Vaccine Preventable Diseases in Colorado

Measles, Rubella, Congenital Rubella, Hepatitis A, Hepatitis B, Diphtheria, Tetanus, Mumps, Polio, Pertussis, *Haemophilus influenzae*, Meningococcal Disease, Pneumococcal Disease, and Varicella

Surveillance Report: 2004

Colorado Department of Public Health and Environment

Communicable Disease Epidemiology Program
4300 Cherry Creek Drive South
Denver, CO 80246

November 2006

Table of Contents

Table of Contents

Introduction

This report highlights 2004 surveillance data for vaccine preventable diseases in Colorado. Colorado rates in this report were calculated as cases per 100,000 population using 2004-based population projections from the Demography Section, Colorado Division of Local Government. National rates are from the **Morbidity and Mortality Weekly Report (MMWR)** "Summary of Notifiable Diseases – 2004", published June 16, 2006, or were calculated using 2004 United States Census Bureau data, published July 1, 2005. Vaccine preventable diseases reported in Colorado during 2000-2004 are summarized below in Table 1.

Table 1. Reported Cases of Vaccine Preventable Diseases, Colorado*, 2000 – 2004

Report Year	Measles	Mumps	Rubella	Tetanus	Pertussis	Invasive Meningococcal Disease	Invasive Pneumococcal Disease**	Invasive H. flu	Hepatitis A	Acute Hepatitis B
2000	2	1	1	0	487	33	180**	33	223	103
2001	0	3	0	1	389	33	317	38	88	100
2002	0	2	0	0	464	23	391	36	75	81
2003	0	1	1	0	368	27	366	39	59	80
2004	1	3	0	3	1185	15	332	44	51	59

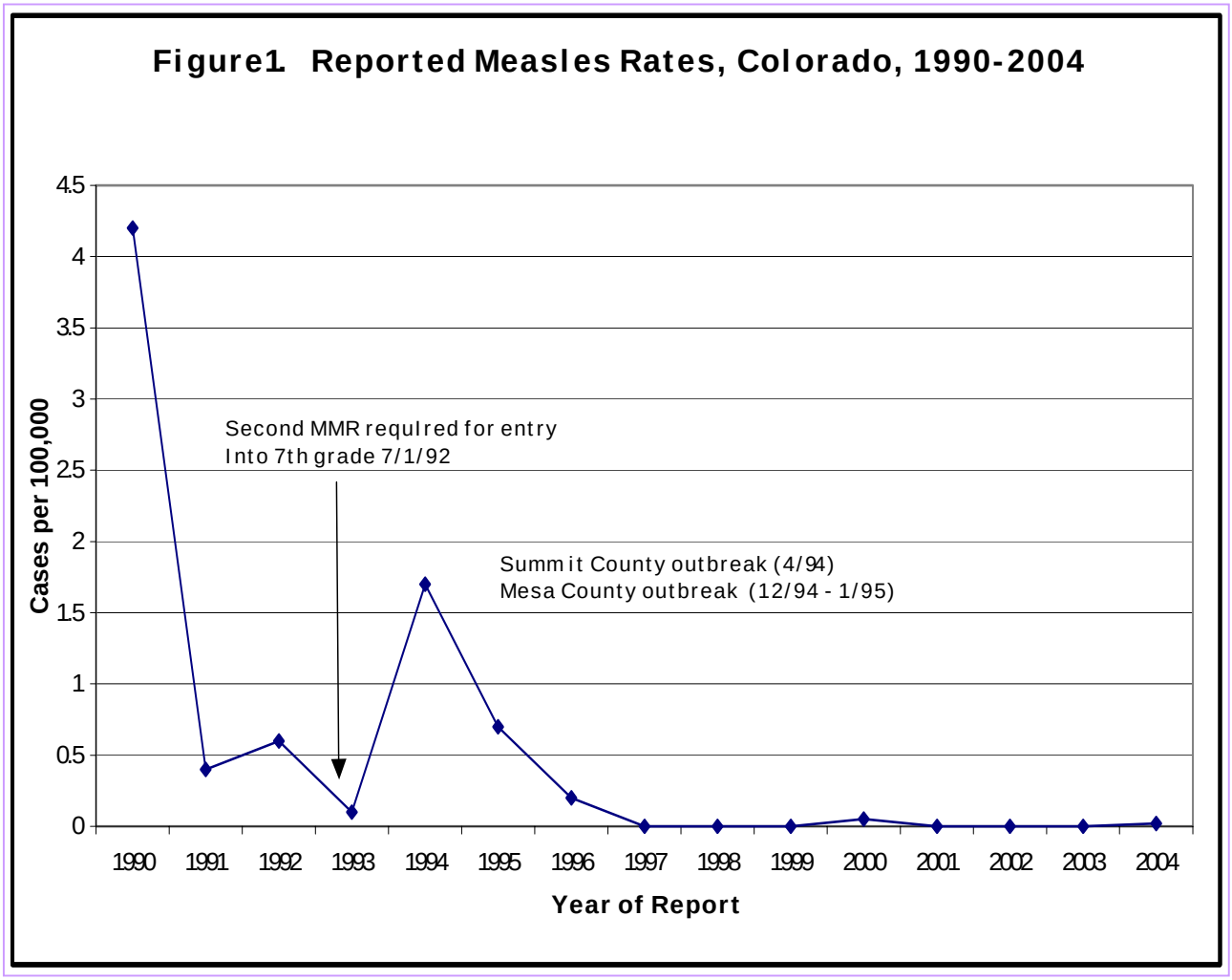
* No congenital rubella, diphtheria, or polio cases were reported during 2000 – 2004.

**As of November 30, 2001 invasive pneumococcal disease became reportable statewide. Prior to November 30, 2001, pneumococcal meningitis was reportable statewide, and all invasive pneumococcal disease was reportable from the 5-county Denver metro area beginning 7/01/ 00; therefore, 2000 data are derived from 6 months of reporting.

Measles

During 2004, one laboratory–confirmed measles case was reported in Colorado, an adult Jefferson County male. He developed measles in May after returning from a trip to Southeast Asia. The case had 2 documented measles vaccinations. A "Measles Alert" was sent to Denver metro area emergency departments, however, no further cases of measles were reported. There were no measles cases reported in Colorado from 2001 – 2003.

The measles incidence rate in Colorado has decreased from 1.7/100,000 in 1994 to 0.02/100,000 in 2004. The Colorado school immunization requirement for two measles vaccinations was implemented July 1992. Figure 1 shows Colorado measles rates from 1990 – 2004. A record low of 37 measles cases were reported in the United States during 2004 for an incidence rate of 0.01/100,000.

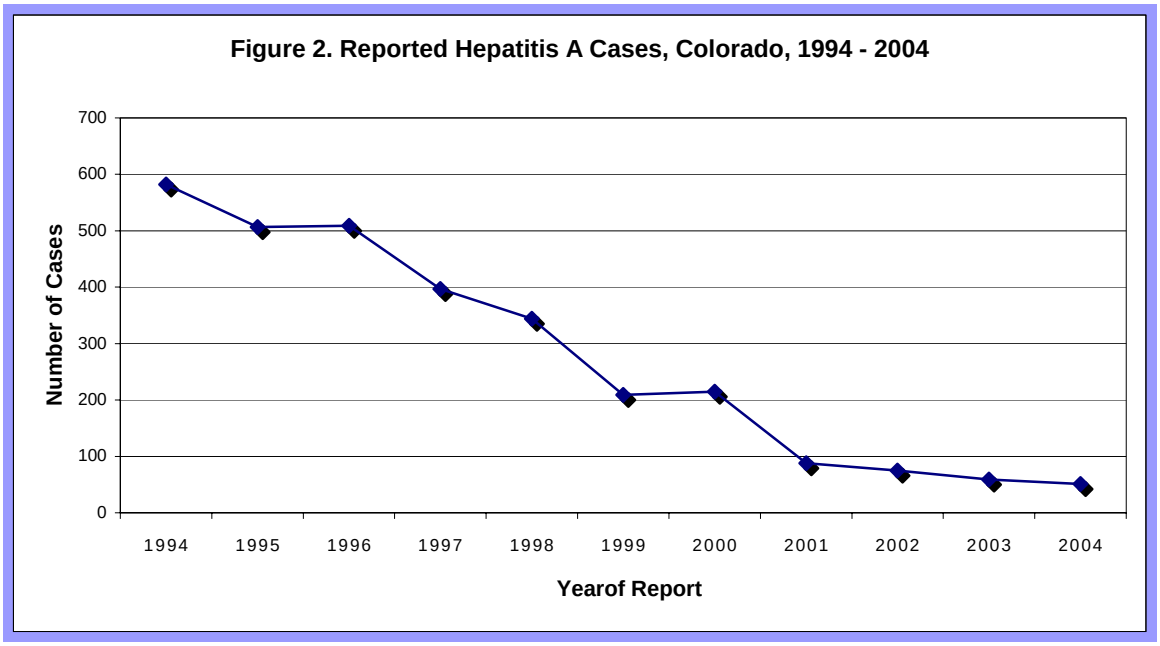


Rubella

There were no rubella cases reported in Colorado during 2004. The ten-year annual average (1994-2003) for rubella in Colorado was less than one case (0.7) per year. There were 10 rubella cases reported in the United States during 2004, for an incidence rate of 0.003/100,000. As reported in MMWR (March 25, 2005), an independent panel unanimously agreed in October 2004 that rubella is no longer endemic in the United States.

Hepatitis A

A total of 51 hepatitis A cases were reported in Colorado during 2004, which represents a 13.6 % decrease from the 59 cases reported in 2003. Hepatitis A has decreased steadily since 1994 in Colorado with an incidence rate of 1.1/100,000 in 2004. Figure 2 displays reported cases of hepatitis A in Colorado since 1994. The United States 2004 hepatitis A incidence rate was 1.9/100,000, based on 5,683 reported cases.



Hepatitis A cases and rates by age group and gender (Table 2) and by year and county of residence (Table 3) are presented in the following two tables.

Table 2. Reported Hepatitis A Cases and Rates by Age Group & Gender, Colorado 2004

Age Group (years)	Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate
0-1	0	0.0	0	0.0	0	0.0
2-4	1	1.0	1	1.0	2	1.0
5-9	3	0.6	0	0.0	3	1.0
10-14	3	1.8	1	0.6	4	1.2
15-19	0	0.0	3	1.8	3	0.9
20-39	6	0.9	11	1.7	17	1.3
40+	13	1.4	9	0.9	22	1.1
Total	26	1.1	25	1.1	51	1.1

Table 3. Reported Hepatitis A Cases and Rates by County, Colorado 2000 – 2004

County	Number of Cases by Year of Report					Average Annual # of cases	Average Rate for 5 Years*
	2000	2001	2002	2003	2004		
Adams	15	12	12	5	1	9.0	2.4
Alamosa	0	0	0	1	0	0.2	*
Arapahoe	21	7	7	9	3	9.4	1.8
Archuleta	0	1	0	0	0	0.2	*
Boulder	16	3	3	5	5	6.4	2.2
Broomfield**	NA	0**	0	0	1	NA	NA
Chaffee	0	0	0	0	2	0.4	*
Cheyenne	1	0	0	0	0	0.2	*
Delta	0	0	1	0	1	0.4	*
Denver	69	23	14	7	3	23.2	4.1
Douglas	4	1	2	3	4	11.0	5.2
Eagle	3	8	2	2	0	3.0	6.5
El Paso	17	1	3	4	6	6.2	1.1
Elbert	0	0	0	0	1	0.2	*
Fremont	0	0	2	0	0	0.4	*
Garfield	1	1	0	8	1	2.2	4.6
Gilpin	1	0	1	0	0	0.4	*
Grand	4	0	0	1	0	1.0	7.5
Gunnison	6	0	0	2	1	1.8	12.9
Jefferson	13	4	11	2	1	6.2	1.1
La Plata	9	4	0	0	2	3.0	6.5
Larimer	8	7	3	2	1	4.2	1.6
Logan	1	1	0	0	0	0.4	*
Mesa	4	1	2	0	1	1.6	1.3
Moffat	0	0	0	0	4	0.8	*
Montrose	1	0	0	1	0	0.4	*
Morgan	0	0	0	2	2	0.8	*
Otero	1	0	0	1	0	0.4	*
Phillips	1	0	0	0	0	0.2	*
Pitkin	1	1	0	0	1	0.6	*
Prowers	1	0	0	0	0	0.2	*
Pueblo	2	3	2	0	1	1.6	1.1
Routt	0	0	2	1	6	1.8	8.6
Saguache	3	0	0	0	0	0.6	*
San Miguel	0	0	0	1	0	0.2	*
Summit	1	0	0	0	0	0.2	*
Teller	0	0	1	0	0	0.2	*
Weld	11	10	7	4	3	7.0	3.5
TOTAL	215	88	75	59	51	97.6	2.1

*Average annual rates were not calculated for counties with <5 hepatitis A cases during the five-year period. Caution should be used when interpreting rates based on small numbers of cases. Rates were calculated using 2002 population figures from the 2004-based population projections, from the Demography Section, Colorado Division of Local Government.

**Broomfield became a county 11/15/01.

Acute Hepatitis B

During 2004, there were 59 acute hepatitis B cases reported in Colorado, which represents a 26.2% decrease compared to the 80 cases reported in 2003. The incidence rate of acute hepatitis B cases in Colorado was 1.3/100,000 in 2004, compared to the United States incidence rate of 2.1/100,000 (6,212 cases). In Colorado, 76.0% of 2004 hepatitis B cases were 20-49 years of age; of these, 73% were male. Hepatitis B data are displayed by rates, age group, and county of residence in Table 4, Figure 3, and Table 5.

Table 4. Reported Acute Hepatitis B Cases and Rates by Age Group & Gender, Colorado, 2004

Age Group (years)	Male		Female		Total	
	Cases	Rate	Cases	Rate	Cases	Rate
< 15	0	0.0	0	0.0	0	0.0
15-19	0	0.0	0	0.0	0	0.0
20-29	12	3.5	3	1.0	15	2.3
30-39	8	2.2	3	0.9	11	1.6
40-49	13	3.5	6	1.6	19	2.5
50-59	7	2.4	4	1.4	11	1.9
≥ 60	3	1.0	0	0.0	3	0.5
Total	43	1.8	16	0.7	59	1.3

Figure 3. Reported Acute Hepatitis B Cases by Age Group and Year, Colorado, 2000- 2004

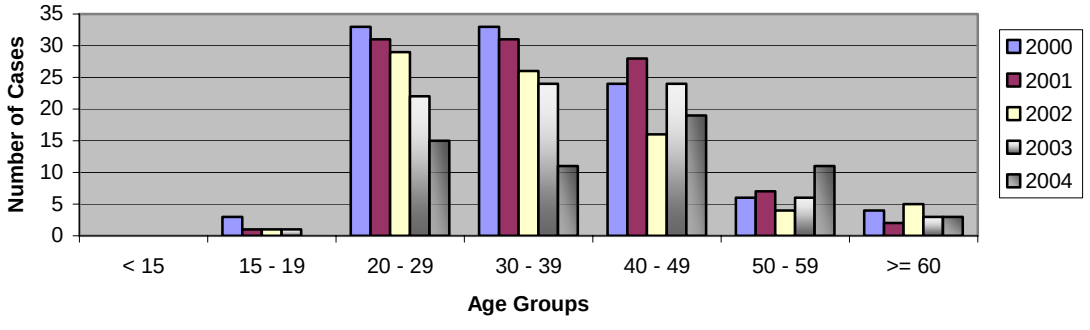


Table 5. Reported Acute Hepatitis B Cases and Rates by County, Colorado 2000 – 2004

County	Number of Cases by Year of Report					Average Annual # of cases	Average Rate for 5 Years*
	2000	2001	2002	2003	2004		
Adams	8	12	4	6	4	6.8	1.8
Alamosa	0	1	0	0	0	0.2	*
Arapahoe	11	15	9	13	5	10.6	2.1
Boulder	5	0	4	1	4	2.8	1.0
Broomfield**	NA	0**	1	0	0	NA	NA
Crowley	2	1	0	0	0	0.6	*
Chaffee	0	0	0	0	1	0.2	*
Denver	34	34	33	29	17	29.4	5.2
Dolores	0	0	0	0	1	0.2	*
Douglas	1	3	3	1	0	1.6	0.7
Eagle	0	1	0	1	0	0.4	*
El Paso	8	8	7	12	8	8.6	1.6
Fremont	3	1	1	0	0	1.0	2.1
Gunnison	0	0	1	0	0	0.2	*
Huerfano	0	0	1	0	0	0.2	*
Jefferson	9	10	6	4	6	7.0	1.3
La Plata	0	0	0	0	1	0.2	*
Larimer	7	2	2	3	4	3.6	1.4
Las Animas	0	0	0	1	0	0.2	*
Logan	0	1	1	0	1	0.6	*
Mesa	0	1	3	0	0	0.8	*
Montezuma	0	0	0	0	1	0.2	*
Montrose	1	0	0	0	0	0.2	*
Morgan	0	0	0	1	0	0.2	*
Pitkin	0	1	1	0	0	0.4	*
Pueblo	3	4	2	4	3	3.2	2.2
Rio Grande	0	0	0	2	0	0.4	*
Routt	0	1	0	0	0	0.2	*
Saguache	0	0	0	0	1	0.2	*
Unknown	1	2	0	0	0	0.6	NA
Weld	10	2	2	2	1	3.4	1.7
TOTAL	103	100	81	80	59	85.0	1.9

* Average annual rates were not calculated for counties with <5 hepatitis B cases during the five-year period. Caution should be used when interpreting rates based on small numbers of cases. Rates were calculated using 2002 population figures from the 2004-based population projections, from the Demography Section, Colorado Division of Local Government.
**Broomfield became a county 11/15/01.

Diphtheria

No cases of diphtheria were reported in Colorado or the United States during 2004. The last case of diphtheria reported in Colorado was in 1985.

Tetanus

Three cases of tetanus were reported in Colorado during 2004. Tetanus is based on clinical diagnosis, as there is no specific laboratory test to confirm the illness. The cases ranged in age from 23 to 44 years of age. Two of the three cases were from Mesa county, and the remaining case was from Arapahoe county.

An adult Arapahoe county male was diagnosed with tetanus in January after a 3-week history of progressively severe muscle cramps. Prior to hospitalization, the case had a severe episode of his jaw locking. The patient injured his hand while hanging holiday lights on his house several weeks prior to the onset of symptoms. He had received a primary series of tetanus toxoid immunization, with his last booster dose in 1993.

In July, an adult female from Mesa county was reported as having tetanus following a head injury and tooth abscess. Her tetanus immunization status was unknown. She was hospitalized for 124 days and discharged to a long-term care facility.

A young adult Mesa county male was diagnosed with tetanus in August. He developed symptoms 2 days after cutting his thumb with a used arrow. He had received 4 doses of DTP vaccine as a child with his last dose being administered 20 years ago.

In Colorado, the ten-year annual average (1994-2003) for tetanus was less than one case (0.7) per year. The 2004 tetanus incidence rate for Colorado was 0.06/100,000, compared with the national incidence rate of 0.01/100,000 (34 cases).

Mumps

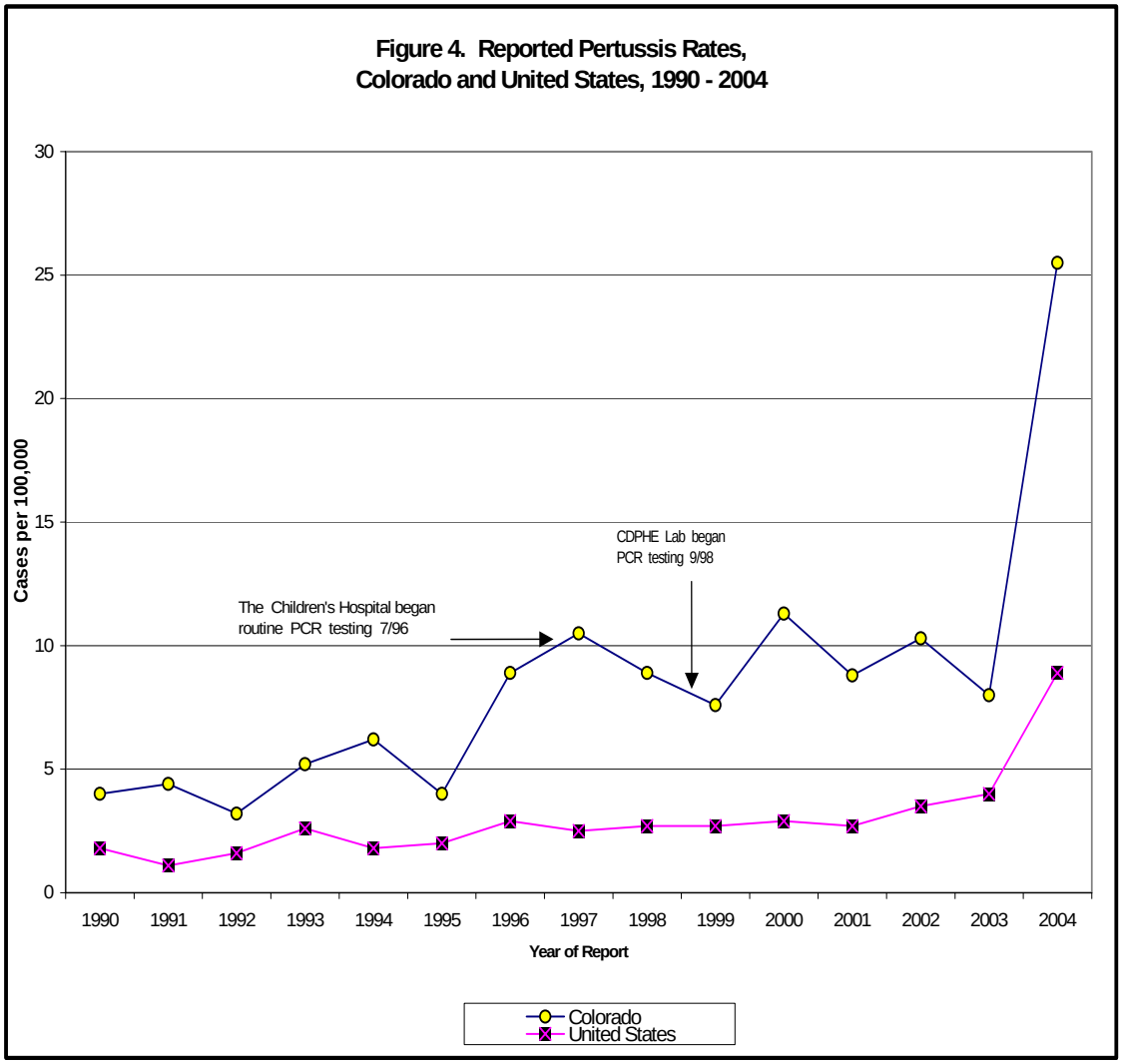
During 2004, three laboratory-confirmed mumps cases were reported in Colorado. All three cases were mumps IgM antibody positive and were related to foreign travel. An adult female from Adams County developed mumps after returning from a visit to the Philippines in April. Her immunization status was unknown. Another case reported in April was an unvaccinated child, who moved to Denver from Mexico 17 days prior to illness onset. In May, an adolescent female Japanese exchange student was reported with mumps. She was exposed to her sibling in Japan who had mumps 3 weeks earlier. There were 7 other Japanese exchange students in the same group and none developed mumps.

The five-year annual average (1999-2003) for reported mumps cases in Colorado was 2.4 cases. During 2004, the Colorado mumps incidence rate was 0.06/100,000, compared to the national incidence rate of 0.09/100,000 (258 cases).

Polio

In 1994, the World Health Organization (WHO) certified the Western Hemisphere as free of wild poliovirus. In the United States, the last case of polio caused by wild poliovirus was identified in 1979.

Pertussis



During 2004, there were 1,185 pertussis cases reported in Colorado. This represented a dramatic 222% increase from the 368 pertussis cases reported in 2003. Pertussis incidence rates for Colorado and the United States from 1990 through 2004 are shown in Figure 4 above.

Colorado's pertussis incidence rate was 25.5/100,000 in 2004, which was the 7th highest rate among the states. There were 25,827 pertussis cases reported in the United States during 2004, for an incidence rate of 8.9/100,000, which was twice the rate reported in 2003. During 2004, the number of cases reported in the United States was the highest reported since 1959.

Colorado's higher reported pertussis incidence rate, compared to the national rate, may be due to truly higher disease incidence and /or the result of surveillance and detection artifacts (e.g. more complete case detection through epidemiologic investigations and testing of contacts, especially among adults; and more widespread use of PCR testing). Grand County had the highest 5-year average annual rate of pertussis (46.2/100,000); this high rate was due to pertussis outbreaks during 2003 and 2004. Pertussis cases and rates by county are displayed in Table 6.

Table 6. Reported Pertussis Cases and Rates by County, Colorado, 2000 – 2004

County	Number of Cases by Year of Report					Average Annual # cases	Average Rate for 5 Years*
	2000	2001	2002	2003	2004		
Adams	68	86	44	24	128	70	18.6
Alamosa	0	0	1	0	6	1.4	9.1
Arapahoe	35	46	74	59	102	63.2	12.3
Archuleta	2	0	0	0	0	0.4	*
Bent	0	0	0	0	1	0.2	*
Boulder	83	61	31	47	175	79.4	28.2
Broomfield**	NA	3**	10	6	23	NA	NA
Chaffee	0	0	0	2	1	0.6	*
Cheyenne	0	0	0	1	1	0.4	*
Clear Creek	0	0	0	4	3	1.4	14.7
Conejos	1	0	1	0	3	1.0	11.9
Costilla	0	0	0	1	2	0.6	*
Crowley	1	0	0	0	0	0.2	*
Delta	0	0	6	1	26	6.6	22.6
Denver	96	49	84	39	78	69.0	12.3
Douglas	9	6	10	27	43	19.0	8.9
Eagle	0	0	0	1	1	0.4	*
El Paso	22	10	6	15	35	17.6	3.3
Elbert	0	0	5	6	1	2.4	10.9
Fremont	0	0	3	1	3	1.4	3.0
Garfield	0	0	0	0	1	0.2	*
Gilpin	0	0	1	0	5	1.2	24.5
Grand	0	0	0	21	10	6.2	46.2
Huerfano	0	0	1	0	0	0.2	*
Jefferson	103	71	122	67	160	104.6	19.7
Kiowa	0	0	0	1	0	0.2	*
Kit Carson	0	0	0	0	1	0.2	*

Table 6. Continues on next page

Table 6. (Continued) Pertussis Cases and Rates by County, Colorado, 2000-2004							
County	Number of Cases by Year of Report					Average Annual # cases	Average Rate for 5 Years*
	2000	2001	2002	2003	2004		
La Plata	6	1	0	3	37	9.4	20.3
Lake	1	0	0	0	0	0.2	*
Larimer	17	25	35	8	140	45.0	17.1
Las Animas	0	2	0	0	0	0.4	*
Logan	0	0	0	0	2	0.4	*
Mesa	31	14	8	3	112	33.6	27.4
Moffat	0	0	0	0	2	0.4	*
Montezuma	0	4	0	0	0	0.8	*
Montrose	0	1	0	1	1	0.6	*
Morgan	0	0	1	0	4	1.0	3.6
Otero	0	0	0	0	19	3.8	19.3
Ouray	0	0	0	0	4	0.8	*
Park	1	0	0	0	0	0.2	*
Phillips	0	0	1	0	0	0.2	*
Pitkin	0	1	0	0	3	0.8	*
Prowers	0	0	0	0	3	0.6	*
Pueblo	2	2	5	2	27	7.6	5.2
Rio Grande	3	5	1	6	2	3.4	27.1
Routt	0	0	2	0	1	0.6	*
Saguache	0	0	4	1	0	1.0	16.1
San Miguel	0	0	0	0	1	0.2	*
Sedgwick	0	0	0	2	0	0.4	*
Summit	0	0	1	1	0	0.4	*
Teller	0	1	0	0	0	0.2	*
Weld	7	0	7	18	18	10.0	4.9
Yuma	0	1	0	0	0	0.2	*
TOTAL	487	389	464	368	1185	578.6	12.8

* Average annual rates were not calculated for counties with < 5 pertussis cases during the five-year period. Caution should be used when interpreting rates based on small number of cases. Rates were calculated using 2002 population figures from the 2004-based population projections from the Demography Section, Colorado Division of Local Government.
** Broomfield became a county 11/15/01.

Children less than one year of age had the highest incidence rate of pertussis during 2004 in Colorado (144.3/100,000) (Table 7) and in the United States 80.8/100,000. In Colorado, the 10-14 year age group had the second highest rate (101.2/100,000), followed by the 15-19 year age group (63.4/100,000). The age distribution and rates for 2004 pertussis cases are displayed in Table 7. There were 82 pertussis outbreaks involving 536 cases reported during 2004. A pertussis outbreak is defined as two or more cases involving two or more households clustered in time and space where transmission is suspected to have occurred (e.g. a school). One case in an

outbreak must be lab confirmed (PCR positive and meets case definition, or culture positive). The 2004 outbreaks ranged in size from 2 to 102 cases. The Mesa County outbreak was the largest with 102 reported cases. During the Mesa County outbreak cases were reported from the entire community, including every school in the county, childcare centers, an assisted living center, and a nursing home. Two of the outbreak cases were connected to 2003 pertussis outbreaks, and 2 outbreak cases were linked to outbreaks in other states.

Table 7. Reported Cases and Rates of Pertussis by Age Group, Colorado, 2004

Age Group (Years)	Cases	%	Rate
<1	99	8.4	144.3
1 – 4	125	10.5	46.7
5 – 9	95	8.0	30.4
10 – 14	326	27.5	101.2
15 – 19	217	18.3	63.4
≥ 20	323	27.3	9.7
TOTAL	1185	100	25.5

The distribution of 2004 reported pertussis cases by symptoms and age group is displayed in Table 8. Pertussis cases less than 5 years of age had the highest proportion of reported post-tussive vomiting and whooping symptoms. Nearly all pertussis case reported paroxysmal cough and almost half (48.9%) reported post-tussive vomiting.

Table 8. Percentage of Reported Pertussis Cases by Symptoms and Age Group, Colorado, 2004

SYMPTOMS	Age Group (years)					
	<1	1 – 4	5 – 9	10 – 19	≥ 20	ALL AGES
Cough	100	100	100	100	100	100
Paroxysmal Cough	94.9	98.4	98.9	97.6	100	98.2+ Unk* (0.3§)
Vomiting After Cough	66.6	63.2	51.6	44.0	45.2	48.9 Unk* (3.0)
Whoop	52.5	48.8	38.9	28.0	36.2	35.4 Unk* (5.4)

* Unk= Unknown.
\+ 17 cases did not have a paroxysmal coughs; 13 were outbreak cases and 4 were < 5months of age and had apnea.
§ Paroxysmal cough was unknown for 4 cases; 2 culture positive cases and 2 PCR positive outbreak cases.

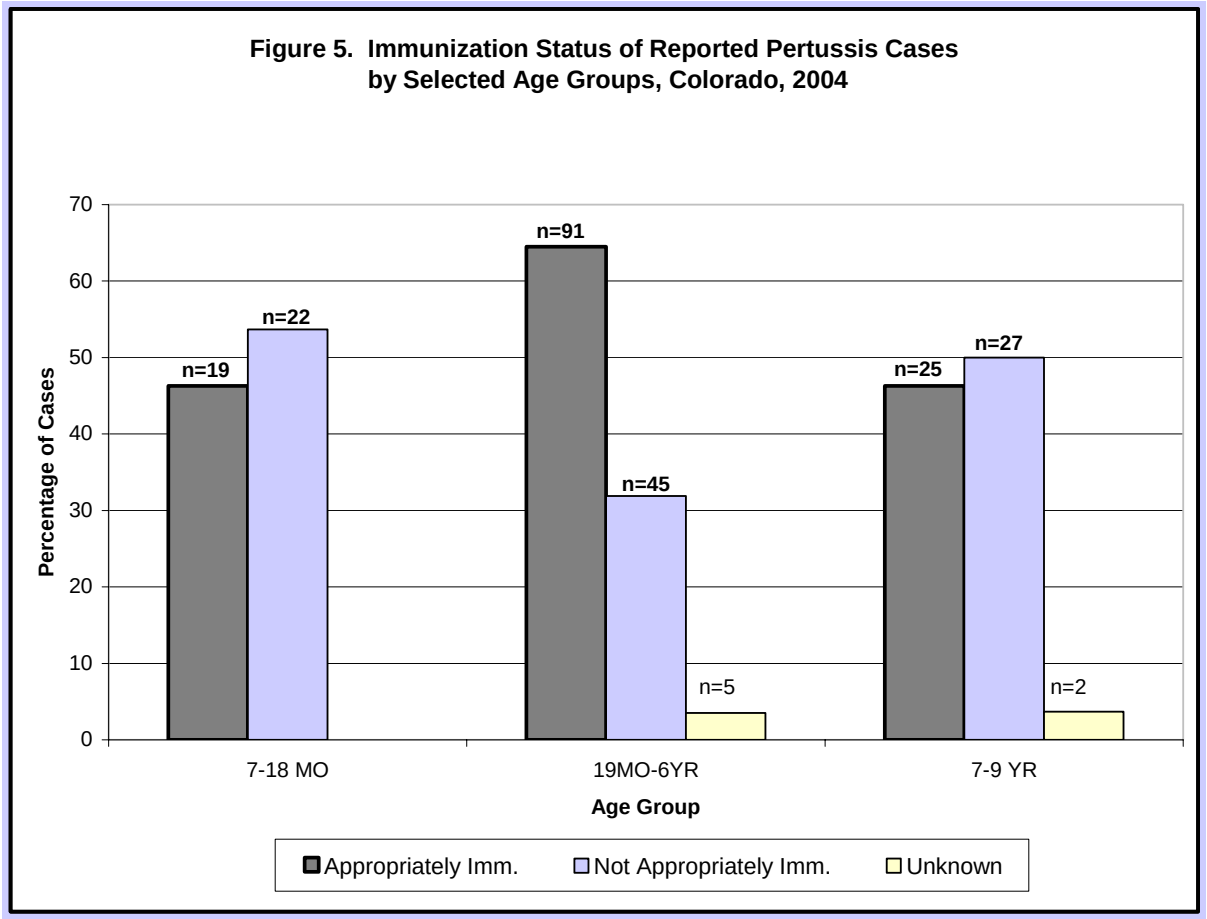
Pertussis cases 7 months through 9 years of age comprised 19.9% (236 cases) of all reported pertussis cases in Colorado during 2004. Of the cases in this age group, 63.6% (150) had received at least three doses of pertussis vaccine (which is considered adequate to provide protective immunity for most children). Of the 1,185 pertussis cases reported in 2004, 83 (7.0%) were < 7 months of age and were not old enough to have routinely received three doses of vaccine. More detailed information regarding vaccination status of pertussis cases for selected age groups is provided in Table 9.

Table 9. Immunization Status of Reported Pertussis Cases by Selected Age Groups, Colorado, 2004

AGE GROUP	NUMBER OF PERTUSSIS VACCINE DOSES			
	Unknown	0 – 2	3 +	Total Cases
	# CASES (%)	# CASES (%)	# CASES (%)	
7 - 18 MONTHS	0 (0.0)	22 (53.7)	19 (46.3)	41
19 MONTHS – 6 YEARS	5 (3.5)	38 (27.0)	98 (69.5)	141
7 - 9 YEARS	2 (3.7)	19 (35.2)	33 (61.1)	54
TOTAL	7 (3.0)	79 (33.5)	150 (63.6)	236

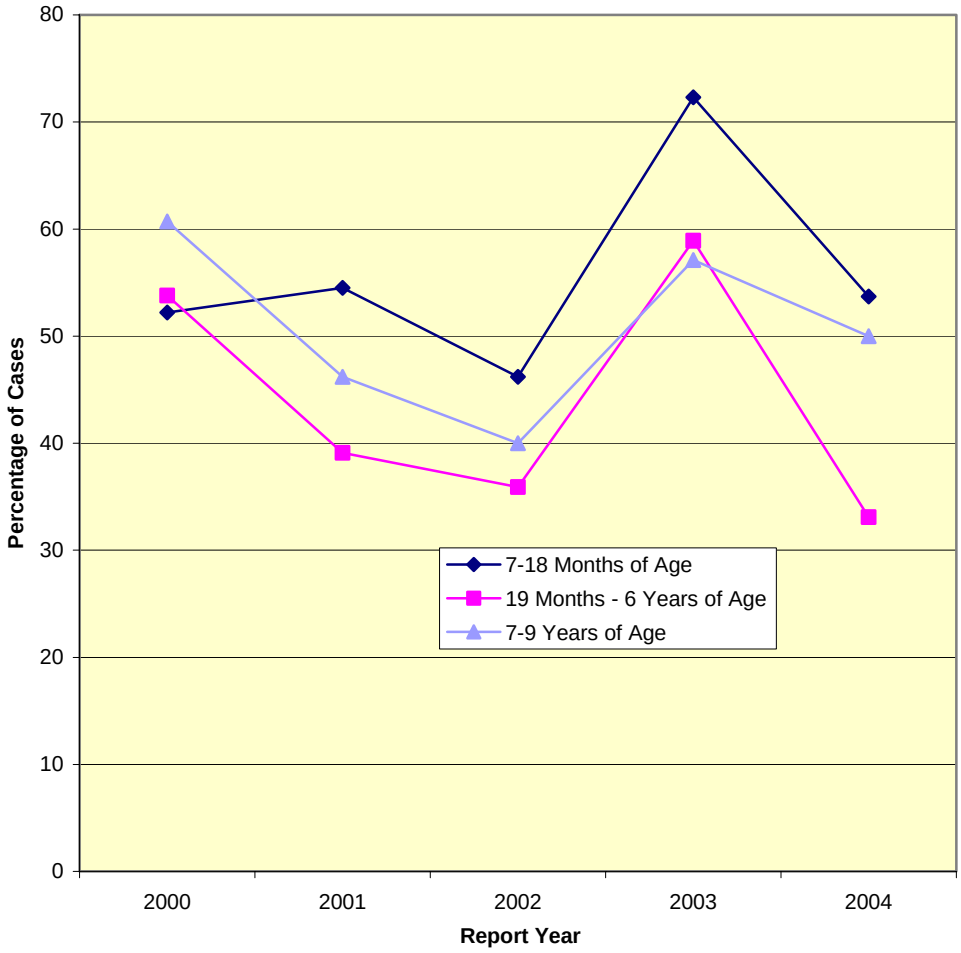
The immunization status of 2004 pertussis cases is shown in Figure 5 for children 7 months to 9 years of age. Appropriately immunized was defined using the Advisory Committee on Immunization Practices (ACIP) recommendations for DTP/DTaP vaccination; three pertussis vaccinations by age 7 months, four pertussis vaccinations by age 19 months and five pertussis vaccinations by age 7 years or four pertussis vaccinations by age 7 years if the fourth dose was administered at age 4 or older. A minimum of three DTP/DTaP doses are needed to provide protection from pertussis, thus children less than 7 months of age were not included in the graph. Protection from pertussis vaccination wanes over time, therefore, children older than 9 years of age were also not included. As seen in the Figure 5, among children 7 months to 9 years of age, 40% of the cases occurred in children who were not appropriately immunized for their age.

Figure 5. Immunization Status of Reported Pertussis Cases by Selected Age Groups, Colorado, 2004



Trends in the proportion of pertussis cases 7 months to 9 years of age who were not age-appropriately immunized are shown in Figure 6. During the past five years (2000 – 2004) the highest percentage of pertussis cases that were not age-appropriately immunized (60%) occurred in 2003. In Colorado, DTaP vaccinations were delayed due to a nationwide DTaP vaccine shortage from March 2001 through February 2003. The shortage resulted in the Colorado Board of Health suspending the school immunization requirement for the 4th and 5th doses of DTaP from April 2001 through September 2004. The same ACIP definition of appropriately immunized was used in Figures 5 and 6.

Figure 6. Percentage of Reported Pertussis Cases Not Appropriately Immunized for Age by Selected Age Groups, Colorado, 2000 - 2004*



* 21 cases with unknown immunization status were not included in the graph (2000-two, 2001-five, 2002-six, 2003-one, & 2004-seven)

There was one pertussis death reported in Colorado during 2004. A 6-week-old infant died from a rare dermatologic condition, pertussis and respiratory failure following 48 days of hospitalization. In the United States, a total of 27 individuals died from pertussis during 2004; 24 (88.8%) of these cases were < 3 months of age.

None of the 2004 Colorado pertussis cases were diagnosed with seizures or encephalopathy. A total of 30 (2.5%) pertussis cases were diagnosed with pneumonia during 2004. Pertussis complications are summarized in Table 10.

Table 10. Reported Pertussis Complications, Colorado, 2000-2004						
COMPLICATIONS	2000	2001	2002	2003	2004	5 YEAR AVERAGE (2000-2004)
DEATH	2	0	0	0	1	0.6
ENCEPHALOPATHY	0	0	0	0	0	0
SEIZURES	1	0	1	3	0	1.0
PNEUMONIA*	24	14	14	6	30	17.6

* Confirmed by X-ray

During 2004, 4.5% (53 cases) of reported pertussis cases were hospitalized (Table 11). Cases less than 6 months of age were most likely (50.6%) to be hospitalized. Hospitalization was infrequent (12/1086=1.1%) among cases greater than 11 months of age, and none of the cases 5-14 years of age were hospitalized. Hospitalized pertussis cases had a median hospital stay of 7 days (range = 1 - 48 days).

Table 11. Reported Hospitalizations Among Pertussis Cases by Age Group, Colorado, 2004			
AGE GROUP	# HOSPITALIZED	# CASES	% HOSPITALIZED
< 6 MONTHS	39	77	50.6
6 – 11 MONTHS	2	22	9.1
1 – 4 YEARS	2	125	1.6
5 – 9 YEARS	0	95	0
10 – 14 YEARS	0	326	0
15 – 19 YEARS	2	217	0.9
≥ 20 YEARS	8	323	2.5
TOTAL	53	1185	4.5

Of the 1,185 reported pertussis cases in 2004, a total of 979 (82.6 %) were classified as confirmed based on the CDC surveillance case definition. Laboratory confirmed pertussis cases are culture positive or PCR (polymerase chain reaction; a DNA amplification methodology) positive and meet the clinical case definition [Clinical case definition is a cough illness lasting at least 14 days with **one** of the following: paroxysms of coughing, inspiratory "whoop", **or** post-tussive vomiting, without other apparent cause (as reported by a health care professional.)]. In addition, cases that are epidemiologically linked to laboratory confirmed cases and meet the clinical case definition are classified as confirmed cases. There were 206 (17.4%) probable pertussis cases reported in 2004. Included in the probable case count were 31 cases that were PCR positive and not reinterviewed to determine whether they met the case definition due to the large increase in pertussis reports. These 31 cases were recorded under a new classification, Probable: Widespread Outbreak/PCR Positive/ Unknown Cough Duration. Otherwise, probable cases met the clinical case definition for pertussis. Confirmed and probable pertussis cases are further classified in Table 12.

Table 12. Classification of Reported Pertussis Cases, Colorado, 2004

CASE CLASSIFICATION	NUMBER	%
Confirmed: Culture &/or PCR Positive	**720**	**60.8**
Confirmed: Epidemiologically–linked to a Culture Positive Case &/or PCR Positive Case	**259**	**21.9**
Probable: DFA* Positive Only	**7**	**0.6**
Probable: Physician Diagnosed Case	**93**	**7.8**
Probable: Serology Positive Only	**42**	**3.5**
Probable: Outbreak Situation**	**33**	**2.8**
Probable: Widespread Outbreak/PCR Positive/ Unknown Cough Duration	**31**	**2.6**
TOTAL	**1185**	**100**

* DFA = Direct fluorescent antibody.

**In outbreak settings, including household exposures, a case may be defined as a cough illness lasting ≥ 2 weeks.

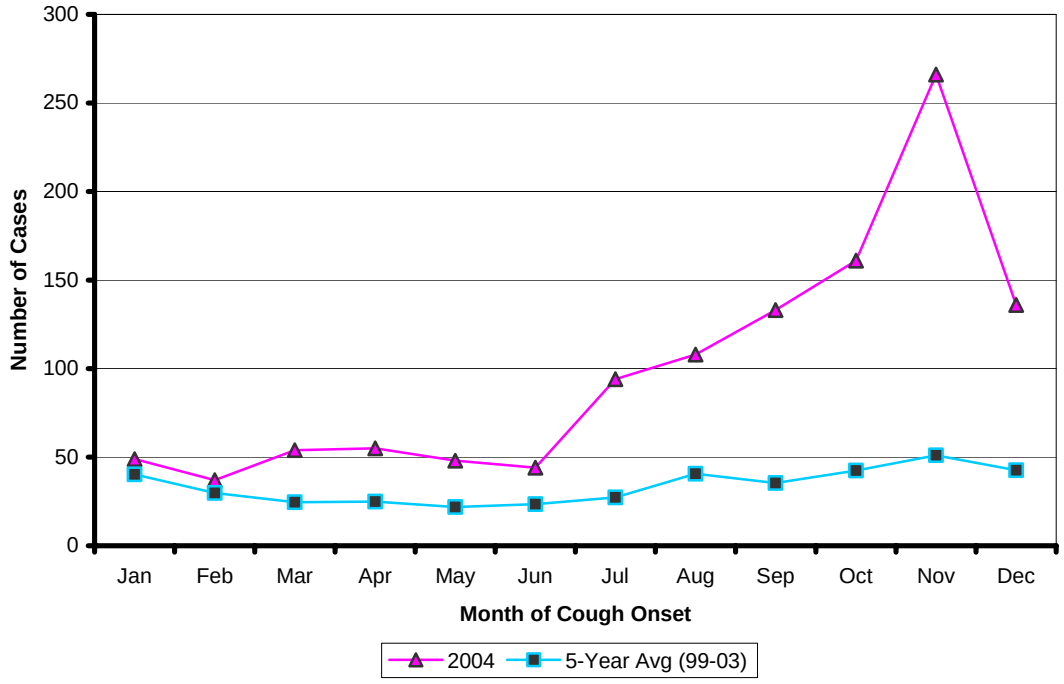
Nasopharyngeal or serum specimens were obtained from 905 (76.4%) of reported pertussis cases during 2004. A total of 280 (23.6%) pertussis cases were not tested in 2004. There were 44 individuals (44/905=4.9%) with negative test results and 31 persons (31/905=3.4%) with indeterminate results counted as pertussis cases because they met the clinical case definition and were physician diagnosed or epidemiologically related to another confirmed case or part of an

outbreak. Serologic testing for pertussis is not recommended for diagnosis, as these tests are not standardized and results are difficult to interpret.

Pertussis PCR is the most widely available type of testing in Colorado. There were 832 positive pertussis lab results reported in 2004; 753 were PCR positive, 60 were serology positive, 13 DFA positive, and 6 culture positive. Some cases were tested with more than 1 type of pertussis test.

Pertussis cases are reported throughout the year in Colorado (Figure 7), although, incidence is typically greatest during August through January, based on the 5-year average. In 2004, there were substantially more cases reported during the months of March through December than the 5-year average for these months.

Figure 7. Colorado Pertussis Cases by Month of Cough Onset, 2004 vs. 5-Year Average (1999-2003)



Haemophilus influenzae

In 2004, there were 44 cases of invasive *Haemophilus influenzae* (H. flu) disease reported in Colorado, which represents a 12.8% increase over the 39 cases reported in 2003. During 2004, only 5 H. flu cases less than 5 years of age were reported in Colorado (serotypes: a[1], b[1], e[1], and nontypeable[2]). The serotype b (Hib) case was an unimmunized 2-year-old child.

In the United States, there were 2,085 H. flu cases reported during 2004. Nationally, among children less than 5 years of age, there were 19 cases of Hib, 135 cases of non-serotype b, and 177 cases of unknown serotypes. The 2004 incidence rate for H. flu in the United States was 0.7/100,000, compared to Colorado's incidence rate of 0.9/100,000. The slightly higher incidence rate in Colorado may be due to active surveillance conducted by the Emerging Infections Program (EIP) in the Denver metropolitan area.

Of the 44 H. flu cases reported during 2004, 29 (65.9%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 15 (34.1%) were from outside the Denver metro area. In Colorado, adults 80 years of age and older had the highest rate of H. flu (8.1/100,00), followed by children < 1 year of age (5.8/100,000). A total of 4 (9.1%) H. flu infections were fatal during 2004. Table 13 displays *Haemophilus influenzae* case rates and case fatality by age group.

Table 13. Reported Invasive *Haemophilus influenzae* Cases, Rates and Case Fatality by Age Group, Colorado, 2004

AGE GROUP	CASES	RATE*	DEATHS	
			#	% OF CASES
< 1	4	5.8	0	0
1 – 4	1	0.4	0	0
5 – 9	1	0.3	0	0
10 – 14	0	0	0	0
15 – 19	1	0.3	0	0
20 – 39	4	0.3	1	25.0
40 – 59	12	0.9	1	8.3
60 – 79	11	2.0	2	18.2
80+	10	8.1	0	0
TOTAL	44	0.9	4	9.1

* Per 100,000 population

Additional invasive H. flu disease statistics are available on the Emerging Infections Program web page at www.cdphe.state.co.us/dc/eip/index.html.

Meningococcal Disease

A total of 15 cases of meningococcal disease were reported in Colorado during 2004, which represents a 44.4% decrease from the 27 cases reported in 2003. There were 1,361 cases of meningococcal disease reported in the United States during 2004, which is a 22% decrease from the number of cases reported in 2003 (1,756 cases). During 2004 the meningococcal disease incidence rate for Colorado was 0.3/100,000, whereas the United States incidence rate was 0.5/100,000. Of the 15 cases reported in Colorado, 9 (60.0%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 6 (40.0%) were from outside the Denver metro area. Children less than 1 year of age had the highest rate of meningococcal disease (8.7/100,000) in Colorado. A total of 2 (13.3%) meningococcal disease infections were fatal in 2004. Table 14 displays meningococcal disease rates and case fatality by age group.

Table 14. Reported Meningococcal Disease Cases, Rates and Case Fatality by Age Group, Colorado, 2004

AGE GROUP	CASES	RATE*	DEATHS	
			#	% OF CASES
< 1	6	8.7	1	16.7
1 – 4	2	0.7	0	0
5 – 9	0	0	0	0
10 – 14	0	0	0	0
15 – 19	2	0.6	0	0
20 – 39	3	0.2	0	0
40 – 59	0	0	0	0
60 – 79	1	0.2	1	100
80 +	1	0.8	0	0
TOTAL	15	0.3	2	13.3

* Per 100,000 population

The majority of Colorado meningococcal disease cases reported in 2004 were serogroup B (46.7%). The meningococcal vaccine is effective against serogroups A, C, Y, and W-135, but not serogroup B. Cases are displayed by serogroup in Table 15.

Table 15. Reported Cases of Meningococcal Disease by Serogroup, Colorado, 2004		
Serogroup	**Cases**	**% of cases**
B	**7**	**46.7**
C	**0**	**0**
Y	**3**	**20.0**
W-135	**1**	**6.7**
Not Groupable	**1**	**6.7**
Unknown	**3**	**20.0**
Total	**15**	**100**

Additional invasive meningococcal disease statistics are available on the Emerging Infections Program web page at www.cdphe.state.co.us/dc/eip/index.html.

Pneumococcal Disease

In Colorado, 332 cases of invasive pneumococcal disease (IPD) were reported during 2004 for an incidence rate of 7.1/100,000. Invasive pneumococcal disease has been reportable in the 5-county Denver metropolitan area since July 2000 and statewide since November 30, 2001. Of the 332 IPD cases reported, 231 (69.6%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 101 (30.4%) were from outside the Denver metro area. In Colorado, the age groups having the highest rates of pneumococcal disease during 2004 were adults ≥ 80 years of age (29.1/100,000) and infants less than 1 year of age (20.4/100,000). During 2004, 11% (37 cases) of reported invasive pneumococcal infections were fatal. Table 16 displays IPD incidence rates and fatality by age group.

Table 16. Reported Invasive Pneumococcal Disease Cases, Rates and Case Fatality by Age Group, Colorado, 2004				
AGE GROUP	**CASES**	**RATE***	**DEATHS**	
			#	**% OF CASES**
< 1	**14**	**20.4**	**0**	**0**
1 – 4	**23**	**8.6**	**0**	**0**
5 – 9	**9**	**2.9**	**1**	**11.1**
10 – 14	**7**	**2.2**	**0**	**0**
15 – 19	**1**	**0.3**	**0**	**0**
20 – 39	**32**	**2.4**	**2**	**6.25**
40 – 59	**127**	**9.6**	**13**	**10.2**
60 – 79	**83**	**15.5**	**17**	**20.5**
80 +	**36**	**29.1**	**7**	**19.4**
TOTAL	**332**	**7.1**	**37**	**11.1**

*Per 100,000 population

There was a 35% decrease in reported IPD cases among children less than five years of age in the Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) from 2003 (40 cases) to 2004 (26 cases). Pneumococcal isolates from 24 (92.3%) of the 2004 cases less than 5 years of age were serotyped at CDC. Of these 24 isolates, 19.2% (5) were serotypes included in the pneumococcal conjugate vaccine, whereas, during 2003, 37.5% (12/32) of isolates serotyped from children less than five years of age were included in the pneumococcal conjugate vaccine.

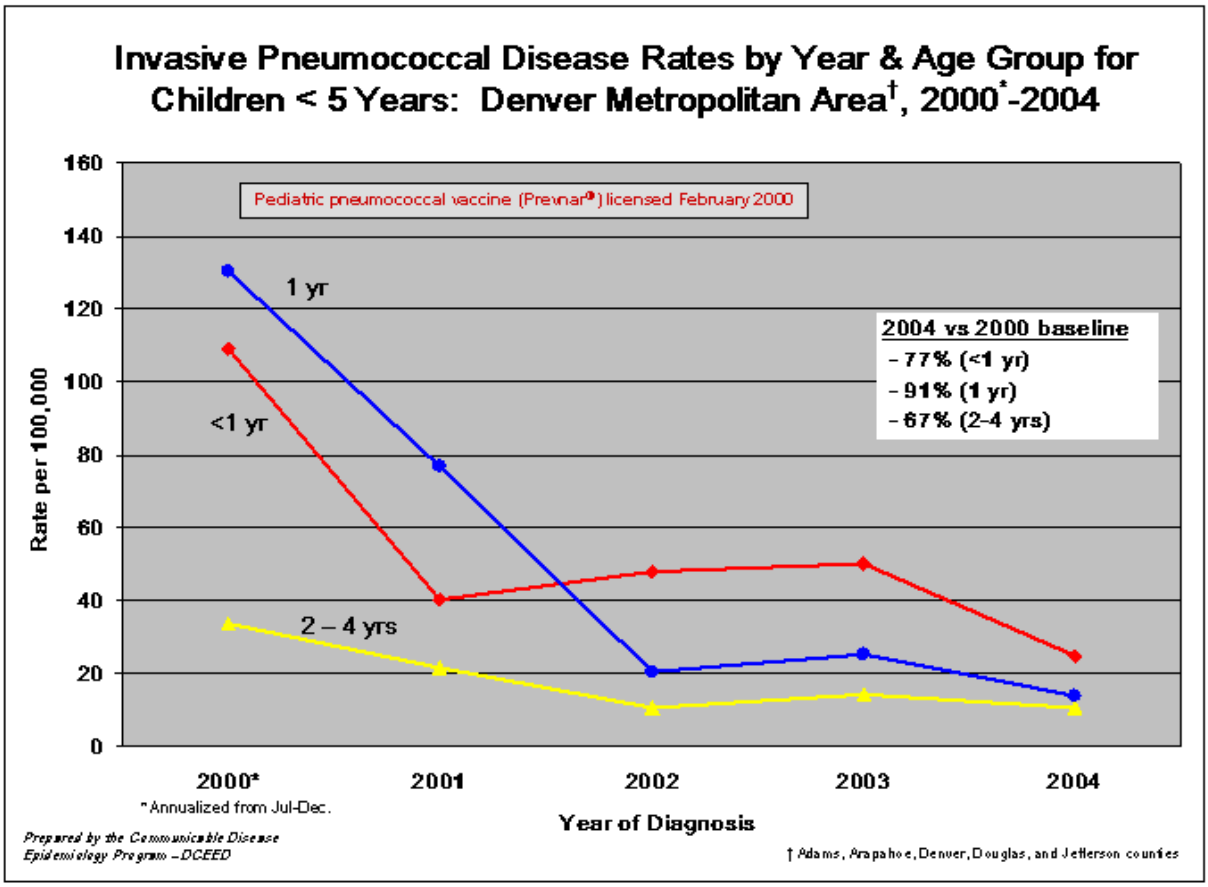
The most frequently reported serotype (29%) from Colorado pneumococcal cases less than five years of age was serotype 19A, which is not included in the vaccine. The increase is serotype 19A has been documented in other states participating in the CDC-funded Emerging Infections Program during 2003-2004. Of the 5 cases with IPD caused by vaccine serotypes; 3 (60%) were not unvaccinated prior to illness onset and 2 (40%) had "unknown vaccine" histories. Cases are shown by serotype and vaccination history in Table 17.

Table 17. Reported Invasive Pneumococcal Disease Cases Less Than 5 Years of Age by Vaccine Serotype, Denver Metro Area¶, Colorado, 2004

Serotype	Number of Cases	Vaccinated Prior to Onset (1+ doses)	Not Vaccinated Prior to Onset	Unknown Vaccine History
4*	0	0	0	0
6B*	0	0	0	0
9V*	0	0	0	0
14*	1	0	1	0
18C*	2	0	1	1
19F*	2	0	1	1
23F*	0	0	0	0
SUBTOTAL*	5	0	3	2
Not in Vaccine	19	13	3	3
Not typed	2	0	0	2
TOTAL	26	13	6	7

¶ Adams, Arapahoe, Denver, Douglas, and Jefferson counties.
* Serotype is included in the Pneumococcal Conjugate Vaccine.

Overall, vaccination status was unknown for 27% of the 2004 Denver area IPD cases less than five years of age. The first pneumococcal conjugate vaccine was licensed in the United States in 2000. The dramatic decline in IPD rates in Denver metro area children < 5 years of age from 2000 to 2004 is shown in Figure 8.



Streptococcus pneumoniae can cause meningitis, bacteremia (blood-stream infection) and pneumonia. Additional invasive pneumococcal disease statistics are available on the web at www.cdphe.state.co.us/dc/eip/index.html.

Varicella

Varicella became a reportable disease in Colorado as of January 30, 2004. Shingles is not a reportable disease. From January 30 – December 31, 2004, a total of 2,040 varicella cases were reported from 50 counties. The incidence rate of varicella cases in Colorado was 43.9/100,000 in 2004. More than half (54.3%) of the reported varicella cases were 5 to 9 years of age and this age group had the highest rate 355.1/100,000. During the 2003 - 2004 school year varicella vaccine was required for all children 18 months or older attending childcare and students in kindergarten through 3rd grade. Each school year another grade is added until 2013 when all children will be required to have varicella vaccine to attend school. Varicella cases are displayed by age and rates in Table 18.

Table 18. Reported Varicella Cases and Rates by Age Group, Colorado January 30 – December 31, 2004

Age Group (Years)	Cases	%	Rate
<1	43	2.1	62.7
1 – 4	250	12.3	93.5
5 – 9	1108	54.3	355.1
10 – 14	535	26.2	166.1
15 – 19	52	2.5	15.2
20 – 39	43	2.1	3.2
≥40	9	0.4	0.5
TOTAL	2040	100	43.9

During 2004, 1.0% (20 cases) of reported varicella cases were hospitalized. Of the 20 cases hospitalized, 7 cases were <10 years of age, 6 were 10-18 years of age, and the remaining 7 cases were >18 years of age. There was one varicella death reported in Colorado during 2004, a young adult male with a significant underlying disease. The severity of varicella disease and vaccine status is summarized in Table 19. Vaccinated cases were more likely to have mild disease (<50 lesions), whereas, unimmunized cases were more likely to have moderate or severe disease (≥ 50 lesions). Of the 1,124 cases that received varicella vaccine only 11 cases had documentation of 2 doses of vaccine.

Table 19. Reported Varicella Cases by Severity of Disease and Vaccine Status January 30, 2004 – December 31, 2004

Severity of Disease	≥ 1 Dose of Vaccine		Unimmunized		Unknown Immunization Status		Total Cases	
	# Cases	(%)	# Cases	(%)	# Cases	(%)	#Cases	(%)
< 50 Lesions	720	(64.1)	241	(34.7)	51	(23.1)	1012	(49.6)
50 – 500 Lesions	256	(22.8)	350	(50.4)	43	(19.5)	649	(31.8)
> 500 Lesions	6	(0.5)	24	(3.5)	1	(0.5)	31	(1.5)
Unknown	142	(12.6)	80	(11.5)	126	(57.0)	348	(17.1)
TOTAL	1124	(100)	695	(100)	221	(100)	2040	(100)