent or active TB. Contacts are 75 times more likely to be infected with TB than the general public. Thus it is critical to find, evaluate, and treat infected contacts when appropriate. **Table 9** gives a summary of contact investigations from 1999 to 2002. Preliminary data for 2003 are not available until August 2004.

Table 9. TB in Colorado: 1999-2002 Follow-up and Treatment for Contacts to Tuberculosis Cases				
	1999	**2000**	**2001**	**2002[a]**
Avg contacts per infectious case	12.6	16.2	14.4	22.4
Total contacts	643	860	1107	1344
# (%) of contacts evaluated	474 (74%)	529 (62%)	864 (78%)	975 (73%)
# (%) of contacts with latent TB infection	145 (31%)	229 (43%)	329 (38%)	245 (25%)
# (%) of infected contacts starting treatment	115 (79%)	153 (67%)	233 (71%)	156 (64%)
# (%) of contacts starting treatment who finished treatment	102 (89%)	86 (56%)	149 (64%)	92 (59%)
# (%) of contacts with active TB	0	1 (<1%)	15 (2%)	1 (<1%)
a. Preliminary data				