

**Surveillance for Vaccination Coverage  
Among Children and Adults —  
United States**

**U.S. DEPARTMENT OF HEALTH & HUMAN SERVICES**  
Centers for Disease Control and Prevention (CDC)  
Atlanta, GA 30333



The *MMWR* series of publications is published by the Epidemiology Program Office, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30333.

SUGGESTED CITATION

General: Centers for Disease Control and Prevention. *CDC Surveillance Summaries*, September 22, 2000. MMWR 2000;49(No. SS-9).  
Specific: [Author(s)]. [Title of particular article]. In: *CDC Surveillance Summaries*, September 22, 2000. MMWR 2000;49(No. SS-9):[inclusive page numbers].

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## Contents

Reports Published in <i>CDC Surveillance Summaries</i> Since January 1, 1990 .....	ii
<b>National, State, and Urban Area Vaccination Coverage Levels Among Children Aged 19–35 Months — United States, 1998 .....</b>	<b>1</b>
Introduction .....	2
Methods .....	2
Results .....	4
Discussion .....	5
References .....	6
Appendix .....	25
<b>Vaccination Coverage Among Children Enrolled in Head Start Programs or Day Care Facilities or Entering School .....</b>	<b>27</b>
Introduction .....	28
Methods .....	29
Results .....	29
Discussion .....	30
References .....	31
<b>Influenza, Pneumococcal, and Tetanus Toxoid Vaccination of Adults — United States, 1993–1997 .....</b>	<b>39</b>
Introduction .....	40
Methods .....	41
Results .....	42
Discussion .....	45
Conclusions .....	49
Acknowledgments .....	50
References .....	50
State and Territorial Epidemiologists and Laboratory Directors .....	Inside Back Cover

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**Reports Published in *CDC Surveillance Summaries* Since January 1, 1990**


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<b>Subject</b>	<b>Responsible CIO/Agency*</b>	<b>Most Recent Report</b>
Abortion	NCCDPHP	1999; Vol. 48, No. SS-4
Aging		
Health Risks	NCCDPHP	1999; Vol. 48, No. SS-8
Health-Care Services	NCCDPHP/NIP	1999; Vol. 48, No. SS-8
Health-Related Quality of Life	NCEH/NCCDPHP	1999; Vol. 48, No. SS-8
Injuries and Violence	NCIPC/NCCDPHP	1999; Vol. 48, No. SS-8
Morbidity and Mortality	NCHS/NCCDPHP	1999; Vol. 48, No. SS-8
AIDS/HIV		
AIDS-Defining Opportunistic Illnesses	NCHSTP/NCID	1999; Vol. 48, No. SS-2
Among Black and Hispanic Children and Women of Childbearing Age	NCEHIC	1990; Vol. 39, No. SS-3
Asthma	NCEH	1998; Vol. 47, No. SS-1
Behavioral Risk Factors		
State-Specific Prevalence of Selected Health Behaviors, by Race and Ethnicity	NCCDPHP	2000; Vol. 49, No. SS-2
State- and Sex-Specific Prevalence of Selected Characteristics	NCCDPHP	2000; Vol. 49, No. SS-6
Birth Defects		
Birth Defects Monitoring Program (see also Malformations)	NCEH	1993; Vol. 42, No. SS-1
Contribution of Birth Defects to Infant Mortality Among Minority Groups	NCEHIC	1990; Vol. 39, No. SS-3
Breast and Cervical Cancer	NCCDPHP	1999; Vol. 48, No. SS-6
Cardiovascular Disease	EPO/NCCDPHP	1998; Vol. 47, No. SS-5
Chancroid	NCPS	1992; Vol. 41, No. SS-3
Chlamydia	NCPS	1993; Vol. 42, No. SS-3
Cholera	NCID	1992; Vol. 41, No. SS-1
Chronic Fatigue Syndrome	NCID	1997; Vol. 46, No. SS-2
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
Developmental Disabilities	NCEH	1996; Vol. 45, No. SS-2
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
<i>Escherichia coli</i> 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
Food Safety	NCID	1998; Vol. 47, No. SS-4
Foodborne-Disease Outbreaks	NCID	2000; Vol. 49, 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
NCHSTP	National Center for HIV, STD, and TB Prevention
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
NIP	National Immunization Program

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**Reports Published in *CDC Surveillance Summaries* Since January 1, 1990 — Continued**


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<b>Subject</b>	<b>Responsible CIO/Agency*</b>	<b>Most Recent Report</b>
Giardiasis	NCID	2000; Vol. 49, No. SS-7
Gonorrhea and 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
Homicide	NCEHC	1992; Vol. 41, No. SS-3
Hysterectomy	NCCDPHP	1997; Vol. 46, No. SS-4
Infant Mortality (see also National Infant Mortality; Birth Defects; Postneonatal Mortality)	NCEHC	1990; Vol. 39, No. SS-3
Influenza	NCID	2000; Vol. 49, No. SS-3
Injury		
Head and Neck	NCIPC	1993; Vol. 42, No. SS-5
In Developing Countries	NCEHC	1992; Vol. 41, No. SS-1
Lead Poisoning, Childhood	NCEHC	1990; Vol. 39, No. SS-4
Low Birth Weight	NCCDPHP	1990; Vol. 39, No. SS-3
Lyme Disease	NCID	2000; Vol. 49, No. SS-3
Malaria	NCID	1999; Vol. 48, No. SS-1
Measles	NCPS	1992; Vol. 41, No. SS-6
Meningococcal Disease	NCID	1993; Vol. 42, No. SS-2
Mumps	NIP	1995; Vol. 44, No. SS-3
<i>Neisseria gonorrhoeae</i> , Antimicrobial Resistance in	NCPS	1993; Vol. 42, No. SS-3
Neural Tube Defects	NCEH	1995; Vol. 44, No. SS-4
Occupational Injuries/Disease		
Asthma	NIOSH	1999; Vol. 48, No. SS-3
Silicosis	NIOSH	1997; Vol. 46, No. SS-1
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
Poliomyelitis	NCPS	1992; Vol. 41, No. SS-1
Postneonatal Mortality	NCCDPHP	1998; Vol. 47, No. SS-2
Pregnancy		
Pregnancy Nutrition	NCCDPHP	1992; Vol. 41, No. SS-7
Pregnancy-Related Mortality	NCCDPHP	1997; Vol. 46, No. SS-4
Pregnancy Risk Assessment Monitoring System (PRAMS)	NCCDPHP	1999; Vol. 48, No. SS-5
Pregnancy, Teenage	NCCDPHP	1993; Vol. 42, No. SS-6
Racial/Ethnic Minority Groups	Various	1990; Vol. 39, No. SS-3
Respiratory Disease	NCEHC	1992; Vol. 41, No. SS-4
Rotavirus	NCID	1992; Vol. 41, No. SS-3
School Health Education Profiles	NCCDPHP	2000; Vol. 49, No. SS-8
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-Control Laws, State	NCCDPHP	1999; Vol. 48, No. SS-3
Tobacco-Use Behaviors	NCCDPHP	1994; Vol. 43, No. SS-3
Spina Bifida	NCEH	1996; Vol. 45, No. SS-2
Streptococcal Disease (Group B)	NCID	1992; Vol. 41, No. SS-6
Syphilis, Congenital	NCPS	1993; Vol. 42, No. SS-6
Syphilis, Primary and Secondary	NCPS	1993; Vol. 42, No. SS-3
Tetanus	NIP	1998; Vol. 47, No. SS-2
Trichinosis	NCID	1991; Vol. 40, No. SS-3
Tuberculosis	NCPS	1991; Vol. 40, No. SS-3

**Reports Published in *CDC Surveillance Summaries* Since January 1, 1990 — Continued**

<b>Subject</b>	<b>Responsible CIO/Agency*</b>	<b>Most Recent Report</b>
Vaccination Coverage		
Among Children Enrolled in Head Start Programs or Day Care Facilities or Entering School	NIP	2000; Vol. 49, No. SS-9
Influenza, Pneumococcal, and Tetanus Toxoid Vaccination (Among Adults)	NIP	2000; Vol. 49, No. SS-9
National, State, and Urban Areas (Among Children Aged 19–35 Months)	NIP	2000; Vol. 49, No. SS-9
Waterborne-Disease Outbreaks	NCID	2000; Vol. 49, No. SS-4
Years of Potential Life Lost	EPO	1992; Vol. 41, No. SS-6
Youth Risk Behaviors	NCCDPHP	2000; Vol. 49, No. SS-5
College Students	NCCDPHP	1997; Vol. 46, No. SS-6
National Alternative High Schools	NCCDPHP	1999; Vol. 48, No. SS-7

## National, State, and Urban Area Vaccination Coverage Levels Among Children Aged 19–35 Months — United States, 1998

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### Abstract

**Problem/Condition:** High vaccination levels in the population are necessary to decrease disease transmission and prevent disease; therefore, an important component of the U.S. vaccination program is the assessment of vaccination coverage. Current goals are for  $\geq 90\%$  coverage with recommended vaccines during the first 2 years of life.

**Reporting Period:** January–December 1998.

**Description of Systems:** The National Immunization Survey (NIS) is an ongoing, random-digit-dialed telephone survey that gathers vaccination coverage data for children aged 19–35 months in all 50 states and 28 urban areas. Vaccination coverage rates derived from NIS data are adjusted statistically for households with multiple telephone lines, household nonresponse, the proportion of households without telephones, and vaccination provider nonresponse. The results were also adjusted to match the known total population of children in each survey area.

**Results:** On the basis of NIS data, national coverage was  $\geq 90\%$  for three doses of poliovirus vaccine (Polio), three doses of *Haemophilus influenzae* type b vaccine (Hib), and one dose of measles-containing vaccine (MCV). Coverage was the highest ever reported for four doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]) (83.9%), three doses of hepatitis B vaccine (Hep B, 87.0%), and one dose of varicella vaccine (43.2%). The number of states achieving the  $\geq 90\%$  goal was 47 for three doses of Hib, 40 for three doses of Polio, 40 for one dose of MCV, nine for three doses of Hep B, and seven for four doses of DTP. Proportionally fewer urban areas achieved the

≥90% goal: 23 of 28 for three doses of Hib, 13 for three doses of Polio, 16 for one dose of MCV, five for three doses of Hep B, and one for four doses of DTP. No state or urban area has yet achieved the ≥90% goal for varicella.

**Interpretation:** Findings from the 1998 NIS indicate that national vaccination coverage levels for routinely recommended childhood vaccines are at the highest levels ever reported. However, substantial variation in coverage remains at the state and urban area levels.

**Public Health Actions:** The public health community and vaccination providers in areas with low coverage should intensify their efforts to implement recommended strategies for increasing vaccination coverage to ensure that children are equally well protected throughout the United States.

## INTRODUCTION

Sustained high vaccination levels in the population are necessary to decrease transmission and prevent occurrence of childhood diseases. Therefore, an important component of the U.S. vaccination program is the assessment of vaccination coverage (1).

In 1993, the Childhood Immunization Initiative (CII) was launched, setting ≥90% coverage goals by 1996 for the following vaccinations: three doses of diphtheria and tetanus toxoids and pertussis vaccine/diphtheria and tetanus toxoids, three doses of polio vaccine (Polio), three doses of *Haemophilus influenzae* type b vaccine (Hib), one dose of measles/mumps/rubella vaccine (MMR), and three doses of hepatitis B vaccine (Hep B) — the Hep B ≥90% goal was set for 1998 (2). Vaccination objectives were also included in the *Healthy People 2000* initiative, which is a national effort to improve the health of U.S. residents during the decade preceding the year 2000 (3). With the exception of three doses of HepB, the ≥90% coverage goals have been achieved and maintained since 1996 through the widespread implementation of the strategies of the CII by public- and private-sector organizations and health-care providers at the national, state, and local levels (4). *Healthy People 2010* objectives also propose ≥90% coverage goals for new vaccines (e.g., varicella) within 5 years of universal recommendations.

In the United States, the National Immunization Survey (NIS) is the primary source of vaccination coverage data. In 1998, the NIS assessed vaccination coverage among children born during February 1995–May 1997 (i.e., aged 19–35 months; median age: 27 months). This report presents national trends in coverage for each of the routinely recommended childhood vaccines for 4 consecutive years, 1995–1998. For the first time, data presented include coverage among children living below poverty level by state and selected urban area. Vaccination coverage data for each antigen by race/ethnicity are also presented.

## METHODS

The NIS is an ongoing random-digit-dialed (RDD) telephone survey that gathers data about children aged 19–35 months for each of the 50 states and 28 urban areas. The NIS collects data in two stages. During the first stage, an RDD sample of telephone numbers is selected and called. When a household with age-eligible children is contacted, the interviewer collects information about the vaccinations received by all age-eligible children in that household. In 1998, 1,027,866 households were contacted by

phone; of these, 34,480 had children that met the age-eligibility criteria. Among households contacted with eligible children, 31,664 (91.8%) completed the telephone survey, providing demographic, vaccination, and other information about 32,511 children. During the second stage, all vaccination providers of sample children for whom consent was obtained during the telephone interview were contacted by mail. In 1998, vaccination information from providers' records was obtained for 21,649 (68.4%) households, providing adequate information about 21,827 children (67.1%).

A two-stage estimation procedure — reflecting the two stages of data collection (i.e., household telephone interview and vaccination provider mail survey) — has been used to estimate vaccination coverage in the NIS since its inception in 1994. Specifically, the first stage of the NIS estimation method uses data collected from the households and weighting adjustments to account for households with multiple telephone lines, household nonresponse, and the exclusion of households without telephones. The second stage uses the number and type of vaccines reported by the vaccination provider and adjustment for provider nonresponse. The second stage concludes by adjusting the demographic distribution of participant children to match the known total population of children in each survey area (5).

In the 1994–1997 survey years, the use of the child's vaccination record (sometimes referred to as the "shot card") and the child's up-to-date status for the 4:3:1:3 combined series (receipt of four doses of any diphtheria and tetanus toxoids and pertussis vaccine [DTP] [i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids (DT), or diphtheria and tetanus toxoids and acellular pertussis vaccine (DTaP)], DTP, three doses of Polio, one dose of MCV, and three doses of Hib) and three doses of Hep B were used to group children into categories predictive of up-to-date status for the weighting adjustments. Next, the proportion of children up to date within each of these categories was calculated based on provider reports. The adjustment factors were applied to the entire NIS sample to estimate vaccination coverage representative of all children surveyed — not only those with provider data. Over time, the percentage of children with provider data increased from 51% in 1995 to 67% in 1998. This increase enabled modification of the original NIS adjustment for provider nonresponse.

Beginning with the 1998 survey year, the method for estimating vaccination coverage was modified. The new method used to obtain vaccination coverage rates from the 1998 NIS is based on identifying groups of sampled children who are similar in their propensity to have provider data. Then the survey weights of children with provider data within each group are adjusted by dividing them by the group-specific weighted response rate (6).

Using the propensity score methodology, 46 of the 50 state estimates for the 4:3:1:3 combined series were within 1.5 percentage points of the estimates obtained using the original methodology (5,6). The vaccination coverage estimates and estimates of standard errors were calculated using SUDAAN statistical software and the Taylor series expansion (see Appendix for specific estimation formula) (7,8).

Guidelines from CDC's National Center for Health Statistics (NCHS) regarding minimum standards for sample size and precision were applied to this analysis. The standard of reliability is  $RSE < 0.3$  (where  $RSE = \text{the ratio of the standard error and the prevalence}$ ). Estimates that do not meet this standard or with a numerator  $< 30$  are not presented.

## RESULTS

In 1998, vaccination coverage with three doses of Polio, three doses of Hib, and one dose of MCV was  $\geq 90\%$  each; coverage with four doses of DTP and three doses of Hep B was the highest ever reported (83.9% and 87.0%, respectively). Coverage with varicella vaccine (which was first recommended in 1996) also was the highest ever reported (43.2%) (Table 1). During 1995–1998, coverage with four doses of DTP increased from 78.5% to 83.9%. Coverage with three doses of Polio increased from 87.9% in 1995 to 91.1% in 1996 and has remained at high levels ( $\geq 90\%$ ) through 1998. Similarly, coverage with three doses of Hib was 91.7% in 1995 and has remained at high levels through 1998. Coverage with one dose of MCV has been high since 1995 (89.9%), increasing by 2.2 percentage points to 92.1% in 1998. Since their addition to the recommended childhood vaccination schedule, large increases in coverage were observed for three doses of Hep B and varicella vaccine; coverage with three doses of Hep B increased 19 percentage points during 1995–1998 (from 68.0% in 1995 to 87.0% in 1998), and coverage with varicella increased 17.3 percentage points in 1 year (from 25.9% in 1997 to 43.2% in 1998). During 1995–1998, coverage with the 4:3:1 (receipt of four doses of DTP, three doses of Polio, and one dose of MCV) and the 4:3:1:3 combined series increased 4.4 and 5.0 percentage points, respectively; at least half of this increase occurred during the 1997 and 1998 survey years.

In 1998, the vaccine-specific differences in coverage between the states with the highest and lowest coverage were 19 percentage points for four doses of DTP, 12 percentage points for three doses of Polio, 11 percentage points for one dose of MCV, 10 percentage points for three doses of Hib, 16 percentage points for three doses of Hep B, and 47 percentage points for varicella vaccine (Figure 1, Table 2). Similar patterns in vaccine-specific differences were observed among urban areas (Figure 2, Table 3).

The number of states that achieved the  $\geq 90\%$  CII coverage goal was highest for three doses of Hib (47 of 50), three doses of Polio (40), and one dose of MCV (40); in contrast, only nine states achieved  $\geq 90\%$  coverage for three doses of Hep B and seven states for four doses of DTP. No state achieved the  $\geq 90\%$  goal for varicella. In general, the relative proportion of urban areas that achieved these two goals was lower: 23 of 28 for three doses of Hib, 13 for three doses of Polio, 16 for one dose of MCV, five for three doses of Hep B, one for four doses of DTP and none for varicella. For the combined series, only one state achieved the  $\geq 90\%$  goal for the 4:3:1 and 4:3:1:3 combined series; one urban area achieved the goal for 4:3:1, and none achieved the goal for 4:3:1:3.

At the national level, the differences in coverage among children in different racial/ethnic groups varied by vaccine, from 4.4 percentage points (MCV) to 24.6 percentage points (varicella vaccine) (Table 4). In general, coverage levels among non-Hispanic black, Hispanic, and American Indian/Alaskan Native children were lower than levels among children in other racial/ethnic groups.

At the national level, differences in coverage between the approximately 22% of children living below poverty level (who participated in NIS in 1998) and all children also varied by vaccine, from 0.9 percentage points (three doses of Polio) to 4.4 percentage points (four doses of DTP). At the state and urban area levels, vaccination coverage and the proportion of children living below poverty level also varied (Tables 5 and 6).

## DISCUSSION

Findings from the 1998 NIS indicate that national coverage levels for routinely recommended childhood vaccines are at the highest levels ever reported. However, substantial variation in coverage remains at the state and urban area levels. Of the 50 states, the number that did not achieve the  $\geq 90\%$  coverage goals for four doses of DTP, three doses of Hep B, three doses of Polio, and one dose of MCV is 43, 41, 10, and 10, respectively. Of the 28 urban areas monitored by NIS, the number that did not achieve the  $\geq 90\%$  coverage goals for four doses of DTP, three doses of Hep B, three doses of Polio, and one dose of MCV is 27, 23, 15, and 12, respectively. Together, the public health community and vaccination providers in areas with low coverage should intensify their efforts to implement recommended strategies for increasing vaccination coverage to ensure that children throughout the United States are equally well protected.

Increases in coverage were documented for three doses of Hep B since 1995 and for varicella vaccine since 1997. Substantial increases in Hep B coverage were observed during 1994–1995 (from 37% to 68%) (3); after varicella vaccine was recommended in 1997, coverage increased from 26% in 1997 to 43% in 1998. In 1998, only children born after mid-1996 were eligible for varicella vaccine; these data were not adjusted for history of varicella illness. Continued monitoring of vaccination coverage levels will help to identify areas of the United States that need increased vaccination efforts. In areas where coverage continues to be low, communities should implement recommended strategies to increase coverage, such as reminder/recall systems, reduction of out-of-pocket costs for vaccines, and assessment and feedback of provider-based coverage levels (AFIX) (9).

The findings in this report are subject to at least four limitations. First, the survey was designed to produce vaccination coverage estimates for the nation, the 50 states, and 28 selected urban areas. As a result, small differences between estimated yearly vaccination coverage levels for the states or urban areas cannot be detected. Second, the sample size of the NIS is not sufficiently large to provide precise coverage estimates for subgroups (e.g., children living in poverty for each state or urban area). Third, because the NIS is a telephone survey and vaccination coverage is lower among children in nontelephone households, data are adjusted based on the National Health Interview Survey (NHIS) to account for the exclusion of nontelephone households (10). Fourth, vaccination coverage in this report might be overestimated because estimates from the NIS are calculated using only the data from children with provider-validated vaccination histories. These children might be better vaccinated than children without provider data. However, estimates are adjusted for provider nonresponse (6). Consequently, this bias should not have a large impact on coverage estimates.

Although the 1998 CII goal of  $\geq 90\%$  coverage with three doses of Hep B was not achieved, coverage with three doses of Hep B increased steadily during 1996–1998, probably as a result of efforts to increase the availability of Hep B during the mid-1990s. In addition to the previously mentioned strategies, coverage with three doses of Hep B might be increased by increasing provider and parental awareness regarding the reasons for vaccinating infants, by passing state laws requiring vaccination for day care and school entry, and by linking vaccine assessment and referral with the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) (11).

The findings in this report highlight the overall increases in coverage with routinely recommended vaccines during 1995–1998 among children aged 19–35 months. In ad-

dition, the disparities in coverage between white and black children aged 19–35 months have also changed over time. (Note: The 1993 NHIS results identified only “White”, “Black”, and “Other” racial/ethnic groups and did not include varicella vaccine.) In 1993, the gap in coverage by race was greatest for three doses of Hib (57.0% among whites versus 44.8% among blacks) and smallest for four doses of DTP (73.0% among whites versus 69.2% among blacks) (12). However, comparing 1998 data for non-Hispanics whites and non-Hispanics blacks, the coverage gap for four doses of DTP (86.6% versus 77.3%) was substantially greater than those for all the other vaccines. Coverage data for the other vaccines analyzed in 1998 indicate that the differences in coverage levels were similar (for three doses of Hib, 4.9 percentage points, for three doses of Hep B, 4.6 percentage points; for one dose of MCV, 4.4 percentage points; and for three doses of Polio, 4.4 percentage points).

Socioeconomic status might account for some of the race/ethnicity-specific differences in vaccination coverage in this report because poverty is a risk factor for undervaccination and the distribution of poverty varies among racial/ethnic groups (13,14). In addition, the varying proportions of children living below poverty level might be associated with the state- and urban area-specific variation in vaccination coverage. Each community, urban area, and state should assess the possible role of poverty in accounting for their respective vaccination coverage levels. For areas with coverage levels still below the  $\geq 90\%$  target levels, strategies that eliminate out-of-pocket costs (9) and address organizational, personal, and attitudinal barriers confronted by families living below poverty level might be most effective (15).

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**TABLE 1. Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by year — United States, National Immunization Survey, 1995–1998\***

Vaccine/Dose	1995	1996	1997	1998
	(n=31,997) % (95% CI) <sup>†</sup>	(n=33,305) % (95% CI)	(n=32,742) % (95% CI)	(n=21,827) % (95% CI)
DTP <sup>§</sup>				
≥3 Doses	94.7 (±0.6)	95.0 (±0.4)	95.5 (±0.4)	95.6 (±0.5)
≥4 Doses	78.5 (±1.0)	81.1 (±0.7)	81.5 (±0.7)	83.9 (±0.8)
Poliovirus				
≥3 Doses	87.9 (±0.8)	91.1 (±0.5)	90.8 (±0.5)	90.8 (±0.7)
<i>Haemophilus influenzae</i> type b (Hib)				
≥3 Doses	91.7 (±0.6)	91.7 (±0.5)	92.7 (±0.5)	93.4 (±0.6)
Measles-containing vaccine (MCV)				
≥1 Doses	89.9 (±0.7)	90.7 (±0.5)	90.5 (±0.5)	92.1 (±0.6)
Hepatitis B				
≥3 Doses	68.0 (±1.0)	81.8 (±0.7)	83.7 (±0.6)	87.0 (±0.7)
Varicella				
≥1 Dose	NA <sup>¶</sup>	NA	25.9 (±0.7)	43.2 (±1.0)
Combined series				
4DTP/3Polio/1MCV**	76.2 (±1.0)	78.4 (±0.8)	77.9 (±0.7)	80.6 (±0.9)
4DTP/3Polio/1MCV/3Hib <sup>††</sup>	74.2 (±1.0)	76.5 (±0.8)	76.2 (±0.8)	79.2 (±0.9)

\* Children in this survey period were born during February 1992–May 1994 (1995 survey), February 1993–May 1995 (1996 survey), February 1994–May 1996 (1997 survey), or February 1995–May 1997 (1998 survey). In 1998, a total of 32,511 interviews were completed; however, a change in NIS methodology resulted in restricting participation in the survey to only children with valid provider data.

<sup>†</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

<sup>§</sup> Any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

<sup>¶</sup> Not applicable. Recommended in July 1996.

\*\* Four or more doses of DTP, three or more doses of poliovirus vaccine, and one or more doses of MCV.

<sup>††</sup> Four or more doses of DTP, three or more doses of poliovirus vaccine, one or more doses of MCV, and three or more doses of Hib.

**TABLE 2. Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by census division and state — United States, National Immunization Survey, 1998\***

Census division/ State	DTP <sup>†</sup>	Polio <sup>§</sup>	MCV <sup>¶</sup>	Hib <sup>**</sup>	Hep B <sup>†</sup>	Varicella <sup>§§</sup>	4:3:1 <sup>¶¶</sup>	4:3:1:3 <sup>***</sup>
	% (95% CI <sup>¶¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)				
<b>East North Central</b>								
Illinois	82.2 (±4.3)	90.6 (±3.3)	91.3 (±3.3)	92.5 (±3.1)	89.5 (±3.1)	25.8 (±4.2)	79.1 (±4.4)	77.5 (±4.5)
Indiana	81.2 (±4.6)	88.6 (±3.8)	92.9 (±2.8)	90.7 (±3.6)	83.5 (±4.2)	30.2 (±4.9)	78.9 (±4.6)	77.5 (±4.8)
Michigan	82.7 (±4.3)	90.2 (±3.4)	90.7 (±3.4)	92.0 (±3.1)	90.5 (±3.0)	29.6 (±5.0)	78.9 (±4.7)	77.7 (±4.7)
Ohio	81.7 (±3.9)	91.0 (±2.6)	91.5 (±2.9)	95.6 (±1.8)	87.6 (±3.2)	36.7 (±4.8)	78.6 (±4.1)	78.0 (±4.1)
Wisconsin	84.4 (±3.6)	92.0 (±2.5)	92.2 (±2.5)	94.4 (±2.1)	84.4 (±3.4)	32.8 (±4.4)	79.3 (±3.9)	77.7 (±4.0)
<b>Total</b>	<b>82.3 (±2.0)</b>	<b>90.5 (±1.5)</b>	<b>91.5 (±1.5)</b>	<b>93.1 (±1.3)</b>	<b>87.9 (±1.5)</b>	<b>30.6 (±2.2)</b>	<b>78.9 (±2.1)</b>	<b>77.7 (±2.1)</b>
<b>East South Central</b>								
Alabama	87.7 (±3.8)	91.4 (±3.2)	95.0 (±2.2)	95.6 (±2.3)	86.3 (±3.7)	52.5 (±5.5)	84.0 (±4.2)	82.1 (±4.3)
Kentucky	86.5 (±4.3)	92.4 (±3.3)	91.6 (±3.5)	95.0 (±2.7)	89.2 (±3.7)	49.4 (±6.2)	83.0 (±4.7)	81.6 (±4.9)
Mississippi	85.2 (±4.6)	91.8 (±3.8)	93.0 (±3.2)	95.0 (±3.1)	89.8 (±4.0)	27.7 (±5.8)	83.7 (±4.9)	83.7 (±4.9)
Tennessee	84.6 (±3.3)	92.6 (±2.2)	93.2 (±2.1)	94.4 (±2.3)	86.1 (±3.1)	41.6 (±4.4)	82.6 (±3.4)	81.5 (±3.5)
<b>Total</b>	<b>86.0 (±2.0)</b>	<b>92.1 (±1.5)</b>	<b>93.3 (±1.3)</b>	<b>95.0 (±1.3)</b>	<b>87.5 (±1.8)</b>	<b>43.8 (±2.7)</b>	<b>83.3 (±2.1)</b>	<b>82.1 (±2.2)</b>
<b>Middle Atlantic</b>								
New Jersey	85.8 (±5.7)	94.5 (±2.7)	96.1 (±2.1)	94.4 (±3.8)	90.0 (±4.1)	51.3 (±7.1)	85.0 (±5.7)	82.3 (±6.2)
New York	89.2 (±3.1)	92.6 (±2.6)	95.1 (±2.2)	94.6 (±2.5)	91.2 (±3.2)	46.1 (±5.0)	85.7 (±3.5)	84.5 (±3.6)
Pennsylvania	87.4 (±3.4)	91.8 (±2.8)	94.4 (±2.4)	97.0 (±1.6)	88.8 (±3.2)	57.7 (±5.0)	84.0 (±3.7)	83.2 (±3.8)
<b>Total</b>	<b>87.9 (±2.2)</b>	<b>92.8 (±1.6)</b>	<b>95.1 (±1.4)</b>	<b>95.2 (±1.6)</b>	<b>90.2 (±2.0)</b>	<b>50.5 (±3.3)</b>	<b>85.1 (±2.4)</b>	<b>83.7 (±2.5)</b>
<b>Mountain</b>								
Arizona	80.5 (±4.1)	88.9 (±3.1)	88.0 (±3.4)	90.4 (±2.8)	83.4 (±3.7)	46.4 (±5.0)	77.8 (±4.2)	75.9 (±4.3)
Colorado	83.7 (±4.8)	93.3 (±3.4)	93.3 (±3.0)	94.5 (±3.3)	86.6 (±4.5)	39.3 (±6.3)	78.2 (±5.3)	75.8 (±5.6)
Idaho	78.8 (±4.9)	90.6 (±3.4)	90.7 (±3.5)	93.5 (±2.8)	80.4 (±4.6)	— <sup>§§§</sup>	76.4 (±5.0)	76.4 (±5.0)
Montana	86.6 (±3.9)	92.4 (±3.1)	91.9 (±3.1)	94.9 (±2.7)	85.6 (±4.0)	35.4 (±5.8)	82.8 (±4.3)	81.9 (±4.4)
New Mexico	77.3 (±6.0)	84.8 (±5.2)	85.9 (±5.1)	90.0 (±4.2)	86.6 (±4.7)	35.4 (±6.7)	73.3 (±6.3)	71.1 (±6.4)
Nevada	79.1 (±5.7)	90.3 (±4.3)	91.6 (±4.3)	88.2 (±4.8)	85.3 (±5.0)	28.7 (±5.8)	78.5 (±5.7)	75.7 (±5.9)
Utah	79.2 (±5.4)	90.8 (±3.5)	90.7 (±3.5)	92.0 (±3.4)	77.7 (±5.3)	23.7 (±5.0)	76.8 (±5.5)	75.6 (±5.6)
Wyoming	84.5 (±4.4)	90.5 (±3.4)	89.5 (±3.6)	93.2 (±3.0)	88.6 (±3.7)	30.4 (±5.4)	80.4 (±4.7)	79.9 (±4.7)
<b>Total</b>	<b>80.7 (±2.0)</b>	<b>90.1 (±1.5)</b>	<b>90.1 (±1.5)</b>	<b>91.7 (±1.4)</b>	<b>83.8 (±1.8)</b>	<b>34.8 (±2.3)</b>	<b>77.5 (±2.1)</b>	<b>75.7 (±2.2)</b>

**TABLE 2. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by census division and state — United States, National Immunization Survey, 1998\***

Census division/ State	DTP <sup>†</sup>	Polio <sup>§</sup>	MCV <sup>¶</sup>	Hib <sup>**</sup>	Hep B <sup>†</sup>	Varicella <sup>§§</sup>	4:3:1 <sup>¶¶</sup>	4:3:1:3 <sup>***</sup>
	% (95% CI <sup>¶¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)				
<b>New England</b>								
Connecticut	95.0 (±2.5)	94.4 (±2.8)	96.6 (±2.1)	98.2 (±1.6)	89.8 (±3.8)	45.4 (±6.3)	90.7 (±3.4)	90.0 (±3.5)
Massachusetts	91.1 (±3.4)	93.5 (±2.5)	96.0 (±2.0)	98.4 (±1.3)	90.5 (±3.2)	47.7 (±5.4)	87.4 (±3.8)	86.7 (±3.9)
Maine	91.4 (±3.5)	96.8 (±2.1)	93.6 (±3.1)	94.4 (±2.8)	89.5 (±3.7)	31.3 (±5.4)	89.0 (±3.9)	86.3 (±4.2)
New Hampshire	91.4 (±3.4)	92.3 (±3.3)	94.8 (±2.7)	94.9 (±2.7)	89.4 (±3.6)	41.4 (±5.9)	85.1 (±4.3)	82.2 (±4.6)
Rhode Island	90.1 (±3.6)	96.2 (±2.2)	96.5 (±2.2)	97.0 (±2.1)	88.8 (±3.8)	56.3 (±6.2)	87.3 (±3.9)	86.3 (±4.1)
Vermont	91.8 (±3.5)	94.7 (±3.2)	96.4 (±2.3)	97.4 (±2.0)	91.4 (±3.3)	37.8 (±5.9)	87.3 (±4.3)	85.8 (±4.4)
<b>Total</b>	<b>92.1 (±1.8)</b>	<b>94.2 (±1.4)</b>	<b>95.9 (±1.1)</b>	<b>97.5 (±0.8)</b>	<b>90.0 (±1.8)</b>	<b>45.4 (±3.1)</b>	<b>88.2 (±2.1)</b>	<b>87.1 (±2.1)</b>
<b>Pacific</b>								
Alaska	85.2 (±4.2)	92.3 (±3.1)	91.1 (±3.4)	92.4 (±3.2)	85.3 (±4.4)	13.4 (±4.0)	82.7 (±4.5)	81.3 (±4.6)
California	81.6 (±3.4)	88.4 (±2.9)	91.5 (±2.6)	91.7 (±2.5)	87.1 (±2.9)	55.2 (±4.2)	77.7 (±3.7)	75.9 (±3.8)
Hawaii	84.2 (±4.9)	91.7 (±3.8)	94.9 (±2.8)	92.8 (±3.4)	87.4 (±4.5)	52.8 (±6.4)	81.7 (±5.2)	79.3 (±5.5)
Oregon	79.2 (±5.1)	86.5 (±4.1)	89.8 (±3.6)	91.8 (±3.3)	81.8 (±4.7)	43.3 (±6.0)	75.5 (±5.3)	75.5 (±5.3)
Washington	84.4 (±3.5)	91.9 (±2.7)	90.0 (±3.1)	94.8 (±2.2)	81.3 (±3.7)	21.2 (±3.7)	81.1 (±3.8)	80.8 (±3.8)
<b>Total</b>	<b>81.9 (±2.7)</b>	<b>88.8 (±2.3)</b>	<b>91.3 (±2.0)</b>	<b>92.1 (±2.0)</b>	<b>86.1 (±2.3)</b>	<b>49.9 (±3.4)</b>	<b>78.1 (±2.9)</b>	<b>76.6 (±3.0)</b>
<b>South Atlantic</b>								
District of Columbia	76.8 (±5.9)	87.6 (±4.4)	93.0 (±3.3)	91.6 (±4.0)	81.9 (±5.5)	59.9 (±6.9)	73.7 (±6.0)	71.4 (±6.2)
Delaware	85.5 (±4.5)	90.0 (±3.9)	94.1 (±3.1)	94.1 (±2.9)	83.5 (±4.7)	45.6 (±6.3)	80.6 (±5.0)	78.9 (±5.1)
Florida	84.7 (±3.7)	89.4 (±3.3)	92.3 (±2.9)	92.5 (±3.0)	90.0 (±3.2)	36.0 (±4.9)	80.9 (±4.1)	78.7 (±4.2)
Georgia	84.1 (±3.8)	91.7 (±2.9)	91.7 (±2.9)	94.5 (±2.4)	89.2 (±3.2)	43.6 (±5.1)	81.1 (±4.0)	80.1 (±4.1)
Maryland	84.1 (±4.3)	89.9 (±3.6)	89.1 (±3.9)	92.3 (±3.4)	87.3 (±4.1)	53.2 (±5.5)	78.8 (±4.7)	77.0 (±4.8)
North Carolina	87.1 (±4.3)	93.7 (±3.0)	95.6 (±2.5)	94.8 (±2.6)	88.8 (±4.0)	59.8 (±6.1)	84.1 (±4.6)	82.8 (±4.7)
South Carolina	90.4 (±3.8)	96.0 (±2.2)	94.4 (±2.9)	97.9 (±1.7)	94.1 (±2.7)	51.4 (±6.5)	88.4 (±4.0)	87.9 (±4.1)
Virginia	86.4 (±4.5)	91.2 (±3.7)	90.1 (±4.1)	94.3 (±3.0)	90.3 (±3.9)	50.4 (±6.4)	82.0 (±5.1)	80.4 (±5.3)
West Virginia	88.1 (±3.8)	92.4 (±3.2)	92.5 (±3.1)	96.9 (±2.2)	90.1 (±3.7)	42.5 (±6.0)	82.7 (±4.5)	82.4 (±4.5)
<b>Total</b>	<b>85.6 (±1.7)</b>	<b>91.4 (±1.4)</b>	<b>92.2 (±1.3)</b>	<b>94.0 (±1.2)</b>	<b>89.6 (±1.5)</b>	<b>46.7 (±2.3)</b>	<b>81.9 (±1.8)</b>	<b>80.3 (±1.9)</b>

**TABLE 2. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by census division and state — United States, National Immunization Survey, 1998\***

Census division/ State	DTP <sup>†</sup> % (95% CI <sup>†††</sup> )	Polio <sup>§</sup> % (95% CI)	MCV <sup>¶</sup> % (95% CI)	Hib <sup>**</sup> % (95% CI)	Hep B <sup>††</sup> % (95% CI)	Varicella <sup>§§</sup> % (95% CI)	4:3:1 <sup>¶¶</sup> % (95% CI)	4:3:1:3 <sup>***</sup> % (95% CI)
<b>West North Central</b>								
Iowa	86.0 (±4.0)	91.9 (±3.2)	92.5 (±3.2)	93.9 (±3.0)	89.2 (±3.5)	33.0 (±5.3)	83.4 (±4.3)	81.7 (±4.5)
Kansas	85.1 (±4.8)	93.9 (±3.2)	90.8 (±4.0)	91.2 (±4.0)	83.7 (±4.9)	42.5 (±6.4)	83.6 (±4.9)	81.8 (±5.2)
Minnesota	88.5 (±4.0)	90.7 (±3.7)	93.3 (±3.2)	95.5 (±2.7)	86.2 (±4.1)	46.1 (±6.1)	83.1 (±4.7)	82.2 (±4.8)
Missouri	87.8 (±4.8)	96.6 (±2.0)	92.8 (±3.5)	96.6 (±2.6)	83.6 (±5.5)	36.4 (±6.6)	85.8 (±5.0)	84.5 (±5.1)
North Dakota	83.3 (±4.7)	89.4 (±3.8)	87.6 (±4.2)	92.3 (±3.3)	86.3 (±4.1)	36.4 (±5.6)	79.8 (±5.0)	79.1 (±5.0)
Nebraska	83.7 (±4.4)	89.4 (±3.7)	90.2 (±3.5)	93.2 (±3.0)	87.1 (±3.9)	35.1 (±5.5)	78.0 (±4.9)	76.4 (±5.0)
South Dakota	78.6 (±5.1)	90.5 (±3.5)	89.8 (±3.9)	92.7 (±3.1)	82.1 (±5.1)	12.9 (±4.1)	75.1 (±5.6)	73.5 (±5.7)
<b>Total</b>	<b>86.4 (±2.0)</b>	<b>92.9 (±1.4)</b>	<b>92.1 (±1.5)</b>	<b>94.5 (±1.3)</b>	<b>85.4 (±2.2)</b>	<b>38.2 (±2.8)</b>	<b>83.1 (±2.2)</b>	<b>81.7 (±2.2)</b>
<b>West South Central</b>								
Arkansas	75.8 (±5.2)	90.1 (±3.6)	87.9 (±4.0)	89.5 (±3.8)	84.4 (±4.3)	27.8 (±5.3)	74.8 (±5.3)	73.1 (±5.4)
Louisiana	82.0 (±4.7)	91.4 (±3.4)	88.3 (±4.1)	93.5 (±3.1)	87.0 (±3.8)	37.6 (±5.7)	79.7 (±4.9)	78.4 (±5.0)
Oklahoma	79.7 (±6.0)	93.5 (±3.8)	94.1 (±3.5)	88.7 (±5.1)	85.4 (±5.2)	49.5 (±7.0)	78.5 (±6.1)	75.3 (±6.4)
Texas	78.3 (±3.6)	87.6 (±2.8)	89.8 (±2.6)	91.3 (±2.3)	79.1 (±3.5)	44.1 (±4.3)	74.8 (±3.7)	74.3 (±3.8)
<b>Total</b>	<b>78.8 (±2.6)</b>	<b>88.9 (±2.1)</b>	<b>89.9 (±1.9)</b>	<b>91.2 (±1.7)</b>	<b>81.1 (±2.5)</b>	<b>42.5 (±3.2)</b>	<b>75.8 (±2.8)</b>	<b>74.8 (±2.8)</b>
<b>National</b>	<b>83.9 (±0.8)</b>	<b>90.8 (±0.7)</b>	<b>92.1 (±0.6)</b>	<b>93.4 (±0.6)</b>	<b>87.0 (±0.7)</b>	<b>43.2 (±1.0)</b>	<b>80.6 (±0.9)</b>	<b>79.2 (±0.9)</b>

\* Children in this survey period were born during February 1995–May 1997. n = 21,827.

<sup>†</sup> Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DPT) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

<sup>§</sup> Three or more doses of poliovirus vaccine (Polio).

<sup>¶</sup> One or more doses of measles-containing vaccine (MCV).

\*\* Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

<sup>††</sup> Three or more doses of hepatitis B vaccine (Hep B).

<sup>§§</sup> One or more doses of varicella vaccine.

<sup>¶¶</sup> Four or more doses of DTP, three or more doses of Polio, and one or more doses of MCV.

<sup>\*\*\*</sup> Four or more doses of DTP, three or more doses of Polio, one or more doses of MCV, and three or more doses of Hib.

<sup>†††</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

<sup>§§§</sup> The standard of reliability for data presented in this report is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the numerator was <30.

**TABLE 3. Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by selected geographic area — United States, National Immunization Survey, 1998\***

Geographic area	DTP <sup>†</sup>		Polio <sup>§</sup>		MCV <sup>¶</sup>		Hib <sup>**</sup>		Hep B <sup>†</sup>		Varicella <sup>§§</sup>		4:3:1 <sup>¶¶</sup>		4:3:1:3 <sup>***</sup>	
	%	(95% CI <sup>¶¶</sup> )	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>Alabama</b>																
Jefferson County	87.4	(±4.5)	92.9	(±3.3)	94.1	(±3.4)	96.3	(±2.5)	86.1	(±4.5)	64.0	(±6.6)	85.8	(±4.7)	84.7	(±4.8)
Rest of state	87.7	(±4.4)	91.1	(±3.7)	95.1	(±2.5)	95.4	(±2.7)	86.3	(±4.2)	50.4	(±6.3)	83.7	(±4.8)	81.7	(±5.0)
<b>Arizona</b>																
Maricopa County	82.5	(±5.4)	89.7	(±4.1)	88.4	(±4.5)	91.6	(±3.7)	84.6	(±5.2)	46.7	(±7.0)	79.5	(±5.6)	77.3	(±5.8)
Rest of state	77.4	(±6.1)	87.7	(±4.7)	87.2	(±4.8)	88.5	(±4.3)	81.6	(±5.1)	45.9	(±6.7)	75.2	(±6.1)	73.5	(±6.2)
<b>California</b>																
Los Angeles County	79.2	(±5.6)	88.9	(±4.5)	89.5	(±4.6)	92.9	(±3.9)	86.8	(±4.9)	59.3	(±6.8)	76.5	(±5.9)	76.0	(±6.0)
San Diego County	82.5	(±4.8)	86.7	(±4.3)	94.1	(±2.9)	89.3	(±4.1)	80.2	(±5.1)	63.3	(±6.1)	79.5	(±5.1)	77.2	(±5.4)
Santa Clara County	88.1	(±4.2)	93.0	(±3.2)	95.7	(±2.6)	94.8	(±2.8)	86.6	(±4.6)	59.8	(±6.6)	85.7	(±4.5)	84.3	(±4.7)
Rest of state	82.1	(±5.2)	88.0	(±4.5)	91.9	(±3.8)	91.2	(±4.0)	88.3	(±4.3)	51.3	(±6.5)	77.4	(±5.6)	74.8	(±5.8)
<b>District of Columbia</b>	76.8	(±5.9)	87.6	(±4.4)	93.0	(±3.3)	91.6	(±4.0)	81.9	(±5.5)	59.9	(±6.9)	73.7	(±6.0)	71.4	(±6.2)
<b>Florida</b>																
Dade County	79.4	(±5.8)	89.3	(±4.6)	95.3	(±2.6)	91.7	(±4.4)	87.4	(±4.9)	32.5	(±6.0)	76.6	(±5.9)	74.8	(±6.0)
Duval County	84.9	(±5.3)	92.6	(±3.6)	92.9	(±3.5)	97.3	(±2.1)	94.2	(±3.2)	44.0	(±7.2)	80.4	(±5.8)	78.7	(±6.0)
Rest of state	85.9	(±4.7)	89.2	(±4.2)	91.6	(±3.8)	92.3	(±3.7)	90.3	(±4.0)	36.1	(±6.2)	81.9	(±5.1)	79.5	(±5.3)
<b>Georgia</b>																
Fulton/Dekalb counties	79.1	(±6.3)	90.5	(±5.3)	89.3	(±5.3)	91.2	(±5.4)	87.5	(±5.5)	49.7	(±7.3)	75.6	(±6.6)	71.1	(±6.9)
Rest of state	85.3	(±4.4)	92.0	(±3.3)	92.2	(±3.3)	95.2	(±2.6)	89.6	(±3.7)	42.1	(±6.0)	82.4	(±4.8)	82.2	(±4.8)
<b>Illinois</b>																
City of Chicago	71.1	(±7.3)	85.9	(±5.7)	86.4	(±5.5)	86.9	(±5.4)	79.6	(±6.4)	30.7	(±6.7)	66.7	(±7.4)	64.4	(±7.4)
Rest of state	86.8	(±5.2)	92.5	(±4.1)	93.3	(±4.1)	94.8	(±3.8)	93.6	(±3.4)	23.8	(±5.2)	84.2	(±5.4)	82.8	(±5.5)
<b>Indiana</b>																
Marion County	81.8	(±5.1)	89.4	(±3.8)	90.1	(±3.7)	93.4	(±3.1)	81.5	(±4.9)	29.8	(±5.8)	78.2	(±5.3)	78.2	(±5.3)
Rest of state	81.1	(±5.4)	88.5	(±4.5)	93.4	(±3.3)	90.2	(±4.2)	83.9	(±5.0)	30.3	(±5.8)	79.1	(±5.5)	77.3	(±5.6)
<b>Louisiana</b>																
Orleans Parish	82.8	(±5.3)	90.1	(±4.2)	86.4	(±5.0)	92.6	(±3.8)	82.7	(±5.4)	35.3	(±6.4)	79.5	(±5.7)	78.8	(±5.7)
Rest of state	81.9	(±5.3)	91.6	(±3.8)	88.6	(±4.6)	93.7	(±3.5)	87.6	(±4.3)	37.9	(±6.4)	79.7	(±5.5)	78.3	(±5.6)
<b>Massachusetts</b>																
City of Boston	92.8	(±3.0)	96.0	(±2.5)	98.4	(±1.3)	98.1	(±1.5)	93.7	(±3.2)	49.7	(±6.6)	90.1	(±3.5)	89.3	(±3.6)
Rest of state	90.9	(±3.8)	93.2	(±2.8)	95.7	(±2.2)	98.4	(±1.4)	90.2	(±3.5)	47.4	(±6.0)	87.1	(±4.2)	86.4	(±4.3)

**TABLE 3. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by selected geographic area — United States, National Immunization Survey, 1998\***

Geographic area	DTP <sup>†</sup>	Polio <sup>§</sup>	MCV <sup>¶</sup>	Hib <sup>**</sup>	Hep B <sup>†</sup>	Varicella <sup>§§</sup>	4:3:1 <sup>¶¶</sup>	4:3:1:3 <sup>***</sup>
	% (95% CI <sup>¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
<b>Maryland</b>								
City of								
Baltimore	85.5 (±5.1)	93.7 (±3.3)	93.2 (±3.6)	97.1 (±2.3)	82.7 (±7.4)	54.7 (±7.7)	81.2 (±5.7)	81.2 (±5.7)
Rest of state	83.9 (±4.9)	89.3 (±4.2)	88.4 (±4.5)	91.4 (±4.0)	88.2 (±4.6)	53.0 (±6.3)	78.4 (±5.4)	76.3 (±5.6)
<b>Michigan</b>								
Detroit	74.6 (±6.1)	83.9 (±5.4)	88.1 (±4.3)	85.1 (±5.2)	82.8 (±5.5)	25.6 (±6.0)	71.6 (±6.3)	69.6 (±6.4)
Rest of state	83.9 (±4.9)	91.1 (±3.8)	91.1 (±3.8)	93.0 (±3.4)	91.6 (±3.3)	30.1 (±5.7)	80.0 (±5.3)	78.9 (±5.4)
<b>New Jersey</b>								
City of Newark	71.0 (±8.3)	75.8 (±8.2)	84.9 (±7.5)	91.3 (±4.5)	88.3 (±5.2)	20.4 (±6.4)	66.3 (±8.7)	64.2 (±8.7)
Rest of state	86.5 (±6.0)	95.4 (±2.8)	96.7 (±2.1)	94.5 (±4.0)	90.0 (±4.3)	52.8 (±7.5)	85.9 (±6.0)	83.2 (±6.5)
<b>New York</b>								
New York City	85.0 (±5.3)	91.6 (±3.9)	95.4 (±2.9)	91.3 (±4.4)	90.0 (±4.8)	52.0 (±7.4)	82.8 (±5.5)	81.1 (±5.8)
Rest of state	92.9 (±3.7)	93.4 (±3.5)	94.8 (±3.2)	97.4 (±2.4)	92.3 (±4.2)	40.9 (±6.7)	88.3 (±4.4)	87.5 (±4.5)
<b>Ohio</b>								
Cuyahoga County	81.4 (±5.6)	88.7 (±4.3)	91.5 (±3.9)	89.4 (±4.3)	87.7 (±4.9)	45.8 (±6.8)	77.5 (±5.8)	74.6 (±6.0)
Franklin County	84.6 (±5.4)	85.6 (±5.3)	93.3 (±3.6)	95.5 (±3.0)	83.3 (±6.0)	41.8 (±7.4)	77.8 (±6.2)	77.8 (±6.2)
Rest of state	81.4 (±5.0)	92.2 (±3.2)	91.2 (±3.7)	96.7 (±2.1)	88.2 (±4.0)	34.4 (±6.1)	78.9 (±5.2)	78.7 (±5.2)
<b>Pennsylvania</b>								
City of								
Philadelphia	85.5 (±5.2)	90.6 (±4.2)	93.0 (±4.2)	92.8 (±3.7)	82.1 (±5.3)	68.6 (±6.6)	81.7 (±5.6)	79.8 (±5.8)
Rest of state	87.8 (±3.9)	92.0 (±3.3)	94.6 (±2.8)	97.8 (±1.8)	90.0 (±3.6)	55.7 (±5.8)	84.4 (±4.3)	83.8 (±4.3)
<b>Tennessee</b>								
Davidson County	84.0 (±4.8)	88.7 (±4.3)	94.7 (±3.0)	94.7 (±3.1)	79.2 (±5.3)	49.1 (±6.7)	81.2 (±5.1)	79.7 (±5.3)
Shelby County	75.8 (±6.2)	90.1 (±4.3)	85.7 (±4.8)	92.1 (±4.0)	90.4 (±4.0)	34.4 (±6.4)	73.7 (±6.3)	71.2 (±6.5)
Rest of state	87.3 (±4.3)	94.0 (±2.9)	95.1 (±2.6)	95.1 (±3.0)	86.1 (±4.2)	42.5 (±5.9)	85.4 (±4.5)	84.7 (±4.6)
<b>Texas</b>								
Bexar County	82.9 (±5.1)	92.7 (±3.4)	92.1 (±3.7)	92.9 (±3.4)	91.6 (±3.7)	47.8 (±6.8)	79.6 (±5.4)	78.8 (±5.5)
City of Houston	64.6 (±7.5)	75.8 (±6.7)	86.7 (±5.1)	83.9 (±5.7)	68.5 (±7.2)	39.2 (±7.3)	61.2 (±7.5)	60.5 (±7.5)
Dallas County	75.6 (±6.4)	87.9 (±4.9)	86.5 (±4.9)	90.2 (±4.3)	73.4 (±6.8)	37.5 (±7.3)	72.5 (±6.6)	71.4 (±6.7)
El Paso County	81.4 (±4.7)	91.2 (±3.5)	88.6 (±3.9)	91.1 (±3.5)	76.1 (±5.2)	41.8 (±6.1)	78.6 (±5.0)	77.5 (±5.0)
Rest of state	80.8 (±5.2)	89.1 (±4.0)	90.9 (±3.8)	92.8 (±3.3)	81.0 (±5.0)	45.9 (±6.4)	77.1 (±5.5)	76.8 (±5.5)

**TABLE 3. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months, by selected geographic area — United States, National Immunization Survey, 1998\***

Geographic area	DTP <sup>†</sup>	Polio <sup>§</sup>	MCV <sup>¶</sup>	Hib <sup>**</sup>	Hep B <sup>††</sup>	Varicella <sup>§§</sup>	4:3:1 <sup>¶¶</sup>	4:3:1:3 <sup>***</sup>
	% (95% CI <sup>†††</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
<b>Washington</b>								
King County	89.4 (±4.3)	93.6 (±3.1)	94.4 (±3.2)	94.7 (±2.9)	79.6 (±5.3)	24.1 (±5.5)	86.7 (±4.6)	85.7 (±4.8)
Rest of state	82.5 (±4.6)	91.3 (±3.5)	88.4 (±4.1)	94.9 (±2.8)	81.9 (±4.6)	20.0 (±4.6)	79.0 (±5.0)	79.0 (±5.0)
<b>Wisconsin</b>								
Milwaukee County	79.8 (±5.6)	87.5 (±4.6)	87.8 (±4.9)	90.0 (±4.4)	76.5 (±5.6)	37.5 (±6.3)	74.6 (±6.0)	73.0 (±6.0)
Rest of state	85.7 (±4.3)	93.3 (±3.0)	93.5 (±2.9)	95.7 (±2.4)	86.7 (±4.1)	31.3 (±5.4)	80.7 (±4.8)	79.1 (±4.9)
<b>National</b>	<b>83.9 (±0.8)</b>	<b>90.8 (±0.7)</b>	<b>92.1 (±0.6)</b>	<b>93.4 (±0.6)</b>	<b>87.0 (±0.7)</b>	<b>43.2 (±1.0)</b>	<b>80.6 (±0.9)</b>	<b>79.2 (±0.9)</b>

\* Children in this survey period were born during February 1995–May 1997.

<sup>†</sup> Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

<sup>§</sup> Three or more doses of poliovirus vaccine (Polio).

<sup>¶</sup> One or more doses of measles-containing vaccine (MCV).

<sup>\*\*</sup> Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

<sup>††</sup> Three or more doses of hepatitis B vaccine (Hep B).

<sup>§§</sup> One or more doses of varicella vaccine.

<sup>¶¶</sup> Four or more doses of DTP, three or more doses of Polio, and one or more doses of MCV.

<sup>\*\*\*</sup> Four or more doses of DTP, three or more doses of Polio, one or more doses of MCV, and three or more doses of Hib.

<sup>†††</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

**TABLE 4. Estimated vaccination coverage with individual vaccines among children aged 19–35 months, by race/ethnicity,\* — United States, National Immunization Survey, 1998†**

Race/Ethnicity	DTP <sup>§</sup>	Polio <sup>¶</sup>	MCV <sup>**</sup>	Hib <sup>††</sup>	Hep B <sup>§§</sup>	Varicella <sup>¶¶</sup>
	% (95% CI <sup>***</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)
White, non-Hispanic	86.6 (±0.9)	92.2 (±0.7)	93.3 (±0.7)	95.0 (±0.6)	88.3 (±0.8)	41.9 (±1.2)
Black, non-Hispanic	77.3 (±2.5)	87.8 (±2.0)	88.9 (±1.9)	90.1 (±1.9)	83.7 (±2.2)	42.4 (±2.8)
Hispanic	80.5 (±2.3)	88.9 (±1.9)	91.2 (±1.6)	91.7 (±1.6)	85.7 (±2.0)	46.9 (±2.8)
American Indian/ Alaskan Native	82.9 (±8.5)	85.1 (±8.6)	91.4 (±7.0)	90.0 (±7.1)	81.6 (±7.7)	28.0 (±8.0)
Asian/Pacific Islander	89.1 (±3.4)	93.4 (±2.8)	92.4 (±3.3)	92.3 (±3.5)	89.0 (±3.6)	52.6 (±5.8)

\* Children of Hispanic origin can be of any race. However, in this analysis, the race groups non-Hispanic white, non-Hispanic black, American Indian/Alaskan Native, and Asian/Pacific Islander do not include children of Hispanic origin.

† Children in this survey period were born during February 1995–May 1997.

§ Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

¶ Three or more doses of poliovirus vaccine (Polio).

\*\* One or more doses of measles-containing vaccine (MCV).

†† Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

§§ Three or more doses of hepatitis B vaccine (Hep B).

¶¶ One or more doses of varicella vaccine.

\*\*\* Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

**TABLE 5. Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by census division and state — United States, National Immunization Survey, 1998†**

Census division/ State	DTP <sup>§</sup>		Polio <sup>¶</sup>		MCV <sup>**</sup>		Hib <sup>†</sup>		Hep B <sup>§§</sup>		Varicella <sup>¶¶</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>†††</sup>		Living below poverty
	% (95% CI <sup>¶¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	level (%) <sup>§§§</sup>								
<b>East North Central</b>																	
Illinois	71.2 (±12.2)	89.4 (± 6.9)	83.7 (± 8.9)	88.2 (± 7.3)	77.6 (± 9.5)	—	****	67.9 (±12.1)	65.1 (±12.1)	18.3							
Indiana	72.0 (±13.6)	85.8 (±11.1)	88.0 (± 9.8)	79.3 (±12.5)	81.3 (±11.4)	32.8 (±13.2)	72.0 (±13.6)	72.0 (±13.6)	16.2								
Michigan	82.1 (± 8.3)	88.5 (± 7.3)	91.4 (± 6.3)	88.8 (± 6.7)	86.5 (± 7.9)	35.8 (±12.7)	77.1 (± 9.6)	76.1 (± 9.6)	15.8								
Ohio	75.0 (± 9.0)	82.7 (± 7.8)	88.0 (± 7.0)	88.8 (± 6.5)	84.1 (± 7.8)	32.8 (±10.2)	72.9 (± 9.2)	71.6 (± 9.2)	20.4								
Wisconsin	68.1 (±12.2)	84.5 (± 9.0)	82.7 (± 9.0)	86.9 (± 8.5)	74.4 (±11.2)	—	****	61.9 (±12.6)	60.0 (±12.8)	15.8							
<b>Total</b>	<b>74.1 (± 5.3)</b>	<b>86.4 (± 3.7)</b>	<b>86.8 (± 3.9)</b>	<b>87.3 (± 3.7)</b>	<b>81.3 (± 4.3)</b>	<b>28.1 (± 5.1)</b>	<b>71.0 (± 5.4)</b>	<b>69.4 (± 5.4)</b>	<b>17.7</b>								
<b>East South Central</b>																	
Alabama	80.0 (± 9.5)	92.8 (± 6.3)	89.8 (± 6.9)	95.8 (± 3.8)	86.1 (± 7.9)	53.7 (±11.4)	79.4 (± 9.5)	77.9 (± 9.7)	23.1								
Kentucky	78.6 (±10.7)	89.2 (± 8.2)	82.7 (± 9.9)	91.5 (± 7.3)	91.1 (± 7.1)	—	****	76.5 (±11.1)	74.8 (±11.4)	27.7							
Mississippi	79.0 (± 9.6)	90.4 (± 6.9)	91.4 (± 6.3)	95.7 (± 5.1)	91.6 (± 6.6)	—	****	76.4 (±10.5)	76.4 (±10.5)	30.3							
Tennessee	83.6 (± 6.0)	88.9 (± 5.4)	87.6 (± 5.6)	91.1 (± 4.9)	86.2 (± 6.3)	35.2 (± 8.8)	80.8 (± 6.5)	78.0 (± 6.9)	23.0								
<b>Total</b>	<b>80.5 (± 4.5)</b>	<b>90.3 (± 3.4)</b>	<b>87.7 (± 3.7)</b>	<b>93.3 (± 2.7)</b>	<b>88.6 (± 3.5)</b>	<b>38.2 (± 5.5)</b>	<b>78.4 (± 4.7)</b>	<b>76.8 (± 4.8)</b>	<b>25.4</b>								
<b>Middle Atlantic</b>																	
New Jersey	79.2 (±20.7)	94.9 (± 5.4)	96.1 (± 5.2)	85.1 (±19.7)	92.7 (± 8.4)	—	****	78.7 (±20.6)	67.4 (±24.3)	14.5							
New York	84.8 (± 7.9)	91.3 (± 5.9)	91.9 (± 5.8)	90.0 (± 7.0)	87.6 (± 7.5)	46.8 (±10.5)	81.3 (± 8.4)	79.8 (± 8.7)	25.0								
Pennsylvania	92.0 (± 5.6)	95.9 (± 4.4)	96.6 (± 4.3)	98.7 (± 2.1)	88.8 (± 6.6)	66.6 (±10.9)	89.2 (± 6.7)	89.2 (± 6.7)	20.2								
<b>Total</b>	<b>85.9 (± 5.8)</b>	<b>93.1 (± 3.7)</b>	<b>93.8 (± 3.7)</b>	<b>91.6 (± 5.2)</b>	<b>88.7 (± 4.9)</b>	<b>51.8 (± 7.7)</b>	<b>83.0 (± 6.1)</b>	<b>80.4 (± 6.7)</b>	<b>21.3</b>								
<b>Mountain</b>																	
Arizona	77.3 (± 8.0)	89.0 (± 5.8)	84.4 (± 6.9)	82.5 (± 7.4)	78.0 (± 7.8)	39.2 (± 9.7)	76.0 (± 8.0)	69.7 (± 8.7)	27.6								
Colorado	89.1 (± 9.8)	92.5 (± 9.1)	95.5 (± 6.1)	95.6 (± 5.9)	86.7 (±10.2)	—	****	80.4 (±13.0)	78.1 (±13.4)	17.8							
Idaho	77.5 (±11.7)	93.3 (± 7.3)	92.4 (± 8.0)	98.2 (± 3.5)	83.1 (± 9.7)	—	****	75.4 (±11.9)	75.4 (±11.9)	18.7							
Montana	88.1 (± 7.2)	92.3 (± 6.3)	96.9 (± 3.6)	95.8 (± 4.2)	84.4 (± 8.4)	—	****	84.6 (± 8.4)	84.6 (± 8.4)	22.9							
New Mexico	78.2 (±10.1)	80.6 (± 9.9)	80.1 (±10.0)	88.5 (± 7.5)	84.0 (± 9.1)	—	****	72.0 (±11.0)	70.8 (±11.1)	34.5							
Nevada	74.4 (±13.9)	88.2 (± 9.7)	88.2 (±11.5)	83.3 (±11.4)	90.8 (± 8.6)	—	****	74.4 (±13.9)	69.4 (±14.5)	20.4							
Utah	76.2 (±19.3)	92.5 (±10.6)	94.2 (± 6.9)	94.9 (± 9.8)	79.4 (±14.1)	—	****	73.8 (±19.3)	73.8 (±19.3)	16.8							
Wyoming	79.9 (±11.4)	91.1 (± 7.3)	88.1 (± 8.6)	91.6 (± 6.6)	90.3 (± 7.5)	—	****	73.5 (±12.0)	72.3 (±12.0)	20.5							
<b>Total</b>	<b>79.5 (± 4.5)</b>	<b>89.0 (± 3.4)</b>	<b>88.1 (± 3.4)</b>	<b>88.7 (± 3.4)</b>	<b>82.6 (± 4.0)</b>	<b>33.4 (± 5.2)</b>	<b>75.9 (± 4.7)</b>	<b>72.7 (± 4.9)</b>	<b>22.9</b>								

**TABLE 5. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by census division and state — United States, National Immunization Survey, 1998†**

Census division/ State	DTP <sup>6</sup>		Polio <sup>1</sup>		MCV <sup>**</sup>		Hib <sup>†</sup>		Hep B <sup>5s</sup>		Varicella <sup>1†</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>††</sup>		Living below poverty level (%) <sup>§§§</sup>
	% (95% CI <sup>¶¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)								
<b>New England</b>																	
Connecticut	95.3 (± 6.6)	97.2 (± 5.5)	92.4 (± 8.4)	97.2 (± 5.5)	85.2 (± 12.1)	—	****	92.4 (± 8.4)	92.4 (± 8.4)	12.9							
Massachusetts	81.9 (± 13.7)	96.3 (± 4.4)	91.4 (± 7.1)	99.6 (± 0.6)	95.1 (± 5.4)	49.1 (± 14.7)	81.4 (± 13.7)	81.2 (± 13.7)	16.9								
Maine	84.6 (± 11.6)	94.5 (± 7.4)	86.7 (± 11.1)	94.0 (± 8.0)	87.2 (± 11.8)	—	****	79.9 (± 12.8)	79.9 (± 12.8)	16.4							
New Hampshire	96.3 (± 7.2)	—	****	93.0 (± 9.4)	—	****	94.1 (± 8.5)	—	****	—	****	—	****	12.1			
Rhode Island	77.7 (± 11.5)	91.6 (± 7.4)	91.1 (± 7.9)	94.0 (± 6.7)	89.6 (± 9.3)	—	****	74.2 (± 12.0)	71.8 (± 12.5)	20.0							
Vermont	87.1 (± 10.9)	90.3 (± 10.5)	98.4 (± 3.2)	98.3 (± 3.3)	90.9 (± 8.9)	—	****	80.6 (± 13.3)	78.9 (± 13.5)	17.5							
<b>Total</b>	<b>85.8 (± 7.3)</b>	<b>94.9 (± 2.8)</b>	<b>91.6 (± 4.2)</b>	<b>97.4 (± 1.7)</b>	<b>91.5 (± 4.1)</b>	<b>47.0 (± 8.5)</b>	<b>82.8 (± 7.4)</b>	<b>81.8 (± 7.4)</b>	<b>15.6</b>								
<b>Pacific</b>																	
Alaska	80.2 (± 13.1)	92.2 (± 8.7)	86.6 (± 11.4)	84.8 (± 11.7)	73.5 (± 14.7)	—	****	80.2 (± 13.1)	76.2 (± 13.8)	15.7							
California	75.9 (± 6.4)	90.5 (± 4.1)	90.9 (± 4.3)	91.4 (± 4.3)	86.5 (± 5.3)	52.1 (± 7.5)	71.7 (± 6.8)	67.7 (± 7.2)	28.4								
Hawaii	90.0 (± 8.1)	95.7 (± 4.9)	97.6 (± 3.4)	96.0 (± 4.6)	93.6 (± 6.9)	58.1 (± 13.7)	86.9 (± 8.9)	85.3 (± 9.4)	21.9								
Oregon	86.7 (± 8.0)	92.2 (± 6.2)	93.3 (± 5.8)	91.9 (± 6.4)	90.4 (± 7.5)	—	****	85.6 (± 8.3)	85.6 (± 8.3)	22.4							
Washington	75.6 (± 10.0)	84.4 (± 9.2)	87.4 (± 8.7)	89.1 (± 7.6)	77.8 (± 9.7)	—	****	72.4 (± 10.4)	72.4 (± 10.4)	18.3							
<b>Total</b>	<b>76.8 (± 5.4)</b>	<b>90.3 (± 3.6)</b>	<b>90.9 (± 3.6)</b>	<b>91.3 (± 3.7)</b>	<b>86.1 (± 4.5)</b>	<b>47.9 (± 6.4)</b>	<b>72.9 (± 5.8)</b>	<b>69.5 (± 6.1)</b>	<b>26.5</b>								
<b>South Atlantic</b>																	
District of Columbia	70.8 (± 11.8)	83.4 (± 9.0)	92.0 (± 6.5)	89.9 (± 8.4)	76.2 (± 11.3)	46.1 (± 12.2)	65.8 (± 11.8)	62.6 (± 12.1)	32.9								
Delaware	78.2 (± 12.0)	85.4 (± 10.6)	96.2 (± 5.5)	86.8 (± 10.2)	84.3 (± 12.4)	—	****	74.5 (± 12.6)	70.5 (± 13.2)	21.7							
Florida	79.4 (± 9.8)	87.4 (± 8.5)	94.1 (± 5.7)	92.9 (± 6.1)	89.3 (± 7.1)	—	****	74.4 (± 10.6)	72.7 (± 10.8)	18.4							
Georgia	84.3 (± 7.9)	93.6 (± 5.7)	90.2 (± 6.6)	92.1 (± 6.1)	89.9 (± 6.7)	48.4 (± 11.2)	83.9 (± 7.9)	82.4 (± 8.1)	22.4								
Maryland	71.8 (± 13.9)	81.4 (± 12.2)	84.1 (± 11.8)	93.3 (± 8.1)	86.1 (± 9.3)	47.5 (± 14.5)	64.5 (± 14.3)	64.5 (± 14.3)	12.0								
North Carolina	90.8 (± 10.1)	93.0 (± 9.3)	99.0 (± 2.0)	96.8 (± 6.2)	90.8 (± 8.8)	—	****	86.0 (± 12.0)	86.0 (± 12.0)	17.5							
South Carolina	83.9 (± 9.1)	97.4 (± 3.0)	92.4 (± 6.6)	97.6 (± 2.7)	93.9 (± 5.0)	44.8 (± 12.5)	82.9 (± 9.3)	82.9 (± 9.3)	29.2								
Virginia	89.5 (± 11.3)	90.1 (± 10.9)	88.2 (± 12.5)	92.5 (± 10.0)	94.3 (± 8.1)	—	****	—	****	—	****	15.3					
West Virginia	80.9 (± 10.2)	84.9 (± 9.4)	87.8 (± 8.7)	89.4 (± 8.3)	90.5 (± 6.9)	—	****	74.9 (± 11.1)	74.9 (± 11.1)	22.7							
<b>Total</b>	<b>83.0 (± 4.1)</b>	<b>90.3 (± 3.4)</b>	<b>92.2 (± 2.8)</b>	<b>93.6 (± 2.7)</b>	<b>90.2 (± 3.0)</b>	<b>37.3 (± 5.2)</b>	<b>79.0 (± 4.5)</b>	<b>77.7 (± 4.6)</b>	<b>19.0</b>								

**TABLE 5. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by census division and state — United States, National Immunization Survey, 1998†**

Census division/ State	DTP <sup>§</sup>		Polio <sup>¶</sup>		MCV <sup>**</sup>		Hib <sup>††</sup>		Hep B <sup>§§</sup>		Varicella <sup>¶¶</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>†††</sup>		Living below poverty level (%) <sup>§§§</sup>		
	%	(95% CI <sup>¶¶¶</sup> )	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%		
<b>West North Central</b>																			
Iowa	—	****	82.6	(±14.2)	91.0	(±11.9)	80.5	(±14.5)	82.6	(±14.2)	—	****	—	****	—	****	—	****	12.9
Kansas	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	10.2
Minnesota	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	11.7
Missouri	81.3	(±13.2)	98.6	(± 2.7)	97.4	(± 5.1)	91.2	(±10.1)	—	****	—	****	81.3	(±13.2)	81.3	(±13.2)	—	****	19.7
North Dakota	77.3	(±14.5)	83.4	(±11.7)	87.8	(±12.1)	89.7	(± 9.9)	83.5	(±11.7)	—	****	75.4	(±14.7)	75.4	(±14.7)	—	****	15.0
Nebraska	76.2	(±13.1)	95.2	(± 6.6)	81.0	(±12.1)	97.1	(± 5.5)	86.8	(±10.3)	—	****	69.8	(±14.0)	69.8	(±14.0)	—	****	15.8
South Dakota	81.6	(± 9.1)	88.6	(± 7.8)	90.7	(± 7.8)	91.6	(± 6.9)	80.6	(±12.2)	—	****	76.9	(±11.7)	76.2	(±11.7)	—	****	23.9
<b>Total</b>	<b>80.5</b>	<b>(± 6.4)</b>	<b>93.7</b>	<b>(± 2.9)</b>	<b>93.1</b>	<b>(± 3.4)</b>	<b>90.3</b>	<b>(± 5.0)</b>	<b>78.3</b>	<b>(± 7.9)</b>	<b>33.2</b>	<b>(± 8.2)</b>	<b>79.2</b>	<b>(± 6.5)</b>	<b>78.2</b>	<b>(± 6.6)</b>	—	****	<b>14.9</b>
<b>West South Central</b>																			
Arkansas	67.9	(±11.5)	87.2	(± 8.3)	82.3	(± 9.7)	85.3	(± 8.9)	86.6	(± 8.1)	—	****	64.9	(±11.7)	61.2	(±12.0)	—	****	25.2
Louisiana	78.5	(± 8.9)	88.8	(± 7.1)	84.6	(± 8.1)	89.8	(± 7.0)	82.2	(± 7.9)	39.9	(±10.6)	75.0	(± 9.3)	73.1	(± 9.6)	—	****	34.8
Oklahoma	—	****	81.7	(±15.1)	89.6	(±10.3)	81.7	(±15.1)	—	****	—	****	—	****	—	****	—	****	17.9
Texas	78.6	(± 6.7)	87.1	(± 5.3)	89.2	(± 4.7)	91.6	(± 3.8)	79.5	(± 6.8)	38.3	(± 8.3)	74.5	(± 7.2)	74.0	(± 7.3)	—	****	27.3
<b>Total</b>	<b>76.9</b>	<b>(± 5.1)</b>	<b>87.0</b>	<b>(± 4.1)</b>	<b>87.9</b>	<b>(± 3.7)</b>	<b>90.2</b>	<b>(± 3.1)</b>	<b>79.9</b>	<b>(± 5.1)</b>	<b>39.0</b>	<b>(± 6.2)</b>	<b>73.2</b>	<b>(± 5.5)</b>	<b>72.3</b>	<b>(± 5.5)</b>	—	****	<b>27.2</b>
<b>National</b>	<b>79.5</b>	<b>(± 2.0)</b>	<b>89.9</b>	<b>(± 1.4)</b>	<b>90.2</b>	<b>(± 1.3)</b>	<b>91.1</b>	<b>(± 1.4)</b>	<b>85.3</b>	<b>(± 1.7)</b>	<b>40.5</b>	<b>(± 2.4)</b>	<b>76.2</b>	<b>(± 2.1)</b>	<b>74.1</b>	<b>(± 2.2)</b>	—	****	<b>21.7</b>

\* Poverty status is based on family income and household size using Bureau of the Census poverty thresholds for 1998.

† Children in this survey period were born during February 1995–May 1997. n=21,827.

§ Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

¶ Three or more doses of poliovirus vaccine (Polio).

\*\* One or more doses of measles-containing vaccine (MCV).

†† Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

§§ Three or more doses of hepatitis B vaccine (Hep B).

¶¶ One or more doses of varicella vaccine.

\*\*\* Four or more doses of DTP/DT, three or more doses of Polio, and one or more doses of MCV.

††† Four or more doses of DTP/DT, three or more doses of Polio, one or more doses of MCV, and three or more doses of Hib.

§§§ Estimated percentage of children aged 19–35 months who live below poverty level.

¶¶¶ Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

\*\*\*\* The standard of reliability for data presented in this report is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the numerator was <30.

**TABLE 6. Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by vaccine and selected geographic area — United States, National Immunization Survey, 1998†**

Geographic area	DTP <sup>§</sup>		Polio <sup>¶</sup>		MCV <sup>**</sup>		Hib <sup>††</sup>		Hep B <sup>§§</sup>		Varicella <sup>¶¶</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>†††</sup>		Living below
	%(95% CI <sup>¶¶¶</sup> )	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	%(95% CI)	poverty level (%) <sup>§§§</sup>	
<b>Alabama</b>																	
Jefferson County	90.5 (± 8.1)	96.9 (± 4.8)	95.4 (± 5.6)	92.9 (± 7.8)	85.9 (± 9.2)	68.7 (±12.3)	—	****	90.5 (± 8.1)	88.6 (± 8.8)	25.9						
Rest of state	77.9 (±11.2)	92.0 (± 7.5)	88.7 (± 8.3)	96.4 (± 4.2)	86.2 (± 9.3)	—	****	77.2 (±11.3)	75.8 (±11.4)	22.6							
<b>Arizona</b>																	
Maricopa County	81.2 (±10.8)	91.8 (± 7.5)	86.9 (± 9.5)	81.7 (±10.9)	80.6 (±10.9)	—	****	80.3 (±10.8)	71.9 (±12.3)	25.7							
Rest of state	72.0 (±11.4)	85.2 (± 8.9)	81.1 (± 9.9)	83.6 (± 9.3)	74.6 (±10.8)	—	****	70.2 (±11.5)	66.8 (±11.7)	30.7							
<b>California</b>																	
Los Angeles County	70.8 (± 9.8)	88.4 (± 6.7)	87.2 (± 7.3)	93.4 (± 4.9)	86.3 (± 7.2)	60.0 (±10.9)	67.3 (±10.5)	65.7 (±10.6)	35.9								
San Diego County	81.5 (± 9.5)	85.7 (± 8.2)	92.6 (± 6.0)	86.1 (± 8.5)	78.7 (± 9.5)	58.0 (±11.8)	76.2 (±10.3)	73.5 (±10.7)	28.2								
Santa Clara County	83.2 (±10.8)	97.9 (± 4.1)	94.9 (± 6.9)	98.6 (± 2.7)	93.7 (± 7.2)	62.0 (±14.4)	81.1 (±11.3)	81.1 (±11.3)	19.9								
Rest of state	78.5 (±10.2)	92.6 (± 6.3)	93.5 (± 6.2)	90.2 (± 7.8)	87.5 (± 8.9)	43.9 (±12.1)	74.0 (±10.9)	67.4 (±11.8)	24.9								
<b>District of Columbia</b>																	
	70.8 (±11.8)	83.4 (± 9.0)	92.0 (± 6.5)	89.9 (± 8.4)	76.2 (±11.3)	46.1 (±12.2)	65.8 (±11.8)	62.6 (±12.1)	32.9								
<b>Florida</b>																	
Dade County	82.5 (±10.1)	87.0 (± 8.6)	91.8 (± 7.0)	91.1 (± 7.5)	87.9 (± 8.5)	—	****	78.1 (±10.8)	78.1 (±10.8)	23.7							
Duval County	94.1 (± 8.1)	100.0 (–10.0)	96.5 (± 6.8)	100.0 (–10.4)	97.2 (± 5.4)	—	****	94.1 (± 8.1)	94.1 (± 8.1)	16.0							
Rest of state	77.4 (±13.0)	86.6 (±11.4)	94.5 (± 7.5)	92.9 (± 8.0)	89.1 (± 9.4)	—	****	—	****	17.5							
<b>Georgia</b>																	
Fulton/Dekalb counties	81.2 (±11.6)	98.1 (± 3.8)	94.5 (± 6.1)	91.6 (± 9.4)	94.6 (± 6.0)	—	****	79.3 (±12.0)	72.8 (±13.8)	27.1							
Rest of state	85.2 (± 9.6)	92.3 (± 7.4)	88.9 (± 8.4)	92.3 (± 7.4)	88.4 (± 8.5)	—	****	85.2 (± 9.6)	85.2 (± 9.6)	21.3							
<b>Illinois</b>																	
City of Chicago	70.5 (±12.9)	86.4 (± 9.6)	80.2 (±12.0)	87.0 (± 9.5)	70.2 (±12.7)	—	****	64.8 (±12.9)	62.5 (±12.9)	36.0							
Rest of state	—	****	—	****	—	****	—	****	—	****	11.1						
<b>Indiana</b>																	
Marion County	72.9 (±14.6)	83.1 (±12.4)	89.8 (± 9.6)	86.0 (±11.4)	80.0 (±12.7)	—	****	72.9 (±14.6)	72.9 (±14.6)	14.9							
Rest of state	71.9 (±15.8)	86.3 (±12.9)	87.7 (±11.4)	78.1 (±14.5)	81.5 (±13.3)	—	****	71.9 (±15.8)	71.9 (±15.8)	16.5							
<b>Louisiana</b>																	
Orleans Parish	82.5 (± 7.7)	91.5 (± 5.8)	88.6 (± 6.3)	93.5 (± 5.2)	87.7 (± 6.6)	33.2 (± 9.2)	80.1 (± 8.0)	79.8 (± 8.0)	45.7								
Rest of state	77.7 (±10.5)	88.2 (± 8.3)	83.9 (± 9.5)	89.2 (± 8.2)	81.2 (± 9.3)	41.2 (±12.4)	74.0 (±10.9)	71.8 (±11.2)	33.3								
<b>Massachusetts</b>																	
City of Boston	94.1 (± 5.0)	97.0 (± 3.4)	98.0 (± 2.8)	97.7 (± 3.2)	94.1 (± 5.9)	50.9 (±12.0)	91.3 (± 5.8)	90.3 (± 6.1)	28.7								
Rest of state	79.3 (±16.4)	96.2 (± 5.3)	90.0 (± 8.7)	100.0 (– 8.5)	95.3 (± 6.4)	—	****	79.3 (±16.4)	79.3 (±16.4)	15.5							

**TABLE 6. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by vaccine and selected geographic area — United States, National Immunization Survey, 1998†**

Geographic area	DTP <sup>b</sup>		Polio <sup>d</sup>		MCV <sup>**</sup>		Hib <sup>†</sup>		Hep B <sup>§§</sup>		Varicella <sup>¶¶</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>†††</sup>		Living below	
	%(95% CI <sup>¶¶¶</sup> )		%(95% CI)		%(95% CI)		%(95% CI)		%(95% CI)		%(95% CI)		%(95% CI)		%(95% CI)		poverty	
	%	(95% CI <sup>¶¶¶</sup> )	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	level (%) <sup>§§§</sup>
<b>Maryland</b>																		
City of																		
Baltimore	79.7	(±10.3)	91.8	(± 7.1)	87.9	(± 8.7)	93.4	(± 6.5)	80.2	(±10.1)	52.2	(±12.3)	75.1	(±10.9)	75.1	(±10.9)		31.9
Rest of state	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****		8.5
<b>Michigan</b>																		
City of Detroit	73.4	(± 9.6)	84.4	(± 8.3)	88.0	(± 6.7)	80.1	(± 9.0)	80.5	(± 8.8)	—	****	71.8	(± 9.7)	69.1	(± 9.9)		43.7
Rest of state	86.8	(±11.7)	90.8	(±10.1)	93.2	(± 8.9)	93.4	(± 8.9)	89.7	(±11.1)	—	****	—	****	—	****		11.8
<b>New Jersey</b>																		
City of Newark	74.8	(±10.6)	79.7	(± 9.7)	89.5	(± 8.1)	88.2	(± 8.4)	88.9	(± 8.0)	—	****	71.4	(±12.1)	67.6	(±12.7)		40.1
Rest of state	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****		13.2
<b>New York</b>																		
New York City	82.9	(±10.0)	90.5	(± 7.3)	92.0	(± 6.5)	87.6	(± 9.2)	85.4	(±10.0)	55.0	(±12.8)	81.1	(±10.2)	78.9	(±10.7)		36.4
Rest of state	88.9	(±12.4)	92.9	(±10.1)	91.6	(±11.6)	95.1	(± 9.3)	92.4	(± 8.9)	—	****	—	****	—	****		14.9
<b>Ohio</b>																		
Cuyahoga County	72.8	(±13.7)	80.4	(±11.7)	90.7	(± 9.0)	80.7	(±11.7)	80.3	(±13.3)	—	****	67.1	(±14.0)	59.3	(±14.1)		25.5
Franklin County	73.4	(±16.2)	81.3	(±14.9)	95.8	(± 8.0)	89.6	(±11.3)	79.5	(±14.5)	—	****	73.4	(±16.2)	73.4	(±16.2)		19.1
Rest of state	75.7	(±11.5)	83.4	(±10.1)	86.4	(± 9.2)	90.5	(± 8.2)	85.5	(± 9.9)	—	****	74.1	(±11.8)	74.1	(±11.8)		19.7
<b>Pennsylvania</b>																		
City of																		
Philadelphia	84.7	(±10.3)	91.0	(± 9.6)	93.8	(± 8.9)	94.7	(± 8.5)	75.1	(±11.7)	80.4	(±11.6)	81.1	(±11.0)	81.1	(±11.0)		30.9
Rest of state	94.3	(± 6.5)	97.5	(± 4.9)	97.5	(± 4.8)	100.0	(- 6.9)	93.1	(± 7.6)	62.3	(±13.9)	91.7	(± 8.0)	91.7	(± 8.0)		18.2
<b>Tennessee</b>																		
Davidson County	70.9	(±12.3)	77.2	(±11.8)	89.2	(± 9.0)	88.6	(± 9.4)	83.5	(± 9.8)	—	****	66.4	(±12.6)	65.4	(±12.6)		24.0
Shelby County	78.2	(±10.0)	88.8	(± 8.5)	80.0	(±10.0)	86.1	(± 9.1)	86.7	(± 8.8)	—	****	74.6	(±10.4)	69.8	(±10.9)		33.6
Rest of state	88.9	(± 8.2)	91.2	(± 7.6)	91.0	(± 7.9)	94.0	(± 6.7)	86.5	(± 9.6)	—	****	86.7	(± 9.0)	84.6	(± 9.7)		19.7
<b>Texas</b>																		
Bexar County	81.2	(± 9.9)	93.0	(± 6.0)	89.4	(± 7.2)	91.6	(± 6.5)	91.2	(± 6.9)	40.1	(±12.3)	79.7	(±10.2)	79.7	(±10.2)		32.3
City of Houston	59.1	(±13.3)	70.8	(±12.2)	84.7	(± 9.2)	81.6	(±11.3)	69.6	(±12.5)	—	****	55.3	(±12.9)	55.3	(±12.9)		29.5
Dallas County	73.0	(±12.4)	90.9	(± 7.4)	84.3	(±10.2)	87.0	(± 8.9)	83.3	(± 9.7)	—	****	73.0	(±12.4)	69.1	(±13.0)		27.1
El Paso County	79.7	(± 7.4)	86.4	(± 6.3)	88.0	(± 6.0)	87.2	(± 6.3)	78.2	(± 7.6)	42.4	(± 9.1)	75.9	(± 7.8)	74.5	(± 8.0)		45.5
Rest of state	83.7	(±10.5)	89.4	(± 8.2)	91.3	(± 7.3)	95.3	(± 5.3)	79.6	(±10.9)	—	****	78.4	(±11.5)	78.4	(±11.5)		25.1

**TABLE 6. (Continued) Estimated vaccination coverage with selected vaccines and combined series among children aged 19–35 months who live below poverty level,\* by vaccine and selected geographic area — United States, National Immunization Survey, 1998†**

Geographic area	DTP <sup>§</sup>		Polio <sup>¶</sup>		MCV <sup>**</sup>		Hib <sup>††</sup>		Hep B <sup>§§</sup>		Varicella <sup>¶¶</sup>		4:3:1 <sup>***</sup>		4:3:1:3 <sup>†††</sup>		Living below poverty level (%) <sup>§§§</sup>
	% (95% CI <sup>¶¶¶</sup> )	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)		
<b>Washington</b>																	
King County	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	11.7
Rest of state	77.2	(±11.4)	84.9	(±10.6)	86.7	(±10.2)	89.9	(± 8.6)	79.3	(±11.0)	—	****	73.4	(±11.9)	73.4	(±11.9)	20.8
<b>Wisconsin</b>																	
Milwaukee County	69.6	(±13.8)	77.5	(±13.1)	73.1	(±14.0)	82.4	(±12.8)	71.8	(±14.0)	—	****	63.5	(±14.3)	63.5	(±14.3)	26.9
Rest of state	—	****	—	****	—	****	—	****	—	****	—	****	—	****	—	****	12.5
<b>National</b>	<b>79.5</b>	<b>(±2.0)</b>	<b>89.9</b>	<b>(±1.4)</b>	<b>90.2</b>	<b>(±1.3)</b>	<b>91.1</b>	<b>(±1.4)</b>	<b>85.3</b>	<b>(±1.7)</b>	<b>40.5</b>	<b>(±2.4)</b>	<b>76.2</b>	<b>(±2.1)</b>	<b>74.1</b>	<b>(±2.2)</b>	<b>21.7</b>

\* Poverty status is based on family income and household size using Bureau of the Census poverty thresholds for 1998.

† Children in this survey period were born during February 1995–May 1997.

§ Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

¶ Three or more doses of poliovirus vaccine (Polio).

\*\* One or more doses of measles-containing vaccine (MCV).

†† Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

§§ Three or more doses of hepatitis B vaccine (Hep B).

¶¶ One or more doses of varicella vaccine.

\*\*\* Four or more doses of DTP, three or more doses of Polio, and one or more doses of MCV.

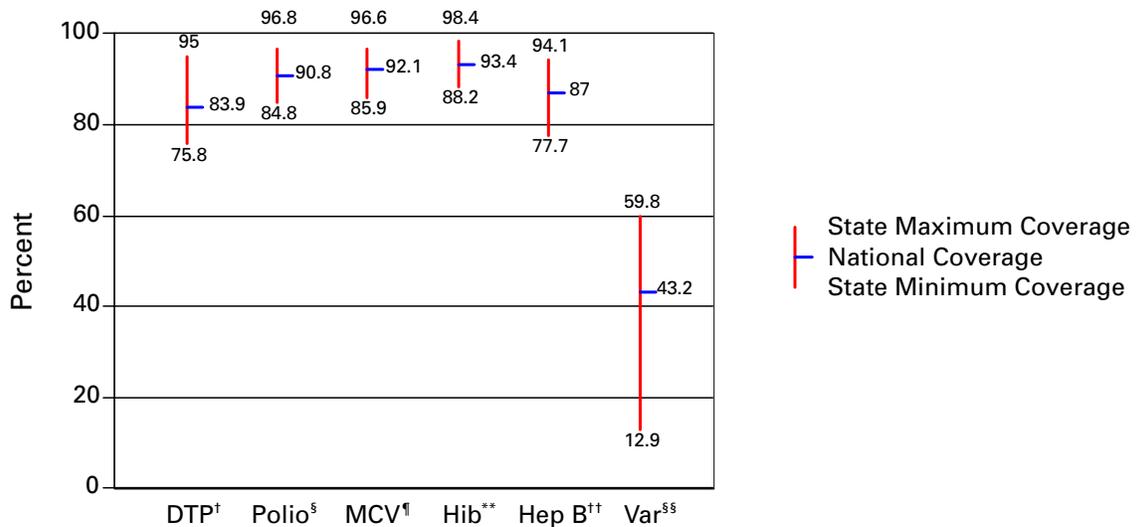
††† Four or more doses of DTP, three or more doses of Polio, one or more doses of MCV, and three or more doses of Hib.

§§§ Estimated percentage of children aged 19–35 months who live below poverty level.

¶¶¶ Confidence interval 95%. CIs were calculated by multiplying the standard error by ±1.96.

\*\*\*\* The standard of reliability for data presented in this report is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the numerator was <30.

**FIGURE 1. National and state maximum and minimum estimated vaccination coverage levels among children aged 19–35 months, by selected vaccine — United States, National Immunization Survey, 1998\***



\* Children in this survey period were born during February 1995–May 1997.

<sup>†</sup> Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

<sup>§</sup> Three or more doses of poliovirus vaccine (Polio).

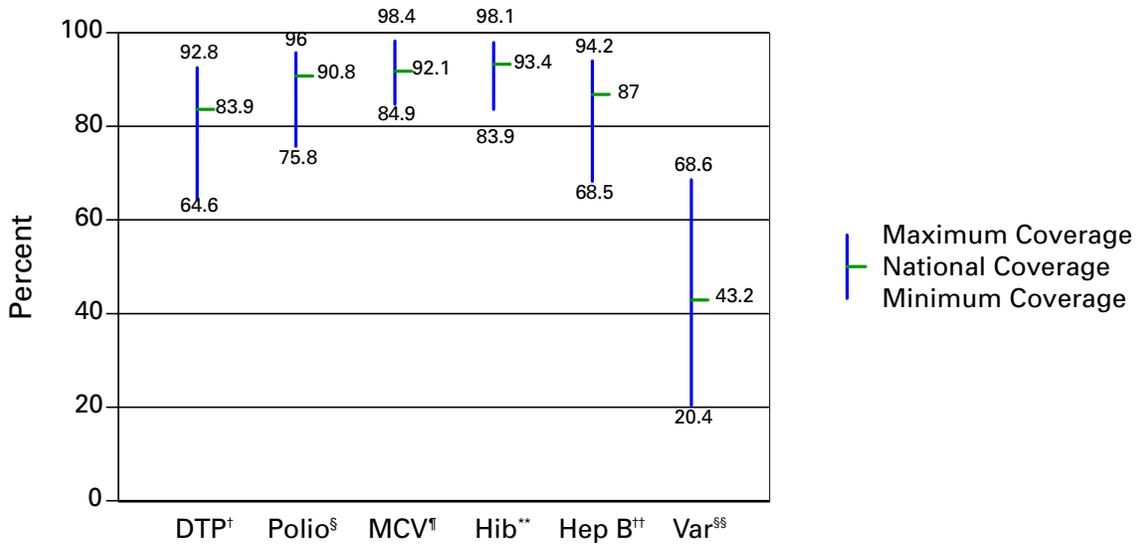
<sup>¶</sup> One or more doses of measles-containing vaccine (MCV).

<sup>\*\*</sup> Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

<sup>††</sup> Three or more doses of hepatitis B vaccine (Hep B).

<sup>§§</sup> Varicella vaccine (Var) on or after the first birthday.

**FIGURE 2. National and selected urban area maximum and minimum estimated vaccination coverage levels among children aged 19–35 months, by selected vaccines — United States, National Immunization Survey, 1998\***



\* Children in this survey period were born during February 1995–May 1997.

† Four or more doses of any diphtheria and tetanus toxoids and pertussis vaccine (DTP) (i.e., diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids [DT], or diphtheria and tetanus toxoids and acellular pertussis vaccine [DTaP]).

§ Three or more doses of poliovirus vaccine (Polio).

¶ One or more doses of measles-containing vaccine (MCV).

\*\* Three or more doses of *Haemophilus influenzae* type b vaccine (Hib).

†† Three or more doses of hepatitis B vaccine (Hep B).

§§ Varicella vaccine (Var) on or after the first birthday.



## Appendix

### Variance Estimation Using SUDAAN

The design option assumed sampling with replacement within a geographic area; sampling probabilities were constant within a geographic area but varied among geographic areas. The household was the primary sampling unit. The procedure described below was used to estimate the variance of the proportion of children up to date with a specific vaccine or combined series (e.g., the 4:3:1:3 combined series, which comprises four doses of any diphtheria and tetanus toxoids and pertussis vaccine [i.e, diphtheria and tetanus toxoids and pertussis vaccine, diphtheria and tetanus toxoids, or diphtheria and tetanus toxoids and acellular pertussis vaccine]; three doses of poliovirus vaccine; one dose of measles-containing vaccine; and three doses of *Haemophilus influenzae* type b vaccine).

Let  $w_{hij}$  be the final weight attached to child  $j$  with vaccination provider data in household  $i$  in geographic area  $h$ . Let  $y_{hij}$  take the value 1 if the  $j$ th child in the  $i$ th household in the  $h$ th area is up to date with the 4:3:1:3 combined series; otherwise let  $y_{hij}$  take the value 0. Let  $x_{hij}$  take the value 1 for every eligible child with provider data. Let  $m_{hi}$  represent the number of eligible children with provider data in household  $i$  in area  $h$ . The estimated number of children up to date with the 4:3:1:3 combined series in area  $h$  is given by

$$\hat{Y}_h = \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} y_{hij},$$

where  $n_h$  is the number of households with eligible children and with provider data. The estimated total number of eligible children in area  $h$  is given by

$$\hat{N}_h = \sum_{i=1}^{n_h} \sum_{j=1}^{m_{hi}} w_{hij} x_{hij}.$$

The estimated proportion of children up to date with the 4:3:1:3 combined series in area  $h$  is given by

$$\hat{P}_h = \frac{\hat{Y}_h}{\hat{N}_h}.$$

The variance of  $\hat{P}_h$  was estimated using a formula given on pages 2–5 of the *Technical Manual, Statistical Methods and Algorithms in SUDAAN*, Release 7.0, July 1993. The variance estimator formula is

$$v(\hat{P}_h) = \frac{n_h}{n_h - 1} \sum_{i=1}^{n_h} (Z_{hi} - \bar{Z}_h)^2$$

where  $Z_{hi} = \sum_{j=1}^{m_{hi}} Z_{hij}$  and  $\bar{Z}_h = \frac{1}{n_h} \sum_{i=1}^{n_h} Z_{hi}$ .

and  $Z_{hij} = \frac{w_{hij} y_{hij} - \hat{P}_h w_{hij} x_{hij}}{\hat{N}_h}$ .

The linearized variable  $Z_{hij}$  is defined on page 5 in the technical manual.

## Vaccination Coverage Among Children Enrolled in Head Start Programs or Day Care Facilities or Entering School

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### Abstract

**Problem/Condition:** Undervaccinated children enrolled in day care centers and schools are vulnerable to outbreaks of vaccine-preventable diseases. A *Healthy People 2000* objective is to increase to  $\geq 95\%$  vaccination coverage among children attending licensed day care facilities and kindergarten through postsecondary school (objective 20.11).

**Reporting Period Covered:** September 1997–June 1998.

**Description of System:** CDC's National Immunization Program administers grants to support 64 vaccination programs. These programs are in all 50 states, eight territories or jurisdictions (American Samoa, Republic of Marshall Islands, Federated States of Micronesia, Guam, Commonwealth of Northern Mariana Islands, Puerto Rico, Republic of Palau, and the U.S. Virgin Islands), five cities (Chicago, Houston, San Antonio, New York City, and Philadelphia), and the District of Columbia. Grant guidelines require annual school vaccination surveys and biennial surveys of Head Start programs and licensed day care facilities. This system constitutes the only source of nationally representative vaccination coverage estimates for these populations.

**Results:** *Head Start Programs:* Of the 64 reporting areas, 33 (51.6%) submitted coverage levels for children enrolled in Head Start programs. Of these, all 33 programs reported coverage levels for diphtheria and tetanus toxoids and pertussis vaccine (DTP), diphtheria and tetanus toxoids (DT), or tetanus toxoids (Td), poliovirus vaccine, and measles vaccine; and 32 reported coverage levels for mumps and rubella vaccines. Four programs reported coverage levels for the combined measles, mumps, and rubella vaccine (MMR). The mean vaccination coverage levels for the 1997–98 school year among the reporting vaccination programs were 97.8% for poliovirus vaccine (range: 80.0%–100.0%), 97.0% for DTP/DT/Td (range: 87.7%–100.0%), 93.3% for measles vaccine (range: 91.4%–100.0%), and 93.2% for mumps and rubella vaccines (range: 91.4%–100.0%).

*Licensed Day Care Facilities:* Of the 63 reporting areas with licensed day care facilities, 38 (60.3%) submitted coverage levels for enrolled children. Of these, all 38 programs reported coverage levels for poliovirus vaccine and DTP/DT/Td, 37 reported coverage levels for measles vaccine, and 36 reported coverage levels for mumps and rubella vaccines. Four programs reported coverage levels for the combined MMR. The mean vaccination coverage levels among the reporting areas were 95.8% for poliovirus

vaccine (range: 85.1%–99.8%), 95.7% for DTP/DT/Td (range: 77.6%–99.9%), 89.1% for measles vaccine (range: 78.0%–99.9%), and 89.1% for mumps and rubella vaccines (range: 78.0%–99.9%).

*Kindergarten/First Grade:* Of the 64 reporting areas, 43 (67.2%) submitted coverage levels for children enrolled in kindergarten and first grade. Of these 43 programs, 42 reported coverage levels for poliovirus vaccine and DTP/DT/Td, and 43 reported coverage levels for measles, mumps, and rubella vaccines. Four of the 43 programs reported coverage levels for the combined MMR. The mean vaccination coverage levels among the reporting areas were 96.7% for poliovirus vaccine (range: 82.8%–99.9%), 96.7% for DTP/DT/Td (range: 82.8%–99.8%), 96.0% for measles vaccine (range: 82.8%–99.9%), and 96.5% for mumps and rubella vaccines (range: 82.8%–99.9%).

**Interpretation:** High levels of vaccination coverage among children entering school most likely result from the successful implementation of state-specific school vaccination laws, which have applied to children entering school in all states and the District of Columbia since at least 1990. All states, territories, and the District of Columbia have additional laws that require vaccination of children in licensed day care facilities. However, because a high proportion of states and territories did not submit vaccination coverage reports to CDC, these estimated means may not reflect levels for all children in the United States.

## INTRODUCTION

Schools and day care centers are places where children come into close contact, facilitating transmission of disease. Undervaccinated children enrolled in day care facilities (1) and schools (2) are vulnerable to outbreaks of vaccine-preventable diseases. State-specific laws in the United States require children to be up to date with vaccinations on entering licensed day care or school and require documentation to be kept on site in the child's health record. A *Healthy People 2000* objective is to increase to  $\geq 95\%$  vaccination coverage among children attending licensed day care facilities and kindergarten through postsecondary school (objective 20.11) (3).

CDC's National Immunization Program administers grants to support 64 vaccination programs. These programs are in all 50 states, eight territories or jurisdictions (American Samoa, Republic of Marshall Islands, Federated States of Micronesia, Guam, Commonwealth of Northern Mariana Islands, Puerto Rico, Republic of Palau, and the U.S. Virgin Islands), five cities (Chicago, Houston, San Antonio, New York City, and Philadelphia), and the District of Columbia. Grant guidelines require annual school vaccination surveys and biennial surveys of Head Start programs and licensed day care facilities. This system constitutes the only source of nationally representative vaccination coverage estimates for these populations.

This is the first report of state-specific results from day care and school vaccination assessments conducted by the 64 vaccination programs that are recipients of CDC grant funds. The report summarizes vaccination coverage data collected during the 1997–98 school year and reported to CDC through April 28, 1999. Coverage levels are reported for poliovirus vaccine; diphtheria and tetanus toxoids and pertussis vaccine (DTP), diphtheria and tetanus toxoids (DT), and tetanus toxoid (Td); and measles, mumps, and rubella vaccines.

## METHODS

Methods of assessing vaccination coverage differ among the 64 reporting areas, in part because state and territorial laws determine which vaccines and doses are required for day care or school attendance (4) and sampling and data abstraction methods vary. In this report, overall mean coverage levels were estimated by weighting the vaccine-specific coverage levels reported by the vaccination programs to the appropriate birth cohorts.

The 64 vaccination programs report summary coverage levels to CDC using a standard one-page form. This form provides a single line to report the proportion of children with three or more doses of DTP/DT/Td and three or more doses of poliovirus vaccine. Separate lines are provided for reporting coverage levels for measles, mumps, and rubella vaccines. In six reporting areas, pertussis vaccination is not required; in at least three reporting areas, mumps vaccination is not required.

## RESULTS

### Head Start Programs

Of the 64 reporting areas, 33 (51.6%) submitted coverage levels for children enrolled in Head Start programs (Table 1). Nebraska, Oklahoma, and Texas combined results from Head Start with data from licensed day care facilities; levels from these states are reported with day care results. Of these 33 programs, all reported coverage levels for poliovirus vaccine, DTP/DT/Td, and measles vaccine; 32 reported coverage levels for mumps and rubella vaccines. Four of the 33 programs reported coverage levels for the combined measles, mumps, and rubella vaccine (MMR).

The mean vaccination coverage levels among the reporting vaccination programs were 97.8% for poliovirus vaccine (range: 80.0%–100.0%), 97.0% for DTP/DT/Td (range: 87.7%–100.0%), 93.3% for measles vaccine (range: 91.4%–100.0%), and 93.2% for mumps and rubella vaccines (range: 91.4%–100.0%).

The proportions of reporting areas that achieved the goal of  $\geq 95\%$  coverage were 78.8% (26 of 33) for poliovirus vaccine, 63.6% (21 of 33) for DTP/DT/Td, 87.8% (29 of 33) for measles vaccine, and 84.3% (27 of 32) for mumps and rubella vaccines. All four programs that reported coverage for the combined MMR achieved the goal of  $\geq 95\%$  coverage.

### Licensed Day Care Facilities

Of the 63 reporting areas with licensed day care facilities, 38 (60.3%) submitted coverage levels for enrolled children (Table 2). Of these 38 programs, all reported coverage levels for poliovirus vaccine and DTP/DT/Td, 37 reported coverage levels for measles vaccine, and 36 reported coverage levels for mumps and rubella vaccines. Four of the 38 programs reported coverage levels for the combined MMR.

The mean vaccination coverage levels among reporting vaccination programs were 95.8% for poliovirus vaccine (range: 85.0%–99.8%), 95.7% for DTP/DT/Td (range: 77.6%–99.9%), 89.1% for measles vaccine (range: 78.0%–99.9%), and 89.1% for mumps and rubella vaccines (range: 78.0%–99.9%).

The proportions of reporting areas that achieved the goal of  $\geq 95\%$  coverage were 57.9% (22 of 38) for poliovirus vaccine, 52.6% (20 of 38) for DTP/DT/Td, 59.4% (22 of 37) for measles vaccine, 58.3% (21 of 36) for mumps vaccine, and 61.1% (22 of 36) for rubella vaccine. Three of the four programs that reported coverage for the combined MMR achieved the goal of  $\geq 95\%$  coverage.

### Kindergarten/First Grade

Of the 64 reporting areas, 43 (67.2%) submitted coverage levels for children enrolled in kindergarten and first grade (Table 3). Of these 43 programs, 42 reported coverage levels for poliovirus vaccine and DTP/DT/Td, and all 43 reported coverage levels for measles, mumps, and rubella vaccines. Four of the 43 programs reported coverage levels for the combined MMR.

The mean vaccination coverage levels among the reporting vaccination programs were 96.7% for poliovirus vaccine (range: 82.8%–99.9%), 96.7% for DTP/DT/Td (range: 82.8%–99.8%), 96.0% for measles vaccine (range: 82.8%–99.9%), and 96.5% for mumps and rubella vaccines (range: 82.8%–99.9%).

The proportions of reporting areas that achieved the goal of  $\geq 95\%$  coverage were 90.5% (38 of 42) for poliovirus vaccine, 92.9% (39 of 42) for DTP/DT/Td, 83.7% (36 of 43) for measles vaccine, and 88.4% (38 of 43) for mumps and rubella vaccines. All four states that reported coverage for the combined MMR achieved the goal of  $\geq 95\%$  coverage.

## DISCUSSION

Since 1978, vaccination coverage levels among children entering either kindergarten or first grade have been assessed annually (5); since 1980, national coverage with three or more doses of poliovirus vaccine, three or more doses of DTP/DT/Td, and one or more doses of measles, mumps, and rubella vaccines has been  $\geq 90\%$  (4). Coverage levels for the 1997–98 school year also were high; coverage among children entering kindergarten or first grade was  $>95\%$  for poliovirus, DTP/DT/Td, measles, mumps, and rubella vaccines. Even though incidence of vaccine-preventable diseases is at an all-time low, high vaccination coverage must be maintained to continue to prevent transmission of disease in the population. For example, coverage levels of  $\geq 95\%$  are considered necessary to prevent transmission of measles (4).

High levels of vaccination coverage among children entering school have resulted from the successful implementation and enforcement of state-specific school vaccination laws, which have applied to children entering school in all states and the District of Columbia since at least 1990 (4). Although in general parents do not delay vaccination until school entry, school laws have been highly effective (4) as a "safety net" that ensures vaccination of children by age 5 or 6 years who missed vaccination during early childhood, the time when most vaccines are recommended (6).

Head Start, a program administered by the Administration for Children and Families, Department of Health and Human Services, enrolls approximately 800,000 low-income children each year. In 1998, approximately 90% of children enrolled in Head Start were aged 3–5 years, 69% were non-white, and 13% had a disability (7). The findings in this report indicate that, during the 1997–98 school year, coverage among children enrolled in Head Start was  $>95\%$  for poliovirus vaccine and DTP/DT/Td, and 93% for measles, mumps, and rubella vaccines. Head Start has also documented high vaccination cover-

age through their own surveys; coverage for the combined series of four or more doses of DTP, three or more doses of poliovirus vaccine, and one or more doses of measles-containing vaccine was 87% among children aged 4 years (7).

All states, territories, and the District of Columbia have additional laws that require vaccination of children in licensed day care facilities. The findings in this report indicate that, compared with children enrolled in Head Start or entering school, coverage levels among all children in day care are lower. Because fewer than one third of children aged <5 years receive care through day care facilities (5) and children are required to be fully vaccinated to enroll in licensed day care facilities, levels for the general population of U.S. children aged <5 years might be lower. However, low vaccination coverage levels among day care children could also reflect a younger age cohort for which the complete basic series of vaccines are not yet applicable.

Obtaining information from schools is one of the least time-consuming approaches to assessing childhood vaccination coverage (8). Moreover, data from school records can potentially reflect vaccination status of nearly all U.S. children because most children, regardless of race/ethnicity, socioeconomic status, and access to care, are enrolled in schools. Accuracy is also high because information regarding vaccinations is generally based on provider records and does not rely on parent recall (4).

The school surveys in this report are subject to at least two limitations. First, children attending private schools might not be included in these surveys; in a comparison of vaccination coverage for three doses of DTP, three doses of poliovirus vaccine, and one dose of MMR between public and private schools in Chicago, Illinois, and Milwaukee, Wisconsin, coverage was generally lower among children attending public schools than among those attending private schools (9). Second, in the 1997–98 survey, nearly half the vaccination programs did not submit vaccination coverage reports to CDC. Therefore, overall weighted mean estimates presented in this report might not be representative of all U.S. children. Thus, the quality and scope of the school surveys in all vaccination programs need to improve to ensure the nation's ability to identify children at risk for outbreaks of disease caused by undervaccination.

High vaccination coverage levels in the U.S. school-aged population is largely the result of school laws that govern vaccination among children entering schools and licensed day care facilities (10). However, reporting areas still vary substantially in the number and doses of required vaccinations. To ensure prevention of vaccine-preventable diseases in the United States, school and day care laws should be maintained. In some reporting areas, new vaccines (e.g., varicella) should be added to reduce further vaccine-preventable diseases (11).

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**TABLE 1. Estimated vaccination coverage among children enrolled in Head Start programs, by reporting area and selected vaccine — 64 U.S. vaccination programs, 1997–98 school year**

Reporting area	Population assessed (%)	Polio* (%)	DTP/DT/Td† (%)	Measles§ (%)	Mumps¶ (%)	Rubella** (%)
<b>United States (weighted mean)</b>		<b>97.8</b>	<b>97.0</b>	<b>93.3</b>	<b>93.2</b>	<b>93.2</b>
<b>New England</b>						
Connecticut	—	—	—	—	—	—
Maine	100.0	95.0	96.0	96.0	96.0	96.0
Massachusetts <sup>#</sup>	99.0	99.5	99.2	99.6	99.6	99.6
New Hampshire	—	—	—	—	—	—
Rhode Island <sup>§§</sup>	42.0	99.5	98.0	99.8	99.8	99.8
Vermont	100.0	93.0	90.0	92.0	92.0	92.0
<b>Middle Atlantic</b>						
New York State <sup>¶¶</sup>	100.0	98.8	99.0	98.4	98.4	98.4
New York City	100.0	99.6	99.8	99.8	99.8	99.8
New Jersey	—	—	—	—	—	—
Pennsylvania	—	—	—	—	—	—
Philadelphia	—	—	—	—	—	—
<b>East North Central</b>						
Illinois <sup>**</sup>	—	93.7	91.4	94.8	94.8	94.8
Chicago	—	—	—	—	—	—
Indiana	—	96.0	94.0	97.0	97.0	97.0
Michigan	—	—	—	—	—	—
Ohio <sup>†</sup>	95.0	97.0	93.0	99.0	99.0	99.0
Wisconsin	33.3	96.6	97.2	97.1	97.1	97.1
<b>West North Central</b>						
Iowa	—	—	—	—	—	—
Kansas	—	—	—	—	—	—
Minnesota <sup>††§§</sup>	—	97.2	93.4	99.4	99.4	99.4
Missouri <sup>‡‡‡</sup>	—	96.0	90.6	98.0	98.0	98.0
Nebraska <sup>§§§</sup>	—	—	—	—	—	—
North Dakota	—	—	—	—	—	—
South Dakota	100.0	97.0	94.4	99.5	99.5	99.5
<b>South Atlantic</b>						
Delaware	—	—	—	—	—	—
District of Columbia	97.0	98.4	97.8	97.8	97.8	97.8
Florida	10.7	99.7	99.8	99.4	99.4	99.3
Georgia	—	—	—	—	—	—
Maryland	—	—	—	—	—	—
North Carolina <sup>¶¶¶</sup>	9.2	98.5	99.3	97.3	97.3	97.3
South Carolina	—	—	—	—	—	—
Virginia	—	—	—	—	—	—
West Virginia	100.0	98.7	99.2	98.0	94.5	94.5
<b>East South Central</b>						
Alabama	—	—	—	—	—	—
Kentucky	—	—	—	—	—	—
Mississippi	—	—	—	—	—	—
Tennessee	82.4	99.4	99.3	99.3	99.3	99.3
<b>West South Central</b>						
Arkansas	—	—	—	—	—	—
Louisiana	—	—	—	—	—	—
Oklahoma <sup>§§§</sup>	—	—	—	—	—	—
Texas <sup>§§§</sup>	—	—	—	—	—	—
Houston	—	—	—	—	—	—
San Antonio	—	—	—	—	—	—

**TABLE 1. (Continued) Estimated vaccination coverage among children enrolled in Head Start programs, by reporting area and selected vaccine — 64 U.S. vaccination programs, 1997–98 school year**

Reporting area	Population assessed (%)	Polio* (%)	DTP/DT/Td† (%)	Measles§ (%)	Mumps¶ (%)	Rubella** (%)
<b>Mountain</b>						
Arizona	99.8	99.0	96.5	99.2	99.2	99.2
Colorado	—	—	—	—	—	—
Idaho	—	—	—	—	—	—
Montana	100.0	99.8	99.8	99.8	99.8	99.8
Nevada	—	—	—	—	—	—
New Mexico	23.8	95.1	97.3	97.1	97.1	97.1
Utah	95.3	97.9	96.1	99.5	99.4	99.4
Wyoming	100.0	93.3	91.2	91.4	91.4	91.4
<b>Pacific</b>						
Alaska§§	35.1	93.2	87.7	98.1	98.1	98.1
California	99.0	98.6	98.9	99.1	99.1	99.1
Hawaii	93.2	99.9	100.0	100.0	100.0	100.0
Oregon§§	100.0	97.9	98.0	98.3	98.3	98.3
Washington****	100.0	100.0	99.0	100.0	100.0	100.0
<b>Territories and jurisdictions</b>						
American Samoa	100.0	80.0	88.0	91.7	91.7	91.7
Federated States of Micronesia	100.0	94.9	93.8	95.8	95.8	95.8
Guam	—	—	—	—	—	—
Commonwealth of Northern Mariana Islands	100.0	99.0	99.0	100.0	—	—
Puerto Rico	100.0	94.0	93.0	99.0	99.0	99.0
Republic of Marshall Islands	—	—	—	—	—	—
Republic of Palau	100.0	99.0	99.0	99.7	99.7	99.7
Virgin Islands	—	—	—	—	—	—
<i>No. achieving ≥95% coverage goal††††</i>		26	21	29	27	27

\* At least 3 doses of poliovirus vaccine.

† At least 3 doses of diphtheria and tetanus toxoids and pertussis vaccine (DTP); diphtheria and tetanus toxoids (DT); or tetanus toxoid (Td), unless otherwise noted.

§ One dose of measles vaccine.

¶ One dose of mumps vaccine.

\*\* One dose of rubella vaccine.

†† At least 4 doses of diphtheria, tetanus toxoids, and pertussis vaccine (DTP); diphtheria and tetanus toxoids (DT); or tetanus toxoid (Td).

§§ Measles, mumps, and rubella coverage reported for combined measles, mumps, and rubella vaccine (MMR). One dose of MMR, unless otherwise noted.

¶¶ Two doses of measles, mumps, and rubella vaccines. Excludes New York City.

\*\*\* Includes Chicago.

††† Includes children aged 16–59 months.

§§§ Head start coverage reported with day care coverage. See Table 2.

¶¶¶ Poliovirus vaccine coverage includes children aged ≥15 months; DTP/DT/Td coverage includes children aged ≥6 months.

\*\*\*\* DTP/DT/Td doses unspecified.

†††† As outlined in — Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives—full report, with commentary. Washington, DC: US Department of Health and Human Services, Public Health Service, 1991; DHHS publication no. (PHS

**TABLE 2. Estimated vaccination coverage among children enrolled in licensed day care facilities, by reporting area and selected vaccine — 64 U.S. vaccination programs, 1997–98 school year**

Reporting area	Population assessed (%)	Polio* (%)	DTP/DT/Td† (%)	Measles§ (%)	Mumps¶ (%)	Rubella** (%)
<b>United States (weighted mean)</b>		<b>95.8</b>	<b>95.7</b>	<b>89.1</b>	<b>89.1</b>	<b>89.1</b>
<b>New England</b>						
Connecticut <sup>†† §§</sup>	100.0	99.0	97.0	98.0	98.0	98.0
Maine	100.0	90.0	94.0	91.0	91.0	91.0
Massachusetts <sup>§§</sup>	90.8	98.1	97.3	97.9	97.9	97.9
New Hampshire	—	—	—	—	—	—
Rhode Island <sup>¶¶</sup>	—	96.2	95.6	98.2	—	—
Vermont	95.0	89.0	86.0	87.0	87.0	87.0
<b>Middle Atlantic</b>						
New York State <sup>***</sup>	100.0	95.6	96.5	94.9	94.9	95.0
New York City	100.0	98.1	98.4	98.0	98.0	98.0
New Jersey	—	—	—	—	—	—
Pennsylvania <sup>†††</sup>	75.6	88.3	87.4	87.6	87.6	87.6
Philadelphia	—	—	—	—	—	—
<b>East North Central</b>						
Illinois <sup>§§§</sup>	55.7	94.0	93.5	93.5	93.5	93.5
Chicago	—	—	—	—	—	—
Indiana	—	93.0	94.0	94.0	94.0	94.0
Michigan	—	—	—	—	—	—
Ohio <sup>§§</sup>	83.0	97.0	96.0	98.0	98.0	98.0
Wisconsin	2.6	91.5	92.3	91.6	91.6	91.6
<b>West North Central</b>						
Iowa	—	—	—	—	—	—
Kansas	—	—	—	—	—	—
Minnesota <sup>§§¶¶</sup>	—	94.2	90.7	95.7	—	—
Missouri <sup>¶¶¶</sup>	—	95.9	90.7	96.3	96.3	96.3
Nebraska <sup>****</sup> <sup>††††</sup>	100.0	87.0	94.0	78.0	78.0	78.0
North Dakota	—	—	—	—	—	—
South Dakota	100.0	95.7	92.4	93.8	93.8	93.8
<b>South Atlantic</b>						
Delaware	—	—	—	—	—	—
District of Columbia	—	—	—	—	—	—
Florida	2.1	97.3	97.8	96.5	96.5	96.5
Georgia	100.0	96.1	96.1	96.1	96.1	96.1
Maryland	—	—	—	—	—	—
North Carolina <sup>§§§§</sup>	8.1	89.6	96.0	—	—	—
South Carolina	—	—	—	—	—	—
Virginia	—	—	—	—	—	—
West Virginia	88.0	87.8	98.0	83.0	83.0	83.0
<b>East South Central</b>						
Alabama	—	—	—	—	—	—
Kentucky	—	—	—	—	—	—
Mississippi	—	—	—	—	—	—
Tennessee	85.2	96.1	95.8	95.5	95.5	95.5
<b>West South Central</b>						
Arkansas	—	95.0	91.0	96.0	96.0	96.0
Louisiana	—	—	—	—	—	—
Oklahoma <sup>*****</sup>	79.3	97.7	95.5	98.1	98.1	98.1
Texas <sup>*****</sup> <sup>¶¶¶¶</sup>	—	97.7	96.5	97.8	97.8	97.8
Houston	—	—	—	—	—	—
San Antonio	—	—	—	—	—	—

**TABLE 2. (Continued) Estimated vaccination coverage among children enrolled in licensed day care facilities, by reporting area and selected vaccine — 64 U.S. vaccination programs, 1997–98 school year**

Reporting area	Population assessed (%)	Polio* (%)	DTP/DT/Td† (%)	Measles§ (%)	Mumps¶ (%)	Rubella** (%)
<b>Mountain</b>						
Arizona	99.5	97.7	95.7	97.6	97.6	97.6
Colorado	—	—	—	—	—	—
Idaho	—	—	—	—	—	—
Montana	—	96.8	98.6	92.8	92.8	92.8
Nevada	—	—	—	—	—	—
New Mexico	6.2	85.1	89.1	87.0	87.0	87.0
Utah	86.2	98.7	94.6	98.5	98.6	98.6
Wyoming	100.0	96.6	94.9	96.0	96.0	96.0
<b>Pacific</b>						
Alaska¶¶	31.5	94.0	85.7	99.9	—	—
California	99.0	97.0	97.8	97.1	97.1	97.1
Hawaii	93.6	99.8	99.9	99.9	99.9	99.9
Oregon¶¶	100.0	94.0	95.6	93.8	—	—
Washington*****	87.0	97.0	95.0	97.0	97.0	97.0
<b>Territories and jurisdictions</b>						
American Samoa	100.0	85.0	77.6	91.7	91.7	91.7
Federated States of Micronesia	100.0	93.5	92.0	92.1	92.1	92.1
Guam	—	—	—	—	—	—
Commonwealth of Northern Mariana Islands	100.0	98.3	98.3	98.3	—	—
Puerto Rico****	63.0	93.0	89.0	97.0	97.0	97.0
Republic of Marshall Islands	—	—	—	—	—	—
Republic of Palau	—	—	—	—	—	—
Virgin Islands	—	—	—	—	—	—
<i>No. achieving ≥ 95% coverage goal §§§§§</i>		22	20	22	21	22

\* At least 3 doses of poliovirus vaccine (Polio), unless otherwise noted.

† At least 3 doses of diphtheria, tetanus toxoids, and pertussis vaccine (DTP); diphtheria and tetanus toxoids (DT); or tetanus toxoid (Td), unless otherwise noted.

§ One dose of measles vaccine.

¶ One dose of mumps vaccine.

\*\* One dose of rubella vaccine.

†† At least 4 doses of Polio.

§§ At least 4 doses of DTP/DT/Td.

¶¶ Measles, mumps, and rubella coverage reported for combined measles, mumps, and rubella vaccine (MMR). One dose of MMR.

\*\*\* Excludes New York City.

††† Includes Philadelphia.

§§§ Includes Chicago.

¶¶¶ Includes children aged 16–59 months.

\*\*\*\* Day care coverage includes Head Start coverage.

†††† Includes children aged 2 years.

§§§§ Poliovirus vaccine coverage includes children aged ≥15 months; DTP/DT/Td coverage includes children aged ≥6 months.

¶¶¶¶ Includes Houston and San Antonio.

\*\*\*\*\* DTP/DT/Td doses unspecified.

††††† Two doses of measles, mumps, and rubella vaccines.

§§§§§ As outlined in — Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives—full report, with commentary. Washington, DC: US Department of Health and Human Services, Public Health Service, 1991; DHHS publication no. (PHS)91-50212.

**TABLE 3. Estimated vaccination coverage among children enrolled in kindergarten and first grade, by reporting area and selected vaccine—64 U.S. vaccination programs, 1997–98 school year**

Area	Grade	Population assessed (%)	Polio* (%)	DTP/DT/Td† (%)	Measles‡ (%)	Mumps§ (%)	Rubella** (%)
<b>United States</b>							
(weighted mean)			96.7	96.7	96.0	96.5	96.5
<b>New England</b>							
Connecticut	—	—	—	—	—	—	—
Maine	K	100.0	96.0	95.0	95.0	95.0	95.0
Massachusetts†	K	—	97.0	96.8	97.3	97.3	97.3
New Hampshire	1	100.0	98.3	97.7	97.4	97.4	97.4
Rhode Island§§	K	80.2	98.6	97.0	98.5	98.5	98.5
Vermont	K–1	100.0	98.7	97.0	99.3	99.3	99.3
<b>Middle Atlantic</b>							
New York State¶¶	K	100.0	97.7	97.8	94.8	98.2	98.2
New York City	K	100.0	96.1	96.2	90.8	97.2	97.2
New Jersey	—	—	—	—	—	—	—
Pennsylvania***	K	—	98.8	97.0	98.8	98.8	98.8
Philadelphia	—	—	—	—	—	—	—
<b>East North Central</b>							
Illinois	—	—	—	—	—	—	—
Chicago	—	—	—	—	—	—	—
Indiana	K	—	99.2	98.2	99.6	99.6	99.6
Michigan	—	—	—	—	—	—	—
Ohio†	K	100.0	99.0	98.0	99.0	99.0	99.0
Wisconsin	K	1.4	92.1	97.0	93.5	93.5	93.5
<b>West North Central</b>							
Iowa	—	—	—	—	—	—	—
Kansas	—	—	—	—	—	—	—
Minnesota††§§	K	99.0	95.9	95.5	98.3	98.3	98.3
Missouri†††	K	—	97.8	97.7	97.6	98.7	97.9
Nebraska	K	100.0	99.1	99.2	99.7	99.7	99.7
North Dakota	—	—	—	—	—	—	—
South Dakota	K	100.0	97.7	97.0	98.1	98.1	98.1
<b>South Atlantic</b>							
Delaware	—	—	—	—	—	—	—
District of Columbia	PreK, K–1	89.4	96.3	97.1	98.8	98.8	98.8
Florida	K	2.6	98.0	98.0	98.0	98.0	98.0
Georgia	K–1	100.0	82.8	82.8	82.8	82.8	82.8
Maryland	—	—	—	—	—	—	—
North Carolina	K–1	—	99.4	99.2	99.4	99.4	99.4
South Carolina	K–1	6.5	97.0	97.0	97.0	97.0	97.0
Virginia	—	—	—	—	—	—	—
West Virginia	K	100.0	98.3	99.2	99.5	99.5	99.5
<b>East South Central</b>							
Alabama	K–1	99.7	99.5	99.5	99.5	99.5	99.5
Kentucky§§§	K	—	—	—	84.9	84.9	84.9
Mississippi	1	100.0	98.8	98.8	98.8	98.8	98.8
Tennessee	K	99.2	96.0	97.0	98.2	98.2	98.2
<b>West South Central</b>							
Arkansas	enterers	—	96.0	96.0	98.0	96.0	98.0
Louisiana	K–1	100.0	97.0	98.6	99.0	99.0	99.0
Oklahoma	K	93.0	96.7	95.8	96.3	97.9	97.9
Texas	—	—	—	—	—	—	—
Houston	—	—	—	—	—	—	—
San Antonio	—	—	—	—	—	—	—

**TABLE 3. (Continued) Estimated vaccination coverage among children enrolled in kindergarten and first grade, by reporting area and selected vaccine—64 U.S. vaccination programs, 1997–98 school year**

Area	Grade	Population	Polio*	DTP/DT/Td†	Measles‡	Mumps¶	Rubella**
		assessed					
		%	%	%	%	%	%
<b>Mountain</b>							
Arizona	K–1	99.8	98.6	96.2	99.0	99.0	99.0
Colorado	—	—	—	—	—	—	—
Idaho	—	—	—	—	—	—	—
Montana	K–1	100.0	99.9	99.8	99.9	99.9	99.9
Nevada¶¶	1	100.0	98.4	97.5	96.8	96.8	96.8
New Mexico	K–1	12.2	97.3	97.9	97.5	97.5	97.5
Utah	K	99.0	98.7	97.0	98.1	98.3	98.3
Wyoming	K	100.0	97.1	97.0	96.8	96.8	96.8
<b>Pacific</b>							
Alaska‡‡	K–1	87.3	96.5	96.5	96.5	96.5	96.5
California†††	K	100.0	96.2	96.6	94.3	94.3	94.3
Hawaii	K	99.1	99.6	99.6	99.9	99.9	99.9
Oregon‡‡	K–1	100.0	97.2	96.9	98.4	98.4	98.4
Washington****	K–1	100.0	95.0	97.0	98.0	98.0	98.0
<b>Territories and jurisdictions</b>							
American Samoa	K–1	100.0	84.6	93.0	91.4	91.4	91.4
Federated States of Micronesia	1	100.0	93.6	91.9	95.6	95.6	95.6
Guam	—	—	—	—	—	—	—
Commonwealth of Northern Mariana Islands	—	—	—	—	—	—	—
Puerto Rico‡‡‡	K	87.0	99.0	96.0	97.0	97.0	97.0
Republic of Marshall Islands	—	—	—	—	—	—	—
Republic of Palau	1	100.0	99.5	97.0	100.0	99.5	100.0
Virgin Islands	—	—	—	—	—	—	—
<i>No. achieving ≥95% coverage goal¶¶¶</i>			<i>38</i>	<i>39</i>	<i>36</i>	<i>38</i>	<i>38</i>

\* At least 3 doses of poliovirus vaccine.

† At least 3 doses of diphtheria, tetanus toxoids, and pertussis vaccine (DTP); diphtheria and tetanus toxoids (DT); or tetanus toxoid (Td), unless otherwise noted.

‡ One dose of measles vaccine, unless otherwise noted.

¶ One dose of mumps vaccine.

\*\* One dose of rubella vaccine.

†† At least 4 doses of diphtheria, tetanus toxoids, and pertussis vaccine (DTP); diphtheria and tetanus toxoids (DT); or tetanus toxoid (Td).

‡‡ Measles, mumps, and rubella coverage reported for combined measles, mumps, and rubella vaccine (MMR). One dose of MMR, unless otherwise noted.

¶¶ Excludes New York City.

\*\*\* Includes Philadelphia.

††† Two doses of measles vaccine.

‡‡‡ Two doses of measles, mumps, and rubella vaccines.

¶¶¶ Two doses of MMR vaccine.

\*\*\*\* DTP/DT/Td doses unspecified.

†††† As outlined in — Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives—full report, with commentary. Washington, DC: US Department of Health and Human Services, Public Health Service, 1991; DHHS publication no. (PHS)91-50212.

## Influenza, Pneumococcal, and Tetanus Toxoid Vaccination of Adults — United States, 1993–1997

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### Abstract

**Problem/Condition:** An increasing proportion of adults have received recommended vaccinations against influenza, pneumococcal infection, and tetanus. However, in 1995, fewer than 60% of adults were vaccinated as recommended.

**Reporting Period Covered:** 1993–1997.

**Description of System:** Data were obtained from the state-based Behavioral Risk Factor Surveillance System (BRFSS) for 1993, 1995, and 1997 and from the National Health Interview Survey (NHIS) for 1995 to describe national, regional, and state-specific patterns of use of influenza and pneumococcal vaccines and tetanus toxoid among noninstitutionalized adults aged  $\geq 18$  years.

**Results:** Among adults aged  $\geq 65$  years in 1995, 58% reported receiving an influenza vaccination during the previous 12 months, and 34% reported ever receiving a pneumococcal vaccination. In this age group, non-Hispanic whites were more likely to report receipt of influenza (61%) and pneumococcal vaccines (36%) than non-Hispanic blacks (40% and 22%, respectively) and Hispanics (50% and 23%, respectively). Among the 50 states and the District of Columbia, the median vaccination level among older adults (i.e., persons aged  $\geq 65$  years) increased from 51% in 1993 to 66% in 1997 for influenza vaccine, and from 28% in 1993 to 46% in 1997 for pneumococcal vaccine. Adults with chronic medical conditions had low vaccination levels. Those aged 50–64 years were more likely than those aged 18–49 years to report influenza (38% versus 20%) and pneumococcal vaccination (20% versus 12%). In 1995, the proportion of adults who reported receiving a tetanus vaccination during the previous 10 years decreased with age, from 65% among those aged 18–49 years to 54% among those aged 50–64 years and to 40% among those aged  $\geq 65$  years. In each age group, women were less likely than men to report receiving tetanus toxoid; and among adults aged  $\geq 65$  years, Hispanics and Asians/Pacific Islanders were least likely among all racial/ethnic groups to report receiving tetanus toxoid.

**Interpretation:** By 1995, the *Healthy People 2000* objective to increase to at least 60% the proportion of persons aged  $\geq 65$  years who had received annual influenza vaccination had been achieved among non-Hispanic whites (objective 20.11).

However, substantial improvement is needed among non-Hispanic blacks, Hispanics, and adults aged <65 years with high-risk medical conditions.

**Public Health Actions:** Continued surveillance of vaccine coverage among adults will direct attention to undervaccinated populations that may be disproportionately affected by vaccine-preventable diseases. Vaccination coverage data can be used to guide efforts to increase awareness among health-care providers and the public about the benefits of vaccination, establish systems to ensure that every contact with the health-care system is used to update vaccinations, and further support financial mechanisms to increase vaccine delivery.

## INTRODUCTION

The Advisory Committee on Immunization Practices (ACIP) recommends annual influenza vaccination and one dose of pneumococcal vaccine for persons at increased risk for complications from influenza and pneumococcal infections, including all adults aged  $\geq 65$  years and younger adults with chronic conditions (e.g., heart disease, lung disease, or diabetes) (1,2). During 11 of 23 annual influenza epidemics during 1972–1995 in the United States, approximately 20,000 deaths—most among persons aged  $\geq 65$  years—were attributed to complications of influenza (e.g., exacerbation of underlying medical conditions, secondary bacterial pneumonia, or primary influenza viral pneumonia) (1). Of cases of community-acquired bacterial pneumonia that require hospitalization, 25%–35% are caused by *Streptococcus pneumoniae*, which also causes an estimated 50,000 cases of pneumococcal bacteremia and 3,000 cases of meningitis annually in the United States (2). Of adults with pneumococcal bacteremia, 60%–87% also develop pneumonia, and as many as 40% die (2). Pneumonia and influenza accounted for most of the infectious disease deaths in the United States during 1900–1996 (3) and were the sixth leading cause of death in the United States in 1996 (4).

A *Healthy People 2000* objective is to increase the proportion of adults who have received influenza and pneumococcal vaccination to at least 60% among persons at high risk for complications from these diseases (objective 20.11) (5). During 1989–1993, the proportion of U.S. adults aged  $\geq 65$  years who reported receiving influenza vaccination during the previous 12 months increased from 33% to 52%; the proportion who reported ever receiving pneumococcal vaccine increased from 15% to 28% (6).

In addition to influenza and pneumococcal vaccination, ACIP recommends that all adults receive a primary series of three vaccines containing tetanus toxoid and booster doses of tetanus and diphtheria toxoids (Td) every 10 years (7). A *Healthy People 2000* objective is to increase to 62% the proportion of persons up to date with the 10-year tetanus booster (objective 21.2) (8). Since the mid-1940s in the United States, incidence of tetanus has declined steadily, following universal availability of tetanus toxoid (9). During 1995–1997, a total of 124 cases of tetanus (95% in persons aged >20 years) were reported in the United States, with adults aged  $\geq 60$  years at highest risk for severe disease (10).

National surveillance for receipt of recommended vaccines by adults is conducted to monitor the performance of vaccination programs, assess progress toward national objectives, and identify populations at high risk for not receiving appropriate vaccinations. In this report, data obtained from the state-based Behavioral Risk Factor Surveillance System (BRFSS) for 1993, 1995, and 1997, and the National Health Interview

Survey (NHIS) for 1995, were used to describe national, regional, and state-specific patterns of use of influenza and pneumococcal vaccines and tetanus toxoid among noninstitutionalized adults aged  $\geq 18$  years.

## METHODS

The data in this report were derived from either NHIS (1995) or BRFSS (1993, 1995, or 1997). NHIS is an ongoing, annual cross-sectional household survey of the U.S. civilian, noninstitutionalized population. In 1995, samples were drawn from each state. Both black and Hispanic persons were oversampled to improve the reliability of estimates for these groups. Responses to three questions were analyzed: "During the past 12 months, have you had a flu shot?"; "Have you ever had a pneumonia vaccination?"; and "During the past 10 years, have you had a tetanus shot?" The estimated prevalence of vaccine receipt for a sample of 17,317 adults aged  $\geq 18$  years was stratified by age. Of these 17,317 persons, 10,826 were aged 18–49 years, 3,023 were aged 50–64 years, and 3,468 were aged  $\geq 65$  years. The questions about vaccination and related medical conditions were asked of one adult sample participant per family in the half of households that were administered the Year 2000 Objectives Supplement.

The prevalence of influenza and pneumococcal vaccination among adults aged 18–64 years was estimated for those at high risk for influenza- or pneumococcal-related complications. A total of 1,979 persons were categorized in the high-risk group for influenza-related complications because they reported one or more of the following: diabetes during the previous year; asthma, emphysema, chronic bronchitis, or tuberculosis during the previous year; chronic kidney disease during the previous year; current treatment for any cancer; or ever being told by a physician about having had a heart attack, heart failure, chronic heart condition, or rheumatic heart disease. Persons who were categorized in the high-risk group for influenza-related complications were also included in the high-risk group for pneumococcal-related complications, along with persons who reported liver disease or cirrhosis during the previous year.

BRFSS is an ongoing, state-based, random-digit-dialed telephone survey of U.S. noninstitutionalized civilian adults aged  $\geq 18$  years. BRFSS excludes households without telephones; however, only approximately 2.5% of older adults do not have a telephone (11). Data from BRFSS were used to summarize state-specific trends in influenza and pneumococcal vaccination among adults aged  $\geq 65$  years during 1993–1997. Responses to two questions about receipt of vaccinations were analyzed: "During the past 12 months, have you had a flu shot?" and "Have you ever had a pneumonia vaccination?" The estimated prevalence of vaccine receipt was analyzed for survey respondents aged  $\geq 65$  years: 19,761 respondents in 1993; 22,889 in 1995; and 26,469 in 1997.

For this report, BRFSS data were aggregated to create annual samples for each of the 50 states and the District of Columbia (DC). Wyoming did not participate in BRFSS in 1993, and the District of Columbia did not participate in 1995. Data were then weighted to account for both the respondent's probability of selection and the distribution of each state's population by age, sex, and race, according to the most recent census or intercensal estimates (12,13). Median vaccination prevalence estimates were based on estimates for the 50 states and the District of Columbia. Overall vaccination prevalence estimates for each of the nine regions used to report weekly cases of nationally

notifiable diseases were based on combined data from the states within each region. Overall vaccination prevalence estimates for the 50 states and the District of Columbia combined, presented by age, race/ethnicity, education level, years since last visit to a doctor for a routine checkup, and self-reported health were previously reported (14).

For both NHIS and BRFSS, SUDAAN statistical software was used to calculate the prevalence estimates, their standard errors, and 95% confidence intervals (CIs) and to adjust for the complex structure of each survey. SUDAAN was also used to compare NHIS prevalence estimates using chi-square tests and odds ratios. Prevalence estimates are presented only if the ratio of the standard error divided by the prevalence estimate was  $<0.3$ , and the denominator comprises at least 30 respondents. The standard of reliability is  $RSE <0.3$  (where  $RSE = \frac{\text{standard error}}{\text{prevalence}}$ ). Estimates that do not meet this standard or with a denominator  $<30$  are not presented. Previously published vaccination data from the 1993 and 1995 BRFSSs included in the denominators those respondents who did not report or did not know their vaccination status. However, in this report, respondents who did not report or did not know their vaccination status were excluded from the analysis; as a result, vaccination prevalence estimates for 1993 and 1995 are slightly higher in this report than in previously published data for the same years (15,16). Institutionalized persons, who accounted for approximately 4% of the population aged  $\geq 65$  years in 1995 (17), are not included in either NHIS or BRFSS.

## RESULTS

### Influenza and Pneumococcal Vaccination of Persons Aged 18–64 Years With High-Risk Medical Conditions

According to 1995 NHIS data, the proportion of persons at increased risk for complications from influenza and pneumococcal infections increased with age, from 11% among adults aged 18–49 years to 24% among those aged 50–64 years. Persons aged 50–64 years with one or more high-risk medical conditions were more likely to report receipt of influenza vaccine during the previous year (37.7%) and to report ever receiving pneumococcal vaccine (20.1%) than those aged 18–49 years with one or more high-risk conditions (for influenza, 20.4%; for pneumococcal, 11.8%) (Table 1).

Of persons aged 50–64 years with one or more high-risk conditions, non-Hispanic whites were more likely to report receipt of influenza vaccine (40.4%) or pneumococcal vaccine (21.5%) than non-Hispanic blacks (24.5% and 11.7%, respectively) (Table 1). For persons aged 18–49 years, the prevalence of vaccine receipt was similar among racial/ethnic groups, by sex and by education level. In addition, adults aged 18–64 years with one or more high-risk conditions who reported having medical insurance or more frequent contacts with physicians were more likely to report receipt of influenza vaccination (Table 1).

Persons aged 18–64 years with one or more high-risk conditions were more likely than those with no high-risk conditions to report receipt of vaccinations (Table 2). Vaccination levels varied among persons with high-risk conditions.

## Influenza and Pneumococcal Vaccination of Persons Aged $\geq 65$ Years

On the basis of 1995 NHIS data, persons aged  $\geq 65$  years were more likely to report receipt of influenza vaccine during the previous 12 months (58.2%) than to report ever receiving pneumococcal vaccine (34.0%). In this age group, vaccination levels were significantly different by race/ethnicity, poverty status, education level, and number of physician contacts during the previous year (Table 1). Vaccination levels were not compared by insurance status because approximately 99% of this population reported having Medicare or another form of medical insurance.

Among persons aged  $\geq 65$  years, non-Hispanic whites were more likely to report receipt of influenza (60.7%) and pneumococcal vaccines (35.9%) than non-Hispanic blacks (39.9% and 21.8%, respectively) and Hispanics (49.9% and 23.2%, respectively) (Table 1). Asians/Pacific Islanders were less likely to report influenza vaccination (50.9%) and pneumococcal vaccination (22.4%) than non-Hispanic whites, but these estimates were less reliable because of small sample sizes. The number of older American Indians/Alaskan Natives included in the NHIS sample was not sufficient to allow reliable estimation of vaccination levels.

Older persons with incomes at or above poverty level were more likely than those with incomes below poverty level to report vaccination (for influenza, 59.4% versus 50.5%, and for pneumococcal, 35.4% versus 25.3%) (Table 1).

Older adults reported frequent contacts with physicians: 89% reported one or more contacts during the previous year, and 34% reported five or more. Influenza and pneumococcal vaccination levels increased as the number of reported physician contacts increased. The greatest percentage difference in frequency of vaccination between groups was observed between persons who reported no physician contact during the previous year and those who reported one or two contacts (for influenza, 32.0% versus 56.4%; for pneumococcal, 17.4% versus 29.9%). Non-Hispanic blacks and Hispanics were as likely as non-Hispanic whites to report at least one physician contact during the previous year (88%–89%) and more likely to report five or more physician contacts during the previous year (38% and 39%, respectively, versus 33%).

To determine whether racial/ethnic disparities in vaccination levels among persons aged  $\geq 65$  years persisted after controlling for differences in socioeconomic status and access to health care, further analysis stratified racial/ethnic groups by poverty status, education level, and number of physician contacts during the previous year (Table 3). For each level of these three variables, non-Hispanic whites were more likely than non-Hispanic blacks to report receipt of influenza vaccine. Large disparities between non-Hispanic whites and non-Hispanics blacks were observed for persons with incomes at or above poverty level (61.0% versus 40.9%), having more than a high school education (64.1% versus 43.0%), and reporting five or more physician contacts during the previous year (68.8% versus 44.4%). Disparities between non-Hispanic whites and non-Hispanic blacks were also evident for pneumococcal vaccine among those with incomes at or above poverty level (36.9% versus 22.3%), with more than a high school education (40.8% versus 23.2%), and reporting five or more physician contacts during the previous year (43.9% versus 25.2%).

Among persons reporting three or four physician contacts during the previous year, non-Hispanic whites were more likely than Hispanics to report receipt of influenza vaccine (65.5% versus 43.7%). Non-Hispanic whites were more likely to report receipt of

pneumococcal vaccine than Hispanics for those with less than a high school education (31.7% versus 17.7%) or with incomes at or above poverty level (36.9% versus 26.5%). Further analysis of vaccination levels among Hispanics was limited by the small number of older Hispanics in the NHIS sample.

## State-Specific Influenza and Pneumococcal Vaccination of Persons Aged $\geq 65$ Years

When BRFSS data for all reporting areas are combined, in the 50 states and District of Columbia, the median proportion of persons aged  $\geq 65$  years reporting receipt of influenza vaccine during the preceding year increased from 50.8% in 1993 to 60.0% in 1995 and 66.0% in 1997 (Table 4). Similarly, the median proportion of older adults reporting ever receiving pneumococcal vaccine increased from 27.8% in 1993 to 38.4% in 1995 and 45.9% in 1997. These data are similar to those reported by NHIS (14, 18). In 50 of the 51 reporting areas, influenza and pneumococcal vaccination levels were higher in 1997 than in 1993 (Wyoming did not participate in BRFSS in 1993). For each vaccine, vaccination levels increased both during 1993–1995 and during 1995–1997 in all but seven of the reporting areas.

In 1997, influenza vaccination levels were  $>70\%$  in nine states: Colorado (74.4%), South Carolina (74.3%), Arizona (72.9%), New Mexico (72.8%), Wyoming (72.4%), Maine (72.1%), Hawaii (71.1%), Missouri (70.3%), and Washington (70.3%). In addition, during this period, pneumococcal vaccination levels were  $\geq 50\%$  in 17 states, including seven of the nine states with the highest influenza vaccination levels: Arizona (59.4%), Colorado (53.3%), Hawaii (51.7%), Washington (51.6%), Wyoming (50.9%), New Mexico (50.1%), and Maine (50.0%).

To assess state-specific variations in vaccination levels among different racial/ethnic populations, data from the 1995 and 1997 BRFSS surveys for each of the 51 reporting areas were combined. Data regarding influenza vaccination coverage among non-Hispanic blacks in 26 reporting areas met the criteria for reliability used in this report. These areas represented 95% of the U.S. non-Hispanic black population aged  $\geq 65$  years as of July 1, 1995. The proportion of older non-Hispanic blacks reporting receipt of influenza vaccine in 1995 or 1997 ranged from 34.5% in Georgia to 60.1% in Nebraska (median: 45.3%) (Table 5). In each of the 26 areas, non-Hispanic whites were more likely than non-Hispanic blacks to report receiving influenza vaccine.

Data regarding pneumococcal vaccination coverage among non-Hispanic blacks from 22 states met the reliability criteria; these states represented 84% of the U.S. non-Hispanic black population aged  $\geq 65$  years as of July 1, 1995. The proportion of older non-Hispanic blacks reporting ever receiving pneumococcal vaccine in 1995 or 1997 ranged from 16.2% in South Carolina and Arkansas to 40.1% in Ohio (median: 26.1%). In all states except one (Ohio), non-Hispanic whites were more likely than non-Hispanic blacks to report ever receiving pneumococcal vaccine.

After combining data for 1995 and 1997, vaccination levels among older Hispanics could be reliably estimated in nine states; however, these states represented 85% of the U.S. Hispanic population aged  $\geq 65$  years as of July 1, 1995. Influenza vaccination levels were substantially higher in Arizona (71.2%), Colorado (74.2%), and New Mexico (69.3%) than in Florida (44.3%). Influenza vaccination levels among non-Hispanic whites were higher than those among Hispanics in all states except two (Arizona and Colo-

rado). Pneumococcal vaccination levels among Hispanics ranged from 15.8% in Florida to 51.5% in Arizona (median: 32.1%).

After combining 1995 and 1997 data for Asians/Pacific Islanders, vaccination levels could be reliably estimated only for California and Hawaii, where 61% of Asians/Pacific Islanders aged  $\geq 65$  years in the United States resided in 1995. Among Asians/Pacific Islanders aged  $\geq 65$  years in California, vaccination levels were 79.1% for influenza vaccine and 49.3% for pneumococcal vaccine; in Hawaii, vaccination levels were 71.6% for influenza and 47.5% for pneumococcal vaccines.

After combining 1995 and 1997 data for American Indians/Alaskan Natives, vaccination levels could be reliably estimated only for Alaska and Oklahoma, where 20% of persons aged  $\geq 65$  years in these racial groups resided in the United States in 1995. Influenza vaccination levels were 77.3% in Alaska and 58.8% in Oklahoma; pneumococcal vaccination levels were 56.4% in Alaska and 49.5% in Oklahoma.

## Tetanus Toxoid Use in Persons Aged $\geq 18$ Years

In contrast with the trend for persons who received influenza and pneumococcal vaccines, the proportion of persons in 1995 who reported receiving tetanus toxoid during the previous 10 years decreased substantially with age, from 65.2% among those aged 18–49 to 53.8% among those aged 50–64 years and 39.6% among those aged  $\geq 65$  years (Table 1). In all three age groups, men were more likely than women to report receipt of tetanus toxoid during the previous 10 years.

In each age group, Asians/Pacific Islanders were least likely to report receipt of tetanus toxoid compared with other racial/ethnic populations. Among adults aged 18–49 years, Hispanics and non-Hispanic blacks were less likely than non-Hispanic whites to report vaccination (53.2% and 60.5% versus 68.9%). A similar difference in receipt of tetanus toxoid between non-Hispanic whites and non-Hispanic blacks was documented among adults aged 50–64 years. However, among older adults, Hispanics were less likely than non-Hispanic whites to report receipt of tetanus toxoid (28.3% versus 40.8%).

Within each of the three age groups, persons with incomes at or above poverty level were more likely than persons with incomes below poverty level to report receipt of tetanus toxoid, and receipt of tetanus toxoid increased as years of education increased. Among persons aged  $< 65$  years, those with medical insurance were more likely than those without medical insurance to report receipt of tetanus toxoid.

## DISCUSSION

### Adult Vaccination Successes

NHIS data indicate that, in 1995, the *Healthy People 2000* objective to increase annual influenza vaccination among persons aged  $\geq 65$  years to at least 60% had been achieved among non-Hispanic whites; the overall national coverage level was within 2 percentage points of the objective. In addition, NHIS data indicate that, in 1995, the *Healthy People 2000* objective to increase to at least 62% the proportion of adults who are up to date with the 10-year tetanus booster had been achieved among persons aged 18–49 years; the coverage level among persons aged 50–64 years was within 8 percentage points of the objective.

Analysis of combined BRFSS data for 1997 from the 50 states and District of Columbia indicates that 65.5% of older persons reported influenza vaccination during the previous 12 months, and 45.4% reported ever receiving pneumococcal vaccine — the highest levels ever recorded (14).

Possible reasons for increases in self-reported influenza and pneumococcal vaccination among persons aged  $\geq 65$  years since 1989 include a) greater acceptance of preventive medical services by practitioners and consumers, b) increased delivery and administration of vaccine by health-care providers and sources other than physicians (e.g., visiting nurse and home-health agencies), c) initiation of Medicare reimbursement for cost of influenza vaccine and its administration in 1993 (19), and d) initiation of Medicare reimbursement for administration of pneumococcal vaccine in 1993 (although authorized in 1981, reimbursement was previously implemented only for the cost of the vaccine) (20). Specific events that might have contributed to greater acceptance and delivery of vaccines include publication of recommendations for adult vaccination (7,21,22); development of standards for adult immunization practice by the National Coalition for Adult Immunization in 1990 (23); establishment of National Adult Immunization Awareness Week (celebrated annually in October) (24); publication of a comprehensive strategy to improve adult vaccination by the Department of Health and Human Services (25); and beginning in 1994, national and state-based campaigns conducted by the Health Care Financing Administration to increase influenza and pneumococcal vaccination coverage among Medicare beneficiaries (26) as well as state and local programs (27,28).

State and local health departments have also contributed to the increases in influenza and pneumococcal vaccination coverage (27,28). Vaccination levels among persons aged  $\geq 65$  years in each state and District of Columbia were higher in 1997 than in 1993. In 1997, the *Healthy People 2000* national objective for an annual influenza vaccination level of 60% was exceeded by 45 states, and if state-specific coverage continues to increase at rates observed during 1995–1997, a total of 28 states will reach or exceed the 60% objective for pneumococcal vaccination by 2000.

## Adult Vaccination Challenges

### ***Inadequate Influenza and Pneumococcal Vaccination of Adults Aged 18–64 Years With High-Risk Medical Conditions***

In 1995, influenza vaccination levels for adults with high-risk medical conditions were 22 percentage points below the  $\geq 60\%$  *Healthy People 2000* objective for those aged 50–64 years and 40 percentage points below for those aged 18–49 years. In 1995, pneumococcal vaccination coverage among persons in these two age groups was only slightly higher than half the influenza vaccination coverage level. To improve influenza vaccination levels among adults aged 50–64 years with high-risk medical conditions and in other target groups, the ACIP recently recommended routine annual vaccination of all persons in this age group (1).

### ***Inadequate Tetanus Vaccination of Adults Aged $\geq 65$ Years***

In 1995, the percentage of adults aged  $\geq 65$  years reporting receipt of tetanus toxoid during the previous 10 years was 22 percentage points below the *Healthy People 2000* objective of  $\geq 62\%$ . Self-reported receipt of tetanus toxoid decreased with increasing

age, consistent with patterns of age-specific prevalence of immunity to tetanus in the United States during 1988–1991 (29). Possible reasons for the decline in receipt of tetanus toxoid with increasing age include lack of payment for decennial tetanus boosters by Medicare Part B and missed opportunities for vaccination. To further reduce tetanus morbidity and mortality, increased use of Td is needed, especially among older adults.

### ***Inadequate Vaccination of Racial/Ethnic Minority Populations***

During 1993–1997, racial/ethnic disparities in vaccination coverage of adults aged  $\geq 65$  years continued for non-Hispanic blacks and Hispanics. Non-Hispanic whites were more likely to report influenza and pneumococcal vaccination than non-Hispanic blacks at all poverty levels, education levels, and levels of frequency of contact with health-care providers. State-specific differences in vaccination coverage among Hispanics might reflect socioeconomic and cultural differences of Hispanic subpopulations.

More information is needed about racial and ethnic disparities in vaccination coverage in states and local areas, health-care systems, patient and provider barriers to vaccination, and effective interventions to improve vaccination levels. This information will be useful in guiding the President's Initiative to Eliminate Racial and Ethnic Disparities in Health, which seeks to eliminate the health disparities of racial/ethnic minorities in adult (and child) vaccination, breast and cervical cancer screening, diabetes, cardiovascular disease, HIV infections, and infant mortality (30). In this effort, CDC is implementing the Racial and Ethnic Approaches to Community Health (REACH) demonstration projects, which are designed to mobilize communities and organize their resources to support effective and sustainable programs to eliminate health disparities.

Pneumococcal vaccination is particularly important for racial/ethnic populations with higher risk for pneumococcal bacteremia and meningitis: Alaskan Natives, some American Indian groups (e.g., Apache), and blacks (2). The relatively high pneumococcal vaccination coverage documented among older American Indians/Alaskan Natives in Oklahoma and Alaska might in part reflect compliance with recommendations for vaccination of these groups.

### ***Missed Opportunities to Offer Vaccination***

In this report, adults who reported more frequent contacts with health-care providers during the previous year were more likely to report vaccination, reflecting increased opportunities for vaccinations to be recommended by providers or requested by patients. Approximately one third of persons aged  $\geq 65$  years or younger adults with high-risk medical conditions reported five or more contacts with health-care providers during the previous year; however, most had not been vaccinated against influenza and pneumococcal disease (except persons aged  $\geq 65$  years receiving influenza vaccine). These data indicate missed opportunities by providers to offer vaccination services.

A physician's recommendation for vaccination services can have a strong influence on the patient's decision to be vaccinated (31–33). Recent surveys of physicians have indicated that most were aware of and agreed with vaccination recommendations; the main reason many cited for not delivering vaccines was oversight (34,35).

Every contact with the health-care system should be used to review and update vaccination status as needed, including review of indications for pneumococcal vac-

cine and tetanus toxoid when influenza vaccine is administered. Interventions (e.g., standing orders for vaccination [36], provider reminders and feedback, and patient recalls and reminders) have been effective in increasing adult vaccination levels (37,38). Guidelines and tools for implementing these interventions are available through *Put Prevention Into Practice*, a nationwide campaign to improve delivery of clinical preventive services (22,39). In addition, opportunities for vaccination at nontraditional health-care settings (e.g., pharmacies, grocery stores, or churches) could be increased to reach persons who do not routinely access traditional health-care settings (36).

The findings in this report indicate that influenza vaccination coverage exceeded pneumococcal vaccination coverage. Influenza vaccination campaigns are conducted annually before each influenza season; however, many providers and patients might not be simultaneously reminded about the need for pneumococcal vaccination. Pneumococcal vaccine can be administered concurrently with influenza or other vaccines (by separate injection in different limbs) without an increase in side effects or decreased antibody response to either vaccine (2). When indicated, pneumococcal vaccine should be administered to patients who are uncertain about their vaccination history (2).

Opportunities for vaccination of adults aged <65 years could also be increased by incorporating vaccination recommendations in guidelines for clinical care of persons with chronic diseases and conducting campaigns designed to reach persons with chronic diseases (e.g., diabetes) and their health-care providers. The finding that vaccination levels varied by type of chronic condition suggests that physicians in certain specialties might assume more responsibility for vaccination of their patients than other physicians (40).

Although >80% of adults aged <65 years with high-risk medical conditions reported having health insurance, influenza and pneumococcal vaccination levels among these insured adults were inadequate in 1995. This finding might reflect lack of coverage of influenza and pneumococcal vaccination services among persons aged <65 years by many health insurance plans. To encourage insurance companies to cover vaccination services, influenza and pneumococcal vaccination of all adults with high-risk medical conditions could be considered for inclusion in health plan performance measures such as the Health Plan Employer Data and Information Set (HEDIS) (41). Influenza vaccination of persons aged ≥65 years is included in the HEDIS version 3.0, and pneumococcal vaccination of persons aged ≥65 years has been included in the draft HEDIS 2001, which is available for review at <<http://www.ncqa.org/pages/communications/news/h2k1rel.htm>>.

### ***Need for Enhanced State and Local Surveillance of Vaccination***

The findings in this report indicate that vaccination coverage among older adults in 1997 and changes in coverage during 1995–1997 varied substantially by state. Multiple factors probably account for these state and regional differences, including physician practice patterns, provision of public health adult vaccination programs, and patient attitudes and access to care. More information is needed at local and state levels about the prevalence of physician recommendations for vaccination, availability of vaccination services in different settings, and consumer barriers to vaccination (31,42,43). This information might assist in identifying effective policies and practices that can be implemented in areas with lower vaccination levels.

## Limitations

The findings in this report are subject to at least five limitations. First, self-reported data about receipt of influenza and pneumococcal vaccine were not validated. However, in previous studies that validated self reports by medical record review, the sensitivity of self-reported data regarding influenza vaccination during previous influenza seasons ranged from 92% to 100%, and specificity ranged from 71% to 98% (44,45). For pneumococcal vaccine, a study documented that the sensitivity of self-reported data ranged from 87% to 97%, and specificity ranged from 53% to 76% (45).

Second, self-reported data regarding receipt of tetanus toxoid also were not validated. Validation studies have documented contrasting findings. In one study, self-report of the date of last tetanus vaccination was within a year of recorded dates for 18 (82%) of the 22 adult participants (46), and in a study of women in Bangladesh, 40% did not recall receiving tetanus toxoid doses administered 12–23 months before the interview (47).

Third, of the persons who reported having any of the pulmonary conditions, those who reported having asthma (which is not an indication for pneumococcal vaccine) could not be distinguished from those who reported having emphysema, chronic bronchitis, or tuberculosis (which are indicators for receiving pneumococcal vaccine). Therefore, the true at-risk population aged <65 years probably is smaller, and the pneumococcal vaccination estimates probably are underestimated.

Fourth, after combining 1995 and 1997 BRFSS data for each racial/ethnic population, estimates for many states did not meet the standard of reliability used in this report. Many estimates that met this standard had wide confidence intervals. Combined estimates represent an average of vaccination coverage in 1995 and 1997 and thus may not reflect changes that occurred from 1995 to 1997. Oversampling of racial/ethnic minority populations within states or local areas would provide more reliable estimates.

Fifth, not all target groups for influenza and pneumococcal vaccine could be identified by NHIS or BRFSS (e.g., persons with HIV infection). In addition, persons living with or having close contact with persons with high-risk conditions (e.g., persons other than health-care workers) weren't readily identified in either survey.

## CONCLUSIONS

The substantial reduction in vaccine-preventable diseases, which resulted from increasing childhood vaccination to all-time high levels, has been cited as one of 10 great public health achievements of the 20th century in the United States (9). Similar success can be achieved among the 35 million U.S. adults aged ≥65 years who should receive annual influenza vaccination and a pneumococcal vaccination, the estimated 33–39 million persons aged <65 years with high-risk conditions who should receive annual influenza vaccination, the 16 million persons aged <65 years with high-risk conditions who should receive a pneumococcal vaccination, and the 202 million adults who should be up to date with tetanus vaccination.

National goals for improving prevention of vaccine-preventable diseases among adults include a) increasing the demand for adult vaccination by improving provider and public awareness; b) increasing the capacity of the health-care delivery system to effectively deliver vaccines to adults; c) expanding financing mechanisms to support

the increased delivery of vaccines to adults; d) monitoring and improving the performance of the nation's immunization program; and e) enhancing the capability and capacity to conduct research regarding vaccine-preventable diseases in adults, vaccination practices, new and improved vaccines, and international programs for adult vaccination (25,48).

Continued efforts will be needed to increase vaccination among older adults during 2000–2010. In *Healthy People 2010* (<http://www.health.gov/healthypeople/Document/default.htm>), objective 14.29 proposes to increase to  $\geq 90\%$  the proportion of persons aged  $\geq 65$  years (and to  $\geq 60\%$  the proportion of younger persons with high-risk medical conditions) who are vaccinated against influenza and pneumococcal infections (49). To achieve these objectives, public, private, and community partners must collaborate to implement culturally appropriate and evidence-based interventions to increase vaccine use among all persons at risk for complications from influenza or pneumococcal infections. Timely surveillance of vaccination coverage among adults will focus the attention of public health programs on the undervaccinated populations most likely to suffer disproportionately from vaccine-preventable diseases.

#### Acknowledgments

The authors thank Peng-Jun Lu for statistical support and Mary McCauley for her critical review of the manuscript, National Immunization Program.

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**TABLE 1. Percentage of persons aged  $\geq 18$  years who reported receiving influenza or pneumococcal vaccine\* or tetanus toxoid, by age and selected characteristics — National Health Interview Survey, United States, 1995†**

Characteristic	Received influenza vaccine during previous 12 mos			Ever received pneumococcal vaccine			Received tetanus toxoid during previous 10 yrs		
	High-risk persons		All persons	High-risk persons		All persons	All persons		
	Aged	Aged	aged	Aged	Aged	aged	Aged	Aged	Aged
	18–49 yrs (n=1,194)	50–64 yrs (n=771)	$\geq 65$ yrs (n=3,442)	18–49 yrs (n=1,146)	50–64 yrs (n=745)	$\geq 65$ yrs (n=3,300)	18–49 yrs (n=10,355)	50–64 yrs (n=2,845)	$\geq 65$ yrs (n=3,207)
% (95% CI) <sup>§</sup>									
<b>Sex</b>									
Male	20.7 (±4.3)	32.3 (± 5.8)	60.1 (± 2.9)	11.3 (±3.2)	17.5 (±5.0)	34.6 (± 2.9)	71.8 (±1.5)	58.9 (± 3.1)	48.2 (± 3.3)
Female	20.1 (±3.4)	42.9 (± 5.3)	56.9 (± 2.4)	12.1 (±2.8)	22.4 (±4.5)	33.6 (±2.5)	58.8 (±1.5)	49.0 (± 2.8)	33.3 (± 2.4)
<b>Race/ethnicity<sup>¶</sup></b>									
Non-Hispanic white	18.9 (±3.0)	40.4 (± 4.7)	60.7 (± 2.0)	11.0 (±2.4)	21.5 (±3.9)	35.9 (± 2.1)	68.9 (±1.3)	56.0 (± 2.3)	40.8 (± 2.2)
Non-Hispanic black	24.4 (±7.0)	24.5 (± 8.9)	39.9 (± 5.6)	15.8 (±6.4)	11.7 (±6.2)	21.8 (± 5.2)	60.5 (±2.9)	43.9 (± 6.2)	36.9 (± 6.1)
Hispanic	18.2 (±7.0)	41.5 (±11.6)	49.9 (± 7.8)	10.7 (±5.6)	18.8 (±9.0)	23.2 (± 6.7)	53.2 (±2.7)	50.1 (± 6.2)	28.3 (± 7.1)
American Indian/ Alaskan Native	** —	** —	** —	** —	** —	** —	74.1 (±13.5)	** —	** —
Asian/Pacific Islander	** —	** —	50.9 (±15.8)	** —	** —	22.4(±12.3) <sup>#</sup>	43.9 (±7.6)	32.0(±14.9) <sup>#</sup>	25.1(±13.7) <sup>#</sup>
<b>Poverty status<sup>§§</sup></b>									
At or above poverty level	20.9 (±3.2)	40.1 (± 4.5)	59.4 (± 2.1)	10.7 (±2.3)	20.9 (±3.9)	35.4 (± 2.1)	66.1 (±1.2)	55.0 (± 2.2)	41.5 (± 2.2)
Below poverty level	19.3 (±5.7)	33.1 (± 9.4)	50.5 (± 5.7)	16.6 (±6.3)	17.2 (±6.8)	25.3 (± 5.4)	62.3 (±3.4)	46.1 (± 6.7)	33.5 (± 5.7)
<b>Education level</b>									
Less than high school	18.0 (±5.8)	35.3 (± 7.0)	54.9 (± 3.0)	12.9 (±4.8)	19.3 (±5.4)	28.8 (± 2.9)	58.0 (±3.0)	45.5 (± 4.4)	35.4 (± 3.1)
High school	19.9 (±4.4)	33.0 (± 6.2)	58.5 (± 3.3)	10.5 (±3.3)	19.1 (±5.1)	35.3 (± 3.1)	65.8 (±1.8)	51.4 (± 3.3)	37.6 (± 3.4)
More than high school	21.9 (±3.9)	46.2 (± 7.4)	62.5 (± 3.6)	12.8 (±3.2)	22.3 (±6.5)	40.0 (± 3.5)	66.6 (±1.5)	61.1 (± 3.2)	47.8 (± 3.6)
<b>Insurance status</b>									
Have medical insurance	21.9 (±3.0)	39.7 (± 4.3)	58.5 (± 1.8)	12.0 (±2.3)	20.5 (±3.5)	34.2 (± 1.8)	66.1 (±1.2)	55.2 (± 2.2)	39.6 (± 2.0)
No medical insurance	13.1 (±5.2)	24.2 (± 9.2)	** —	10.8 (±4.9)	17.6 (±9.2)	** —	61.2 (±2.5)	43.8 (± 5.5)	** —

**TABLE 1. (Continued) Percentage of persons aged  $\geq 18$  years who reported receiving influenza or pneumococcal vaccine\* or tetanus toxoid, by age and selected characteristics — National Health Interview Survey, United States, 1995<sup>†</sup>**

Characteristic	Received influenza vaccine during previous 12 mos			Ever received pneumococcal vaccine			Received tetanus toxoid during previous 10 yrs			
	High-risk persons		All persons	High-risk persons		All persons	All persons			
	Aged	Aged	aged	Aged	Aged	aged	Aged	Aged	Aged	
	18–49 yrs (n=1,194)	50–64 yrs (n=771)	$\geq 65$ yrs (n=3,412)	18–49 yrs (n=1,146)	50–64 yrs (n=745)	$\geq 65$ yrs (n=3,300)	18–49 yrs (n=10,355)	50–64 yrs (n=2,845)	$\geq 65$ yrs (n=3,207)	
	% (95% CI) <sup>§</sup>	% (95% CI)	% (95% CI)	% (95% CI)						
<b>No. physician contacts during the previous 12 mos</b>										
None	11.3 ( $\pm 5.9$ )	** —	32.0 ( $\pm 5.2$ )	** —	** —	17.4 ( $\pm 4.1$ )	59.6 ( $\pm 2.0$ )	46.4 ( $\pm 4.5$ )	29.0 ( $\pm 5.2$ )	
1–2	17.7 ( $\pm 4.8$ )	29.5 ( $\pm 7.3$ )	56.4 ( $\pm 3.5$ )	9.9 ( $\pm 3.4$ )	14.4 ( $\pm 5.6$ )	29.9 ( $\pm 3.3$ )	66.8 ( $\pm 1.7$ )	52.0 ( $\pm 3.6$ )	37.5 ( $\pm 3.4$ )	
3–4	22.1 ( $\pm 7.0$ )	41.0 ( $\pm 9.0$ )	62.3 ( $\pm 3.7$ )	10.2 ( $\pm 5.0$ )	23.1 ( $\pm 8.7$ )	37.2 ( $\pm 4.0$ )	66.5 ( $\pm 2.9$ )	57.3 ( $\pm 5.0$ )	40.2 ( $\pm 3.9$ )	
$\geq 5$	24.8 ( $\pm 4.2$ )	45.0 ( $\pm 5.7$ )	65.8 ( $\pm 2.9$ )	15.3 ( $\pm 3.6$ )	23.8 ( $\pm 4.7$ )	41.1 ( $\pm 3.2$ )	69.4 ( $\pm 2.2$ )	59.8 ( $\pm 3.9$ )	44.8 ( $\pm 3.5$ )	
<b>Total</b>	<b>20.4 (<math>\pm 2.6</math>)</b>	<b>37.7 (<math>\pm 4.0</math>)</b>	<b>58.2 (<math>\pm 1.8</math>)</b>	<b>11.8 (<math>\pm 2.1</math>)</b>	<b>20.1 (<math>\pm 3.3</math>)</b>	<b>34.0 (<math>\pm 1.8</math>)</b>	<b>65.2 (<math>\pm 1.1</math>)</b>	<b>53.8 (<math>\pm 2.1</math>)</b>	<b>39.6 (<math>\pm 2.0</math>)</b>	

\* The prevalences of influenza and pneumococcal vaccination were estimated only for persons at high risk for complications caused by these infections (i.e., 18–49-year-olds and 50–64-year-olds at high risk and all persons aged  $\geq 65$  years). Persons categorized as “high risk” for influenza-related complications self-reported one or more of the following: diabetes during the previous year; asthma, emphysema, chronic bronchitis, or tuberculosis during the previous year; chronic kidney disease during the previous year; current treatment for any cancer; or ever being told by a physician about having had a heart attack, heart failure, a chronic heart condition, or rheumatic heart disease. Persons categorized at high risk for pneumococcal-related complications either met the criteria for being at high risk for influenza-related complications or reported liver disease or cirrhosis during the previous year.

<sup>†</sup> n=17,317. Sample sizes might not total 17,317 because persons with unknown vaccination status were excluded from analysis.

<sup>§</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by  $\pm 1.96$ .

<sup>¶</sup> Persons of Hispanic origin can be of any race; however, the race groups non-Hispanic white, non-Hispanic black, American Indian/Alaskan Native, and Asian/Pacific Islander do not include persons of Hispanic origin.

\*\* The standard of reliability is RSE  $< 0.3$  (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the denominator was  $< 30$ .

<sup>††</sup> Meets the standard of reliability; however,  $< 50$  respondents were in the denominator.

<sup>§§</sup> Poverty status is based on family size, number of children aged  $< 18$  years, and family income using the 1994 poverty levels derived from the August 1995 Current Population Survey. Persons for whom poverty status was not determined were excluded from this analysis.

**TABLE 2. Percentage of persons aged 18–64 years who reported receiving influenza or pneumococcal vaccine, by age and medical condition — National Health Interview Survey, United States, 1995\***

Condition <sup>†</sup>	Received influenza vaccine during previous 12 mos		Ever received pneumococcal vaccine	
	18–49 yrs (n=10,757)	50–64 yrs (n=3,000)	18–49 yrs (n=10,055)	50–64 yrs (n=2,901)
	% (95% CI) <sup>§</sup>	% (95% CI)	% (95% CI)	% (95% CI)
Diabetes during the previous year	28.9 (± 6.6)	38.5 (± 6.6)	14.2 (± 9.1)	21.5 (± 5.7)
Asthma, emphysema, chronic bronchitis, or tuberculosis during the previous year	18.6 (± 3.3)	43.6 (± 7.4)	11.8 (± 3.1)	29.9 (± 6.7)
Ever had a heart attack, heart failure, a chronic heart condition, or rheumatic heart disease	20.1 (± 6.1)	37.9 (± 6.1)	9.7 (± 4.1)	17.4 (± 5.0)
Chronic kidney disease during the previous year	17.2 (± 9.8)	39.2 (±14.9)	¶ —	18.6 (±10.5)
Current treatment for any cancer	28.6 (±13.2)	40.1 (±12.8)	23.3 (±13.7)	22.8 (±11.5)
Liver disease or cirrhosis during the previous year	** —	** —	¶ —	¶ —
None of the above high-risk conditions	12.2 (± 0.8)	23.5 (± 2.0)	5.9 (± 0.6)	6.8 (± 1.2)

\* n=13,849. Sample sizes might not total 13,849 because persons with unknown vaccination status were excluded from analysis.

<sup>†</sup> The prevalences of influenza and pneumococcal vaccination among persons aged 18–64 years was estimated only for those at high risk for complications caused by these infections. The high-risk medical conditions presented were self-reported. Persons who indicated more than one condition were included in the calculation of vaccination coverage for each condition reported.

<sup>§</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by  $\pm 1.96$ .

<sup>¶</sup> The standard of reliability is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the denominator was <30.

\*\* Not included as a high-risk condition for which influenza vaccination is recommended.

**TABLE 3. Percentage of persons aged  $\geq 65$  years who reported receiving influenza or pneumococcal vaccine, by race/ethnicity\*, poverty status†, education level, and number of physician contacts during the previous 12 months — National Health Interview Survey, United States, 1995‡**

Characteristic	Received influenza vaccine during previous 12 mos						Ever received pneumococcal vaccine					
	Non-Hispanic white (n=2,745)		Non-Hispanic black (n=358)		Hispanic (n=243)		Non-Hispanic white (n=2,644)		Non-Hispanic black (n=341)		Hispanic (n=227)	
	%	(95% CI) <sup>§</sup>	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>Poverty status</b>												
At or above poverty level	61.0	(±2.3)	40.9	(± 8.3)	53.4	(±10.1)	36.9	(±2.3)	22.3	(± 6.8)	26.5	(± 8.5)
Below poverty level	56.8	(±7.4)	37.2	(±10.3)	45.7	(±14.6)	30.2	(±7.3)	18.7	(± 9.2)	**	—
<b>Education level</b>												
Less than high school	58.2	(±3.4)	41.8	(± 7.3)	49.9	(± 9.8) <sup>†</sup>	31.7	(±3.5)	21.5	(± 7.0)	17.7	(± 7.7)
High school	60.0	(±3.5)	34.6	(±11.4)	50.2	(±18.5)**	36.1	(±3.3)	22.6	(±10.5)	30.4	(±17.2) <sup>†</sup>
More than high school	64.1	(±3.8)	43.0	(±14.1)	**	—	40.8	(±3.8)	23.2	(±12.0)	**	—
<b>No. physician contacts during the previous 12 mos</b>												
None	33.7	(±5.8)	**	—	**	—	18.1	(±4.6)	**	—	**	—
1–2	57.9	(±3.8)	36.8	(±11.5)	52.6	(±15.0)	30.9	(±3.6)	16.6	(± 9.6)	27.3	(±15.8)
3–4	65.5	(±4.0)	46.5	(±12.7)	43.7	(±15.8)	39.7	(±4.5)	27.7	(±12.3)	**	—
$\geq 5$	68.8	(±3.1)	44.4	(± 8.7)	61.7	(±12.9)	43.9	(±3.6)	25.2	(± 8.0)	30.3	(±12.4)
<b>Total</b>	<b>60.7</b>	<b>(±2.0)</b>	<b>39.9</b>	<b>(± 6.4)</b>	<b>49.9</b>	<b>(± 7.8)</b>	<b>35.9</b>	<b>(±2.1)</b>	<b>21.8</b>	<b>(± 5.2)</b>	<b>23.2</b>	<b>(± 6.7)</b>

\* Data are presented only for non-Hispanic whites, non-Hispanic blacks, and Hispanics because numbers for other racial/ethnic groups were too small for meaningful analysis. Persons of Hispanic origin can be of any race; however, the racial/ethnic groups non-Hispanic white and non-Hispanic black do not include persons of Hispanic origin.

† Poverty status is based on family size, number of children aged <18 years, and family income using the 1994 poverty levels derived from the August 1995 Current Population Survey. Persons for whom poverty status was not determined were excluded from this analysis.

‡ n=3,468. Sample sizes might not total 3,468 because persons with unknown vaccination status were excluded from analysis.

§ Confidence interval. 95% CIs were calculated by multiplying the standard error by  $\pm 1.96$ .

\*\* The standard of reliability is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the denominator was <30.

†† Meets the standard of reliability; however, <50 respondents were in the denominator.

**TABLE 4. Percentage of persons aged  $\geq 65$  years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1993, 1995, and 1997 combined\***

Reporting area	Received influenza vaccine during the previous 12 mos						Ever received pneumococcal vaccine					
	1993		1995		1997		1993		1995		1997	
	%	(95% CI) <sup>†</sup>	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>New England</b>												
Maine	49.5	( $\pm 6.3$ )	64.5	( $\pm 6.4$ )	72.1	( $\pm 5.4$ )	20.5	( $\pm 5.1$ )	35.5	( $\pm 6.5$ )	50.0	( $\pm 5.7$ )
New Hampshire	51.1	( $\pm 6.9$ )	56.0	( $\pm 6.6$ )	64.6	( $\pm 6.2$ )	20.3	( $\pm 5.6$ )	40.5	( $\pm 6.8$ )	49.6	( $\pm 6.5$ )
Vermont	57.2	( $\pm 5.9$ )	64.1	( $\pm 4.9$ )	69.5	( $\pm 4.1$ )	29.8	( $\pm 5.5$ )	36.0	( $\pm 4.8$ )	51.6	( $\pm 4.5$ )
Massachusetts	50.1	( $\pm 6.3$ )	59.3	( $\pm 5.9$ )	66.0	( $\pm 6.0$ )	22.7	( $\pm 5.4$ )	32.4	( $\pm 5.8$ )	52.7	( $\pm 6.3$ )
Rhode Island	51.4	( $\pm 5.8$ )	66.6	( $\pm 5.4$ )	67.7	( $\pm 5.3$ )	21.1	( $\pm 4.5$ )	30.8	( $\pm 5.5$ )	43.0	( $\pm 5.6$ )
Connecticut	54.0	( $\pm 5.8$ )	62.5	( $\pm 5.6$ )	67.2	( $\pm 5.1$ )	19.8	( $\pm 4.5$ )	38.3	( $\pm 5.7$ )	43.0	( $\pm 5.4$ )
<b>Total</b>	<b>51.5</b>	<b>(<math>\pm 3.4</math>)</b>	<b>61.1</b>	<b>(<math>\pm 3.2</math>)</b>	<b>67.1</b>	<b>(<math>\pm 3.1</math>)</b>	<b>21.7</b>	<b>(<math>\pm 2.8</math>)</b>	<b>34.8</b>	<b>(<math>\pm 3.2</math>)</b>	<b>48.9</b>	<b>(<math>\pm 3.3</math>)</b>
<b>Middle Atlantic</b>												
New York	45.9	( $\pm 5.3$ )	55.9	( $\pm 5.3$ )	64.5	( $\pm 4.2$ )	22.9	( $\pm 4.2$ )	26.2	( $\pm 4.7$ )	38.9	( $\pm 4.5$ )
New Jersey	53.2	( $\pm 6.6$ )	48.0	( $\pm 7.6$ )	60.7	( $\pm 4.8$ )	23.3	( $\pm 5.7$ )	13.0	( $\pm 5.1$ )	33.9	( $\pm 4.6$ )
Pennsylvania	49.1	( $\pm 4.5$ )	58.6	( $\pm 4.4$ )	65.8	( $\pm 3.8$ )	25.9	( $\pm 4.0$ )	38.5	( $\pm 4.9$ )	47.1	( $\pm 4.1$ )
<b>Total</b>	<b>48.5</b>	<b>(<math>\pm 3.2</math>)</b>	<b>55.3</b>	<b>(<math>\pm 3.2</math>)</b>	<b>64.1</b>	<b>(<math>\pm 2.5</math>)</b>	<b>24.0</b>	<b>(<math>\pm 2.6</math>)</b>	<b>28.1</b>	<b>(<math>\pm 3.1</math>)</b>	<b>40.7</b>	<b>(<math>\pm 2.7</math>)</b>
<b>East North Central</b>												
Ohio	50.6	( $\pm 6.1$ )	63.0	( $\pm 6.5$ )	65.4	( $\pm 4.1$ )	29.0	( $\pm 5.7$ )	40.7	( $\pm 6.9$ )	38.5	( $\pm 4.5$ )
Indiana	47.6	( $\pm 5.2$ )	59.2	( $\pm 4.8$ )	62.5	( $\pm 5.2$ )	27.8	( $\pm 4.6$ )	34.1	( $\pm 4.5$ )	38.0	( $\pm 5.4$ )
Illinois	45.8	( $\pm 5.2$ )	57.9	( $\pm 6.2$ )	67.8	( $\pm 6.5$ )	24.4	( $\pm 4.5$ )	28.9	( $\pm 5.8$ )	44.7	( $\pm 6.6$ )
Michigan	47.9	( $\pm 5.4$ )	56.7	( $\pm 4.8$ )	63.6	( $\pm 5.0$ )	24.9	( $\pm 4.5$ )	39.9	( $\pm 4.8$ )	45.6	( $\pm 5.2$ )
Wisconsin	49.9	( $\pm 6.3$ )	56.9	( $\pm 5.9$ )	66.1	( $\pm 5.3$ )	28.6	( $\pm 5.9$ )	35.8	( $\pm 5.6$ )	42.6	( $\pm 5.7$ )
<b>Total</b>	<b>48.3</b>	<b>(<math>\pm 2.6</math>)</b>	<b>59.2</b>	<b>(<math>\pm 2.7</math>)</b>	<b>65.0</b>	<b>(<math>\pm 2.3</math>)</b>	<b>26.7</b>	<b>(<math>\pm 2.4</math>)</b>	<b>36.9</b>	<b>(<math>\pm 2.8</math>)</b>	<b>41.7</b>	<b>(<math>\pm 2.4</math>)</b>
<b>West North Central</b>												
Minnesota	51.0	( $\pm 4.0$ )	63.2	( $\pm 3.7$ )	69.0	( $\pm 3.3$ )	26.7	( $\pm 3.6$ )	40.1	( $\pm 3.7$ )	48.3	( $\pm 3.5$ )
Iowa	49.7	( $\pm 5.1$ )	63.7	( $\pm 3.6$ )	69.7	( $\pm 3.4$ )	32.7	( $\pm 4.7$ )	44.9	( $\pm 3.8$ )	51.5	( $\pm 3.9$ )
Missouri	54.9	( $\pm 5.9$ )	66.6	( $\pm 6.0$ )	70.3	( $\pm 5.0$ )	32.0	( $\pm 5.8$ )	32.2	( $\pm 6.1$ )	44.3	( $\pm 5.7$ )
North Dakota	49.1	( $\pm 5.0$ )	57.4	( $\pm 4.9$ )	64.8	( $\pm 4.8$ )	20.6	( $\pm 4.1$ )	33.3	( $\pm 4.8$ )	40.8	( $\pm 4.8$ )
South Dakota	47.7	( $\pm 5.1$ )	60.0	( $\pm 5.0$ )	65.6	( $\pm 4.5$ )	27.0	( $\pm 4.6$ )	31.5	( $\pm 4.9$ )	40.6	( $\pm 4.5$ )
Nebraska	53.4	( $\pm 5.1$ )	64.4	( $\pm 4.6$ )	65.8	( $\pm 4.1$ )	27.8	( $\pm 4.6$ )	36.0	( $\pm 4.6$ )	49.8	( $\pm 4.4$ )
Kansas	53.4	( $\pm 6.6$ )	62.2	( $\pm 5.2$ )	61.5	( $\pm 5.2$ )	23.7	( $\pm 5.5$ )	44.7	( $\pm 5.3$ )	43.7	( $\pm 5.3$ )
<b>Total</b>	<b>52.2</b>	<b>(<math>\pm 2.4</math>)</b>	<b>63.9</b>	<b>(<math>\pm 2.2</math>)</b>	<b>67.9</b>	<b>(<math>\pm 2.0</math>)</b>	<b>28.7</b>	<b>(<math>\pm 2.2</math>)</b>	<b>38.2</b>	<b>(<math>\pm 2.3</math>)</b>	<b>46.5</b>	<b>(<math>\pm 2.2</math>)</b>

**TABLE 4. (Continued) Percentage of persons aged  $\geq 65$  years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1993, 1995, and 1997 combined\***

Reporting area	Received influenza vaccine during the previous 12 mos						Ever received pneumococcal vaccine					
	1993		1995		1997		1993		1995		1997	
	%	(95% CI) <sup>†</sup>	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>South Atlantic</b>												
Delaware	55.0	( $\pm 5.4$ )	57.2	( $\pm 5.1$ )	68.6	( $\pm 4.2$ )	38.1	( $\pm 5.2$ )	41.5	( $\pm 4.9$ )	52.6	( $\pm 4.7$ )
Maryland	49.4	( $\pm 4.1$ )	58.3	( $\pm 3.7$ )	63.4	( $\pm 4.4$ )	35.5	( $\pm 3.9$ )	33.6	( $\pm 3.5$ )	41.0	( $\pm 4.4$ )
District of Columbia	29.6	( $\pm 6.9$ )	§	—	54.3	( $\pm 7.1$ )	22.5	( $\pm 7.3$ )	§	—	32.3	( $\pm 6.7$ )
Virginia	46.4	( $\pm 6.6$ )	52.4	( $\pm 6.9$ )	67.7	( $\pm 4.8$ )	34.7	( $\pm 6.3$ )	39.5	( $\pm 7.2$ )	53.6	( $\pm 5.6$ )
West Virginia	49.8	( $\pm 4.4$ )	53.2	( $\pm 4.4$ )	58.2	( $\pm 4.4$ )	28.8	( $\pm 4.1$ )	37.0	( $\pm 4.5$ )	41.3	( $\pm 4.4$ )
North Carolina	51.1	( $\pm 5.0$ )	52.5	( $\pm 3.9$ )	64.6	( $\pm 3.8$ )	27.1	( $\pm 4.7$ )	31.3	( $\pm 3.5$ )	50.6	( $\pm 3.9$ )
South Carolina	47.8	( $\pm 5.7$ )	51.1	( $\pm 5.6$ )	74.3	( $\pm 4.2$ )	20.5	( $\pm 4.7$ )	26.5	( $\pm 4.9$ )	41.6	( $\pm 4.8$ )
Georgia	44.9	( $\pm 5.6$ )	47.0	( $\pm 4.9$ )	58.5	( $\pm 5.8$ )	29.2	( $\pm 5.1$ )	39.6	( $\pm 4.7$ )	48.5	( $\pm 5.7$ )
Florida	46.5	( $\pm 3.8$ )	61.7	( $\pm 3.6$ )	62.3	( $\pm 3.4$ )	26.1	( $\pm 3.4$ )	39.5	( $\pm 3.7$ )	45.5	( $\pm 3.5$ )
<b>Total</b>	<b>47.4</b>	<b>(<math>\pm 2.0</math>)</b>	<b>56.2</b>	<b>(<math>\pm 2.0</math>)</b>	<b>63.5</b>	<b>(<math>\pm 1.8</math>)</b>	<b>28.3</b>	<b>(<math>\pm 1.9</math>)</b>	<b>36.9</b>	<b>(<math>\pm 2.0</math>)</b>	<b>46.5</b>	<b>(<math>\pm 1.9</math>)</b>
<b>East South Central</b>												
Kentucky	45.5	( $\pm 4.4$ )	53.5	( $\pm 4.4$ )	61.2	( $\pm 3.7$ )	25.5	( $\pm 4.0$ )	25.3	( $\pm 3.9$ )	38.6	( $\pm 3.7$ )
Tennessee	46.1	( $\pm 4.4$ )	63.2	( $\pm 5.4$ )	69.1	( $\pm 4.1$ )	25.8	( $\pm 3.9$ )	29.9	( $\pm 4.9$ )	45.0	( $\pm 4.5$ )
Alabama	40.4	( $\pm 4.7$ )	45.1	( $\pm 5.7$ )	62.6	( $\pm 4.9$ )	25.8	( $\pm 4.3$ )	33.1	( $\pm 5.4$ )	47.5	( $\pm 5.2$ )
Mississippi	43.0	( $\pm 6.6$ )	57.0	( $\pm 5.9$ )	61.1	( $\pm 5.5$ )	27.8	( $\pm 5.6$ )	39.4	( $\pm 5.8$ )	45.9	( $\pm 6.0$ )
<b>Total</b>	<b>43.9</b>	<b>(<math>\pm 2.4</math>)</b>	<b>55.0</b>	<b>(<math>\pm 2.8</math>)</b>	<b>64.2</b>	<b>(<math>\pm 2.3</math>)</b>	<b>26.1</b>	<b>(<math>\pm 2.2</math>)</b>	<b>31.2</b>	<b>(<math>\pm 2.5</math>)</b>	<b>44.3</b>	<b>(<math>\pm 2.4</math>)</b>
<b>West South Central</b>												
Arkansas	52.4	( $\pm 5.6$ )	61.0	( $\pm 5.1$ )	61.1	( $\pm 5.3$ )	27.6	( $\pm 4.6$ )	37.1	( $\pm 5.4$ )	39.1	( $\pm 5.4$ )
Louisiana	36.4	( $\pm 5.9$ )	52.2	( $\pm 6.2$ )	58.4	( $\pm 6.1$ )	18.9	( $\pm 4.8$ )	26.0	( $\pm 5.2$ )	32.2	( $\pm 5.8$ )
Oklahoma	58.5	( $\pm 5.7$ )	61.1	( $\pm 4.7$ )	69.3	( $\pm 4.2$ )	29.6	( $\pm 4.8$ )	37.2	( $\pm 4.6$ )	40.4	( $\pm 4.3$ )
Texas	57.1	( $\pm 5.9$ )	56.7	( $\pm 6.8$ )	68.0	( $\pm 5.2$ )	38.2	( $\pm 5.6$ )	44.8	( $\pm 7.0$ )	44.4	( $\pm 5.6$ )
<b>Total</b>	<b>53.5</b>	<b>(<math>\pm 3.7</math>)</b>	<b>57.2</b>	<b>(<math>\pm 4.2</math>)</b>	<b>66.0</b>	<b>(<math>\pm 3.4</math>)</b>	<b>32.7</b>	<b>(<math>\pm 3.5</math>)</b>	<b>39.9</b>	<b>(<math>\pm 4.4</math>)</b>	<b>41.5</b>	<b>(<math>\pm 3.6</math>)</b>

**TABLE 4. (Continued) Percentage of persons aged  $\geq 65$  years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1993, 1995, and 1997 combined\***

Reporting area	Received influenza vaccine during the previous 12 mos			Ever received pneumococcal vaccine		
	1993	1995	1997	1993	1995	1997
	% (95% CI) <sup>†</sup>	% (95% CI)				
<b>Mountain</b>						
Montana	62.4 ( $\pm$ 6.6)	64.0 ( $\pm$ 6.3)	68.4 ( $\pm$ 5.4)	34.2 ( $\pm$ 6.7)	34.9 ( $\pm$ 6.3)	50.8 ( $\pm$ 5.9)
Idaho	64.4 ( $\pm$ 5.9)	64.2 ( $\pm$ 4.4)	66.4 ( $\pm$ 3.5)	33.7 ( $\pm$ 5.9)	40.2 ( $\pm$ 4.6)	50.2 ( $\pm$ 3.8)
Wyoming	<sup>§</sup> —	66.8 ( $\pm$ 5.0)	72.4 ( $\pm$ 4.8)	<sup>§</sup> —	43.8 ( $\pm$ 5.2)	50.9 ( $\pm$ 5.4)
Colorado	64.6 ( $\pm$ 6.4)	66.7 ( $\pm$ 5.5)	74.4 ( $\pm$ 5.5)	41.0 ( $\pm$ 6.7)	46.6 ( $\pm$ 6.0)	53.3 ( $\pm$ 6.1)
New Mexico	61.7 ( $\pm$ 6.8)	69.0 ( $\pm$ 7.0)	72.8 ( $\pm$ 4.9)	33.5 ( $\pm$ 6.4)	39.6 ( $\pm$ 7.3)	50.1 ( $\pm$ 5.7)
Arizona	66.2 ( $\pm$ 6.4)	65.3 ( $\pm$ 5.8)	72.9 ( $\pm$ 5.4)	31.6 ( $\pm$ 6.2)	49.2 ( $\pm$ 6.3)	59.4 ( $\pm$ 6.1)
Utah	54.8 ( $\pm$ 6.7)	70.2 ( $\pm$ 4.8)	66.1 ( $\pm$ 5.6)	35.7 ( $\pm$ 6.6)	42.7 ( $\pm$ 5.5)	48.5 ( $\pm$ 6.2)
Nevada	44.1 ( $\pm$ 6.6)	52.5 ( $\pm$ 5.9)	56.5 ( $\pm$ 10.2)	32.9 ( $\pm$ 6.6)	40.3 ( $\pm$ 5.9)	53.5 ( $\pm$ 10.4)
<b>Total</b>	<b>62.0 (<math>\pm</math> 2.9)</b>	<b>65.1 (<math>\pm</math> 2.5)</b>	<b>70.1 (<math>\pm</math> 2.5)</b>	<b>34.8 (<math>\pm</math> 2.9)</b>	<b>44.3 (<math>\pm</math> 2.7)</b>	<b>54.0 (<math>\pm</math> 2.7)</b>
<b>Pacific</b>						
Washington	53.5 ( $\pm$ 5.3)	66.7 ( $\pm$ 4.6)	70.3 ( $\pm$ 4.0)	33.5 ( $\pm$ 5.0)	46.0 ( $\pm$ 4.9)	51.6 ( $\pm$ 4.5)
Oregon	56.0 ( $\pm$ 4.4)	67.0 ( $\pm$ 4.1)	69.8 ( $\pm$ 4.1)	35.8 ( $\pm$ 4.5)	45.9 ( $\pm$ 4.4)	55.9 ( $\pm$ 4.3)
California	54.6 ( $\pm$ 4.4)	60.0 ( $\pm$ 4.8)	65.5 ( $\pm$ 3.8)	36.9 ( $\pm$ 4.4)	44.3 ( $\pm$ 4.8)	49.8 ( $\pm$ 4.0)
Alaska	53.5 ( $\pm$ 11.1)	49.8 ( $\pm$ 15.8)	58.3 ( $\pm$ 11.4)	31.5 ( $\pm$ 10.0)	45.9 ( $\pm$ 16.3)	39.2 ( $\pm$ 11.2)
Hawaii	57.1 ( $\pm$ 7.4)	62.3 ( $\pm$ 5.5)	71.1 ( $\pm$ 5.2)	40.5 ( $\pm$ 7.1)	43.0 ( $\pm$ 5.7)	51.7 ( $\pm$ 5.9)
<b>Total</b>	<b>54.7 (<math>\pm</math> 3.4)</b>	<b>61.6 (<math>\pm</math> 3.6)</b>	<b>66.7 (<math>\pm</math> 2.9)</b>	<b>36.4 (<math>\pm</math> 3.3)</b>	<b>44.7 (<math>\pm</math> 3.6)</b>	<b>50.6 (<math>\pm</math> 3.1)</b>
<b>Range</b>	<b>29.6–66.2</b>	<b>45.1–70.2</b>	<b>54.3–74.4</b>	<b>18.9–41.0</b>	<b>13.0–49.2</b>	<b>32.2–59.4</b>
<b>Median</b>	<b>50.8</b>	<b>60.0</b>	<b>66.0</b>	<b>27.8</b>	<b>38.4</b>	<b>45.9</b>

\* Persons with unknown or uncertain vaccination status were excluded from this analysis. Because in previously published analyses of 1993 and 1995 data these persons were categorized as “unvaccinated,” vaccination coverage estimates for 1993 and 1995 in this analysis are slightly higher than those previously published.

<sup>†</sup> Confidence interval. 95% CIs were calculated by multiplying the standard error by  $\pm 1.96$ .

<sup>§</sup> Not available. The District of Columbia did not participate in the 1995 BRFSS, and Wyoming did not participate in 1993.

**TABLE 5. Percentage of persons aged  $\geq 65$  years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area and race/ethnicity\* — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1995 and 1997 combined**

Reporting area	Received influenza vaccine during previous 12 mos						Ever received pneumococcal vaccine					
	Non-Hispanic white		Non-Hispanic black		Hispanic		Non-Hispanic white		Non-Hispanic black		Hispanic	
	%	(95% CI) <sup>†</sup>	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>New England</b>												
Maine	68.2	( $\pm 4.2$ )	§	—	§	—	42.3	( $\pm 4.4$ )	§	—	§	—
New Hampshire	60.5	( $\pm 4.6$ )	§	—	§	—	45.4	( $\pm 4.8$ )	§	—	§	—
Vermont	67.2	( $\pm 3.2$ )	§	—	§	—	44.1	( $\pm 3.4$ )	§	—	§	—
Massachusetts	62.8	( $\pm 4.3$ )	§	—	§	—	43.0	( $\pm 4.5$ )	§	—	§	—
Rhode Island	67.4	( $\pm 3.9$ )	§	—	§	—	37.6	( $\pm 4.1$ )	§	—	§	—
Connecticut	65.3	( $\pm 3.9$ )	§	—	§	—	41.5	( $\pm 4.1$ )	§	—	§	—
<b>Total</b>	<b>64.3</b>	<b>(<math>\pm 2.3</math>)</b>	<b>63.4</b>	<b>(<math>\pm 15.7</math>)</b>	<b>63.6</b>	<b>(<math>\pm 17.3</math>)</b>	<b>42.4</b>	<b>(<math>\pm 2.4</math>)</b>	<b>29.2</b>	<b>(<math>\pm 17.0</math>)</b>	<b>36.0</b>	<b>(<math>\pm 16.1</math>)</b>
<b>Middle Atlantic</b>												
New York	63.7	( $\pm 3.5$ )	40.3	( $\pm 11.4$ )	51.8	( $\pm 20.2$ ) <sup>‡</sup>	34.9	( $\pm 3.6$ )	18.6	( $\pm 9.9$ )	31.6	( $\pm 17.3$ ) <sup>‡</sup>
New Jersey	56.3	( $\pm 4.7$ )	40.7	( $\pm 17.3$ ) <sup>‡</sup>	§	—	25.2	( $\pm 3.8$ )	§	—	§	—
Pennsylvania	64.1	( $\pm 3.0$ )	44.6	( $\pm 14.1$ )	§	—	44.1	( $\pm 3.3$ )	32.1	( $\pm 13.3$ )	§	—
<b>Total</b>	<b>62.4</b>	<b>(<math>\pm 2.1</math>)</b>	<b>41.4</b>	<b>(<math>\pm 8.1</math>)</b>	<b>48.7</b>	<b>(<math>\pm 14.0</math>)</b>	<b>36.4</b>	<b>(<math>\pm 2.2</math>)</b>	<b>20.3</b>	<b>(<math>\pm 7.0</math>)</b>	<b>24.3</b>	<b>(<math>\pm 11.3</math>)</b>
<b>East North Central</b>												
Ohio	64.9	( $\pm 4.0$ )	57.7	( $\pm 12.6$ )	§	—	39.8	( $\pm 4.3$ )	40.1	( $\pm 12.7$ )	§	—
Indiana	61.5	( $\pm 3.6$ )	47.8	( $\pm 15.8$ ) <sup>‡</sup>	§	—	37.4	( $\pm 3.6$ )	§	—	§	—
Illinois	64.4	( $\pm 4.9$ )	46.6	( $\pm 17.0$ ) <sup>‡</sup>	65.6	( $\pm 16.1$ ) <sup>‡</sup>	37.9	( $\pm 4.9$ )	30.7	( $\pm 15.6$ ) <sup>‡</sup>	30.6	( $\pm 16.4$ ) <sup>‡</sup>
Michigan	62.0	( $\pm 3.7$ )	47.5	( $\pm 13.0$ )	§	—	45.0	( $\pm 3.8$ )	26.4	( $\pm 11.3$ )	§	—
Wisconsin	61.2	( $\pm 4.1$ )	§	—	§	—	39.5	( $\pm 4.1$ )	§	—	§	—
<b>Total</b>	<b>63.1</b>	<b>(<math>\pm 1.9</math>)</b>	<b>51.8</b>	<b>(<math>\pm 7.3</math>)</b>	<b>59.1</b>	<b>(<math>\pm 14.0</math>)</b>	<b>40.3</b>	<b>(<math>\pm 1.9</math>)</b>	<b>29.8</b>	<b>(<math>\pm 6.7</math>)</b>	<b>30.9</b>	<b>(<math>\pm 13.5</math>)</b>
<b>West North Central</b>												
Minnesota	66.4	( $\pm 2.5$ )	§	—	§	—	44.1	( $\pm 2.6$ )	§	—	§	—
Iowa	67.2	( $\pm 2.5$ )	§	—	§	—	48.4	( $\pm 2.7$ )	§	—	§	—
Missouri	69.0	( $\pm 4.0$ )	52.7	( $\pm 18.4$ ) <sup>‡</sup>	§	—	39.1	( $\pm 4.4$ )	25.8	( $\pm 15.6$ ) <sup>‡</sup>	§	—
North Dakota	60.7	( $\pm 3.5$ )	§	—	§	—	36.7	( $\pm 3.5$ )	§	—	§	—
South Dakota	62.2	( $\pm 3.5$ )	§	—	§	—	35.4	( $\pm 3.4$ )	§	—	§	—
Nebraska	65.0	( $\pm 3.2$ )	60.1	( $\pm 19.2$ ) <sup>‡</sup>	§	—	43.6	( $\pm 3.3$ )	§	—	§	—
Kansas	63.8	( $\pm 3.7$ )	§	—	§	—	45.5	( $\pm 3.9$ )	§	—	§	—
<b>Total</b>	<b>66.4</b>	<b>(<math>\pm 1.5</math>)</b>	<b>48.4</b>	<b>(<math>\pm 12.3</math>)</b>	<b>62.5</b>	<b>(<math>\pm 14.8</math>)</b>	<b>42.9</b>	<b>(<math>\pm 1.6</math>)</b>	<b>28.1</b>	<b>(<math>\pm 10.5</math>)</b>	<b>31.4</b>	<b>(<math>\pm 14.4</math>)</b>

**TABLE 5. (Continued) Percentage of persons aged  $\geq 65$  years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area and race/ethnicity\* — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1995 and 1997 combined**

Reporting area	Received influenza vaccine during previous 12 mos						Ever received pneumococcal vaccine					
	Non-Hispanic white		Non-Hispanic black		Hispanic		Non-Hispanic white		Non-Hispanic black		Hispanic	
	%	(95% CI) <sup>†</sup>	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>South Atlantic</b>												
Delaware	64.7	( $\pm 3.5$ )	52.6	( $\pm 11.4$ )	§	—	49.1	( $\pm 3.6$ )	34.1	( $\pm 12.2$ )	§	—
Maryland	65.0	( $\pm 3.0$ )	42.6	( $\pm 8.1$ )	§	—	40.3	( $\pm 3.2$ )	26.3	( $\pm 6.8$ )	§	—
District of Columbia**	64.0	( $\pm 13.5$ )	49.4	( $\pm 8.2$ )	§	—	40.4	( $\pm 13.8$ )	29.0	( $\pm 7.5$ )	§	—
Virginia	63.9	( $\pm 4.6$ )	35.6	( $\pm 11.8$ )	§	—	49.3	( $\pm 5.0$ )	31.4	( $\pm 12.6$ )	§	—
West Virginia	56.1	( $\pm 3.2$ )	39.1	( $\pm 17.9$ ) <sup>¶</sup>	§	—	40.0	( $\pm 3.2$ )	§	—	§	—
North Carolina	62.8	( $\pm 3.0$ )	38.5	( $\pm 6.8$ )	§	—	45.0	( $\pm 3.0$ )	23.0	( $\pm 5.9$ )	§	—
South Carolina	66.0	( $\pm 4.0$ )	52.3	( $\pm 8.4$ )	§	—	39.1	( $\pm 4.1$ )	16.2	( $\pm 6.0$ )	§	—
Georgia	57.6	( $\pm 4.3$ )	34.5	( $\pm 8.2$ )	§	—	49.7	( $\pm 4.2$ )	23.0	( $\pm 7.7$ )	§	—
Florida	64.3	( $\pm 2.6$ )	54.7	( $\pm 11.6$ )	44.3	( $\pm 9.6$ )	45.9	( $\pm 2.7$ )	28.8	( $\pm 10.5$ )	15.8	( $\pm 7.0$ )
<b>Total</b>	<b>63.1</b>	<b>(<math>\pm 1.4</math>)</b>	<b>42.9</b>	<b>(<math>\pm 3.7</math>)</b>	<b>47.4</b>	<b>(<math>\pm 8.2</math>)</b>	<b>45.4</b>	<b>(<math>\pm 1.5</math>)</b>	<b>24.8</b>	<b>(<math>\pm 3.3</math>)</b>	<b>19.8</b>	<b>(<math>\pm 6.3</math>)</b>
<b>East South Central</b>												
Kentucky	58.4	( $\pm 2.9$ )	42.0	( $\pm 12.9$ )	§	—	32.8	( $\pm 2.8$ )	19.1	( $\pm 9.9$ )	§	—
Tennessee	69.9	( $\pm 3.5$ )	40.5	( $\pm 10.8$ )	§	—	39.5	( $\pm 3.6$ )	25.5	( $\pm 9.8$ )	§	—
Alabama	55.8	( $\pm 4.3$ )	46.2	( $\pm 9.3$ )	§	—	43.9	( $\pm 4.3$ )	25.3	( $\pm 8.0$ )	§	—
Mississippi	66.1	( $\pm 4.5$ )	40.4	( $\pm 8.5$ )	§	—	51.4	( $\pm 4.9$ )	19.2	( $\pm 7.2$ )	§	—
<b>Total</b>	<b>62.8</b>	<b>(<math>\pm 1.9</math>)</b>	<b>42.6</b>	<b>(<math>\pm 5.2</math>)</b>	<b>57.5</b>	<b>(<math>\pm 16.1</math>)</b>	<b>40.5</b>	<b>(<math>\pm 1.9</math>)</b>	<b>23.0</b>	<b>(<math>\pm 4.5</math>)</b>	<b>31.4</b>	<b>(<math>\pm 14.1</math>)</b>
<b>West South Central</b>												
Arkansas	63.4	( $\pm 3.8$ )	39.3	( $\pm 12.2$ )	§	—	40.0	( $\pm 4.1$ )	16.2	( $\pm 9.4$ )	§	—
Louisiana	58.1	( $\pm 5.0$ )	46.0	( $\pm 9.2$ )	§	—	30.7	( $\pm 4.4$ )	22.3	( $\pm 9.0$ )	§	—
Oklahoma	67.2	( $\pm 3.2$ )	§	—	§	—	38.5	( $\pm 3.3$ )	33.2	( $\pm 15.9$ ) <sup>¶</sup>	§	—
Texas	66.4	( $\pm 4.7$ )	43.1	( $\pm 16.3$ ) <sup>¶</sup>	48.9	( $\pm 12.8$ )	48.3	( $\pm 5.0$ )	§	—	31.6	( $\pm 12.2$ )
<b>Total</b>	<b>65.0</b>	<b>(<math>\pm 2.9</math>)</b>	<b>42.7</b>	<b>(<math>\pm 7.6</math>)</b>	<b>50.8</b>	<b>(<math>\pm 11.5</math>)</b>	<b>43.5</b>	<b>(<math>\pm 3.1</math>)</b>	<b>19.9</b>	<b>(<math>\pm 6.0</math>)</b>	<b>32.7</b>	<b>(<math>\pm 11.0</math>)</b>

**TABLE 5. (Continued) Percentage of persons aged ≥65 years who reported receiving influenza vaccine or pneumococcal vaccine, by reporting area and race/ethnicity\* — Behavioral Risk Factor Surveillance System (BRFSS), 50 states and the District of Columbia, 1995 and 1997 combined**

Reporting area	Received influenza vaccine during previous 12 mos						Ever received pneumococcal vaccine					
	Non-Hispanic white		Non-Hispanic black		Hispanic		Non-Hispanic white		Non-Hispanic black		Hispanic	
	%	(95% CI)†	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
<b>Mountain</b>												
Montana	66.5	(± 4.2)	§	—	§	—	43.5	(± 4.4)	§	—	§	—
Idaho	65.3	(± 2.9)	§	—	§	—	45.2	(± 3.0)	§	—	§	—
Wyoming	70.2	(± 3.5)	§	—	§	—	47.7	(± 3.8)	§	—	§	—
Colorado	71.0	(± 4.0)	§	—	74.2	(±12.8)	51.7	(± 4.5)	§	—	40.0	(±16.5)
New Mexico	71.8	(± 5.1)	§	—	69.3	(± 8.3)	47.1	(± 5.5)	§	—	39.4	(± 9.0)
Arizona	69.8	(± 4.0)	§	—	71.2	(±15.4)	55.2	(± 4.5)	§	—	51.5	(±19.0)
Utah	68.6	(± 3.7)	§	—	§	—	45.5	(± 4.3)	§	—	§	—
Nevada	56.9	(± 6.6)	§	—	§	—	48.1	(± 6.8)	§	—	§	—
<b>Total</b>	<b>68.3</b>	<b>(± 1.8)</b>	<b>48.9</b>	<b>(±21.4)</b>	<b>67.1</b>	<b>(± 6.5)</b>	<b>50.2</b>	<b>(± 2.0)</b>	<b>39.0</b>	<b>(±20.2)</b>	<b>41.4</b>	<b>(± 7.5)</b>
<b>Pacific</b>												
Washington	69.6	(± 3.1)	§	—	§	—	50.0	(± 3.4)	§	—	§	—
Oregon	68.8	(± 2.9)	§	—	§	—	50.7	(± 3.2)	§	—	§	—
California	62.8	(± 3.3)	53.1	(±15.3)	56.6	(±10.3)	49.6	(± 3.4)	36.0	(±14.7)	32.1	(± 9.2)
Alaska	53.0	(±10.8)	§	—	§	—	41.4	(±10.9)	§	—	§	—
Hawaii	59.4	(± 7.5)	§	—	58.2	(±15.1)	51.5	(± 7.8)	§	—	45.4	(±15.3)
<b>Total</b>	<b>64.5</b>	<b>(± 2.4)</b>	<b>51.7</b>	<b>(±14.1)</b>	<b>56.5</b>	<b>(± 9.5)</b>	<b>49.8</b>	<b>(± 2.5)</b>	<b>36.9</b>	<b>(±13.7)</b>	<b>32.3</b>	<b>(± 8.6)</b>

\* Data are presented only for non-Hispanic whites, non-Hispanic blacks, and Hispanics because numbers for other racial/ethnic groups were too small for meaningful analysis. Persons of Hispanic origin can be of any race; however, the racial/ethnic groups non-Hispanic white and non-Hispanic black do not include persons of Hispanic origin.

† Confidence interval. 95% CIs were calculated by multiplying the standard error by ±1.96.

§ The standard of reliability is RSE <0.3 (where RSE = the ratio of the standard error and the prevalence). This estimate did not meet that standard, or the denominator was <30.

¶ Meets the standard of reliability; however, <50 respondents were in the denominator.

\*\* Includes 1997 data only; the District of Columbia did not participate in the 1995 BRFSS.





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State and Territorial Epidemiologists and Laboratory Directors are acknowledged for their contributions to *CDC Surveillance Summaries*. The epidemiologists and the laboratory directors listed below were in the positions shown as of July 2000.

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