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Sustained Decrease in Laboratory Detection of Rotavirus after Implementation of Routine Vaccination — United States, 2000–2014

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Rotavirus infection is the leading cause of severe gastroenteritis among infants and young children worldwide (*1*,*2*). Before the introduction of rotavirus vaccine in the United States in 2006, rotavirus infection caused significant morbidity among U.S. children, with an estimated 55,000–70,000 hospitalizations and 410,000 clinic visits annually (*3*). The disease showed a characteristic winter-spring seasonality and geographic pattern, with annual seasonal activity beginning in the West during December-January, extending across the country, and ending in the Northeast during April-May (*4*). To characterize changes in rotavirus disease trends and seasonality following introduction of rotavirus vaccines in the United States, CDC compared data from CDC's National Respiratory and Enteric Virus Surveillance System (NREVSS), a passive laboratory reporting system, for prevaccine (2000–2006) and postvaccine (2007–2014) years. National declines in rotavirus detection were noted, ranging from 57.8%–89.9% in each of the 7 postvaccine years compared with all 7 prevaccine years combined. A biennial pattern of rotavirus activity emerged in the postvaccine era, with years of low activity and highly erratic seasonality alternating with years of moderately increased activity and seasonality similar to that seen in the prevaccine era. These results demonstrate the substantial and sustained effect of rotavirus vaccine in reducing the circulation and changing the epidemiology of rotavirus among U.S. children.

NREVSS is a national laboratory-based passive reporting system for respiratory and enteric viruses, including rotavirus. Participating laboratories report weekly data to CDC, including the total number of stool samples tested for rotavirus by enzyme immunoassay and the number of specimens that tested positive. Annually, 75 to 90 laboratories report rotavirus testing data to NREVSS. A reporting year is defined as the period from July (epidemiologic week 27) to June (epidemiologic week 26) of the following year, beginning in July 2000. Rotavirus season onset is defined as the first of 2 consecutive weeks where 10% or more of specimens test positive for rotavirus. Similarly, season offset is defined as the last of 2 consecutive weeks where 10% or more of samples test positive. Peak season intensity is defined as the week with the highest proportion of tests positive for rotavirus. For analysis of season duration and peak intensity, data from all participating laboratories were included. The proportion of samples that tested positive for rotavirus and the mean decrease from the prevaccine years are reported for these data. Analyses of trends in disease were restricted to the 23 laboratories that consistently reported at least 26 weeks of data for each reporting year from July 2000 through June 2014. For this analysis, data are aggregated by week and reported as a 3-week moving average of total number of tests and rotavirus positive tests performed

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for the prevaccine period (2000–2006) and for each prevaccine season. Data are presented for the United States overall and for each U.S. census region.

Data from all participating NREVSS laboratories showed that with prevaccine seasons (2000–2006), median season onset was in epidemiologic week 50 (in December), peak activity was in week 9 (February/March, 43.1% positive samples) and season duration was 26 weeks. In comparison, these data showed that each of the 7 postvaccine seasons from 2007–2014 started later (if at all), had lower peak positivity for rotavirus (10.9%–27.3%), and were shorter in duration (0–18 weeks) (Table 1 and Figure 1). In the rotavirus reporting years spanning 2009–2010, 2011–2012 and 2013–2014, no seasonal onset occurred nationally, and the proportion of tests positive for rotavirus during the peak week was lower than the immediately preceding and following seasons. Examination of data for each region individually showed slight differences in seasonal onset, duration, and offset. Notably, in the South, season onset and duration varied, with some postvaccine years' season onset and duration comparable with median values from prevaccine years. This region also had only one reporting year where no season onset threshold was reached, whereas all other regions had at least two such reporting years. Regardless of these variations, most seasons within each region showed decreased length and activity compared with prevaccine years.

Data from 23 consistently reporting laboratories demonstrated a marked decline in rotavirus testing and positivity in the postvaccine years (Table 2 and Figure 2). Overall, after vaccine introduction, the number of total tests performed as well as the number of positive rotavirus tests declined each reporting year compared with those of the prevaccine years. Furthermore, the proportion of tests that were positive for rotavirus declined from 57.8%–89.9% in each of the seven postvaccine reporting years compared with prevaccine years combined, with alternating years of lower and greater positivity rates. Similar patterns were observed when the data were examined for each region.

Discussion

A marked and sustained decline in rotavirus activity was seen nationally in all seven rotavirus reporting years from 2007 to 2014 following the implementation of routine rotavirus vaccination of U.S. children. The decline was accompanied by changes in the predictable prevaccine seasonal pattern of rotavirus activity. The later onset and shorter duration of rotavirus seasons in the postvaccine era, including some years without a defined rotavirus season, could be a result of fewer unvaccinated, susceptible infants, resulting in reduced intensity and duration of rotavirus transmission (5). This reduced transmission of rotavirus likely also explains the declines in rates of rotavirus disease that have been seen in unvaccinated

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TABLE 1. Rotavirus season onset, peak activity, offset, and duration, by region — National Respiratory and Enteric Virus Surveillance System, United States 2000–2014

		Peak			
Overall	Onset (week no.)	(Week no.)	(% tests positive)	Offset (week no.)	Season duration (no. weeks)
2000–2006	50	9	43.1	24	26
2007–2008	9	17	17.3	21	12
2008–2009	4	11	25.3	21	17
2009–2010	NA*	18	10.9	NA	NA
2010–2011	3	11	23.4	21	18
2011–2012	NA	22	12.2	NA	NA
2012–2013	1	13	27.3	18	17
2013–2014	NA	21	11.3	NA	NA
Northeast					
2000–2006	2	11	45.2	23	21
2007–2008	18	18	13.9	19	1
2008–2009	7	11	20.1	17	10
2009–2010	NA	20	13.5	NA	NA
2010–2011	6	14	23.6	18	12
2011–2012	NA	47	10.5	NA	NA
2012–2013	10	16	28.9	21	11
2013–2014	NA	23	11.0	NA	NA
Midwest					
2000–2006	1	9	49.0	21	20
2007–2008	6	18	27.5	25	19
2008–2009	3	10	34.0	19	16
2009–2010	NA	19	11.6	NA	NA
2010–2011	2	14	34.3	16	14
2011–2012	18	19	13.6	19	1
2012–2013	1	11	34.3	18	17
2013–2014	NA	21	6.8	NA	NA
South					
2000–2006	51	10	44.0	23	28
2007–2008	12	15	16.5	21	9
2008–2009	50	9	37.2	19	31
2009–2010	15	18	17.5	18	3
2010–2011	50	11	24.7	22	28
2011–2012	NA	13	12.7	NA	NA
2012–2013	49	13	28.9	18	31
2013–2014	17	21	22.1	21	4
West					
2000–2006	47	5	38.1	24	23
2007–2008	11	17	28.0	22	11
2008–2009	10	15	20.9	21	11
2009–2010	NA	18	11.5	NA	NA
2010–2011	7	12	19.5	21	14
2011–2012	22	22	24.1	23	1
2012–2013	1	13	25.9	23	22
2013–2014	NA	24	17.4	NA	NA

* NA indicates years in which seasonal onset and offset threshold were not reached.

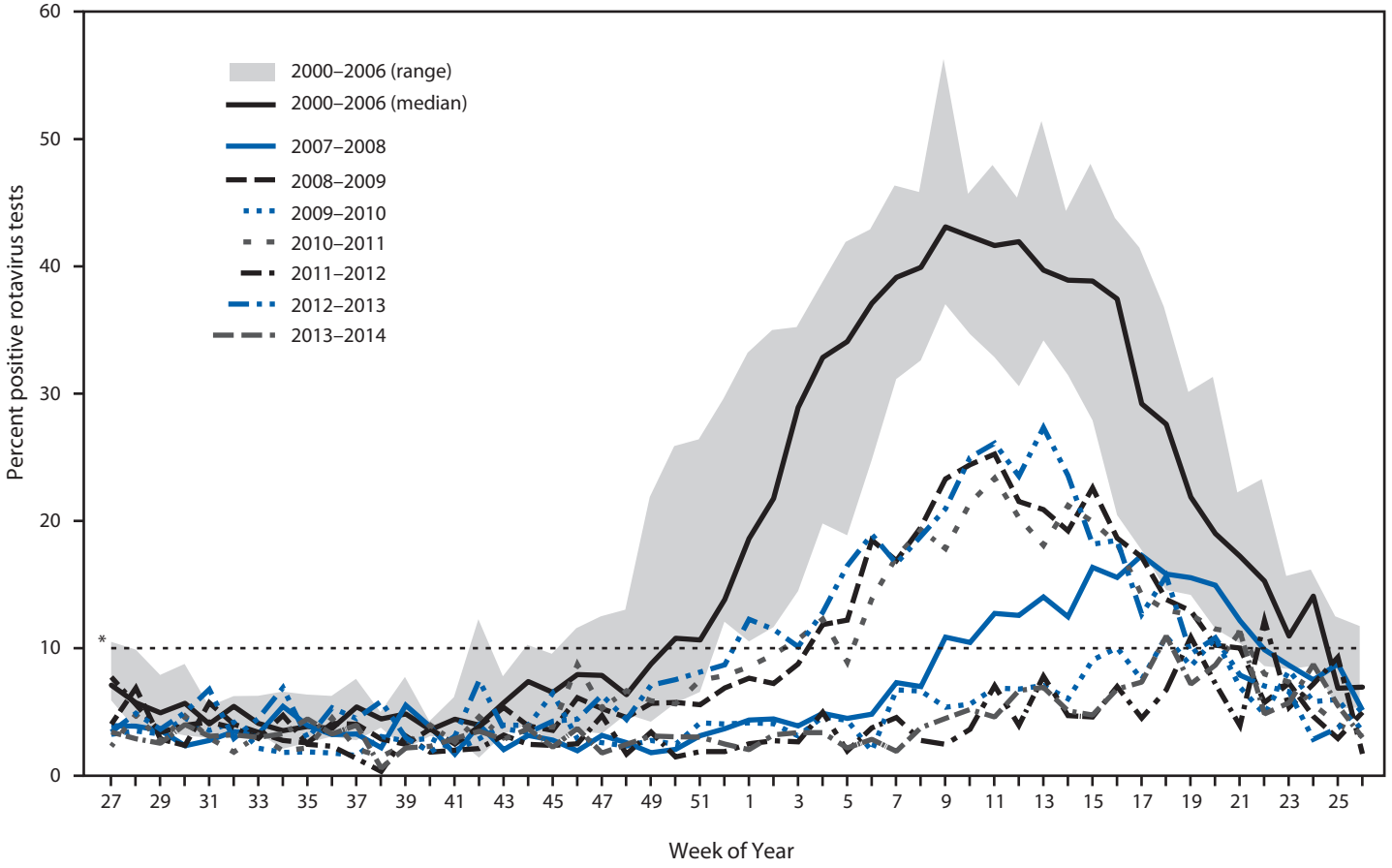
older children and even in some adult age groups in postvaccine years compared with the prevaccine era, resulting from the phenomenon known as herd immunity (*6*).

Biennial peaks in rotavirus activity also emerged in the postvaccine era in contrast to the annual peaks before vaccine implementation, although even the postvaccine reporting years with heavier rotavirus burden still demonstrated rotavirus activity levels that were substantially lower than those of the prevaccine years. This biennial pattern might be explained by an accumulation of a sufficient number of unvaccinated susceptible children over two successive reporting years to result in stronger rotavirus seasons every other year. Though rotavirus vaccine coverage among children aged 19–35 months has increased nationally since the vaccine was introduced, from 43.9% in 2009 to 72.6% 2013 (*7*), some children remain unvaccinated. In a low rotavirus reporting year, these unvaccinated children might not be exposed to wild-type rotavirus and thus remain susceptible in their second year of life. These susceptible children aged 12–23 months, together with unvaccinated infants from the next birth cohort, might form a critical mass of susceptible children sufficient to sustain more intense rotavirus transmission in alternate years.

The findings in this report are subject to at least four limitations. First, NREVSS only receives aggregate reports of the number of stool samples tested for rotavirus and the number of these that test positive, without any information on demographics or clinical features of individual patients, precluding detailed examination of these characteristics. Second, participating laboratory locations do not uniformly cover all areas of the United States, and as such regional biases might exist. Third, because testing for rotavirus does not alter clinical management of patients, testing practices might differ and affect comparability of data from site to site and year to year. Finally, any changes in rotavirus testing practices coinciding with implementation of the rotavirus vaccination program could affect interpretation of the disease trends, although the consistency of the declines in rotavirus activity across all regions and years argues against changes in testing being the main cause of the decline.

The declines in rotavirus activity seen in NREVSS data after vaccine introduction are supported by other U.S. studies showing declines in laboratory-confirmed rotavirus hospitalization (*4*) as well as reductions in outpatient visits, emergency room visits, acute gastroenteritis, and rotavirus-coded hospitalizations (*8*). During 2007–2011 more than 176,000 hospitalizations, 242,000 emergency department visits, and 1.1 million outpatients visits due to diarrhea were averted, resulting in costs savings of $924 million over this 4-year period (*9*). Given the sustained decline in rotavirus activity observed in the NREVSS data through 2014, we would expect additional medical visits due to diarrhea will have been prevented and additional cost savings accrued in the United States. The findings in this report are consistent with the high field effectiveness of vaccination observed in post-licensure epidemiologic studies (*10*). Taken together, these findings reaffirm the large public health impact of routine rotavirus vaccination in reducing the circulation of rotavirus among U.S. children.

FIGURE 1. Rotavirus season duration and peak activity by reporting years (prevaccine 2000–2006 and postvaccine 2007–2011), NREVSS data — United States, 2000–2014



* Dashed line indicates the 10% threshold of numbers of positive test results, which is used to determine onset and offset of a rotavirus season.

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TABLE 2. Rotavirus tests and percent rotavirus positive results from 23 continuously reporting NREVSS laboratories , by season and region — National Respiratory and Enteric Virus Surveillance System, United States 2000–2014

Season	No. tests performed	Positive test results		Decline in no. of positive tests (%)*
		No.	%	
All regions (23 laboratories)				
2000–2006†	12,184	3,109	25.5	NA§
2007–2008	12,544	1,130	9	63.7
2008–2009	12,322	1,312	10.6	57.8
2009–2010	9,684	447	4.6	85.6
2010–2011	9,168	817	8.9	73.7
2011–2012	8,335	315	3.8	89.9
2012–2013	8,162	893	10.9	71.3
2013–2014	7,080	342	4.8	89
West (eight laboratories)				
2000–2006†	4,862	1,104	22.7	NA
2007–2008	5,813	556	9.6	49.6
2008–2009	5,127	360	7	67.4
2009–2010	4,504	196	4.4	82.2
2010–2011	3,909	257	6.6	76.7
2011–2012	3,385	144	4.3	87
2012–2013	3,043	286	9.4	74.1
2013–2014	2,939	158	5.4	85.7
South (eight laboratories)				
2000–2006†	3,893	1,024	26.3	NA
2007–2008	3,272	281	8.6	72.5
2008–2009	3,365	490	14.6	52.1
2009–2010	2,499	181	7.2	82.3
2010–2011	2,415	241	10	76.5
2011–2012	2,251	84	3.7	91.8
2012–2013	2,228	267	12	73.9
2013–2014	1,835	144	7.8	85.9
Midwest (six laboratories)				
2000–2006†	3,173	885	27.9	NA
2007–2008	3,276	281	8.6	68.2
2008–2009	3,603	450	12.5	49.1
2009–2010	2,506	63	2.5	92.9
2010–2011	2,689	298	11.1	66.3
2011–2012	2,538	84	3.3	90.5
2012–2013	2,776	330	11.9	62.7
2013–2014	2,180	36	1.7	95.9
Northeast (one laboratory)				
2000–2006†	194	39	19.9	NA
2007–2008	183	12	6.6	68.8
2008–2009	227	12	5.3	68.8
2009–2010	175	7	4	81.8
2010–2011	150	21	14	45.5
2011–2012	161	3	1.9	92.2
2012–2013	115	10	8.7	74
2013–2014	126	4	3.2	89.6

* This represents the decline in number of positive tests as compared to the prevaccine years (2000–2006) median; that is: (median number of positive tests 2000–2006)-(subsequent year number of positive tests)/ (median number of positive tests 2000–2006)

† Median data are reported for the prevaccine seasons spanning 2000–2006.

§ NA indicates the reference period, so no values are reported.

What is already known on this topic?

Following the introduction of rotavirus vaccine in the United States in 2006, large declines have been observed in diarrhea and rotavirus hospitalizations among children aged <5 years, and onset of the rotavirus season has occurred later.

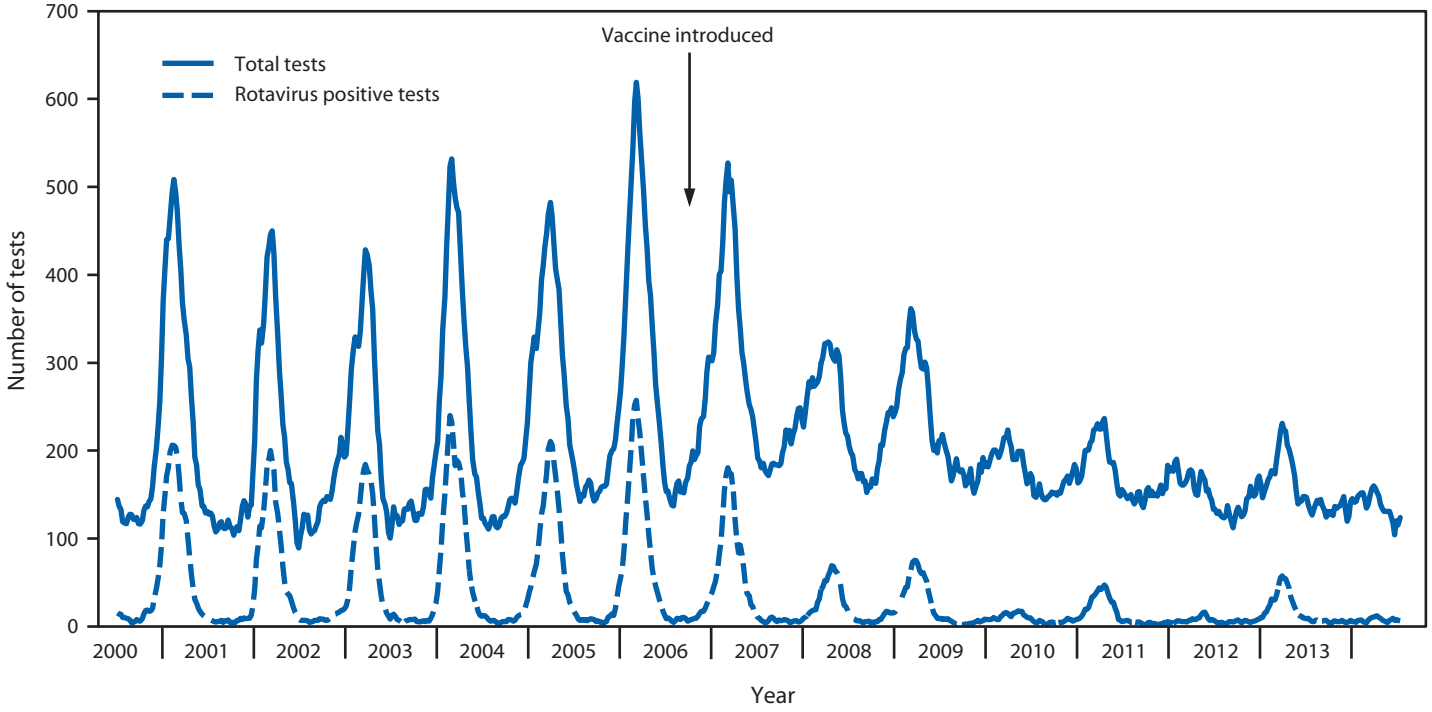
What is added by this report?

Analysis of data from the National Respiratory and Enteric Virus Surveillance System showed a marked and sustained decline in rotavirus activity nationally and regionally for the seven rotavirus reporting years from 2007 to 2014 following the implementation of routine rotavirus vaccination of U.S. children. In addition to rotavirus seasons with later onset and shorter duration, a biennial pattern of rotavirus activity emerged in the postvaccine era, with years of low activity and highly erratic seasonality alternating with years of greater activity and seasonality similar to those in the prevaccine era.

What are the implications for public health practice?

These findings reaffirm the large public health impact of routine rotavirus vaccination in reducing the circulation of rotavirus in U.S. children.

FIGURE 2. Total and positive rotavirus tests, NREVSS data — United States, 2000–2014



Work-Related Asthma — 22 States, 2012

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Work-related asthma* (WRA) is a preventable occupational disease associated with serious adverse health outcomes (*1–3*). Using the 2006–2009 Behavioral Risk Factor Surveillance System (BRFSS) Adult Asthma Call-back Survey (ACBS) data from 38 states and the District of Columbia, CDC estimated that among ever-employed adults with current asthma, the proportion of current asthma that is work-related was 9.0% (*4*). In 2011, the BRFSS cellular telephone samples were added to the traditional landline telephone samples and the weighting methodology was changed.† In 2012, a revised ACBS question on WRA diagnosis§ was asked. To provide updated estimates of current asthma prevalence and the proportion of asthma that is work-related, by state, CDC analyzed data from BRFSS and ACBS collected from 22 states using both landline and cellular telephone samples during 2012. This report summarizes the results of that analysis, which indicate that 9.0% of adults had current asthma and that among ever-employed adults with current asthma, the overall proportion of current asthma that is work-related was 15.7%. State-specific proportions of asthma that is work-related ranged from 9.0% to 23.1%. Distribution of the proportion of WRA significantly differed by age and was highest among persons aged 45–64 years (20.7%). These findings provide a new baseline after the implementation of changes in survey methodology (*5*) and the adoption of a revised WRA question. These results can assist states, other government agencies, health professionals, employers, workers, and worker representatives to better target intervention and prevention efforts to reduce the burden of WRA.

BRFSS is a state-based, random-digit–dialed telephone survey of the non-institutionalized U.S. civilian population aged ≥18 years that collects information on health risk factors, preventive health practices, and disease status.¶ The 2012 BRFSS included a standard set of core questions, 27 optional modules, and state-added questions. One of the optional modules, the CDC-funded ACBS, is designed to collect detailed information on asthma, including WRA. BRFSS respondents who answer "yes" to the question, "Have you ever been told by a doctor, nurse, or other health professional that you had asthma?" are invited to participate in ACBS.** Those who agree to participate are interviewed within 2 weeks of the BRFSS completion date. In 2012, ACBS was administered among adults in 22 states.

In 2011, in order to address the effect of an increasing number of cellular telephone–only households on BRFSS coverage, cellular telephone samples were added to landline telephone samples (*5*). To address this change and to reduce the potential for bias associated with declining response rates, BRFSS also adopted a new statistical weighting methodology (*5*). Also, in 2012, the content of the ACBS WRA section was revised. Adult data from 2012 BRFSS and ACBS collected from 22 states using both landline and cellular telephone samples are included in this analysis. The median response rate among the 22 states was 44.9% (range: 27.7%–56.8%) for BRFSS†† and 47.2% (range: 38.5%–60.6%) for ACBS.§§

For this analysis, BRFSS participants who responded "yes" to the questions, "Have you ever been told by a doctor or other health professional that you have asthma?" and "Do you still have asthma?" were identified as having current asthma. Ever-employed ACBS participants were those who indicated that they were currently employed full- or part-time or that they had ever been employed. Ever-employed adults with current asthma who responded "yes" to the question, "Have you ever been told by a doctor or other health professional that your asthma was caused by, or your symptoms made worse by, any job you ever had?" were classified as having WRA.

Data for 2012 from all 22 states collecting adult data using landline and cellular telephone samples were weighted¶¶ to account for noncoverage, unequal probability of sample

* WRA includes occupational asthma (i.e., new-onset asthma caused by factors related to work) and work-exacerbated asthma (i.e., preexisting or concurrent asthma worsened by factors related to work).

† Additional information is available at http://www.cdc.gov/brfss/annual_data/2012/pdf/Overview_2012.pdf and at http://www.cdc.gov/brfss/acbs/2012/pdf/ACBS_2012.pdf.

§ "Have you ever been told by a doctor or other health professional that your asthma was caused by, or your symptoms made worse by, any job you ever had?" Before 2012, the question was, "Were you ever told by a doctor or other health professional that your asthma was related to any job you ever had?"

¶ Additional information and survey data and documentation available at http://www.cdc.gov/brfss/about/index.htm and at http://www.cdc.gov/brfss/annual_data/annual_data.htm#2013.

** Additional information and survey data and documentation available at http://www.cdc.gov/brfss/acbs/index.htm.

†† Source: CDC. Behavioral Risk Factor Surveillance System, 2012 Summary Data Quality Report, July 3, 2013. Available at http://www.cdc.gov/brfss/annual_data/2012/pdf/summarydataqualityreport2012_20130712.pdf.

§§ Source: 2012 Behavioral Risk Factor Surveillance System, asthma call-back survey summary data quality. Available at http://www.cdc.gov/brfss/acbs/2012/pdf/SDQReportACBS_12.pdf.

¶¶ CDC. The BRFSS Data User Guide, August 15, 2013. Available at http://www.cdc.gov/brfss/data_documentation/PDF/UserguideJune2013.pdf.

selection, and nonresponse differences in the sample. Statistically significant differences in distribution were determined by using the Rao-Scott chi-square test of independence at p≤0.05.

In the 22 states, a sample of 205,755 adults participated in BRFSS (representing an estimated 137 million persons) and 9,893 adults participated in the ACBS (representing an estimated 18 million persons). In 2012, an estimated 9.0% of adults had current asthma in these 22 states (Table). The prevalence of current asthma significantly differed by age, sex, race/ethnicity, and education. Prevalence was highest among persons aged 45–64 years (9.4%), women (11.4%), blacks (12.5%), and those with less than a high school education (9.5%). By state, estimates of the current asthma prevalence ranged from 6.8% to 10.9%.

A total of 7,275 adults who participated in ACBS were ever-employed and had current asthma, representing an estimated 12 million adults in these 22 states. Of these, the estimated proportion who had WRA was 15.7% (an estimated 1.9 million persons) (Table). The proportion of WRA among ever-employed persons with current asthma differed significantly by age and was highest among persons aged 45–64 years (20.7%). By state, the estimated proportions of ever-employed adults with current asthma who had WRA ranged from 9.0% to 23.1%.

Discussion

Among ever-employed adults with current asthma, 15.7% had WRA, indicating that an estimated 1.9 million WRA cases (new-onset and work-exacerbated asthma) could potentially have been prevented in these 22 states. These findings provide a new baseline to be compared with future estimates. Several factors need to be considered when interpreting these results. First, the 2012 data are not comparable methodologically with those collected during preceding years and should be used as a baseline to compare with subsequent survey results. The addition of cellular telephone–only households to the survey sample improved the representativeness of data collected by BRFSS and likely increased the coverage of respondents who are younger and who have a lower income, less education, an unmet need for medical care, and a higher number of risk factors for chronic diseases (*5*–*8*). In 2012, the estimated median proportion of cellular telephone-only households in the 22 states included in this study was 36.7% (range: 23.5%–49.4%).*** Moreover, weights used in this analysis were computed by using an iterative proportional fitting (i.e., "raking") method, which offers several advantages over the method used previously (i.e., "poststratification"). Raking allows for the introduction of more demographic variables and the incorporation of telephone ownership into statistical weighting, thus reducing the potential for bias and improving the representativeness of estimates (*5,8*). Finally, in 2012 a revised question that identifies respondents with WRA was asked as part of ACBS.

Administration of ACBS should continue to allow state asthma programs to monitor the proportion of asthma that is work-related. In addition, the National Institute for Occupational Safety and Health (NIOSH) supported an optional module in 2013 and 2014††† to collect information on the current industry and occupation of participants. These data will inform the development of public health intervention strategies (i.e., occupations suspected to place workers at high risk for development of WRA should be evaluated, and effective exposure control measures should be implemented to prevent WRA) (*4*). Because a WRA diagnosis offers unique opportunities for prevention for the patient and among workers with similar occupational exposures, health-care providers should ask workers with asthma about occupational exposures and be alert to potential associations between workplace exposures and asthma symptoms (*2*).

The findings in this report are subject to at least six limitations. First, measures of current asthma and WRA were based on self-report and not validated by medical records review or follow-up with health-care providers. Previous studies have found self-report of adult asthma to be reliable compared with reviews of medical records (*9*). Moreover, because of the potential impact of a work-related asthma diagnosis on a patient's work (*3*), it is likely that respondents would report their work-related asthma history accurately whereas a diagnosis that did not lead to changes at work might be forgotten. Second, a study showed that clinicians documented occupational exposures in only 7% of adult-onset asthma cases (*10*) indicating that WRA is underdiagnosed in the United States; thus results are likely underestimates of the true proportion of WRA. Third, no data were available in BRFSS to assess the prevalence of current asthma among ever-employed adults. Therefore findings on the prevalence of current asthma and the proportion of current asthma that is work-related were calculated using different populations and should be interpreted with caution. Fourth, the data used in this analysis are limited to adults living in 22 states participating in ACBS; therefore, the estimates are not nationally representative or representative of nonparticipating states. Fifth, because the BRFSS and ACBS median response rates were <50%, nonresponse bias might have affected the results. Finally, small sample sizes for some subpopulations

*** Source: Blumberg SJ, Ganesh N, Luke JV, Gonzales G. Wireless substitution: state-level estimates from the National Health Interview Survey, 2012. Natl Health Stat Report 2013;1–16. Available at http://www.cdc.gov/nchs/data/nhsr/nhsr070.pdf.

††† NIOSH will also support the Industry and Occupation optional module in 2015 and 2016.

TABLE. Prevalence of current asthma* in adults and proportion of ever-employed† adults with current asthma who have been told by a health professional that their asthma was work-related,§ by state and selected characteristics — Behavioral Risk Factor Surveillance System (BRFSS) and Adult Asthma Call-Back Survey (ACBS), 22 states, 2012

Characteristic	Adults				Ever-employed adults with current asthma			
	No. in sample¶	Weighted no. (in thousands)**	Prevalence of current asthma %**	(95% CI)	No. in sample¶	Weighted no. (in thousands)**	Proportion with work-related asthma %**	(95% CI)
Total	**205,755**	**137,831**	**9.0**	**(8.7–9.2)**	**7,275**	**12,270**	**15.7**	**(13.7–17.7)**
Age group (yrs)††,§§								
18–44	57,172	65,456	8.8	(8.4–9.2)	1,514	5,562	13.0	(10.0–16.1)
45–64	79,883	46,997	9.4	(9.0–9.8)	3,363	4,550	20.7	(17.2–24.1)
≥65	66,978	24,566	8.7	(8.2–9.1)	2,373	2,133	12.1	(9.3–15.0)
Sex††								
Male	84,488	67,117	6.4	(6.1–6.7)	2,122	4,275	17.6	(13.5–21.6)
Female	121,267	70,714	11.4	(11.0–11.8)	5,153	7,995	14.8	(12.6–16.9)
Race/Ethnicity††,¶¶								
White	158,929	86,226	9.2	(8.9–9.4)	5,729	8,430	14.9	(13.1–16.7)
Black	12,899	12,829	12.5	(11.4–13.5)	554	1,299	12.3	(7.2–17.4)
Hispanic	15,907	24,813	6.8	(6.1–7.4)	332	1,452	18.2	(10.0–26.4)
Other race	15,498	12,407	8.7	(7.7–9.7)	583	993	23.5	(10.7–36.2)
Education††								
<High school	79,948	60,017	9.5	(9.1–9.9)	2,686	4,574	16.1	(13.1–19.0)
≥High school	125,115	77,297	8.6	(8.3–8.9)	4,584	7,694	15.5	(12.9–18.2)
State								
California	14,574	28,845	8.8	(8.2–9.5)	355	2,744	14.2	(8.5–19.9)
Hawaii	7,582	1,080	8.9	(7.9–9.9)	228	92	9.0	(3.8–14.2)
Illinois	5,579	9,810	8.5	(7.4–9.6)	215	729	16.0	(8.3–23.7)
Indiana	8,645	4,946	9.1	(8.3–9.8)	330	447	16.2	(10.9–21.4)
Iowa	7,166	2,345	8.1	(7.2–8.9)	233	181	18.0	(12.1–23.8)
Michigan	10,499	7,583	10.5	(9.6–11.3)	546	836	14.7	(10.3–19.1)
Mississippi	7,788	2,236	8.1	(7.3–9.0)	310	191	20.6	(13.7–27.5)
Missouri	6,754	4,609	10.4	(9.3–11.5)	278	449	23.1	(15.0–31.3)
Montana	8,679	781	9.5	(8.6–10.3)	292	75	14.5	(9.0–20.0)
Nebraska	19,173	1,391	7.4	(6.9–7.9)	633	101	15.7	(11.8–19.6)
Nevada	4,846	2,078	7.4	(6.3–8.4)	159	161	13.7	(6.6–20.8)
New Hampshire	7,530	1,041	10.2	(9.2–11.3)	294	109	14.4	(7.8–20.9)
New Mexico	8,776	1,582	9.2	(8.5–10.0)	375	155	13.5	(8.6–18.4)
New York	6,060	15,274	9.3	(8.3–10.3)	190	1,332	13.6	(6.0–21.2)
Ohio	13,026	8,856	10.5	(9.7–11.2)	424	948	20.3	(12.3–28.3)
Oklahoma	8,015	2,886	10.2	(9.3–11.0)	249	286	13.9	(7.2–20.6)
Oregon	5,302	3,039	10.6	(9.5–11.8)	218	315	—***	—
Pennsylvania	19,958	10,025	10.1	(9.4–10.8)	696	898	14.6	(10.9–18.5)
Texas	9,129	19,185	6.8	(6.1–7.6)	245	1,257	17.6	(10.2–25.0)
Vermont	6,056	501	10.9	(9.8–12.0)	271	57	14.3	(7.6–21.1)
Washington	15,319	5,336	9.7	(9.1–10.3)	515	515	14.2	(9.9-18.5)
Wisconsin	5,299	4,402	8.6	(7.4–9.7)	219	394	21.1	(13.4–28.9)

Abbreviation: CI = confidence interval.

* Based on a "yes" response to both questions, "Has a doctor, nurse, or other health professional ever told you that you had asthma?" (BRFSS) and "Do you still have asthma?"

† Current employment status described as "employed full-time" or "employed part-time" or a "yes" response to the question, "Have you ever been employed?"

§ Based on a "yes" response to the question, "Have you ever been told by a doctor or other health professional that your asthma was caused by, or your symptoms made worse by, any job you ever had?"

¶ Landline and cellular telephone combined unweighted sample size.

** Weighted to the state population using the survey sample weights for each BRFSS and ACBS participant.

†† For current asthma: Rao-Scott chi-square test; p-value <0.01.

§§ For work-related asthma: Rao-Scott chi-square test; p-value <0.01.

¶¶ Persons identified as Hispanic might be of any race. Persons identified as white, black, or other race are all non-Hispanic.

*** Relative standard error >0.30; estimate suppressed.

resulted in estimates with wide confidence intervals. Additional years of data are needed to calculate more precise estimates.

For many states, ACBS provides the only state-based estimates of WRA. These new, improved results can assist states, other government agencies, health professionals, employers, workers, and worker representatives to prioritize disease intervention and prevention efforts to reduce the burden of WRA.

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What is already known on this topic?

Work-related asthma (WRA) is a preventable, often underdiagnosed, occupational lung disease. On the basis of the 2006–2009 Behavioral Risk Factor Surveillance System Adult Asthma Call-back Survey (ACBS) data from 38 states and the District of Columbia among ever-employed adults with current asthma, the overall proportion of current asthma that is work-related was estimated to be 9.0%.

What is added by this report?

An estimated 1.9 million cases of asthma among adults were work-related (new-onset and work-exacerbated), accounting for 15.7% of current asthma cases among ever-employed adults, and thus could potentially have been prevented in the 22 states conducting ACBS in 2012. This estimate provides a new baseline for comparison with future estimates and reflects Behavioral Risk Factor Surveillance System methodology changes including new, improved statistical weighting, improved data collection by addition of cellular telephone samples to landline telephone samples, and revision of the ACBS question on WRA diagnosis to specifically ask about asthma caused by or made worse by work.

What are the implications for public health practice?

For many states, ACBS provides the only state-based estimates of WRA. These new results can assist states, other government agencies, health professionals, employers, workers, and worker representatives in prioritizing disease intervention and prevention efforts to reduce the burden of WRA.

Ebola Active Monitoring System for Travelers Returning from West Africa — Georgia, 2014–2015

Mary Parham[1], Laura Edison[2,3], Karl Soetebier[2], Amanda Feldpausch[2], Audrey Kunkes[2], Wendy Smith[2], Taylor Guffey[2], Romana Fetherolf[4], Kathryn Sanlis[3], Julie Gabel[2], Alex Cowell[2], Cherie Drenzek[2] (Author affiliations at end of text)

The Ebola virus disease (Ebola) epidemic in West Africa has so far produced approximately 25,000 cases, more than 40 times the number in any previously documented Ebola outbreak (*1*). Because of the risk for imported disease from infected travelers, in October 2014 CDC recommended that all travelers to the United States from Ebola-affected countries receive enhanced entry screening and postarrival active monitoring for Ebola signs or symptoms until 21 days after their departure from an Ebola-affected country (*2*). The state of Georgia began its active monitoring program on October 25, 2014. The Georgia Department of Public Health (DPH) modified its existing, web-based electronic notifiable disease reporting system to create an Ebola Active Monitoring System (EAMS). DPH staff members developed EAMS from conceptualization to implementation in 6 days. In accordance with CDC recommendations, "low (but not zero) risk" travelers are required to report their daily health status to DPH, and the EAMS dashboard enables DPH epidemiologists to track symptoms and compliance with active monitoring. Through March 31, 2015, DPH monitored 1,070 travelers, and 699 (65%) used their EAMS traveler login instead of telephone or e-mail to report their health status. Medical evaluations were performed on 30 travelers, of whom three were tested for Ebola. EAMS has enabled two epidemiologists to monitor approximately 100 travelers daily,* and to rapidly respond to travelers reporting signs and symptoms of potential Ebola virus infection. Similar electronic tracking systems might be useful for other jurisdictions.

Active monitoring of travelers facilitates early detection of symptoms consistent with Ebola infection, rapid isolation of potential Ebola patients to prevent spread, and appropriate medical evaluation for prompt diagnosis. Active monitoring requires that travelers who are considered low (but not zero) risk (i.e., had been in Ebola-affected countries but had no reported contact with a person who was ill with Ebola) (*3*) report their health status to DPH once daily. The health status report includes their temperatures taken each morning and evening, whether they are experiencing any of a specified list of symptoms commonly associated with Ebola, and any other symptoms of illness. In Georgia, travelers categorized as having "some risk" for exposure (i.e., had contact with Ebola patients while wearing appropriate personal protective equipment) must be observed taking their temperatures each day by an epidemiologist via video direct active monitoring. "High-risk" travelers (i.e., had contact with an Ebola patient without adequate personal protective equipment) are quarantined upon arrival in their homes, or other location designated by DPH, if nonresidents, and also are observed via video connection for daily temperature checks. Active monitoring for Ebola can be labor intensive and costly (*4*). To reduce the burden of monitoring large numbers (>30 each week) of travelers arriving from Ebola-affected countries, DPH developed an automated system to assist with monitoring and data management.

Development and Implementation of EAMS

DPH used the infrastructures of its State Electronic Notifiable Disease Surveillance System (SendSS) and its Public Health Information Portal to rapidly develop and deploy the web-based EAMS. Through close collaboration between DPH information technology development staff and epidemiologists responsible for initiating the active monitoring program, the core functions of EAMS were developed and deployed in 6 days. EAMS's flexibility enables rapid updates for new data collection as surveillance needs are better understood.

EAMS consists of four components: 1) an online query capability designed to enable emergency departments to search EAMS by name and date of birth to quickly determine whether a patient is enrolled in active monitoring, 2) a traveler component that facilitates the online recording of daily symptom data, 3) a public health component that allows DPH epidemiologists to manage travelers throughout their active monitoring period, and 4) a reporting component that provides summary statistics, the capability to produce a line list of travelers, and a summary report to assist with weekly reporting to CDC. Epidemiologists in Georgia's 18 health districts can log into the system to view and follow up with travelers in their own district; however, 14 districts have designated DPH to conduct monitoring.

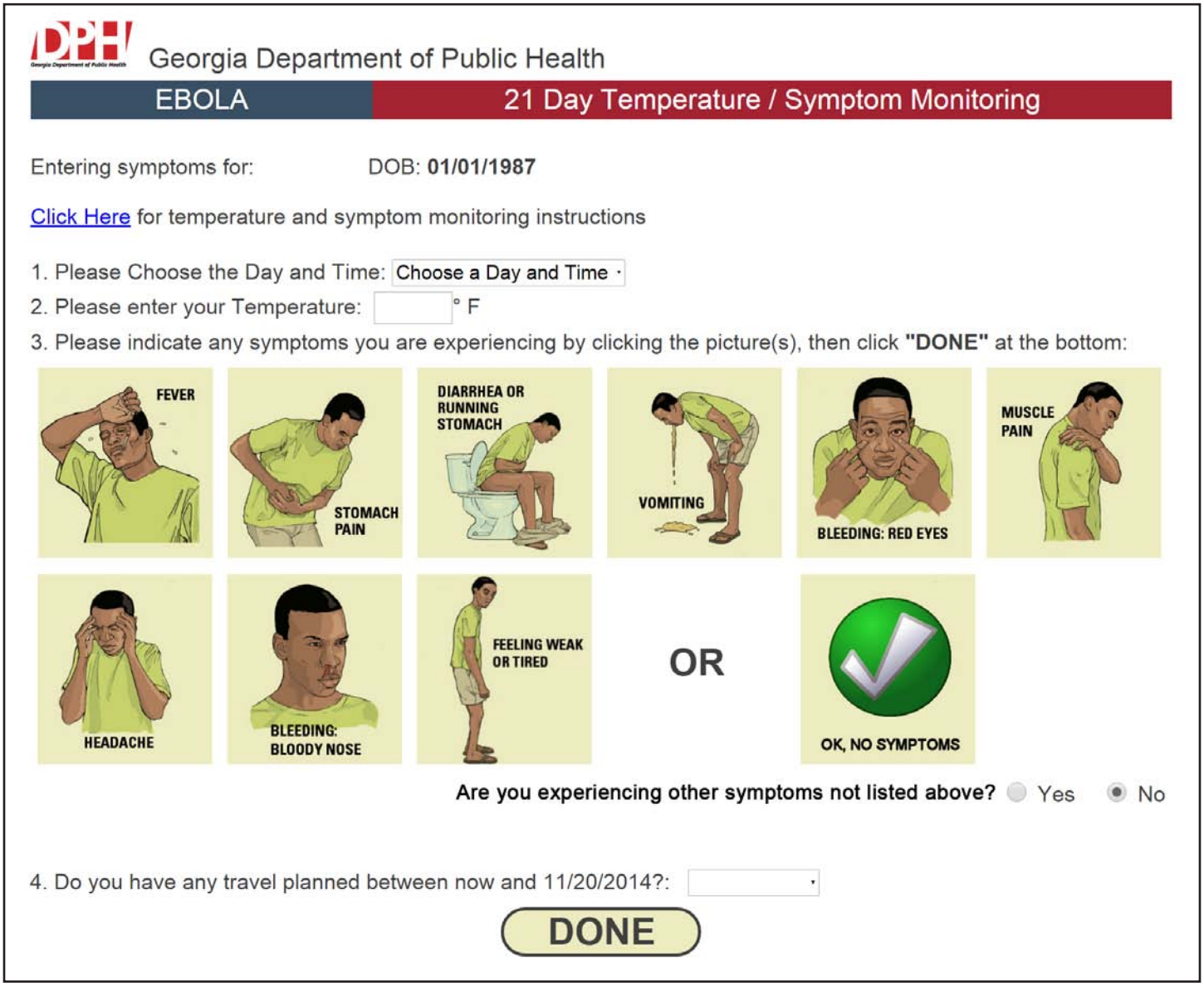
The EAMS process begins when DPH epidemiologists create a record for each traveler from information obtained during entry screening and provided by CDC. The record for each traveler includes demographics, contact information,

*Maintaining a precise count is difficult because persons move in and out of EAMS monitoring every day. Since December, however, the daily average has been 114, with a range of 81–153 per day.

travel-related information, and the traveler's risk categorization. Each record also contains a time-stamped progress notes section that facilitates communication among epidemiologists regarding individual records, including notes about noncompliance or symptomatic travelers. Once the record is created, an epidemiologist conducts a scripted telephone enrollment interview with the traveler to verify and complete information, and explain the system and monitoring requirements. The epidemiologist also provides the traveler with a legally binding Active Monitoring Agreement that explains the traveler's responsibilities, instructions for reporting, and consequences of not reporting. After the enrollment process is completed, an EAMS system–generated e-mail is sent to the traveler that includes an individual username and password for accessing their EAMS account. Using their account, travelers can input their temperature and symptom checks each day into the secure system. Travelers can also report by telephone or e-mail if they prefer.

When reporting through EAMS, travelers log in, select the day and time, then enter their measured body temperatures. The system then prompts the traveler to indicate specific Ebola symptoms using pictorial selection boxes taken from the CDC-developed Ebola care kit (*5*), and offers a free-text box to enter other symptoms (Figure 1). Travelers also can enter details of any planned upcoming interstate or international

FIGURE 1. Ebola active monitoring system traveler symptom input screen for a fictitious traveler returning from West Africa — Georgia, 2014–2015



travel during their monitoring period so that DPH can notify CDC and the receiving state.

Once travelers are enrolled, EAMS helps epidemiologists monitor travelers' health and compliance with active monitoring through automated e-mail alerts and dashboards. Automated e-mail alerts notify epidemiologists when a traveler reports symptoms or a temperature >99.4° F (>37.2° C). Automated status updates enable the EAMS dashboard to clearly identify travelers who have not reported their temperature and symptom checks by a designated time so that epidemiologists can follow up and assure compliance (Figure 2). The visual dashboard displays the traveler's name, the date of arrival in Georgia, the time remaining in the 21-day monitoring period, whether there are plans to travel to another state or country during the monitoring period, and whether this travel has been reported to CDC. Travelers who report fever or other signs or symptoms are labeled "symptomatic" and an email is sent to designated epidemiologists for follow-up. Travelers who do not report by 2 p.m., Eastern Time, are sent an automated email reminder. At 3 p.m., the status of travelers who have not reported becomes "noncompliant," prompting epidemiologists to attempt contact. A status of "complete" is assigned at the end of travelers' monitoring periods, and an automated e-mail informs them that they no longer need to report.

When symptoms are reported, the traveler is contacted by DPH. Low (but not zero) risk travelers who report mild symptoms (e.g., upper respiratory or gastrointestinal symptoms that don't typically require seeing a clinician) are asked to self-isolate until symptoms subside. If more severe symptoms are reported, including any fever ≥100.4° F (≥38° C) with no other likely diagnosis, DPH epidemiologists coordinate with hospital preparedness personnel in DPH's Emergency Preparedness Section to arrange medical evaluation at a designated hospital near the traveler's current location that has the necessary isolation capabilities and willingness to screen potential Ebola cases. If a traveler needs urgent care or does not have private transportation, DPH will arrange transportation.

Results of Active Monitoring

Active monitoring is conducted by two DPH epidemiologists each day. During October 25, 2014–March 31, 2015, DPH monitored 1,070 travelers (Table). The majority of travelers (65%) used the EAMS login system for one or more of their daily reports, and an estimated 85% reported on time each day to remain compliant. Thirty (2.8%) travelers received medical evaluations. Ebola testing was performed by real-time polymerase chain reaction on specimens from three travelers; all test results were negative. Among the 1,070 actively monitored travelers, 564 (53%) were CDC employees.

Discussion

In October 2014, Ebola was diagnosed in a traveler from West Africa staying in Dallas (*6*). Thereafter, active monitoring was developed and implemented (*2*), enabling the timely detection of illness in travelers, which can facilitate early isolation of potential Ebola patients to prevent the spread of disease, appropriate medical evaluation, and early detection and management of Ebola. EAMS makes it possible for two epidemiologists to monitor approximately 100 travelers each day. It achieves this 1) by allowing travelers to report their own monitoring information via computer or web-enabled mobile telephone, 2) by providing a summary dashboard to

FIGURE 2. Ebola active monitoring system sample visual dashboard — Georgia, 2014–2015

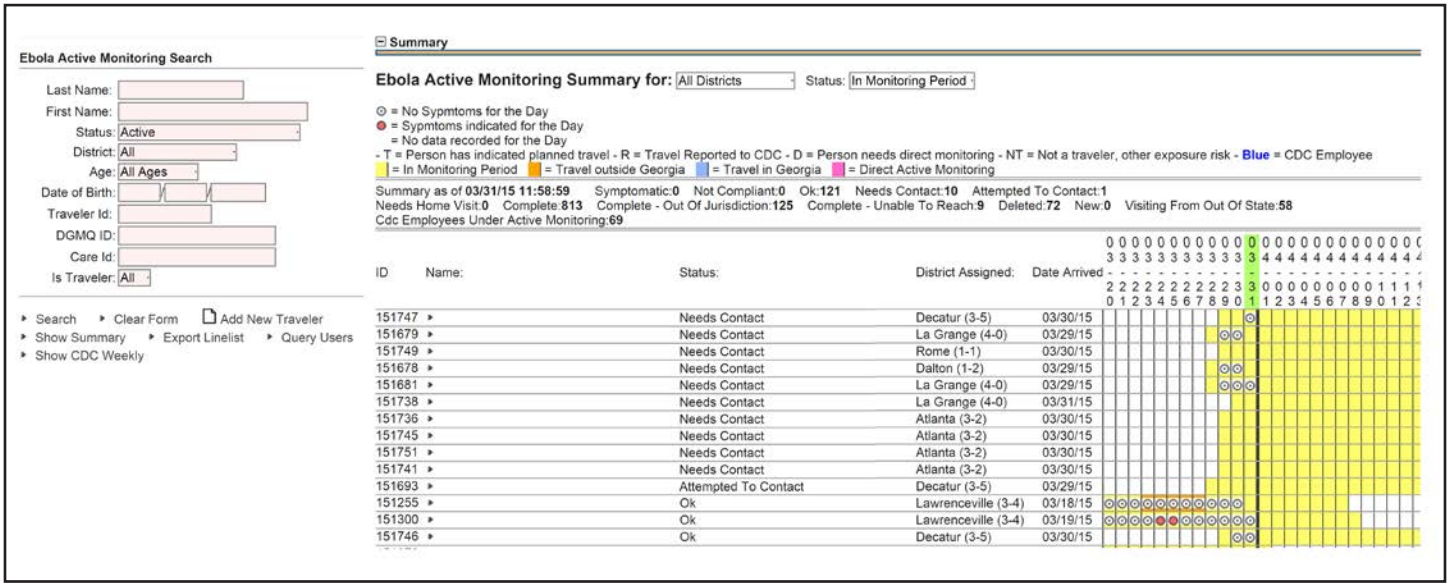


TABLE. Number of travelers from Ebola-affected countries (N = 1,070) actively monitored for signs and symptoms of Ebola, by selected characteristics — Georgia, October 25, 2014-March 31, 2015

Characteristic	No.	(%)
Total monitored	1,070	(100)
Average no. monitored per day*	114	—
Completed monitoring	957†	(89)
Reported using EAMS log-in§	699	(65)
CDC employees monitored	564	(53)
Medical evaluation performed	30	(2.8)
Tested for Ebola¶	3	(0.2)

Abbreviations: EAMS = Ebola Active Monitoring System.
* During December 2014–March 2015.
† As of March 31, 2015; a total of 113 other travelers were still being actively monitored.
§ Travelers logged temperature and symptom reports directly into EAMS for at least one daily report.
¶ Tested by real-time polymerase chain reaction at an Ebola reference laboratory.

allow epidemiologists to quickly assess the status of travelers, and 3) by sending automated e-mail alerts to epidemiologists when symptoms are reported.

Because monitoring must occur every day, including on weekends and holidays, having a web-based system that is accessible from any computer helped foster acceptability among monitoring personnel. The simplicity of EAMS enables travelers to enter their own information if they choose and allows for many travelers to be managed by few epidemiologists. Ease of use for the travelers has resulted in a high level of acceptability, with 65% of travelers choosing to use EAMS direct login over sending e-mails or telephone messages. Most importantly, the instant e-mail alert of reported symptoms to DPH epidemiologists provides timely notification of illness among travelers.

Monitoring for Ebola is necessary to detect and isolate cases early, facilitate medical evaluation, and prevent its spread. Georgia, with its large number of travelers and limited number of DPH epidemiologists, needed an efficient system to ensure the success of its monitoring program. Including DPH's information technology staff as members of Georgia's Ebola response team was crucial to Georgia's ability to develop this flexible online module in 6 days. Similar systems might be useful for other jurisdictions and might potentially reduce the cost of monitoring (*4*). EAMS also might serve as a model for meeting the surveillance needs of other public health programs in a timely manner.

What is already known on this topic?

Because Ebola can only be transmitted through close contact with a person who has developed symptoms, close monitoring of persons with potential exposure facilitates early identification of suspected cases, appropriate medical evaluation, and rapid isolation to prevent further spread.

What is added by this report?

Modifying and leveraging the existing infrastructure of the current Georgia State Electronic Notifiable Disease Surveillance System has provided the flexibility for two staff members to efficiently and effectively monitor approximately 100 travelers from Ebola-affected countries on a daily basis.

What are the implications for public health practice?

Simple electronic tools can be adapted or developed for active monitoring and make data easily accessible to epidemiologists. Such systems also can enable travelers being monitored to take an active role in their own reporting. The system has been instrumental in the successful monitoring of Georgia's travelers from Ebola-affected countries, and similar systems might be useful for other jurisdictions.

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Progress in Identifying Infants with Hearing Loss — United States, 2006–2012

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Congenital hearing loss affects one to three of every 1,000 live born infants (*1*) and negatively impacts children through delayed speech, language, social, and emotional development when undetected (*2*,*3*). To address this public health issue, jurisdiction-based Early Hearing Detection and Intervention (EHDI) programs are working to ensure all newborns are screened for hearing loss, receive follow-up diagnostic testing (DX) if they do not pass the screening, and are enrolled in early intervention (EI) services if diagnosed with a permanent hearing loss. Although substantial progress has been made in the provision and documentation of services, challenges remain because, unlike screening results, diagnostic test results and enrollment in EI are not consistently reported to the EHDI programs. Therefore, it is difficult for states and territories to know if infants received recommended follow-up services (diagnostic testing and/or EI services), often resulting in infants being classified at either stage as lost to follow-up (LFU)/lost to documentation (LTD). To assess progress toward identifying children with hearing loss and reducing LFU/LTD for DX (LFU/LTD-DX) and EI enrollment (LFU/LTD-EI*), CDC analyzed EHDI surveillance data for 2006–2012. Results indicated that the number of jurisdictions reporting data increased from 49 to 57, rates of screening increased from 95.2% to 96.6%, rates of referral from screening decreased from 2.3% to 1.6%, rates of diagnosis among infants not passing their final screening increased from 4.8% to 10.3%, and enrollment in EI among children diagnosed with hearing loss increased from 55.4% to 61.7%, whereas rates for both LFU/LTD-DX and LFU/LTD-EI declined. These findings show sustained progress toward screening, identification, and enrollment in EI as well as highlighting the need for continued improvements in the provision and documentation of EHDI services.

Congenital hearing loss affects one to three of every 1,000 live born infants (*1*) and negatively impacts children through delayed speech, language, social, and emotional development when undetected (*2*,*3*). To address this public health issue, jurisdiction-based Early Hearing Detection and Intervention (EHDI) programs are working to ensure all newborns are screened for hearing loss, receive follow-up diagnostic testing (DX) if they do not pass the screening, and are enrolled in early intervention (EI) services if diagnosed with a permanent hearing loss. Although substantial progress has been made in the provision and documentation of services, challenges remain because, unlike screening results, diagnostic test results and enrollment in EI are not consistently reported to the EHDI programs. Therefore, it is difficult for states and territories to know if infants received recommended follow-up services (diagnostic testing and/or EI services), often resulting in infants being classified at either stage as lost to follow-up (LFU)/lost to documentation (LTD). To assess progress toward identifying children with hearing loss and reducing LFU/LTD for DX (LFU/LTD-DX) and EI enrollment (LFU/LTD-EI*), CDC analyzed EHDI surveillance data for 2006–2012. Results indicated that the number of jurisdictions reporting data increased from 49 to 57, rates of screening increased from 95.2% to 96.6%, rates of referral from screening decreased from 2.3% to 1.6%, rates of diagnosis among infants not passing their final screening increased from 4.8% to 10.3%, and enrollment in EI among children diagnosed with hearing loss increased from 55.4% to 61.7%, whereas rates for both LFU/LTD-DX and LFU/LTD-EI declined. These findings show sustained progress toward screening, identification, and enrollment in EI as well as highlighting the need for continued improvements in the provision and documentation of EHDI services.

Data were gathered by using the EHDI Hearing Screening and Follow-up Survey (HSFS), which was fully implemented starting in 2006. This survey is sent annually to the EHDI program coordinator in each U.S. state, the District of Columbia, and each participating territory and freely associated state. The HSFS requests nonestimated, aggregate information about the receipt of hearing screening, diagnostic testing, and EI for every occurrent birth within the jurisdiction. The numbers of occurrent births are compared for accuracy with data from the jurisdiction's Vital Records program and the National Vital Statistics System. Infants were classified as LFU/LTD-DX or LFU/LTD-EI if they did not receive recommended follow-up services or if they received services without the results being reported to the jurisdictional EHDI program. LTD can occur because the results of diagnostic testing and enrollment in EI are not universally required to be reported. Although strategies used to target LFU and LTD differ, these two categories are grouped together in the HSFS because it is problematic for most programs to differentiate between these different types of cases. The denominators for LFU/LTD-DX and LFU/LTD-EI used by CDC are total infants not passing the final hearing screening and total infants identified with a permanent hearing loss, respectively. More details about the HSFS and data definitions have been published (*4*,*5*). The reasons for being LFU/LTD listed in the HSFS include the following: the parents/family were contacted but unresponsive, unable to contact, and unknown. Cases in which the infant died, the parents refused services, or the parents moved were not classified as LFU/LTD.[†]

Data for this report are based on the HSFS conducted for the years 2006–2012, using aggregate jurisdiction-reported totals. Some jurisdictions did not respond to the HSFS in ≥1 years because completion of the survey is voluntary, the requested data were not available at the time of reporting, or another reason. Data for individual years and data at the jurisdictional level are available online.[§] Eighty-three percent of jurisdictions responded to the survey in 2006, and 97% responded in 2012. Information was excluded if, after consultation with

* **Lost to follow-up (LFU)** describes an event in which an infant needs a specific follow-up action but does not receive it. LFU for diagnosis (LFU-DX) occurs when an infant does not pass the hearing screening, is referred for diagnostic testing by a qualified provider (e.g., an audiologist) but never receives the testing needed to confirm whether a hearing loss is present. LFU for early intervention (LFU-EI) occurs when an infant diagnosed with a permanent hearing loss is not enrolled in any early intervention services. **Lost to documentation (LTD)** describes an event in which an infant receives a specific follow-up action, but neither confirmation that the follow-up was provided nor the results are reported to the jurisdictional EHDI program. LTD for diagnosis (LTD-DX) occurs when an infant not passing the hearing screening does receive follow-up testing that either confirms a hearing loss or does not identify any loss but this information is not reported to the jurisdictional EHDI program. LTD for early intervention (LTD-EI) occurs when an infant diagnosed with a permanent hearing loss is enrolled in early intervention services but this information is not reported to the jurisdictional EHDI program.

† In 2006, of those infants needing diagnostic follow-up testing, 998 (2.2%) did not receive it because of parent refusals or infant deaths and 510 (1.1%) because of being nonresidents or moving out of state. In 2012, of those infants needing diagnostic follow-up testing, 2,141 (4.0%) did not receive it because of parent refusals or infant deaths and 1,505 (2.8%) because of being nonresidents or moving out of state.

§ Available at http://www.cdc.gov/ncbddd/hearingloss/ehdi-data.html.

TABLE 1. Number and percentages of infants screened, diagnosed, and enrolled in early intervention programs for hearing loss, by jurisdiction and birth year — United States, 2006*

	2006										
	Screening		Diagnosis					Early intervention			
	Screened	Not pass screening	Permanent hearing loss			LFU/LTD-DX		Enrolled		LFU/LTD-EI	
Jurisdiction†	(%)	No.	No.	%	Prevalence per 1,000 screened	No.	(%)	No.	(%)	No.	(%)
Alabama	(97.6)	2,699	43	(1.6)	0.7	572	(21.2)	32	(74.4)	11	(25.6)
Alaska	(90.4)	301	21	(7.0)	2.1	224	(74.4)	0	—	21	(100.0)
American Samoa	—	—	—	—	—	—	—	—	—	—	—
Arizona	(96.3)	1,982	107	(5.4)	1.1	1,722	(86.9)	98	(91.6)	2	(1.9)
Arkansas	(97.1)	948	45	(4.7)	1.2	590	(62.2)	12	(26.7)	32	(71.1)
California	—	—	—	—	—	—	—	—	—	—	—
Colorado	(98.0)	192	115	(59.9)	1.7	17	(8.9)	115	(100.0)	0	—
CNMI	98.9)	38	2	(5.3)	1.4	27	(71.1)	2	(100.0)	0	—
Connecticut	(99.0	383	62	(16.2)	1.5	41	(10.7)	40	(64.5)	14	(22.6)
Delaware	—	—	—	—	—	—	—	—	—	—	—
DC	(99.3)	241	8	(3.3)	0.5	0	—	8	(100.0)	0	—
Florida	(87.9)	2,655	185	(7.0)	0.8	2,470	(93.0)	121	(65.4)	55	(29.7)
Georgia	(97.5)	5,326	52	(1.0)	0.4	5,271	(99.0)	31	(59.6)	19	(36.5)
Guam	(83.8)	119	8	(6.7)	2.8	104	(87.4)	3	(37.5)	2	(25.0)
Hawaii	(98.6)	255	62	(24.3)	3.3	75	(29.4)	49	(79.0)	2	(3.2)
Idaho	(99.1)	1,039	30	(2.9)	1.3	63	(6.1)	28	(93.3)	0	—
Illinois	—	—	—	—	—	—	—	—	—	—	—
Indiana	(97.8)	1,665	112	(6.7)	1.3	248	(14.9)	—	—	—	—
Iowa	(97.7)	1,944	73	(3.8)	1.9	0	—	—	—	—	—
Kansas	(96.6)	1,196	68	(5.7)	1.7	0	—	12	(17.6)	54	(79.4)
Kentucky	(99.3)	2,193	33	(1.5)	0.6	1,348	(61.5)	23	(69.7)	10	(30.3)
Louisiana	(95.9)	1,617	34	(2.1)	0.6	1,484	(91.8)	18	(52.9)	15	(44.1)
Maine	(96.6)	305	13	(4.3)	1.0	194	(63.6)	0	—	13	(100.0)
Marshall Islands	—	—	—	—	—	—	—	—	—	—	—
Maryland	(94.8)	3,620	108	(3.0)	1.5	3,369	(93.1)	0	—	108	(100.0)
Massachusetts	(98.9)	1,299	226	(17.4)	2.9	93	(7.2)	152	(67.3)	54	(23.9)
Michigan	(98.0)	1,882	101	(5.4)	0.8	1,324	(70.4)	33	(32.7)	68	(67.3)
Micronesia	—	—	—	—	—	—	—	—	—	—	—
Minnesota	(82.6)	2,695	65	(2.4)	1.1	2,601	(96.5)	29	(44.6)	36	(55.4)
Mississippi	(98.6)	541	70	(12.9)	1.6	41	(7.6)	40	(57.1)	16	(22.9)
Missouri	(98.4)	1,387	35	(2.5)	0.4	509	(36.7)	25	(71.4)	9	(25.7)

See table footnotes on next page.

a jurisdictional EHDI program, the reported data were found to be incomplete or derived from estimated information. Because some jurisdictions did not respond to the survey in ≥1 years, there are differences in the number of jurisdictions reporting each year.

In 2012, an average of 96.6% of newborns were screened for hearing loss compared with 95.2% in 2006 (Tables 1 and 2). Overall, the number and average percentage of those infants that did not pass the hearing screening and were subsequently diagnosed with a permanent hearing loss increased from 4.8% (3,261) to 10.3% (5,475). The proportion of infants identified with hearing loss increased from 1.1 to 1.6 per 1,000 infants screened (Figure). For those infants with a confirmed, permanent hearing loss, an average of 61.7% were documented as receiving EI in 2012 compared with 55.4% in 2006 (Tables 1 and 2). The average percentage of LFU/LTD-DX decreased from 47.7% to 35.9%, and the average percentage of LFU/LTD-EI decreased from 40.3% to 24.6% (Figure).

Based on available data from the HSFS, a number of jurisdictions have made progress in documenting the diagnosis of infants with permanent hearing loss and their enrollment in EI. For example, 10 jurisdictions had an improvement of at least 10% for diagnosed hearing loss among infants who did not pass the hearing screening (Tables 1 and 2). Seventeen jurisdictions had at least a 10% improvement in infants enrolled in EI. In addition, 12 jurisdictions had a 30% decrease in LFU/LTD-DX, and 12 jurisdictions had at least a 30% decrease in their LFU/LTD-EI rates.

Discussion

Improvements in the provision and documentation of EHDI services between 2006 and 2012 have resulted in decreases in the rate of infants referred from screening and increases in

TABLE 1. (*Continued*) Number and percentages of infants screened, diagnosed, and enrolled in early intervention programs for hearing loss, by jurisdiction and birth year — United States, 2006*

	2006										
	Screening		Diagnosis					Early intervention			
	Screened	Not pass screening	Permanent hearing loss			LFU/LTD-DX		Enrolled		LFU/LTD-EI	
Jurisdiction†	(%)	No.	No.	%	Prevalence per 1,000 screened	No.	(%)	No.	(%)	No.	(%)
Montana	(93.0)	392	17	(4.3)	1.5	374	(95.4)	0	—	17	(100.0)
Nebraska	(98.9)	181	28	(15.5)	1.1	104	(57.5)	16	(57.1)	12	(42.9)
Nevada	—	—	—	—	—	—	—	—	—	—	—
New Hampshire	(98.7)	318	58	(18.2)	4.2	188	(59.1)	33	(56.9)	25	(43.1)
New Jersey	(98.9)	1,876	102	(5.4)	0.9	1,454	(77.5)	69	(67.6)	30	(29.4)
New Mexico	(71.5)	1,342	38	(2.8)	1.9	0	—	37	(97.4)	0	—
New York	(98.9)	—	—	—	—	—	—	—	—	—	—
North Carolina	(98.2)	1,505	234	(15.5)	1.8	808	(53.7)	146	(62.4)	88	(37.6)
North Dakota	(96.6)	424	6	(1.4)	0.8	397	(93.6)	0	—	6	(100.0)
Ohio	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	(95.0)	1,875	81	(4.3)	1.6	468	(25.0)	70	(86.4)	7	(8.6)
Oregon	(38.6)	930	78	(8.4)	4.2	359	(38.6)	53	(67.9)	17	(21.8)
Palau	(74.1)	—	—	—	—	—	—	—	—	—	—
Pennsylvania	(95.5)	1,400	143	(10.2)	1.0	290	(20.7)	143	(100.0)	0	—
Rhode Island	(98.9)	141	15	(10.6)	1.2	17	(12.1)	12	(80.0)	2	(13.3)
South Carolina	(98.3)	1,911	77	(4.0)	1.3	509	(26.6)	56	(72.7)	21	(27.30
South Dakota	(97.8)	427	4	(0.9)	0.3	381	(89.2)	0	—	4	(100.0)
Tennessee	(89.9)	3,499	50	(1.4)	0.6	1,297	(37.1)	28	(56.0)	15	(30.0)
Texas	(98.7)	7,656	259	(3.4)	0.7	487	(6.4)	0	—	259	(100.0)
Utah	(98.4)	731	56	(7.7)	1.1	414	(56.6)	33	(58.9)	20	(35.7)
Vermont	(96.3)	59	9	(15.3)	1.5	29	(49.2)	5	(55.6)	4	(44.4)
Virginia	(97.6)	2,318	132	(5.7)	1.3	486	(21.0)	93	(70.5)	21	(15.9)
Washington	(93.9)	2,302	119	(5.2)	1.5	1,731	(75.2)	0	—	119	(100.0)
West Virginia	(96.0)	67	11	(16.4)	0.5	3	(4.5)	6	(54.5)	3	(27.3)
Wisconsin	(93.9)	1,586	52	(3.3)	0.8	0	—	24	(46.2)	28	(53.8)
Wyoming	(98.6)	28	14	(50.0)	2.0	6	(21.4)	8	(57.1)	0	—
Totals	**(95.2)**	**67,490**	**3,261**	**(4.8)**	**1.1**	**32,189**	**(47.7)**	**1,703**	**(55.4)**	**1,239**	**(40.3)**

Abbreviations: CNMI = Commonwealth of Northern Mariana Islands; DC = District of Columbia; LFU/LTD-DX = lost to follow-up/lost to documentation for diagnostic testing; LFU/LTD-EI = lost to follow-up/lost to documentation for early intervention.
Source: The Early Hearing Detection and Intervention program's Hearing Screening and Follow-up Survey.
* Some jurisdictions did not provide complete data.
† More comparisons can be made using interactive maps at http://ehdidash.cdc.gov/IAS_WebApp/.

infants receiving the testing needed to confirm a hearing loss. This progress has helped drive increases in the number of children reported with permanent hearing loss from 3,261 (2006) to 5,475 (2012) and an increase in prevalence from 1.1 to per 1.6 per 1,000 screened. The increase in documented cases was accompanied by a decrease in LFU/LTD-DX of 11.8% between 2006 and 2012. Similarly, the documented receipt of EI services increased by 6.3% while LFU/LTD-EI decreased by 15.7%. Other factors that contributed at least in part to this progress include 1) improvements in the functionality of state and territorial EHDI information systems, 2) increased awareness among health care providers about the importance of documenting the receipt of follow-up services, 3) continued progress by state and territorial EHDI programs in tracking infants needing follow-up services, and 4) active support by national agencies and organizations.

To build on the progress already made in diagnosing and enrolling infants with hearing loss in EI services, continued work is needed to further reduce the number of infants classified as LFU/LTD each year. Unless infants with hearing loss receive recommended diagnostic and EI services, they are still at risk for avoidable delays in their speech and language development (*2*,*3*). In addition, without appropriate documentation, it is difficult to ensure infants are receiving recommended services. Additional coordination among audiologists, physicians, jurisdictional EHDI, and EI programs can further improve documentation and provision of services.

This report updates an earlier summary of EHDI data during 1999–2007 that provided information on infants with hearing loss (*4*). Since that time, there have been several important policy and practice changes that could have had a direct impact on rates of LFU/LTD. For example, some hospitals

TABLE 2. Number and percentages of infants screened, diagnosed, and enrolled in early intervention programs for hearing loss, by jurisdiction and birth year — United States, 2012*

	2012										
	Screening		Diagnosis					Early intervention			
	Screened	Not pass screening	Permanent hearing loss			LFU/LTD-DX		Enrolled		LFU/LTD-EI	
Jurisdiction†	(%)	No.	No.	(%)	Prevalence per 1,000 screened	No.	(%)	No.	(%)	No.	(%)
Alabama	(98.5)	222	60	(27.0)	1.1	86	(38.7)	35	(58.3)	10	(16.7)
Alaska	(95.8)	159	22	(13.8)	2.1	72	(45.3)	11	(50.0)	6	(27.3)
American Samoa	(99.2)	10	1	(10.0)	0.9	4	(40.0)	0	—	0	—
Arizona	(98.8)	833	157	(18.8)	1.8	410	(49.2)	61	(38.9)	8	(5.1)
Arkansas	(95.4)	743	40	(5.4)	1.1	248	(33.4)	13	(32.5)	10	(25.0)
California	(95.9)	2,770	945	(34.1)	2.0	436	(15.7)	718	(76.0)	54	(5.7)
Colorado	(97.9)	716	116	(16.2)	1.8	538	(75.1)	55	(47.4)	35	(30.2)
CNMI	(97.8)	27	3	(11.1)	2.7	15	(55.6)	3	(100.0)	0	—
Connecticut	(98.9)	579	50	(8.6)	1.4	202	(34.9)	35	(70.0)	13	(26.0)
Delaware	(99.0)	209	20	(9.6)	1.8	101	(48.3)	0	—	20	(100.0)
DC	(86.3)	374	25	(6.7)	2.1	52	(13.9)	21	(84.0)	4	(16.0)
Florida	(97.3)	1,625	225	(13.8)	1.1	736	(45.3)	167	(74.2)	34	(15.1)
Georgia	(97.3)	1,115	229	(20.5)	1.8	491	(44.0)	143	(62.4)	28	(12.2)
Guam	(99.1)	25	9	(36.0)	2.9	3	(12.0)	8	(88.9)	0	—
Hawaii	(98.3)	221	54	(24.4)	2.9	33	(14.9)	36	(66.7)	9	(16.7)
Idaho	(99.3)	720	64	(8.9)	3.0	226	(31.4)	62	(96.9)	1	(1.6)
Illinois	(99.4)	—	—	—	—	—	—	198	(81.5)	44	(18.1)
Indiana	(96.6)	2,364	145	(6.1)	1.8	257	(10.9)	83	(57.2)	48	(33.1)
Iowa	(98.7)	461	48	(10.4)	1.3	127	(27.5)	36	(75.0)	9	(18.8)
Kansas	(98.7)	354	93	(26.3)	2.3	42	(11.9)	67	(72.0)	17	(18.3)
Kentucky	(99.6)	2,344	58	(2.5)	1.1	240	(10.2)	38	(65.5)	20	(34.5)
Louisiana	(98.9)	3,404	66	(1.9)	1.1	1,073	(31.5)	43	(65.2)	15	(22.7)
Maine	(97.9)	208	23	(11.1)	1.9	33	(15.9)	13	(56.5)	8	(34.8)
Marshall Islands	(52.1)	47	2	(4.3)	4.3	39	(83.0)	0	—	2	(100.0)
Maryland	(99.4)	820	78	(9.5)	1.1	257	(31.3)	49	(62.8)	24	(30.8)
Massachusetts	(99.1)	1,153	200	(17.3)	2.8	29	(2.5)	143	(71.5)	18	(9.0)
Michigan	(99.0)	1,173	162	(13.8)	1.5	569	(48.5)	32	(19.8)	125	(77.2)
Micronesia	(91.6)	—	—	—	—	—	—	—	—	—	—
Minnesota	(98.1)	601	162	(27.0)	2.4	150	(25.0)	83	(51.2)	48	(29.6)
Mississippi	(98.9)	492	76	(15.4)	2.0	26	(5.3)	58	(76.3)	9	(11.8)
Missouri	(97.9)	1,431	100	(7.0)	1.3	461	(32.2)	66	(66.0)	7	(7.0)

See table footnotes on next page.

and EHDI programs now assist parents in making appointments for follow-up testing and calling families to remind them about upcoming appointments. These and other changes were developed during a collaborative improvement project funded by the Health Resources and Services Administration. All jurisdictions participated in this project and worked to develop strategies specific to their jurisdiction to increase the rates of documented follow-up testing and enrollment in EI services.¶

The findings in this report are subject to at least five limitations. First, some states and territories either did not respond to the HSFS or were only able to provide limited data in ≥1 reporting years. As a result there are differences in the number of jurisdictions reporting data each year. Second, the data reported only reflect those services that infants were documented to have received. Because reporting of newborn hearing screening and follow-up data are not required in each state and territory, it is possible for a jurisdiction to have a higher percentage of infants receiving diagnostic and EI services (and therefore lower rates of LFU/LTD) than what was reported by the HSFS. Third, there are multiple ways to calculate LFU/LTD, and the CDC definition might not fully reflect the progress jurisdictions have made in ensuring that infants receive recommended follow-up services. Fourth, there is variation between jurisdictions in the percentage diagnosed with permanent hearing loss and the reasons for this, including the impact of different screening protocols, cannot be assessed with currently available HSFS data. Fifth, all HSFS data are reported voluntarily and might include inaccuracies because some jurisdictions did not correctly report LFU/LTD and other data in accordance with the HSFS data definitions.

¶ Additional information available at http://newbornhearing.nichq.org/solutions/ihsis.

TABLE 2. (*Continued*) Number and percentages of infants screened, diagnosed, and enrolled in early intervention programs for hearing loss, by jurisdiction and birth year — United States, 2012*

	2012										
	Screening		Diagnosis					Early intervention			
	Screened	Not pass screening	Permanent hearing loss			LFU/LTD-DX		Enrolled		LFU/LTD-EI	
Jurisdiction†	(%)	No.	No.	(%)	Prevalence per 1,000 screened	No.	(%)	No.	(%)	No.	(%)
Montana	(96.3)	193	14	(7.3)	1.2	94	(48.7)	7	(50.0)	5	(35.7)
Nebraska	(99.4)	120	36	(30.0)	1.4	34	(28.3)	30	(83.3)	2	(5.6)
Nevada	(95.8)	340	41	(12.1)	1.2	174	(51.2)	34	(82.9)	3	(7.3)
New Hampshire	(97.8)	356	13	(3.7)	1.1	129	(36.2)	12	(92.3)	0	—
New Jersey	(99.4)	883	129	(14.6)	1.3	378	(42.8)	92	(71.3)	24	(18.6)
New Mexico	(66.6)	911	46	(5.0)	2.6	693	(76.1)	37	(80.4)	9	(19.6)
New York	(83.2)	—	—	—	—	—	—	—	—	—	—
North Carolina	(99.1)	854	190	(22.2)	1.6	323	(37.8)	161	(84.7)	13	(6.8)
North Dakota	(98.8)	369	24	(6.5)	2.1	182	(49.3)	24	(100.0)	0	—
Ohio	(98.6)	3,945	213	(5.4)	1.5	1,254	(31.8)	129	(60.6)	68	(31.9)
Oklahoma	(99.0)	2,386	74	(3.1)	1.5	592	(24.8)	57	(77.0)	17	(23.0)
Oregon	(96.3)	1,287	82	(6.4)	1.9	624	(48.5)	56	(68.3)	18	(22.0)
Palau	(99.3)	4	0	—	0.0	2	(50.0)	—	—	—	—
Pennsylvania	(95.6)	2,270	206	(9.1)	1.5	176	(7.8)	162	(78.6)	16	(7.8)
Rhode Island	(99.4)	116	12	(10.3)	1.0	24	(20.7)	11	(91.7)	0	—
South Carolina	(96.9)	775	85	(11.0)	1.6	388	(50.1)	40	(47.1)	45	(52.9)
South Dakota	(98.1)	280	27	(9.6)	2.2	234	(83.6)	0	—	27	(100.0)
Tennessee	(97.9)	3,585	84	(2.3)	1.0	1,239	(34.6)	73	(86.9)	9	(10.7)
Texas	(98.8)	4,927	412	(8.4)	1.1	3,776	(76.6)	70	(17.0)	241	(58.5)
Utah	(98.9)	696	100	(14.4)	1.9	381	(54.7)	70	(70.0)	19	(19.0)
Vermont	(99.9)	155	3	(1.9)	0.5	46	(29.7)	2	(66.7)	0	—
Virginia	(98.4)	1,100	161	(14.6)	1.6	407	(37.0)	110	(68.3)	48	(29.8)
Washington	(95.0)	988	154	(15.6)	1.9	495	(50.1)	0	—	154	(100.0)
West Virginia	(85.7)	597	8	(1.3)	0.4	310	(51.9)	4	(50.0)	4	(50.0)
Wisconsin	(99.1)	577	110	(19.1)	1.7	85	(14.7)	54	(49.1)	56	(50.9)
Wyoming	(96.3)	47	18	(38.3)	2.7	10	(21.3)	15	(83.3)	0	—
Totals	**(96.6)**	**52,961**	**5,475**	**(10.3)**	**1.6**	**19,006**	**(35.9)**	**3,527**	**(61.7)**	**1,404**	**(24.6)**

Abbreviations: CNMI = Commonwealth of Northern Mariana Islands; DC = District of Columbia; LFU/LTD-DX = lost to follow-up/lost to documentation for diagnostic testing; LFU/LTD-EI = lost to follow-up/lost to documentation for early intervention.
Source: The Early Hearing Detection and Intervention program's Hearing Screening and Follow-up Survey.
* Some jurisdictions did not provide complete data.
† More comparisons can be made using interactive maps at http://ehdidash.cdc.gov/IAS_WebApp/.

To build on the recent improvements summarized here and ensure continued progress toward identifying and providing EI for all infants with permanent hearing loss, current practices should evolve and take advantage of new collaborations and opportunities, such as emerging technologies. Improvements in existing clinical and public health infrastructures and adoption of technologies, such as electronic health records and clinical decision support tools, can assist providers and EHDI programs in improving coordination, delivery, and documentation of recommended EHDI services (*6*–*9*).

Acknowledgments

EHDI programs in U.S. states, American Samoa, the Commonwealth of the Northern Mariana Islands, the District of Columbia, Guam, the Marshall Islands and Palau.

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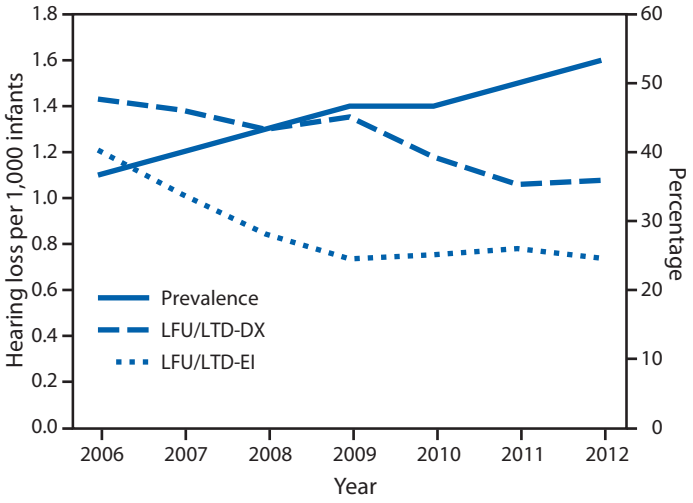
FIGURE. Prevalence of infants identified with hearing loss and percentage of those infants who were lost to follow-up/lost to documentation (LFU/LTD) for diagnostic testing (DX) or for early intervention (EI) — United States, 2006–2012



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What is already known on this topic?

Progress has been made in screening and diagnosing infants with hearing loss, reducing the number of infants lost to follow-up/lost to documentation, and increasing enrollment in early intervention. Ensuring infants receive recommended services is crucial to help prevent delays in speech, language, social, and emotional development that can occur when permanent hearing loss is not identified early.

What is added by this report?

Analysis of Early Hearing Detection and Intervention program survey data showed that, during 2006–2012, the number of jurisdictions reporting data increased from 49 to 57, rates of screening increased from 95.2% to 96.6%, rates of diagnosis among infants not passing the final screening increased from 4.8% to 10.3%, and enrollment in early intervention of infants diagnosed with permanent hearing loss increased from 55.4% to 61.7%, while the rates of lost to follow-up/lost to documentation declined.

What are the implications for public health practice?

EHDI programs should continue to work with health care providers who provide diagnostic and early intervention services to accurately document the receipt of necessary follow-up services, thereby increasing the opportunities for infants to receive proper care to minimize the negative impact that hearing loss can have on their speech, language, and emotional development.

Progress Toward Measles Elimination — Philippines, 1998–2014

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In 2005, the Regional Committee for the World Health Organization (WHO) Western Pacific Region (WPR) established a goal to eliminate measles* by 2012 (*1*).The recommended elimination strategies in WPR include 1) ≥95% 2-dose coverage with measles-containing vaccine (MCV) through routine immunization services and supplementary immunization activities (SIAs)†; 2) high-quality case-based measles surveillance; 3) laboratory surveillance with timely and accurate testing of specimens to confirm or discard suspected cases and detect measles virus genotypes; and 4) measles outbreak preparedness, rapid response, and appropriate case management (*2*). In the WPR, the Philippines set a national goal in 1998 to eliminate measles by 2008 (*3*). This report describes progress toward measles elimination in the Philippines during 1998–2014 and challenges remaining to achieve the goal. WHO–United Nations Children's Fund (UNICEF)–estimated coverage with the routine first dose of MCV (MCV1) increased from 80% in 1998 to 90% in 2013, and coverage with the routine second dose of MCV (MCV2) increased from 10% after nationwide introduction in 2010 to 53% in 2013. After nationwide SIAs in 1998 and 2004, historic lows in the numbers and incidence of reported measles cases occurred in 2006. Despite nationwide SIAs in 2007 and 2011, the number of reported cases and incidence generally increased during 2007–2012, and large measles outbreaks occurred during 2013–2014 that affected infants, young children, older children, and young adults and that were prolonged by delayed and geographically limited outbreak response immunization activities during 2013–2014. For the goal of measles elimination in WPR to be achieved, sustained investments are required in the Philippines to strengthen health systems, implement the recommended elimination strategies, and develop additional strategies to identify and reduce measles susceptibility in specific geographic areas and older age groups.

Immunization Activities

MCV1 and MCV2 coverage data are reported each year from the 17 regions§ in the Philippines to the National Immunization Programme; national coverage data are reported annually to WHO and UNICEF. WHO and UNICEF use reported data from administrative records and surveys to estimate coverage with MCV1 and MCV2 through routine immunization services. In the Philippines, MCV1 administered at age 9 months was introduced nationwide in 1983, and MCV2 administered at age 12–15 months was introduced nationwide in 2010.¶ WHO-UNICEF–estimated MCV1 coverage increased nationally from 80% in 1998 to 92% during 2004–2008, decreased to 79% in 2011, and increased to 90% in 2013. The number of regions with >95% MCV1 coverage decreased from seven in 2007 to none in 2013. Estimated MCV2 coverage increased nationally from 10% in 2010 to 53% in 2013. During 1998–2014, approximately 76.4 million children received MCV during SIAs. Nationwide SIA coverage was 94%–95% in 1998, 2004, and 2007, but only 84% in 2011 and 91% in 2014. There was significant regional variation in vaccination coverage with MCV1 and with SIAs (Table 1).

Surveillance Activities

Sentinel site-based surveillance with reporting of line lists of suspected measles cases started in 1989; nationwide measles case-based surveillance with laboratory testing started in 1992, and virus genotyping started in 2010. Key surveillance performance indicators include 1) rate of discarded (i.e., nonmeasles) suspected cases reported per 100,000 population (target: ≥2); 2) percentage of suspected cases with adequate investigation (target: ≥80%); 3) percentage of suspected cases with adequate blood specimens collected for laboratory testing (target: ≥80%); and 4) percentage of suspected cases with

* Measles elimination is defined as the absence of endemic measles virus transmission in a defined geographical area (e.g. region or country) for ≥12 months in the presence of a well-performing surveillance system..

† Measles SIAs generally are carried out using two target age ranges. An initial, nationwide catch-up SIA targets all children aged 9 months–14 years, with the goal of eliminating susceptibility to measles in the general population. Periodic follow-up SIAs then target all children born since the most recent SIA. Follow-up SIAs generally are conducted nationwide every 2–4 years and target children aged 9–59 months; their goal is to eliminate any measles susceptibility that has developed in recent birth cohorts and to protect children who did not respond to the first measles vaccination.

§ The 17 administrative regions in the Philippines include the Cordillera Autonomous Region (CAR), the National Capital Region (NCR), Region 1 (Ilocos), Region 2 (Cagayan Valley), Region 3 (Central Luzon), Region 4A (Calabarzon), Region 4B (Mimaropa) and Region 5 (Bicol) in Luzon; Region 6 (Western Visayas), Region 7 (Central Visayas), and Region 8 (Eastern Visayas) in Visayas; and Region 9 (Zamboanga Peninsula), Region 10 (Northern Mindanao), Region 11 (Davao), Region 12 (SOCCSKSARGEN), Caraga, and ARMM (Autonomous Region in Muslim Mindanao) in Mindanao.

¶ MCV2 was introduced in Regions 4A, 5, 6, 7, and 12 in 2009 and introduced nationwide in 2010.

TABLE 1. Coverage with measles-containing vaccine by vaccination delivery strategy and measles surveillance performance — Philippines, 1998–2014

Immunization activities				No. (%) of regions,* by coverage					National	
Delivery strategy	Vaccine	Target age group	Year	<80%	80%–89%	90%–94%	≥95%	Range by region (%)	Reported	WUENIC
SIA	M	9 mos–14 yrs	1998	0 (0)	1 (6)	5 (31)	10 (62)	89–105	94	
		9 mos–7 yrs	2004	0 (0)	6 (35)	3 (17)	8 (47)	85–100	95	
		9–48 mos	2007	0 (0)	2 (11)	6 (35)	9 (52)	85–99	95	
	MR	9–95 mos	2011	4 (23)	9 (52)	4 (23)	0 (0)	75–91	84	
	M	6–59 mos	2014†	2 (66)	0 (0)	1 (33)	0 (0)	76–92		
	MR	9–59 mos	2014	0 (0)	2 (11)	9 (52)	6 (35)	82–103	91	
MCV1§	M	9 mos	1998					NA	87	80
			1999					NA	ND	80
			2000					NA	80	78
			2001	12 (80)	3 (20)	0 (0)	0 (0)	49–89	75	81
			2002	11 (68)	5 (31)	0 (0)	0 (0)	59–88	82	82
			2003	8 (50)	6 (37)	2 (12)	0 (0)	66–90	87	87
			2004	6 (37)	9 (56)	1 (6)	0 (0)	75–93	81	92
			2005	1 (5)	5 (29)	7 (41)	4 (23)	78–102	82	92
			2006	0 (0)	7 (41)	7 (41)	3 (17)	82–106	92	92
			2007	1 (5)	4 (23)	5 (29)	7 (41)	72–100	92	92
			2008	0 (0)	8 (47)	5 (29)	4 (23)	81–98	86	92
			2009	1 (5)	11 (64)	5 (29)	0 (0)	63–93	88	88
			2010	5 (29)	8 (47)	2 (11)	2 (11)	73–95	80	80
			2011	5 (29)	8 (47)	4 (23)	0 (0)	70-–94	79	79
			2012	2 (11)	10 (58)	5 (29)	0 (0)	62-–92	85	85
			2013	10 (58)	5 (29)	2 (11)	0 (0)	39–91	90	90
MCV2¶	MMR	12 mos	2010	7 (100)	0 (0)	0 (0)	0 (0)	2–35	10	10
		12–15 mos	2011	16 (100)	0 (0)	0 (0)	0 (0)	5–55	28	28
			2012	17 (100)	0 (0)	0 (0)	0 (0)	11–62	38	38
			2013	17 (100)	0 (0)	0 (0)	0 (0)	5–63	53	53

See table footnotes on next page.

results reported within 7 days of the laboratory receiving the specimen (target: ≥80%). During 2009–2011, surveillance performance improved: the discarded non-measles case rate increased from 1.6 to 3.1; the adequate case investigation rate increased from 29.5% to 88.6%; the adequate specimen collection rate increased from 74.1% to 98.0%; and the timeliness of laboratory reporting increased from 53.8% to 72.6%. However, performance declined or varied in 2012 and during the 2013–2014 measles resurgence (Table 1).

Measles Incidence and Measles Viral Genotypes

During 1998–2014, the number of annual reported measles cases varied in relation to SIAs, declining after SIAs were conducted and then increasing in subsequent years (Figure 1). Overall, annual reported measles cases and incidence per 1 million population decreased from 1,984 and 27.1 in 1998 to nine and 0.1 in 2006 and then increased to 21,403 and 233.2 in 2014. On the basis of SIAs conducted, 2007–2014 can be divided into two periods (Figure 1). During the 2007–2011 inter-SIA period,** 14,142 measles cases were reported. During the 2011–2014 inter-SIA period††, 58,700 measles cases were reported. At the national level, the proportion of measles cases in children aged 9 months–4 years decreased from 38% in the first inter-SIA period to 28% in the second inter-SIA period, and the proportion of measles cases in adolescents and adults aged ≥15 years increased from 18% in the first period to 29% in the second period (Table 2). The nationwide measles resurgence started with outbreaks in Calabarzon (Region 4A), Central Luzon (Region 3), the Cordillera Autonomous Region (CAR), and Western Visayas (Region 6) during the first half of 2013 and spread to many parts of Luzon and Visayas geographical divisions during October–December 2013. Outbreak response immunization activities targeting children aged 6–59 months were implemented in Calabarzon, Central Luzon, and the National Capital Region during January–February 2014; however, by that time the whole country was affected by measles outbreaks (Figure 2). After implementation of the nationwide SIA in September 2014 targeting children aged 9–59 months, 642 (37%) of the 1,719 measles cases during October–December 2014 were in persons aged ≥15 years (Table 2). The predominant measles virus genotype was D3 before 2007, then D9 and G3 during 2007–2009 (*4*) and

** From the end of the nationwide SIA targeting children aged 9–48 months in October 2007 until the completion of the nationwide SIA targeting children aged 9–95 months in April–May 2011.

†† From the end of the nationwide SIA in April–May 2011 until the completion of the nationwide SIA targeting children aged 9–59 months in September 2014.

TABLE 1. (*Continued*) Coverage with measles-containing vaccine by vaccination delivery strategy and measles surveillance performance — Philippines, 1998–2014

Surveillance performance			No. (%) of regions, by performance				Range by region	National
Performance indicator	Target	Year	0–0.5	0.6–0.9	1–1.9	≥2		
Discarded nonmeasles rate per 100,000 population	≥2	2009	2 (11)	1 (5)	10 (58)	4 (23)	0.1–4.2	1.6
		2010	1 (5)	0 (0)	3 (17)	13 (76)	0.3–21.4	4.3
		2011	1 (5)	1 (5)	5 (29)	10 (58)	0.2–19.1	3.1
		2012	4 (23)	1 (5)	5 (29)	7 (41)	0.1–7.5	2.1
		2013	1 (5)	1 (5)	5 (29)	10 (58)	0.3-–7.6	3.3
		2014	0 (0)	2 (11)	5 (29)	10 (58)	0.8–5.1	3.3
			<60%	**60%–69%**	**70%–79%**	**≥80%**		
% suspected cases with adequate investigation**	≥80%	2009	17 (100)	0 (0)	0 (0)	0 (0)	6.3–47.0	29.5
		2010	17 (100)	0 (0)	0 (0)	0 (0)	8.1–59.3	40.6
		2011	8 (47)	4 (23)	3 (17)	2 (11)	23.2–81.6	88.6
		2012	10 (58)	2 (11)	2 (11)	3 (17)	15.7–88.3	57.1
		2013	9 (52)	3 (17)	3 (17)	2 (11)	4.2–81.3	46.1
		2014	12 (70)	1 (5)	3 (17)	1 (5)	5.1–90.4	52.5
% suspected cases with adequate blood specimens††	≥80%	2009	6 (35)	5 (29)	2 (11)	4 (23)	25.3–89.6	74.1
		2010	6 (35)	2 (11)	5 (29)	4 (23)	24.1–95.4	87.1
		2011	4 (23)	1 (5)	6 (35)	6 (35)	27.7–93.9	98.0
		2012	3 (17)	3 (17)	3 (17)	8 (47)	33.9–98.1	80.4
		2013	1 (5)	1 (5)	7 (41)	8 (47)	35.0–95.3	63.2
		2014	5 (29)	3 (17)	4 (23)	5 (29)	18.0–94.7	82.0
% serology laboratory results ≤ 7 days of receipt	≥80%	2009	8 (47)	6 (35)	1 (5)	2 (11)	22.1–100.0	53.8
		2010	15 (88)	1 (5)	1 (5)	0 (0)	27.5–71.9	43.9
		2011	6 (35)	3 (17)	6 (35)	2 (11)	44.7–81.0	72.6
		2012	0 (0)	1 (5)	0 (0)	16 (94)	66.7–100.0	95.3
		2013	0 (0)	1 (5)	4 (23)	12 (70)	68.4–100.0	80.2
		2014	17 (100)	0 (0)	0 (0)	0 (0)	0–23.5	1.3

Abbreviations: M = measles vaccine; MCV = measles-containing vaccine; MMR = measles, mumps, and rubella vaccine; MR = measles and rubella vaccine; NA = not available; ND = no data; SIAs = supplementary immunization activities; WUENIC = World Health Organization–UNICEF estimate of national immunization coverage.

* The total number of regions in the Philippines is 17 after 2004.

† SIAs with measles vaccine targeting children aged 6–59 months were carried out only in Regions 3 and 4A and in the National Capital Region.

§ Routine first dose of measles-containing vaccine. MCV1 coverage by region is not available before 2001.

¶ Routine second dose of measles-containing vaccine. Introduction of MCV2 started in 2009 in Regions 4A, 5, 6, 7, and 12. In 2010, MCV2 was introduced into the routine immunization nationwide; however, reporting was incomplete until the recording/reporting tool was updated in 2012 to accommodate the addition of MCV2.

** Adequate investigation is defined as investigation initiated within 48 hours of notification, with collection of all 10 core variables (case identification, date of birth/age, sex, place of residence, vaccination status or date of last vaccination, date of rash onset, date of notification, date of investigation, date of blood specimen collection, and place of infection or travel history).

†† Adequate specimens are minimum of 5 ml of blood sample for older children and adults and 1 ml for infants and younger children or dried blood sample with at least three fully filled circles on filter paper collected within 28 days of rash onset.

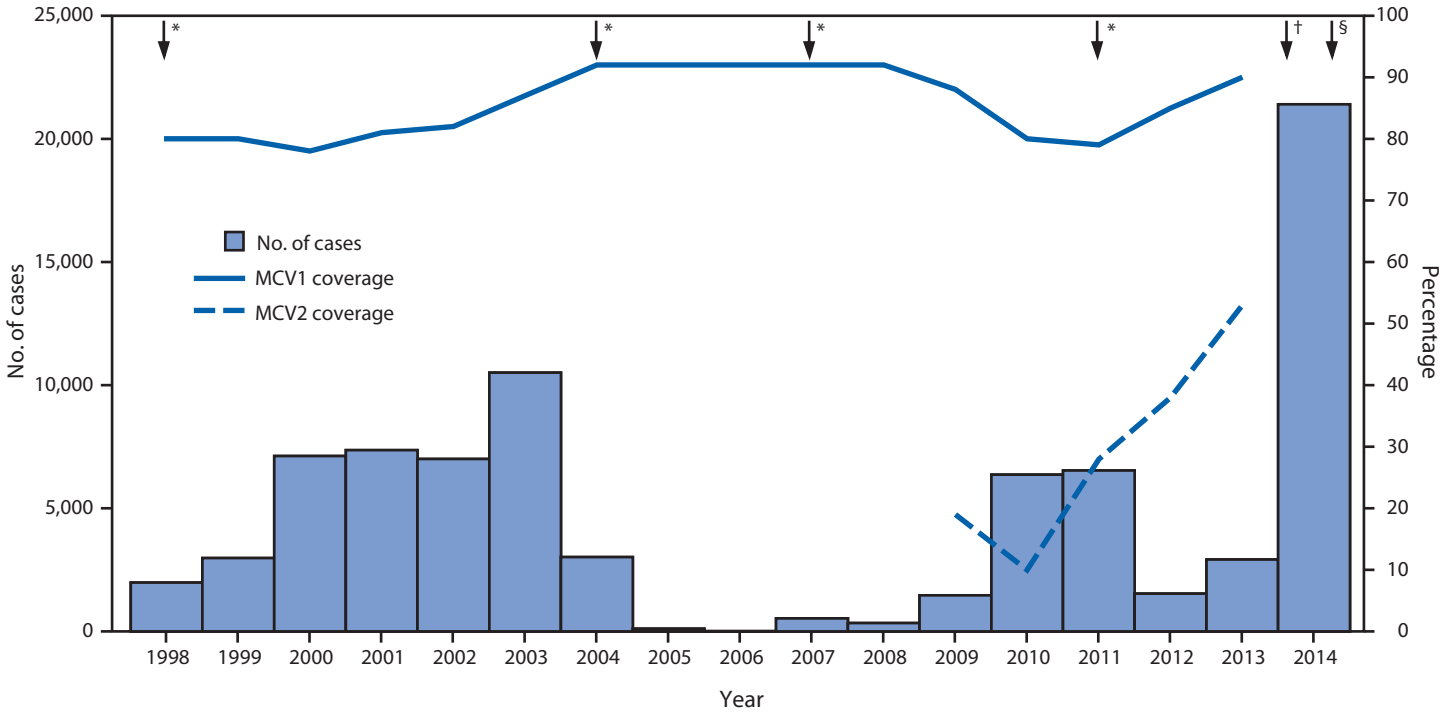
D9 during 2010–2012. During 2013–2014, of 69 cases with genotyping, 68 were B3 and one was D9. Genotypes D3 and G3 have not been reported since 2005 and 2010, respectively.

Discussion

The nationwide measles resurgence in the Philippines during 2013–2014 reflected the insufficient implementation of measles elimination strategies. Persistent low vaccination coverage since 1998 combined with the relatively low level of circulation of measles virus after SIAs resulted in the accumulation of measles-susceptible cohorts of older age children and young adults and a change in the epidemiology of measles in the Philippines. The resurgence highlighted key program challenges: 1) persistent suboptimal MCV1 coverage, 2) low MCV2 coverage since introduction during 2009–2010; 3) suboptimal SIA coverage with large variations in coverage by region; 4) recent SIA target age groups too narrow to interrupt measles virus transmission among older children, evidenced by the proportion of cases occurring outside the SIA target age group; and 5) inadequate outbreak response activities before widespread measles virus transmission started. The failure to achieve high population immunity among the targeted age groups before 2013 contributed to the observed increase in the proportion of measles cases among older children and young adults that indicated a shift in the age of the measles-susceptible population from young children to a wider age group during the nationwide measles resurgence in 2013–2014. This shift will require special strategies for vaccination activities.

In June 2014, the WPR Immunization and Vaccine-Preventable Diseases Technical Advisory Group recommended that countries achieve and maintain ≥95% 2-dose MCV

FIGURE 1. Number of reported measles cases and estimated percentage of MCV1 and MCV2 coverage, by year — Philippines, 1998–2014



Abbreviation: MCV = measles-containing vaccine.

Source: World Health Organization (WHO)–UNICEF estimates of national immunization coverage are available at http://www.who.int/immunization_monitoring/routine/immunization_coverage/en/index4.htm. Estimated coverage with the routine first dose of measles-containing vaccine (MCV1) was among children aged 1 year; estimated coverage with the routine second dose of measles-containing vaccine (MCV2) was among children at the recommended age of administration of MCV2, as per the national immunization schedule. Introduction of MCV2 started in 2009 in Regions 4A, 5, 6, 7, and 12. In 2010, MCV2 was introduced into the routine immunization nationwide; however, reporting was incomplete until the recording/reporting tool was updated in 2012 to accommodate the addition of MCV2. The number of reported measles cases during 1998–2013 is as reported to the World Health Organization (WHO) and UNICEF through the Joint Reporting Form and during 2014 as reported in monthly reports to the WHO Western Pacific Regional Office by December 20, 2014.

* Supplementary immunization activities using measles-containing vaccine were implemented in 1998 (nationwide) for children aged 9 months–14 years, 2004 (nationwide) for children aged 9 months–7 years, 2007 (nationwide) for children aged 9–48 months, and using measles-rubella vaccine in 2011 (nationwide) for children aged 9–95 months.

† Outbreak response immunization activities using measles vaccine during January–February 2014 targeting children aged 6–59 months in Calabarzon, Central Luzon, and the National Capital Region.

§ Nationwide supplementary immunization activity using measles-rubella vaccine implemented during September 2014 for children aged 9–59 months.

coverage through routine services and periodic SIAs, and, in addition, that endemic countries and countries experiencing nation-wide resurgence 1) update national plans and develop subnational plans with focus on high-risk and measles-susceptible groups; 2) enhance surveillance activities, including rapid case detection and outbreak investigation; 3) annually review and identify districts and age groups with suboptimal population immunity; and 4) increase population immunity by taking corrective actions such as periodic selective immunization activities and more frequent subnational or national SIAs (*5*). The Technical Advisory Group also recommended maintaining a national outbreak response plan for implementation of timely and prompt response activities.

Based on these recommendations, the Philippines Department of Health proposed new activities for measles elimination in the draft National Immunization Programme Strategic Plan for 2015–2019 (*6*), with plans to conduct 1) selective immunization activities[§§] for children aged 12–35 months in all regions in 2015 and 2) nonselective SIAs for a wide target age group during 2015–2017 in regions with sustained measles virus transmission or identified measles susceptibility among older children and adults. In October 2014, the Department of Health issued an administrative order to strengthen local government capacity to identify measles outbreaks, plan outbreak response activities, and provide health workers with guidance on how to respond appropriately to new outbreaks and

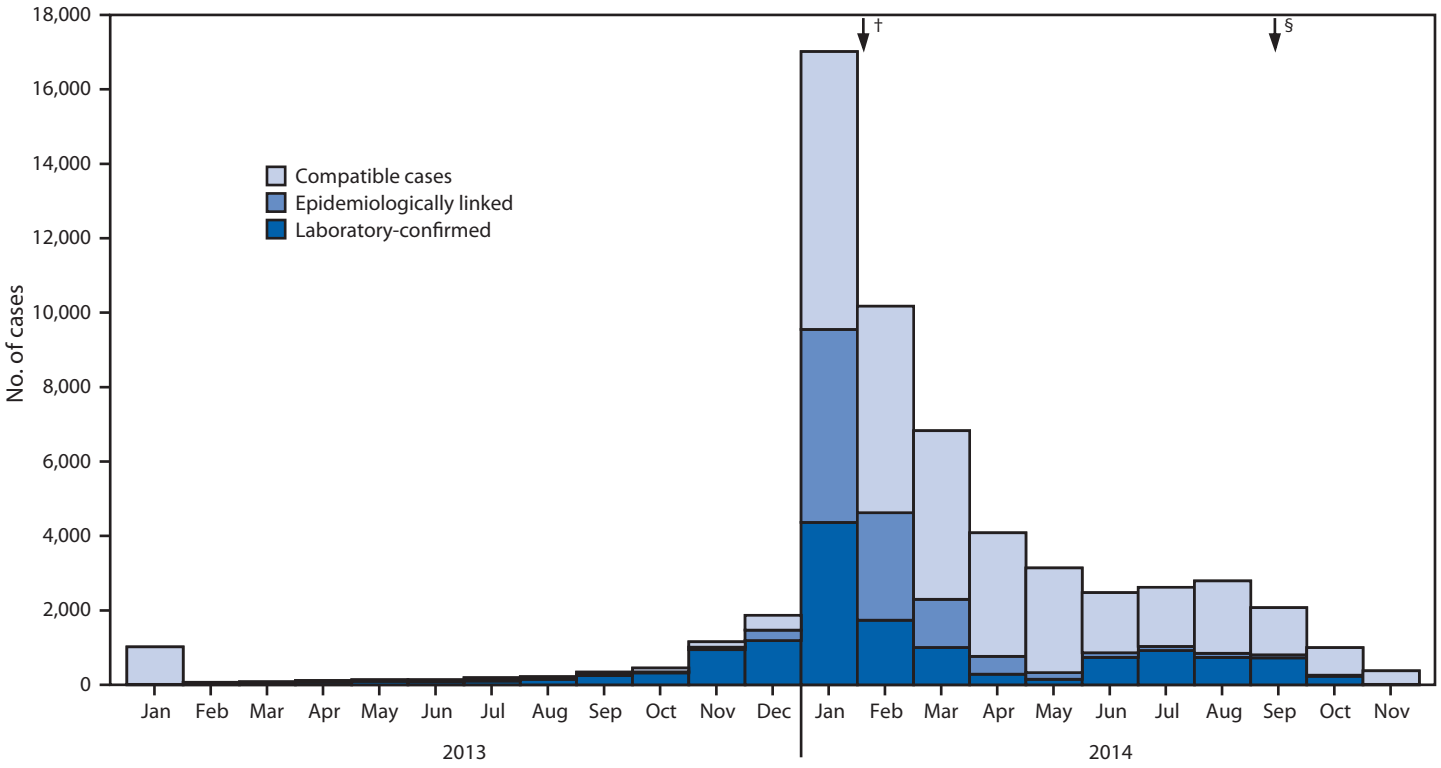
[§§] Selective immunization activities will be carried out for children aged 12–35 months who have not yet been fully vaccinated with 2 doses of measles-containing vaccines while nonselective SIAs will be done for any person in the target age group regardless of past vaccination history.

TABLE 2. Reported measles cases* before and after supplementary immunization activities (SIAs)† in 2011 and 2014, by age group — Philippines, November 1, 2007–December 31, 2014

	Time Period					
	Nov 2007–May 2011		June 2011–Sept 2014		Oct 2014–Dec 2014	
Age group	No.	(%)	No.	(%)	No.	(%)
0–8 mos	1,831	(13)	18,033	(31)	462	(27)
9 mos–4 yrs	5,412	(38)	16,671	(28)	357	(21)
5–9 yrs	2,664	(19)	2,846	(5)	115	(7)
10–14 yrs	1,222	(9)	4,188	(7)	141	(8)
15–29 yrs	2,073	(15)	12,552	(21)	450	(26)
30–39 yrs	331	(2)	3,866	(7)	169	(10)
≥40 yrs	102	(1)	482	(1)	23	(1)
No data	507	(4)	62	(0)	2	(0)
Total	**14,142**	**(100)**	**58,700**	**(100)**	**1,719**	**(100)**

* Includes reported measles cases that were laboratory confirmed, epidemiologically linked, and either clinically confirmed (2007–2012) or clinically compatible (2013–2014). Both clinically confirmed and clinically compatible cases were suspected cases with fever and maculopapular (nonvesicular) rash and one of cough, coryza, or conjunctivitis for which no adequate clinical specimens were taken and that were not linked epidemiologically to laboratory-confirmed cases of measles.
† SIAs were implemented in October 2007 (nationwide) targeting children aged 9–48 months, during April–May 2011 (nationwide) for children aged 9–95 months, during January–February 2014 (in Regions 3 and 4A and in the National Capital Region) for children aged 6–59 months, and in September 2014 (nationwide) for children aged 9–59 months.

FIGURE 2. Number* of reported confirmed measles cases, by month of rash onset — Philippines, 2013–2014



Source: As reported in monthly reports to the World Health Organization Western Pacific Regional Office by December 20, 2014.
* N = 58,389.
† Outbreak response immunization activities using measles vaccine during January–February 2014 targeting children aged 6–59 months in Calabarzon, Central Luzon, and the National Capital Region.
§ Nationwide supplementary immunization activity using measles-rubella vaccine implemented during September 2014 for children aged 9–59 months.

sustained measles virus transmission (*7*). In August 2015, the government will implement a nationwide public school-based measles-rubella-tetanus-diphtheria vaccination of 7th-grade students and establish a school entry immunization check in all public and private schools. Children with incomplete vaccination records at the time of school entry immunization

What is already known on this topic?

In 2005, the World Health Organization (WHO) Regional Committee for the Western Pacific Region (WPR) resolved to eliminate measles by 2012. In the WPR, the Philippines set a national goal in 1998 to eliminate measles by 2008.

What is added by this report?

WHO-UNICEF–estimated coverage with the routine first dose of a measles-containing vaccine (MCV1) increased from 80% in 1998 to 90% in 2013. The estimated coverage with the routine second dose (MCV2) increased from 10% after introduction in 2010 to 53% in 2013. After nationwide supplementary immunization activities (SIAs) in 1998 and 2004, historic lows in numbers and incidence of reported measles cases occurred in 2006. Despite nationwide SIAs in 2007 and 2011, reported cases and incidence generally increased during 2007–2012. During 2013–2014, nationwide measles resurgence occurred, including cases among older children and young adults, because of persistent MCV1 coverage <95%, low MCV2 coverage, and suboptimal MCV coverage in several regions of the country by SIAs conducted during 1998–2011.

What are the implications for public health practice?

Resuming progress toward measles elimination in the Philippines requires sustained investments to strengthen health systems and implement the recommended national and subnational strategies, including achieving and maintaining ≥95% 2-dose MCV coverage, implementing additional strategies for reducing accumulated measles susceptibility among older children and adults, and strengthening surveillance and outbreak response.

check will be referred to either the school clinic or the nearest health center to receive missed vaccinations.

The findings in this report are subject to at least two limitations. First, administrative coverage data might be unreliable because of inaccurate estimates of the size of target populations and the reported number of doses delivered. Second, surveillance data underestimate the likely number of cases that occurred because not all persons with measles sought care and were reported through surveillance.

In 2013, the WPR Regional Verification Committee for Measles Elimination[¶¶] verified that endemic measles virus transmission had been interrupted for a period of at least 36 months in Australia, Macao [China], Mongolia, and the Republic of Korea. However, during 2013–2014, the measles resurgence in the Philippines led to measles virus importations and increased incidence in several WPR countries including Australia and the Republic of Korea and in countries in other WHO regions[***] (*8–10*). Resuming progress toward regional measles elimination goals requires sustained investments, including strengthening health systems and implementing the recommended strategies in the Philippines.

[¶¶] In 2005, the Regional Committee for the WHO WPR established a goal for measles elimination by 2012, and a Regional Verification Committee (RVC) was established in 2013. In March 2015, the RVC verified that endemic measles virus transmission had been interrupted for a period of at least 36 months in Brunei Darussalam, Cambodia, and Japan.

[***] During 2013–2014, a total of 17 countries in four WHO regions reported measles virus genotype B3 in persons who had a history of recent travel to the Philippines.

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Vital Signs: Trends in Use of Long-Acting Reversible Contraception Among Teens Aged 15–19 Years Seeking Contraceptive Services — United States, 2005–2013

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Abstract

Background: Nationally, the use of long-acting reversible contraception (LARC), specifically intrauterine devices (IUDs) and implants, by teens remains low, despite their effectiveness, safety, and ease of use.

Methods: To examine patterns in use of LARC among females aged 15–19 years seeking contraceptive services, CDC and the U.S. Department of Health and Human Services' Office of Population Affairs analyzed 2005–2013 data from the Title X National Family Planning Program. Title X serves approximately 1 million teens each year and provides family planning and related preventive health services for low-income persons.

Results: Use of LARC among teens* seeking contraceptive services at Title X service sites increased from 0.4% in 2005 to 7.1% in 2013 (p-value for trend <0.001). Of the 616,148 female teens seeking contraceptive services in 2013, 17,349 (2.8%) used IUDs, and 26,347 (4.3%) used implants. Use of LARC was higher among teens aged 18–19 years (7.6%) versus 15–17 years (6.5%) (p<0.001). The percentage of teens aged 15–19 years who used LARC varied widely by state, from 0.7% (Mississippi) to 25.8% (Colorado).

Conclusions: Although use of LARC by teens remains low nationwide, efforts to improve access to LARC among teens seeking contraception at Title X service sites have increased use of these methods.

Implications for public health practice: Health centers that provide quality contraceptive services can facilitate use of LARC among teens seeking contraception. Strategies to address provider barriers to offering LARC include: 1) educating providers that LARC is safe for teens; 2) training providers on LARC insertion and a client-centered counseling approach that includes discussing the most effective contraceptive methods first; and 3) providing contraception at reduced or no cost to the client.

Introduction

The teen birth rate in the United States has continued to decline during the past two decades, from 61.8 births per 1,000 teens aged 15–19 years in 1991 to an all-time low of 26.5 births per 1,000 teens in 2013 (*1*). Improved contraceptive use has contributed substantially to this decline (*2*); however, there were approximately 273,000 births to teens in 2013 (*1*), and the U.S. teen pregnancy rate remains up to seven times higher than in some developed countries (*3*). Teen childbearing has potential negative health, economic, and social consequences for mothers and their children (*4*), and each year costs the United States approximately $9.4 billion (*5*).

A key strategy for further reducing teen pregnancy is increasing awareness, access, and availability of long-acting reversible contraception (LARC), specifically intrauterine devices (IUDs) and implants. IUD use was more common among U.S. women in the 1970s before concerns about safety led to a decline; however, with approval of redesigned IUDs and implants, there has been growing interest in the use of LARC (*6*). LARC requires no effort after insertion, and can prevent unintended pregnancy for at least 3 to 10 years, depending on the type of LARC (*7*). During the first year of typical use, both IUDs and implants have lower failure rates (<1%) than oral contraceptives (9%) and condoms (18%) (*8*), the two methods teens use most often (*9*). Among teens, LARC also has high acceptability (*10*) and higher continuation rates than shorter-acting methods (*11*). Further, LARC is safe and appropriate for teens (*12*): major professional societies, including the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics, have endorsed LARC as a first-line contraceptive

* For this study, teens are defined as persons aged 15–19 years.

Key Points

- Intrauterine devices (IUDs) and implants, known as Long-Acting Reversible Contraception (LARC), are the most effective types of birth control for teens. With use of LARC, less than 1% of users become pregnant during the first year of use.
- LARC is safe for teens, requires no effort after insertion, and can prevent pregnancy for 3 to 10 years.
- Nationally, use of LARC among teens has increased but still remains low (<5%).
- Strategies for removing barriers to LARC include: 1) educating providers that LARC is safe for teens, 2) training providers on LARC insertion and use of a client-centered counseling approach that includes discussing the most effective contraceptive methods first, and 3) providing contraception at reduced or no cost to the client.
- Efforts to address barriers at Title X service sites have increased the percentage of teens selecting LARC as their preferred contraceptive option from 0.4% in 2005 to 7.1% in 2013.
- Additional information is available at http://www.cdc.gov/vitalsigns.

choice for teens that can be combined with condoms to provide the best protection against pregnancy and sexually transmitted diseases (*13*,*14*).

National estimates suggest use of LARC among teens has increased but still remains low (<5%) (*15*,*16*). Common barriers to LARC use by teens include unfounded concerns about safety, high upfront costs, and lack of awareness about LARC (*17*,*18*). For example, in a nationally representative sample of U.S. publicly funded family planning clinics, LARC was discussed with teen clients at fewer than half of these clinics (*18*). Common challenges reported by clinic directors included cost (60%), staff concerns about IUD use among teens (47%), and lack of training on insertion of implants (47%) and IUDs (38%) (*18*).

The reported barriers to use of LARC prompted CDC and the U.S. Department of Health and Human Services' Office of Population Affairs to analyze clinic data from the Title X National Family Planning Program. Since 1970, this program has provided cost-effective and confidential family planning and related preventive health services for low-income women and men; it serves approximately 1 million teens each year (*19*). The Title X National Family Planning Program encourages health care providers to offer LARC as an option for teens by increasing awareness of clinical guidelines on LARC for teens, training providers on LARC insertion and client-centered contraceptive counseling, and supporting community education and outreach. The Title X Program also helps its service sites to reduce financial barriers to LARC (e.g., by building capacity to bill third-party payers).

Methods

To examine use of LARC among female teens aged 15–19 years attending service sites funded under the Title X National Family Planning Program, data from the 2005–2013 Family Planning Annual Report[†] were analyzed. These years include the period during which modern IUDs and implants were available for use by women of all ages, including teens. The Family Planning Annual Report contains data from all entities that receive Title X grants to support delivery of family planning and related preventive health services through approximately 4,200 service sites. This report includes data on the number and percentage of female family planning users aged 15–19 years by primary contraceptive method and age.

A family planning user was defined as a person who had at least one family planning encounter at a Title X service site in a calendar year. The primary contraceptive method was defined as the method adopted or continued at exit from the last encounter of that year. If a user reported more than one method, only the most effective method was recorded as the primary method. Female clients were excluded from analyses if they were pregnant or seeking pregnancy; they or their partner were sterile by means other than surgical sterilization; or they reported refraining from sexual intercourse. A small percentage of clients (range = 1.8%–5.3% by year) was excluded because the primary contraceptive method at their last encounter was unknown.

Reversible contraceptive methods were placed in three tiers based on the percentage of users who experience pregnancy during the first year of typical use: most effective (<1%), moderately effective (6%–12%), and least effective (≥18%) (*8*). The most effective methods included IUDs and implants; moderately effective methods included oral contraceptives, injectables (e.g., Depo-Provera), the contraceptive patch, the vaginal ring, and diaphragms; and least effective methods included condoms, contraceptive sponges, spermicides, fertility awareness-based methods, and other methods, including withdrawal. Trends over time and by age, region, and type of service site were evaluated using the Cochran-Mantel-Haenszel test statistic.

[†] Available at http://www.hhs.gov/opa/title-x-family-planning/research-and-data/fp-annual-reports.

Results

Among approximately 7.5 million female clients aged 15–19 years who sought contraceptive services during 2005–2013 from Title X service sites in the United States, the percentage who adopted or continued use of LARC at their last visit increased from 0.4% (2005) to 7.1% (2013) (p-value for trend <0.001); the number of LARC users increased from 4,112 (2005) to 43,696 (2013). During this time, the percentage that used moderately effective methods decreased from 76.9% to 73.4%, and the percentage that used least effective methods decreased from 22.7% to 19.5% (Figure 1).

By type of LARC, use of IUDs for teens aged 15–19 years increased from 3,685 (0.4%) to 17,349 (2.8%), and use of implants increased from 427 (0.04%) to 26,347 (4.3%) (Figure 2). Use of IUDs was more prevalent than use of implants during 2005–2011 but was surpassed by implants in 2012 and 2013.

By age, overall use of LARC during 2005–2013 was higher each year among teens aged 18–19 versus 15–17 years (p<0.001 for each year). Use of LARC increased from 0.6% to 7.6% among teens aged 18–19 years, and from 0.3% to 6.5% among teens aged 15–17 years. For both age groups, the increase in use of implants exceeded the increase in use of IUDs (teens 15–17 years: 0.05% to 4.5% for implants, and 0.2% to 2.0% for IUDs; teens 18–19 years: 0.04% to 4.1% for implants, and 0.5% to 3.4% for IUDs).

In 2013, among 616,148 female clients aged 15–19 years seeking contraception at Title X service sites, the use of LARC varied markedly by region (Table). Use was highest in the West (9.5%), followed by the Northeast and Midwest (both 6.4%), and lowest in the South (5.3%) (p<0.001). By state, Colorado had the highest percentage of teen clients using LARC (25.8%), followed by Alaska (19.6%), District of Columbia (17.9%), Iowa (16.6%), Hawaii (14.4%), and Vermont (13.8%); conversely, the lowest percentage of teen clients using LARC was in West Virginia (2.0%), Indiana (1.5%), and Mississippi (0.7%) (Figure 3). By type of LARC, use of IUDs was highest in Colorado (8.2%), Rhode Island (5.4%), New Hampshire (5.2%), and Washington (5.2%), and use of implants was highest in Colorado (17.6%), Alaska (15.4%), Iowa (13.4%), District of Columbia (12.9%), and Hawaii (12.2%) (Table).

Use of LARC among teens aged 15–19 years seeking contraception at Title X service sites also varied by type of facility. Service sites that focused primarily on delivering family planning services, as opposed to primary care services, had the highest percentage of teen clients using LARC (7.5%), followed by health departments (6.7%), other types of service sites (5.7%), and Federally Qualified Health Centers[§] (5.6%) (p<0.001) (Table). By type of LARC, use of IUDs was highest at service sites that focused primarily on family planning services (3.3%), whereas use of implants was equally high (4.3%) at health departments and services sites that focused primarily on family planning services.

FIGURE 1. Percentage of female teens aged 15–19 years using moderately effective and least effective contraceptive methods, compared with long-acting reversible contraception (LARC), among those seeking contraceptive services at Title X service sites — United States, 2005–2013

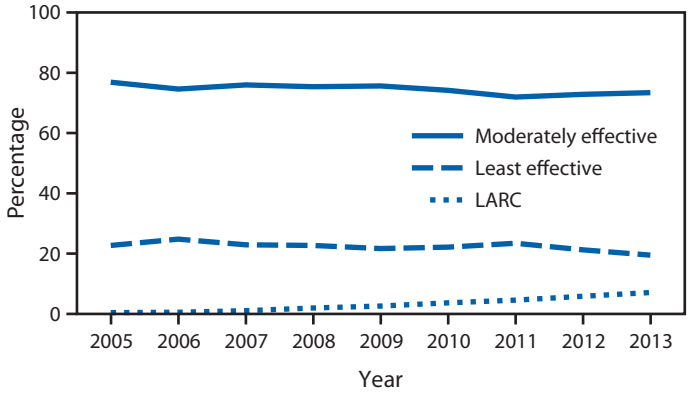
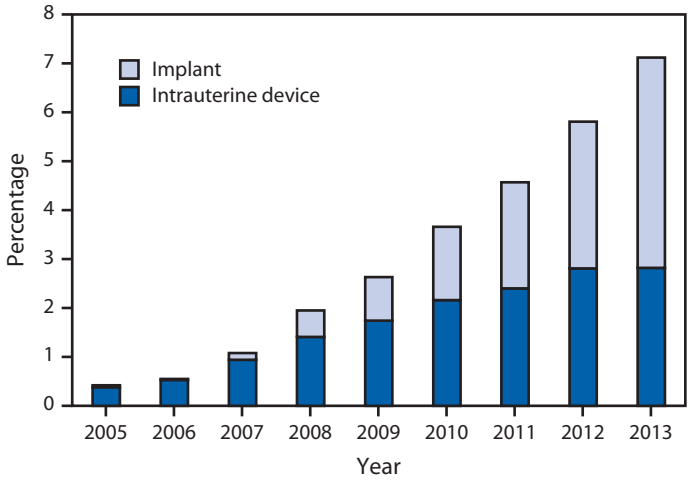


FIGURE 2. Percentage of female teens aged 15–19 years using long-acting reversible contraception (LARC) among those seeking contraceptive services at Title X service sites, by LARC type — United States, 2005–2013



Conclusions and Comment

These data show efforts to improve access to LARC among teens seeking contraception at Title X service sites have increased use of these methods more than 15-fold from 0.4% in 2005 to 7.1% in 2013, with a marked increase in use of implants. Concurrently, use of moderately effective and least

[§] Federally Qualified Health Centers are "safety net" providers such as community health centers, public housing centers, outpatient health programs funded by the Indian Health Service, and programs serving migrants and the homeless. The main purpose of these centers is to enhance the provision of primary care services in underserved urban and rural communities.

TABLE. Percentage of female Title X clients aged 15–19 years using long-acting reversible contraception (LARC), by age group, type of service site, region, and state — Family Planning Annual Report, United States, 2013

		% using LARC								
		15–19 yrs			15–17 yrs			18–19 yrs		
Characteristic	No.	Total	IUD	Implant	Total	IUD	Implant	Total	IUD	Implant
Total	**616,148**	**7.1**	**2.8**	**4.3**	**6.5**	**2.0**	**4.5**	**7.6**	**3.4**	**4.1**
Type of service site										
Health department	333,203	6.7	2.5	4.3	6.4	1.8	4.6	7.0	3.0	4.0
Family planning	277,000	7.5	3.3	4.3	6.6	2.2	4.4	8.2	4.0	4.2
FQHC	1,738	5.6	1.8	3.8	4.5	0.7	3.8	6.7	3.0	3.8
Other	4,207	5.7	1.9	3.9	4.8	0.8	4.0	6.4	2.7	3.8
Region*										
Northeast	115,850	6.4	3.2	3.2	5.8	2.4	3.4	6.9	3.9	3.1
Midwest	89,359	6.4	2.0	4.4	6.3	1.3	5.0	6.5	2.5	4.0
South	199,619	5.3	1.6	3.6	4.9	1.1	3.8	5.5	2.1	3.5
West	211,320	9.5	4.1	5.4	8.6	2.9	5.6	10.1	4.8	5.3
State										
Alabama	16,677	3.7	0.3	3.4	3.3	0.1	3.2	4.0	0.5	3.5
Alaska	1,207	19.6	4.1	15.4	18.6	2.9	15.8	20.3	5.1	15.1
Arizona	5,307	5.8	3.8	2.0	4.6	2.3	2.3	6.7	4.8	1.8
Arkansas	9,734	2.5	2.3	0.2	1.7	1.5	0.1	3.2	3.0	0.3
California	144,157	9.0	4.1	4.9	7.9	2.9	5.0	9.7	4.7	4.9
Colorado	9,211	25.8	8.2	17.6	24.8	6.3	18.6	26.6	9.8	16.8
Connecticut	5,556	6.9	2.4	4.4	6.4	1.7	4.8	7.2	3.0	4.2
Delaware	1,660	3.9	1.8	2.0	3.3	1.0	2.3	4.2	2.4	1.9
District of Columbia	2,116	17.9	5.0	12.9	14.9	2.7	12.2	20.3	6.9	13.4
Florida	22,027	2.5	2.0	0.5	1.8	1.3	0.6	3.1	2.6	0.5
Georgia	18,016	4.1	1.2	2.9	3.6	0.7	3.0	4.5	1.7	2.8
Hawaii	2,787	14.4	2.2	12.2	13.0	1.1	11.9	16.0	3.5	12.5
Idaho	3,539	3.6	2.9	0.7	1.9	1.5	0.4	5.3	4.3	0.9
Illinois	13,613	7.7	2.9	4.8	6.6	1.8	4.9	8.4	3.8	4.7
Indiana	4,539	1.5	0.7	0.9	1.1	0.6	0.5	1.8	0.7	1.1
Iowa	9,402	16.6	3.2	13.4	17.7	2.2	15.5	15.7	4.0	11.7
Kansas	3,890	3.1	1.8	1.3	2.8	1.5	1.4	3.3	2.0	1.3
Kentucky	8,787	2.6	0.5	2.1	2.9	0.1	2.8	2.4	0.7	1.7
Louisiana	5,708	3.7	0.6	3.1	3.6	0.2	3.5	3.7	0.9	2.9
Maine	3,673	9.5	4.6	4.8	9.0	3.3	5.7	9.9	5.9	4.0
Maryland	8,436	8.3	3.3	5.0	7.5	2.1	5.5	9.0	4.4	4.6
Massachusetts	8,905	9.0	3.5	5.4	7.0	2.1	4.9	10.7	4.8	5.9
Michigan	15,165	3.3	1.2	2.1	3.2	0.9	2.4	3.4	1.5	1.9
Minnesota	8,258	8.8	2.5	6.3	9.5	1.4	8.2	8.4	3.1	5.3
Mississippi	12,089	0.7	0.5	0.2	0.4	0.3	0.1	0.9	0.7	0.3
Missouri	9,146	3.8	0.9	2.9	4.2	0.7	3.5	3.4	1.1	2.2
Montana	4,382	3.0	1.5	1.5	2.7	1.0	1.7	3.2	1.9	1.2
Nebraska	2,887	7.2	3.1	4.1	6.2	2.0	4.2	7.8	3.8	4.0
Nevada	2,747	3.8	2.1	1.7	2.4	1.2	1.3	5.0	2.9	2.0
New Hampshire	2,982	10.6	5.2	5.4	10.1	3.7	6.4	11.0	6.4	4.6
New Jersey	10,519	2.1	1.6	0.5	1.4	1.0	0.5	2.5	2.0	0.5
New Mexico	5,064	7.4	2.2	5.3	5.0	1.2	3.8	9.5	3.0	6.5
New York	43,748	8.5	4.8	3.7	8.0	3.8	4.1	8.9	5.5	3.4
North Carolina	16,584	7.4	2.8	4.6	7.0	1.8	5.2	7.7	3.5	4.2
North Dakota	1,661	3.5	1.2	2.3	4.4	0.9	3.4	2.9	1.4	1.6
Ohio	12,599	5.2	1.7	3.5	5.3	1.2	4.1	5.2	2.2	3.0
Oklahoma	10,438	10.0	1.4	8.6	10.1	0.9	9.1	10.0	1.9	8.1
Oregon	9,949	11.0	4.5	6.5	10.4	3.3	7.1	11.5	5.7	5.8
Pennsylvania	36,229	3.1	1.2	1.9	2.8	1.0	1.8	3.4	1.4	2.0
Rhode Island	2,706	11.6	5.4	6.2	10.8	3.3	7.5	12.2	6.9	5.4
South Carolina	10,316	6.5	1.8	4.7	6.8	1.5	5.3	6.4	1.9	4.5
South Dakota	1,564	2.2	1.5	0.8	1.6	0.9	0.7	2.6	1.8	0.8
Tennessee	17,370	5.8	1.2	4.5	6.2	0.7	5.5	5.4	1.6	3.8
Texas	18,583	9.1	2.6	6.5	8.2	1.8	6.4	9.7	3.2	6.5
Utah	6,679	3.5	2.5	1.0	2.8	1.6	1.2	3.9	3.0	0.9
Vermont	1,532	13.8	4.2	9.5	13.4	2.3	11.1	14.1	5.9	8.3
Virginia	11,620	7.3	1.7	5.6	7.7	1.9	5.8	7.1	1.6	5.5
Washington	14,457	11.2	5.2	6.1	10.6	4.2	6.4	11.7	5.9	5.8

See table footnotes on next page.

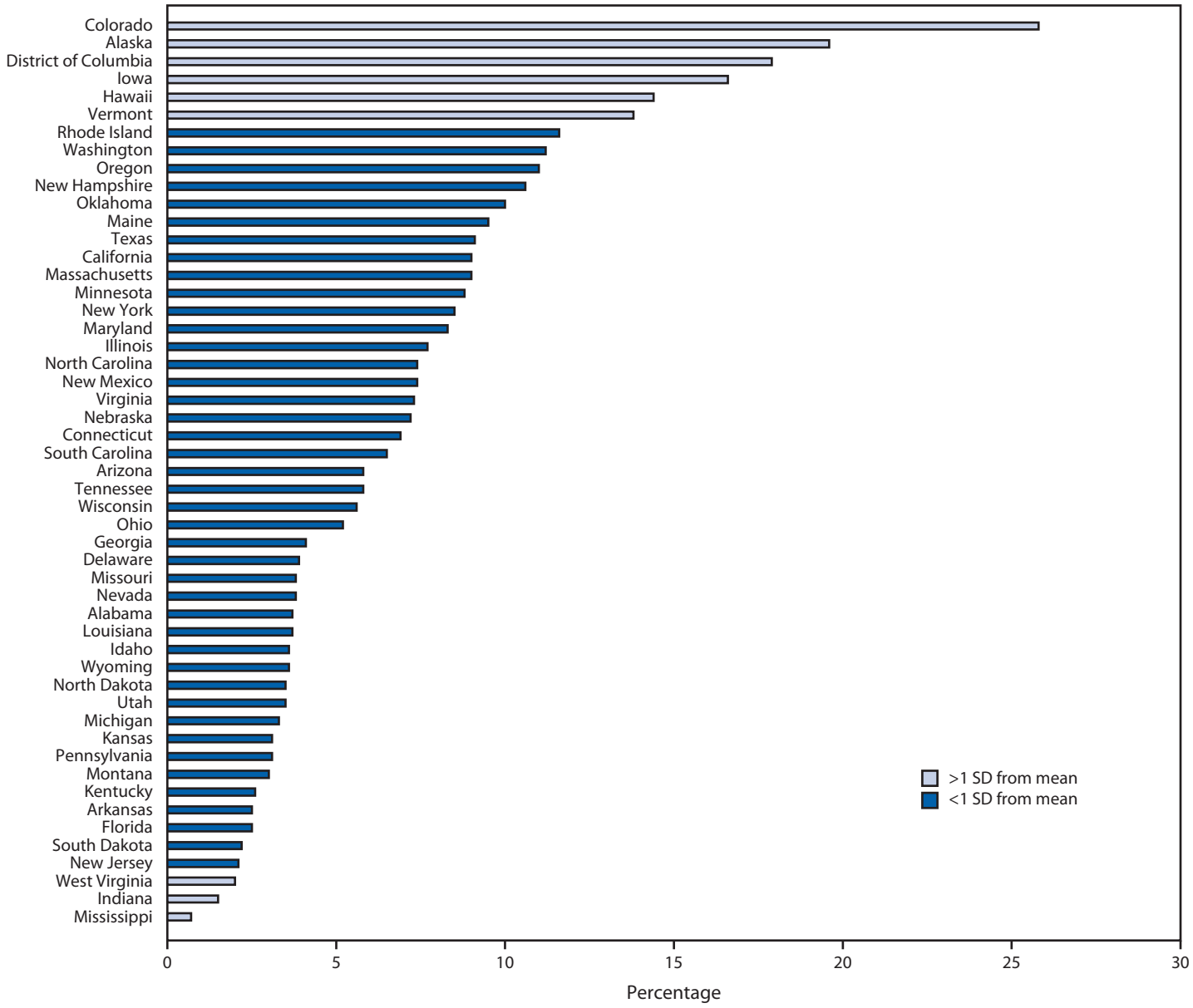
TABLE. (*Continued*) Percentage of female Title X clients aged 15–19 years using long-acting reversible contraception (LARC), by age group, type of service site, region, and state — Family Planning Annual Report, United States, 2013

Characteristic	No.	% using LARC								
		15–19 yrs			15–17 yrs			18–19 yrs		
		Total	IUD	Implant	Total	IUD	Implant	Total	IUD	Implant
West Virginia	9,458	2.0	1.0	1.0	1.8	0.7	1.1	2.2	1.3	0.9
Wisconsin	6,635	5.6	2.0	3.6	4.7	0.9	3.8	6.1	2.6	3.5
Wyoming	1,834	3.6	0.8	2.8	3.0	0.4	2.6	4.1	1.2	2.9

Abbreviations: IUD = intrauterine device; FQHC = federally qualified health center.

* *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont. *Midwest:* Illinois, Iowa, Indiana, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin. *South:* Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Texas, Tennessee, Virginia, West Virginia. *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming.

FIGURE 3. Percentage of female teens aged 15–19 years using long-acting reversible contraception (LARC) among those seeking contraceptive services at Title X service sites, by state — United States, 2013



Abbreviation: SD = standard deviation.

effective methods among teens seeking contraceptive services declined. Given the estimated 4.4 million sexually experienced female teens in the United States (*9*), and the high effectiveness, safety and ease of using LARC, continued efforts are needed to increase access and availability of these methods for teens.

CDC, in partnership with the U.S. Department of Health and Human Services' Office of Population Affairs, recently issued recommendations for providing quality family planning services, based on the Title X program's guidance for direct service delivery (*20*). These recommendations outline a client-centered approach for contraceptive counseling, in which a client's reproductive life plan, social needs, and contraceptive preferences are discussed along with medical information to identify acceptable methods for the client. By recommending that the most effective methods be discussed first, these recommendations promote increased awareness of LARC. In concurrence with statements from the American College of Obstetricians and Gynecologists and the American Academy of Pediatrics, these recommendations also emphasize the need to include information on the use of condoms for teens to reduce the risk for sexually transmitted diseases (*13*,*14*). Despite the long-term protection provided by LARC, it is important that teens have frequent follow-up to reinforce healthy decision-making, promote problem-solving regarding contraceptive continuation and sexually transmitted disease prevention, and receive other preventive health services (*13*).

Three other initiatives (*21–23*) have facilitated use of LARC among reproductive aged women, including teens, by underscoring the importance of educating providers that LARC is medically safe for teens (*12*), training providers on LARC insertion and use of a client-centered counseling approach that includes discussing the most effective contraceptive methods first (*20*), and providing contraception at reduced or no cost to the client. These efforts have increased the percentage of teens and young women selecting LARC as their preferred option for contraception and have been associated with declines in teen pregnancies, births, and abortions (*21*,*22*).

The findings of this report suggest that implants, as compared with IUDs, accounted for a greater proportion of the increase in use of LARC among teens seeking contraceptive services at Title X service sites. However, national surveys indicate that more service sites, whether privately or publicly funded, offer IUDs than implants on-site (*24–26*). To meet the increasing demand for implants by teens, providers should consider increasing on-site availability and affordability of implants.

This report documents that use of LARC among females aged 15–19 years seeking contraception through Title X was highest at services sites that focused primarily on delivering family planning services. This finding is consistent with a recent study of publicly funded clinics, in which those primarily focusing on family planning (compared with those focusing on primary care) offered more methods on-site, including IUDs and implants (*24*). Additionally, a 2011 survey of Federally Qualified Health Centers found that a higher percentage of centers receiving Title X funding (compared with those not receiving funding) offered IUDs and implants on-site (*25*). Together, these findings suggest the importance of providing quality contraceptive services, regardless of setting, to ensure that the contraceptive needs of teens are met.

The considerable state-specific variation observed in the prevalence of LARC use suggests that state-based policies and programs might also influence teen use of LARC. Over the past two decades, many states have expanded eligibility for Medicaid coverage of family planning services. Currently 25 states grant coverage solely on the basis of income, and in 20 states this expansion includes persons aged <19 years (*27*). Recent surveys have found that Title X service sites in states with Medicaid family planning expansions (compared with those without such expansions) are more likely to provide LARC on-site, report fewer cost-related difficulties obtaining LARC, have extended weekend and evening hours, have a higher percentage of clients paying for services with Medicaid, and assist clients with Medicaid enrollment (*24*).

The findings in this report are subject to at least three limitations. First, to minimize data collection burden for Title X grantees, only summary information on a limited number of client characteristics is requested for the Family Planning Annual Report. This limits the type of questions than can be addressed. For example, it is currently not possible to examine the use of the primary contraceptive method, including LARC, by factors such as race or ethnicity. Second, the use of existing clinic records might have been subject to error regarding the primary contraceptive method provided to teens; however, such records circumvent many of the biases associated with relying on self-report for sensitive behaviors. Finally, the Title X service sites provide care to those from underserved, primarily low-income communities nationwide, including teens, and might not be generalizable to the population of teens nationally. However, given the higher rates of unintended pregnancy among teens and low-income women (*28*), Title X data offer important information on a population with a high need for increased access to contraceptive services, including LARC.

This report documents increasing use of LARC among teens seeking contraceptive services at Title X service sites during the past decade. Approximately one out of every 14 teen clients seeking contraceptive services chose LARC as their preferred method. The type of data presented in this report can help identify areas where barriers remain and guide interventions to increase access to and awareness of LARC among teens. Removing barriers to LARC by educating providers that LARC

is medically safe for teens, training providers on LARC insertion and a client-centered counseling approach that includes discussing the most effective contraceptive methods first, and providing contraception at reduced or no cost to the client, can increase the array of options available to teens and may contribute to the continuing declines in teen pregnancy in the United States.

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Announcements

National Public Health Week — April 6–12, 2015

Every year since 1995, the American Public Health Association has led the observation of National Public Health Week in the United States during the first full week of April. The goal of National Public Health Week is to acknowledge contributions made by public health and to raise awareness of issues important to improving the nation's health. This year's observance (April 6–12) focuses on making the United States the Healthiest Nation in One Generation by 2030. Additional information about this year's observance is available at http://www.nphw.org.

In conjunction with this year's observance, CDC is partnering with the American Public Health Association to promote daily themes for National Public Health Week, by sharing information on CDC topics that align with each day's theme. Additional information available at http://www.cdc.gov/features/public-health-week/.

National Infant Immunization Week — April 18–25, 2015

National Infant Immunization Week (NIIW) is April 18–25, 2015. This annual observance promotes the benefits of childhood immunizations and their role in improving the health of children aged ≤2 years. Since 1994, local and state health departments, immunization partners, health care professionals, community leaders, clinicians from across the United States, and CDC have come together to highlight the importance of vaccination in the lives of infants and children.

Although immunization coverage among children remains at high levels, recent outbreaks of measles in the United States highlight the importance of maintaining high immunization rates. NIIW provides an opportunity to celebrate immunization achievements, recognize partners and volunteers dedicated to childhood immunization, and revitalize community efforts to maintain high vaccination levels.

During NIIW, local and state health departments, national immunization partners, and health care professionals will host events and educational activities for parents and clinicians. To help with planning these activities, various promotional and educational materials are available from CDC on the NIIW website.* Also available are materials from CDC's new *Born with Protection* campaign,† which promotes whooping cough vaccination during the third trimester of each pregnancy to help protect babies during their first few months of life when they are most vulnerable.

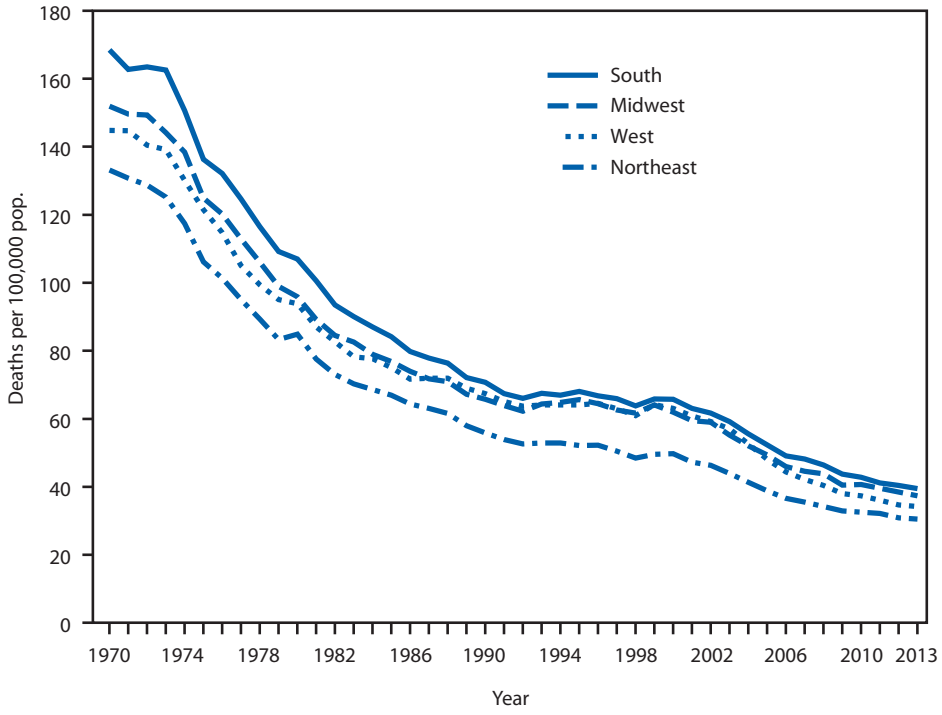
* Additional information available at http://www.cdc.gov/vaccines/events/niiw/index.html.

† Additional information available at http://www.cdc.gov/pertussis/pregnant/index.html.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Age–Adjusted Death Rates* for Stroke,† by U.S. Census Region§ — United States, 1970–2013



* Per 100,000 standard population.

† Stroke cases are identified using underlying cause of death with codes 430-438 (1970–1998), and I60–I69 (1999–2013) in the *International Classification of Diseases, Eighth, Ninth and Tenth Revisions*. ICD-10 replaced ICD-9 in 1999, and its new classification scheme has had a net effect of increasing counts of stroke as an underlying cause of death by about 6% starting that year.

§ *Northeast:* Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, New Jersey, New York, Pennsylvania, and Vermont; *Midwest:* Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South:* Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Mississippi, Maryland, North Carolina, Oklahoma, South Carolina, Virginia, Tennessee, Texas, West Virginia, and District of Columbia; *West:* Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The age-adjusted death rates for stroke in all U.S. Census regions in the United States generally decreased from 1970 to 2013, although the rates in all regions were relatively stable from 1992 to 1999. From 1970 to 2013, the rate decreased an average of 3.3% per year in the South, 3.2% in the Midwest, 3.3% in the West, and 3.4% in the Northeast. Throughout the period, the rate was the highest in the South and lowest in the Northeast region.

Source: National Vital Statistics System. Mortality public use data files, 1970–2013. Available at http://www.cdc.gov/nchs/data_access/vitalstatsonline.htm.

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