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Mumps Surveillance — United States, 1988–1993

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Contents

Reports Published in *CDC Surveillance Summaries*
Since January 1, 1985 ii
Introduction 2
Methods 2
Results 3
General Trends 3
Incidence by Age Groups of Patients 3
Incidence by Race/Ethnicity of Patients 6
State Immunization Laws 6
Geographic Distribution of Cases 8
Seasonality 11
Discussion 11
Summary 13
State and Territorial Epidemiologists and
Laboratory Directors ..... Inside back cover

Reports Published in *CDC Surveillance Summaries* Since January 1, 1985

Subject	Responsible CIO/Agency*	Most Recent Report
Abortion	NCCDPHP	1995; Vol. 44, No. SS-2
AIDS/HIV		
Distribution by Racial/Ethnic Group	NCID	1988; Vol. 37, No. SS-3
Among Black & Hispanic Children & Women of Childbearing Age	NCEHIC	1990; Vol. 39, No. SS-3
Behavioral Risk Factors	NCCDPHP	1991; Vol. 40, No. SS-4
Birth Defects		
B.D. Monitoring Program (see also Malformations)	NCEH	1993; Vol. 42, No. SS-1
Contribution of B.D. to Infant Mortality Among Minority Groups	NCEHIC	1990; Vol. 39, No. SS-3
Breast & Cervical Cancer	NCCDPHP	1992; Vol. 41, No. SS-2
Campylobacter	NCID	1988; Vol. 37, No. SS-2
Chancroid	NCPS	1992; Vol. 41, No. SS-3
Chlamydia	NCPS	1993; Vol. 42, No. SS-3
Cholera	NCID	1992; Vol. 41, No. SS-1
Congenital Malformations, Minority Groups	NCEHIC	1988; Vol. 37, No. SS-3
Contraception Practices	NCCDPHP	1992; Vol. 41, No. SS-4
Cytomegalovirus Disease, Congenital	NCID	1992; Vol. 41, No. SS-2
Dengue	NCID	1994; Vol. 43, No. SS-2
Dental Caries & Periodontal Disease Among Mexican-American Children	NCPS	1988; Vol. 37, No. SS-3
Diabetes Mellitus	NCCDPHP	1993; Vol. 42, No. SS-2
Dracunculiasis	NCID	1992; Vol. 41, No. SS-1
Ectopic Pregnancy	NCCDPHP	1993; Vol. 42, No. SS-6
Elderly, Hospitalizations Among	NCCDPHP	1991; Vol. 40, No. SS-1
Endometrial & Ovarian Cancers	EPO, NCCDPHP	1986; Vol. 35, No. 2SS
Escherichia coli O157	NCID	1991; Vol. 40, No. SS-1
Evacuation Camps	EPO	1992; Vol. 41, No. SS-4
Family Planning Services at Title X Clinics	NCCDPHP	1995; Vol. 44, No. SS-2
Foodborne Disease	NCID	1990; Vol. 39, No. SS-1
Gonorrhea & Syphilis, Teenagers	NCPS	1993; Vol. 42, No. SS-3
Hazardous Substances Emergency Events	ATSDR	1994; Vol. 43, No. SS-2
Health Surveillance Systems	IHPO	1992; Vol. 41, No. SS-4
Hepatitis	NCID	1985; Vol. 34, No. 1SS
Homicide	NCEHIC	1992; Vol. 41, No. SS-3
Homicides, Black Males	NCEHIC	1988; Vol. 37, No. SS-1
Hysterectomy	NCCDPHP	1986; Vol. 35, No. 1SS
Infant Mortality (see also National Infant Mortality; Birth Defects; Postneonatal Mortality)	NCEHIC	1990; Vol. 39, No. SS-3
Influenza	NCID	1993; Vol. 42, No. SS-1
Injury		
Death Rates, Blacks & Whites	NCEHIC	1988; Vol. 37, No. SS-3
Drownings	NCEHIC	1988; Vol. 37, No. SS-1
Falls, Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Firearm-Related Deaths, Unintentional	NCEHIC	1988; Vol. 37, No. SS-1
Head & Neck	NCIPC	1993; Vol. 42, No. SS-5
In Developing Countries	NCEHIC	1992; Vol. 41, No. SS-1

*Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CIO	Centers/Institute/Offices
EPO	Epidemiology Program Office
IHPO	International Health Program Office
NCCDPHP	National Center for Chronic Disease Prevention and Health Promotion
NCEH	National Center for Environmental Health
NCEHIC	National Center for Environmental Health and Injury Control
NCID	National Center for Infectious Diseases
NCIPC	National Center for Injury Prevention and Control
NCPS	National Center for Prevention Services
NIOSH	National Institute for Occupational Safety and Health

Reports Published in *CDC Surveillance Summaries* Since January 1, 1985 — Continued

Subject	Responsible CIO/Agency*	Most Recent Report
In the Home, Persons <15 Years of Age	NCEHIC	1988; Vol. 37, No. SS-1
Motor Vehicle-Related Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, State & Local	NCEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, National	NCEHIC	1988; Vol. 37, No. SS-1
Residential Fires, Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Tap Water Scalds	NCEHIC	1988; Vol. 37, No. SS-1
Lead Poisoning, Childhood	NCEHIC	1990; Vol. 39, No. SS-4
Low Birth Weight	NCCDPHP	1990; Vol. 39, No. SS-3
Maternal Mortality	NCCDPHP	1991; Vol. 40, No. SS-2
Measles	NCPS	1992; Vol. 41, No. SS-6
Meningococcal Disease	NCID	1993; Vol. 42, No. SS-2
Mining	NIOSH	1986; Vol. 35, No. 2SS
Mumps	NCID	1995; Vol. 44, No. SS-3
National Infant Mortality (see also Infant Mortality; Birth Defects)	NCCDPHP	1989; Vol. 38, No. SS-3
Neisseria gonorrhoeae, Antimicrobial Resistance in	NCPS	1993; Vol. 42, No. SS-3
Nosocomial Infection	NCID	1986; Vol. 35, No. 1SS
Occupational Injuries/Disease		
Asthma	NIOSH	1994; Vol. 43, No. SS-1
Hazards, Occupational	NIOSH	1985; Vol. 34, No. 2SS
In Meatpacking Industry	NIOSH	1985; Vol. 34, No. 1SS
Silicosis	NIOSH	1993; Vol. 42, No. SS-5
State Activities	NIOSH	1987; Vol. 36, No. SS-2
Parasites, Intestinal	NCID	1991; Vol. 40, No. SS-4
Pediatric Nutrition	NCCDPHP	1992; Vol. 41, No. SS-7
Pertussis	NCPS	1992; Vol. 41, No. SS-8
Plague	NCID	1985; Vol. 34, No. 2SS
Plague, American Indians	NCID	1988; Vol. 37, No. SS-3
Poliomyelitis	NCPS	1992; Vol. 41, No. SS-1
Postneonatal Mortality	NCCDPHP	1991; Vol. 40, No. SS-2
Pregnancy Nutrition	NCCDPHP	1992; Vol. 41, No. SS-7
Pregnancy, Teenage	NCCDPHP	1993; Vol. 42, No. SS-6
Rabies	NCID	1989; Vol. 38, No. SS-1
Racial/Ethnic Minority Groups	Various	1990; Vol. 39, No. SS-3
Respiratory Disease	NCEHIC	1992; Vol. 41, No. SS-4
Rotavirus	NCID	1992; Vol. 41, No. SS-3
Salmonella	NCID	1988; Vol. 37, No. SS-2
Sexually Transmitted Diseases in Italy	NCPS	1992; Vol. 41, No. SS-1
Smoking	NCCDPHP	1990; Vol. 39, No. SS-3
Smoking-Attributable Mortality	NCCDPHP	1994; Vol. 43, No. SS-1
Tobacco-Use Behaviors	NCCDPHP	1994; Vol. 43, No. SS-3
Streptococcal Disease (Group B)	NCID	1992; Vol. 41, No. SS-6
Sudden Unexplained Death Syndrome Among Southeast Asian Refugees	NCEHIC, NCPS	1987; Vol. 36, No. 1SS
Suicides, Persons 15–24 Years of Age	NCEHIC	1988; Vol. 37, No. SS-1
Syphilis, Congenital	NCPS	1993; Vol. 42, No. SS-6
Syphilis, Primary & Secondary	NCPS	1993; Vol. 42, No. SS-3
Tetanus	NCPS	1992; Vol. 41, No. SS-8
Trichinosis	NCID	1991; Vol. 40, No. SS-3
Tuberculosis	NCPS	1991; Vol. 40, No. SS-3
Waterborne Disease Outbreaks	NCID	1993; Vol. 42, No. SS-5
Years of Potential Life Lost	EPO	1992; Vol. 41, No. SS-6
Youth Risk Behaviors	NCCDPHP	1995; Vol. 44, No. SS-1

Mumps Surveillance — United States, 1988–1993

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Abstract

Problem/Condition: CDC monitors the incidence of mumps in the United States through the passive reporting of cases to its National Notifiable Disease Surveillance System (NNDSS).

Reporting Period Covered: 1988–1993.

Description of System: Weekly reports to the NNDSS from 48 states and the District of Columbia were used to calculate incidence rates for mumps. State immunization requirements were obtained from the U.S. Department of Health and Human Services.

Results: After the licensure of mumps vaccine in the United States in December 1967 and the subsequent introduction of state immunization laws in an increasing number of states, the reported incidence of mumps decreased substantially. The 1,692 cases of mumps reported for 1993 represent the lowest number of cases ever reported to NNDSS and a 99% decrease from the 152,209 cases reported for 1968. During 1988–1993, most cases occurred in children 5–14 years of age (52%) and in persons ≥15 years of age (36%). Although the incidence decreased in all age groups, the largest decreases (>50% reduction in incidence rate per 100,000 population) occurred in persons ≥10 years of age. Overall, the incidence of mumps was lowest in states that had comprehensive school immunization laws requiring mumps vaccination and highest in states that did not have such requirements.

Interpretation: Because of the extensive use of mumps vaccine and the increased number of states that had enacted mumps immunization laws, the number of reported mumps cases decreased further since the marked decline that began during the early 1970s. The earlier shift in incidence from children of school ages to older persons that was noted during 1985–1988 continued until 1992, when the proportion of cases occurring in children of school ages increased and exceeded the proportions occurring in other age groups.

Actions Taken: All health-care providers are encouraged to a) report mumps cases to their local and state health departments for transmission to NNDSS and b) enact school immunization laws requiring mumps vaccination.

INTRODUCTION

Mumps vaccine was licensed in the United States in December 1967, and the Advisory Committee on Immunization Practices (ACIP) recommended that its use be considered for children approaching puberty, for adolescents, and for adults (*1*). At that time, the public health community considered mumps control a low priority, and ACIP stated that mumps immunization should not compromise the effectiveness of established public health programs (*1,2*). In 1972, however, ACIP recommendations were strengthened to indicate that mumps vaccination was particularly important for the initially targeted age groups; in 1977, ACIP recommended the routine vaccination of all children ≥12 months of age. The use of mumps vaccine in young children was facilitated by the introduction (in 1977) and extensive use of measles-mumps-rubella (MMR) vaccine (*3*). In 1980, stronger recommendations called for the vaccination of susceptible* children, adolescents, and adults, unless such vaccination was contraindicated (*4*). Following these increasingly comprehensive recommendations and the enactment of state laws requiring mumps vaccination for school entry and attendance, the reported incidence of mumps declined steadily. However, during 1986 and 1987, large outbreaks occurred among underimmunized cohorts of persons born during 1967–1977, resulting in a shift in peak incidence from persons 5–9 years of age to persons 10–19 years of age (*5*). In 1989, ACIP recommended that a second dose of measles-containing vaccine be administered to children 4–6 years of age (at time of entry to kindergarten or first grade), and designated MMR as the vaccine of choice (*6*).

This report is a summary of mumps surveillance data in the United States for 1988–1993. Surveillance data from earlier time periods have been published previously (*7,8*).

METHODS

Incidence rates for mumps were calculated from weekly reports of cases sent to CDC's National Notifiable Disease Surveillance System (NNDSS). Cases were reported from 49 areas (i.e., 48 states and the District of Columbia); mumps was not a reportable disease in Mississippi and Rhode Island during 1988 and in New Mexico and Oregon during 1988–1993. Reports of outbreaks also were received sporadically throughout the entire time period.

Population estimates for 1988–1993 were based on 1990 U.S. census data. The U.S. Department of Health and Human Services provided information on state immunization requirements.

Reports of mumps cases were analyzed to determine the distribution of patients by age, race, and ethnicity; the month of report; and the reporting area. Accurate information concerning the race and ethnicity of patients was not available for 1988 and 1989; however, these variables were reported by 41 states in 1990, 38 in 1991, 34 in 1992, and 43 in 1993. This report includes race and ethnicity data from 28 states in which such data were reported for >50% of cases during each of these 4 years.

*Not known to have become immune to mumps by either natural or artificial means.

RESULTS

General Trends

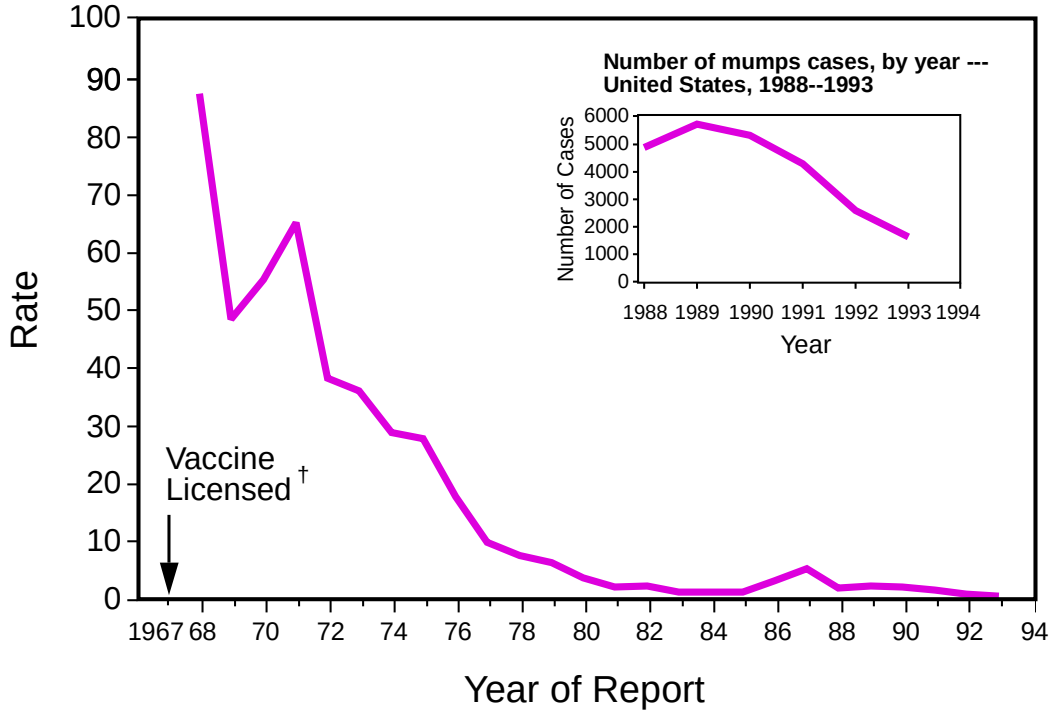
Except for a minimal increase in 1989, the incidence of mumps continued to decline during 1988–1993, from 2.0 per 100,000 population in 1988 to 0.7 per 100,000 population in 1993 (Figure 1). Only 1,692 mumps cases were reported for 1993; this was the lowest number ever reported to NNDSS and a 99% reduction from the 152,209 cases reported for 1968.

Incidence by Age Groups of Patients

During 1988–1993, patient age was reported for 85% of cases (Table 1). During 1991–1993, mumps incidence rates decreased in all age groups from rates for 1988–1990; the largest decreases (i.e., >50% reductions) occurred among persons 10–19 years of age and among children <1 year of age (Table 2). From 1988 through 1991, annual incidence rates for children ages 10–14 years (5.3–7.8 per 100,000) exceeded those for children ages 5–9 years (4.5–6.6 per 100,000) (Figure 2). In 1992 and 1993, incidence rates for children ages 5–9 years were minimally higher than those for children ages 10–14 years (3.2 vs. 2.6 per 100,000 in 1992, and 2.8 vs. 1.9 per 100,000 in 1993).

During the entire period, an average of 52% (range: 47%–55%) of reported cases for which patient age was known occurred in children ages 5–14 years; 36% (range: 31%–38%), in persons ages ≥15 years; and 11% (range: 9%–18%), in children ages 1–4 years

FIGURE 1. Reported mumps incidence rates,* 1968–1993, and number of mumps cases, 1988–1993, by year of report — United States



*Per 100,000 population.
†Licensed in December 1967.

TABLE 1. Reported number of mumps cases, by age of patient and year of occurrence — United States,* 1988–1993

Age group (yrs)	Year of occurrence												Total	
	1988		1989		1990		1991		1992		1993			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
<1	61	1.5	106	2.1	40	0.9	23	0.7	36	1.7	14	0.9	280	1.3
1–4	392	9.4	438	8.8	504	11.1	381	11.5	342	15.8	284	17.6	2,341	11.3
5–9	1,022	24.5	1,194	24.0	1,068	23.5	811	24.4	572	26.4	497	30.8	5,164	24.8
10–14	1,284	30.7	1,324	26.7	1,312	28.9	900	27.1	442	20.4	316	19.6	5,578	26.8
15–19	861	20.6	1,198	24.1	948	20.9	639	19.2	394	18.2	186	11.5	4,226	20.3
≥20	559	13.4	706	14.2	671	14.8	573	17.2	384	17.7	319	19.7	3,212	15.4
Age known	**4,179**	**100.0**	**4,966**	**100.0**	**4,543**	**100.0**	**3,327**	**100.0**	**2,170**	**100.0**	**1,616**	**100.0**	**20,801**	**100.0**
Age unknown	687	—	746	—	749	—	937	—	402	—	76	—	3,597	—
Total	**4,866**	**—**	**5,712**	**—**	**5,292**	**—**	**4,264**	**—**	**2,572**	**—**	**1,692**	**—**	**24,398**	

* Includes the District of Columbia. Excludes states not reporting mumps cases (i.e., New Mexico and Oregon, 1988–1993; Mississippi and Rhode Island, 1988).

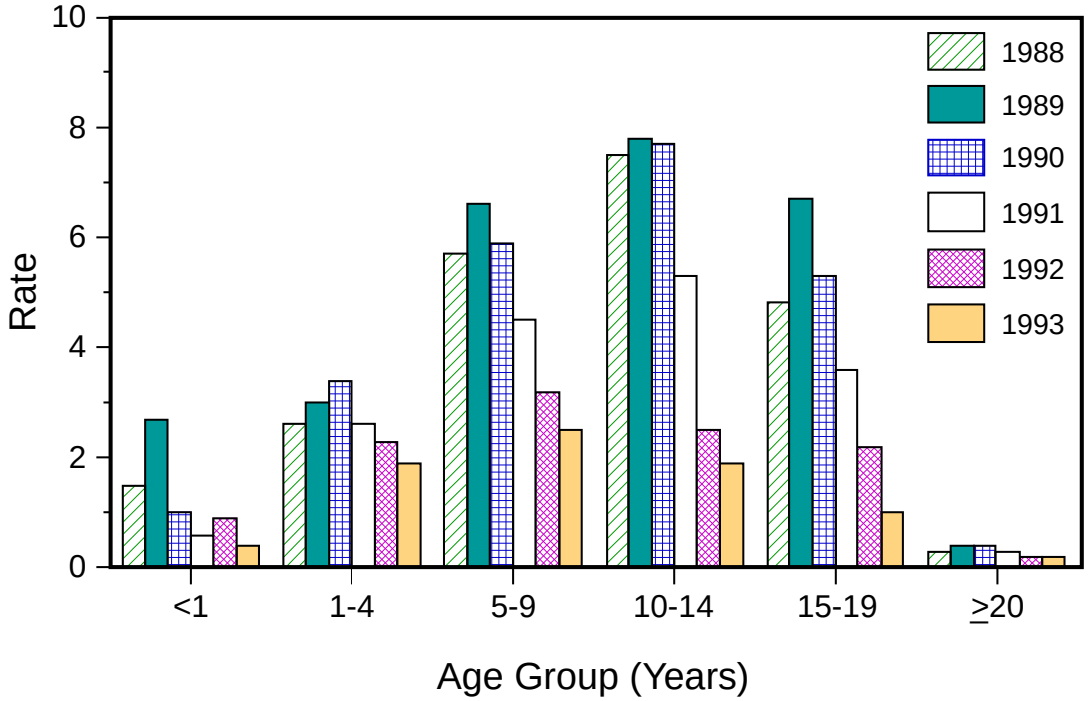
(Table 1). The remaining 1% of cases occurred in children <1 year of age. Although this pattern was similar throughout the 6-year period, a smaller proportion of cases occurred in children ages 5–14 years in 1993 compared with 1988 (50% and 55%, respectively) and in persons ages 15–19 years (12% and 21%, respectively). A larger

TABLE 2. Age-specific mumps incidence rates* during selected periods, by age group — United States†

Age group (yrs)	Incidence rates			Percentage change	
	1985–1987	1988–1990	1991–1993	From 1985–1987 to 1988–1990	From 1988–1990 to 1991–1993
<1	2.4	1.7	0.6	(–29.2)	(–64.7)
1–4	4.1	3.0	2.3	(–26.8)	(–23.3)
5–9	9.7	6.1	3.5	(–37.1)	(–42.6)
10–14	16.9	7.7	3.3	(–54.4)	(–57.1)
15–19	10.3	5.6	2.3	(–45.6)	(–58.9)
≥20	0.4	0.4	0.2	—	(–50.0)
Total	**3.7**	**2.2**	**1.1**	**(–40.5)**	**(–50.0)**

*Per 100,000 population.
†Includes the District of Columbia. Excludes states not reporting mumps cases (i.e., New Mexico and Oregon, 1985–1993; Mississippi, 1985–1988; Oklahoma, 1985–1987; Rhode Island, 1988).

FIGURE 2. Age-specific mumps incidence rates*, by year and age group — United States, 1988–1993



*Per 100,000 population.

proportion of cases occurred in children ages 1–4 years (18% and 9%, respectively) and in persons ages ≥20 years (20% and 13%, respectively).

Incidence by Race/Ethnicity of Patients

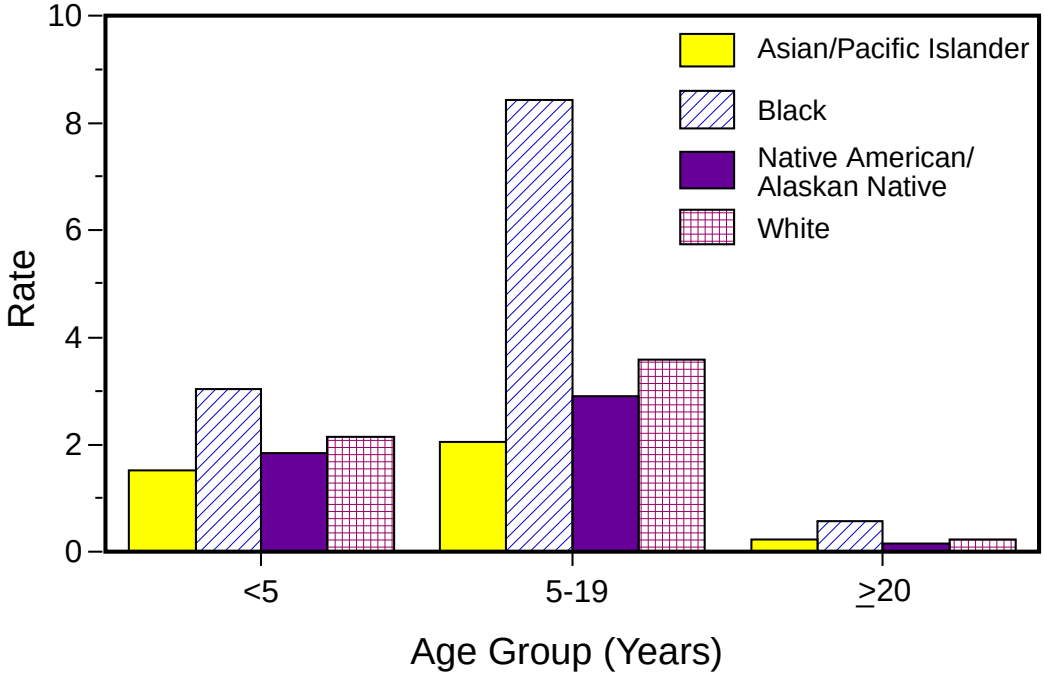
During 1990–1993, race and ethnicity were reported for approximately two thirds of cases in each of 28 states and the District of Columbia. Mumps incidence decreased for all races during this 4-year period. For each year, the highest incidence was among black persons, ranging from 1.2 to 8.2 times the incidence of any other racial group. In every age group, incidence rates for black persons exceeded rates for the other racial groups; this relationship was most notable for persons 5–19 years of age (Figure 3).

Although incidence rates for Hispanics exceeded the rates for non-Hispanics in every age group, the differences in rates were minimal for children <5 years of age and for persons ≥20 years of age (Figure 4). The greatest difference in incidence rates between Hispanics and non-Hispanics were for persons 5–19 years of age.

State Immunization Laws

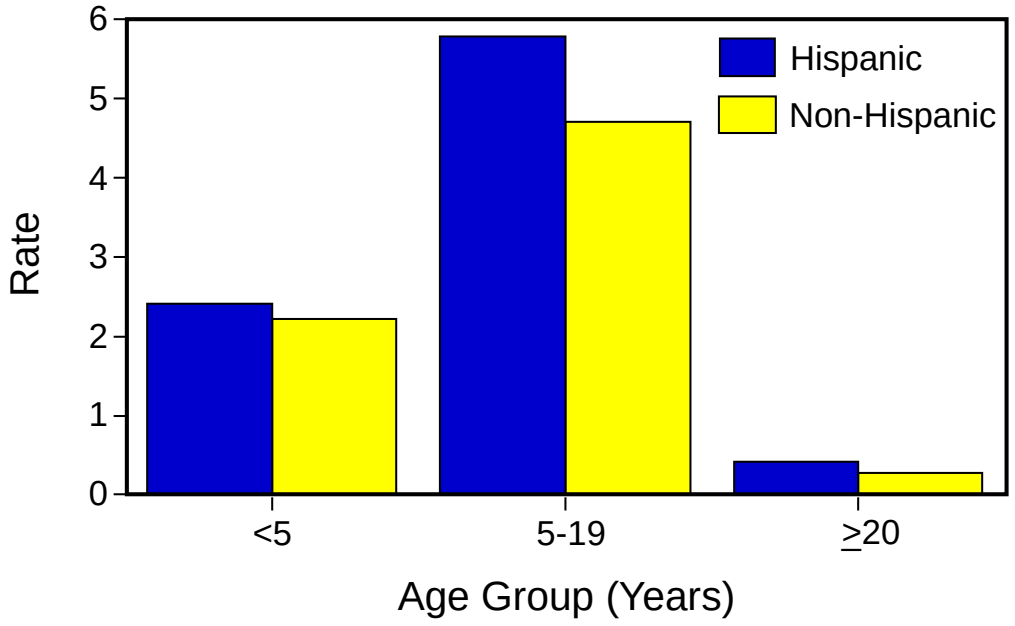
Comprehensive state immunization laws for mumps require documentation of vaccination for all children attending school (i.e., kindergarten through grade 12 [grades K–12]); partial immunization laws require documentation of vaccination for selected groups of children (i.e., at entry to school or at grades K–5, K–6, or K–10). During 1988–1993, the number of states that had adopted comprehensive immunization laws increased from 16 to 40 (Table 3). In 1993, only four states had partial immunization laws, and seven other states, including a state that did not report mumps cases, had no school immunization laws (Figure 5).

FIGURE 3. Average annual mumps incidence rates*, by age group and race — United States,† 1990–1993



*Per 100,000 population.
†From 29 areas reporting race for >50% of cases.

FIGURE 4. Average annual mumps incidence rates*, by age group and ethnicity—United States,† 1990–1993



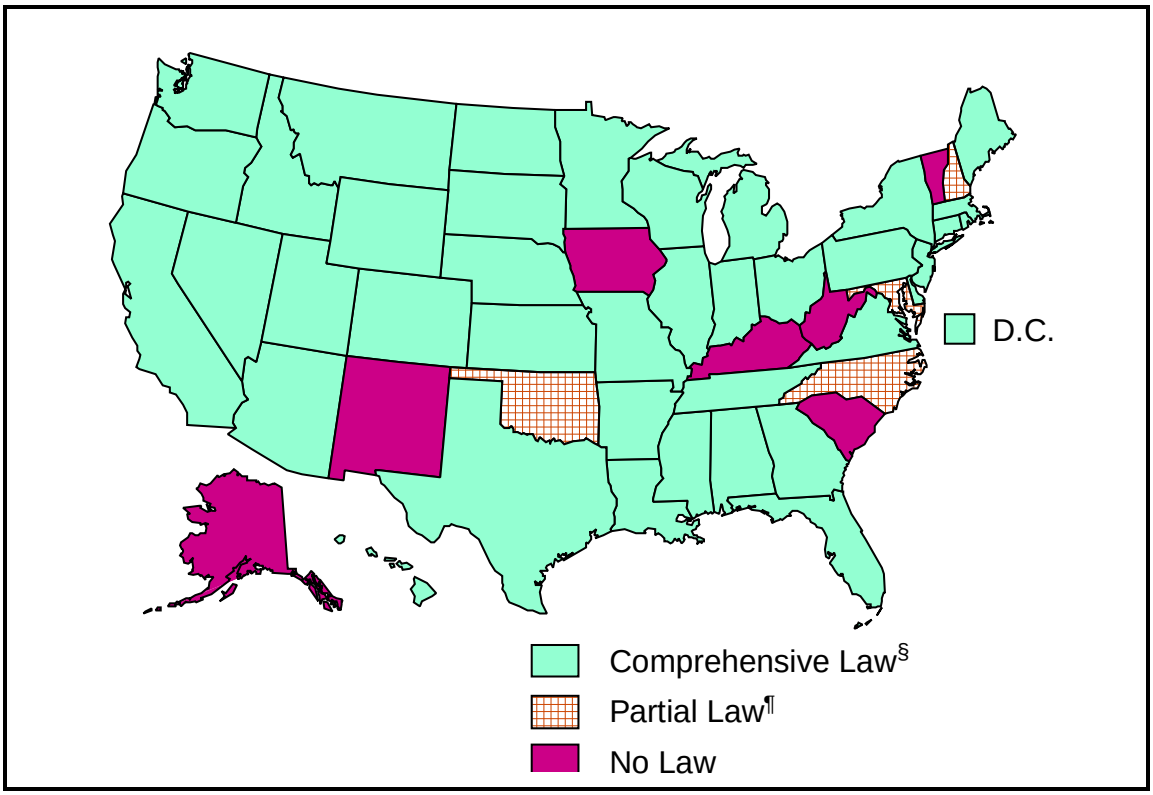
*Per 100,000 population.
†From 29 areas reporting ethnicity for >50% of cases.

TABLE 3. Reported mumps incidence rates* for persons 5–19 years of age, by type of state immunization requirements† — United States,§ 1988–1993

	State immunization requirements					
	No laws¶		Partial laws**		Comprehensive laws††	
Year	No. of states	Incidence rate	No. of states	Incidence rate	No. of states	Incidence rate
1988	14	11.2	19	6.7	16	5.9
1989	11	13.2	19	7.9	21	4.7
1990	11	18.7	19	5.5	21	3.9
1991	8	6.8	5	6.1	38	4.0
1992	8	2.8	5	4.8	38	2.3
1993	7	3.7	4	1.3	40	1.8
Total mean		**9.4**		**5.4**		**3.8**
% decrease§§		**(67.0)**		**(80.6)**		**(69.5)**

*Cases per 100,000 population, adjusted for states not reporting mumps (i.e., New Mexico and Oregon, 1988–1993; Mississippi and Rhode Island, 1988).
†Requirements represent classifications at the beginning of the calendar year.
§Includes the District of Columbia.
¶No requirement for mumps vaccination before entering school.
**Includes some children but not all children in kindergarten through grade 12 (grades K–12); California excluded for 1988 because information concerning age was not available.
††Requires proof of immunity (i.e., documentation of vaccination or previous mumps infection) before entering school (e.g., day care, Head Start, and grades K–12).
§§Incidence rates for 1993 compared with those for 1988.

FIGURE 5. State immunization requirements* for measles, mumps and rubella (MMR) — United States,† 1993–1994 school year



*For students in kindergarten through grade 12 (grades K–12) and children in day care and Head Start programs.
†Includes District of Columbia.
§Requires documentation of vaccination for all children attending school (i.e., grades K–12).
¶Requires documentation of vaccination for selected groups of children (i.e., at entry to school or at grades K–5, K–6, or K–10.)

In states that had comprehensive immunization laws during 1988–1993, the average annual incidence rate of mumps for persons of all ages was 1.3 cases per 100,000 population. In comparison, the reported incidence was 1.8 cases per 100,000 population in states that had partial immunization laws and 2.9 cases per 100,000 population in states that did not require mumps vaccination. For persons 5–19 years of age, the average annual incidence rate per 100,000 population was 3.8 for states that had comprehensive immunization laws, 5.4 for states that had partial immunization laws, and 9.4 for states that did not require mumps vaccination (Table 3). In 1989, three of four states and, in 1990, one of two states reporting >500 cases of mumps did not have comprehensive immunization laws.

Geographic Distribution of Cases

In 1988, 1992, and 1993, no state reported >500 cases (Table 4). In 1989, four states (i.e., California, Louisiana, Maryland, and Texas) each reported >500 cases. In 1990, both California and Maryland reported >500 cases; in 1991, both California and Florida reported 500 cases. In 1993, all but four states (i.e., Kentucky, Maine, Montana, and South Dakota) that routinely report mumps cases reported at least one case.

TABLE 4. Reported number of mumps cases and estimated incidence rates,* by state — United States, 1988–1993

State	1988		1989		1990		1991		1992		1993		1993 compared with 1988 (% change)
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	
Alabama	16	0.4	29	0.7	19	0.5	15	0.4	14	0.3	22	0.5	(37.5)
Alaska	13	2.5	2	0.4	6	1.1	18	3.2	3	0.5	11	1.8	(–15.4)
Arizona	148	4.2	131	3.7	143	3.9	123	3.3	84	2.2	19	0.5	(–87.2)
Arkansas	180	7.5	208	8.6	140	6.0	46	1.9	16	0.7	10	0.4	(–94.4)
California	494	1.7	541	1.9	571	1.9	500	1.6	311	1.0	285	0.9	(–42.3)
Colorado	33	1.0	86	2.6	28	0.9	136	4.0	34	1.0	18	0.5	(–45.5)
Connecticut	10	0.3	11	0.3	17	0.5	14	0.4	8	0.2	8	0.2	(–20.0)
Delaware	1	0.2	1	0.1	8	1.2	7	1.0	8	1.2	1	0.1	0.0
District of Columbia	294	47.6	150	24.8	53	8.7	24	4.0	7	1.2	1	0.2	(–99.7)
Florida	43	0.3	65	0.5	197	1.5	500	3.8	288	2.1	48	0.4	(11.6)
Georgia	37	0.6	87	1.4	98	1.5	87	1.3	84	1.2	20	0.3	(–45.9)
Hawaii	18	1.6	20	1.8	26	2.3	30	2.6	28	2.4	30	2.6	(66.7)
Idaho	11	1.1	40	3.9	137	13.6	13	1.3	4	0.4	6	0.5	(–45.5)
Illinois	348	3.0	218	1.9	205	1.8	166	1.4	128	1.1	74	0.6	(–78.7)
Indiana	84	1.5	49	0.9	27	0.5	7	0.1	12	0.2	8	0.1	(–90.5)
Iowa	43	1.5	54	1.9	22	0.8	24	0.9	13	0.5	11	0.4	(–74.4)
Kansas	205	8.2	297	11.8	91	3.7	31	1.2	3	0.1	1	0.0	(–99.5)
Kentucky	185	5.0	9	0.2	0	0.0	0	0.0	4	0.1	0	0.0	(–100.0)
Louisiana	365	8.3	783	17.9	118	2.8	37	0.9	35	0.8	20	0.5	(–94.5)
Maine	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0.0
Maryland	204	4.4	603	12.8	1,141	23.9	249	5.1	93	1.9	82	1.7	(–59.8)
Massachusetts	17	0.3	57	1.0	14	0.2	3	0.1	3	0.1	1	0.0	(–94.1)
Michigan	236	2.6	161	1.7	177	1.9	121	1.3	85	0.9	80	0.8	(–66.1)
Minnesota	2	0.0	2	0.0	16	0.4	21	0.5	26	0.6	2	0.0	0.0
Mississippi	NN[†]	NA[§]	87	3.3	28	1.1	23	0.9	33	1.3	17	0.6	NA
Missouri	68	1.3	87	1.7	62	1.2	40	0.8	39	0.8	46	0.9	(–32.4)
Montana	2	0.2	4	0.5	1	0.1	0	0.0	2	0.2	0	0.0	(–100.0)
Nebraska	11	0.7	6	0.4	0	0.0	9	0.6	7	0.4	1	0.1	(–90.9)
Nevada	16	1.5	7	0.6	18	1.5	19	1.5	14	1.1	27	1.9	(68.8)
New Hampshire	106	9.8	15	1.4	11	1.0	6	0.5	8	0.7	3	0.3	(–97.2)
New Jersey	57	0.7	214	2.8	104	1.3	43	0.6	18	0.2	17	0.2	(–70.2)
New Mexico	NN	NA	NN	NA	NN	NA	NN	NA	NN	NA	NN	NA	NA

TABLE 4. Reported number of mumps cases and estimated incidence rates,* by state — United States, 1988–1993

State	1988		1989		1990		1991		1992		1993		1993 compared with 1988 (% change)
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate	
New York													
(excluding NYC¶)	110	1.0	176	1.7	161	1.5	111	1.0	88	0.8	46	0.4	(–58.2)
NYC	0	0.0	22	0.3	65	0.9	14	0.2	12	0.2	2	0.0	0.0
N. Carolina	52	0.8	45	0.7	325	4.9	269	4.0	219	3.2	231	3.3	(344.2)
N. Dakota	0	0.0	0	0.0	0	0.0	2	0.3	4	0.6	6	0.9	0.0
Ohio	144	1.3	165	1.5	91	0.8	112	1.0	117	1.1	74	0.7	(–48.6)
Oklahoma	250	7.7	211	6.5	119	3.8	16	0.5	21	0.7	13	0.4	(–94.8)
Oregon	NN	NA	NN	NA	NN	NA	NN	NA	NN	NA	NN	NA	NA
Pennsylvania	128	1.1	88	0.7	144	1.2	132	1.1	87	0.7	70	0.6	(–45.3)
Rhode Island	NN	NA	0	0.0	10	1.0	4	0.4	2	0.2	2	0.2	NA
S. Carolina	9	0.3	56	1.6	76	2.2	402	11.3	52	1.4	17	0.5	(88.9)
S. Dakota	1	0.1	0	0.0	0	0.0	2	0.3	0	0.0	0	0.0	(–100.0)
Tennessee	214	4.4	89	1.8	56	1.1	189	3.8	15	0.3	19	0.4	(–91.1)
Texas	327	1.9	551	3.2	470	2.8	363	2.1	388	2.2	231	1.3	(–29.4)
Utah	9	0.5	14	0.8	14	0.8	16	0.9	24	1.3	6	0.3	(–33.3)
Vermont	6	1.1	3	0.5	2	0.4	4	0.7	2	0.4	1	0.2	(–83.3)
Virginia	139	2.3	125	2.0	108	1.7	70	1.1	58	0.9	40	0.6	(–71.2)
Washington	44	0.9	59	1.2	66	1.4	178	3.5	18	0.4	14	0.3	(–68.2)
W. Virginia	19	1.0	19	1.0	44	2.5	30	1.7	31	1.7	23	1.3	(21.1)
Wisconsin	160	3.3	57	1.2	60	1.2	33	0.7	21	0.4	23	0.5	(–85.6)
Wyoming	7	1.5	8	1.7	3	0.7	5	1.1	1	0.2	5	1.1	(–28.6)
Total	**4,866**	**2.0**	**5,712**	**2.3**	**5,292**	**2.2**	**4,264**	**1.7**	**2,572**	**1.0**	**1,692**	**0.7**	**(–65.2)**

* Per 100,000 population.
† Not notifiable.
§ Not applicable.
¶ New York City.

Seasonality

During 1988–1993, mumps incidence, as determined by month of reporting, was consistently highest during winter and early spring and lowest during the summer (data not shown). This seasonal trend did not change during the 6 reporting years, despite the overall decline in mumps incidence during this time period.

DISCUSSION

Since the introduction of mumps vaccine in the United States in 1967, several developments have contributed substantially to the 99% reduction in mumps incidence. These developments include a) an increasingly inclusive vaccination policy; b) the 1989 ACIP recommendation for a two-dose measles vaccination schedule, designating MMR as the preferred vaccine; and c) the enactment, in an increasing number of states since 1977, of state immunization laws that require mumps vaccination for school attendance. The introduction of mumps vaccine was associated with both an overall decline in reported disease incidence and a change in the epidemiology of the disease.

During the prevaccine era and for >10 years after vaccine licensure, the risk for mumps was highest among children 5–9 years of age. During the 1980s, concomitant with an overall decline in the incidence of mumps, the proportion of cases occurring in older children and adolescents increased (7–9). In 1980, ACIP had recommended vaccination for all susceptible children (i.e., no clinical history of disease), adolescents, and adults unless contraindicated (4). Nevertheless, during 1986 and 1987, outbreaks occurred among susceptible adolescents and young adults in high schools and colleges (*10–13*), hospitals (*14,15*), and in work places where persons are in close contact (*16*). This trend reflected underimmunization of the cohort born from 1967 through 1977, a period when vaccine was not administered routinely to children and the risk for exposure to mumps was decreasing. Thus, the age associated with the highest incidence shifted from children of school ages to older children, adolescents, and young adults. A less pronounced shift in incidence by age also occurred in 1982 (*11*).

The incidence of mumps during 1988–1993 decreased among all age groups. The greatest decrease occurred among persons 10–19 years of age—the same ages at which the greatest increases had occurred during 1986 and 1987, when a resurgence of outbreaks occurred among susceptible adolescents and young adults (*10–16*). Subsequent outbreaks have occurred among highly vaccinated populations. During 1989–1990, a large outbreak occurred among students in a primary and a secondary school; most of the students in these schools had been vaccinated, suggesting that vaccination failure, in addition to failure to vaccinate, might have contributed to the outbreak (*17*). In 1991, another outbreak occurred in a secondary school where most of the students had been vaccinated; this outbreak also was mostly attributed to primary vaccination failure (*18*).

The shift in higher risk for mumps to these other age groups (i.e., from younger children of school ages to older children, adolescents, and young adults)—which occurred after the routine use of mumps vaccine was initiated—has persisted despite minimal fluctuations in disease incidence that occurred in recent years among the various age groups. The age distribution of persons who had mumps during 1988–1993 was similar to that of the 3 preceding years (*8*). Although the majority of cases

during 1988–1993 (52%) and 1985–1987 (58%) occurred in children 5–14 years of age, a higher proportion (75%) was reported in this age group during the 5 years after vaccine licensure (i.e., 1967–1971) and before the routine administration of mumps vaccine (*11*). Conversely, an increasingly larger proportion of cases in persons ≥15 years of age have been reported in recent periods (i.e., 1967–1971, 8%; 1985–1987, 28%; 1988–1993, 36%).

The large decrease in the incidence of mumps during 1988–1993 also might reflect the change in the recommended use of MMR. In 1989, after the resurgence of measles among children of school ages during the late 1980s, ACIP recommended a two-dose measles vaccination schedule using MMR as the preferred vaccine (*6*). The implementation of the two-dose MMR vaccination schedule, with the second dose administered at 4–6 years or at 11–12 years (*6,19*), probably affected the incidence of mumps by conferring immunity to children who had had primary vaccination failure.

The single most important measure for reducing mumps incidence has been the enactment of state immunization laws requiring that students be vaccinated (*7,8,11,20*). States with comprehensive immunization laws had lower incidence rates for mumps than states without such laws; the highest incidence rates occurred in states with no laws, and intermediate incidence rates were reported from states with partial laws. In addition, the shift in the age distribution of patients that was noted during the mumps outbreaks of the 1980s occurred only in states with partial or no school immunization laws (*11*).

Although the association between mumps incidence rates and state immunization laws during 1993 did not differ from that in 1988, the number of states that had comprehensive immunization laws more than doubled, and this probably contributed to the 65% decrease in the national incidence of mumps during 1993 in comparison with 1988. For example, Tennessee adopted a comprehensive immunization law in September 1988 and noted a 91% decrease in the incidence of mumps during 1993 in comparison with 1988.

Mumps incidence rates also decreased in the seven states that did not have immunization laws. These decreases might be attributed partially to the decreased number of cases in states that had immunization laws, which likely resulted in decreased virus transmission to persons in neighboring states that did not have such laws. Similarly, the decreased number of cases in infants and children of preschool ages probably reflects the decreased transmission in families as a result of the reduced incidence among children of school ages.

During 1990–1993, mumps incidence decreased among all racial groups. However, incidence rates were higher for black persons, particularly for those 5–19 years of age. In areas without state immunization requirements for school attendance, the higher incidence rate of mumps for blacks may reflect lower vaccination rates for black children in comparison with white children and adolescents (*5*).

Although overall incidence rates for mumps declined, the seasonal pattern for 1988–1993 remained consistent with the pattern characteristic of earlier prevaccine and postvaccine licensure periods (*7–9*).

The mumps surveillance data for 1988–1993 have certain inherent limitations. Because the NNDSS depends on passive reporting, iadditional validation studies are required to estimate the completeness of reporting and accuracy of the data collected. Furthermore, the association between increased mumps vaccine coverage and de-

creased mumps incidence could not be confirmed because vaccination status of patients was not reported to NNDSS.

From 1967 through 1993, an estimated 137 million doses of mumps vaccine (as MMR, monovalent mumps, or other combined vaccines) were distributed in the United States. The vaccine is safe, efficacious, and cost-beneficial in preventing mumps illness (*21–23*). Groups other than ACIP also have recommended mumps immunization; these groups include the American Academy of Pediatrics, which recommends mumps vaccination of children and adolescents (*19*), and the American College Health Association (ACHA), which recommends requiring that all students born after 1956 present documentation of vaccination against mumps before matriculation (*24*).

Several approaches would ensure that high rates of vaccination are maintained and transmission of mumps is controlled. First, all health-care providers are encouraged to report mumps cases to their local and state health departments for transmission to NNDSS. Reporting of additional data, including vaccination status, via CDC's National Electronic Telecommunication System for Surveillance (NETSS) is currently being implemented. Second, all states are encouraged to enact comprehensive school immunization laws, if they have not already done so, to ensure that all students receive at least one dose of mumps vaccine. States should continue to implement the two-dose measles vaccination policy, using MMR for both doses, to further decrease mumps susceptibility. Third, other groups that are responsible for populations at risk for mumps (e.g., employers) are encouraged to adopt requirements similar to ACHA's recommendations (*24*). Fourth, recommended outbreak control measures for mumps (e.g., exclusion policies for susceptible students) should be applied more aggressively (*25*).

As part of the Childhood Immunization Initiative, the national reduction goal for mumps (i.e., the maximum number of cases expected) for 1996 is 1,600 cases. Although the number of mumps cases reported for 1993 reflects achievement of this objective, the incidence could increase as a result of importation of cases and the increasing emphasis on surveillance.

CONCLUSION

Incidence rates for mumps in the United States have declined substantially since the licensure and widespread use of mumps vaccine. Policies for providing routine vaccination of young children, policies targeting older populations at risk, and the enactment of school immunization laws have all contributed to the decrease in mumps incidence. During 1988–1993, the incidence of mumps decreased further after the number of states with immunization laws increased and the two-dose vaccination schedule for measles using MMR was initiated.

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State and Territorial Epidemiologists and Laboratory Directors are acknowledged for their contributions to *CDC Surveillance Summaries*. The epidemiologists listed below were in the positions shown as of June 1995, and the laboratory directors listed below were in the positions shown as of June 1995.

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