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National, State, and Selected Local Area Vaccination Coverage Among Children Aged 19–35 Months — United States, 2014

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The reduction in morbidity and mortality associated with vaccine-preventable diseases in the United States has been described as one of the 10 greatest public health achievements of the first decade of the 21st century (*1*). A recent analysis concluded that routine childhood vaccination will prevent 322 million cases of disease and about 732,000 early deaths among children born during 1994–2013, for a net societal cost savings of $1.38 trillion (*2*). The National Immunization Survey (NIS) has monitored vaccination coverage among U.S. children aged 19–35 months since 1994 (*3*). This report presents national, regional, state, and selected local area vaccination coverage estimates for children born from January 2011 through May 2013, based on data from the 2014 NIS. For most vaccinations, there was no significant change in coverage between 2013 and 2014. The exception was hepatitis A vaccine (HepA), for which increases were observed in coverage with both ≥1 and ≥2 doses. As in previous years, <1% of children received no vaccinations. National coverage estimates indicate that the *Healthy People 2020* target* of 90% was met for ≥3 doses of poliovirus vaccine (93.3%), ≥1 dose of measles, mumps, and rubella vaccine (MMR) (91.5%), ≥3 doses of hepatitis B vaccine (HepB) (91.6%), and ≥1 dose of varicella vaccine (91.0%). Coverage was below target for ≥4 doses of diphtheria, tetanus, and acellular pertussis vaccine (DTaP), the full series of *Haemophilus influenzae* type b (Hib) vaccine, hepatitis B (HepB) birth dose,† ≥4 doses pneumococcal conjugate vaccine (PCV), ≥2 doses of HepA, the full series of rotavirus vaccine, and the combined vaccine series.§ Examination of coverage by child's race/ethnicity revealed lower estimated coverage among non-Hispanic black children compared with non-Hispanic white children for several vaccinations, including DTaP, the full series of Hib, PCV, rotavirus vaccine, and

* Additional information on *Healthy People 2020* is available at http://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives.

† The *Healthy People 2020* target for the birth dose (0–3 days) of HepB is 85%, measured by annual birth cohort. For the three most recent completed birth cohorts examined by NIS, coverage with the birth dose of HepB was 70.6% for children born in 2009, 71.8% for children born in 2010, and 73.2% for children born in 2011.

§ The combined (4:3:1:3*:3:1:4) vaccine series includes ≥4 doses of DTaP/diphtheria and tetanus toxoids vaccine/diphtheria, tetanus toxoids, and pertussis vaccine, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, ≥3 or ≥4 doses of Hib (depending on product type of vaccine), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

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the combined series. Children from households classified as below the federal poverty level had lower estimated coverage for almost all of the vaccinations assessed, compared with children living at or above the poverty level. Significant variation in coverage by state¶ was observed for several vaccinations, including HepB birth dose, HepA, and rotavirus. High vaccination coverage must be maintained across geographic and sociodemographic groups if progress in reducing the impact of vaccine-preventable diseases is to be sustained.

NIS employs a dual-frame landline and cell phone** random-digit–dialing (RDD) design to identify households with children aged 19–35 months in the 50 states, the District of Columbia, selected local areas, and, in 2014, Puerto Rico.†† Once households with age-eligible children are identified, a parent or guardian is interviewed and asked for consent to contact the child's vaccination provider. If consent is obtained, the providers receive a mail survey requesting the child's vaccination history, including dates of receipt of specific vaccine doses. This information is used to calculate comprehensive estimates of coverage (i.e., the percentage of children who are up-to-date as recommended by the Advisory Committee on Immunization Practices [ACIP]) (*4*). Data are weighted to be representative of the population of U.S. children aged 19–35 months and are adjusted for multiple telephone lines, mixed telephone use (i.e., landline and cellular), household nonresponse, and the exclusion of households without telephones. Details regarding NIS methodology, including methods for synthesizing provider-reported immunization histories and weighting, have been described previously.§§ National estimates for the 2014 NIS are based upon 14,893

¶ Samples of telephone numbers were drawn independently, for each calendar quarter, within selected geographical areas, or strata. In 2014, there were 58 geographic strata for which vaccination coverage levels could be estimated, including seven primarily urban city/county areas (including the District of Columbia); the remaining 51 estimation areas were either entire states or territories (including Puerto Rico). This design allowed for annual estimates of vaccination coverage levels for each of the 58 estimation areas with a specified degree of precision (a coefficient of variation of approximately 6.5 percent). Further, by using the same data collection methodology and survey instruments in all estimation areas, the NIS produces comparable vaccination coverage levels among estimation areas and over time.

** All identified cell telephone households were eligible for interview. Sampling weights were adjusted to correct for dual-frame (landline and cell telephone) sampling, nonresponse, noncoverage, and overlapping samples of mixed (landline and cellular) telephone use. A description of NIS dual-frame survey methodology and its effect on reported vaccination estimates is available at http://www.cdc.gov/vaccines/imz-managers/coverage/nis/child/dual-frame-sampling.html.

†† The local areas sampled separately for the 2014 NIS included areas that receive federal Section 317 immunization funds and are included in the NIS sample every year (Chicago, Illinois; New York, New York; Philadelphia County, Pennsylvania; Bexar County, Texas; and Houston, Texas) and one additional sampled area (El Paso County, Texas). The 2014 NIS was also conducted in Puerto Rico, but Puerto Rico was excluded from national coverage estimates.

§§ A description of the statistical methodology of the NIS is available at http://www.cdc.gov/nchs/nis/data_files.htm.

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children with adequate provider data.¶¶ The national Council of American Survey Research Organizations (CASRO) response rates were 62.6% for the landline and 33.5% for the cell phone frame.*** Coverage estimates for Hib††† and rotavirus§§§ take into account the type of vaccine used because the number of doses required differs, depending on the manufacturer. Logistic regression was used to assess differences among racial/ethnic groups, adjusting for poverty status. Statistical comparisons were made using t-tests on weighted data, taking into account the complex survey design. Statistical significance was defined as a p-value of <0.05.

National Vaccination Coverage

Among U.S. children aged 19–35 months, changes in coverage between 2013 and 2014 were small and not statistically significant (Table 1). The only exception was an estimated 2.0 percentage point increase for ≥1 HepA dose and 2.8 percentage point increase for ≥2 HepA doses. Coverage with the combined series and the vaccines that comprise the series were similar to those in 2013.

¶¶ Children from Puerto Rico (n = 166) were excluded from the national estimates. Of the 466 completed interviews among Puerto Rican children, 40 by landline (35.7%) and 126 by cell telephone (35.6%) had adequate provider data.

*** The CASRO household response rate, calculated as the product of the resolution rate (percentage of the total telephone numbers called that were classified as nonworking, nonresidential, or residential), screening completion rate (percentage of known households that were successfully screened for the presence of age-eligible children), and the interview completion rate (percentage of households with one or more age-eligible children that completed the household survey). For Puerto Rico, the landline and cell telephone sample CASRO rates were 53.2% and 32.5%, respectively. Additional information is available at http://www.casro.org. The CASRO response rate is equivalent to the American Association for Public Opinion Research (AAPOR) type 3 response rate. Information about AAPOR response rates is available at http://www.aapor.org/AAPORKentico/AAPOR_Main/media/publications/Standard-Definitions2015_8theditionwithchanges_April2015_logo.pdf.

††† Coverage for primary Hib series was based on receipt of ≥2 or ≥3 doses, depending on product type received. The PRP-OMB Hib products require a 2-dose primary series with doses at ages 2 months and 4 months. All other Hib products require 3-dose primary series with doses at ages 2, 4, and 6 months. Coverage for the full series, which includes the primary series and a booster dose, was based on receipt of ≥3 or ≥4 doses, depending on product type received. All Hib products require a booster dose at age 12–15 months.

§§§ Coverage for rotavirus vaccine was based on ≥2 or ≥3 doses, depending on product type received (≥2 doses for Rotarix [RV1], licensed in April 2008, or ≥3 doses for RotaTeq [RV5], licensed in February 2006). ACIP does not recommend mixing the two rotavirus vaccines, but in the event that mixing is inevitable because of nonavailability of vaccine used to initiate series, then a total of 3 doses are required if RV5 is one of the vaccine doses (or there is at least 1 dose of unknown type). Rotavirus vaccine type was known for 95.9% of the children in the 2014 NIS who had adequate provider data, including 96.1% of those living at or above the poverty level and 95.4% of those living below the poverty level. Additional information at http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5802a1.htm.

Summary

What is already known on this topic?

Vaccines remain one of the most effective tools available for the prevention of childhood diseases. Since 1994, the National Immunization Survey (NIS) has monitored vaccination coverage among U.S. children aged 19–35 months for vaccines recommended by the Advisory Committee on Immunization Practices. To gauge progress toward achieving full vaccination with recommended childhood vaccines, observed coverage levels are compared to targets set by *Healthy People 2020*.

What is added by this report?

This report presents national, regional, state, and selected local area vaccination coverage estimates based on data from the 2014 NIS. For most vaccinations, coverage is high and remains similar to levels seen in the previous year. Coverage with ≥2 doses of hepatitis A vaccine increased significantly to 57.5% but remains well below the *Healthy People 2020* target of 85%. The national target of 90% coverage was reached for ≥3 doses of poliovirus vaccine, ≥1 dose of measles, mumps, and rubella vaccine, ≥3 doses of hepatitis B vaccine, and ≥1 dose of varicella vaccine. Children living below the federal poverty level had lower coverage for almost all of the vaccinations assessed, compared with children living at or above the poverty level. Significant variation in coverage was also observed by state for several vaccinations, especially the hepatitis B birth dose, ≥2 doses of hepatitis A, and rotavirus.

What are the implications for public health practice?

Greater effort should be focused on facilitating receipt of booster doses recommended for the second year of life, when routine health care provider visits are less frequent. Ensuring that providers are fully aware of appropriate catch-up vaccination practices could be an important strategy for achieving full coverage with these vaccines, as could encouraging use of combination vaccines. Additional interventions targeted at families living below the poverty level are needed to address the lower coverage levels observed among children from such families. Proven strategies recommended in the *Guide to Community Preventive Services* should be implemented, and additional effective interventions sought. Achieving and maintaining high coverage with childhood vaccinations is critical to sustaining progress in reducing the impact of vaccine-preventable diseases in children.

Vaccination Coverage by Selected Demographic Characteristics

Non-Hispanic black¶¶¶ children had lower coverage levels than non-Hispanic white children for DTaP, the full series of Hib, PCV, rotavirus, and the combined series (Table 2). Except

¶¶¶ Child's race/ethnicity was reported by his/her parent or guardian. Children categorized in this report as white, black, American Indian/Alaska Native, Asian, Native Hawaiian/other Pacific Islander, or multiracial were identified as non-Hispanic by the parent or guardian. Children identified as multiracial had more than one race category selected. Persons identified as Hispanic might be of any race.

TABLE 1. Estimated vaccination coverage among children aged 19–35 months, by selected vaccines and doses — National Immunization Survey, United States, 2010–2014*

	2010		2011		2012		2013		2014	
Vaccine and doses	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**	**%**	**(95% CI)**
DTaP										
≥3 doses	95.0	(±0.6)	95.5	(±0.5)	94.3	(±0.7)	94.1	(±0.9)	94.7	(±0.7)
≥4 doses	84.4	(±1.0)	84.6	(±1.0)	82.5	(±1.2)	83.1	(±1.3)	84.2	(±1.2)
Poliovirus (≥3 doses)	93.3	(±0.7)	93.9	(±0.6)	92.8	(±0.7)	92.7	(±1.0)	93.3	(±0.8)
MMR (≥1 dose)	91.5	(±0.7)	91.6	(±0.8)	90.8	(±0.8)	91.9	(±0.9)	91.5	(±0.9)
Hib†										
Primary series	92.2	(±0.8)	94.2	(±0.6)	93.3	(±0.7)	93.7	(±0.9)	93.3	(±0.8)
Full series	66.8	(±1.3)	80.4	(±1.1)	80.9	(±1.2)	82.0	(±1.3)	82.0	(±1.3)
HepB										
≥3 doses	91.8	(±0.7)	91.1	(±0.7)	89.7	(±0.9)	90.8	(±1.0)	91.6	(±0.9)
1 dose by 3 days (birth)§	64.1	(±1.3)	68.6	(±1.3)	71.6	(±1.4)	74.2	(±1.4)	72.4	(±1.5)
Varicella (≥1 dose)	90.4	(±0.8)	90.8	(±0.7)	90.2	(±0.8)	91.2	(±0.9)	91.0	(±0.9)
PCV										
≥3 doses	92.6	(±0.8)	93.6	(±0.6)	92.3	(±0.8)	92.4	(±1.0)	92.6	(±0.8)
≥4 doses	83.3	(±1.0)	84.4	(±1.0)	81.9	(±1.1)	82.0	(±1.3)	82.9	(±1.3)
HepA										
≥1 dose	78.3	(±1.1)	81.2	(±1.0)	81.5	(±1.1)	83.1	(±1.2)	85.1	(±1.1)¶
≥2 doses	49.7	(±1.4)	52.2	(±1.4)	53.0	(±1.5)	54.7	(±1.6)	57.5	(±1.6)¶
Rotavirus**	59.2	(±1.4)	67.3	(±1.3)	68.6	(±1.4)	72.6	(±1.5)	71.7	(±1.6)
Combined series††	56.6	(±1.3)	68.5	(±1.3)	68.4	(±1.4)	70.4	(±1.5)	71.6	(±1.5)
Children who received no vaccinations	0.7	(±0.2)	0.8	(±0.2)	0.8	(±0.1)	0.7	(±0.3)	0.8	(±0.2)

Abbreviations: CI = confidence interval; DTaP = diphtheria, tetanus toxoids, and acellular pertussis vaccine (includes children who might have been vaccinated with diphtheria and tetanus toxoids vaccine, or diphtheria, tetanus toxoids, and pertussis vaccine); MMR = measles, mumps, and rubella vaccine; Hib = *Haemophilus influenzae* type b vaccine; HepB = hepatitis B vaccine; PCV = pneumococcal conjugate vaccine; HepA = hepatitis A vaccine.

* For 2010, includes children born January 2007–July 2009; for 2011, children born January 2008–May 2010; for 2012, children born January 2009–May 2011; for 2013, children born January 2010–May 2012; and for 2014, children born January 2011–May 2013.

† Hib primary series: receipt of ≥2 or ≥3 doses, depending on product type received. Full series: receipt of ≥3 or ≥4 doses, depending on product type received (primary series and booster dose).

§ HepB administered from birth through age 3 days.

¶ Statistically significant change in coverage compared with 2013 (p<0.05).

** Rotavirus vaccine includes ≥2 or ≥3 doses, depending on the product type received (≥2 doses for Rotarix [RV1] or ≥3 doses for RotaTeq [RV5]).

†† The combined (4:3:1:3*:3:1:4) vaccine series includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, full series of Hib vaccine (≥3 or ≥4 doses, depending on product type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

for rotavirus vaccination, coverage differences between non-Hispanic black and non-Hispanic white children were no longer statistically significant after adjustment for poverty status. DTaP coverage was lower for multiracial children compared to their non-Hispanic white counterparts. In some instances, coverage among other racial/ethnic groups exceeded levels among non-Hispanic whites. Poliovirus vaccination and HepB birth dose coverage were similar among racial/ethnic groups. With few exceptions, vaccination coverage was significantly lower for children living below the federal poverty level**** compared with those classified as at or above the poverty level (Table 2). As in 2013, lower coverage for children living below the poverty level was observed for DTaP, poliovirus vaccine, the primary and full series of Hib, PCV, rotavirus vaccine, and the combined series. In contrast to 2013, coverage was also lower for MMR and ≥2 HepA doses.

Vaccination Coverage by Geographic Area

Variation in vaccination coverage by geographic area was also evident (Table 3). For MMR, the highest state-level coverage was observed in Maine (97.2%), where coverage increased by 6.2 percentage points from 2013 levels. The lowest estimated MMR coverage was 84.1% (Arizona). Coverage with ≥4 doses of DTaP vaccine ranged from 93.1% (Maine) to 72.8% (Wyoming). HepB birth dose coverage ranged from 88.4% (North Dakota) to 48.4% (Vermont). Coverage with ≥2 HepA doses ranged from 69.0% (Connecticut) to 32.7% (Wyoming), for rotavirus vaccination from 88.8% (Rhode Island) to 59.2% (Michigan), and for completion of the combined series from 84.7% (Maine) to 63.4% (West Virginia). Increases in rotavirus vaccination coverage compared with 2013 levels were observed in Alabama, North Carolina, Arkansas, New Mexico, Oklahoma, and Wyoming.

**** Poverty level uses income and family size to categorize households into 1) at or above the poverty level, and 2) below the poverty level. Poverty level was based on 2013 U.S. Census poverty thresholds, available at http://www.census.gov/hhes/www/poverty/data/threshold.

TABLE 2. Estimated vaccination coverage among children aged 19–35 months, by selected vaccines and doses, race/ethnicity,* and poverty level† — National Immunization Survey, United States, 2014§

	Race/Ethnicity														Poverty level			
	White, non-Hispanic		Black, non-Hispanic		Hispanic		American Indian/ Alaska Native, non-Hispanic		Asian, non-Hispanic		Native Hawaiian or other Pacific Islander, non-Hispanic		Multiracial, non-Hispanic		At or above		Below	
Vaccine and doses	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
DTaP																		
≥3 doses	94.7	(±0.9)	93.2	(±2.1)	95.2	(±1.6)	93.8	(±6.8)	95.8	(±3.3)	96.4	(±4.5)	95.0	(±3.0)	95.9	(±0.7)	93.1	(±1.5)**
≥4 doses	85.5	(±1.3)	79.1	(±3.8)¶	85.4	(±2.6)	NA	(±NA)	87.4	(±4.9)	NA	(±NA)	79.6	(±5.6)¶	87.4	(±1.2)	79.1	(±2.5)**
Poliovirus (≥3 doses)	93.3	(±0.9)	92.0	(±2.3)	93.8	(±1.9)	93.8	(±6.8)	93.2	(±4.0)	93.8	(±7.5)	94.0	(±3.1)	94.5	(±0.8)	92.0	(±1.6)**
MMR (≥1 dose)	91.2	(±1.1)	90.3	(±3.0)	91.9	(±2.0)	96.5	(±3.7)¶	95.7	(±2.4)¶	95.7	(±4.7)	90.5	(±4.5)	92.8	(±0.9)	89.5	(±1.9)**
Hib††																		
≥3 doses	92.6	(±1.0)	91.0	(±2.4)	93.6	(±1.9)	91.3	(±7.4)	91.4	(±4.5)	95.8	(±4.9)	93.6	(±3.1)	94.4	(±0.8)	90.1	(±1.8)**
Primary series	93.4	(±1.0)	91.7	(±2.3)	94.0	(±1.9)	93.6	(±6.7)	91.9	(±4.5)	97.3	(±3.8)	94.5	(±3.0)	95.0	(±0.8)	90.9	(±1.8)**
Full series	83.8	(±1.4)	75.2	(±4.1)¶	82.8	(±2.9)	83.8	(±8.8)	83.1	(±5.3)	NA	(±NA)	78.7	(±5.5)	85.5	(±1.3)	76.3	(±2.6)**
HepB																		
≥3 doses	90.7	(±1.1)	92.3	(±2.1)	91.9	(±2.1)	98.5	(±1.4) ¶	92.9	(±3.9)	95.2	(±5.3)	92.9	(±3.4)	92.0	(±1.0)	91.3	(±1.7)
1 dose by 3 days (birth)§§	70.5	(±1.8)	72.5	(±4.8)	74.8	(±3.7)	NA	(±NA)	73.3	(±6.1)	NA	(±NA)	75.2	(±5.9)	71.6	(±1.8)	73.7	(±3.1)
Varicella (≥1 dose)	90.3	(±1.1)	90.1	(±3.0)	92.1	(±2.0)	95.7	(±4.1)¶	95.3	(±2.6)¶	94.9	(±5.3)	90.0	(±4.6)	91.9	(±1.1)	89.9	(±1.8)
PCV																		
≥3 doses	92.5	(±1.1)	91.7	(±2.2)	93.7	(±1.8)	90.2	(±8.9)	90.1	(±4.6)	96.3	(±4.5)	93.3	(±3.4)	94.0	(±0.9)	90.9	(±1.7)**
≥4 doses	84.5	(±1.5)	78.0	(±4.0)¶	83.2	(±2.9)	NA	(±NA)	80.9	(±5.7)	93.1	(±6.6)¶	82.1	(±5.2)	86.9	(±1.3)	76.9	(±2.7)**
HepA (≥2 doses)	55.4	(±1.9)	56.7	(±4.5)	61.6	(±3.9)¶	NA	(±NA)	67.7	(±6.5)¶	NA	(±NA)	53.7	(±6.3)	59.2	(±1.9)	54.0	(±3.1)**
Rotavirus¶¶	74.8	(±1.7)	61.6	(±4.7)¶	71.3	(±3.9)	NA	(±NA)	72.4	(±6.8)	NA	(±NA)	73.9	(±5.2)	76.9	(±1.7)	62.8	(±3.1)**
Combined series* **	72.6	(±1.8)	65.4	(±4.5)¶	74.3	(±3.3)	NA	(±NA)	69.5	(±6.5)	NA	(±NA)	68.5	(±6.0)	75.4	(±1.6)	65.7	(±2.9)**

Abbreviations: CI = confidence interval; DTaP = diphtheria, tetanus toxoids, and acellular pertussis vaccine (includes children who might have been vaccinated with diphtheria and tetanus toxoids vaccine, or diphtheria, tetanus toxoids, and pertussis vaccine); NA = not available (estimate not available if the unweighted sample size for the denominator was <30 or 95% CI half width / estimate >0.588 or 95% CI half width was ≥10); MMR = measles, mumps, and rubella vaccine; Hib = *Haemophilus influenzae* type b vaccine; HepB = hepatitis B vaccine; PCV = pneumococcal conjugate vaccine; HepA = hepatitis A vaccine.

* Children's race/ethnicity was reported by parent or guardian. Children identified in this report as white, black, Asian, American Indian/Alaska Native, Native Hawaiian or other Pacific Islander, or multiracial were reported by the parent or guardian as non-Hispanic. Children identified as multiracial had more than one race category selected. Children identified as Hispanic might be of any race.

† Children were classified as below the poverty level if their total family income was less than the poverty threshold specified for the applicable family size and number of children aged <18 years. Children with total family income at or above the poverty threshold specified for the applicable family size and number of children aged <18 years were classified as at or above poverty. A total of 492 children with adequate provider data and missing data on income were excluded from the analysis. Poverty thresholds reflect yearly changes in the Consumer Price Index. Additional information available at http://www.census.gov/hhes/www/poverty.html.

§ Children in the 2014 National Immunization Survey were born January 2011–May 2013.

¶ Statistically significant difference (p<0.05) in estimated vaccination coverage by race/ethnicity. Children identified as non-Hispanic white were the reference group.

** Statistically significant difference (p<0.05) in estimated vaccination coverage by poverty level. Children living at or above poverty were the reference group.

†† Hib primary series: receipt of ≥2 or ≥3 doses, depending on product type received. Full series: primary series and booster dose; includes receipt of ≥3 or ≥4 doses, depending on product type received.

§§ HepB administered from birth through age 3 days.

¶¶ Includes ≥2 or ≥3 doses, depending on product type received (≥2 doses for Rotarix [RV1] or ≥3 doses for RotaTeq [RV5]).

*** The combined (4:3:1:3*:3:1:4) vaccine series includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, full series of Hib vaccine (≥3 or ≥4 doses, depending on type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

Discussion

Based on results from the 2014 NIS, national coverage for ACIP-recommended vaccines among U.S. children aged 19–35 months remained largely stable compared with 2013. *Healthy People 2020* coverage targets were met only for poliovirus, MMR, HepB, and varicella vaccination. Coverage with the combined series remained below target levels; this appears to be largely because of suboptimal coverage with DTaP, the full series of Hib, and PCV. Coverage with the penultimate dose of each of these vaccines exceeded 90%, indicating that efforts focused on ensuring receipt of the final dose are important. The final dose for these vaccines is often scheduled during the second year of life, when routine visits to health care providers occur less frequently, and thus, opportunities to vaccinate are fewer. Ensuring that providers are fully aware of appropriate catch-up vaccination practices could be an important strategy for achieving full coverage with these vaccines, as could encouraging increased use of combination vaccines.

Lower coverage for non-Hispanic black children relative to their non-Hispanic white counterparts appears to be largely explained by poverty status, except in the case of rotavirus vaccination. Reasons for the persistent disparity are unclear and merit further investigation. Disparities in vaccination

TABLE 3. Estimated vaccination coverage with selected individual vaccines and a combined vaccine series* among children aged 19–35 months, by U.S. Department of Health and Human Services (HHS) region and state and local area — National Immunization Survey, United States, 2014†

HHS region, state, and local area	MMR (≥1 dose)		DTaP (≥4 doses)		Hep B (birth)§		HepA (≥2 doses)		Rotavirus¶		Combined vaccine series*	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
U.S. overall	**91.5**	**(±0.9)**	**84.2**	**(±1.2)**	**72.4**	**(±1.5)**	**57.5**	**(±1.6)****	**71.7**	**(±1.6)**	**71.6**	**(±1.5)**
HHS Region I	**94.3**	**(±2.0)**	**89.1**	**(±2.9)**	**74.0**	**(±3.8)**	**64.2**	**(±4.3)**	**79.6**	**(±3.7)**	**75.9**	**(±4.0)**
Connecticut	93.2	(±4.6)	86.0	(±6.0)	76.8	(±6.7)	69.0	(±7.8)	76.4	(±7.2)	73.0	(±7.7)
Maine	97.2	(±2.0)**	93.1	(±3.5)	73.0	(±7.3)	62.1	(±7.5)	75.4	(±6.6)	84.7	(±5.0)**
Massachusetts	94.7	(±3.2)	89.8	(±5.0)	74.8	(±6.9)	64.3	(±7.8)	80.3	(±6.6)	75.4	(±7.2)
New Hampshire	93.1	(±3.8)	91.3	(±4.2)	72.8	(±6.8)	56.8	(±7.4)	82.6	(±5.6)	80.4	(±6.1)
Rhode Island	94.6	(±3.7)	88.8	(±5.5)	74.9	(±7.3)	63.9	(±8.1)	88.8	(±5.2)	75.6	(±7.3)
Vermont	93.2	(±3.4)	86.1	(±5.4)	48.4	(±7.5)	52.8	(±7.5)	76.6	(±6.3)	71.8	(±6.7)
HHS Region II	**93.2**	**(±2.3)**	**85.4**	**(±3.2)**	**62.2**	**(±4.4)**	**53.0**	**(±4.6)**	**67.3**	**(±4.4)**	**69.6**	**(±4.3)**
New Jersey	93.3	(±3.8)	85.4	(±5.4)	58.6	(±7.6)	50.9	(±7.6)	66.2	(±7.5)	67.2	(±7.4)
New York	93.1	(±2.9)	85.4	(±4.0)	63.8	(±5.3)	54.0	(±5.7)	67.8	(±5.5)	70.7	(±5.2)
City of New York	95.0	(±3.3)	85.1	(±5.7)	56.5	(±8.0)	54.6	(±8.1)	62.1	(±8.2)	70.1	(±7.5)
Rest of state (NY)	91.2	(±4.7)	85.7	(±5.6)	71.1	(±6.9)	53.3	(±8.0)	73.5	(±7.1)	71.4	(±7.3)
HHS Region III	**92.2**	**(±2.1)**	**86.0**	**(±2.9)**	**78.1**	**(±3.5)**	**59.4**	**(±4.1)**	**75.9**	**(±3.7)**	**75.2**	**(±3.6)**
Delaware	90.8	(±4.8)	85.4	(±6.0)	84.1	(±5.4)	67.2	(±7.0)	81.4	(±6.3)	74.5	(±6.9)
District of Columbia	90.9	(±4.8)	80.6	(±6.6)	74.4	(±6.9)	63.2	(±7.6)	67.3	(±7.5)	71.1	(±7.5)
Maryland	94.9	(±3.3)	85.4	(±6.4)	83.5	(±6.4)	60.9	(±8.5)	81.9	(±6.6)	74.4	(±7.6)
Pennsylvania	92.0	(±3.3)	87.0	(±4.2)	78.7	(±5.0)	61.9	(±6.1)	76.0	(±5.3)	78.6	(±4.9)
Philadelphia	94.3	(±4.3)	85.6	(±5.7)	72.2	(±7.1)	59.8	(±7.7)	70.0	(±7.5)	76.2	(±6.8)
Rest of state (PA)	91.6	(±3.8)	87.3	(±4.9)	80.0	(±5.8)	62.4	(±7.1)	77.2	(±6.2)	79.0	(±5.7)
Virginia	91.5	(±5.1)	87.2	(±6.7)	73.9	(±8.8)	55.2	(±9.6)	74.1	(±9.0)	73.7	(±8.8)
West Virginia	88.9	(±5.4)	77.2	(±7.2)	75.0	(±7.0)	50.9	(±7.9)	63.3	(±8.1)	63.4	(±7.7)
HHS Region IV	**92.8**	**(±1.8)**	**85.0**	**(±2.6)**	**72.0**	**(±3.5)**	**55.9**	**(±3.6)**	**74.1**	**(±3.5)****	**74.3**	**(±3.3)**
Alabama	92.0	(±5.6)	84.1	(±7.4)	87.2	(±6.0)	62.3	(±9.2)	85.4	(±6.8)**	76.9	(±8.3)
Florida	91.2	(±4.8)	86.2	(±6.1)	53.2	(±9.2)	54.9	(±9.1)	67.9	(±9.4)	72.7	(±8.7)
Georgia	94.2	(±3.9)	85.7	(±6.2)	78.4	(±7.3)	58.3	(±8.6)	71.6	(±7.8)	74.0	(±7.6)
Kentucky	88.6	(±5.5)	83.2	(±6.5)	83.1	(±7.7)	47.9	(±9.0)	64.4	(±8.5)	72.3	(±7.8)
Mississippi	95.0	(±4.3)	83.3	(±7.6)	82.9	(±7.1)	38.3	(±9.1)	69.8	(±8.5)	70.7	(±8.8)
North Carolina	94.3	(±4.1)	86.9	(±5.9)	79.8	(±7.2)	58.2	(±8.7)	86.7	(±5.5)**	80.8	(±6.9)
South Carolina	90.8	(±5.3)	85.1	(±6.3)	67.9	(±8.5)	56.8	(±9.1)	75.0	(±8.0)	72.6	(±8.1)
Tennessee	95.8	(±2.4)	80.7	(±7.2)	79.5	(±6.1)	59.3	(±7.9)	75.4	(±6.9)	71.9	(±7.7)
HHS Region V	**92.5**	**(±1.8)**	**84.3**	**(±2.5)**	**75.3**	**(±2.9)**	**58.5**	**(±3.2)****	**70.7**	**(±3.1)**	**67.9**	**(±3.1)**
Illinois	93.2	(±2.8)	87.8	(±3.9)	73.3	(±5.4)	62.3	(±5.7)**	73.7	(±5.5)	68.3	(±5.6)
City of Chicago	90.5	(±4.7)	82.7	(±6.3)	81.8	(±6.0)	61.0	(±8.0)**	66.1	(±8.4)	67.4	(±7.6)
Rest of state (IL)	94.1	(±3.5)	89.5	(±4.7)	70.5	(±6.9)	62.7	(±7.1)**	76.3	(±6.8)	68.6	(±7.1)
Indiana	91.5	(±4.5)	82.8	(±5.7)	83.1	(±5.7)	53.8	(±7.3)	66.0	(±7.1)	66.3	(±7.1)
Michigan	87.4	(±6.5)	77.7	(±8.1)	78.0	(±7.0)	51.4	(±8.6)	59.2	(±8.7)	65.0	(±8.5)
Minnesota	94.3	(±4.2)	87.1	(±6.2)	70.2	(±8.5)	56.4	(±9.8)	74.6	(±9.8)	70.5	(±8.8)
Ohio	95.6	(±2.9)**	85.1	(±6.0)**	73.6	(±7.8)	60.3	(±8.0)**	73.8	(±7.3)	68.1	(±7.7)
Wisconsin	93.2	(±4.2)	84.4	(±5.8)	74.4	(±7.1)	66.0	(±7.9)	78.5	(±6.9)	70.9	(±7.6)
HHS Region VI	**90.8**	**(±2.3)**	**79.5**	**(±3.5)**	**76.7**	**(±3.2)**	**58.5**	**(±3.8)**	**69.5**	**(±3.6)**	**66.5**	**(±3.8)**
Arkansas	89.1	(±5.4)	80.0	(±6.8)	76.4	(±7.5)	43.3	(±8.7)	69.8	(±8.5)**	66.0	(±8.2)
Louisiana	91.8	(±4.1)	83.3	(±5.6)	83.2	(±5.1)	52.4	(±7.9)	68.4	(±8.0)	73.2	(±7.0)
New Mexico	94.6	(±3.0)	87.5	(±5.1)	61.4	(±8.4)	53.8	(±8.4)	80.9	(±6.4)**	75.9	(±6.9)**
Oklahoma	92.0	(±5.4)	80.4	(±7.2)	72.1	(±7.6)	58.5	(±8.4)	72.5	(±7.7)**	73.3	(±7.5)**
Texas	90.4	(±3.2)	78.2	(±4.9)	77.4	(±4.4)	61.2	(±5.1)	68.5	(±4.9)	64.0	(±5.2)††
Bexar County	92.3	(±4.2)	79.0	(±6.1)	71.1	(±7.1)	67.9	(±7.0)	70.9	(±7.1)	66.4	(±7.0)
City of Houston	92.4	(±4.5)	85.9	(±6.2)	79.9	(±7.1)	69.9	(±7.6)	74.5	(±7.9)	70.4	(±8.0)
El Paso County	94.3	(±3.4)	86.8	(±4.8)**	83.0	(±6.0)	62.2	(±7.8)	78.9	(±6.6)	74.4	(±6.9)
Rest of state (TX)	89.7	(±4.1)	76.4	(±6.2)	77.3	(±5.5)	59.2	(±6.5)	66.8	(±6.2)	62.2	(±6.5)††

See table footnotes on next page.

coverage by poverty status were frequent and often sizeable. Children living below the poverty level had rotavirus coverage that was 14.1 percentage points lower than that of children at or above the poverty level. ACIP recommends that rotavirus vaccination be initiated at age 2 months (maximum age at first dose is 15 weeks) and completed by age 6 months (maximum age at final dose is 8 months) (*4*). Therefore, the window for administering rotavirus vaccine is narrow and could be missed because of transportation challenges, difficulty obtaining time off from work, or other logistical issues, situations that might occur more frequently in poorer families. Disparities by poverty status were also observed for PCV, the full series of Hib, and

TABLE 3. (*Continued*) Estimated vaccination coverage with selected individual vaccines and a combined vaccine series* among children aged 19–35 months, by U.S. Department of Health and Human Services (HHS) region and state and local area — National Immunization Survey, United States, 2014[†]

HHS region, state, and local area	MMR (≥1 dose)		DTaP (≥4 doses)		Hep B (birth)[§]		HepA (≥2 doses)		Rotavirus[¶]		Combined vaccine series*	
	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
HHS Region VII	**92.0**	**(±2.5)**	**83.5**	**(±3.6)**	**77.5**	**(±3.8)**	**52.9**	**(±4.7)**	**74.4**	**(±4.1)**	**73.2**	**(±4.1)**
Iowa	91.1	(±5.2)	87.4	(±5.7)	68.2	(±8.5)[††]	58.3	(±8.7)	67.5	(±8.6)	71.3	(±8.2)
Kansas	93.4	(±4.0)	85.3	(±6.2)	78.9	(±6.6)	63.0	(±8.0)	77.5	(±7.2)	76.5	(±7.1)
Missouri	90.3	(±4.7)	79.2	(±7.3)	80.9	(±6.7)	39.5	(±8.5)	74.4	(±7.4)	70.0	(±7.8)
Nebraska	96.0	(±2.9)	87.3	(±5.4)	79.2	(±7.1)	67.9	(±7.9)	79.6	(±6.8)	80.2	(±6.2)
HHS Region VIII	**88.3**	**(±3.1)**	**83.4**	**(±3.1)**	**74.3**	**(±3.6)**	**53.6**	**(±4.1)**	**74.2**	**(±3.7)**	**71.5**	**(±3.8)**
Colorado	87.4	(±5.4)	85.4	(±4.9)	68.2	(±6.6)	52.7	(±7.0)	73.4	(±6.4)	72.8	(±6.4)
Montana	93.4	(±4.4)	83.1	(±7.0)	71.4	(±8.0)	49.2	(±8.9)	68.7	(±8.3)	67.1	(±8.2)
North Dakota	94.9	(±3.3)	81.8	(±6.2)	88.4	(±4.6)	61.1	(±7.1)	78.1	(±6.4)	71.3	(±7.0)
South Dakota	94.1	(±4.2)	87.8	(±6.5)	80.0	(±7.2)	50.0	(±9.8)	71.8	(±8.7)	76.3	(±8.3)
Utah	85.3	(±6.4)	81.9	(±6.5)[††]	79.2	(±6.7)	58.3	(±8.2)	75.7	(±7.0)	70.8	(±7.8)
Wyoming	90.4	(±5.0)	72.8	(±8.7)	72.4	(±8.8)	32.7	(±8.5)	77.6	(±7.2)**	64.0	(±9.2)
HHS Region IX	**89.7**	**(±3.8)**	**86.0**	**(±4.2)**	**66.6**	**(±6.4)**	**60.9**	**(±6.5)**	**69.0**	**(±6.4)**	**75.6**	**(±5.5)**
Arizona	84.1	(±6.3)	81.4	(±6.4)	76.1	(±6.8)	54.3	(±8.1)	72.9	(±7.3)	66.1	(±8.0)
California	90.5	(±4.7)	87.3	(±5.3)	63.9	(±8.1)	62.5	(±8.2)	68.5	(±8.0)	77.9	(±6.8)
Hawaii	92.5	(±3.7)	82.4	(±5.9)	79.5	(±6.5)	55.4	(±7.5)	75.4	(±6.2)	73.7	(±6.5)
Nevada	90.4	(±4.2)	81.0	(±5.8)	75.5	(±6.4)	57.9	(±7.1)	62.0	(±7.3)	67.7	(±6.6)
HHS Region X	**86.7**	**(±3.8)[††]**	**80.7**	**(±4.2)**	**71.6**	**(±4.3)**	**53.2**	**(±5.3)**	**69.3**	**(±5.0)**	**66.6**	**(±5.0)**
Alaska	90.2	(±4.3)	78.7	(±6.3)	54.1	(±7.6)	55.0	(±7.4)	63.5	(±7.2)	67.3	(±7.2)
Idaho	89.7	(±5.1)	77.7	(±7.2)	75.4	(±7.4)	59.4	(±8.2)	79.5	(±6.7)	65.9	(±8.0)
Oregon	85.1	(±6.0)	80.7	(±6.8)	58.6	(±8.4)	56.4	(±8.5)	66.7	(±8.1)	65.3	(±7.9)
Washington	86.3	(±6.2)	81.6	(±6.7)	79.5	(±6.2)	49.7	(±8.5)	68.9	(±8.2)	67.4	(±8.1)
Range	*(84.1–97.2)*		*(72.8–93.1)*		*(48.4–88.4)*		*(32.7–69.0)*		*(59.2–88.8)*		*(63.4–84.7)*	
Territory												
Puerto Rico[§§]	93.2	(±4.1)	81.7	(±7.2)	83.3	(±7.1)	62.0	(±9.4)	60.9	(±9.4)	60.3	(±9.5)

Abbreviations: MMR = measles, mumps, and rubella vaccine; DTaP = diphtheria, tetanus toxoids, and acellular pertussis vaccine (includes children who might have been vaccinated with diphtheria and tetanus toxoids vaccine, or diphtheria, tetanus toxoids, and pertussis vaccine); HepB = hepatitis B vaccine; HepA = hepatitis A vaccine; CI = confidence interval; Hib = *Haemophilus influenzae* type b vaccine; PCV = pneumococcal conjugate vaccine.

* The combined (4:3:1:3*:3:1:4) vaccine series includes ≥4 doses of DTaP, ≥3 doses of poliovirus vaccine, ≥1 dose of measles-containing vaccine, full series of Hib vaccine (≥3 or ≥4 doses, depending on product type), ≥3 doses of HepB, ≥1 dose of varicella vaccine, and ≥4 doses of PCV.

† Children in the 2014 National Immunization Survey were born January 2011–May 2013.

§ HepB administered from birth through age 3 days.

¶ Either ≥2 or ≥3 doses of rotavirus vaccine, depending on product type received (≥2 doses for Rotarix [RV1] or ≥3 doses for RotaTeq [RV5]).

** Statistically significant increase in coverage compared with 2013 estimates from the National Immunization Survey (p<0.05).

†† Statistically significant decrease in coverage compared with 2013 estimates from the National Immunization Survey (p<0.05).

§§ Children from Puerto Rico (n = 166) were excluded from the national estimates.

DTaP. Although these vaccines have longer catch-up periods relative to rotavirus vaccine, receiving 3 or 4 doses to be up-to-date appears to pose a greater challenge to families living below the poverty level. The Vaccines for Children program (*2*) was implemented to eliminate financial barriers and appears to have been successful in substantially reducing disparities by race/ethnicity.

Additional interventions targeted at families living below the poverty level are needed to further reduce, and ultimately eliminate, these disparities. Evidence-based strategies can be adopted by providers and public health systems to maintain overall immunization coverage and improve coverage in vulnerable subpopulations. Actively adopting such strategies is key to improving coverage among children living in poverty and for increasing coverage with vaccine booster doses at and after age 12 months. *The Guide to Community Preventive Services* (*5*) recommends strategies to enhance access to vaccination services, including reduced out-of-pocket costs, home visits, and vaccination programs in child care centers, schools, and Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) settings. The guide also recommends interventions aimed at increasing community demand for vaccination, such as client reminder and recall, client or family incentives, and vaccination requirements for child care and school attendance. Proven provider or system-based strategies include use of immunization information systems (*6*), provider assessment and feedback, provider education, provider reminders, and standing orders for vaccination.

Geographic variation in coverage can result in pockets of susceptibility even for vaccinations associated with high national coverage, such as MMR. During the first 3 months of 2015, a total of 159 measles cases from 18 states and the

District of Columbia were reported to CDC (*7*). Four outbreaks were identified, and >80% of cases occurred among unvaccinated persons or persons with unknown vaccination status. The largest outbreak was associated with Disney theme parks in California, accounting for 111 (70%) of the cases reported before the beginning of April 2015 (*8*). Although the United States reported elimination of indigenous measles transmission in 2000,[††††] about 20 million measles cases still occur worldwide. Importation of measles from other countries remains a risk for unvaccinated U.S. residents, emphasizing the need for continued vigilance and maintenance of high vaccination coverage. Increasing DTaP coverage should also be an area of enhanced effort. A total of 28,660 pertussis cases were reported to CDC during 2014, a slight increase over the final case count of 28,639 reported in 2013 (*9*). Because vaccine-induced immunity to pertussis is known to wane over time, it is important that children receive all recommended DTaP vaccinations and boosters.

The findings in this report are subject to at least two limitations. First, household interview response rates were only 62.6% for the landline sample and 30.5% for the cell telephone sample. Among all eligible children with completed household interviews, 59.8% had adequate provider-confirmed vaccination data. This creates the possibility of selection bias, even after use of sample weights to adjust for nonresponse, exclusion of households without telephones, and overlapping samples of mixed (landline and cell) telephone users. Although results are weighted to be representative of the population of children aged 19–35 months, such weighting does not guarantee there will be no bias. Analyses of total survey error for the NIS for 2010,[§§§§] 2011, and 2012 (through June) indicated bias in estimates attributable to incomplete sample frame and selection bias was low, on the order of less than two percentage points (*10*). Second, NIS estimates of ≥2 HepA doses likely underestimate the proportion of children who ultimately reach complete vaccination levels. ACIP recommendations are that children receive a dose of HepA at age 12–23 months, with a second dose 6–18 months later (*4*). Therefore, a child could be on schedule but not receive the second dose until age 41 months; this second dose would not be captured by NIS, which does not assess coverage for children aged >35 months.

For approximately 20 years, NIS has monitored vaccination coverage levels among young children in the United States. The 2014 data indicate that coverage remains consistently high for most vaccinations, although variation by poverty status and geographic area was observed. For some vaccines and population subgroups, improvement in coverage is necessary to achieve optimal protection. For all vaccines, maintaining high coverage is critical to sustain progress in reducing the impact of vaccine-preventable diseases.

†††† Measles elimination is defined as the absence of continuous disease transmission for ≥12 months in a specific geographic area. Additional information available at http://www.cdc.gov/measles/about/faqs.html.

§§§§ Additional information available at http://www.amstat.org/meetings/jsm/2012/onlineprogram/abstractdetails.cfm?abstractid=304324.

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Vaccination Coverage Among Children in Kindergarten — United States, 2014–15 School Year

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State and local jurisdictions require children to be vaccinated before starting school to maintain high vaccination coverage and protect schoolchildren from vaccine-preventable diseases (*1*). State vaccination requirements, which include school vaccination and exemption laws and health department regulations, permit medical exemptions for students with a medical contraindication to receiving a vaccine or vaccine component and may allow nonmedical exemptions for religious reasons or philosophic beliefs. To monitor state and national vaccination coverage and exemption levels among children attending kindergarten, CDC analyzes school vaccination data collected by federally funded state, local, and territorial immunization programs. This report describes vaccination coverage estimates in 49 states and the District of Columbia (DC) and vaccination exemption estimates in 46 states and DC that reported the number of children with at least one exemption among kindergartners during the 2014–15 school year. Median vaccination coverage* was 94.0% for 2 doses of measles, mumps, and rubella (MMR) vaccine; 94.2% for the local requirements for diphtheria, tetanus, and acellular pertussis vaccine (DTaP); and 93.6% for 2 doses of varicella vaccine among the 39 states and DC with a 2-dose requirement. The median percentage of any exemptions† was 1.7%. Although statewide vaccination coverage among kindergartners was high during the 2014–15 school year, geographic pockets of low vaccination coverage and high exemption levels can place children at risk for vaccine-preventable diseases (*2*). Appropriate school vaccination coverage assessments can help immunization programs identify clusters of low coverage and develop partnerships with schools and communities to ensure that children are protected from vaccine-preventable diseases.

Federally funded immunization programs work with health departments, education departments, school nurses, or other school personnel to assess the vaccination and exemption status (as defined by state and local school vaccination requirements) of children enrolled in public and private kindergartens. Among the 50 states and DC, 44 programs used an immunization information system as a source of data for their assessment.§ For the 2014–15 school year, the type of vaccination assessment varied: 29 programs used a census, including all kindergartners in all schools; two used a voluntary response¶ of schools; 10 used a sample**; and 10 used a mix of methods.†† Three states (Alaska, Kansas, and New Mexico) used a sample to collect vaccination coverage data and a census for exemption data. Two local areas (Houston, Texas; New York, New York) reported separately. Because these areas are represented in their respective state reports, the area-specific data are not included in the calculation of median MMR, DTaP, and varicella vaccine coverage and medical, nonmedical, and any exemption levels.§§

Data from the assessments were aggregated by state or area¶¶ and sent to CDC. California, Minnesota, Oregon, Pennsylvania, and Vermont reported data for selected

* Data from Hawaii, Houston, New York City, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands were not included in the coverage medians. Hawaii reported the number of children compliant with school vaccination requirements, either by being vaccinated or by having an exemption.

† Data from Illinois, Minnesota, Missouri, Wyoming, Houston, New York City, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands were not included in the exemption medians. Data from Texas were included in the median for nonmedical exemptions, but not for medical or any exemptions.

§ An immunization information system is a confidential, population-based, computerized database that records all immunization doses reported by participating providers to persons residing within a given geopolitical area.

¶ A voluntary response of schools was defined as census survey with a response rate <90% of the known population of kindergartners.

** The type of sample employed by the 10 states using a sample for determining coverage rates varied, and included a stratified two-stage cluster sample (eight states), a stratified one-stage cluster sample (one), and a simple random sample (one).

†† A mix of methods includes two or more described methods (e.g., a combination of a census and voluntary response).

§§ Texas collected and reported data from a self-report census of all schools and students in the state, including Houston. However, the estimates reported separately for Houston are not from the Texas census. Houston collected data from a nonrandom sample of schools as part of a different assessment directed by the Texas Department of State Health Services, and reported these results separately to CDC.

¶¶ Most of the programs using a census or voluntary response provided CDC with data aggregated at the state level. Coverage and exemption data based on a census were adjusted for nonresponse using the inverse of the response rate, stratified by school type. Programs using complex sample surveys provided CDC with de-identified data aggregated at the school or county level for weighted analysis. Weights were calculated to account for sample design and adjusted for nonresponse for data collected by complex sample design wherever possible. Data from Houston's nonrandom sample were analyzed as a stratified simple random sample.

homeschooled kindergartners.*** The 49 states and DC reported vaccination coverage data for 4,121,322 kindergartners, and 46 states and DC reported exemption data, including the number of children with at least one exemption, for 3,829,686 kindergartners.†††

Vaccination coverage was used to identify state/local areas with high (≥90%) 2-dose MMR coverage (*3*), and median vaccination coverage was used to assess progress toward the national *Healthy People 2020* target of ≥95% vaccination coverage for kindergartners.§§§ The reported medians for medical and any exemptions include the 45 states and DC that reported data for all types of allowed exemptions, whereas the median for nonmedical exemptions includes 46 states and DC that reported, for at least one type of allowed exemption, the number of children with an exemption. Coverage and exemption estimates were adjusted based on survey type and response rates. State and local vaccination requirements for school entry varied.¶¶¶ Kindergartners were considered up-to-date for any vaccine if they received all doses required for school entry in their residence jurisdiction. In most jurisdictions, kindergartners with a history of varicella disease are considered to be vaccinated against varicella, whereas in some jurisdictions they may be given a medical exemption. Eight states considered kindergartners up-to-date only if they had received all doses of all vaccines required for school entry in their jurisdiction.**** Coverage estimates were based on completed vaccination series in those jurisdictions. Among all 50 states and DC, 13 met CDC standards for school assessment methods in 2014–15.††††

Among the 49 reporting states and DC, median reported MMR coverage was 94.0% (range = 86.9% [Colorado] to 99.2% [Mississippi]); 17 areas reported MMR coverage ≥95%; and seven reported MMR coverage <90% (Table 1). Median reported DTaP coverage was 94.2% (range = 84.3% [Colorado] to 99.6% [Maryland]); 21 areas reported coverage ≥95%. Among the 39 states and DC requiring and reporting 2-dose varicella vaccination coverage, median reported coverage was 93.6% (range = 85.4% [Colorado] to 99.2% [Mississippi]); 17 areas reported coverage ≥95%.

Among the 45 states and DC reporting vaccination exemption data for any medical and nonmedical exemptions allowed in the jurisdictions, the percentage of kindergartners with any exemption was <1% in six states and ≥4% in 11 states (range = <0.1% [Mississippi] to 6.5% [Idaho]), with a median of 1.7% (Figure) (Table 2). Three states (Kansas, Maine, and Oregon) reported a decrease of >1.0 percentage points in exemptions from the 2013–14 school year to the 2014–15 school year. Where reported separately, the median percentage of medical exemptions was 0.2% (range = <0.1% in four states [Colorado, Hawaii, Mississippi, and Arkansas] to 1.3% [Alaska]). Where allowed and reported separately, the median percentage of nonmedical exemptions was 1.5% (range = 0.5% [DC] to 6.2% [Idaho]).

Discussion

Most federally funded immunization programs reported high vaccination coverage and low levels of exemptions among kindergartners. Even so, 32 states and DC did not report meeting the *Healthy People 2020* target of ≥95% coverage with 2 MMR doses,§§§§ and seven states had <90% 2-dose MMR coverage. During 2015, measles outbreak cases have included 68 unvaccinated U.S. residents, among whom 29

*** California reported data for an unspecified number of homeschooled students, and these students might be included with public and private school students. Minnesota required vaccination and exemption reporting for homeschooled students beginning at age 7 years, although the actual number of homeschooled students included in the data is not known. Oregon estimates included vaccination coverage and exemption data for children enrolled in public online homeschools. Pennsylvania included homeschooled students in their public school data. Vermont includes homeschooled students in their public and private school data if they are enrolled in one or more classes in those schools; homeschooled children who are exclusively homeschooled are not subject to vaccination requirements and are not included in these estimates.

††† Texas was unable to report the number of children with at least one medical exemption, so their data were excluded from the medical exemption and any exemption data (Table 2).

§§§ *Healthy People 2020* objective IID-10.1 is based on 4 doses of DTaP vaccine. This report describes compliance with state regulations of 3, 4, or 5 doses of DTaP vaccine. Of the 50 states and DC, only Nebraska required and reported 3 doses of DTaP vaccine. IID-10.2 sets a target of ≥95% of kindergartners receiving ≥2 doses of MMR vaccine. Four states required 2 doses of measles-containing vaccine, but only 1 dose each of mumps and rubella vaccine. One state required 2 doses measles and mumps, but only 1 dose of rubella vaccine. One state required only 1 dose of MMR vaccine until age 7 years. IID-10.5 sets a target of ≥95% of kindergartners receiving ≥2 doses of varicella vaccine. State-level data with *Healthy People 2020* targets are available at http://www.cdc.gov/vaccines/imz-managers/coverage/SchoolVaxView/pubs-resources.html.

¶¶¶ Among the 50 states and DC, all but New York State required 2 doses of a measles-containing vaccine, with MMR as the only measles-containing vaccine available in the United States. For local requirements for DTaP vaccine, one (Nebraska) required 3 doses, one (Virginia) required 4 doses, one (Pennsylvania) did not require pertussis, and all others required 5 doses unless the fourth dose was administered on or after the fourth birthday. For varicella vaccine, 10 areas required 1 dose, 40 required 2 doses, and one (Montana) did not require varicella vaccination.

**** States reporting estimates based on receiving all doses of all vaccines required for school entry might have actual vaccine-specific coverage estimates higher than the coverage for all required vaccines.

†††† CDC standards include use of a census or random sample of public and private schools or students, assessment using number of doses recommended by the Advisory Committee on Immunization Practices, assessment of vaccination status before December 31, collection of data by health department personnel or school nurses, validation if data are collected by school administrative staff, and documentation of vaccination from a health care provider.

§§§§ New York State reports coverage with ≥1 dose of MMR vaccine.

TABLE 1. Estimated vaccination coverage* by state/area, vaccine, and survey methodology among children enrolled in kindergarten — United States, 2014–15 school year

Survey methodology and state/area	Kindergarten population[†]	Total surveyed	Proportion surveyed (%)	Type of survey conducted[§]	MMR[¶] 2 doses (%)	DTaP** 5 doses (%)	Varicella 2 doses (%)
Census/ Voluntary response							
Alabama[††]	59,660	59,660	100.0	Census	≥93.5	≥93.5	NReq
Arizona	86,153	84,651	98.3	Census	94.2	94.3	NReq
Arkansas[§§]	41,252	39,581	95.9	Census (public), Voluntary response (private)	88.4	85.6	88.0
California[§§]	552,583	535,234	96.9	Census	92.6	92.4	NReq
Connecticut[††]	39,948	39,948	100.0	Census	97.0	97.0	96.8
District of Columbia[††]	7,840	7,840	100.0	Census	90.4	90.2	90.0
Florida[††¶¶]	228,982	228,982	100.0	Census	≥93.3	≥93.3	≥93.3
Georgia[††]	139,471	139,471	100.0	Census	≥94.0	≥94.0	≥94.0
Idaho[††]	22,968	22,968	100.0	Census	89.5	89.4	88.4
Illinois[††]	156,942	156,942	100.0	Census	94.7	94.9	95.3
Indiana	85,477	59,909	70.1	Voluntary response	89.3	92.7	90.1
Iowa	43,239	41,656	96.3	Census	≥91.9	≥91.9	≥91.9
Kentucky[§§]	57,884	56,238	97.2	Census	92.7	94.4	92.3
Louisiana[††]	60,377	60,377	100.0	Census	96.8	98.3	96.7
Maine[§§]	13,704	12,185	88.9	Voluntary response (public), Census (private)	92.1	95.4	NReq
Maryland[§§]	75,391	67,997	90.2	Census (public), Voluntary response (private)	99.1	99.6	98.8
Massachusetts[††§§]	74,869	74,869	100.0	Census	94.7	92.9	94.1
Michigan[††]	117,963	117,963	100.0	Census	94.3	95.1	93.9
Minnesota	70,896	69,319	97.8	Census	93.5	93.7	92.7
Mississippi[††]	44,129	44,129	100.0	Census	≥99.2	≥99.2	≥99.2
Missouri[††]	75,900	75,900	100.0	Census	95.8	96.0	95.3
Montana	12,501	11,968	95.7	Census (public), Voluntary response (private)	94.6	94.6	NReq
Nebraska[††§§]	26,665	26,665	100.0	Census	96.0	96.4	95.8
New Hampshire	12,422	12,290	98.9	Census (public), Voluntary response (private)	≥91.4	≥91.4	≥91.4
New Jersey[§§]	120,471	113,123	93.9	Census (public), Voluntary response (private)	≥92.3	≥92.3	NReq
New York State (including New York City)[††§§]	237,045	237,045	100.0	Census	98.2	97.5	96.4
North Carolina	129,792	123,238	95.0	Census (public), Voluntary response (private)	98.5	98.4	NReq
North Dakota	10,017	10,002	99.9	Census	89.8	89.6	89.5
Ohio	149,080	135,658	91.0	Census (public), Voluntary response (private)	91.9	92.2	91.2
Oklahoma[§§]	56,967	54,642	95.9	Census	90.3	90.0	NReq
Oregon[†† §§]	46,229	46,229	100.0	Census	94.1	93.8	NReq
Pennsylvania[§§]	146,378	143,852	98.3	Census	91.7	NReq***	92.0
Rhode Island[§§]	11,163	11,043	98.9	Census	95.7	96.1	95.4
South Dakota[††]	12,008	12,008	100.0	Census	97.1	97.2	96.8
Tennessee[††]	78,276	78,276	100.0	Census	≥95.1	≥95.1	≥95.1
Texas (including Houston)[§§†††]	406,099	399,199	98.3	Census (public), Voluntary response (private)	97.4	97.2	97.0
Utah[††]	50,916	50,916	100.0	Census	94.0	93.8	NReq
Vermont[††]	6,277	6,277	100.0	Census	92.7	93.2	90.5
Washington	88,809	85,913	96.7	Census (public), Voluntary response (private)	89.4	90.7	87.9
West Virginia	22,016	17,888	81.3	Voluntary response	97.6	97.6	97.0
Wyoming[§§§]	7,983	7,817	97.9	Census	96.8	96.7	96.5

See table footnotes on next page.

(43%) cited philosophic or religious objections to vaccination (*4*). Maintaining high vaccination coverage levels is important for measles control and elimination (*3*).

CDC's Public Health Law Program recently reviewed state school and childcare vaccination requirements and provided a summary of state vaccination laws, including both statutes and regulations (*5*). State laws are subject to change and will continue to be tracked. For example, earlier this year, California removed both religious and philosophic exemptions for children attending public and private schools, and eliminated all vaccination requirements for homeschooled children; and Vermont removed philosophic but not religious exemptions for children in public and private schools. Both changes take effect at the beginning of the 2016–17 school year (*6*,*7*). Both states will continue to allow medical exemptions. Changes in vaccination requirements have resulted in changes in patterns of types of exemptions claimed, with an increase in the proportion of kindergartners with medical exemptions offsetting decreases in the proportion of kindergartners with nonmedical exemptions (*8*). Parents have the option, depending on state vaccination requirements, to place their children in private schools or to homeschool them to avoid state laws regarding

TABLE 1. (*Continued*) Estimated vaccination coverage* by state/area, vaccine, and survey methodology among children enrolled in kindergarten — United States, 2014–15 school year

Survey methodology and state/area	Kindergarten population†	Total surveyed	Proportion surveyed (%)	Type of survey conducted§	MMR¶ 2 doses (%)	DTaP** 5 doses (%)	Varicella 2 doses (%)
Sample							
Alaska¶¶¶	10,129	795	7.8	Stratified two-stage cluster sample	92.7	92.7	91.6
Colorado	70,597	350	0.5	Simple random sample	86.9	84.3	85.4
Delaware	11,476	901	7.9	Stratified two-stage cluster sample	97.8	97.7	97.7
Hawaii	20,085	1,121	5.6	Stratified two-stage cluster sample	NA	NA	NReq
Kansas§§¶¶¶	39,685	9,739	24.5	Stratified two-stage cluster sample	89.2	89.6	88.9
Nevada	36,755	1,017	2.8	Stratified two-stage cluster sample	94.0	93.2	92.9
New Mexico¶¶¶	29,918	987	3.3	Stratified two-stage cluster sample	97.7	96.4	97.2
South Carolina	62,864	7,640	12.2	Stratified one-stage cluster sample	96.5	97.2	95.4
Virginia	103,821	4,218	4.1	Stratified two-stage cluster sample	93.4	97.4	90.4
Wisconsin§§	69,335	1,718	2.5	Stratified two-stage cluster sample	91.6	96.5	90.9
*Median**** *					*94.0*	*94.2*	*93.6*
Other areas							
Houston, Texas†††	45,191	1,734	3.8	Stratified two-stage cluster sample, nonrandom schools selection	95.3	95.1	95.0
New York City††	106,922	106,922	100.0	Census	98.9	98.3	97.2
Guam	2,712	2,630	97.0	Census	89.2	92.5	NReq
N. Mariana Islands††	840	840	100.0	Census	94.8	96.0	94.0
Puerto Rico	38,151	1,198	3.1	Stratified two-stage cluster sample	97.2	91.9	95.8
U.S. Virgin Islands	1,466	437	29.8	Stratified two-stage cluster sample	89.3	86.6	89.2

Abbreviations: MMR = measles, mumps, and rubella vaccine; DTaP/DT = diphtheria, tetanus, and acellular pertussis vaccine/diphtheria and tetanus vaccine; NA = not available; NReq = not required for school entry.

* Estimates are adjusted for nonresponse and weighted for sampling where appropriate. Percentages for Houston are approximations. Estimates based on a completed vaccine series (i.e., not antigen-specific) are designated by use of the ≥ symbol. Coverage may include history of disease and laboratory evidence of immunity.

† The kindergarten population is an approximation provided by each state/area.

§ Sample designs varied by state/area: census = all schools (public and private) and all children within schools were included in the assessment; simple random = a simple random sample design was used; one-stage or two-stage cluster sample = schools were randomly selected, and all children in the selected schools were assessed (one-stage) or a random sample of children within the schools were selected (two-stage); voluntary response = a census with a student response rate of <90% and does not imply that participation was optional.

¶ Most states require 2 doses of MMR vaccine; Alaska, California, and Oregon require 2 doses of measles, 1 dose of mumps, and 1 dose of rubella vaccine. Pennsylvania requires 2 doses of measles and mumps, and 1 dose of rubella vaccine. New York requires 2 doses of measles and mumps vaccine and 1 dose of rubella vaccine by age 7 years but reports ≥1 dose of MMR.

** Pertussis vaccination coverage might include some DTP (diphtheria, tetanus, and pertussis vaccine) vaccinations if administered in another country or vaccination provider continued to use after 2000. Most states require 5 doses of DTaP vaccine for school entry; Virginia requires 4 doses; Nebraska requires 3 doses. Pennsylvania requires 4 doses of diphtheria and tetanus vaccine, but pertussis vaccine is not required. Kentucky requires ≥5 but reports ≥4 doses of DTaP.

†† The proportion surveyed is probably <100% but is shown as 100% based on incomplete information about the actual current enrollment.

§§ Counts some or all vaccine doses received regardless of Advisory Committee on Immunization Practices recommended age and time interval; vaccination coverage rates shown might be higher than those for valid doses.

¶¶ Does not include non–district-specific, virtual, and college laboratory schools, or private schools with fewer than 10 students.

*** Pertussis vaccine is not required in Pennsylvania. Coverage for diphtheria and tetanus was 93.9%.

††† Texas collected and reported data from a self-report census of all schools and students in the state, including Houston. However, the estimates reported separately in this table for Houston are not from the Texas census. Houston collected data from a nonrandom sample of schools as part of a different assessment directed by the Texas Department of State Health Services, and reported these results separately to CDC.

§§§ Collected public school data only.

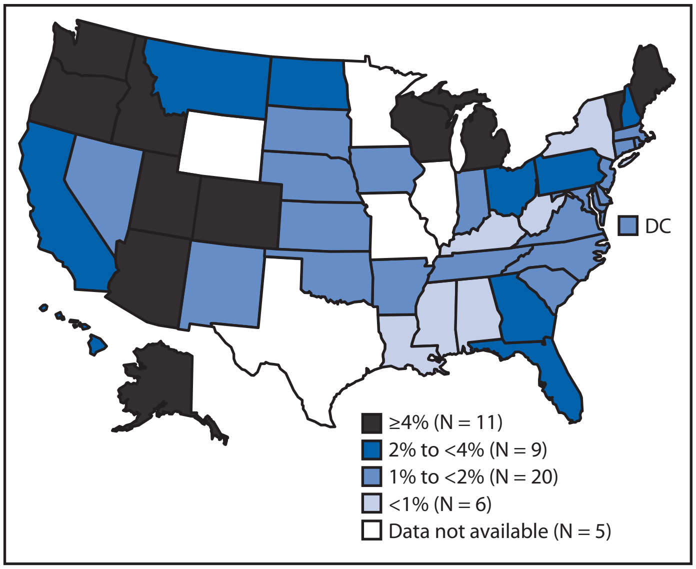
¶¶¶ Kindergarten coverage data were collected from a sample, and exemption data were collected from a census of kindergartners.

**** The median is the center of the estimates in the distribution. The median does not include Hawaii, Houston, New York City, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. Hawaii reported the number of children compliant with school vaccination requirements, either by being vaccinated or by having an exemption.

exemptions. Continued monitoring of trends in vaccination coverage and exemptions, including the number of children exempted by type of exemption, and enrollment in public and private schools or homeschools, will be critical to identify the potential impact of changes in school vaccination requirements.

The current assessment methods used to estimate coverage and exemptions in many states might be insufficient for immunization programs to identify children or communities at risk for vaccine-preventable diseases and might limit the ability of immunization programs to respond to outbreaks. In assessing school vaccination coverage and exemptions, states must balance the need for efficiency, accuracy and ability to have estimates at the community, school or child level. Using immunization information system vaccination data can streamline data collection, and provide accurate vaccination coverage data at the community, child, and possibly school levels. A census report by all schools provides local data but might be more resource-intensive to obtain. Statistically appropriate sampling methods can streamline data collection and can be used to validate census data, but do not provide local data.

FIGURE. Estimated percentage of children enrolled in kindergarten who have been exempted from receiving one or more vaccines,* by state† — United States, 2014–15 school year



* Exemptions might not reflect a child's vaccination status. Children with an exemption who did not receive any vaccines are indistinguishable from those who have an exemption but are up-to-date for one or more vaccines.
† Seven states used a sample for exemption data: Colorado, Delaware, Hawaii, Nevada, South Carolina, Virginia, and Wisconsin.

Using a census to track exemptions is preferred to ensure that immunization and education programs can identify geographic clusters of high exemption levels at the school or community level. To track vaccination coverage, it is desirable to use immunization information system data, or census data with a sample validation of vaccination status. Schools with high exemption rates do not necessarily have low vaccination rates (e.g., if many exemptions are filed for convenience by parents of fully vaccinated children) and a low exemption rate does not necessarily imply a high vaccination rate (e.g., if school vaccination requirements are not applied in a school with lower vaccination rates). Local availability of reliable information might lead to improved and effective engagements with local partner organizations, including private and homeschool associations and the community, to enhance understanding of school vaccination requirements and address concerns, thereby helping to ensure that children are protected against vaccine-preventable diseases. Availability of local data can also help parents understand their child's risk within their school and community. During the 2014–15 school year, 21 states provided local-level coverage and exemption data online,¶¶¶¶ compared with 18 last school year and 11 in 2012–13.

¶¶¶¶ Information available at http://www.cdc.gov/vaccines/imz-managers/SchoolVaxView/pubs-resources.html.

Summary

What is already known on this topic?

Annual school vaccination assessments help immunization programs protect school children from vaccine-preventable diseases by monitoring vaccination coverage based on state vaccination requirements. Although overall vaccination coverage is high and exemptions are low, undervaccination clusters geographically.

What is added by this report?

In 49 reporting states and the District of Columbia (DC), median vaccination coverage was 94.0% for measles, mumps, and rubella (MMR) vaccine and 94.2% for local requirements for diphtheria, tetanus, and acellular pertussis vaccine. Among the 39 states and DC with a 2-dose varicella vaccine requirement, varicella coverage was 93.6%. Seven areas had <90% coverage with 2 MMR doses. Median exemption levels are low overall (1.7%) but vary by state.

What are the implications for public health practice?

Monitoring and use of local data are essential to control the spread of vaccine-preventable diseases. Accurate and reliable school vaccination assessments, conducted using appropriate methods (including a census of all vaccination exemptions) can provide school and health departments with data to identify areas of undervaccination, even at a school or classroom level where the potential for disease transmission is higher, and identify areas to focus public health interventions to improve school vaccination coverage.

The findings in this report are subject to at least four limitations. First, immunization programs used different school vaccination assessment methods. Assessments based on surveys or voluntary response (e.g., an incomplete census) can miss schools with higher or lower vaccination coverage and thereby bias results. Surveys with inadequate sample size will yield imprecise estimates. Additionally, differences in reporting vaccine-specific vaccination coverage and exemption data limit comparability across all immunization programs. Second, exemption status does not always reflect vaccination status. A child with an exemption might not be completely unvaccinated. Although state-reported exemptions varied from <0.1% to 6.5% in this assessment, >99% of the 2009–2011 birth cohort who became kindergartners in 2014–15 received at least one vaccine in early childhood (*9*). An exemption may be given for all vaccines even if a child missed all doses of a single vaccine or a single vaccine dose. Parents or guardians might have obtained an exemption rather than submit documentation of a child's vaccination history. This could account for up to 25% of nonmedical exemptions (*10*). Vaccination and exemption status reflected the child's status at the time of assessment or at an earlier point in the school year and might

TABLE 2. Estimated number and percentage[*] of children enrolled in kindergarten with a reported exemption to vaccination, by state/area, survey methodology and type of exemption — United States, 2014-15 school year

Survey methodology and state/area	Medical exemptions[†]		Nonmedical exemptions[†]				Any exemption[†]			% point difference
	No.	%	No. of religious exemptions	No. of philosophic exemptions	Total	%	Total no.	2014–15 (%)	2013–14 (%)	
Census/ Voluntary response[§]										
Alabama[¶]	59	0.1	396	**	396	0.7	450	0.8	0.7	0.1
Alaska	135	1.3	453	**	453	4.5	588	5.8	5.3	0.5
Arizona	126	0.1	††	3,978	3,978	4.6	4,104	4.8	4.9	-0.1
Arkansas	18	<0.1	157	355	512	1.2	530	1.3	1.2	0.1
California	1,066	0.2	2,850	11,143	13,993	2.5	15,059	2.7	3.3	-0.6
Connecticut	114	0.3	628	**	628	1.6	742	1.9	1.9	0.0
District of Columbia	46	0.6	43	**	43	0.5	89	1.1	1.5	-0.4
Florida	745	0.3	4,113	**	4,113	1.8	4,858	2.1	2.0	0.1
Georgia	138	0.1	2,729	**	2,729	2.0	2,867	2.1	1.8	0.3
Idaho	68	0.3	137	1,295	1,432	6.2	1,500	6.5	6.4	0.1
Illinois[§§]	NA				NA		NA	NA	NA	NA
Indiana	406	0.5	651	**	651	0.8	977	1.1	1.2	-0.1
Iowa	143	0.3	618	**	618	1.4	761	1.8	1.7	0.1
Kansas	114	0.3	454	**	454	1.1	569	1.4	2.6	-1.2
Kentucky	116	0.2	378	**	378	0.7	494	0.9	0.9	0.0
Louisiana	53	0.1	24	315	339	0.6	392	0.6	0.8	-0.2
Maine	63	0.5	33	504	536	3.9	599	4.4	5.5	-1.1
Maryland	336	0.4	571	**	571	0.8	907	1.2	1.0	0.2
Massachusetts	261	0.3	803	**	803	1.1	1,064	1.4	1.5	-0.1
Michigan	389	0.3	1,391	4,494	5,885	5.0	6,274	5.3	5.9	-0.6
Minnesota[§§]	NA				NA		NA	NA	NA	NA
Mississippi[¶]	17	<0.1	††	**	NA		17	<0.1	<0.1	0.0
Missouri[§§]	NA				NA		NA	NA	NA	NA
Montana	34	0.3	454	**	454	3.6	487	3.9	3.6	0.3
Nebraska	150	0.6	287	**	287	1.1	437	1.6	1.7	-0.1
New Hampshire	25	0.2	331	**	331	2.7	357	2.9	2.8	0.1
New Jersey[¶]	241	0.2	1,918	**	1,918	1.6	2,159	1.8	1.6	0.2
New Mexico	18	0.1	347	**	347	1.2	365	1.2	1.1	0.1
New York State (including New York City)	309	0.1	1,640	**	1,640	0.7	1,949	0.8	0.8	0.0
North Carolina[¶]	178	0.1	1,127	**	1,127	0.9	1,306	1.0	1.0	0.0
North Dakota[¶]	28	0.3	53	188	241	2.4	269	2.7	2.7	0.0
Ohio	384	0.3	¶¶	¶¶	2,707	1.8	3,091	2.1	2.0	0.1
Oklahoma	76	0.1	229	571	800	1.4	877	1.5	1.5	0.0
Oregon	78	0.2	¶¶	¶¶	2,693	5.8	2,771	6.0	7.1	-1.1
Pennsylvania	470	0.3	1,181	1,412	2,593	1.8	3,063	2.1	2.0	0.1
Rhode Island	27	0.2	102	**	102	0.9	128	1.1	1.0	0.1
South Dakota[¶]	21	0.2	181	**	181	1.5	202	1.7	1.8	-0.1
Tennessee	140	0.2	718	**	718	0.9	858	1.1	1.1	0.0
Texas (including Houston)[§§] [***]	NA		¶¶	¶¶	5,273	1.3	NA	NA	1.9	NA
Utah[¶]	90	0.2	16	2,094	2,110	4.1	2,200	4.3	4.4	-0.1
Vermont	13	0.2	8	365	373	5.9	386	6.1	6.2	-0.1
Washington[¶]	1,055	1.2	258	2,811	3,069	3.5	4,054	4.6	4.7	-0.1
West Virginia	38	0.2	††	**			38	0.2	0.2	0.0
Wyoming[§§]	NA				NA		NA	NA	NA	NA

See table footnotes on next page.

not have been updated when the child later received needed vaccines. Furthermore, exemptions do not account for all undervaccinated kindergartners. Third, because immunization programs do not have vaccination coverage and exemption data on all kindergartners, including those who are in private schools, in boarding schools, or are home-schooled, where vaccination requirements might be different or not measured, actual vaccination coverage could be different from estimates presented in this report. Finally, adjustments to account for nonresponse assumed similar vaccination coverage and level of exemptions among nonrespondents and respondents within the same school type.

School vaccination regulations provide an opportunity for children who are behind on vaccination in infancy to be

TABLE 2. (*Continued*) Estimated number and percentage* of children enrolled in kindergarten with a reported exemption to vaccination, by state/area, survey methodology and type of exemption — United States, 2014-15 school year

	Medical exemptions†		Nonmedical exemptions†				Any exemption†			
Survey methodology and state/area	No.	%	No. of religious exemptions	No. of philosophic exemptions	Total	%	Total no.	2014–15 (%)	2013–14 (%)	% point difference
Sample§										
Colorado	0	<0.1	202	3,631	3,832	5.4	3,832	5.4	4.6	0.8
Delaware	46	0.4	106	**	106	0.9	152	1.3	0.8	0.5
Hawaii	0	<0.1	754	**	754	3.3	754	3.3	3.2	0.1
Nevada	92	0.3	401	**	401	1.1	493	1.3	2.0	-0.7
South Carolina¶	74	0.1	648	**	648	1.0	722	1.2	1.4	-0.2
Virginia¶	305	0.3	891	**	891	0.8	1,195	1.1	0.6	0.5
Wisconsin	301	0.4	49	3,319	3,368	4.9	3,669	5.3	4.9	0.4
Median¶¶¶		*0.2*				*1.5*		*1.7*	*1.8*	-0.1
Other areas										
Houston, Texas***	0	<0.1	¶¶	¶¶	145	0.3	145	0.3	0.3	0.0
New York City	53	<0.1	415	**	415	0.4	468	0.4	NA	NA
Guam	0	0.0	3	**	3	0.1	3	0.1	<0.1	0.0
N. Mariana Islands	0	0.0	0	0	0	0.0	0	0.0	0.0	0.0
Puerto Rico	21	0.1	53	**	53	0.1	73	0.2	0.0	0.2
U.S. Virgin Islands	0	<0.1	25	**	25	1.7	25	1.7	1.1	0.6

Abbreviation: NA = not available (i.e., not collected or reported to CDC).

* Estimates are adjusted for nonresponse and weighted for sampling where appropriate. Percentages for Houston are approximations.

† Medical and nonmedical exemptions might not be mutually exclusive. Some children might have both medical and nonmedical exemptions. Temporary exemptions are included in the "any exemptions" totals for Alabama, Mississippi, New Jersey, North Carolina, North Dakota, South Carolina, South Dakota, Utah, Virginia, and Washington.

§ Sample designs varied by state/area: census = all schools (public and private) and all children within schools were included in the assessment; voluntary response = a census with a student response rate of <90% and does not imply that participation was optional; sample includes simple random and one-stage or two-stage cluster sample.

¶ Includes both temporary and permanent medical exemptions.

** Exemptions because of philosophic reasons are not allowed.

†† Exemptions because of religious reasons are not allowed.

§§ State did not report the number of children with exemptions, but instead reported the number of exemptions for each vaccine, which would count some children more than once. Lower bounds of the percentage of children with any exemptions, estimated using the individual vaccines with the highest number of exemptions are, for Illinois, 0.3% with medical exemptions, 1.1% with religious exemptions, and 1.4% for any exemptions; for Minnesota, 0.2% with medical exemptions, 2.8% with nonmedical exemptions, and 3.0% for any exemptions; for Missouri 0.2% with medical exemptions, 1.8% with religious exemptions, and 2.0% for any exemptions; for Texas, 0.1% with medical exemptions, and 1.4% for any exemptions; and for Wyoming, 0.3% with medical exemptions, 2.2% with religious exemptions, and 2.5% for any exemptions.

¶¶ Religious and philosophic exemptions are not reported separately.

*** Texas collected and reported data from a self-report census of all schools and students in the state, including Houston. However, the estimates reported separately in this table for Houston are not from the Texas census. Houston collected data from a nonrandom sample of schools as part of a different assessment directed by the Texas Department of State Health Services, and reported these results separately to CDC.

¶¶¶ The median is the center of the estimates in the distribution. The medians do not include Illinois, Minnesota, Missouri, Wyoming, Houston, New York City, Guam, the Commonwealth of the Northern Mariana Islands, Puerto Rico, and the U.S. Virgin Islands. Texas is not included in the medians for medical exemptions or any exemptions.

vaccinated by school entry. For example, the kindergartners covered in this report were born during 2009–2011. Despite differences in methodologies, when this cohort of children was included in the National Immunization Survey of children aged 19–35 months, their coverage with ≥1 MMR dose was 90.8%, compared with a median of 94.0% who had received ≥2 doses in this assessment during the school 2014–15 school year (*9*). Appropriate school vaccination coverage assessments at the state and local levels for all kindergartners will be critical to aid in identification of communities at risk for vaccine-preventable disease transmission, where further action could improve vaccination coverage to ensure that more children are able to benefit from the protection offered by vaccines.

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School-Level Practices to Increase Availability of Fruits, Vegetables, and Whole Grains, and Reduce Sodium in School Meals — United States, 2000, 2006, and 2014

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Students consume up to half of their daily calories at school, often through the federal school meal programs (e.g., National School Lunch Program) administered by the U.S. Department of Agriculture (USDA) (*1*). In 2012, USDA published new required nutrition standards for school meals.* These standards were the first major revision to the school meal programs in >15 years and reflect current national dietary guidance and Institute of Medicine recommendations to meet students' nutrition needs (*2*,*3*). The standards require serving more fruits, vegetables, and whole grains and gradually reducing sodium content over 10 years. To examine the prevalence of school-level practices related to implementation of the nutrition standards, CDC analyzed data from the 2000, 2006, and 2014 School Health Policies and Practices Study (SHPPS) on school nutrition services practices related to fruits, vegetables, whole grains, and sodium. Almost all schools offered whole grain foods each day for breakfast and lunch, and most offered two or more vegetables and two or more fruits each day for lunch. The percentage of schools implementing practices to increase availability of fruits and vegetables and decrease sodium content in school meals increased from 2000–2014. However, opportunities exist to increase the percentage of schools nationwide implementing these practices.

SHPPS is a national survey developed and periodically conducted by CDC to assess school health policies and practices at state, district, school, and classroom levels. This report uses school-level data from the 2000, 2006, and 2014 surveys. In each study year, all public, private, and state-administered schools in the United States, containing any of grades kindergarten through grade 12, were eligible for the survey. A two-stage sample design was used to generate a nationally representative sample of elementary, middle, and high schools. Seven school-level questionnaires were administered in each study year; this report provides results from the questionnaire focused on school nutrition services. In each school, the principal or other school contact identified the most knowledgeable respondent for each questionnaire. Between February and June of each study year, trained interviewers visited each school to conduct computer-assisted personal interviews. Across the 3 study years, the number of sampled schools that completed the nutrition services questionnaire ranged from 554 to 944, and the response rates ranged from 66% to 71%.† The percentage of respondents to the nutrition services questionnaire that were food service managers ranged from 69% to 80%, and the percentage of respondents who were other school nutrition services staff ranged from 10% to 12%.

The data from each study were weighted to provide national estimates of school nutrition services practices related to fruits, vegetables, whole grains, and sodium; the statistical software used accounted for the complex sample design. For the 2014 data, prevalence estimates and 95% confidence intervals were computed for each practice, overall and by school level (elementary, middle, and high school). Differences in prevalence estimates by school level were assessed by t-test; p values <0.05 were considered statistically significant. The number of school nutrition services practices used in each school also was calculated. For each question that was included in the 2000, 2006, and 2014 studies, logistic regression analyses with all 3 years of data were used to detect overall trends over time.

During 2014, almost all schools offered whole grain foods each day for breakfast (97.2%) and lunch (94.4%) (Table 1). Most schools offered two or more vegetables (79.4%) and two or more fruits (78.0%) each day for lunch. Approximately one third (30.5%) of schools offered self-serve salad bars. Among the 55.0% of schools that prepared food at the school rather than in another location, such as a central kitchen, during the 30 days before the study, approximately half almost always or always used practices to reduce sodium, including using fresh or frozen vegetables instead of canned vegetables (54.1%), using low-sodium canned vegetables instead of regular canned vegetables (51.8%), using other seasonings instead of salt (65.1%), and reducing the amount of salt called for in recipes or using low-sodium recipes (68.0%).

* National School Lunch Program requirements available at http://www.ecfr.gov/cgi-bin/text-idx?SID=6e619efd3476fc185e85495e42f62127&node=7:4.1.1.1.1.3.1.2&rgn=div8 and School Breakfast Program requirements available at http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=7:4.1.1.1.3#7:4.1.1.1.3.0.1.8.

† In the 2014 sample, 52.0% of schools were elementary schools, 27.4% were middle schools, and 20.6% were high schools. Additionally, 72.6% were public schools, 22.9% were private schools, and 4.4% were state-administered schools.

TABLE 1. Percentage of schools that engaged in specific school nutrition services practices in the school meal programs, by school level — School Health Policies and Practices Study, 2014

			School level					
	Total (n = 554)		Elementary (n = 192)		Middle (n = 179)		High (n = 183)	
Practice	%	(95% CI)	%	(95% CI)	%	(95% CI)	%	(95% CI)
Offered								
Whole grain foods each day for breakfast	97.2	(94.9–98.5)	98.4	(93.9–99.6)	98.8	(95.1–99.7)	93.1	(87.3–96.3)*
Whole grain foods each day for lunch	94.4	(91.4–96.4)	94.2	(88.4–97.2)	94.1	(88.8–96.9)	95.5	(89.5–98.1)
≥2 different nonfried vegetables each day for lunch	79.4	(73.8–84.1)	79.5	(71.0–86.0)	78.0	(70.1–84.3)	80.9	(71.5–87.8)
≥2 different fruits or types of 100% fruit juice each day for lunch	78.0	(72.1–82.9)	74.9	(65.4–82.5)	77.2	(69.3–83.6)	86.8	(80.5–91.3)†
Self-serve salad bar	30.5	(24.9–36.9)	28.6	(21.5–37.0)	31.2	(23.6–39.9)	34.7	(26.9–43.4)
Always or almost always§								
Used fresh or frozen vegetables (instead of canned)	54.1	(46.6–61.4)	51.7	(40.6–62.7)	58.5	(49.3–67.1)	54.0	(41.9–65.7)
Used low-sodium (instead of regular) canned vegetables	51.8	(44.9–58.7)	54.2	(44.0–64.0)	52.5	(41.1–63.6)	46.0	(35.9–56.4)
Used other seasonings instead of salt	65.1	(58.4–71.3)	68.9	(59.2–77.2)	59.5	(47.6–70.3)	63.7	(51.8–74.2)
Reduced amount of salt called for in recipes or used low-sodium recipes	68.0	(61.2–74.1)	69.2	(58.4–78.3)	65.3	(54.8–74.5)	68.5	(56.5–78.5)

Abbreviation: CI = confidence interval.
* The percentage of high schools that offered whole grain foods each day for breakfast was significantly lower than the percentage of elementary schools and middle schools that did so (p≤0.05).
† The percentage of high schools that offered two or more fruits each day for lunch was significantly higher than the percentage of elementary schools and middle schools that did so (p≤0.05).
§ During the 30 days before the study, among the 55.0% of schools overall, 50.6% of elementary schools, 55.2% of middle schools, and 66.0% of high schools in which food is prepared at the school.

Only two of the nine school nutrition services practices examined in the 2014 study varied by school level. The percentage of high schools that offered whole grain foods each day for breakfast was significantly lower than the percentage of elementary schools and middle schools that did so, and the percentage of high schools that offered two or more fruits each day for lunch was significantly higher than the percentage of elementary schools and middle schools that did so. Overall, 97.5% of schools used at least one of the nine school nutrition services practices examined, with 23.9% using one to three of the practices, 48.3% using four to six of the practices, and 25.3% using seven or more of the practices.

From 2000 through 2014, the percentage of schools offering two or more fruits every day for lunch, offering two or more vegetables every day for lunch, using low-sodium canned vegetables instead of regular canned vegetables, using other seasonings instead of salt, and reducing the amount of salt called for in recipes or using low-sodium recipes increased significantly (Table 2).

Discussion

Most U.S. youth do not meet national recommendations for having a healthy diet, including consuming sufficient amounts of fruits, vegetables, and whole grains (*3–5*); this can put them at risk for weight gain, obesity, diabetes, and other diseases. Additionally, approximately 90% of U.S. children consume more sodium than recommended (*6*). School meal programs are an important source of nutrition for U.S. youth. Each school day, >30 million students participate in the National School Lunch Program§ and >13 million participate in the School Breakfast Program.¶ Students who eat school meals are more likely to consume milk, fruits, and vegetables during meal times than students who do not participate in the meal programs (*7*). Additionally, school meal participants have better intake of some key nutrients, such as calcium and fiber, than nonparticipants (*8*).

Recently published data indicate that 95% of school food authorities** or school districts nationwide are certified as compliant with the nutrition standards.†† Findings in this report also show that schools are using various practices to meet the nutrition standards for school meals. Furthermore, use of all five school nutrition services practices examined for which trend analyses are possible has increased over time.

However, opportunities to increase implementation of school nutrition services practices related to fruit and vegetable availability and sodium reduction still exist. For example, many

§ U.S. Department of Agriculture (USDA), National School Lunch Program: participation and lunches served. Available at http://www.fns.usda.gov/sites/default/files/pd/slsummar.pdf.
¶ USDA School Breakfast program: participation and meals served. Available at http://www.fns.usda.gov/sites/default/files/pd/sbsummar.pdf.
** School food authority means the governing body, such as a school district, that is responsible for the administration of one or more schools and has the legal authority to operate the school meal programs (e.g., National School Lunch Program).
†† USDA, Percent of School Food Authorities (SFA) certified for the performance based reimbursement as of December 2014. Available at http://www.fns.usda.gov/school-meals/school-meal-certification-data.

TABLE 2. Trends over time* in the percentage of schools that engaged in specific school nutrition services practices in the school meal programs, School Health Policies and Practices Study, 2000, 2006, and 2014

Practice	Year						p-value for trend
	2000 (n = 841)		2006 (n = 944)		2014[†] (n = 554)		
	%	(95% CI)	%	(95% CI)	%	(95% CI)	
Offered each day							
≥2 different nonfried vegetables for lunch	61.7	(56.9–66.2)	63.4	(58.8–67.8)	79.4	(73.8–84.1)	<0.001
≥2 different fruits or types of 100% fruit juice for lunch	68.1	(63.1–72.7)	66.3	(61.2–71.0)	78.0	(72.2–82.9)	0.064
Always or almost always[§]							
Used low-sodium (instead of regular) canned vegetables	10.3	(7.8–13.6)	15.6	(12.4–19.5)	51.8	(44.8–58.8)	<0.001
Used other seasonings instead of salt	32.8	(28.6–37.3)	39.2	(34.1–44.6)	65.1	(58.4–71.3)	<0.001
Reduced amount of salt called for in recipes or used low-sodium recipes	34.1	(29.4–39.1)	45.8	(41.2–50.5)	68.0	(61.3–74.1)	<0.001

Abbreviation: CI = confidence interval.
* Trend analyses conducted for questions included in 2000, 2006, and 2014 studies. Table includes significant linear trends based on logistic regression analyses with all 3 years of data.
† Results reflect practices after the new nutrition standards for school meals went into effect.
§ During the 30 days before the study, among the schools in which food is prepared at the school.

schools need new kitchen equipment to store, prepare, and serve fruits and vegetables (*9*). Although self-serve salad bars can help schools meet the requirements for amount and variety of vegetables offered, they were only offered in one third of schools in 2014. One public-private partnership, Let's Move Salad Bars to Schools (http://www.saladbars2schools.org/), has provided approximately 4,000 self-serve salad bars to schools across the country (*10*). Although implementation of practices to reduce sodium has increased since 2000, further training and technical assistance could support more widespread implementation of sodium reduction strategies. USDA is leading the What's Shaking? Creative Ways to Boost Flavor with Less Sodium initiative to help schools offer flavorful school meals with lower sodium content (http://healthymeals.nal.usda.gov/whatsshaking). This initiative provides resources for school nutrition professionals, including training, sample menus, and recipes, plus materials for school administrators, teachers, parents, and other stakeholders to increase awareness and support schools in achieving sodium reduction in school meals. Reducing sodium in school meals will depend on the efforts of multiple stakeholders, including schools, school districts, parents and other caregivers, and industry.

The findings in this report are subject to at least three limitations. First, the SHPPS questions differ in some ways from the nutrition standards for school meals. For example, SHPPS questions ask about whole grain foods in the school meal programs, whereas the requirements are for whole grain–rich foods, which have a specific definition.[§§] Second, four of the nine school nutrition services practices examined only reflect responses from the 55% of schools in which food is prepared at the school. In the remaining 45% of schools, food is not prepared at the school and therefore respondents in these schools did not answer these specific questions. However, SHPPS 2012 data, collected among a nationally representative sample of school districts, show similar improvements in these school nutrition services practices among districts in which food is not prepared at individual schools.[¶¶] Third, as data are self-reported, there might be over- or underreporting, or responses might reflect poor respondent knowledge.

Many resources exist to help schools meet nutrition standards for school meals. The foods available to schools through the USDA Foods program include whole grain–rich options (e.g., parboiled brown rice, whole grain macaroni), lower sodium mozzarella cheese, and only reduced sodium canned beans and vegetables.[***] USDA's Team Nutrition initiative (http://www.teamnutrition.usda.gov/) provides technical assistance and resources to schools on meeting the new nutrition standards. State agencies and school districts can continue to provide schools with training and technical assistance on practices to prepare meals that meet the standards, including choosing lower sodium versions of foods, flavoring foods with spices and herbs, preparing fruits and vegetables that are appealing to students, and incorporating whole grain–rich foods into meals. The Institute of Child Nutrition (http://www.nfsmi.org/) offers in-person and online trainings for school nutrition professionals on these topics. In addition to these resources, school districts can publicize their successes in newsletters and stories

§§ Foods that qualify as whole grain-rich for the school meal programs are foods that contain 100% whole grain or contain a blend of whole-grain meal and/or flour and enriched meal and/or flour of which at least 50% is whole grain. Whole grain–rich products must contain at least 50% whole-grains and the remaining grain, if any, must be enriched. Available at http://www.fns.usda.gov/sites/default/files/SP30-2012os.pdf.

¶¶ Results from the School Health Policies and Practices Study 2012, chapter seven, table six. Available at http://www.cdc.gov/healthyyouth/shpps/2012/pdf/shpps-results_2012.pdf#page=81.

*** Reduced sodium = ≤140 mg per half-cup serving.

Summary

What is already known about this topic?

In 2012, the U.S. Department of Agriculture published new required nutrition standards for the National School Lunch Program and School Breakfast Program, which require serving more fruits, vegetables, and whole grains and gradually reducing sodium over 10 years.

What is added by this report?

To examine the prevalence of school-level practices related to the implementation of the nutrition standards, CDC analyzed data from the 2000, 2006, and 2014 School Health Policies and Practices Study on school nutrition services practices related to fruits, vegetables, whole grains, and sodium. Although most schools are implementing practices to help meet the standards, opportunities exist to increase fruit and vegetable availability and reduce sodium content in school meals.

What are the implications for public health practice?

Efforts at the national, state, and local levels are needed to help schools meet the nutrition standards. These efforts include ensuring schools have appropriate kitchen equipment; providing training for school nutrition professionals on choosing lower sodium versions of foods, flavoring foods with spices and herbs, preparing fruits and vegetables that are appealing to students, and incorporating whole grain–rich foods into meals; continuing industry efforts to reformulate products to reduce sodium content; and engaging other stakeholders to help increase awareness about and support school meals that meet the nutrition standards.

to local media to encourage participation in the school meal programs, and share successful strategies and lessons learned with other school districts. Implementation of the nutrition standards for school meals helps to ensure that all students have access to meals that align with national recommendations for healthy eating.

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Injuries from Methamphetamine-Related Chemical Incidents — Five States, 2001–2012

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Methamphetamine (meth), a highly addictive drug, can be illegally manufactured using easily acquired chemicals; meth production can cause fires, explosions, injuries, and environmental contamination (*1*). To analyze injury incidence and trends, data on 1,325 meth-related chemical incidents reported to the Agency for Toxic Substances and Disease Registry's (ATSDR) Hazardous Substances Emergency Events Surveillance (HSEES) system and National Toxic Substance Incidents Program (NTSIP) by the five participating states (Louisiana, Oregon, Utah, New York, and Wisconsin) with complete information during 2001–2012 were examined. The findings suggested that meth-related chemical incidents increased with the drug's popularity (2001–2004), declined with legislation limiting access to precursor chemicals (2005–2007), and increased again as drug makers circumvented precursor restrictions (2008–2012). Seven percent of meth-related chemical incidents resulted in injuries to 162 persons, mostly members of the general public (97 persons, including 26 children) and law enforcement officials (42). Recent trends suggest a need for efforts to protect the general public, particularly children and law enforcement officials. Because individual state legislative actions can result in increased illegal meth production in neighboring states, a regional approach to prevention is recommended.

ATSDR supports state health departments to collect and analyze data about the public health impact of acute toxic substance releases. Data were analyzed from five states that collected information on meth-related chemical incidents for ATSDR's HSEES system during 2001–2009 and for NTSIP (the successor to HSEES), during 2010–2012. All chemical incidents possibly related to meth production, including ammonia releases associated with thefts for presumed meth production, were reviewed and confirmed. Injured persons were classified as responders (firefighters, law enforcement officials, or unspecified responders), employees, and members of the public, who could include meth producers (i.e., "cooks") or other household residents, including children. Joinpoint analysis was used to examine trends in meth-related chemical incidents.* Data on injured persons including their age group, injury severity, injury type, and population category were tabulated and analyzed by time interval.

During 2001–2012, a total of 1,325 meth-related chemical incidents were reported in the five states. Among all chemical incidents, the percentage that were classified as meth-related, by year, were plotted, and joinpoint analysis verified three trend periods: 2001–2004, 2005–2007, and 2008–2012. This percentage increased each year from 2001 through 2004, then decreased each year through 2007, and increased again through 2012 (Figure).

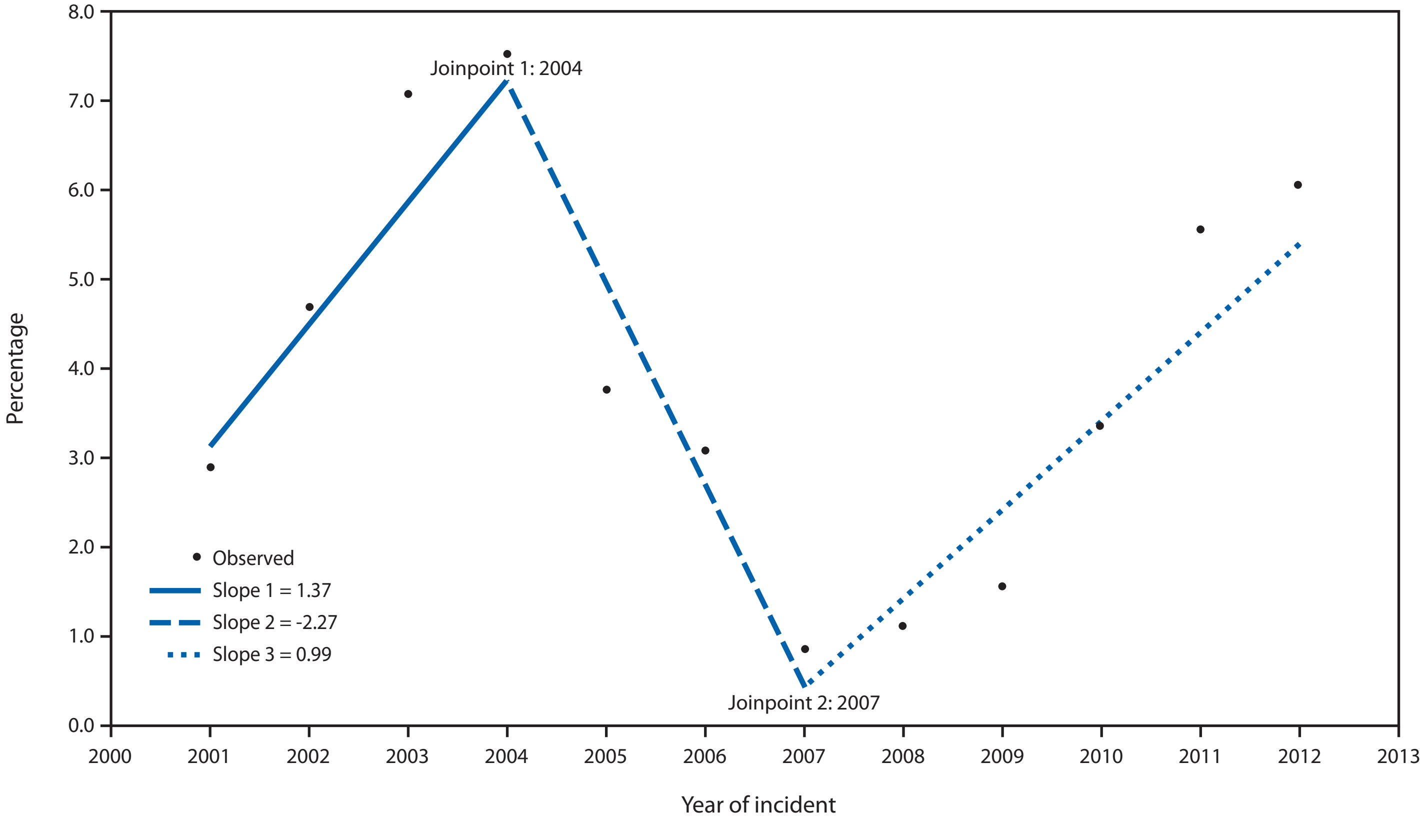
In 87 (7%) of the meth-related chemical incidents, 162 persons were injured, including at least 26 (16%) children (Table 1). Among those injured, 136 (84%) were treated at a hospital, including 19 (73%) children; 36 (22%) injured persons, including 19 (73%) children, required hospital admission. The percentage of injured persons who went to a hospital increased over time, from 75% (2001–2004), to 86% (2005–2007), to 90% (2008–2012). Two adults died: one, who might have been a meth cook, was found dead in a meth laboratory; the second was a law enforcement official.

The percentage of meth-related chemical incidents with injured persons increased from <5% during 2001–2004 and 2005–2007 to 10% during 2008–2012 (Table 1). The most commonly reported injuries were respiratory irritation (44%), chemical and thermal burns (27%), and eye irritation (22%) (Table 1). Chemical and thermal burns significantly increased, from 7% during 2005–2007 to 44% during 2008–2012 ($p<0.001$), temporally associated with new, hazardous production methods. During the same time, skin irritation injuries decreased from 20% to 2% ($p = 0.004$), eye symptoms decreased from 18% to 11%, and respiratory symptoms decreased from 57% to 31% ($p>0.05$).

Most injuries were to members of the general public (97) and law enforcement officials (42), followed by employees working in areas where meth contamination occurs, including hotels and motels, abandoned buildings, and treatment centers (14); and firefighters (7) (Table 1). The most commonly reported injuries among the general public were burns (43%) and respiratory irritation (37%); among injured law enforcement officials, respiratory irritation (64%), and eye irritation (38%) were most frequently reported (Table 2). Only two injured law enforcement officials used personal protective equipment (PPE). All seven injured firefighters used protective clothing with respiratory protection; one had respiratory irritation, but more symptoms consistent with inadequate

* Additional information available at http://surveillance.cancer.gov/joinpoint/.

FIGURE. Joinpoint analysis of percentage of chemical incidents that were methamphetamine-related — Hazardous Substances Emergency Events Surveillance System and National Toxic Substance Incidents Program, five states, 2001–2012



skin protection (skin irritation) and wearing heavy, hot gear (headache and gastrointestinal) were observed. Among the 14 injured employees, nine reported headache, seven respiratory irritation, and seven eye irritation.

Discussion

In September 2006, federal legislation restricting the retail sale of the common meth precursor drugs ephedrine and pseudoephedrine was enacted (*2*). Many states independently implemented this act in 2005, and the number of meth-related chemical incidents in the HSEES database subsequently declined. However, this trend was reversed in 2008 when meth cooks learned to circumvent the laws and obtain the restricted precursor drugs by purchasing permitted quantities from multiple locations, often using false identification and the assistance of other persons (*3*). Also around 2008, the "shake-and-bake" meth-making method became popular (*4*). This method involves shaking smaller amounts of precursor chemicals in a 2-L plastic bottle, which frequently bursts, causing burns and environmental contamination (*3*,*4*). Burn injuries increased during this time, particularly to members of the public, who might have been meth cooks or household residents.

"Prescription-only" laws for ephedrine and pseudoephedrine were enacted in Oregon (2006) and Mississippi (2010). Since the law went into effect in Oregon, fewer meth laboratories have been seized, and Oregon has reported fewer meth-related chemical incidents. Meth-related chemical incident data are not available for Mississippi; however, since Mississippi's prescription law went into effect, fewer meth laboratories were seized in that state (*3*), but meth-related chemical incidents increased in neighboring Louisiana (*5*). To most effectively reduce meth production, a regional, rather than state-by-state approach to outreach has been proposed by the Office of National Drug Control Policy, including implementing stricter laws limiting meth precursors, using electronic monitoring systems to track precursor purchasers, and developing and maintaining a database including information about offenders (*6*).

Workers, including responders, should be trained and prepared to recognize the different potential hazards of their occupations, and to know control measures to prevent injury such as avoidance, proper PPE selection and proper PPE use. Law enforcement personnel might encounter dangerous meth situations while responding to other calls, in conducting public safety assignments in response to meth incidents, and during meth laboratory seizures (*1*). Although the number and severity

TABLE 1. Number and description of persons injured, and severity of injuries in methamphetamine-chemical incidents, by period — Hazardous Substances Emergency Events Surveillance System and National Toxic Substance Incidents Program, five states, 2001–2012

No. of incidents with injuries (% of incidents)	Period 2001–2004 32 (4.8%)	2005–2007 11 (5.0%)	2008–2012 44 (10.1%)	Overall 87 (6.6%)
No. of persons injured	**57**	**44**	**61**	**162**
Age group*				
Adults	42	36	46	124
Children	15	8	3	26
Category of persons injured†				
General public	28	25	44	97
Firefighters	4	3	0	7
Law enforcement officials	20	11	11	42
Unspecified responders	1	0	0	1
Employees	4	5	5	14
Severity of injuries				
Treated on scene	4	2	2	8
Treated at hospital§	43	38	49	130
Admitted	11	4	21	36
Not admitted	32	34	28	94
Died	0	1	1	2
Other	10	3	3	16
Injury type¶				
Respiratory irritation	28	25	19	72
Burns	14	3	27	44
Eye irritation	20	8	7	35
Skin irritation	7	9	1	17
Other	4	3	5	12
Gastrointestinal	4	5	2	11
Headache	1	6	4	11
Dizziness/CNS	2	3	4	9
Trauma	3	2	3	8

Abbreviation: CNS = central nervous system.
* Age for 12 injured persons was unknown.
† Category for one injured person was unknown.
§ Admission status for six injured persons was unknown.
¶ Persons might have more than one type of injury.

TABLE 2. Injuries sustained in methamphetamine-chemical incidents, by injury type and category of injured persons — Hazardous Substances Emergency Events Surveillance System and National Toxic Substance Incidents Program, five states, 2001–2012

Injury type*	Category of persons injured: General public	Firefighter	Law enforcement official	Responder not specified/ Employee	Overall
Respiratory irritation	36	1	27	8	**72**
Burns	42	0	0	2	**44**
Eye irritation	11	1	16	7	**35**
Dizziness/CNS	3	0	5	1	**9**
Gastrointestinal	3	2	5	1	**11**
Skin irritation	7	4	5	1	**17**
Other	4	1	2	5	**12**
Headache	1	1	0	9	**11**
Trauma	7	0	1	0	**8**
All	**114**	**10**	**61**	**34**	**219**

Abbreviation: CNS = central nervous system.
* Persons might have more than one type of injury.

of law enforcement personnel injuries was slightly reduced, which might be related to targeted outreach, this group remains at high risk and needs training to recognize these risks and use appropriate PPE and procedures to avoid exposure and injury (*7*). The use of PPE by firefighters appears to afford respiratory protection; however, their gear is not designed to protect their skin from chemicals and can be heavy and hot during response. If possible, they should have physical fitness qualifications and physical monitoring for PPE usage.[†] Other workers were injured in locations where meth laboratories or contaminated persons are often encountered; therefore, employees working as cleanup contractors, or in housekeeping, patient intake, and other high-risk occupations should be alerted to the dangers.

Children who are present during drug production face many hazards in addition to threats to their health and safety (*8*,*9*). Several states, including Georgia, have enacted laws to protect children from meth-related injuries. In 2004, Georgia's governor used ATSDR data to support passage of a law that provides for serious penalties to meth producers if a child is present or is seriously injured during meth production (*8*).[§] As part of the president's 2010 National Drug Control Strategy, the Department of Justice established the Federal Interagency Drug Endangered Children Task Force to provide guidance to professionals to help identify, respond to, and serve children endangered by drugs.[¶]

With the increase in residential meth laboratories comes an increase in contaminated housing. The Drug Enforcement Agency maintains the National Clandestine Laboratory Register, which lists meth laboratories or illegal dump sites reported by law enforcement; some states maintain independent registries. These registries might help prevent inadvertent occupation of nonremediated contaminated housing. The agency's Clandestine Drug Laboratory Cleanup Program assists states with the removal and disposal of seized drug-making chemicals and equipment, and the U.S. Environmental Protection Agency provides national remediation guidelines and remediation support (*9*). In February 2011, state assistance was temporarily discontinued. During the unfunded period, according to an Associated Press report, local governments did not seize at least one third of known meth laboratories

† Additional information available at http://www.cdc.gov/niosh/fire/reports/face201218.html.

§ Georgia code § 16-5-73(b).
¶ Additional information available at http://www.whitehouse.gov/ondcp/dec-info.

Summary

What is already known on this topic?

Illegal methamphetamine production results in fires, explosions, spills, or air releases of hazardous chemicals (meth-chemical incidents), placing the meth producer and others nearby, including children, workers, and responders, at risk for injury or death and causing environmental contamination.

What is added by this report?

Data from five states suggest that, beginning in 2005, when state and federal legislative efforts to restrict meth precursors were enacted, meth-related chemical incidents temporarily declined in those states. However, in 2008, as meth producers learned to circumvent laws and obtain restricted precursor drugs, and introduced the hazardous "shake-and-bake" meth-making method, such incidents began to rise, as did the percentage of events with injuries, particularly burns. The general public, including many children, and law enforcement officials are most often injured. Prescription-only precursor laws have been effective in states that have implemented them, but also have had unintended consequences on neighboring states.

What are the implications for public health practice?

Additional measures should be taken to protect the public, particularly children, from meth-related chemical exposures. Law enforcement officials might need increased awareness and training. It is also important to consider regional approaches because actions in one state might result in increased meth production in a neighboring state.

because they could not afford the clean-up cost, highlighting the importance of these resources for the seizure and effective clean-up of meth laboratories.**

The findings in this report are subject to at least three limitations. First, all meth-related incidents for the five states in the database might not have been captured because of the queries used. NTSIP does not include meth incidents in homes unless there is a public health action, such as evacuation. In addition, because of pending legal actions, data on meth-chemical incidents are often difficult to obtain. Second, because states rely on relationships with law enforcement agencies and on scanning media reports, the quality of meth-related chemical incident data differs among states. Finally, trends from the five states cannot be generalized to the entire United States.

** Available at http://news.yahoo.com/ap-exclusive-national-meth-lab-busts-2011-185113059.html.

Implementation of federal and individual state legislative efforts to curb meth production has sometimes resulted in unintended consequences, such as shifting the problem to other states and circumvention of laws limiting precursor availability. Public health outreach aimed at protecting the general public (including children) and law enforcement officials, the groups most often injured in meth incidents is urgently needed. Possible actions include additional legislative restrictions, continued support for the identification and remediation of contaminated housing, professional responder training, and identifying children at risk for exposure.

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World Health Organization Guidelines for Containment of Poliovirus Following Type-Specific Polio Eradication — Worldwide, 2015

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In 1988, the World Health Assembly of the World Health Organization (WHO) resolved to eradicate polio worldwide. Among the three wild poliovirus (WPV) types (type 1, type 2, and type 3), WPV type 2 (WPV2) has been eliminated in the wild since 1999, and WPV type 3 (WPV3) has not been reported since 2012. In 2015, only Afghanistan and Pakistan have reported WPV transmission (*1*). On May 25, 2015, all WHO Member States endorsed World Health Assembly resolution 68.3 on full implementation of the *Polio Eradication and Endgame Strategic Plan 2013–2018* (*2*,*3*) (the Endgame Plan), and with it, the third *Global Action Plan to minimize poliovirus facility-associated risk* (*4*) (GAPIII). All WHO Member States have committed to implementing appropriate containment of WPV2 in essential laboratory and vaccine production facilities* by the end of 2015 and of type 2 oral poliovirus vaccine (OPV2) within 3 months of global withdrawal of OPV2, which is planned for April 2016 (*5*). This report summarizes critical steps for essential laboratory and vaccine production facilities that intend to retain materials confirmed to contain or potentially containing type-specific WPV, vaccine-derived poliovirus (VDPV), or OPV/Sabin viruses, and steps for nonessential facilities† that process specimens that contain or might contain polioviruses. National authorities will need to certify that the essential facilities they host meet the containment requirements described in GAPIII. After certification of WPV eradication, the use of all OPV will cease; final containment of all polioviruses after polio eradication and OPV cessation will minimize the risk for reintroduction of poliovirus into a polio-free world.

* A facility designated by the ministry of health or other designated national body or authority as serving critical national or international functions that involve handling and storage of needed poliovirus infectious materials or potentially infectious materials under conditions set out in GAPIII.

† Any facility that is likely to investigate new WPV2, type 2 attenuated vaccine-derived poliovirus (aVDPV2), type 2 circulating vaccine-derived poliovirus (cVDPV2), or inactivated type 2 vaccine-derived poliovirus (VDPV2) isolates, or new fecal or respiratory samples originating from recent OPV-using countries, and adopts and implements 1) safe and secure working practices based on a risk assessment and the implementation of appropriate biorisk management systems as described in GAPIII, 2) a nonretention policy for WPV2 materials as of the beginning of Phase IIa of the poliovirus type 2 containment period, and 3) a nonretention policy for OPV2/Sabin2 materials as of the beginning of Phase IIb of the poliovirus type 2 containment period.

Background

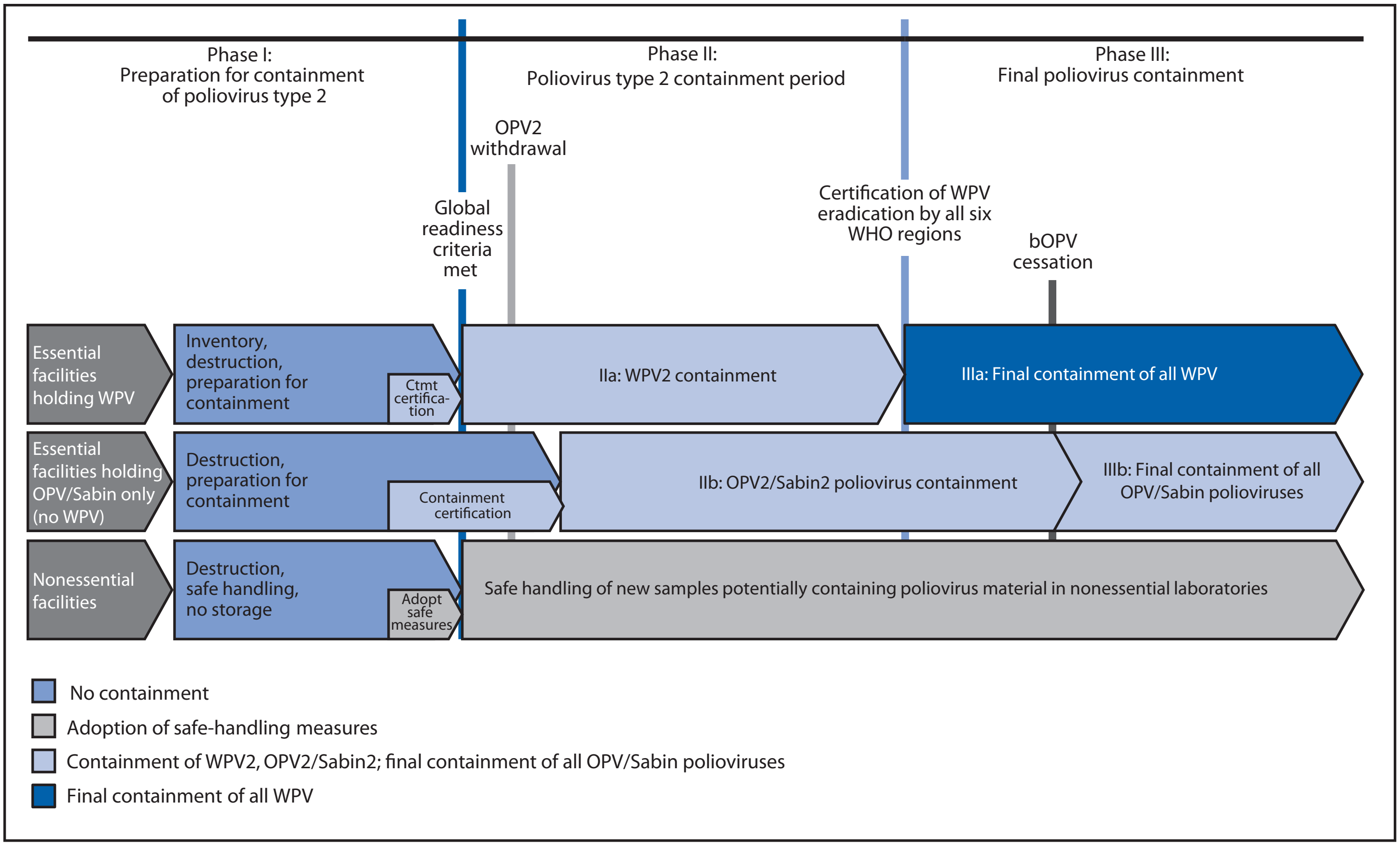
The Endgame Plan (*3*) set the goal of eradicating WPV and VDPV. Achieving this goal requires 1) detection of circulating polioviruses and interruption of transmission; 2) sequential cessation of the use of type-specific OPV to eliminate the risks for vaccine-associated paralytic poliomyelitis, chronic VDPV infections of immunodeficient persons, and outbreaks of circulating VDPV (cVDPV) (*6*,*7*); and 3) implementation of measures for the safe handling and containment of polioviruses to minimize the risks for facility-associated reintroduction of virus into polio-free communities. The first step toward OPV cessation will be the global, synchronized withdrawal of OPV2, which has caused approximately 90% of cVDPV cases since WPV2 was last reported in 1999. OPV2 withdrawal will be accomplished by replacing trivalent OPV (tOPV) with bivalent OPV (bOPV, protecting against types 1 and 3 in all countries using OPV for routine immunization, preceded by the introduction of a minimum of 1 dose of inactivated poliovirus vaccine (IPV), which protects against all three virus types (*5*). Approval to confirm the global switch from tOPV to bOPV, anticipated in April 2016, will follow review in October 2015 of whether a number of readiness criteria are met, including progress toward completion of the initial phase of poliovirus containment activities and establishment of readiness for appropriate handling of residual type 2 materials, as described below.

Methods

The Endgame Plan includes phased withdrawal of OPV strains. GAPIII was aligned to the Endgame Plan and comprises three phases (Figure): Phase I, Preparation for containment of poliovirus type 2, lasting until global readiness criteria for the switch are met (current target is end of 2015); Phase II, Poliovirus type 2 containment, lasting until all WHO regions certify WPV elimination; and Phase III, Final poliovirus containment. National authorities in all countries are currently tasked with completing Phase I and preparing for Phase II (Table 1).

The controls described in GAPIII reflect containment best practices, and are largely derived from the *European Committee for Standardization Workshop Agreement 15793 (2011) — Laboratory Biorisk Management* (*8*), with input from leaders in the field of poliovirus transmission and biorisk management.

FIGURE. Schematic diagram of the phased poliovirus containment, by type of facility — worldwide



Abbreviations: WPV = wild poliovirus; OPV = oral poliovirus vaccine.

Rationale

Reintroduction of WPV from a poliovirus facility after type-specific eradication risks the potentially disastrous consequence of reestablishing WPV transmission. When OPV use stops, many countries will maintain high population coverage with IPV, other countries will have suboptimal IPV coverage, and still others might discontinue use of IPV and all national polio immunization activities. Reintroduction of an OPV/Sabin strain from a facility creates risks for unrecognized virus transmission, reversion to cVDPV, and reestablishment of poliovirus transmission.

Most countries will have no need to retain polioviruses following WPV eradication and cessation of OPV use. Facility-associated risks in these countries can be eliminated by a thorough nationwide search for, and destruction of, all infectious and potentially infectious materials, including WPV, VDPV, and OPV/Sabin viruses. Some countries will host a limited number of essential laboratory and vaccine production facilities that serve critical program and research functions, including production of IPV and Sabin-IPV (IPV produced using attenuated strains from the Sabin oral vaccine as seed), production and storage of monovalent OPV stockpiles of each type, vaccine quality assurance, diagnostic reagent production, and crucial research. Each essential poliovirus facility should manage biorisk appropriately to minimize the risk for virus reintroduction into the community, with effective national certification and WHO verification programs to assure compliance with GAPIII. The risk for a poliovirus reintroduction can further be minimized by ensuring that essential facilities are located in areas with high levels of population immunity and acute flaccid paralysis and environmental surveillance, supplemented by efficient public health and response capacity (Table 2). Minimizing the number of essential facilities worldwide will further reduce the magnitude of risk, facilitate national and international oversight, and strengthen the likelihood that global containment standards can be met and successfully maintained.

Policy and Implementation

Phase I: Preparation for containment of all type 2 polioviruses. Phase I is currently in progress. Phase I for WPV2 will continue until the conditions of global readiness for

TABLE 1. Phased implementation of poliovirus containment activities in the third Global Action Plan (GAPIII)* to minimize poliovirus facility-associated risk, worldwide

Prerequisites	Begins	Target for completion	Key activities
Phase I: Preparation for containment of PV type 2			
None	Ongoing	For WPV2: global readiness for OPV2 withdrawal (target for global readiness review is October 2015) For OPV2/Sabin2: 3 months after the withdrawal of tOPV	• Governments, institutions, and laboratory and vaccine production facilities informed about the upcoming need for type-specific poliovirus containment • Inventory and survey of laboratory facilities and vaccine production facilities handling or storing infectious or potentially infectious poliovirus materials Essential facilities†: • National certification of WPV2-holding laboratories and IPV production facilities Nonessential facilities§: • Destruction of unneeded PV material • Transfer of needed PV type 2 material to essential laboratory facilities • If specimen investigations continue, adoption of nonretention policy for new WPV2 isolates, to be implemented in Phase IIa
Phase IIa: WPV2 containment			
Elimination of circulating WPV2 Elimination of persistent cVDPV2	As soon as the criteria for global readiness for OPV2 withdrawal are met (target is January 2016)	After all six WHO Regions have certified WPV eradication	Essential facilities†: • Handle and store WPV2 materials in "Containment of WPV2" conditions outlined in GAPIII Nonessential facilities§: • Destroy remaining unneeded OPV2 material • Transfer needed OPV2 material to certified essential laboratory facilities Nonessential facilities that continue specimen investigations¶: • Implement nonretention policy • Destroy unneeded recently isolated PV material • Transfer needed recently isolated PV material to certified essential facilities
Phase IIb: OPV/Sabin PV type 2 (OPV2/Sabin2) containment			
Licensed, available bOPV (types 1 and 3) Global IPV introduction Global tOPV-bOPV switch	Within 3 months of global tOPV to bOPV switch (target for global switch is April 2016)	Within 3 months of global bOPV cessation (planned 1 year after global certification of WPV eradication)	Essential facilities†: • Handle and store OPV materials in "Containment of OPV2/Sabin2 polioviruses" conditions outlined in GAPIII
Phase IIIa: Final containment of all WPV after polio eradication			
3 years pass without isolation of WPV	As soon as all six WHO Regions certify WPV eradication	Long-term eradication (beyond global bOPV cessation)	Essential facilities†: • Handle and store all WPV materials in "Final containment of all WPV" conditions, as outlined in GAPIII
Phase IIIb: Final biocontainment of all OPV/Sabin PV after bOPV cessation			
Global bOPV cessation	Within 3 months of global bOPV cessation (planned 1 year after global certification of WPV eradication)	Long-term eradication (beyond global bOPV cessation)	Essential facilities†: • Handle and store OPV materials in "Final containment of all OPV/Sabin polioviruses" conditions, as outlined in GAPIII

Abbreviations: bOPV = bivalent oral polio vaccine (types 1 and 3); cVDPV2 = type 2 circulating vaccine-derived poliovirus; GAPIII = third Global Action Plan to minimize poliovirus facility-associated risk; IPV = inactivated poliovirus vaccine; OPV = oral poliovirus vaccine; OPV2 = type 2 OPV; PV = poliovirus; tOPV = trivalent OPV (types 1, 2 and 3); WHO = World Health Organization; WPV = wild poliovirus; WPV2 = type 2 WPV.

* Available at http://www.polioeradication.org/Portals/0/Document/Resources/PostEradication/GAPIII_2014.pdf.

† A facility designated by the ministry of health or other designated national body or authority as serving critical national or international functions that involve handling and storage of needed poliovirus infectious materials or potentially infectious materials under conditions set out in GAPIII.

§ Any facility that is likely to investigate new WPV2, aVDPV2, cVDPV2 or iVDPV2 isolates, or new fecal or respiratory samples originating from recent OPV-using countries, and adopts and implements a) safe and secure working practices based on a risk assessment and the implementation of appropriate biorisk management systems as described in GAPIII, b) a nonretention policy for WPV2 materials as of the beginning of Phase IIa of the poliovirus type 2 containment period, and c) a nonretention policy for OPV2/Sabin2 materials as of the beginning of Phase IIb of the poliovirus type 2 containment period.

¶ All nonessential laboratories investigating new WPV2; aVDPV2, cVDPV2, or iVDPV2 isolates, or new fecal and respiratory samples originating from recent OPV-using countries.

OPV2 withdrawal have been met (Table 1), which include elimination of persistent cVDPV2 and certification of WPV2 eradication, currently planned for review in October 2015. Phase I for OPV2/Sabin2 will continue until 3 months after the switch from tOPV to bOPV. Surveyed national laboratories should include 1) all public or private facilities working with

TABLE 2. Containment safeguards to minimize poliovirus facility-associated risks after type-specific eradication of wild polioviruses and sequential cessation of oral polio vaccine use, worldwide

	Poliovirus type 2 biocontainment (phases IIa and IIb)	Final poliovirus biocontainment (phases IIIa and IIIb)	
Safeguards	**All type 2 polioviruses**	**All OPV/Sabin polioviruses**	**All wild polioviruses**
Primary safeguards: prevention of infection with and release of contaminated materials			
Operator protection*	Yes	Yes	Yes
Decontamination of materials/equipment	Yes	Yes	Yes
Dedicated effluent treatment plant	No†	No†	Yes§
Air/exhaust treatment	No	No	Yes¶
Secondary safeguards: population immunity in country hosting facility			
Number of IPV doses	≥1	≥1	≥3
IPV coverage	= DTP3 coverage**	= DTP3 coverage**	>90%
Tertiary safeguards: environment and location			
Situating facilities in areas with low transmission potential for wild polioviruses	No	No	Yes

* Because the operator is considered to be one of the sources of release of poliovirus from the facility, specific measures of protection are required, including use of personal protective equipment, use of primary containment devices, and vaccination.
† Untreated release into a closed sewage system with secondary effluent treatment in facility location (Note: all waste from facilities, potentially containing live poliovirus, should be inactivated before release through adequate and validated inactivation procedures. For facilities without a dedicated effluent treatment plant, this would normally be done through the application of heat or chemicals as part of a validated treatment process. Under no circumstances should raw poliovirus containing effluents be discharged to drains, unless the effluent treatment plant has been designed and validated to handle such effluents, effectively acting as part of the primary containment system).
§ Facility effluent treatment before release into closed sewage system with secondary or greater effluent treatment in facility location.
¶ HEPA (high efficiency particulate arresting) filtration on exhaust air.
** Diphtheria-tetanus-pertussis (DTP3) vaccine third dose coverage; available at http://www.who.int/gho/immunization/dtp3/en/.

WPV2/VDPV2 and all facilities working with OPV2/Sabin2 or with fecal or respiratory materials that could contain WPV2, VDPV2, or OPV2/Sabin2 (collected at a time and place when OPV was in use), and 2) all public or private facilities that might have collections of infectious or potentially infectious WPV2, VDPV2 or OPV2/Sabin2 materials of any origin that are maintained for any reason.

Facilities that retain specimens that might contain WPV2/VDPV2 viruses must destroy or contain such materials before Phase IIa can begin. Facilities that wish to retain specimens that might contain OPV2/Sabin2 viruses (i.e., fecal or respiratory samples collected in places when OPV was in use) must destroy or contain such materials before commencement of Phase IIb. Laboratories wishing to retain historic collections of clinical materials potentially containing polioviruses, but that are not planning to implement the poliovirus containment measures described in GAPIII, must explore transfer options with designated certified essential poliovirus facilities for handling and storage arrangements.

Phase II: Poliovirus type 2 containment period. Phase II begins as soon as the criteria for global readiness for OPV2 withdrawal are met (*5*) and is currently planned for January 2016 (Table 1). This phase comprises two parts: the first (Phase IIa) addresses the containment of WPV2, and the second (Phase IIb) the containment of OPV2/Sabin2 polioviruses in certified essential facilities. Phase IIa begins after elimination of persistent cVDPV2 and certification of WPV2 eradication, at the time of global readiness for OPV2 withdrawal, and ends after all six WHO regions have certified WPV eradication. Phase IIb begins within 3 months of withdrawal of tOPV and the switch to bOPV, and ends within 3 months after global bOPV cessation. Essential poliovirus facilities handling and storing WPV2 or OPV2/Sabin2 materials in Phase II must be certified to implement containment procedures, and be regularly reassessed against WPV2 containment provisions described in GAPIII, including primary and secondary safeguards (Table 2). Once Phase II begins, facilities that have not received national certification for WPV2 containment will no longer be permitted to handle and store WPV2 materials. Countries or concerned facilities may apply to WHO through their national authorities for verification of containment in essential poliovirus facilities, certified by the ministries of health or other designated national authority, and declared to meet all biorisk management criteria consistent with GAPIII.

Phase III: Final poliovirus containment. Phase III also has two parts (Phases IIIa and IIIb). Phase IIIa (final containment of all WPV after polio eradication) begins when all six WHO regions have completed the certification of WPV eradication, at least 3 years after the last isolation of WPV (Table 1). Certified essential laboratories and IPV production facilities handling and storing any WPV or VDPV materials must implement final containment of all WPV provisions, including primary, secondary, and tertiary safeguards (Table 2). Once Phase III begins, facilities that have not received national certification for final containment of all WPV will no longer be permitted to handle and store any WPV materials. At the time of global bOPV cessation (currently planned for 1 year after the global declaration of WPV eradication), all countries must recall and destroy bOPV stocks. WHO will provide specific implementation guidelines for collection and destruction of bOPV from designated collection points, health facilities, or private practitioners, and national and subnational storage facilities (*9*).

Phase IIIb (final containment of all OPV poliovirus after bOPV cessation) will begin 3 months after global bOPV cessation (Figure) (Table 1). Certified essential poliovirus laboratories and Sabin-IPV vaccine production facilities handling and storing OPV/Sabin materials (but no WPV) must implement final provisions for containment of all OPV/Sabin polioviruses, including primary and secondary safeguards (Table 2). Once Phase IIIb begins, facilities that have not received national certification for final containment of all OPV/Sabin polioviruses will no longer be permitted to handle and store OPV/Sabin materials. Within 6 months of bOPV cessation, all countries must submit documentation that requirements for final containment of all OPV/Sabin polioviruses have been met.

Discussion

An estimated 500 facilities worldwide are currently holding type 2 polioviruses. One of the goals of poliovirus containment is to reduce this number substantially (*10*), dissuading candidate facilities not meeting the GAPIII containment criteria for essential facilities from holding any polioviruses.

It is important to note that poliovirus diagnostic laboratories will continue to be critical for surveillance and will remain so for years to come. Poliovirus diagnostic laboratories are not required to become certified essential poliovirus facilities to continue to perform their jobs, as long as they do not retain live polioviruses. However, laboratories that perform reference (and diagnostic) functions need to retain live polioviruses and thus be certified to meet the criteria for essential poliovirus facilities. Only designated essential poliovirus facilities that are certified to meet GAPIII containment requirements will handle and store polioviruses.

The timeline presented in GAPIII for the type-specific containment of polioviruses is short, both for candidate essential poliovirus facilities to be assessed and certified to meet GAPIII requirements, and for national authorities responsible for containment to deliver containment certificates. However, continuation of polio vaccine production, surveillance, and research is critical and must continue. To help manage the practical challenges associated with implementation of containment for essential laboratory and vaccine production facilities, interim certification of containment has been proposed. Interim certification would allow containment certification to proceed during the endgame phases of eradication in a controlled and structured manner, as issues associated with meeting the requirements for full containment certificates are addressed within pressing timelines. The proposed mechanisms will provide some degree of flexibility as facilities make the required changes, and national authorities and other governing bodies develop the required capacity to implement certification requirements.

The final containment of all WPV/VDPVs, including types 1 and 3, is approaching. After WPV transmission has been stopped, final containment of all polioviruses will minimize the risk for poliovirus reintroduction into a polio-free world once all OPV use is phased out. As is the case with variola virus, containment requirements will have to be regularly assessed and maintained, until a global decision is made to destroy all remaining poliovirus materials and prohibit any de novo synthesis.

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Human Plague — United States, 2015

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Since April 1, 2015, a total of 11 cases of human plague have been reported in residents of six states: Arizona (two), California (one), Colorado (four), Georgia (one), New Mexico (two), and Oregon (one). The two cases in Georgia and California residents have been linked to exposures at or near Yosemite National Park in the southern Sierra Nevada Mountains of California. Nine of the 11 patients were male; median age was 52 years (range = 14–79 years). Three patients aged 16, 52, and 79 years died.

Plague is a rare, life-threatening, flea-borne zoonosis caused by the bacterium *Yersinia pestis*. During 2001–2012, the annual number of human plague cases reported in the United States ranged from one to 17 (median = three cases) (*1*). It is unclear why the number of cases in 2015 is higher than usual. Plague circulates among wild rodents and their fleas in rural and semirural areas in the western United States (*2*). Transmission to humans occurs through the bite of infected fleas, direct contact with infected body fluids or tissues, or inhalation of respiratory droplets from ill persons or animals, including ill domesticated cats and dogs (*3*). The usual incubation period between exposure and illness onset is 2–6 days.

In humans, plague is characterized by the sudden onset of fever and malaise, which can be accompanied by abdominal pain, nausea, and vomiting. There are three main forms of plague, depending upon the route of infection. Bubonic plague, resulting from the bite of an infected flea, accounts for approximately 80%–85% of cases; patients develop a "bubo," a painful swelling of one or several lymph nodes that progresses during the first few days of illness. Septicemic plague, accounting for approximately 10% of cases, can occur from a flea bite or from direct contact with infectious fluids; infection spreads directly through the bloodstream with no localizing signs. Primary pneumonic plague, occurring in approximately 3% of plague patients, results from aerosol exposure to infective droplets and is characterized by a fulminant primary pneumonia. Secondary pneumonic plague can result from the spread of *Y. pestis* to the lungs in patients with untreated bubonic or septicemic infection.

The mortality rate for untreated plague has ranged from 66% to 93%; however, in the antibiotic era, mortality has been reduced to approximately 16% (*4*). Prompt treatment with antimicrobials such as aminoglycosides, fluoroquinolones, or doxycycline greatly improves outcome (*4*).

Health care providers should consider the diagnosis of plague in any patient with compatible signs or symptoms, residence or travel in the western United States, and recent proximity to rodent habitats or direct contact with rodents or ill domestic animals. Suspicion of plague should prompt 1) collection of blood, bubo aspirate, or sputum samples for *Y. pestis* diagnostic testing; 2) implementation of isolation and respiratory droplet precautions for patients with respiratory involvement; 3) immediate antibiotic treatment (before laboratory confirmation); and 4) notification of public health officials. *Y. pestis*–specific testing is available at state health laboratories. Recommendations for diagnostic testing and antibiotic treatment are available at http://www.cdc.gov/plague/healthcare/clinicians.html. Misidentification of *Y. pestis* as *Pseudomonas luteola* and other organisms through the use of automated bacterial identification systems has been reported (*5*).

Persons engaging in outdoor activities in areas where plague is endemic should wear long pants when possible and use insect repellent on clothing and skin. Persons also should avoid direct contact with ill or dead animals and never feed squirrels, chipmunks, or other rodents. In addition, pet owners should regularly use flea control products on their pets and consult a veterinarian if their pet is ill. Rodent habitat can be reduced around the home by removing brush, clutter, and potential rodent food sources such as garbage or pet food. Additional information on prevention of plague is available at http://www.cdc.gov/plague/prevention/index.html.

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Notes from the Field

Snowstorm-Related Mortality — Erie County, New York, November 2014

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During November 18–21, 2014, a narrow band of central and southern Erie County in New York received unprecedented amounts of snowfall. The duration of the storm and amount of snowfall rapidly exceeded weather service forecasts, with some areas receiving 60–84 inches (1.5–2.1 meters) of snow. The rapid accumulation resulted in stranded drivers, travel bans, and logistical challenges associated with snow removal. Sporadic power outages affected a limited number of households. Eleven deaths were linked to the snowstorm, including one that was directly related, nine that were indirectly related, and one that was classified as possibly storm-related.

Erie County has a population of nearly 923,000, with 16.3% of persons aged ≥65 years (*1*). On November 18, in anticipation of the storm, the Erie County Emergency Operations Center (EOC) was activated. The EOC monitored and coordinated county, state, city, town, and village disaster preparedness and relief efforts involving both governmental and nongovernmental organizations. On November 18, the EOC began receiving unconfirmed reports of storm-related deaths from police, fire, and other first responder agencies. To measure the burden of storm-related mortality, the Erie County Department of Health Medical Examiner's Office worked with local law enforcement, hospitals, and urgent care centers, first responders, funeral homes, and a nursing home to investigate and classify reports. Deaths that were directly caused by environmental forces (e.g., snow or cold) or by the direct consequences of these forces (e.g., structure collapse) were classified as directly storm-related. Deaths that occurred as a consequence of unsafe conditions (e.g., hazardous roads) or a disruption of services (e.g., loss of emergency transport services) caused by the storm were classified as indirectly storm-related (*2*). Deaths not classified as directly or indirectly storm-related were reported as possibly storm-related deaths.

During November 18–21, a total of 11 storm-related deaths occurred (Table). Decedents ranged in age from 30 to 92 years, (mean = 64 years; median = 60 years), and nine were male. One death, in which a person with hypothermia was found outside the home, was classified as directly storm-related. Nine deaths were indirectly storm-related: four involved shoveling or blowing snow; two carbon monoxide intoxication deaths occurred in stranded vehicles; two persons with acute medical emergencies died because they could not be transported to facilities with appropriate levels of care; and one death occurred during efforts to free a stuck vehicle. One possibly storm-related death occurred following an emergency relocation of nursing home residents. All 11 deaths occurred in areas that received the most snow. The number of deaths attributed to the storm might have been reduced as a result of widespread road closures, driving bans, and implementation of regional emergency response.

Although public health agencies commonly evaluate the impact of natural disasters such as hurricanes, tornadoes, and earthquakes, assessments of the impact of snowstorms are rarely reported (*2*). Most of the reported deaths that occurred during this storm were potentially preventable and provide an opportunity to reinforce community prevention and preparedness educational messages. Providers caring for persons with heart disease should caution their patients about the risks associated with shoveling snow or performing strenuous work in the cold, which is associated with cardiac-related deaths (*3*). Drivers should be aware of safety precautions to prevent hypothermia, including keeping extra clothing and blankets in their vehicles. Drivers who become stranded are advised to remain with their vehicles and to run the engine to generate heat for 10 minutes each hour, after checking that the window is slightly open and that snow is not blocking the exhaust pipe, to reduce risk of carbon monoxide poisoning. Stranded travelers should avoid eating unmelted snow because it lowers body temperature (*4*).

CDC has developed a checklist emphasizing advance preparedness for winter weather emergencies (*5*). This information can be incorporated into media messages from government agencies to inform and protect the public during extreme winter weather conditions.

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TABLE. Snowstorm-related deaths by date, age, and sex of decedent, circumstances of death, and classification of death — Erie County, New York, November 18–21, 2014

Date	Age of decedent (yrs)	Sex	Circumstance of death	Storm-related classification*
Nov. 18	59	F	Shoveling snow	Indirect
	82	M	Shoveling snow	Indirect
	30	M	Payloader accident	Indirect
	82	M	Medical emergency, unable to transport to appropriate care	Indirect
Nov. 19	46	M	Found in stranded vehicle	Indirect
	60	M	Snow blowing	Indirect
	77	M	Medical emergency, unable to transport to appropriate care	Indirect
Nov. 20	57	M	Found outside on front steps of home	Direct
	92	F	Died at nursing home after emergency relocation	Possible
Nov. 21	68	M	Snow blowing	Indirect
	51	M	Found in stranded vehicle	Indirect

Abbreviations: M = male; F = female.

* Direct: caused by environmental forces or direct consequences of these forces. Indirect: caused by unsafe conditions related to the storm. Possible: not classified as direct or indirect.

Notes from the Field

Increase in Reports of *Strongyloides* Infection — Los Angeles County, 2013–2014

Curtis Croker, MPH[1]; Rosemary She, MD[2]

During the 1990s, reports of infection with the nematode (roundworm) *Strongyloides stercoralis* submitted to the Los Angeles County Department of Public Health (LACDPH) ranged from 40 to 50 per year, but by 2000, reports had decreased to five per year; in 2006, *Strongyloides* infection was removed from the LACDPH reportable disease list. Currently, it is only reported at the discretion of Los Angeles County clinicians and laboratories as an unusual disease occurrence. LACDPH currently only monitors case counts and does not investigate reported *Strongyloides* cases. During 2013–2014, an increase in *Strongyloides* cases occurred, with 43 cases reported.

Although *Strongyloides* infects humans worldwide, typically through skin contact with contaminated soil (*1*), infection is rare in the United States. Persons at risk for infection include immigrants, refugees, military veterans who have lived in areas where *Strongyloides* is endemic, (*1*) and persons who have lived in rural areas of the southeastern United States (*2*). Most infections are asymptomatic and might remain latent for decades. Persons with latent infection who receive immunosuppressive treatments or are otherwise immunosuppressed are at risk for a severe hyperinfection syndrome and disseminated disease, which is associated with a high mortality rate (*3*). During 1991–2006, the number of *Strongyloides*-associated deaths in the United States listed on death certificates ranged from 14 to 29 annually (*4*). Eosinophilia is the most common indicator of infection, but it is not specific to this disease and is not always present (*5*).

Beginning in 2013, *Strongyloides* case reports in Los Angeles County increased; no cases were reported in 2012, but 14 were reported in 2013 and 29 in 2014. Twenty-five (58%) of these reports were submitted by CDC's parasitic serology reference laboratory, for patients examined at Los Angeles County–University of Southern California Medical Center (LAC-USC). Sixteen reports were submitted by refugee health clinics, and two by other health care providers. The increase in case reports prompted a review of the 25 patients with *Strongyloides* examined at LAC-USC, a facility that accounts for 3% of all hospitalizations in a county of nearly 10 million residents.

The patients with *Strongyloides* examined at LAC-USC were mostly male (76%), Hispanic (80%), or Asian (16%). Most were foreign born (75%), primarily from a Latin American country (60%). The average patient age was 50 years (median = 55 years; range = 25–73 years). All patients tested positive for *Strongyloides*-specific antibody by enzyme immunoassay (EIA) testing performed by the CDC reference laboratory, indicating current or recent infection (*6*). The average test reaction value was 25.76 units/μl (range = 2.37–75.58 units/μl; reference 1.7 units/μl). Four were immunocompromised. Three patients were hospitalized at the time of testing; no patient had a diagnosis of disseminated disease or hyperinfection.

Of the 25 patients, 21 (88%) had peripheral eosinophilia (>450 eosinophils/μl) at the time of *Strongyloides* testing; the average eosinophil count was 1,297/μl (range = 201–3,472/μl). Nearly all patients (96%) had documentation of eosinophilia at some point during the 6 months preceding *Strongyloides* testing. Most were tested in an outpatient facility (88%), and many were being followed for other chronic health conditions such as hypertension (52%) or diabetes (48%), where eosinophilia appeared to be an incidental finding. Treatment was documented for 17 patients (68%), consisting of ivermectin alone for 15 patients, albendazole alone for one patient, and both drugs for one patient.

The recent increase in reports of *Strongyloides* in Los Angeles County is likely the result of screening guidelines published in 2012, which recommend screening all persons with a potential *Strongyloides* exposure history who are at risk for disseminated disease, including persons requiring immunosuppressive therapy (*7*), and changes in existing screening protocols, rather than an actual increase in disease prevalence. The high prevalence of eosinophilia among persons with latent *Strongyloides* infection in Los Angeles County highlights the importance of screening persons with eosinophilia for whom more common causes have been ruled out. Diagnosis of latent infection is important so that treatment can be initiated and the risk for more severe disease eliminated, and is crucial for persons with unexplained eosinophilia who will be placed on immunosuppressive drug regimens (*7*).

The burden of disseminated disease and hyperinfection in Los Angeles County remains unknown. Further research is needed to better characterize the at-risk group in Los Angeles County and enhance screening policies.

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Errata

Vol. 64, No. RR-3

In the *MMWR* Recommendations and Reports entitled "Sexually Transmitted Diseases Treatment Guidelines, 2015," several errors occurred.

On page 50 in the box, the bullet under "Positive Control" should read: "Commercial histamine for scratch testing (1.0 mg/mL)"

On page 93, the second sentence under the heading "Anal Cancer" should read: "However, an annual digital anorectal examination may be useful to detect masses on palpation that could be anal cancer in persons with HIV infection and possibly HIV-negative MSM with a history of receptive anal intercourse."

On page 101, in the recommendations box under "Alternative Regimens," it should read: "Malathion 0.5% lotion applied to affected areas and washed off after 8–12 hours OR Ivermectin 250 *u*g/kg orally, repeated in 2 weeks."

On page 102, in the recommendations box, the dagger footnote should be placed after "Lindane."

On page 103, the fifth sentence under the heading "Crusted Scabies," should read: "Combination treatment is recommended with a topical scabicide, either 25% topical benzyl benzoate or 5% topical permethrin cream (full-body application to be repeated daily for 7 days then two times weekly until discharge or cure), and treatment with oral ivermectin 200 *u*g/kg on days 1,2,8,9, and 15."

Vol. 63, No. 45

In the report, "Tobacco Use Among Middle and High School Students — United States, 2013," two errors occurred on page 1024 in the third and fourth footnotes under Table 2. Those footnotes should read as follows:

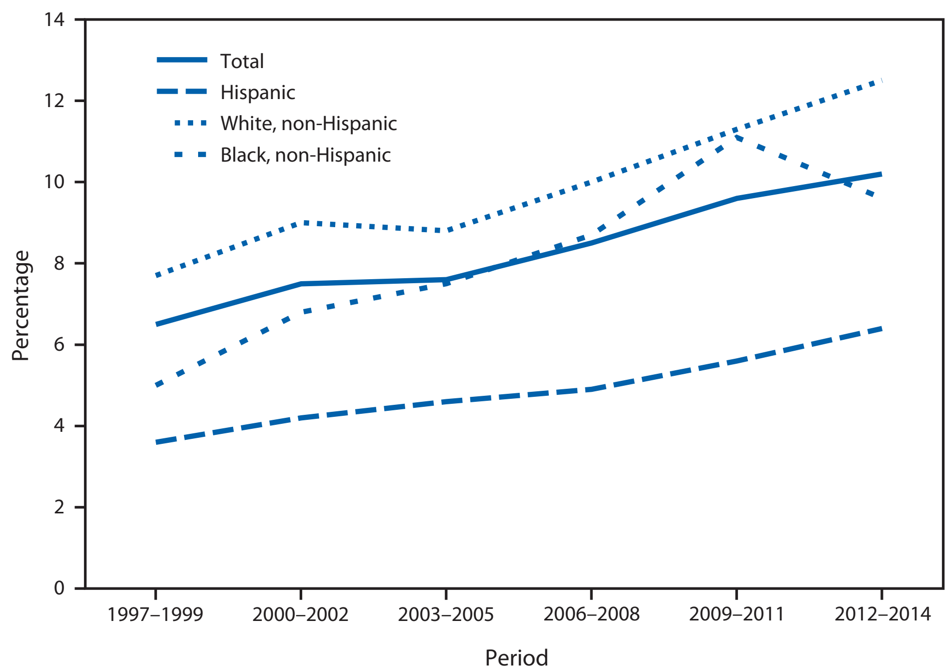
§ Any tobacco product use is ever use of cigarettes, cigars, smokeless tobacco, tobacco pipes, bidis, kreteks, hookah, snus, dissolvable tobacco, and/or electronic cigarettes.

¶ Two or more tobacco product use is ever use of products from two or more of the following categories: cigarettes, cigars, smokeless tobacco, tobacco pipes, bidis, kreteks, hookah, snus, dissolvable tobacco, and/or electronic cigarettes.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Children and Adolescents Aged 5–17 Years with Diagnosed Attention-Deficit/Hyperactivity Disorder (ADHD),* by Race and Hispanic Ethnicity — National Health Interview Survey,† United States, 1997–2014



* Based on responses to the question, "Has a doctor or health professional ever told you that (child) had attention-deficit/hyperactivity disorder (ADHD) or attention deficit disorder (ADD)?"

† Estimates are based on household interviews of a sample of the civilian noninstitutionalized U.S. population and are derived from the National Health Interview Survey's Sample Child component.

From 1997–1999 to 2012–2014, the percentage of all children aged 5–17 years with diagnosed attention-deficit/hyperactivity disorder (ADHD) increased significantly from 7.0% to 10.2%, and so did the prevalence among non-Hispanic white children (8.4% to 12.5%), non-Hispanic black children (5.5% to 9.6%), and Hispanic children (3.8% to 6.4%). Throughout 1997–2014, Hispanic children were the least likely to have diagnosed ADHD.

Source: National Center for Health Statistics, CDC. National Health Interview Survey. Available at http://www.cdc.gov/nchs/nhis.htm.

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