

Vaccine Preventable Diseases in Colorado

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

Surveillance Report: 2003



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Introduction

This report highlights 2003 surveillance data for vaccine preventable diseases in Colorado. Colorado rates in this report were calculated as cases per 100,000 population using 2003-based population projections from the Demography Section, Colorado Division of Local Government. National rates were calculated using United States Census Bureau data as of July 1, 2003. Vaccine preventable diseases reported in Colorado during 1999-2003 are summarized below in Table 1.

Table 1. Reported Cases of Vaccine Preventable Diseases, Colorado*, 1999 – 2003

| Report Year | Measles | Mumps | Rubella | Congenital Rubella | Tetanus | Pertussis | Invasive Meningococcal Disease | Invasive Pneumococcal Disease** | Invasive H. flu | Hepatitis A | Acute Hepatitis B |
|-------------|---------|-------|---------|--------------------|---------|-----------|--------------------------------|---------------------------------|-----------------|-------------|-------------------|
| 1999 | 0 | 5 | 1 | 1 | 0 | 312 | 36 | -- | 14 | 219 | 95 |
| 2000 | 2 | 1 | 1 | 0 | 0 | 487 | 33 | 180** | 33 | 223 | 103 |
| 2001 | 0 | 3 | 0 | 0 | 1 | 389 | 33 | 317 | 38 | 88 | 100 |
| 2002 | 0 | 2 | 0 | 0 | 0 | 464 | 23 | 391 | 36 | 75 | 81 |
| 2003 | 0 | 1 | 1 | 0 | 0 | 368 | 27 | 366 | 39 | 59 | 80 |

* No diphtheria or polio cases were reported during 1999 – 2003.

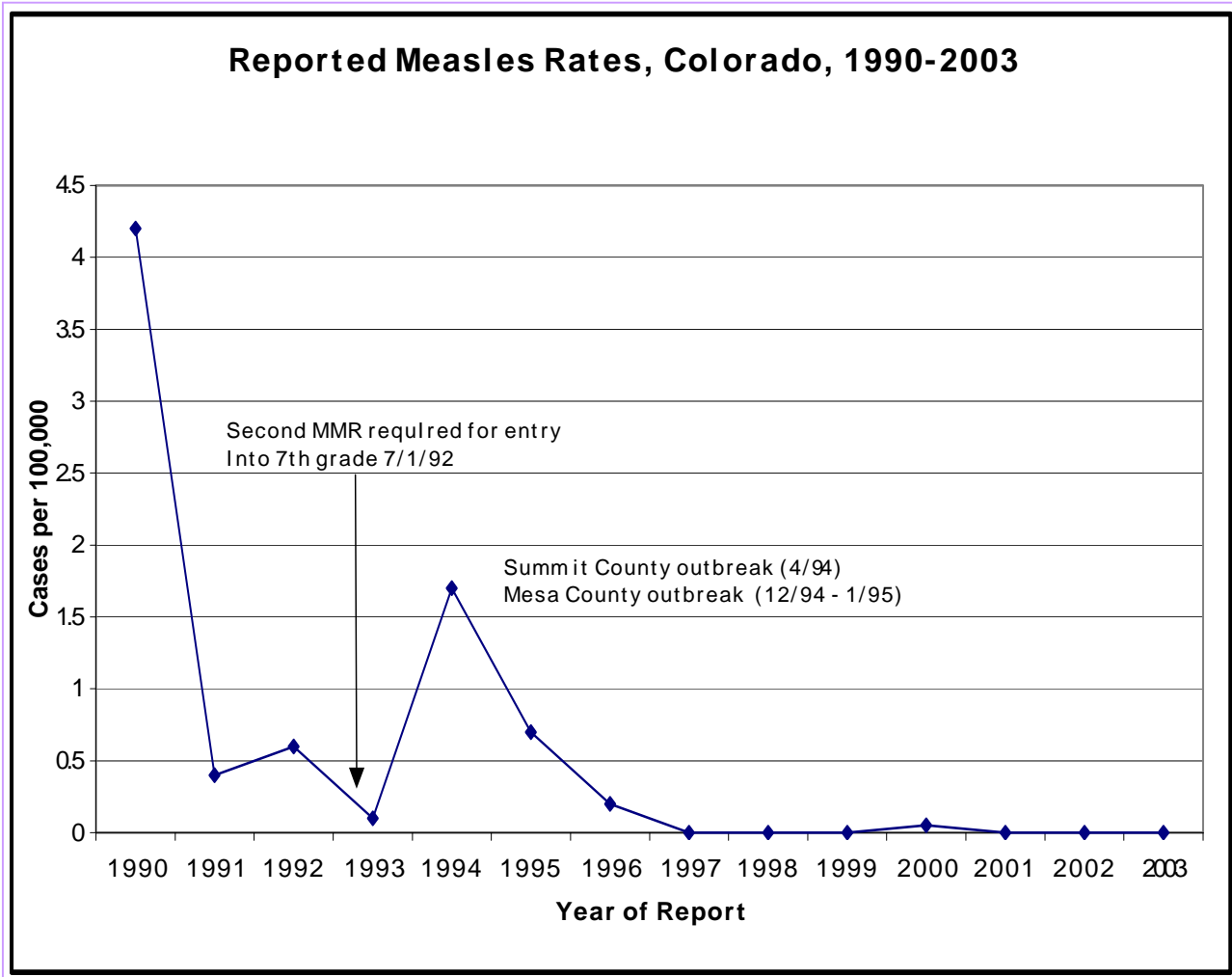
**As of November 30, 2001 invasive pneumococcal disease became reportable statewide. Prior to November 30, 2001, pneumococcal meningitis was reportable statewide, and all invasive pneumococcal disease was reportable from the 5-county Denver metro area beginning 7/01/00; therefore, 2000 data are derived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

Measles

During 2003, no measles cases were reported in Colorado. The last measles cases in Colorado were reported in 2000 from Boulder County. Prior to 2000, the last reported cases of measles occurred in 1996 when 7 cases were reported.

The measles incidence rate in Colorado has decreased from 1.7/100,000 in 1994 to 0.0/100,000 in 2003. Only 56 measles cases were reported in the United States during 2003 for an incidence rate of 0.02/100,000. The Colorado school immunization requirement for two measles vaccinations was implemented July 1992. Figure 1 shows Colorado measles rates from 1990 – 2003.

Figure 1:



Rubella

In 2003, one rubella case was reported in Colorado. The case, a 21-year-old female, had a positive IgM test as part of a preconception screening. An additional specimen obtained 16 days after the original specimen was equivocal at the Centers for Disease Control and Prevention (CDC) by rubella capture IgM testing. The case had symptoms of rubella in December 2002 with out-of-state travel during her source period. She was unimmunized for rubella according to her school immunization record and attempts to verify the immunization record with her provider were unsuccessful. In consultation with CDC, it was decided to count this as a confirmed case of rubella. No additional cases of rubella were reported in Colorado.

The ten-year annual average (1993-2002) for rubella in Colorado was 0.8 cases. There were 7 rubella cases reported in the United States during 2003, for an incidence rate of 0.002/100,000.

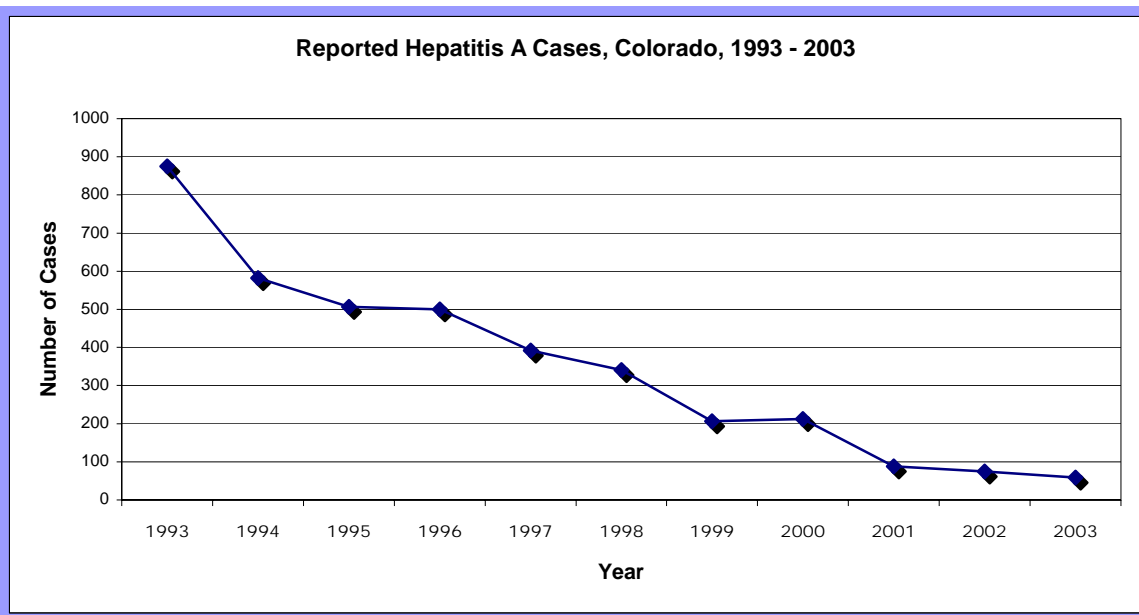
Congenital Rubella

No cases of congenital rubella syndrome were reported in Colorado during 2003. In the past 10 years (1993 – 2002), only one congenital rubella syndrome case was reported (1999) in Colorado. Only one congenital rubella case was reported in the United States during 2003.

Hepatitis A

A total of 59 hepatitis A cases were reported in Colorado during 2003, which represents a 21.3 % decrease from the 75 cases reported in 2002. Hepatitis A has decreased steadily since 1993 in Colorado with an incidence rate of 1.3/100,000 in 2003. The United States 2003 hepatitis A incidence rate was 2.6/100,000, based on 7,653 cases reported. Figure 2 displays reported cases of hepatitis A in Colorado since 1993.

Figure 2:



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 2003 | | | | | | |
|---|--------------|-------------|---------------|-------------|--------------|-------------|
| Age Group (years) | Male | | Female | | Total | |
| | Cases | Rate | Cases | Rate | Cases | Rate |
| 0-1 | 0 | 0 | 1 | 1.5 | 1 | 0.7 |
| 2-4 | 0 | 0 | 2 | 2.1 | 2 | 1.0 |
| 5-9 | 6 | 3.8 | 2 | 1.3 | 8 | 2.6 |
| 10-14 | 1 | 0.6 | 4 | 2.5 | 5 | 1.5 |
| 15-19 | 2 | 1.1 | 1 | 0.6 | 3 | 0.9 |
| 20-39 | 11 | 1.6 | 11 | 1.7 | 22 | 1.6 |
| 40+ | 11 | 1.2 | 7 | 0.7 | 18 | 0.9 |
| Total | 31 | 1.3 | 28 | 1.2 | 59 | 1.3 |

**Table 3. Reported Hepatitis A Cases and Rates by County, Colorado
1999 – 2003**

| County | Number of Cases by Year of Report | | | | | Average Annual # of cases | Average Rate for 5 Years* |
|--------------|-----------------------------------|------------|-----------|-----------|-----------|---------------------------|---------------------------|
| | 1999 | 2000 | 2001 | 2002 | 2003 | | |
| Adams | 13 | 15 | 12 | 12 | 5 | 11.4 | 3.2 |
| Alamosa | 2 | 0 | 0 | 0 | 1 | 0.6 | 3.9 |
| Arapahoe | 24 | 21 | 7 | 7 | 9 | 13.6 | 2.7 |
| Archuleta | 0 | 0 | 1 | 0 | 0 | 0.2 | * |
| Baca | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Boulder | 14 | 15 | 3 | 3 | 5 | 8.0 | 2.9 |
| Chaffee | 5 | 0 | 0 | 0 | 0 | 1.0 | 6.1 |
| Cheyenne | 0 | 1 | 0 | 0 | 0 | 0.2 | * |
| Crowley | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Custer | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Delta | 1 | 0 | 0 | 1 | 0 | 0.4 | * |
| Denver | 56 | 69 | 23 | 14 | 7 | 33.8 | 6.0 |
| Douglas | 3 | 4 | 1 | 2 | 3 | 2.6 | 1.3 |
| Eagle | 6 | 3 | 8 | 2 | 2 | 4.2 | 9.4 |
| El Paso | 3 | 17 | 1 | 3 | 4 | 5.6 | 1.0 |
| Fremont | 2 | 0 | 0 | 2 | 0 | 0.8 | 1.7 |
| Garfield | 1 | 1 | 1 | 0 | 8 | 2.2 | 4.8 |
| Gilpin | 0 | 1 | 0 | 1 | 0 | 0.4 | * |
| Grand | 0 | 4 | 0 | 0 | 1 | 1.0 | 7.5 |
| Gunnison | 2 | 6 | 0 | 0 | 2 | 2.0 | 14.3 |
| Jefferson | 17 | 11 | 4 | 11 | 2 | 9.0 | 1.7 |
| La Plata | 0 | 9 | 4 | 0 | 0 | 2.6 | 5.7 |
| Larimer | 6 | 8 | 7 | 3 | 2 | 5.2 | 2.0 |
| Logan | 1 | 1 | 1 | 0 | 0 | 0.6 | 2.7 |
| Mesa | 12 | 4 | 1 | 2 | 0 | 3.8 | 3.2 |
| Moffat | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Montezuma | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Montrose | 1 | 1 | 0 | 0 | 1 | 0.6 | 1.7 |
| Otero | 1 | 1 | 0 | 0 | 1 | 0.6 | 3.0 |
| Park | 2 | 0 | 0 | 0 | 0 | 0.4 | * |
| Phillips | 0 | 1 | 0 | 0 | 0 | 0.2 | * |
| Pitkin | 0 | 1 | 1 | 0 | 0 | 0.4 | * |
| Prowers | 3 | 1 | 0 | 0 | 0 | 0.8 | 5.6 |
| Pueblo | 9 | 2 | 3 | 2 | 0 | 3.2 | 2.2 |
| Routt | 0 | 0 | 0 | 2 | 1 | 0.6 | 2.9 |
| Saguache | 0 | 3 | 0 | 0 | 0 | 0.6 | 9.8 |
| San Miguel | 0 | 0 | 0 | 0 | 1 | 0.2 | * |
| Sedgwick | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Summit | 10 | 1 | 0 | 0 | 0 | 2.2 | 8.3 |
| Teller | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Weld | 6 | 11 | 10 | 7 | 4 | 7.6 | 3.9 |
| TOTAL | 206 | 212 | 88 | 75 | 59 | 128.0 | 2.9 |

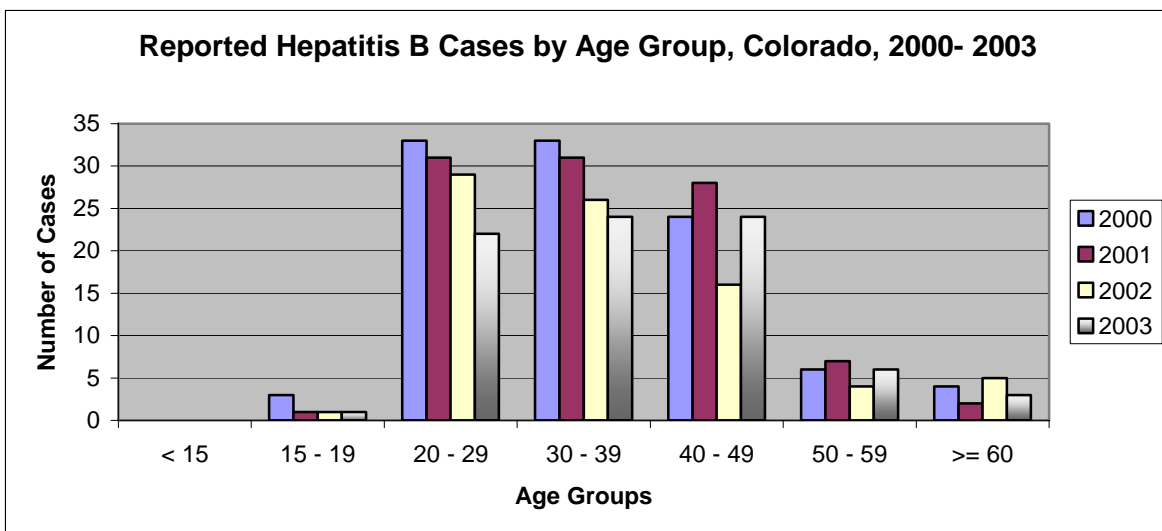
*Average annual rates were not calculated for counties with <3 hepatitis A cases during the five-year period. Caution should be used when interpreting rates based on small numbers of cases. Rates were calculated using 2001 population figures from the 2003-based population projections, from the Demography Section, Colorado Division of Local Government.

Hepatitis B

During 2003, there were 80 acute hepatitis B cases reported in Colorado, which is similar to the number of cases reported in 2002 (81 cases). The incidence rate of acute hepatitis B cases in Colorado was 1.7/100,000 in 2003, compared to the United States incidence rate of 2.6/100,000 (7,526 cases). In Colorado, 88.0% of 2003 hepatitis B cases were 20-49 years of age; of these, 84.3% were male. The male to female rate ratio was 4.8:1.0. 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, 2003 | | | | | | |
|--|-----------|------------|-----------|------------|-----------|------------|
| Age Group (years) | Male | | Female | | Total | |
| | Cases | Rate | Cases | Rate | Cases | Rate |
| < 15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 15-19 | 0 | 0 | 1 | 0.6 | 1 | 0.3 |
| 20-29 | 17 | 5.0 | 5 | 1.6 | 22 | 3.4 |
| 30-39 | 21 | 5.7 | 3 | 0.9 | 24 | 3.4 |
| 40-49 | 21 | 5.6 | 3 | 0.8 | 24 | 3.2 |
| 50-59 | 4 | 1.4 | 2 | 0.7 | 6 | 1.1 |
| ≥ 60 | 3 | 1.1 | 0 | 0 | 3 | 0.5 |
| Total | 66 | 2.9 | 14 | 0.6 | 80 | 1.7 |

Figure 3:



**Table 5. Reported Acute Hepatitis B Cases and Rates by County, Colorado
1999 – 2003**

| County | Number of Cases by Year of Report | | | | | Average Annual # of cases | Average Rate for 5 Years* |
|--------------|-----------------------------------|------------|------------|-----------|-----------|---------------------------|---------------------------|
| | 1999 | 2000 | 2001 | 2002 | 2003 | | |
| Adams | 10 | 8 | 12 | 4 | 6 | 8.0 | 2.2 |
| Alamosa | 0 | 0 | 1 | 0 | 0 | 0.2 | * |
| Arapahoe | 20 | 11 | 15 | 9 | 13 | 13.6 | 2.9 |
| Archuleta | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Boulder | 3 | 5 | 0 | 4 | 1 | 2.6 | 0.9 |
| Broomfield** | NA | NA | 0 | 1 | 0 | 0.2 | * |
| Crowley | 0 | 2 | 1 | 0 | 0 | 0.6 | 10.9 |
| Denver | 33 | 34 | 34 | 33 | 29 | 32.6 | 5.8 |
| Douglas | 0 | 1 | 3 | 3 | 1 | 1.6 | 0.8 |
| Eagle | 1 | 0 | 1 | 0 | 1 | 0.6 | 1.3 |
| El Paso | 5 | 8 | 8 | 7 | 12 | 8.0 | 1.5 |
| Elbert | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Fremont | 0 | 3 | 1 | 1 | 0 | 1.0 | 2.1 |
| Gunnison | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Huerfano | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Jefferson | 7 | 9 | 10 | 6 | 4 | 7.2 | 1.4 |
| Larimer | 2 | 7 | 2 | 2 | 3 | 3.2 | 1.2 |
| Las Animas | 0 | 0 | 0 | 0 | 1 | 0.2 | * |
| Logan | 0 | 0 | 1 | 1 | 0 | 0.4 | * |
| Mesa | 0 | 0 | 1 | 3 | 0 | 0.8 | 0.7 |
| Mineral | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Montezuma | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Montrose | 0 | 1 | 0 | 0 | 0 | 0.2 | * |
| Morgan | 1 | 0 | 0 | 0 | 1 | 0.2 | * |
| Pitkin | 0 | 0 | 1 | 1 | 0 | 0.4 | * |
| Pueblo | 3 | 3 | 4 | 2 | 4 | 3.2 | 2.2 |
| Rio Grande | 1 | 0 | 0 | 0 | 2 | 0.6 | 4.8 |
| Routt | 0 | 0 | 1 | 0 | 0 | 0.2 | * |
| Teller | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Unknown | 1 | 1 | 2 | 0 | 0 | 0.8 | * |
| Weld | 3 | 10 | 2 | 2 | 2 | 3.8 | 2.0 |
| TOTAL | 95 | 103 | 100 | 81 | 80 | 91.8 | 2.1 |

* Average annual rates were not calculated for counties with <3 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 2001 population figures from the 2003-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 during 2003. The last case of diphtheria reported in Colorado was in 1985. Only one diphtheria case was reported in the United States during 2003.

Tetanus

No cases of tetanus were reported in Colorado during 2003. The last tetanus case was reported in 2001. In Colorado, the ten-year annual average (1994-2003) for tetanus was less than one case (0.7) per year. The tetanus incidence rate for the United States was 0.007/100,000 during 2003 (20 cases).

Mumps

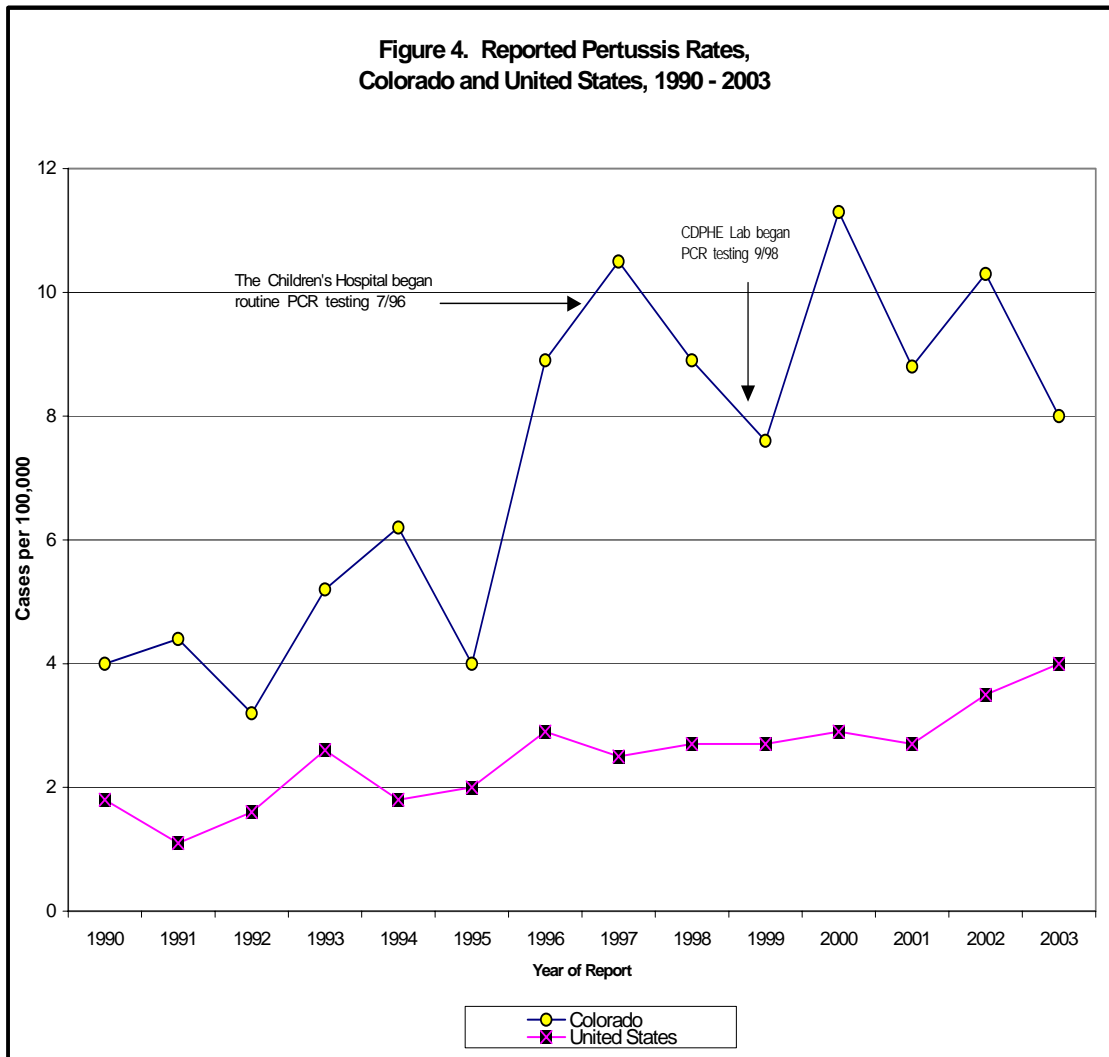
During 2003, only one laboratory-confirmed mumps case was reported in Colorado. The case, a 30-year-old female, developed mumps after returning from a visit to Southeast Asia. She had a positive mumps IgM antibody test at CDC, and her immunization status was unknown. The case worked in a factory with approximately 100 co-workers while infectious. The local health department administered 78 MMR vaccine doses to employees determined to be susceptible. No further mumps cases were reported.

The five-year annual average (1998-2002) for reported mumps cases in Colorado is 3.6 cases. The Colorado mumps incidence rate was 0.02/100,000 during 2003. Colorado's mumps incidence rate was less than the United States' incidence rate of 0.08/100,000 (231 cases).

Polio

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

Pertussis



During 2003, there were 368 pertussis cases reported in Colorado. This represents a 20.7% decrease from the 464 pertussis cases reported in 2002. Pertussis incidence rates for Colorado and the United States from 1990 through 2003 are shown in Figure 4 above.

Colorado's pertussis incidence rate was 8.0/100,000 in 2003, which was the 10th highest rate among the states. There were 11,647 pertussis cases reported in the United States during 2003, for an incidence rate of 4.0/100,000. Colorado's higher reported pertussis incidence rate, compared to the national rate, may be due to truly higher disease incidence in Colorado 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 (32.1/100,000); this high rate was due to a pertussis outbreak during 2003. There was only 1 pertussis case reported in the previous 4 years (1999-2002) in Grand County. Pertussis cases and rates by county are displayed in Table 6.

**Table 6. Reported Pertussis Cases and Rates by County, Colorado,
1999 – 2003**

| County | Number of Cases by Year of Report | | | | | Average Annual # cases | Average Rate for 5 Years* |
|--------------|-----------------------------------|------|------|------|------|------------------------|---------------------------|
| | 1999 | 2000 | 2001 | 2002 | 2003 | | |
| Adams | 25 | 68 | 86 | 44 | 24 | 49.4 | 13.7 |
| Alamosa | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Arapahoe | 30 | 35 | 46 | 74 | 59 | 48.8 | 9.7 |
| Archuleta | 0 | 2 | 0 | 0 | 0 | 0.4 | * |
| Boulder | 106 | 83 | 61 | 31 | 47 | 65.6 | 23.4 |
| Broomfield** | NA | NA | 3** | 10 | 6 | NA | NA |
| Chaffee | 0 | 0 | 0 | 0 | 2 | 0.4 | * |
| Cheyenne | 0 | 0 | 0 | 0 | 1 | 0.2 | * |
| Clear Creek | 0 | 0 | 0 | 0 | 4 | 0.8 | 8.4 |
| Conejos | 0 | 1 | 0 | 1 | 0 | 0.4 | * |
| Costilla | 0 | 0 | 0 | 0 | 1 | 0.2 | * |
| Crowley | 1 | 1 | 0 | 0 | 0 | 0.4 | * |
| Custer | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Delta | 2 | 0 | 0 | 6 | 1 | 1.8 | 6.3 |
| Denver | 35 | 96 | 49 | 84 | 39 | 60.6 | 10.8 |
| Douglas | 4 | 9 | 6 | 10 | 27 | 11.2 | 5.6 |
| Eagle | 1 | 0 | 0 | 0 | 1 | 0.4 | * |
| El Paso | 13 | 22 | 10 | 6 | 15 | 13.2 | 2.5 |
| Elbert | 1 | 0 | 0 | 5 | 6 | 2.4 | 11.2 |
| Fremont | 0 | 0 | 0 | 3 | 1 | 0.8 | 1.7 |
| Garfield | 6 | 0 | 0 | 0 | 0 | 1.2 | 2.6 |
| Gilpin | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Grand | 1 | 0 | 0 | 0 | 21 | 4.4 | 33.2 |
| Huerfano | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Jefferson | 46 | 103 | 71 | 122 | 67 | 81.8 | 15.5 |
| Kiowa | 0 | 0 | 0 | 0 | 1 | 0.2 | * |
| La Plata | 0 | 6 | 1 | 0 | 3 | 2.0 | 4.4 |
| Lake | 0 | 1 | 0 | 0 | 0 | 0.2 | * |
| Larimer | 10 | 17 | 25 | 35 | 8 | 19.0 | 7.3 |
| Las Animas | 0 | 0 | 2 | 0 | 0 | 0.4 | * |
| Logan | 1 | 0 | 0 | 0 | 0 | 0.2 | * |
| Mesa | 10 | 31 | 14 | 8 | 3 | 13.2 | 11.0 |
| Montezuma | 1 | 0 | 4 | 0 | 0 | 1.0 | 4.2 |
| Montrose | 0 | 0 | 1 | 0 | 1 | 0.4 | * |
| Morgan | 1 | 0 | 0 | 1 | 0 | 0.4 | * |
| Park | 0 | 1 | 0 | 0 | 0 | 0.2 | * |

Table 6. continues on next page

Table 6. (Continued) Pertussis Cases and Rates by County, Colorado, 1999-2003

| County | Number of Cases by Year of Report | | | | | Average Annual # cases | Average Rate for 5 Years* |
|--------------|-----------------------------------|------------|------------|------------|------------|------------------------|---------------------------|
| | 1999 | 2000 | 2001 | 2002 | 2003 | | |
| Phillips | 0 | 0 | 0 | 1 | 0 | 0.2 | * |
| Pitkin | 0 | 0 | 1 | 0 | 0 | 0.2 | * |
| Pueblo | 2 | 2 | 2 | 5 | 2 | 2.6 | 1.8 |
| Rio Grande | 0 | 3 | 5 | 1 | 6 | 3.0 | 24.0 |
| Routt | 0 | 0 | 0 | 2 | 0 | 0.4 | * |
| Saguache | 0 | 0 | 0 | 4 | 1 | 1.0 | 16.4 |
| Sedgwick | 1 | 0 | 0 | 0 | 2 | 0.6 | 22.1 |
| Summit | 0 | 0 | 0 | 1 | 1 | 0.4 | * |
| Teller | 3 | 0 | 1 | 0 | 0 | 0.8 | 3.7 |
| Weld | 10 | 7 | 0 | 7 | 18 | 8.4 | 4.3 |
| Yuma | 0 | 0 | 1 | 0 | 0 | 0.2 | * |
| TOTAL | 312 | 487 | 389 | 464 | 368 | 404 | 9.1 |

* Average annual rates were not calculated for counties with < 3 pertussis cases during the five-year period. Caution should be used when interpreting rates based on small number of cases. Rates were calculated using 2001 population figures from the 2003-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 2003 in Colorado (66.8/100,000) (Table 7) and in the United States 58.3/100,000 (number of US cases from the CDC and US population data from US Census Bureau table “Single Years of Age Under 30 Years and Sex: 2000”). In Colorado, the 15-19 year age group had the second highest rate (16.4/100,000), closely followed by the 1-4 year age group (16.1/100,000). The age distribution and rates for 2003 pertussis cases are displayed in Table 7.

There were 29 pertussis outbreaks involving 112 cases reported during 2003. The majority of (63.4%) of the 112 outbreak cases were 5 to 19 years of age. 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). Schools or childcare settings were involved in 16 of the 29 reported pertussis outbreaks. The 2003 outbreaks ranged in size from 2 to 22 cases (median=3 cases). The Grand County outbreak of 22 cases (includes 1 Adams county case) started in a school and spread to the community.

Table 7. Reported Cases and Rates of Pertussis by Age Group, Colorado, 2003

| Age Group (Years) | Cases | % | Rate |
|-------------------|------------|------------|------------|
| <1 | 46 | 12.5 | 66.8 |
| 1 – 4 | 42 | 11.4 | 16.1 |
| 5 – 9 | 42 | 11.4 | 13.5 |
| 10 – 14 | 96 | 26.1 | 13.0 |
| 15 – 19 | 56 | 15.2 | 16.4 |
| ≥ 20 | 86 | 23.4 | 2.6 |
| TOTAL | 368 | 100 | 8.0 |

The distribution of 2003 reported pertussis cases by symptoms and age group is displayed in Table 8. Pertussis cases less than 10 years of age had the highest proportion of post-tussive vomiting and whooping symptoms. More than half (61.6%) of the 2003 pertussis cases had post-tussive vomiting.

Table 8. Percentage of Reported Pertussis Cases by Symptoms and Age Group, Colorado, 2003*

| SYMPTOMS | Age Group (years) | | | | | |
|----------------------|-------------------|-------|-------|---------|------|----------|
| | <1 | 1 – 4 | 5 – 9 | 10 – 19 | ≥ 20 | ALL AGES |
| Cough§ | 97.8 | 100 | 100 | 100 | 100 | 99.7 |
| Paroxysmal Cough | 97.8 | 100 | 100 | 98.0 | 100 | 98.9 |
| Vomiting After Cough | 79.5 | 76.2 | 81.0 | 51.7 | 53.5 | 61.6 |
| Whoop | 51.1 | 43.9 | 47.6 | 28.5 | 31.4 | 35.9 |

* Symptoms were unknown for 5 cases, and not included in percentage calculations.

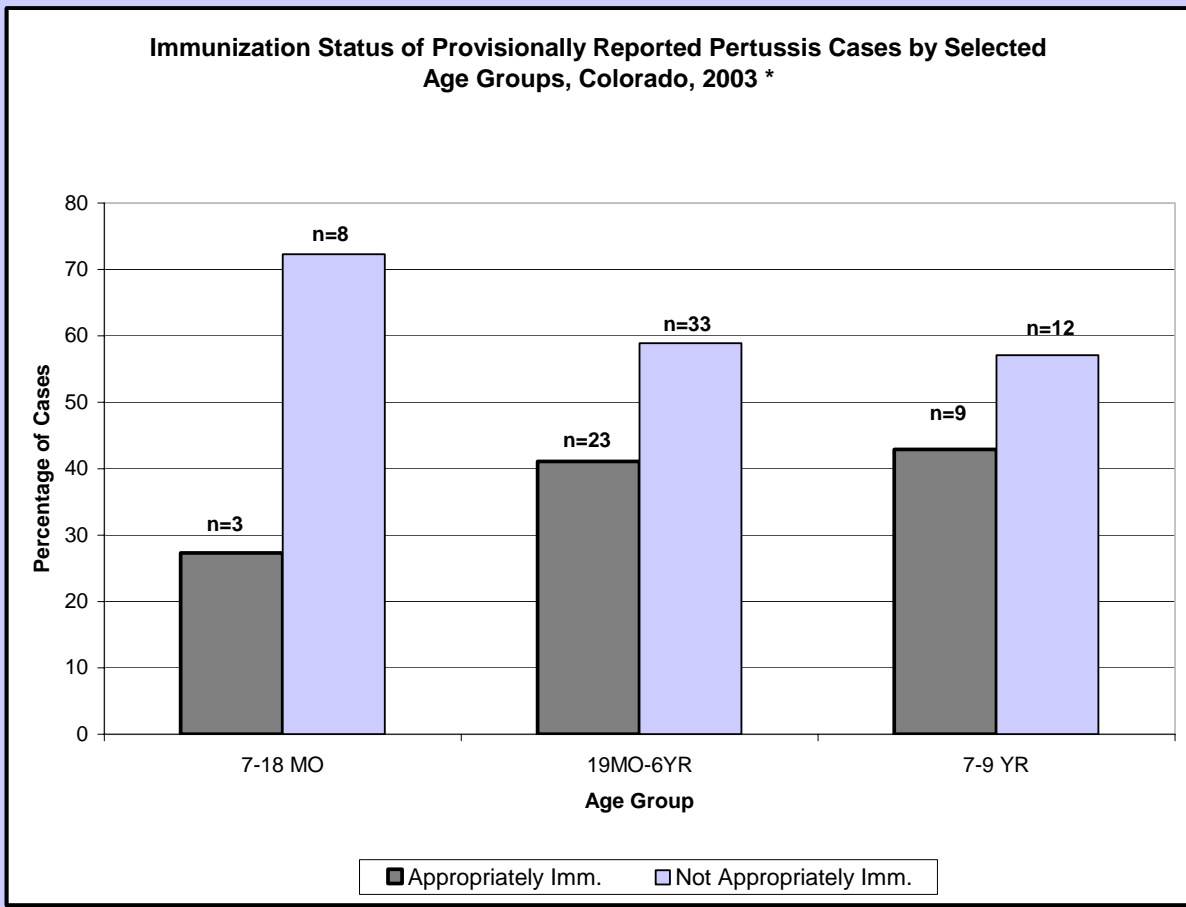
§ Case without a cough was a 3-month-old infant with apnea and seizures.

Pertussis cases 7 months through 9 years of age comprised 24.2% of all reported pertussis cases in Colorado during 2003. Of the cases in this age group, 43.8% (39) had received at least three doses of pertussis vaccine (which is considered adequate to provide protective immunity for most children). Of the 368 pertussis cases reported in 2003, 41 (11.1%) 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, 2003 | | | | |
|---|--|--------------------|--------------------|------------------------|
| AGE GROUP | NUMBER OF PERTUSSIS VACCINE DOSES | | | Total Cases |
| | Unknown | 0 – 2 | 3 + | |
| | # CASES (%) | # CASES (%) | # CASES (%) | |
| 7 - 18 MONTHS | 0 (0%) | 8 (72.7%) | 3 (27.3%) | 11 |
| 19 MONTHS – 6 YEARS | 1 (1.8%) | 31(54.4%) | 25 (43.9%) | 57 |
| 7 - 9 YEARS | 0 (0%) | 10 (47.6%) | 11 (52.4%) | 21 |
| TOTAL | 1 (1.1%) | 49 (55.1%) | 39 (43.8%) | 89 |

The immunization status of 2003 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, 60% of the cases occurred in children who were not appropriately immunized for their age.

Figure 5:



* One 5-year-old child (1.4%) with unknown immunization status was not included in the graph.

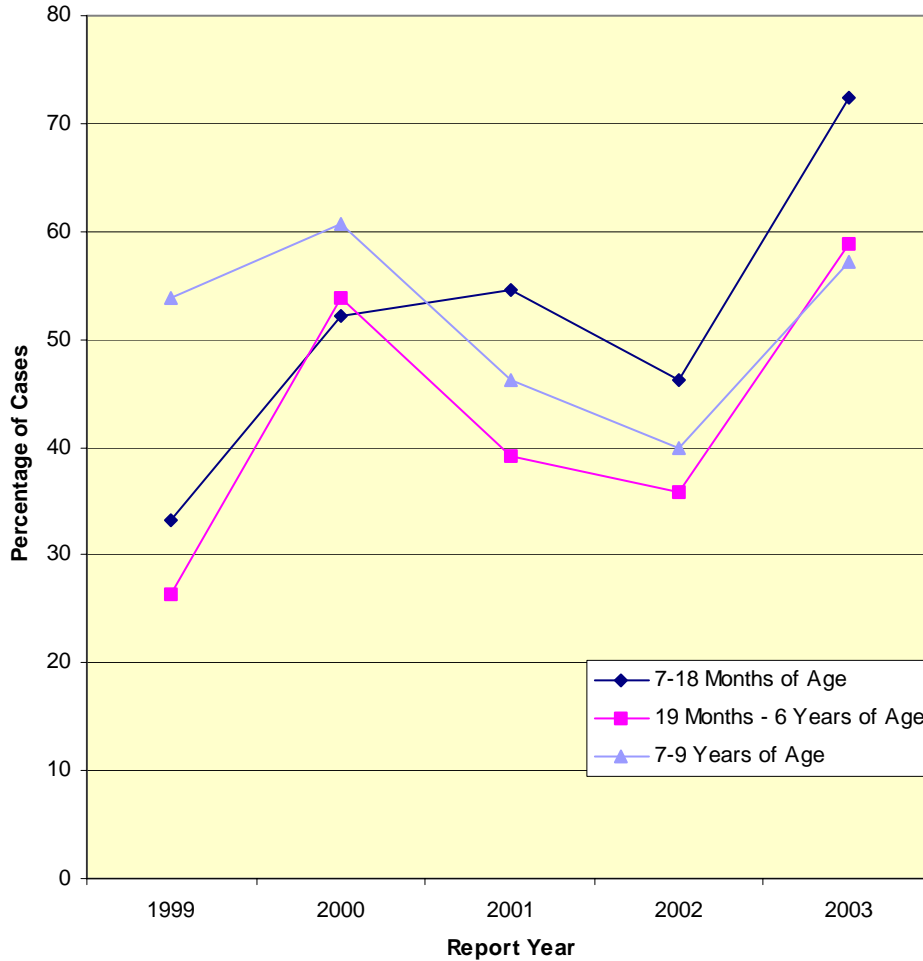
Only one (2.9%) of the appropriately immunized cases 7 months to 9 years of age was hospitalized for pertussis, whereas, 3 (5.6%) of the cases who were not appropriately immunized were hospitalized (one 7-month-old, one 1-year-old, and one 6-year-old without any DTaP vaccine).

Colorado had no pertussis deaths reported in 2003. In the United States, a total of 11 individuals died from pertussis during 2003; 10 (90.0%) of these cases were < 3 months of age.

Trends in the proportion of pertussis cases under nine years of age who were not age-appropriately immunized are shown in Figure 6. During the past five years (1999 – 2003) the highest percentage of pertussis cases that were not age-appropriately immunized occurred in 2003. In Colorado, DTaP vaccinations were delayed due to a nationwide DTaP vaccine shortage from March 2001 through February 2003. 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, 1999 - 2003*



* 20 cases with unknown immunization status were not included in the graph (1999-six, 2000-two, 2001-five, 2002-six, & 2003-one)

Nine Colorado pertussis cases in 2003 experienced complications; 6 (1.6 %) cases were diagnosed with pneumonia and 3 cases (0.8 %) were diagnosed with seizures. The 3 cases with seizures were hospitalized and each was less than 3 months of age (9-days-old, 11-days-old, and 2-months-old). Only two of 6 cases with pneumonia were hospitalized (a 9-day-old and a 20-day old). The remaining 4 cases with pneumonia were 11 to 16 years of age. The proportion of cases with pneumonia has decreased from 1999 (7.1%) to 2003 (1.6%). The reason for this decline is unclear. Pertussis complications are summarized in Table 10.

| Table 10. Reported Pertussis Complications, Colorado 1999-2003 | | | | | | |
|---|-------------|-------------|-------------|-------------|-------------|---------------------------------------|
| COMPLICATIONS | 1999 | 2000 | 2001 | 2002 | 2003 | 5 YEAR AVERAGE (1999-2003) |
| DEATH | 0 | 2 | 0 | 0 | 0 | 0.4 |
| ENCEPHALOPATHY | 0 | 0 | 0 | 0 | 0 | 0 |
| SEIZURES | 2 | 1 | 0 | 1 | 3 | 1.4 |
| PNEUMONIA* | 22 | 24 | 14 | 14 | 6 | 16.0 |

* Confirmed by X-ray

During 2003, 8.4% (31 cases) of reported pertussis cases were hospitalized (Table 11). Cases < 1 year of age were most likely (54.3%) to be hospitalized. Hospitalization was infrequent (6/322=1.9%) among cases greater than 11 months of age, and none of the cases 10-19 years of age were hospitalized. Hospitalized pertussis cases had a median hospital stay of 5 days (range = 1 - 30 days).

| Table 11. Reported Hospitalizations Among Pertussis Cases, by Age Group, Colorado, 2003 | | | |
|--|-----------------------|----------------|-----------------------|
| AGE GROUP | # HOSPITALIZED | # CASES | % HOSPITALIZED |
| < 6 MONTHS | 22 | 40 | 55.0 |
| 6 - 11 MONTHS | 3 | 6 | 50.0 |
| 1 - 4 YEARS | 2 | 42 | 4.8 |
| 5 - 9 YEARS | 1 | 42 | 2.4 |
| 10 - 14 YEARS | 0 | 96 | 0 |
| 15 - 19 YEARS | 0 | 56 | 0 |
| ≥ 20 YEARS | 3 | 86 | 3.5 |
| TOTAL | 31 | 368 | 8.4 |

Of the 368 reported pertussis cases in 2003, a total of 334 (90.8 %) 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. In addition, cases that are epidemiologically linked to laboratory confirmed cases and meet the clinical case definition are classified as confirmed cases. There were 34 (9.2%) probable pertussis cases reported in 2003. Confirmed and probable pertussis cases are further classified in Table 12.

| Table 12. Classification of Reported Pertussis Cases, Colorado, 2003 | | |
|---|---------------|-------------|
| CASE CLASSIFICATION | NUMBER | % |
| Confirmed: Culture &/or PCR Positive | 220 | 59.8 |
| Confirmed: Epidemiologically-linked to a Culture Positive Case &/or PCR Positive Case | 114 | 31.0 |
| Probable: DFA* Positive Only | 3 | 0.8 |
| Probable: Physician Diagnosed Case | 22 | 6.0 |
| Probable: Serology Positive Only | 7 | 1.9 |
| Probable: Outbreak Situation** | 2 | 0.5 |
| TOTAL | 368 | 100 |

* DFA = Direct fluorescent antibody.

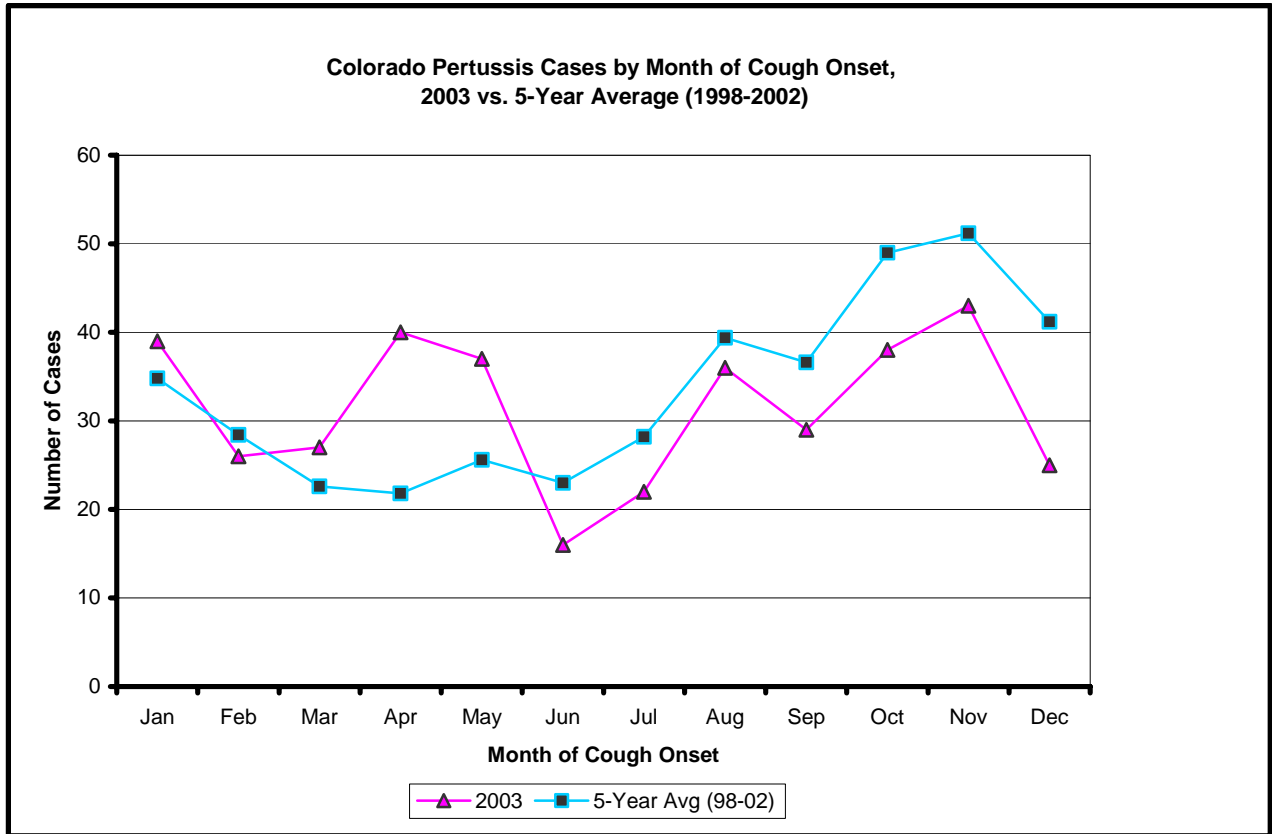
**In outbreak settings, including household exposures, a case may be defined as a cough illness lasting ≥ 2 weeks.

Nasopharyngeal or serum specimens were obtained from 256 (69.6%) of reported pertussis cases during 2003. A total of 112 (30.4%) pertussis cases were not tested in 2003. Fourteen individuals (14/256=5.5%) with negative test results and eight (8/256=3.1%) with indeterminate results were counted as pertussis cases because they met the clinical case definition and were physician diagnosed or epidemiologically related to another confirmed case. Serologic testing for pertussis is not recommended for diagnosis, as this test is not standardized and results are difficult to interpret.

Most laboratory confirmed pertussis cases in 2003 were PCR positive, as PCR is the most widely available type of testing in Colorado. Of the 220 laboratory confirmed cases, 219 (99.5%) were positive by PCR only, and 1 (0.5%) was positive by both culture and PCR.

Pertussis cases are reported throughout the year in Colorado (Figure 7), although, incidence is typically greatest during August through January. In 2003, there were substantially more cases reported during the months of April and May than the 5-year average for these months.

Figure 7:



Haemophilus influenzae

In 2003, there were 39 cases of invasive *Haemophilus influenzae* (H. flu) disease reported in Colorado, which represents an 8.3% increase over the 36 cases reported in 2002. There were no H. flu serotype b (Hib) cases reported in Colorado during 2003. In the United States, there were 2,013 H. flu cases reported during 2003. Nationally, among children less than 5 years of age; 32 cases were Hib, 117 were non-serotype b, and 227 cases were unknown serotypes. During 2003, only 7 H. flu cases less than 5 years of age were reported in Colorado, all 7 were nontypeable. The 2003 incidence rate for H. flu in the United States was 0.7/100,000, compared to Colorado's incidence rate of 0.85/100,000. 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 39 H. flu cases reported, 23 (59.0%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 16 (41.0%) were from outside the Denver metro area. In Colorado, adults 80 years of age and older had the highest rate of H. flu (7.8/100,00), followed by children < 1 year of age (5.8/100,000). A total of 6 (15.4%) H. flu cases were fatal during 2003. Table 13 displays *Haemophilus influenzae* case rates and case fatality by age group.

| Table 13. Reported Invasive <i>Haemophilus influenzae</i> Cases, Rates and Case Fatality By Age Group, Colorado, 2003 | | | | |
|--|--------------|--------------|---------------|-------------------|
| AGE GROUP | CASES | RATE* | DEATHS | |
| | | | # | % OF CASES |
| < 1 | 4 | 5.8 | 1 | 25 |
| 1 – 4 | 3 | 1.1 | 0 | 0 |
| 5 – 9 | 1 | 0.3 | 0 | 0 |
| 10 – 14 | 0 | 0 | 0 | 0 |
| 15 – 19 | 0 | 0 | 0 | 0 |
| 20 – 39 | 2 | 0.1 | 0 | 0 |
| 40 – 59 | 6 | 0.5 | 1 | 16.7 |
| 60 – 79 | 14 | 2.8 | 3 | 21.4 |
| 80+ | 9 | 7.8 | 1 | 11.1 |
| TOTAL | 39 | 0.85 | 6 | 15.4 |

* 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/eipmain.asp.

Meningococcal Disease

A total of 27 cases of invasive meningococcal disease were reported in Colorado during 2003, which represents a 17.4% increase from the 23 cases reported in 2002. There were 1,756 cases of meningococcal disease reported in the United States during 2003. The meningococcal disease incidence rates for Colorado and the United States were the same during 2004, 0.6/100,000. Of the 27 cases reported, 16 (59.3%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 11 (40.7%) were from outside the Denver metro area. Children less than 1 year of age had the highest rate of meningococcal disease (4.4/100,000). A total of 5 (18.5%) meningococcal disease cases were fatal in 2003. Table 14 displays meningococcal disease rates and case fatality by age group.

| Table 14. Reported Invasive Meningococcal Disease Cases, Rates and Case Fatality by Age Group, Colorado, 2003 | | | | |
|--|--------------|--------------|---------------|-------------------|
| AGE GROUP | CASES | RATE* | DEATHS | |
| | | | # | % OF CASES |
| < 1 | 3 | 4.4 | 0 | 0 |
| 1 – 4 | 3 | 1.1 | 0 | 0 |
| 5 – 9 | 0 | 0.0 | 0 | 0 |
| 10 – 14 | 1 | 0.3 | 0 | 0 |
| 15 – 19 | 5 | 1.5 | 0 | 0 |
| 20 – 39 | 5 | 0.4 | 1 | 20 |
| 40 – 59 | 5 | 0.4 | 1 | 20 |
| 60 – 79 | 5 | 1.0 | 3 | 60 |
| 80 + | 0 | 0 | 0 | 0 |
| TOTAL | 27 | 0.6 | 5 | 18.5 |

* Per 100,000 population

The majority of Colorado meningococcal disease cases reported in 2003 were serogroup B (51.9%). Cases are displayed by serogroup in Table 15.

| Table 15. Reported Invasive Meningococcal Disease by Serogroup, Colorado, 2003 | | |
|---|--------------|-------------------|
| Serogroup | Cases | % of cases |
| B | 14 | 51.9 |
| C | 5 | 18.5 |
| Y | 3 | 11.1 |
| W-135 | 2 | 7.4 |
| Not Groupable | 1 | 3.7 |
| Unknown | 2 | 7.4 |
| Total | 27 | 100 |

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

Pneumococcal Disease

In Colorado, 366 cases of invasive pneumococcal disease (IPD) were reported during 2003 for an incidence rate of 8.0/100,000. Invasive pneumococcal disease has been reportable in the 5-county Denver metropolitan area since July 2000 and statewide since November 30, 2001. Of the 366 IPD cases reported, 281 (76.8%) were from the 5-county Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) and 85 (23.2%) were from outside the Denver metro area. In Colorado, the age groups having the highest rates of pneumococcal disease during 2003 were adults ≥ 80 years of age (45.3/100,000) and infants less than 1 year of age (31.9/100,000). Approximately 11% (40 cases) of reported invasive pneumococcal infections were fatal in 2003. 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, 2003 | | | | |
|---|--------------|--------------|---------------|-------------------|
| AGE GROUP | CASES | RATE* | DEATHS | |
| | | | # | % OF CASES |
| < 1 | 22 | 31.9 | 2 | 9.1 |
| 1 – 4 | 32 | 12.2 | 3 | 9.4 |
| 5 – 9 | 11 | 3.5 | 0 | 0 |
| 10 – 14 | 4 | 1.2 | 0 | 0 |
| 15 – 19 | 8 | 2.3 | 0 | 0 |
| 20 – 39 | 47 | 3.5 | 3 | 6.4 |
| 40 – 59 | 121 | 9.2 | 9 | 7.4 |
| 60 – 79 | 69 | 13.7 | 14 | 20.3 |
| 80 + | 52 | 45.3 | 9 | 17.3 |
| TOTAL | 366 | 8 | 40 | 10.9 |

*Per 100,000 population

During 2003, 39 children less than five years of age from the Denver metro area (Adams, Arapahoe, Denver, Douglas, and Jefferson counties) were diagnosed with IPD. Pneumococcal isolates from 32 (82.1%) of these cases were serotyped. Of the 32 isolates, 12 (37.5%) were serotypes included in the pneumococcal conjugate vaccine. Only two vaccinated cases had disease caused by vaccine serotypes; a 4-month-old with 1 vaccination and a 6-month-old with 2 vaccinations. Of the remaining ten cases due to vaccine serotypes, half (5 cases) were unvaccinated prior to illness onset and half (5 cases) had unknown vaccination histories. The most frequently reported serotype overall (21.9%) was serotype 3, which is not included in the vaccine. Cases are shown by serotype and vaccination history in Table 17.

| Table 17. Invasive Pneumococcal Disease Cases Less Than 5 Years of Age by Serotype and Immunization Status, Denver Metro Area[¶], Colorado, 2003 | | | | |
|--|------------------------|---|--------------------------------------|------------------------------------|
| Serotype | Number of Cases | Vaccinated Prior to Onset (1+ doses) | Not Vaccinated Prior to Onset | Unknown Vaccination History |
| 4* | 2 | 0 | 1 | 1 |
| 6B* | 3 | 1 | 1 | 1 |
| 9V* | 1 | 0 | 0 | 1 |
| 14* | 1 | 0 | 1 | 0 |
| 18C* | 1 | 0 | 1 | 0 |
| 19F* | 3 | 1 | 1 | 1 |
| 23F* | 1 | 0 | 0 | 1 |
| SUBTOTAL* | 12 | 2 [§] | 5 | 5 |
| Not in Vaccine | 19 | 7 | 4 | 8 |
| Not Typeable | 1 | 0 | 1 | 0 |
| Not typed | 6 | 5 | 1 | 0 |
| Pending | 1 | 0 | 1 | 0 |
| TOTAL | 39 | 14 | 12 | 13 |

[¶] Adams, Arapahoe, Denver, Douglas, and Jefferson counties.
^{*} Serotype is included in the Pneumococcal Conjugate Vaccine.
[§] One 4-month-old with 1 dose (6B) & one 6-month-old with 2 doses (19F).

Vaccination status was unknown for 33.3% of the 2003 Denver area IPD cases less than five years of age. More than two thirds (76.9%) of the cases with unknown vaccine status were 1-4 years of age. The first pneumococcal conjugate vaccine was licensed in the United States in 2000. The dramatic decline in the IPD rate in Denver metro area children < 5 years of age from 2000 to 2003 is shown in Figure 8.

Figure 8. Invasive Pneumococcal Disease Rates in Children < 5 Years Old by Age Group and Report Year, Denver Metro Area, 2000*-2003

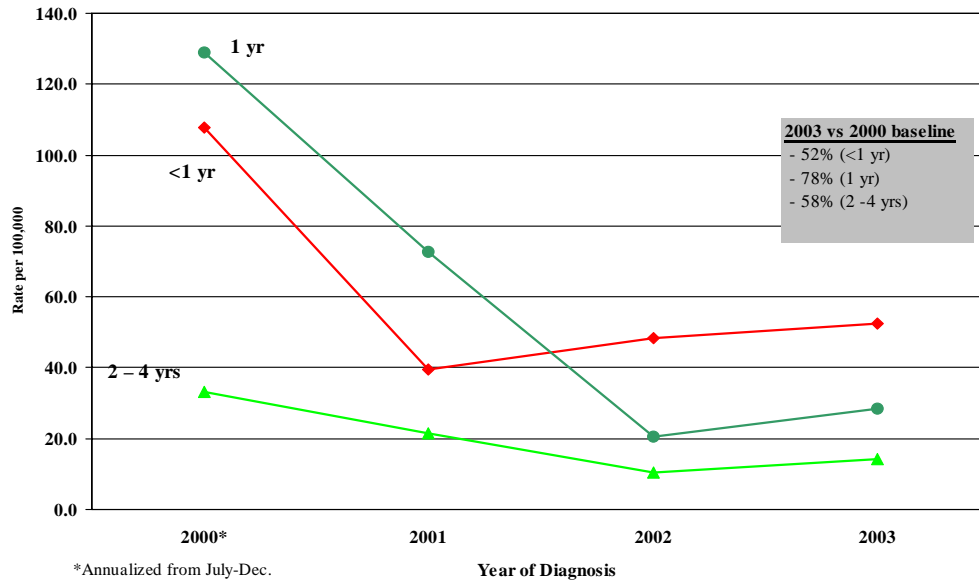


Figure 8 courtesy of CDPHE Emerging Infections Program.

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/eipmain.asp.