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Injuries from Batteries Among Children Aged <13 Years — United States, 1995–2010

Injuries to children caused by batteries have been documented in the medical literature and by poison control centers for decades (*1,2*). Of particular concern is the ingestion of button batteries,* especially those ≥20 mm in diameter (coin size), which can lodge in the esophagus, leading to serious complications or death (*3–5*). To estimate the number of nonfatal battery injuries among children aged <13 years, U.S. Consumer Product Safety Commission (CPSC) staff analyzed 1997–2010 data from the National Electronic Injury Surveillance System (NEISS). To identify fatal battery exposures, other CPSC databases covering 1995–2010 were examined, including the 1) Injury and Potential Injury Incident File; 2) Death Certificate Database (DTHS); and 3) In-Depth Investigation File (INDP). From 1997 to 2010, an estimated 40,400 children aged <13 years were treated in hospital emergency departments (EDs) for battery-related injuries, including confirmed or possible battery ingestions. Nearly three quarters of the injuries involved children aged ≤4 years; 10% required hospitalization. Battery type was reported for 69% of cases, and of those, button batteries were implicated in 58%. Fourteen fatal injuries were identified in children ranging in age from 7 months to 3 years during 1995–2010. Battery type was reported in 12 of these cases; all involved button batteries. CPSC is urging the electronics industry and battery manufacturers to develop warnings and industry standards to prevent serious injuries and deaths from button batteries. Additionally, public health and health-care providers can encourage parents to keep button batteries and products containing accessible button batteries (e.g., remote controls) away from young children.

NEISS data are collected from 96 hospitals, each with a minimum of six beds and a 24-hour ED (*6*), which are selected as a stratified probability sample of all hospitals in the United States and its territories.† To obtain national estimates, a sample weight is assigned to each case based on the inverse probability of selection for the sample. NEISS cases were identified using product codes 884 (batteries), 891 (unspecified batteries), and 892 (non–motor-vehicle batteries).§ Battery exposures described in this report include battery ingestion (i.e., an oral exposure), batteries placed in the nose, and acid burns from ruptured batteries. Narratives were examined to exclude cases not meeting this definition (e.g., injuries sustained [such as scalp laceration] from being physically hit with a battery and suspected ingestions that were ruled out by radiographs or other means). Cases identified as confirmed oral exposures included those 1) with a diagnosis of foreign body ingestion; 2) confirmed by radiography or a battery found in the stool; and 3) with an affirmative statement in the narrative of a child swallowing, chewing, or sucking on a battery. Other cases that could not be confirmed as battery ingestions, but could not be excluded as noningestions, also were included. NEISS narratives for these types of cases included the following language:

* Generally, a battery with a diameter greater than its height is referred to as button or coin-size, depending on its width (e.g., a button battery with the width of a nickel coin is approximately 21 mm in diameter).

† Hospital EDs are grouped into five strata, with four based on size (i.e., annual number of ED visits) and a fifth representing children's hospitals.

§ Battery types include button and cylindrical (e.g., AA, AAA, C, and D).

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1) "possibly" or "might have" ingested/swallowed; or 2) suspected ingestion. Of the total 40,400 estimated cases, 3,900 were unconfirmed ingestions that could not be positively excluded.

The Injury and Potential Injury Incident File is a database consisting of injury or potential injury reports to CPSC from various sources, including news clips, consumer complaints, and medical examiners and coroners. The INDP file provides incident details from follow-up interviews with patients and witnesses. The DTHS database collects death certificates for certain causes of death from 50 states, New York City, the District of Columbia, and some U.S. territories.¶

During 1997–2010, an estimated 40,400 children aged <13 years were treated in hospital EDs for battery-related injuries (Table 1).** Moreover, a statistically significant increasing trend was observed in the yearly estimates ($p<0.001$), with a 2.5-fold increase in these cases, from 1,900 in 1998 to 4,800 in 2010 (Figure).†† Most of the children were treated and released or examined and released without treatment; approximately 10% required hospitalization. Nearly 72% of all the estimated exposures seen in EDs involved children aged ≤4 years. The battery was identified for 69% of the estimated injuries and among those, 58% of injuries were caused by button-type batteries and 11% by cylindrical batteries. The battery source was identified in 17% of the NEISS cases and included toys, flashlights, remote controls, watches, hearing aids, and light-up jewelry.

Additional CPSC databases covering 1995–2010 were searched for battery-related deaths in children aged <13 years, resulting in the identification of 14 battery-related deaths, all involving children aged <4 years (Table 2). Thirteen deaths occurred during 2002–2010, with only one documented earlier, in 1998. Button-type batteries were involved in 12 deaths, with 10 described as coin, disc, or flat round batteries and four of these specifically associated with 20-mm, 3-volt lithium batteries such as the CR2032.§§ The remaining two deaths likely were associated with button types because of similarities in the incident scenarios (e.g., nonspecific symptoms with delayed diagnosis or a battery lodged in the esophagus) or causes of death (e.g., esophageal perforation with bleeding).

In four of the fatal cases, patients were misdiagnosed and released, delaying identification and treatment (Table 2). For example, a boy, aged 2 years, was treated and released from the ED for coughing/choking episodes and abdominal pain (Table 2 [case 3]). Eight days later, he was brought back to the ED unconscious and in respiratory distress. He subsequently

¶ Death certificate collection takes time. As of July 2011, DTHS was considered 97% complete for 2007, 87% complete for 2008, 73% complete for 2009, and 34% complete for 2010.

** CPSC staff did not analyze NEISS data from 1995 to 1996 because the sample frame and sample changed in 1997.

†† NEISS data for 1997 were not sufficient to provide a reliable estimate. The trend analysis was an F-test of the year effect on the estimates adjusted for changes in the population.

§§ The designation CR2032 defines a 3-volt lithium battery that is 20 mm in diameter (approximately the size of a nickel) with a height of 3.2 mm.

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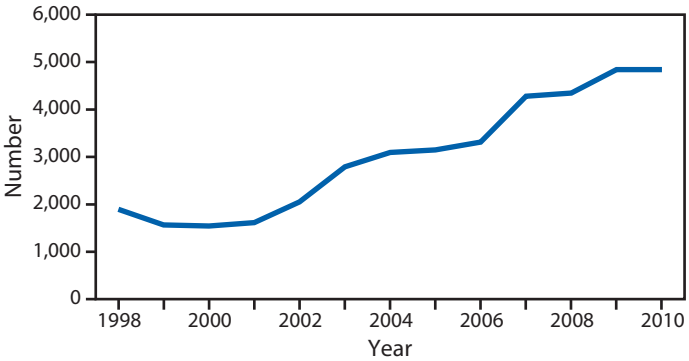
TABLE 1. Estimated number of emergency department–treated battery injuries involving children aged <13 years, by selected characteristics — National Electronic Injury Surveillance System (NEISS), United States, 1997–2010*

Characteristic	Injuries No.	Injuries (95% CI)
Age group (yrs)		
<1	3,100	(2,000–4,200)
1	9,700	(7,600–11,800)
2	6,600	(4,800–8,300)
3	5,400	(4,100–6,700)
4	4,400	(2,900–5,900)
5–8	7,900	(5,900–9,900)
9–12	3,300	(2,100–4,500)
Sex		
Male	23,500	(18,100–28,900)
Female	16,900	(13,600–20,200)
Disposition†		
Treated and released	32,200	(28,500–44,000)
Hospitalized	3,900	(2,700-5,200)
Battery type		
Button	23,400	(18,000–28,700)
Cylindrical	4,600	(3,400–5,700)
Unknown	12,400	(9,300–15,600)
Total§	**40,400**¶	**(32,100–48,700)**

Abbreviation: CI = confidence interval.
* All the estimates and 95% CIs are rounded to the nearest 100.
† Those who left against medical advice were not included because the number of observations was not sufficient for a reliable estimate.
§ Categories might not sum to totals because of rounding.
¶ Of the total estimated cases, 3,900 were unconfirmed ingestions that could not be positively excluded.

FIGURE. Estimated annual number of emergency department–treated battery injuries involving children aged <13 years — National Electronic Injury Surveillance System (NEISS), United States, 1998–2010*



* NEISS data for 1997 were not sufficient to provide a reliable estimate.

died from bleeding associated with a perforated esophagus and aorta caused by ingestion of a round, flat battery from a remote control. Additionally, in three cases previously reported (*4*; National Battery Ingestion Hotline database, unpublished data, 2012), children sent home after battery removal suffered a fatal hemorrhage several days to weeks later (Table 2 [cases 4, 9, and 10]).

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Editorial Note

The findings in this report highlight the growing problem of battery ingestions, especially of button batteries, by children aged <13 years. As the use of these batteries expands, so do the estimated number of ED-treated battery exposures in children, with the vast majority of these involving ingestions. This information is consistent with recent reports showing an increase in severe or fatal outcomes with button battery ingestions from 1985 to 2009 (*7*). At least five deaths identified in this report appear to be documented in the National Battery Ingestion Hotline database.¶¶

Three proposed mechanisms of battery-induced injury include 1) leakage of caustic alkaline electrolyte; 2) ischemic necrosis caused by direct pressure; and 3) production of an external electrolytic current that hydrolyzes tissue fluids, creating hydroxide at the negative pole (*4,5,7*). Medical experts have attributed severe injuries and death to the latter mechanism when button batteries get lodged in the esophagus rather than passing through the gastrointestinal tract (*3,7*). Another complicating factor arises when incidents are not witnessed or the diagnosis or treatment of battery ingestion is delayed as it was in at least nine of the 14 fatal cases (Table 2).

Typical symptoms associated with battery ingestion are relatively nonspecific, making the diagnosis difficult, particularly when ingestions go unwitnessed. These include vomiting, abdominal pain, fever, diarrhea, respiratory distress, and dysphagia (*5*). Serious complications and death are associated most frequently with 3-volt lithium, coin-size batteries ≥20 mm in diameter (*7*). Since a battery lodged in the esophagus can cause serious burns in only 2 hours, and fatal hemorrhage has occurred >2 weeks after endoscopic removal, health-care providers have developed management guidelines for button battery ingestion (*3*).***

To protect children, the CPSC sets safety standards for toys. Under Section 106 of the Consumer Product Safety Improvement Act of 2008,††† the American Society for Testing

¶¶ Database available at http://www.poison.org/battery. Possible duplicate cases cannot be confirmed without more detailed incident information.
*** Additional information available at http://www.poison.org/battery/guideline.asp.
††† Additional information available at http://www.cpsc.gov/about/cpsia/cpsia.html.

TABLE 2. Summary characteristics of battery ingestion deaths in children — selected databases, United States, 1995–2010*

Case	Age	Sex	Year	Battery type	Intended use	Location	Symptoms	Cause of death	Incident information
1	16 mos	Female	1998	Disc	Unknown	Esophagus	Unknown	Exsanguination/ arterio-esophageal fistula	Unknown
2	15 mos	Female	2002	3-volt lithium CR2016	Possibly a toy watch	Proximal esophagus	Vomiting, black stools, hemorrhaging	Exsanguination/ aortic-esophageal fistula	Became symptomatic >5 hours after ingestion. Battery identified by radiograph approximately 19 hours after symptoms developed. Child died approximately 13 hours after battery removal.
3	2 yrs	Male	2004	Flat round	Radio remote control	Esophagus	Coughing, choking, abdominal pain, respiratory distress, unconscious	Exsanguination and perforation of esophagus and aorta	Child treated and released from emergency department (ED) for coughing/choking episode and abdominal pain. Returned 8 days later unconscious and in respiratory distress, and died.
4	19 mos	Male	2005	Button size	Garage door opener	Esophagus and stomach	Difficulty breathing, pneumonia, listless, diaphoretic	Hemorrhagic shock/ aorto-esophageal fistula	Became symptomatic approximately 1 day after batteries discarded in trash (suspected that child retrieved from there). At ED, a radiograph showed one battery each in stomach and esophagus. Both removed. Child released, but returned to hospital approximately 1 week later and died during exploratory surgery.
5	1 yr	Male	2006	Alkaline	Remote car alarm	Esophagus	Fever, loss of appetite, suspected croup	Anoxic encephalopathy from complications of a tracheo-esophageal fistula.	Child taken to hospital after 2 days with fever. Diagnosed with croup and sent home. Two days later returned to hospital, where a radiograph showed a battery in the esophagus. Battery removed, but child died 6 days later.
6	7 mos	Female	2007	Disc	Unknown	Esophagus	Unknown	Massive hematemesis/ Acute fistulous erosion of preexisting esophageal ulcer into carotid artery	No details. Esophagoscopic removal of battery.
7	16 mos	Female	2008	Disc	Unknown	Esophagus	Unknown	Hemorrhagic shock/ esophageal erosion with hemorrhage	Unknown
8	2 yrs	Male	2009	Watch	Unknown		Unknown	Acute hemorrhage/ esophageal ulceration	Unknown
9	2 yrs	Female	2009	3-volt lithium CR2032	Hand held game	Esophagus	Chest/Stomach pain, vomiting blood	Gastroesophageal hemorrhage/ aorto-esophageal fistula	Child taken to hospital for chest pain. Radiograph showed battery in esophagus. After removal, symptoms continued and child died 18–19 days later.
10	13 mos	Male	2009	3-volt lithium CR2032	Unknown	Esophagus/ stomach	Influenza-like symptoms, altered eating habits, inability to retain food, hemorrhaging	Esophageal ulceration/ tracheo-esophago-aortic fistula	Child diagnosed with a viral infection after several doctor visits. After lack of improvement, an initial radiograph was negative, but 1 week later, a battery was identified in the stomach, which was surgically removed, and child was released without complications. Child hemorrhaged to death 2 days later.
11	3 yrs	Female	2009	Coin	Unknown	Mid-trachea	Unknown	Bronchopneumonia and blood aspiration	Unknown
12	2 yrs	Female	2010	Flat, round disc	Unknown	Upper thoracic esophagus	Sore throat, dysphagia, choking, shortness of breath, tachypneic, dark bowel movements, listless	Esophageal perforation/ bleeding	Child with sore throat treated for strep by pediatrician. Taken to ED 5 days later, where a radiograph identified a foreign object lodged in the esophagus. Battery removed in hospital, where child died 2 days later.
13	2 yrs	Female	2010	CR2023†	Unknown	Clot in stomach	Feeling ill, vomiting blood	Cardiovascular collapse attributed to esophageal damage, necrosis, and hemorrhage	Ingestion time unknown, but child became ill and vomited blood. After transfer from initial hospital, her condition deteriorated, and endoscopy showed an esophageal tear. Died at hospital.
14	2 yrs	Female	2010	Unknown	Unknown	Abdomen	Coughing blood, unresponsive	Esophageal perforation	Child at daycare when she began coughing blood and became unresponsive. Chest radiograph showed an eroded battery. Ingestion time unknown.

* U.S. Consumer Product Safety Commission staff members searched non–National Electronic Injury Surveillance System databases for the period 1995–2010 and found no deaths before 1998. Databases included 1) Injury and Potential Injury Incident File; 2) Death Certificate Database; and 3) In-Depth Investigation File.

† Whether the battery identified in this medical examiner/coroner report (CR2023) exists is unclear; the last two digits might have been transposed.

and Materials (ASTM) international voluntary standard for toy safety, known as F963-11, became mandatory. ASTM F963-11 requires that batteries be inaccessible (e.g., secured in compartments with screws) in all toys intended for children aged <3 years and in all toys using batteries that fit within the small parts test cylinder[§§§] for children aged <12 years. The latter requirement recognizes that smaller batteries, which can be easily ingested, should be kept inaccessible to all children and that older siblings might leave their toys accessible to younger siblings. Recently, ASTM issued a new safety standard for children's jewelry, F2923-11, which has a similar requirement to prevent button battery access by children.[¶¶¶] Legislation also is under consideration in Congress to address the potential risk of unintentional ingestion of button cell batteries by requiring that child-resistant battery compartment closures are used on all consumer products using button cell batteries. Measures that might protect children from battery-related injuries include child-resistant packaging for batteries, changing to child-resistant closures on all consumer products that use button batteries, and warnings regarding the dangers of ingestion on packages of button cell batteries and in literature accompanying all consumer products that use button cell batteries. At least three deaths in this report involved devices not intended for use by small children. Additionally, increased public awareness through public health and health-care providers could reduce exposure to and injuries from these batteries.

The findings in this report are subject to at least three limitations. First, NEISS case narratives are brief, and detailed information is not always provided unless a follow-up investigation is conducted. Second, NEISS documents only ED visits; it does not capture incidents involving untreated persons or patients treated in doctors' offices or outpatient facilities. Finally, the fatality data in this report are a case series based on available CPSC databases and might underrepresent the extent of the problem.

Parents and caregivers should be aware of the potential hazards associated with battery exposure (particularly ingestion of button batteries) and ensure that products containing them are either kept away from children or that the batteries are secured safely in the product.[****] Because delays in diagnosis and treatment can lead to serious complications and death, children suspected of having ingested a battery should get prompt medical attention. It is also important to recognize that children might be reluctant or unable to say that they ingested a battery or gave one to a sibling. Additional battery hazard information is available at http://www.cpsc.gov/cpscpub/prerel/prhtml11/11181.html.[††††]

What is already known on this topic?

Injuries to children caused by batteries have been documented in the medical literature and by poison control centers for decades. Of particular concern is the ingestion of button batteries, especially those ≥20 mm in diameter (coin size), which can lodge in the esophagus, leading to serious complications or death.

What is added by this report?

During 1997–2010, an estimated 40,400 children aged <13 years were treated in hospital emergency departments for battery-related injuries. Nearly three quarters of the injuries involved children aged ≤4 years; 10% required hospitalization. Moreover, a 2.5-fold increase in these cases was observed from 1998 to 2010. Fourteen battery-related fatalities were identified, all in children aged <4 years. Button batteries were confirmed to be involved in 12 of the 14 cases.

What are the implications for public health practice?

To improve medical outcomes, health-care providers should be aware of the injuries associated with ingestion of button cell batteries. Given the increasing use of such batteries, public health and health-care providers should include warnings of the dangers of button cell battery exposures when counseling parents. To prevent serious injury and death, button batteries and products containing button batteries (e.g., remote controls) should be kept away from young children unless the batteries are secured safely in the product.

[§§§] Specifications for the small parts test cylinder are described in 16 CFR § 1501.4. Additional information available at http://www.cpsc.gov/businfo/regsumsmallparts.pdf.

[¶¶¶] Additional information available at http://www.astmnewsroom.org/default.aspx?pageid=2620.

[****] Additional information available at http://www.poison.org/battery/tips.asp.

[††††] Three deaths in children associated with battery ingestion occurred since the compilation of data for this report. Two cases were identified in 2011. The first case involved a boy aged 3 years who died after ingesting a button battery. The battery became impacted in his esophagus and caused acute esophageal bleeding because of an esophageal-aortic fistula. In the second case, a girl aged 13 months died after she swallowed a 2-cm (or 20-mm) watch battery and it lodged in her esophagus. Most recently, in 2012, a boy aged 4 years died after complications from swallowing a button battery. The boy complained of pain in his throat 4 days after reportedly swallowing a battery, and a battery was located in his stomach and removed without incident. The boy remained in the hospital and suffered complications, including an esophageal leak. He died 32 days after ingestion of the button battery.

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Increases in Quitline Calls and Smoking Cessation Website Visitors During a National Tobacco Education Campaign — March 19–June 10, 2012

Mass media campaigns and telephone quitlines are effective in increasing cessation rates among cigarette smokers (*1–5*). During March 19–June 10, 2012, CDC aired Tips from Former Smokers (TIPS), the first federally funded, nationwide, paid-media tobacco education campaign in the United States. The TIPS campaign featured former smokers talking about their experiences living with diseases caused by smoking. The campaign was primarily intended to encourage adult smokers aged 18–54 years to quit by making them aware of the health damage caused by smoking and letting them know that they could call the telephone quitline portal 1-800-QUIT-NOW or visit the National Cancer Institute (NCI) smoking cessation website (http://www.smokefree.gov) if they needed free help to quit. The campaign included advertising on national and local cable television, local radio, online media, and billboards, and in movie theaters, transit venues, and print media. To determine the effects of the TIPS campaign on weekly quitline call volume and weekly unique visitors to the cessation website, CDC analyzed call and visitor data immediately before, during, and immediately after the campaign period and compared them with data from the corresponding weeks in 2011. This report summarizes the results of that analysis, which found that the number of weekly calls to the quitline from the 50 states, the District of Columbia, Guam, and Puerto Rico increased 132% (207,519 additional calls) during the TIPS campaign, and the number of unique visitors to the cessation website increased 428% (510,571 additional unique visitors). These results indicate that many smokers are interested in quitting and learning more about cessation assistance, and will respond to motivational messages that include an offer of help.

The distribution of the TIPS campaign advertising purchases included 80% for national advertising and 20% for additional advertising in media markets with higher-than-average adult smoking prevalence. The advertising was intended to reach approximately 87% of U.S. adults aged 18–54 years an average of 18 times each.* All television and radio advertisements included either the quitline portal number or the smoking cessation website address, each of which appeared on television for approximately 3 seconds while being read aloud.† CDC compared weekly quitline call volume and number of unique website visitors during the TIPS campaign period (March 19–June 10, 2012) with the corresponding weeks (March 21–June 12, 2011) in the previous year. Data on calls and unique website visitors were obtained from NCI. Call volume represented total attempted calls, not unique callers. Some persons might have both called the portal number and visited the NCI website. Data for the 2-week period May 30–June 12, 2011, (corresponding to approximately 15% of the 12-week baseline comparison period) were missing because of a database error, and therefore were imputed from the average weekly call volume during March 21–May 29, 2011. The number of unique visitors to the cessation website was obtained by NCI from Google Analytics.

Total call volume during the TIPS campaign was 365,194 calls, compared with 157,675 calls during the corresponding 12 weeks in 2011, for a total of 207,519 additional calls or a 132% increase (Figure 1). Compared with the corresponding weeks in 2011, weekly increases in calls during the campaign ranged from 86% to 160%. The website received 629,898 unique visitors during the TIPS campaign, compared with 119,327 during the same period in 2011, for a total of 510,571 additional unique visitors or a 428% increase (Figure 2). Weekly increases in visitors compared with the corresponding weeks in 2011 ranged from 355% to 484%. Altogether, compared with 2011 data, 718,090 additional calls and unique website visitors were received during the TIPS campaign.

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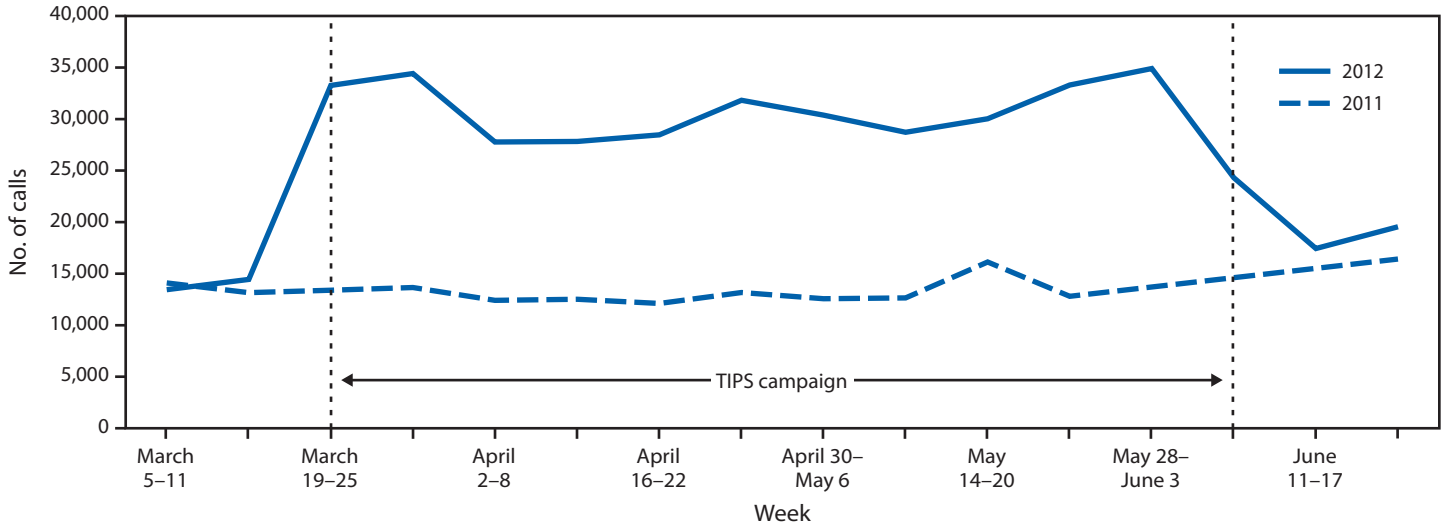
Editorial Note

Well-designed tobacco education media campaigns with adequate reach increase cessation and reduce tobacco use (*1–3*). Evidence reviews of tobacco education media campaigns have found that emotionally evocative advertisements that employ graphic images and personal testimonials showing the negative health consequences of smoking are especially effective in motivating smokers to quit (*2,3*). The findings from the analysis described in this report generally were consistent with results reported from campaigns conducted in U.S. states and other countries (*2,3*).

* Final, verified, gross rating point data are not yet available.

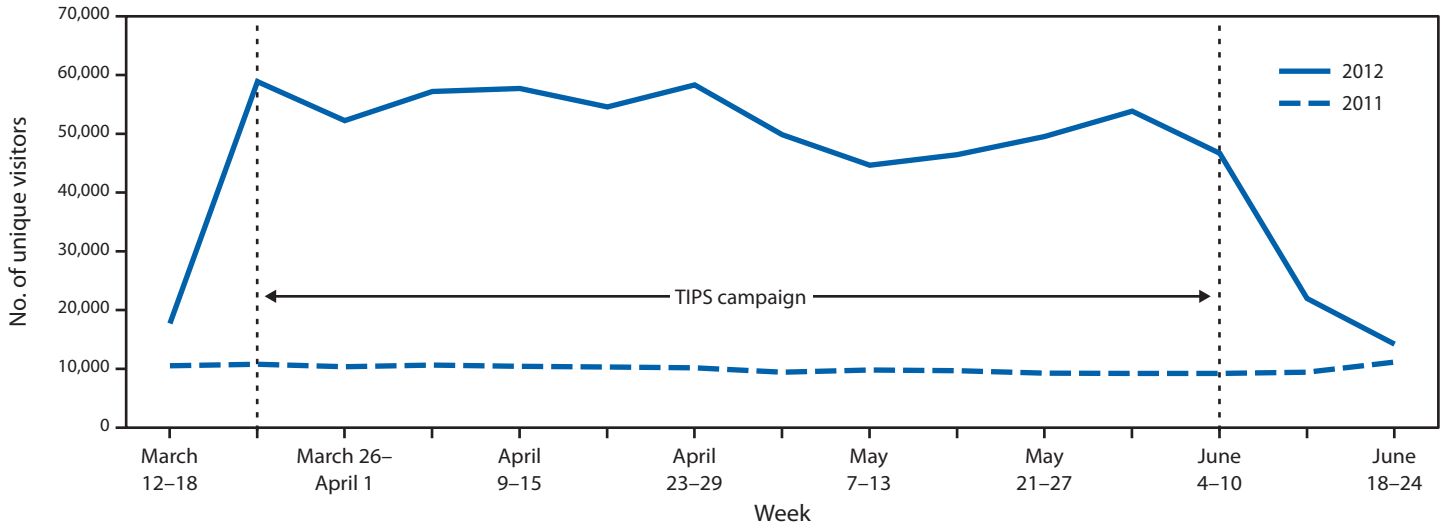
† Certain advertisements displayed other website addresses. For example, digital advertisements displayed http://www.cdc.gov/quitting/tips, and an asthma print advertisement with a secondhand smoke focus showed http://www.cdc.gov/tobacco in the English version and http://www.cdc.gov/español in the Spanish version.

FIGURE 1. Number of weekly telephone calls made to national portal to state tobacco quitlines before, during, and after CDC's Tips from Former Smokers Campaign (TIPS),* compared with 2011 calls — United States, March 5–June 24, 2012†



* TIPS was conducted during March 19–June 10, 2012.
† Data for May 30–June 19, 2011, were imputed using straight-line regression.

FIGURE 2. Number of weekly unique visitors to National Cancer Institute (NCI) smoking cessation website before, during, and after CDC's Tips from Former Smokers Campaign (TIPS),* compared with 2011 visitors — United States, March 12–June 24, 2012†



* TIPS was conducted during March 19–June 10, 2012.
† Data were collected by Google Analytics.

The TIPS campaign was based on previous research and formative testing indicating that an approach featuring testimonials from former smokers living with smoking-related diseases was memorable and believable, resonated well with both smokers and nonsmokers, and would encourage both of these groups to take action. The campaign was designed to have sufficient reach and frequency to be effective in encouraging change in smoking behaviors, in keeping with CDC recommendations (*5*). The primary long-term goals of the TIPS campaign were to generate at least 500,000 quit attempts and 50,000 successful quits. A short-term goal was to generate additional calls to state quitlines and additional visitors to the NCI smoking cessation website. The $54 million spent on the TIPS campaign is the equivalent of what cigarette manufacturers spend on advertising and promotion in 2 days.[§]

[§] Federal Trade Commission cigarette report for 2007 and 2008. Available at http://www.ftc.gov/reports/index.shtm#2011.

What is already known on this topic?

Mass media campaigns and telephone quitlines are effective in increasing smoking cessation.

What is added by this report?

The Tips from Former Smokers national tobacco education campaign conducted by CDC increased the number of calls to a national portal to state quitlines by 132%, compared with the corresponding period in 2011, resulting in an estimated 207,519 additional calls. The campaign also increased the number of unique visitors to a smoking cessation website by 428%, compared with the corresponding period in 2011, resulting in an estimated 510,571 additional unique visitors.

What are the implications for public health practice?

An evidence-based, emotionally evocative national tobacco education media campaign with adequate reach and frequency can substantially increase calls to state quitlines and the number of visitors to a cessation website.

Quitlines significantly increase rates of smoking cessation, compared with minimal interventions, self-help, or no counseling; a meta-analysis of nine studies estimated the odds of quitting as 1.6 to 1 (95% confidence interval = 1.4–1.8) (*4*). All 50 states and the District of Columbia have their own quitlines. Callers to the national 1-800-QUIT-NOW portal are transferred to their state quitlines. The quitline network is supported by NCI, which manages the national portal, and by CDC, which provides supplemental funding to state quitlines as part of its support for comprehensive state tobacco control programs, as well as providing funding to the North American Quitline Consortium. State quitlines provide a variety of services, including brief advice, counseling, medications, self-help materials, and referrals to other cessation resources (*6,7*). Services usually are provided by a contractor, which can be a public or private organization. The specific services provided vary by state and eligibility (*6*). State quitlines currently reach only 1%–2% of smokers, largely because most state tobacco control programs lack sufficient funding to provide and promote quitline services to more callers (*6,7*). CDC recommends that state quitlines reach 6%–8% of the state's smokers (*5*), a level that has been achieved in a few U.S. states where services and promotional activities have been funded consistently (*8*).

The NCI smoking cessation website is administered by NCI. The website provides practical advice and tools, such as a step-by-step quit guide, to assist smokers as they think about and prepare for quitting. Smokers interested in quitting also can access NCI's LiveHelp service to chat with a counselor or sign up for the SmokefreeTXT text-messaging cessation program.¶ Although the Community Preventive Services Task Force recently found mixed evidence of the effectiveness of Internet-based cessation programs, in part because of wide variation in the content provided, the Task Force concluded that text messaging is effective in increasing cessation (*1*).

Results of the analysis described in this report suggest that smokers have not been "saturated" by state media campaigns or other health information to the point that they no longer respond to tobacco education campaigns. These results also illustrate the significant untapped potential of state quitlines to reach more smokers, especially given that only about one fourth of the television advertisements included the quitline portal number.

The increase in calls to 1-800-QUIT-NOW suggests that the TIPS campaign likely will generate increases in smoking cessation over time. This effect would be expected to occur through two mechanisms. First, smokers who called quitlines and obtained free counseling and, in some cases, free cessation medications would increase their chances of quitting successfully. Second, because mass media campaigns that include information on cessation resources normalize quitting and make smokers aware that help with quitting is available should they need it, the campaigns increase the number of quit attempts and successful quits, even among smokers who never call the quitline (*7,9,10*). The fact that the TIPS campaign resulted in more than 700,000 additional calls to state quitlines and visits to a cessation website suggests that the campaign motivated many other smokers to try to quit without assistance or with other forms of assistance.

The findings in this report are subject to at least four limitations. First, this was a natural history time series analysis and did not control for other factors that could have contributed to the observed increases in call volume and unique website visitors from 2011 to 2012. However, the immediate sharp uptick in both calls and visits at the onset of the campaign and the rapid tailing-off in both calls and visits after the campaign ended are strongly suggestive of a causal relationship between the campaign and these increases. Second, the NCI data on calls reflect only the number of attempted calls that were received by NCI at the national portal. The disposition of the callers and the types of services received once the caller was transferred to state quitlines were not captured by this analysis. In addition, the data do not reflect calls that might have been received directly by some state quitlines through other telephone numbers. Third, the analysis did not correlate quitline calls or visits to the cessation website with exposure to TIPS campaign advertisements. Finally, some states scaled back or halted their own media efforts before the TIPS campaign to conserve funding and to avoid generating more calls

¶ Available at http://smokefree.gov/smokefreetxt.

than their quitlines could handle, which might have resulted in understating the campaign's effect.

This report indicates that an evidence-based national tobacco education media campaign with adequate reach and frequency can lead to substantial increases in calls to a national portal for state quitlines and unique visitors to a cessation website. The increase indicates that many smokers are interested in quitting and in finding out more about cessation assistance, and will respond to motivational messages that include an offer of help. This analysis provides additional evidence that, within the context of comprehensive tobacco control efforts, tobacco education media campaigns are an important intervention for increasing cessation.

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National and State Vaccination Coverage Among Adolescents Aged 13–17 Years — United States, 2011

Since 2005, the Advisory Committee on Immunization Practices (ACIP) has expanded the routine adolescent vaccination schedule with administration of the following vaccines at ages 11 or 12 years: meningococcal conjugate (MenACWY), 2 doses*; tetanus, diphtheria, acellular pertussis (Tdap), 1 dose; human papillomavirus (HPV), 3 doses; and influenza, 1 dose annually (*1*). To assess vaccination coverage among adolescents aged 13–17 years,† CDC analyzed data from the National Immunization Survey-Teen (NIS-Teen). This report summarizes the results of that assessment, which indicated that, from 2010 to 2011, vaccination coverage increased for ≥1 dose Tdap on or after age 10 years (from 68.7% to 78.2%), ≥1 dose MenACWY (from 62.7% to 70.5%), and, among females, for ≥1 dose of HPV (from 48.7% to 53.0%) and ≥3 doses of HPV§ (from 32.0 to 34.8%) (*2*). Vaccination coverage varied widely among states. Interventions that increase adolescent vaccination coverage include strong recommendations from health-care providers, urging consideration of every health visit as an opportunity for vaccination, reducing out-of-pocket costs, and using reminder/recall systems. Despite increasing adolescent vaccination coverage, the percentage point increase in ≥1 dose HPV coverage among adolescent females was less than half that of the increase in ≥1 dose of Tdap or MenACWY. The causes of lower coverage with HPV vaccine are multifactorial; addressing missed opportunities for vaccination, as well as continued evaluation of vaccination-promoting initiatives, is needed to protect adolescents against HPV-related cancers.

NIS-Teen collects vaccination information for adolescents aged 13–17 years in the 50 states, the District of Columbia, selected areas,¶ and the U.S. Virgin Islands,** using a random-digit–dialed sample of landline and, starting in 2011, cellular telephone numbers.†† Parent/guardian respondents provide vaccination and sociodemographic information on adolescents in their care. After the parent/guardian grants permission to contact their child's vaccination provider, a questionnaire is mailed to that provider to obtain a vaccination history from the medical record.§§ A total of 23,564 adolescents (12,328 males and 11,236 females) are included in the national estimates.¶¶ NIS-Teen methodology, including weighting procedures, has been described previously.*** Differences in vaccination coverage were evaluated using t-tests and were considered statistically significant at $p \leq 0.05$.

National Vaccination Coverage

Adolescent vaccination coverage increased from 2006 to 2011, although the rate of increase differed by vaccine (Figure). The average annual percentage point increase from 2007 to 2010 was 12.8 (95% confidence interval [CI] = 11.9–13.6) for ≥1 dose of Tdap, 10.1 (CI = 9.3–10.9) for ≥1 dose of MenACWY, and among females, 7.9 (CI = 6.7–9.0) for ≥1 dose of HPV. The percentage point increase from 2010 to 2011 was 9.5 for ≥1 dose of Tdap, 7.8 for ≥1 dose of MenACWY, 4.3 for ≥1 dose and 2.8 for ≥3 doses of HPV among females,

* If the first MenACWY dose is administered to adolescents at age 11 through 12 years, a booster dose should be administered at 16 years. Adolescents who receive their first dose at 13 through 15 years should receive a booster dose at age 16 through 18 years.

† Eligible participants were born during January 1993–February 1999.

§ Some adolescents might have received more than the 3 recommended doses of HPV.

¶ Six areas that received federal Section 317 immunization grants were sampled separately: District of Columbia; Chicago, Illinois; New York, New York; Philadelphia County, Pennsylvania; Bexar County, Texas; and Houston, Texas. Two local areas were chosen for oversampling: Dallas County, Texas, and El Paso County, Texas.

** Sampling was conducted during July–September 2011 based on landline telephone sampling frame only and included St. Croix, St. Thomas, and St. John.

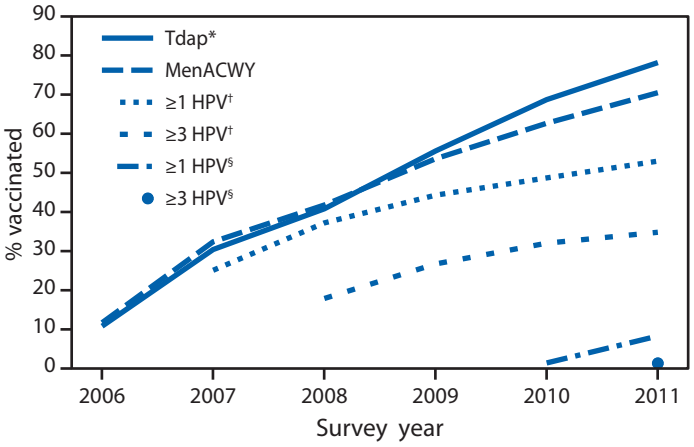
†† For the first quarter of 2011, participants were eligible for interview from the cellular telephone sampling frame if their household was cellular-telephone-only (household with access to a cellular telephone but not a landline telephone) or cellular-telephone-mainly (household containing both a cellular phone and a landline phone, but reporting they are not at all likely or are somewhat unlikely to answer the landline phone if it rang). For Q2–Q4/2011, all identified cellular-telephone households from the cellular telephone sampling frame were eligible for interview. Sampling weights have been adjusted for dual-frame (both landline and cellular telephone) sampling, nonresponse, noncoverage, and overlapping samples of mixed telephone users. A description of NIS-Teen dual-frame survey methodology and its effect on reported vaccination estimates is available at http://www.cdc.gov/vaccines/stats-surv/nis/dual-frame-sampling-08282012.htm.

§§ In 2011, the Council of American Survey Research Organizations (CASRO) landline response rate was 57.2%. A total of 20,848 adolescents with vaccination provider–reported vaccination records are included in this report, representing 61.5% of all adolescents from the landline sample with completed household interviews. The cellular-telephone sample CASRO response rate was 22.4%. A total of 2,716 adolescents with vaccination provider–reported vaccination records are included in this report, representing 54.6% of all adolescents from the cellular-telephone sample with completed household interviews. The CASRO response rate is the product of three other rates: 1) the resolution rate, which is the proportion of telephone numbers that can be identified as either for a business or residence; 2) the screening rate, which is the proportion of qualified households that complete the screening process; and 3) the cooperation rate, which is the proportion of contacted eligible households for which a completed interview is obtained.

¶¶ Adolescents from the U.S. Virgin Islands (232 females and 253 males) are excluded from the national estimates.

*** Information available at ftp://ftp.cdc.gov/pub/health_statistics/nchs/dataset_documentation/nis/nisteenpuf10_codebook.pdf

FIGURE. Estimated vaccination coverage with selected vaccines and doses among adolescents aged 13–17 years, by survey year — National Immunization Survey-Teen, United States, 2006–2011



Abbreviations: Tdap = tetanus toxoid, diphtheria toxoid, acellular pertussis vaccine; MenACWY = meningococcal conjugate vaccine; HPV = human papillomavirus vaccine.
* On or after age 10 years.
† Among females.
§ Among males.

and 6.9 for ≥1 dose of HPV among males (Table 1). Among females and males who initiated the HPV series, 70.7% and 28.1% received 3 doses, respectively. Coverage with measles, mumps, and rubella (MMR) and hepatitis B (HepB) vaccines remained above 90%, and 2-dose varicella vaccine coverage was 68.3%. No significant differences were observed in vaccination coverage among males and females, except for vaccination with HPV (Table 1) and ≥2 doses of varicella vaccine (males [70.3%], females [66.1%]; p<0.01).[†††]

Vaccination Coverage by Age, Race/Ethnicity, and Poverty Status

Compared with adolescents aged 13 years, coverage with ≥1 dose of Tdap, ≥3 doses of HepB, and ≥2 doses of MMR was significantly lower among adolescents aged 17 years. Coverage with ≥1 and ≥2 doses of varicella was significantly lower among adolescents aged 15–17 years compared with those aged 13 years. Vaccination coverage increased with age for ≥1 and ≥3 HPV doses among females, with coverage significantly lower among females aged 13 years compared with those aged 14–17 years. Coverage with ≥1 dose of Tdap was higher for Asians compared with whites and lower for those living below the federal poverty level[§§§] compared with those living at or above poverty level (Table 2). For ≥1 dose of MenACWY, coverage was higher for blacks, Hispanics, and Asians compared with whites; no differences were observed in coverage by poverty status.

For HPV, patterns differed by racial/ethnic group and poverty status depending upon the measure of HPV vaccination (Table 2). Among females and males, HPV initiation was higher for blacks and Hispanics compared with whites; coverage with ≥3 HPV doses was higher for Hispanics compared with whites. However, among females, completion of the HPV series among those who had started it was lower for blacks compared with whites. Among females and males, coverage with ≥1 and ≥3 HPV doses was higher for those living below poverty level compared with those living at or above poverty level; however, among females, HPV series completion was lower among those living below poverty level compared with those living at or above poverty level.

What is already known on this topic?

Since 2006, vaccination coverage with routinely recommended vaccines among U.S. adolescents has increased; but coverage with vaccines recommended at 11 or 12 years of age still remains below target levels, especially for human papillomavirus (HPV) vaccine.

What is added by this report?

From 2010 to 2011, vaccination coverage among U.S. adolescents increased for ≥1 dose of tetanus, diphtheria, acellular pertussis (Tdap) vaccine to 78.2%, ≥1 dose of meningococcal conjugate (MenACWY) vaccine to 70.5%, and ≥1 dose and ≥3 doses of HPV vaccine among females to 53.0% and 34.8%, respectively. The increase in HPV 1-dose coverage among females (4.3 percentage points) was half the increase in Tdap and MenACWY vaccination (7.8–9.5 percentage points) for the third consecutive year.

What are the implications for public health practice?

Although coverage with routine adolescent vaccines is increasing, the increase in HPV coverage among adolescent females is lagging, with only one half initiating the HPV series and the proportion of adolescent females protected from HPV-related cancers by the complete series ranging by state from 56.8% to as low as 15.5%. Stronger health-care provider recommendations for HPV vaccination, implementation of reminder/recall systems, elimination of missed opportunities for vaccination, and education of parents of adolescents regarding the risk for HPV infection and the benefits of vaccination are needed to protect adolescents from HPV-related cancers.

Healthy People 2020 Targets

The *Healthy People 2020* targets for vaccination coverage of adolescents aged 13–15 years are 80.0% for ≥1 dose of Tdap, ≥1 dose MenACWY, ≥3 doses of HPV (among females), and

[†††] In persons with no history of varicella disease.
[§§§] Adolescents were classified as below poverty level if their total family income was less than the federal poverty level specified for the applicable family size and number of children aged <18 years. All others were classified as at or above the poverty level. Additional information available at http://www.census.gov/hhes/www/poverty. Poverty status was unknown for 878 adolescents.

TABLE 1. Estimated vaccination coverage with selected vaccines and doses among adolescents aged 13–17* years, by age at interview — National Immunization Survey-Teen (NIS-Teen), United States, 2010 and 2011

	Age at interview (yrs)										Year			
	13		14		15		16		17		2010		2011	
	(n = 4,763)		(n = 4,842)		(n = 4,750)		(n = 4,774)		(n = 4,435)		(N = 19,257)		(N = 23,564)	
Vaccine/Doses	%	(95% CI)†	%	(95% CI)†	%	(95% CI)†	%	(95% CI)†	%	(95% CI)†	%	(95% CI)†	%	(95% CI)†
Td or Tdap§														
≥1 dose Td or Tdap on or after age 10 yrs	83.9	(±1.8)	85.2	(±1.7)	86.2	(±2.0)	86.7	(±1.7)¶	84.2	(±1.9)	81.2	(±1.0)	85.3	(±0.8)**
≥1 dose Tdap on or after age 10 yrs	81.0	(±2.0)	80.6	(±2.0)	79.8	(±2.2)	78.3	(±2.0)	70.8	(±2.4)¶	68.7	(±1.2)	78.2	(±0.9)**
MenACWY†† ≥1 dose	71.4	(±2.1)	72.0	(±2.2)	71.1	(±2.6)	69.5	(±2.4)	68.5	(±2.4)	62.7	(±1.2)	70.5	(±1.0)**
HPV§§														
Females														
≥1 dose	41.6	(±3.6)	45.5	(±3.6)	56.4	(±3.8)¶	59.2	(±3.7)¶	62.8	(±3.4)¶	48.7	(±1.8)	53.0	(±1.7)**
≥3 doses	22.9	(±2.9)	29.2	(±3.2)¶	37.8	(±4.1)¶	40.0	(±3.7)¶	44.5	(±3.7)¶	32.0	(±1.6)	34.8	(±1.6)**
3-dose series completion¶¶	63.6	(±5.7)	72.1	(±5.0)¶	70.8	(±5.0)	71.0	(±5.0)¶	74.0	(±4.9)¶	69.6	(±2.7)	70.7	(±2.3)
Males														
≥1 dose	9.8	(±2.4)	8.2	(±2.0)	7.4	(±1.7)	9.8	(±2.7)	6.2	(±1.3)¶	1.4	(±0.4)	8.3	(±1.0)**
≥3 doses	1.6	(±0.8)	1.8	(±1.1)	0.9	(±0.4)	1.3	(±0.6)	1.0	(±0.5)	NA	—	1.3	(±0.3)**
3-dose series completion¶¶	32.4	(±14.1)	35.7	(±16.6)	21.6	(±10.6)	21.1	(±11.8)	32.0	(±12.0)	41.6	(±21.0)	28.1	(±6.5)
MMR* ≥2 doses**	92.0	(±1.3)	91.8	(±1.5)	90.6	(±1.7)	91.8	(±1.5)	89.2	(±1.7)¶	90.5	(±0.8)	91.1	(±0.7)
Hepatitis B ≥3 doses	93.7	(±1.2)	93.5	(±1.3)	91.8	(±1.8)	92.1	(±1.5)	90.4	(±1.5)¶	91.6	(±0.8)	92.3	(±0.7)
Varicella														
History of varicella disease†††	22.1	(±2.1)	29.6	(±2.2)¶	36.0	(±2.6)¶	43.8	(±2.6)¶	51.8	(±2.6)¶	44.7	(±1.3)	36.6	(±1.1)**
≥1 dose vaccine if no history of disease	96.4	(±1.1)	96.2	(±1.3)	90.4	(±3.1)¶	90.3	(±2.4)¶	84.7	(±3.0)¶	90.5	(±1.1)	92.3	(±1.0)**
≥2 doses vaccine if no history of disease	74.3	(±2.4)	73.5	(±2.6)	67.0	(±3.4)¶	63.9	(±3.4)¶	57.5	(±3.9)¶	58.1	(±1.7)	68.3	(±1.4)**
History of disease or received ≥2 doses varicella vaccine	80.0	(±1.9)	81.3	(±1.9)	78.9	(±2.4)	79.7	(±2.1)	79.5	(±2.2)	76.8	(±1.1)	79.9	(±1.0)

Abbreviation: NA = Not available.

* Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999.

† CI = confidence interval. Estimates with CI widths >20 might not be reliable.

§ Includes percentages receiving tetanus and diphtheria toxoid vaccine (Td) on or after age 10 years, or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap), or tetanus–unknown type vaccine on or after age 10 years.

¶ Statistically significant difference (p≤0.05) in estimated vaccination coverage by age: reference group was adolescents aged 13 years.

** Statistically significant difference (p≤0.05) compared with 2010 NIS-Teen overall estimates

†† Includes percentages receiving meningococcal conjugate vaccine (MenACWY) or meningococcal–unknown type vaccine.

§§ Human papillomavirus vaccine, either quadrivalent or bivalent. Percentage reported among females (n = 11,236) and males (n = 12,328). Some adolescents might have received more than the 3 recommended HPV doses.

¶¶ Percentage of females or males who received 3 doses among those who had ≥1 HPV dose and ≥24 weeks between the first dose and the interview date.

*** ≥2 doses of measles, mumps, and rubella vaccine.

††† Based on parent/guardian report or health-care provider records.

90.0% for ≥2 doses of varicella vaccine (*3*). Vaccination coverage in 2011 was 80.5% (CI = 79.2–81.6) for ≥1 dose of Tdap, 71.5% (CI = 70.1–72.8) for ≥1 dose of MenACWY, 30.0% (CI = 28.0–32.1) for ≥3 doses of HPV (among females), and 71.8% (CI = 70.1–73.4) for ≥2 doses of varicella vaccine.¶¶¶

State Vaccination Coverage

Coverage estimates for ≥1 dose of Tdap ranged from 36.9% (Mississippi) to 95.0% (New Hampshire), and for ≥1 dose of MenACWY, from 27.6% (Arkansas) to 92.1% (Indiana) (Table 3). Among females, coverage for ≥1 dose of HPV varied from 31.9% (Mississippi) to 76.1% (Rhode Island), and for ≥3 doses of HPV, from 15.5% (Arkansas) to 56.8% (Rhode Island). Compared with the Northeast and West, the South had significantly lower vaccination rates for ≥1 dose of Tdap, ≥1 dose of MenACWY, and among females, ≥1 and ≥3 doses of HPV. Among females, the difference in coverage estimates, or coverage gap, between the vaccine with the highest coverage (either Tdap or MenACWY) and coverage with ≥1 dose of HPV was 25.3 percentage points nationally and varied widely by state and reporting area, ranging from -0.6 (Hawaii) to 49.4 (New York [excluding New York City]) percentage points (Table 3). The coverage gap between the vaccine with the highest and lowest coverage (either Tdap or MenACWY)**** among males was 6.8 percentage points nationally and also varied widely by state and reporting area, ranging from 0.4 (Georgia) to 48.2 (Montana) percentage points.

¶¶¶ In persons with no history of varicella disease.

**** Receipt of ≥1 dose of HPV not assessed among males because several state estimates did not meet reporting criteria.

TABLE 2. Estimated vaccination coverage with selected vaccines and doses among adolescents aged 13–17 years,* by race/ethnicity† and poverty level§ — National Immunization Survey-Teen (NIS-Teen), United States, 2011

	Race/Ethnicity										Poverty status			
	White		Black		Hispanic		American Indian/ Alaska Native		Asian		Below poverty level		At or above poverty level	
	(n = 15,970)		(n = 2,408)		(n = 3,234)		(n = 296)		(n = 651)		(n = 3,480)		(n = 19,206)	
Vaccine/Doses	%	(95% CI)¶	%	(95% CI)¶	%	(95% CI)¶	%	(95% CI)¶	%	(95% CI)¶	%	(95% CI)¶	%	(95% CI)¶
Td or Tdap**														
≥1 dose Td or Tdap on or after age 10 yrs	85.1	(±1.0)	83.1	(±2.3)	86.7	(±2.2)	80.8	(±11.0)	89.6	(±4.1)††	81.5	(±2.2)††	86.5	(±0.8)
≥1 dose Tdap on or after age 10 yrs	78.6	(±1.1)	75.7	(±2.7)	78.4	(±2.6)	72.3	(±11.7)	83.8	(±4.7)††	74.0	(±2.5)††	79.5	(±1.0)
MenACWY ≥1§§	68.4	(±1.2)	72.1	(±2.9)††	75.3	(±2.7)††	64.4	(±10.9)	76.0	(±7.2)††	69.0	(±2.6)	70.7	(±1.2)
HPV¶¶														
Females														
≥1 dose	47.5	(±1.9)	56.0	(±4.7)††	65.0	(±4.1)††	59.4	(±11.9)	55.8	(±10.8)	62.1	(±3.7)††	50.1	(±1.9)
≥3 doses	33.0	(±1.8)	31.7	(±4.6)	41.6	(±4.5)††	37.8	(±11.5)	35.0	(±11.8)	39.0	(±3.9)††	33.4	(±1.8)
3-dose series completion***	74.8	(±2.5)	60.8	(±6.7)††	69.4	(±5.5)	71.1	(±13.3)	70.5	(±15.2)	66.4	(±4.8)††	72.6	(±2.6)
Males														
≥1 dose	5.6	(±0.8)	10.6	(±2.6)††	14.9	(±3.6)††	NA	NA	NA	NA	14.1	(±3.0)††	6.7	(±0.9)
≥3 doses	0.8	(±0.2)	NA	NA	2.7	(±1.3)††	NA	NA	NA	NA	2.5	(±0.9)††	1.1	(±0.3)
3-dose series completion***	25.9	(±7.5)	NA	NA	29.0	(±13.7)	NA	NA	NA	NA	28.9	(±11.9)	28.5	(±7.9)
MMR ≥2 doses†††	91.4	(±0.8)	90.6	(±1.9)	90.6	(±1.8)	81.1	(±11.4)	94.6	(±2.3)	90.3	(±1.5)††	91.4	(±0.8)
Hepatitis B ≥3 doses	92.8	(±0.8)	91.7	(±1.7)	91.7	(±1.8)	89.1	(±5.9)	91.9	(±6.4)	91.4	(±1.6)	92.6	(±0.7)
Varicella														
History of varicella disease§§§	38.7	(±1.3)	31.6	(±3.1)††	35.1	(±3.1)††	47.6	(±10.5)	30.6	(±7.4)††	36.4	(±2.8)	36.3	(±1.2)
Among adolescents without history of disease														
≥1 dose vaccine	92.9	(±1.1)	91.3	(±2.4)	91.0	(±2.9)	94.5	(±4.2)	93.0	(±8.6)	91.1	(±2.4)	92.6	(±1.1)
≥2 doses vaccine	67.3	(±1.6)	65.3	(±3.7)	71.4	(±3.7)††	61.8	(±13.1)	74.8	(±9.7)	67.2	(±3.3)	68.4	(±1.6)
History of disease or received ≥2 doses varicella vaccination	79.9	(±1.1)	76.3	(±2.8)††	81.4	(±2.6)	80.0	(±7.9)	82.5	(±7.3)	79.1	(±2.3)	79.9	(±1.1)

Abbreviation: NA = Not available.

* Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999.

† Adolescents who were reported by the adult as Hispanics might be of any race. Adolescents who were reported by the adult as white, black, Asian, or American Indian/Alaska Native all were considered non-Hispanic. Native Hawaiian, other Pacific Islanders and persons of multiple races were categorized as "other." Vaccination estimates for persons of other races are available at http://www.cdc.gov/vaccines/stats-surv/nis/default.htm#nisteen.

§ Adolescents were classified as below poverty level if their total family income was less than the federal poverty level specified for the applicable family size and number of children aged <18 years. All others were classified as at or above the poverty level. Additional information available at http://www.census.gov/hhes/www/poverty.html. Poverty status was unknown for 878 adolescents.

¶ CI = confidence interval. Estimates with CI widths >20 might not be reliable.

** Includes ≥1 dose of tetanus toxoid-diphtheria vaccine (Td) since age 10 years, or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) since age 10 years.

†† Statistically significant difference (p<0.05) in estimated vaccination coverage by race/ethnicity or poverty level; referent groups were non-Hispanic white adolescents and adolescents living at or above poverty level, respectively.

§§ Includes percentages receiving meningococcal conjugate vaccine (MenACWY) and meningococcal–unknown type vaccine.

¶¶ Human papillomavirus vaccine, either quadrivalent or bivalent. Percentage reported among females (n = 11,236) and males (n = 12,328). Some adolescents might have received more than the 3 recommended HPV doses.

*** Percentage of females or males who received 3 doses among those who had ≥1 HPV dose and ≥24 weeks between the first dose and the interview date.

††† Includes ≥2 doses of measles, mumps, and rubella vaccine.

§§§ By parent/guardian report or health-care provider records.

Reported by

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Editorial Note

Adolescent vaccination coverage increased from 2010 to 2011, with Tdap coverage reaching the *Healthy People 2020* target of 80%. Coverage with MMR and HepB vaccines remained above 90%, and 2-dose varicella vaccine coverage had a 10 percentage point increase since 2010. However, the percentage-point increase in ≥1 dose of HPV among females was half the increase observed for ≥1 dose of Tdap and ≥1 dose of MenACWY for the third consecutive year. Among males,

TABLE 3. Estimated vaccination coverage with selected vaccines and doses* among adolescents aged 13–17 years,† by state/area — National Immunization Survey-Teen (NIS-Teen), United States, 2011

							Females						Males			
	≥2 VAR§		≥1 Tdap on or after age 10 yrs¶		≥1 MenACWY**		≥1 HPV††		≥3 HPV§§		Coverage gap¶¶		≥1 HPV		Coverage gap***	
State/Area	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††
United States overall	**68.3**	(±1.4)§§§	**78.2**	(±0.9)§§§	**70.5**	(±1.0)§§§	**53.0**	(±1.7)§§§	**34.8**	(±1.6)§§§	**25.3**	(±2.1)	**8.3**	(±1.0)§§§	**6.8**	(±1.9)
Northeast census region	76.9	(±2.4)	84.9	(±1.7)	80.4	(±1.9)	53.4	(±3.3)	39.9	(±3.2)	—	—	7.4	(±1.5)	—	—
Connecticut	87.2	(±4.7)	83.0	(±4.8)	81.1	(±5.0)§§§	60.5	(±8.5)	43.0	(±8.8)	24.6	(±10.8)	17.3	(±6.3)	2.7	(±10.3)
Maine	69.6	(±6.8)§§§	69.2	(±5.7)	64.9	(±5.8)	56.1	(±8.2)	44.5	(±8.3)§§§	11.9	(±11.7)	NA¶¶¶	—	1.9	(±11.1)
Massachusetts	82.3	(±6.0)	91.6	(±3.4)§§§	84.4	(±5.3)	61.1	(±8.9)	48.5	(±9.2)	30.4	(±10.4)	NA¶¶¶	—	5.8	(±8.1)
New Hampshire	88.2	(±4.4)§§§	95.0	(±2.4)§§§	80.6	(±5.2)	65.8	(±7.7)§§§	46.0	(±8.4)	30.3	(±8.2)	NA¶¶¶	—	11.1	(±7.1)
New Jersey	71.5	(±6.3)	78.9	(±5.0)§§§	85.9	(±4.2)	55.5	(±8.1)§§§	38.7	(±8.3)§§§	32.9	(±9.7)	NA¶¶¶	—	4.1	(±9.3)
New York	68.9	(±4.7)	88.5	(±2.5)§§§	74.9	(±3.8)	46.6	(±5.9)****	34.2	(±5.5)	40.4	(±6.9)	6.4	(±2.7)	11.2	(±6.2)
New York City	70.7	(±6.1)	87.0	(±3.7)	79.1	(±4.7)	56.8	(±7.9)	38.6	(±7.6)	26.0	(±9.7)	10.1	(±4.2)	12.6	(±8.1)
Rest of state	67.6	(±6.7)	89.5	(±3.4)	72.3	(±5.4)	40.3	(±8.1)	31.5	(±7.4)	49.4	(±9.3)	NA¶¶¶		10.2	(±8.6)
Pennsylvania	85.0	(±4.7)	81.0	(±4.3)	83.8	(±4.2)	51.9	(±8.0)	41.0	(±7.7)	29.4	(±10.1)	8.5	(±3.6)	6.1	(±7.8)
Philadelphia County	80.4	(±6.0)	81.0	(±5.3)§§§	88.7	(±3.9)	75.9	(±7.9)§§§	48.8	(±9.3)	11.7	(±9.9)	19.0	(±6.7)	7.0	(±8.5)
Rest of state	85.7	(±5.3)	81.0	(±4.8)	83.2	(±4.7)	48.8	(±8.9)	39.9	(±8.6)	32.8	(±11.3)	7.2	(±4.0)	6.0	(±8.7)
Rhode Island	83.1	(±6.1)	87.5	(±3.5)§§§	88.9	(±4.2)	76.1	(±7.2)	56.8	(±9.2)	11.4	(±10.3)	24.6	(±6.7)	2.1	(±6.0)
Vermont	81.7	(±6.8)	90.1	(±3.3)§§§	65.7	(±5.8)§§§	63.0	(±8.0)§§§	50.1	(±8.8)	25.1	(±9.5)	NA¶¶¶		23.2	(±8.9)
Midwest census region	69.4	(±2.6)	77.6	(±1.9)	69.0	(±2.0)	51.1	(±3.1)	33.5	(±3.0)	—	—	5.9	(±1.5)	—	—
Illinois	63.7	(±6.2)§§§	71.8	(±4.6)	66.5	(±5.1)§§§	51.6	(±7.5)§§§	34.0	(±7.9)	23.7	(±9.7)	6.2	(±3.0)	3.1	(±9.8)
Chicago	66.2	(±7.3)	69.8	(±5.6)	72.2	(±5.7)	47.0	(±9.5)	24.7	(±8.2)	30.0	(±12.0)	NA¶¶¶	—	8.2	(±11.5)
Rest of state	63.1	(±7.5)§§§	72.3	(±5.6)	65.2	(±6.1)§§§	52.7	(±9.0)§§§	36.2	(±9.5)	22.2	(±11.7)	NA¶¶¶	—	5.6	(±11.8)
Indiana	86.2	(±6.4)§§§	92.7	(±3.0)§§§	92.1	(±3.6)§§§	40.8	(±9.2)	28.4	(±8.1)	47.9	(±11.4)	NA¶¶¶	—	1.2	(±3.7)
Iowa	49.8	(±9.6)	74.7	(±5.9)§§§	60.5	(±6.7)	53.5	(±10.0)	40.7	(±10.2)	24.6	(±13.1)	NA¶¶¶	—	12.9	(±12.6)
Kansas	60.9	(±9.6)	79.1	(±5.6)	47.7	(±6.6)	37.2	(±8.7)	21.9	(±6.6)	42.1	(±11.8)	NA¶¶¶	—	34.7	(±11.9)
Michigan	80.3	(±6.6)§§§	71.0	(±6.5)	77.9	(±5.8)	55.6	(±9.8)	31.6	(±8.6)	18.5	(±13.7)	NA¶¶¶	—	6.5	(±10.2)
Minnesota	81.9	(±7.7)§§§	82.5	(±6.0)§§§	63.1	(±7.0)	55.5	(±9.9)	35.1	(±9.1)	27.1	(±13.0)	NA¶¶¶	—	18.5	(±13.3)
Missouri	46.7	(±9.0)	79.6	(±5.3)§§§	54.6	(±6.5)	49.5	(±9.7)	30.8	(±9.0)	32.1	(±12.3)	NA¶¶¶	—	32.7	(±11.2)
Nebraska	76.4	(±7.8)§§§	81.8	(±5.2)§§§	76.0	(±5.6)§§§	59.0	(±9.9)	32.6	(±8.6)	25.9	(±12.1)	14.2	(±8.1)	4.0	(±10.8)
North Dakota	61.4	(±11.3)	87.5	(±6.0)	84.2	(±6.9)	51.2	(±12.6)	27.8	(±10.3)	34.3	(±15.7)	NA¶¶¶	—	4.9	(±11.9)
Ohio	59.9	(±7.8)§§§	72.7	(±5.5)§§§	66.0	(±6.0)	45.5	(±8.5)	32.6	(±8.2)	23.7	(±11.9)	NA¶¶¶	—	9.3	(±11.2)
South Dakota	37.1	(±13.8)§§§	54.4	(±10.3)	37.4	(±9.5)	58.1	(±13.8)	50.1	(±13.7)	6.1	(±18.6)	NA¶¶¶	—	12.7	(±19.0)
Wisconsin	86.6	(±6.7)	89.7	(±4.1)§§§	74.5	(±5.7)	65.7	(±8.4)	46.2	(±9.8)	22.9	(±10.7)	NA¶¶¶	—	12.6	(±8.6)
South census region	65.3	(±2.2)	73.4	(±1.6)	66.6	(±1.7)	48.4	(±2.7)	30.6	(±2.6)	—	—	8.3	(±1.3)	—	—
Alabama	56.4	(±7.6)§§§	74.4	(±5.2)	64.3	(±5.9)§§§	49.5	(±9.3)	31.2	(±8.6)§§§	23.7	(±12.1)	NA¶¶¶	—	4.1	(±10.0)
Arkansas	47.2	(±10.6)§§§	48.4	(±8.0)	27.6	(±7.0)	36.1	(±12.3)	15.5	(±7.9)	9.4	(±17.3)	NA¶¶¶	—	20.0	(±14.4)
Delaware	79.2	(±5.5)§§§	80.7	(±4.5)§§§	78.2	(±4.9)	60.2	(±8.7)	46.8	(±8.8)	18.2	(±11.1)	11.6	(±5.2)	2.3	(±8.4)
District of Columbia	92.2	(±3.9)	82.0	(±5.0)§§§	90.3	(±3.7)	55.0	(±9.4)	36.0	(±8.5)	34.8	(±11.0)	NA¶¶¶	—	12.1	(±8.9)
Florida	66.1	(±7.3)§§§	77.5	(±5.3)§§§	61.2	(±6.1)	50.0	(±8.8)	35.3	(±8.4)	28.7	(±11.0)	NA¶¶¶	—	14.5	(±11.7)
Georgia	85.8	(±5.4)§§§	68.0	(±5.9)	67.7	(±5.8)	48.4	(±9.0)	30.0	(±8.4)	22.9	(±12.4)	7.3	(±3.8)	0.4	(±11.5)
Kentucky	43.8	(±8.4)	70.0	(±6.0)§§§	55.0	(±6.6)§§§	46.0	(±9.8)	30.5	(±8.6)	22.3	(±13.2)	NA¶¶¶	—	16.2	(±12.2)
Louisiana	84.2	(±5.9)§§§	85.9	(±4.2)§§§	90.0	(±3.5)§§§	63.0	(±8.8)	36.3	(±8.5)	29.2	(±10.1)	15.8	(±6.4)	0.8	(±7.1)
Maryland	69.7	(±6.5)	72.9	(±5.3)§§§	78.5	(±4.8)§§§	45.7	(±8.3)	29.9	(±7.1)	26.8	(±11.3)	14.0	(±6.2)	11.5	(±9.0)
Mississippi	32.9	(±9.3)	36.9	(±6.8)	34.2	(±6.8)§§§	31.9	(±10.3)	19.6	(±9.3)	4.3	(±14.3)	NA¶¶¶	—	5.3	(±13.2)
North Carolina	62.7	(±8.6)	77.8	(±5.6)§§§	65.9	(±6.3)§§§	54.4	(±9.7)	32.3	(±9.6)	25.0	(±12.4)	NA¶¶¶	—	9.8	±11.7)
Oklahoma	48.4	(±8.4)	66.0	(±6.3)§§§	55.3	(±6.6)§§§	49.8	(±10.0)	27.7	(±8.7)	14.5	(±13.9)	8.9	(±4.9)	10.6	(±12.1)
South Carolina	49.7	(±8.8)§§§	59.4	(±7.0)§§§	55.4	(±6.9)§§§	38.7	(±10.6)	23.3	(±8.6)	22.0	(±14.8)	NA¶¶¶	—	4.0	(±13.1)
Tennessee	61.3	(±9.0)	67.6	(±6.4)	63.3	(±6.4)§§§	46.0	(±9.4)§§§	27.2	(±8.3)	16.9	(±13.0)	NA¶¶¶	—	3.6	(±12.5)
Texas	73.1	(±5.3)§§§	80.7	(±3.4)§§§	79.1	(±3.9)§§§	48.8	(±6.7)	31.5	(±6.6)	33.1	(±8.1)	10.4	(±3.3)	1.5	(±6.6)
Bexar County	71.5	(±6.7)§§§	85.2	(±4.0)§§§	82.2	(±4.5)§§§	51.5	(±8.9)	31.9	(±8.3)	32.1	(±10.9)	12.1	(±5.9)	4.9	(±8.1)
Houston	77.7	(±6.6)	76.1	(±6.0)	83.3	(±5.1)	49.7	(±9.0)	26.9	(±7.8)	31.6	(±12.0)	14.5	(±6.0)	5.3	(±10.2)
Dallas County	70.6	(±7.7)	76.9	(±6.1)	75.7	(±6.4)	41.2	(±9.4)	23.4	(±8.2)	35.4	(±12.7)	12.9	(±5.9)	0.7	(±12.8)
El Paso County	75.1	(±7.4)	83.6	(±4.9)	84.2	(±5.1)	75.0	(±8.0)	45.1	(±9.6)	14.6	(±9.7)	27.6	(±8.2)	1.0	(±11.2)
Rest of state	73.0	(±7.1)§§§	81.1	(±4.4)§§§	78.5	(±5.2)§§§	48.2	(±8.9)	32.3	(±8.8)	35.0	(±10.8)	8.7	(±4.4)	2.0	(±8.7)
Virginia	54.9	(±7.6)§§§	77.9	(±5.7)	61.8	(±6.1)	46.9	(±9.6)	29.8	(±8.8)	27.3	(±13.4)	NA¶¶¶	—	17.2	(±10.0)
West Virginia	46.8	(±8.1)	60.1	(±6.0)§§§	54.9	(±6.0)§§§	50.6	(±9.2)	28.6	(±8.1)	8.7	(±12.9)	6.9	(±3.4)	6.4	(±11.2)

See table footnotes on page 676.

coverage with ≥1 dose of HPV increased 6.9 percentage points in 2011 and reflects receipt of vaccination as a result of the 2009 ACIP guidance stating that HPV vaccination could be administered to males aged 9–26 years.††††

Despite higher coverage with the Tdap, MMR, HepB, and varicella vaccines among younger compared with older adolescents, coverage with ≥1 dose of HPV was higher among older compared with younger adolescents. Although not evaluated in this analysis, parental delay of HPV vaccination of adolescent girls has been associated with lower vaccination rates (*4,5*). Additionally, fewer and weaker health-care provider

†††† HPV vaccination for males at age 11 or 12 years (and for those not previously vaccinated, through age 21 years) was not included in the routine immunization schedule until late October 2011.

TABLE 3. (*Continued*) Estimated vaccination coverage with selected vaccines and doses* among adolescents aged 13–17 years,† by state/area — National Immunization Survey-Teen (NIS-Teen), United States, 2011

							Females						Males			
	≥2 VAR§		≥1 Tdap on or after age 10 yrs¶		≥1 MenACWY**		≥1 HPV††		≥3 HPV§§		Coverage gap¶¶		≥1 HPV		Coverage gap***	
State/Area	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††	%	(95% CI)†††
West census region	65.0	(±3.6)	81.2	(±2.3)	70.8	(±2.6)	61.6	(±4.0)	38.7	(±4.2)	—	—	11.0	(±2.9)	—	—
Alaska	59.5	(±10.4)§§§	65.6	(±7.0)	46.1	(±7.2)	59.5	(±9.5)§§§	40.4	(±9.8)§§§	7.0	(±13.2)	NA¶¶¶	—	21.3	(±14.7)
Arizona	60.5	(±8.6)	85.3	(±5.3)§§§	82.9	(±5.6)	55.3	(±10.3)	36.7	(±10.0)	28.1	(±13.3)	8.4	(±4.4)	0.9	(±8.8)
California	66.5	(±5.9)	82.5	(±3.9)§§§	75.4	(±4.4)§§§	65.0	(±6.8)	42.9	(±7.3)§§§	19.5	(±8.6)	13.0	(±5.1)	4.1	(±8.1)
Colorado	74.0	(±8.1)	84.7	(±5.8)	64.4	(±7.0)	45.9	(±10.4)	25.3	(±7.7)****	37.4	(±14.2)	13.6	(±7.3)	20.2	(±11.0)
Hawaii	73.6	(±6.7)	67.7	(±6.2)§§§	70.2	(±5.9)	73.1	(±8.0)	50.9	(±9.6)	0.6	(±11.6)	11.7	(±5.4)	0.5	(±11.7)
Idaho	49.9	(±10.7)	58.3	(±7.1)	50.5	(±7.2)§§§	45.5	(±10.5)§§§	30.0	(±9.8)§§§	15.2	(±14.9)	NA¶¶¶	—	5.1	(±13.6)
Montana	51.8	(±12.9)	85.0	(±6.0)	39.8	(±8.4)	52.9	(±11.9)	39.8	(±12.1)	36.5	(±13.1)	NA¶¶¶	—	48.2	(±15.4)
Nevada	51.2	(±9.2)	80.2	(±5.8)§§§	60.3	(±7.3)	55.3	(±11.2)	30.9	(±10.2)	23.7	(±14.2)	NA¶¶¶	—	24.1	(±12.6)
New Mexico	70.7	(±7.4)§§§	81.3	(±5.1)§§§	64.8	(±6.0)§§§	58.1	(±8.6)	29.7	(±7.7)	23.1	(±11.5)	11.3	(±4.9)	12.8	(±10.6)
Oregon	61.5	(±8.2)	83.1	(±5.0)§§§	55.8	(±6.7)	68.6	(±8.5)§§§	38.5	(±10.0)	14.3	(±11.3)	NA¶¶¶	—	34.7	(±11.3)
Utah	54.5	(±8.9)	81.4	(±6.0)§§§	58.5	(±7.0)§§§	53.3	(±10.5)§§§	20.4	(±7.0)	30.4	(±13.3)	NA¶¶¶	—	25.4	(±13.0)
Washington	65.6	(±8.5)	75.0	(±6.3)	69.4	(±6.4)	66.5	(±8.9)	40.0	(±9.0)	11.2	(±12.2)	8.9	(±4.9)	5.4	(±13.2)
Wyoming	78.8	(±8.7)§§§	86.2	(±4.9)§§§	60.8	(±8.1)	60.9	(±10.5)	40.9	(±10.9)	22.5	(±13.1)	NA¶¶¶	—	27.9	(±13.3)
U.S. Virgin Islands	66.1	(±5.2)	63.5	(±5.1)	31.5	(±4.8)	26.4	(±6.6)	8.3	(±3.8)§§§	35.0	(±9.9)	NA¶¶¶	—	35.6	(±9.7)

Abbreviation: NA = Not available.

* Adolescents (N = 23,564) in the 2011 NIS-Teen were born during January 1993–February 1999.

† Vaccination estimates for ≥2 doses measles, mumps, and rubella, ≥3 doses hepatitis B, ≥1 dose varicella, and ≥1 dose tetanus and diphtheria toxoids vaccine or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccines, and human papilloma virus (HPV) series completion among females are available at http://www.cdc.gov/vaccines/stats-surv/nis/default.htm#nisteen.

§ ≥2 doses of varicella vaccine among adolescents without a reported history of varicella disease.

¶ Tetanus and diphtheria toxoids vaccine (Td), or tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap), or tetanus–unknown type vaccine on or after age 10 years.

** ≥1 dose of meningococcal conjugate vaccine or meningococcal–unknown type vaccine.

†† ≥1 dose of human papillomavirus vaccine, either quadrivalent or bivalent. Percentage reported among females only (n = 11,236) and among males only (n = 12,328).

§§ ≥3 doses of human papillomavirus vaccine, either quadrivalent or bivalent. Some adolescents might have received more than the 3 recommended HPV doses. Percentage reported among females only (N = 11,236).

¶¶ The difference in coverage estimates between the vaccine with the highest coverage (either Tdap or MenACWY) and coverage with ≥1 dose of HPV among females only.

*** The difference between the vaccine with the highest and lowest coverage (either Tdap or MenACWY) among males only.

††† CI = confidence interval. Estimates with CI half-widths >10 might not be reliable.

§§§ Statistically significant (p≤0.05) percentage point increase from 2010.

¶¶¶ Estimate not reported because unweighted sample size for the denominator was <30 or (CI half-width) / estimate was >0.6.

**** Statistically significant (p≤0.05) percentage point decrease from 2010.

recommendations for the HPV vaccine to younger adolescents most likely contribute to lower vaccination rates (*6*). As in previous years, Hispanic and black females had higher coverage with ≥1 dose of HPV compared with white females (*2*). Risk-based approaches that base health-care provider recommendations for HPV on the perceived level of the patient's risk for cervical cancer might contribute to higher HPV initiation rates among blacks and Hispanics (*7*). Hispanic females were more likely than white females to be fully protected with 3 doses of HPV, and females living below the poverty line were more likely to be fully protected than those living at or above poverty. HPV series completion rates demonstrate the extent and timeliness of the receipt of 3 doses of HPV among those who initiated the series. Among females with adequate time to complete the series, 29.3% had not done so. Despite equal or higher 3-dose HPV coverage among blacks and those living below poverty, HPV series completion rates were lower among these populations known to have higher cervical cancer rates (*8*). Reminder/recall systems and the use of every office visit to administer needed vaccinations could improve HPV completion rates within the recommended dosing intervals.

Vaccination estimates continue to vary widely by state and vaccine. The number of states with middle school enrollment vaccination requirements increased from the 2010–11 school year, when 31 states required Tdap, 19 required MenACWY, and 42 required varicella, to the 2011–12 school year, when 36 states required Tdap, 19 required MenACWY, and 43 required varicella. These new state requirements might have contributed to increased coverage for these vaccines (*9*). Despite the publication of routine recommendations for Tdap, MenACWY, and HPV vaccination of adolescents within 2 years of one another (2005–2007), large coverage gaps persist between Tdap, MenACWY, and HPV among females and between Tdap and MenACWY among males in many states. Large coverage gaps demonstrate achievable coverage if all recommended vaccines were given simultaneously and missed vaccination opportunities were decreased.

The findings in this report are subject to at least four limitations. First, the cellular phone household response rate was only 22.4%, and the landline household response rate was 57.2%. Only 54.6% (cellular telephones phone) and 61.5% (landline) of those with completed household interviews also had adequate vaccination provider data. Differences between

national coverage estimates from landline only and dual-frame (both landline and cellular telephone household) samples were small, ranging from -1.2 to 2.7 percentage points. Nonresponse and noncoverage (from exclusion of households without telephones) bias might remain after weighting adjustments; a total survey error model based on data from vaccination provider–reported vaccination coverage rates from the National Health Interview Survey estimated 2010 NIS-Teen estimates were 4–5 percentage points higher for Tdap and MenACWY and 1 percentage point higher for HPV initiation among females.[§§§§] Second, underestimates of vaccination coverage might have resulted from the exclusive use of vaccination provider–verified vaccination histories because the completeness of these records is unknown. Third, estimates for particular states and reporting areas and for racial/ethnic populations should be interpreted with caution because of smaller sample sizes and wider CIs. Finally, smaller sample sizes of females might result in less power to detect differences in HPV coverage by state.

The *Healthy People 2020* objective for ≥1 dose of Tdap was achieved in 2011, with 80.5% coverage among adolescents aged 13–15 years, demonstrating that high vaccination rates with vaccines recommended for adolescents are achievable. Promoting health-care provider recommendations and parental awareness of adolescent vaccines, urging consideration of every health visit as an opportunity for vaccination, reducing out-of-pocket costs, and using immunization information systems and reminder/recall systems can increase vaccination among adolescents (*10*). Continued vaccination surveillance and assessment of hesitancy among parents are needed to better understand characteristics associated with the delay or refusal of adolescent vaccines, especially the HPV vaccine. Increasing HPV series completion among those who initiate the vaccine is also needed. Finally, state and local immunization programs should make adolescent vaccination a priority and implement initiatives aimed at decreasing coverage gaps.

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Measles — Horn of Africa, 2010–2011

Member states of the World Health Organization (WHO) African (AFR) and Eastern Mediterranean (EMR) regions have set goals for measles elimination by 2020 and 2015, respectively. The two WHO regions include AFR member states Ethiopia and Kenya, and EMR member state Somalia. All three countries are in the Horn of Africa, where measles remains endemic, with periodic outbreaks despite efforts to achieve elimination goals (*1*). This report describes outbreaks that occurred in the Horn of Africa during 2010–2011. The outbreaks were exacerbated by a complex humanitarian emergency in Somalia, with an influx of an estimated 600,000 refugees into camps in Kenya and Ethiopia near the borders with Somalia. During 2010–2011, a total of 9,756 measles cases were reported in Ethiopia and 2,566 in Kenya, with wide age distributions, and 16,135 were reported in Somalia, with 78% occurring among children aged <5 years. Cases occurred predominantly in unvaccinated persons. Outbreak response immunization (ORI) strategies were implemented; however, outbreaks continued. To reach AFR and EMR measles elimination targets, uniform high coverage with 2 doses of measles-containing vaccine (MCV) must be achieved and maintained in Horn of Africa countries, including in refugee camps.

In 2010, the World Health Assembly endorsed targets to be met by 2015 as milestones toward eventual global measles eradication. These included 1) increasing first dose coverage with MCV (MCV1) to ≥90% nationally and ≥80% in every district, 2) reducing to and maintaining an annual measles incidence of <5 cases per million population, and 3) reducing estimated measles mortality by ≥95% in comparison with 2000 estimates (*2*). WHO recommends 2 MCV doses for all children and emphasizes on-time delivery of the first dose at age 9 months in countries with ongoing measles virus transmission (*3*). In Ethiopia, Kenya, and Somalia, MCV1 is provided in the routine childhood vaccination schedule at age 9 months, and a second dose of MCV is provided through periodic supplemental immunization activities (SIAs). In Somalia, MCV also is provided to children aged 9–59 months during child health days or SIAs. In refugee settings, Sphere standards for humanitarian response* recommend providing MCV to ≥95% of new arrivals aged 6 months–15 years and SIAs to prevent outbreaks (*4*). Infants that receive MCV1 at age <9 months should receive 2 additional doses at least 1 month apart and according to the national immunization schedule (*3*).

*A set of universal minimum standards established by nongovernment organizations for humanitarian response in situations of disaster and conflict. Additional information available at http://www.sphereproject.org.

WHO and the United Nations Children's Fund (UNICEF) annually estimate MCV1 coverage administered through routine immunization services among children aged 1 year. Countries annually report the number of districts with ≥80% MCV1 coverage (*5*). In refugee camps, MCV coverage is monitored by the United Nations High Commissioner for Refugees using administrative records and nutrition surveys (*6*). Countries report annual measles surveillance data to WHO and UNICEF (*7*). In Kenya and Ethiopia, measles surveillance is case-based with laboratory confirmation of suspected measles (*8*). In Somalia, case-based surveillance with laboratory testing is limited to sentinel sites; an integrated disease surveillance system collects aggregated case counts of clinically confirmed measles cases nationally.

Ethiopia

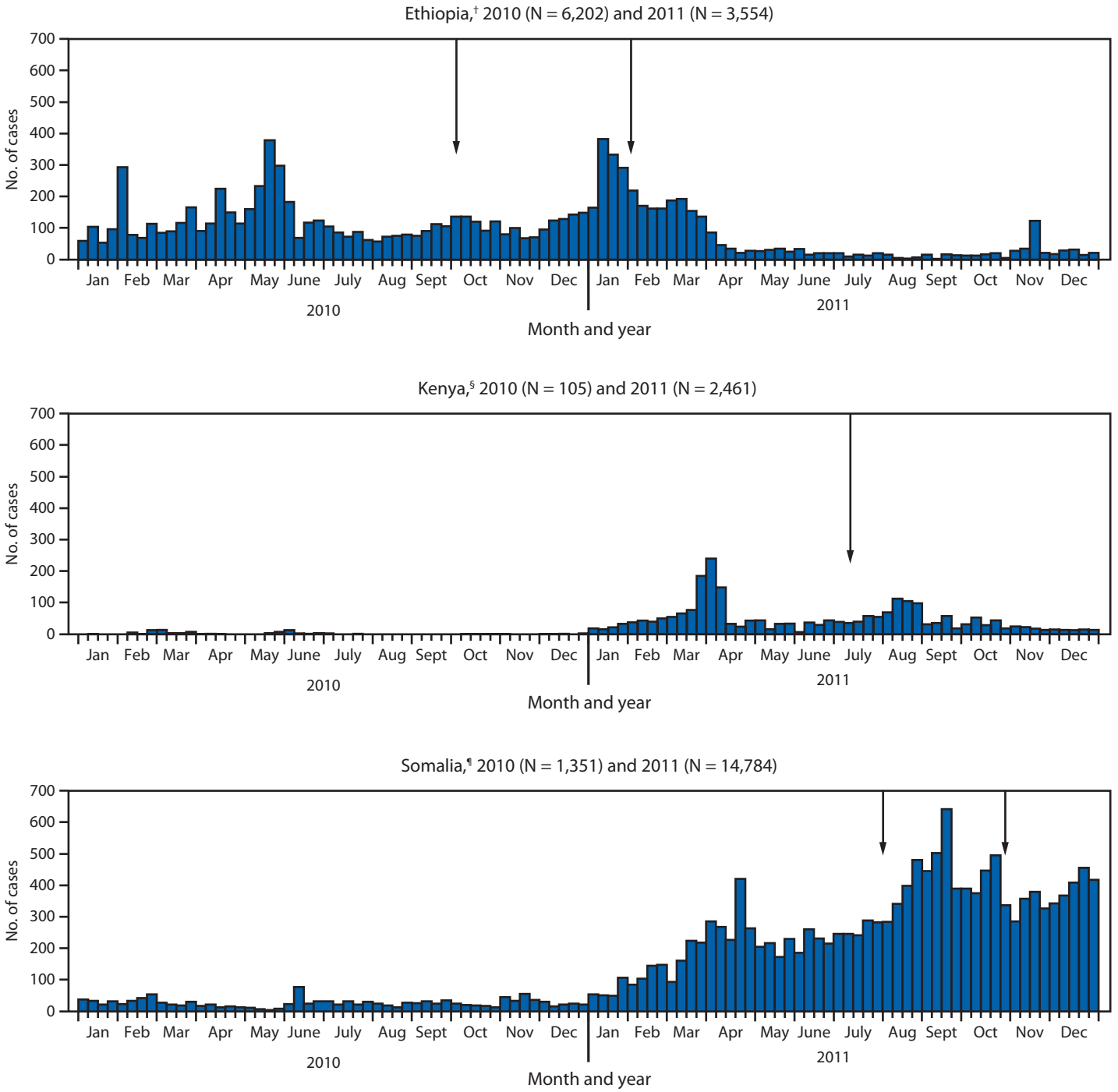
Estimated MCV1 coverage in Ethiopia was 56% in 2010 and 57% in 2011; the percentage of districts reporting ≥80% MCV1 coverage was 45% in 2010 and 43% in 2011. A nationwide measles SIA targeting approximately 9.1 million children aged 9–47 months was conducted in two phases; seven regions were targeted in October 2010 and the four remaining regions in February 2011 (Figure 1). Administrative coverage† was 106%, and coverage based on a population-based survey was 88.2% (95% confidence interval [CI] = 85.1%–90.6%); 87 (91%) districts reported >95% administrative coverage. During 2010–2011, annual reported measles incidence decreased from 75 to 42 per 1 million population; the percentage of reported cases among children aged <5 years decreased from 45% to 31% (Table, Figure 2).

Kenya

Estimated MCV1 coverage in Kenya was 86% in 2010 and 87% in 2011. The percentage of districts reporting ≥80% MCV1 coverage was 66% in 2010 and 65% in 2011. The most recent nationwide measles SIA in 2009 reached approximately 82% of an estimated 5.5 million children aged 9–59 months. During 2010, 105 measles cases were reported, primarily in the northeast during the first half of the year. Starting in January 2011, measles cases increased throughout the country, first occurring in the Northeast Province and among the Somali community in Nairobi. National reported measles incidence

†Administrative coverage estimates, derived by dividing the number of vaccine doses reported administered to the target population by the estimated number of persons in the target population, are reported annually by WHO member states, and can be supplemented by special coverage surveys and other published and unpublished data.

FIGURE 1. Reported measles cases* by epidemiologic week — Horn of Africa, 2010–2011



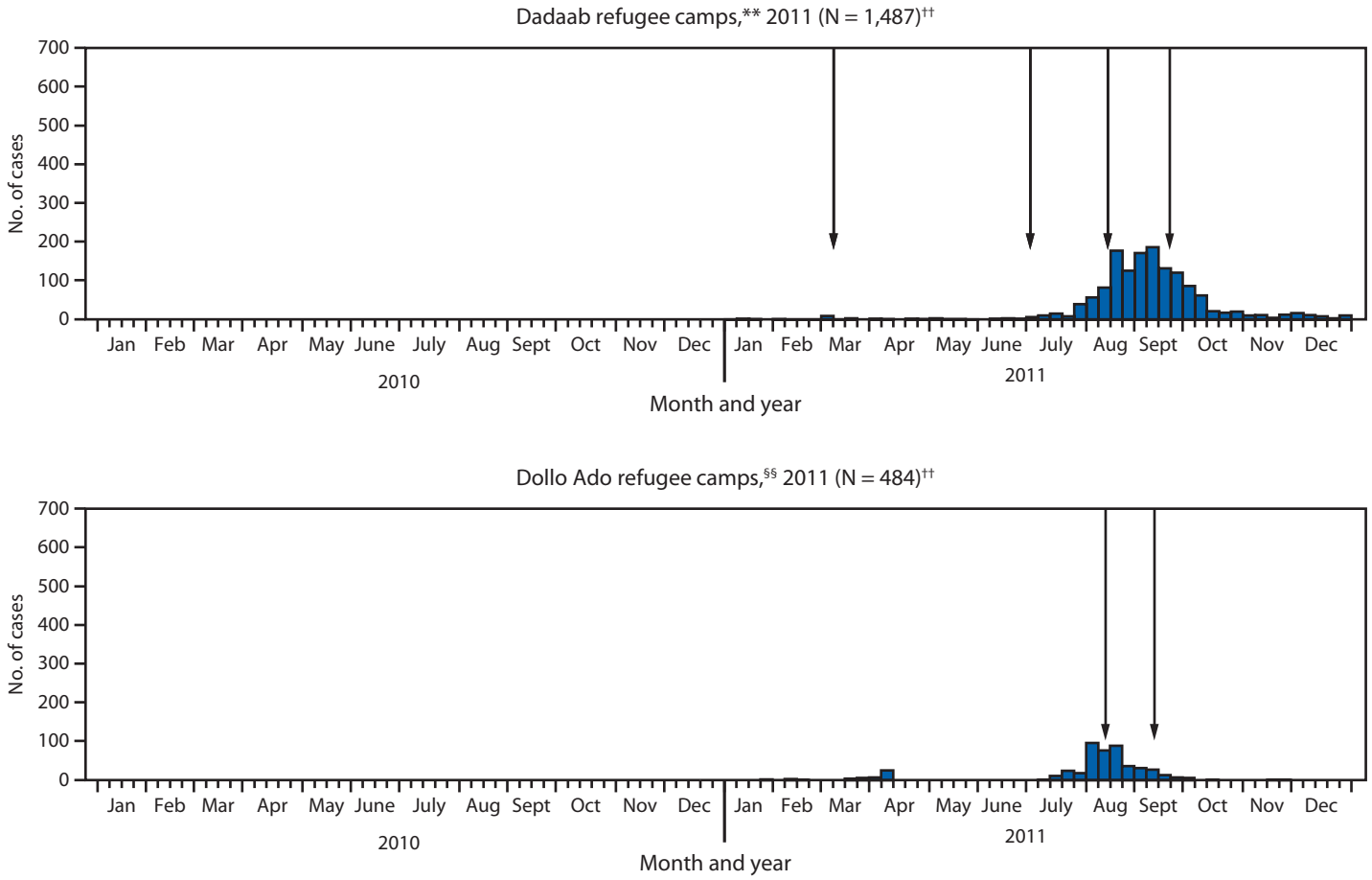
See figure footnotes on page 680.

increased from 3 per 1 million population in 2010 to 59 per 1 million population in 2011 (Table). During July–August 2011, ORIs were conducted in five districts in the Northeast Province; however, cases coinciding with outbreaks in Dadaab refugee camps and in southern Somalia continued to occur (Figures 1 and 2).

Somalia

Estimated MCV1 coverage in Somalia was 46% in both 2010 and 2011. The percentage of districts reporting ≥80% MCV1 coverage was 20% in 2010 and 35% in 2011. During three rounds of child health days conducted during

FIGURE 1. (*Continued*) Reported measles cases* by epidemiologic week — Horn of Africa, 2010–2011



* As of July 12, 2012. Geneva, Switzerland: World Health Organization; 2012. Available at http://apps.who.int/immunization_monitoring/en/globalsummary/timeseries/tsincidencemea.htm. Accessed August 20, 2012.

† Ethiopia: Two arrows indicate the two phases of a nationwide follow-up measles supplemental immunization activity (SIA), targeting approximately 9.1 million children aged 9–47 months in seven regions in October 2010 and the remaining four regions in February 2011, and achieving 106% administrative coverage with 91% of districts reporting >95% administrative coverage.

§ Kenya: Arrow indicates measles outbreak response immunization (ORI) campaign that was conducted during July–August 2011 in five districts in the North Eastern Province, targeting 165,102 children aged 6–59 months and achieving 107% administrative coverage.

¶ Somalia: Two arrows indicate measles ORI conducted during August 25–29, 2011, that reached 656,266 children aged 6 months–14 years with a reported 88% coverage, and ORI conducted during October 26–28 and November 1–3, 2011, targeting children aged 6 months–14 years in 14 districts of Banaadir region. Because of security constraints, the ORI was not conducted in Daynile and in Heliwa district.

** Dadaab: Four arrows indicate 1) ORI conducted during March 28–April 7, 2011, targeting children aged 9 months–14 years and achieving administrative coverage of 98% in Hagadera, 88% in Ifo, and 98% in Dagahaley; 2) ORI conducted during July 25–29, targeting 215,000 children aged 6–59 months before arrival at the camp; 3) ORI conducted during August 1–5, targeting children aged 6–59 months and achieving 99% administrative coverage; and 4) ORI conducted during September 12–17, targeting adults aged 15–29 years in three camps and achieving administrative coverage of 87% in Ifo, 104% in Ifo extension, and 88% in Dagahaley.

†† Numbers of reported measles cases in refugee camps during 2010 were not available.

§§ Dollo Ado: Two arrows indicate ORI conducted during August 11–27, 2011, targeting children aged 6 months–14 years and achieving administrative coverage of 98% in Boko, 94% in Melkadida, and 85% in Kobe; and ORI conducted during September 2–7, targeting children aged 6 months–15 years (coverage percentage not available).

May 2010–January 2011, southern and central regions were inaccessible because of armed conflict, and national administrative coverage was 39%–62%. During 2010–2011, reported measles incidence increased from 145 to 1,542 cases per 1 million population (Table, Figure 2). ORIs were implemented, but cases continued to occur in 2011 (Figure 1).

Refugee Camps

In 1991, the Hagadera, Ifo, and Dagahaley camps were established in the Dadaab refugee complex in northeastern Kenya to house Somali refugees fleeing civil war. During 2005–2011, the estimated refugee population increased from 127,387 to 443,974 in Dadaab. To accommodate approximately 75,000 refugees in unplanned settlements, Ifo-extension and Kambioos

TABLE. Reported measles incidence and number of cases by sex, age group, and vaccination status — Horn of Africa, 2010–2011

	Country												Refugee camp			
	Ethiopia				Kenya				Somalia				Dadaab		Dollo Ado	
Characteristic	2010		2011		2010		2011		2010		2011		2011		2011	
Measles cases*	6,202		3,554		105		2,461		1,351		14,784		1,487		484	
Incidence per 1 million†	75		42		3		59		145		1,542		3,853		5,398	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Sex																
Male	3,308	(53)	1,872	(54)	75	(73)	1,279	(52)	NA§	—	NA	—	728	(49)	182	(45)
Age group¶																
<5 yrs	2,812	(45)	970	(31)	20	(20)	983	(41)	976	(72)	11,601	(78)	349	(24)	67	(16)
≥5 yrs	3,390	(55)	2,124	(69)	80	(80)	1,411	(59)	375	(28)	3,183	(22)	1,130	(76)	340	(84)
<9 mos	343	(6)	178	(6)	1	(1)	217	(9)	NA	—	NA	—	180	(12)	6	(1)
9 mos–4 yrs	2,469	(40)	792	(26)	19	(19)	766	(32)	NA	—	NA	—	169	(11)	61	(15)
5 yrs–9 yrs	1,464	(24)	702	(23)	30	(30)	553	(23)	NA	—	NA	—	153	(10)	123	(30)
10 yrs–14 yrs	843	(14)	423	(14)	35	(35)	277	(12)	NA	—	NA	—	106	(7)	39	(10)
≥15 yrs	1,083	(17)	999	(32)	15	(15)	581	(24)	NA	—	NA	—	871	(59)	178	(44)
Vaccination status**																
None	2,937	(64)	1,497	(63)	53	(62)	1,023	(52)	NA	—	NA	—	1,111	(79)	NA	—
1 dose	1,309	(29)	670	(28)	12	(14)	697	(36)	NA	—	NA	—	293	(21)	NA	—
≥2 doses	321	(7)	225	(9)	20	(24)	234	(12)	NA	—	NA	—	0	(0)	NA	—

Abbreviation: NA = not available.

* Measles cases were confirmed by laboratory testing, epidemiologic link, or clinical compatibility as reported by Ethiopia and Kenya using measles case-based surveillance to the World Health Organization (WHO) African Regional Office. In Somalia, measles cases were clinically confirmed using the Communicable Disease Surveillance and Response (CSR) system, which collects aggregated case counts, and limited laboratory testing at sentinel sites, as reported to the WHO Eastern Mediterranean Regional Office. In refugee camps, cases were clinically confirmed as reported by the United Nations High Commisioner for Refugees (UNHCR).

† Annual measles incidence was calculated using confirmed measles cases from national measles case-based surveillance for Ethiopia and Kenya, or national measles CSR data for Somalia, or UNHCR surveillance data for the refugee camps, and denominators from national population estimates from the United Nations Population Division for countries and mid-year population estimates from UNHCR for refugee camps.

§ In Somalia the CSR system collects aggregated case counts in two age groups. More specific age and sex data are not recorded.

¶ Patient ages were missing for five in 2010 and 460 in 2011 in Ethiopia, 67 in 2011 in Kenya, eight in Dadaab, and 77 in Dollo Ado.

** Patient vaccination status was missing for 1,635 in 2010 and 1,162 in 2011 in Ethiopia, 20 in 2010 and 507 in 2011 in Kenya, and 83 in Dadaab. Vaccination status was not collected in Somalia and Dollo Ado.

camps were added in August 2011. In the Dollo Ado region of southern Ethiopia, Bokolmanyo and Malkadida refugee camps were established in response to refugees arriving from Somalia during 2009–2010. In 2011, the estimated population of the Dollo Ado camps increased from 46,000 to 142,233, and Kobe, Hilaweyn, and Bur-Amino camps were opened to accommodate the influx of refugees.

In the Dadaab refugee camps, sporadic measles cases occurred during January–June 2011 (Figure 1). In July 2011, an outbreak began, coinciding with a large influx of refugees and the measles outbreak in Somalia; 59% of cases were among refugees aged ≥15 years. During 2011, ORIs were conducted during March 28–April 7, targeting children aged 9 months–14 years; during August 1–5, targeting children aged 6 months–5 years; and during September 12–17, targeting adults aged 15–29 years. In addition, in August 2011, measles vaccination was provided to new arrivals aged 6 months–29 years, all hospitalized pediatric patients, and unvaccinated household contacts aged 6 months–14 years. Beginning in October, reported cases decreased as the numbers of newly arriving refugees also decreased. During March–April 2011, a cluster of measles cases occurred in the Dollo Ado refugee camps, followed by an outbreak involving 436 cases during July–October; 44% of cases were among refugees aged ≥15 years (Figure 1). In September 2011, routine measles vaccination was expanded to include new arrivals aged 6 months–29 years. Beginning in September, the number of new arrivals and reported cases decreased.

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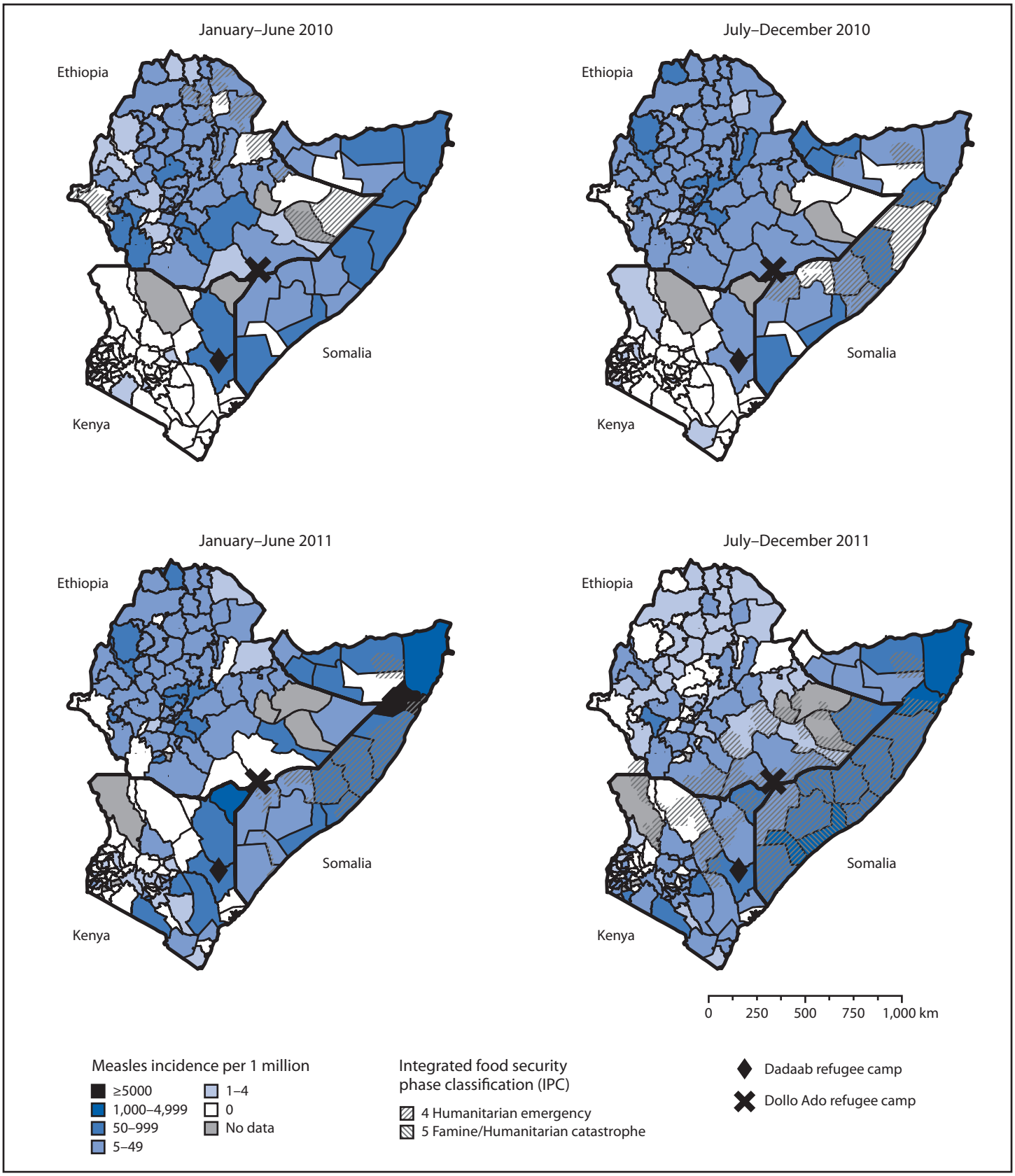
FIGURE 2. Annualized reported measles incidence,* by administrative area† — Horn of Africa, 2010–2011



* Annualized reported measles incidence was calculated by dividing the number of reported confirmed measles cases from national measles case-based surveillance data by annual population estimates from national census projections.

† The administrative areas were zones in Ethiopia, districts in Kenya, and regions in Somalia.

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Editorial Note

Severe drought, famine, war, large-scale population movements, and overcrowded refugee camps led to a complex emergency in the Horn of Africa during 2010–2011. In Somalia, low MCV coverage in areas where immunization services could not be provided for nearly 2 years led to a massive measles outbreak, primarily among children aged <5 years. Population movements, including large influxes of refugees from southern and central areas of Somalia into camps in Kenya and Ethiopia near the Somalia borders led to measles virus transmission among refugees and to outbreaks in Ethiopia and Kenya. After ORIs, the number of cases decreased in the refugee camps; the decrease coincided with a decrease in the number of arriving refugees. However, large outbreaks continued in Kenya and Somalia.

In Somalia, a decades-long civil war and the absence of a centralized government crippled efforts to provide basic public health services, including delivering vaccinations to children. Strategies to achieve high vaccination coverage in such settings should use "days of tranquility" to implement vaccination and child health days (*9*), and should be designed to ensure that every child receives 2 MCV doses, in accordance with WHO recommendations (*3*). In 2012, the measles outbreak has continued, and additional vaccination activites should be implemented.

In Kenya, 41% of cases nationally occurred among children aged <5 years, indicating that substantial numbers of children were missed by ORIs and SIAs during the past 4 years. In 2011, an ORI was implemented 6 months after the start of the outbreak, targeting a narrow age group in a limited geographic area, but cases continued to occur. A nationwide follow-up measles SIA is planned for 2012, and efforts are needed to ensure a high-quality campaign.

In Ethiopia, although estimated MCV1 coverage nationally was ≤50% before 2009, measles incidence decreased from 2010 to 2011, which might be related to achieving high coverage in the nationwide SIA targeting children aged 9–47 months during 2010–2011. A comprehensive review of surveillance data and SIA implementation conducted in March 2010 led to the development of SIA "best practices," which were implemented during the 2010–2011 SIA, including involving local leaders in microplanning and social mobilization, focusing on hard-to-reach areas, improving training, and house-to-house canvassing during the SIA.

What is already known on this topic?

The member states of the World Health Organization's African Region (AFR) and Eastern Mediterranean Region (EMR) have set goals for measles elimination by 2020 and 2015, respectively. After implementation of measles vaccination strategies, estimated coverage with the first dose of measles-containing vaccine (MCV1) in 2010 was 76% in AFR and 85% in EMR. However, reported measles cases in AFR increased from 37,012 to 199,174 during 2008–2010. Reported measles cases in EMR increased from 12,120 to 36,605 during 2008–2009 but declined to 10,072 in 2010. During 2010, reported measles incidence per 1 million population was 238 in AFR and 17 in EMR.

What is added by this report?

Estimated MCV1 coverage for Ethiopia, Kenya, and Somalia in the Horn of Africa was 56%, 86%, and 46% in 2010, and 57%, 87%, and 46% in 2011, respectively. Measles outbreaks occurred in the region and were exacerbated by a complex humanitarian emergency in Somalia. During 2010–2011, annual reported measles incidence in Somalia increased from 145 to 1,542 cases per 1 million, and an influx of refugees from Somalia into border camps in Kenya and Ethiopia resulted in outbreaks in the camps. Outbreak response immunization campaigns were implemented but with limited effect.

What are the implications for public health practice?

To reach AFR and EMR measles elimination targets, uniform high coverage with 2 doses of measles-containing vaccine (MCV) must be achieved and maintained in Horn of Africa countries, including in refugee camps where Sphere standards for humanitarian response should be fully implemented. To reach global measles reduction targets, strengthened vaccination strategies including supplemental immunization activity "best practices," uniform 2-dose MCV coverage, and improved outbreak preparedness and response among displaced populations are necessary to achieve immunity to measles in 93%–95% of the population.

To prevent large measles outbreaks and ultimately reach measles elimination goals in EMR by 2015 and in AFR by 2020, vaccination strategies must be implemented to achieve and maintain uniformly high 2-dose MCV coverage to reach the 93%–95% population immunity threshold that can provide herd immunity in all countries. In refugee settings, Sphere minimum standards for humanitarian response should highlight the need to provide 1) 2 MCV doses to every child, 2) close monitoring of 2-dose MCV coverage, and 3) inclusion of informal settlements and host communities in vaccination plans. Outbreak preparedness should be maintained to ensure high-quality surveillance for measles cases, appropriate case management, and rapid ORI strategies that reach susceptible populations, based on the age distribution of infected persons in a particular outbreak (*10*).

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Announcement

Addition of Households with Only Cellular Telephone Service to the National Immunization Survey, 2011

Before 2011, the National Immunization Survey (NIS) used a random-digit–dialed, list-assisted landline telephone sample of households to monitor national, state, and selected local area vaccination coverage among noninstitutionalized children aged 19–35 months and 13–17 years (NIS-Teen) in the United States. Since NIS was begun in 1994, landline telephone use has decreased while cellular telephone use has increased. By the second half of 2011, the proportion of children in the United States living in households with only cellular telephone service was 38.1% (*1*). At least one factor, poverty, has been associated both with having only cellular telephone service and lower vaccination coverage, increasing the potential for bias in landline telephone surveys because of a lack of a representative sampling frame (*1–3*).

Beginning in 2011, the NIS sampling frame was expanded from a single landline frame to dual landline and cellular telephone sampling frames. This change increased the representativeness of the sample characteristics but had little effect on the final 2011 NIS and NIS-Teen national estimates of vaccination coverage overall and when stratified by poverty status (*4,5*).

Public health surveillance systems must occasionally change methods, and telephone surveys particularly need to include households with only cellular telephone service (*6*). The impact of this change on the validity of NIS estimates will be monitored annually. Further information, including a description of the dual landline and cellular sampling frames, specific weighting methods, and detailed national, state, and local area tables comparing estimates from the landline and dual frames by poverty level, is available at http://www.cdc.gov/vaccines/stats-surv/nis/dual-frame-sampling-08282012.htm.

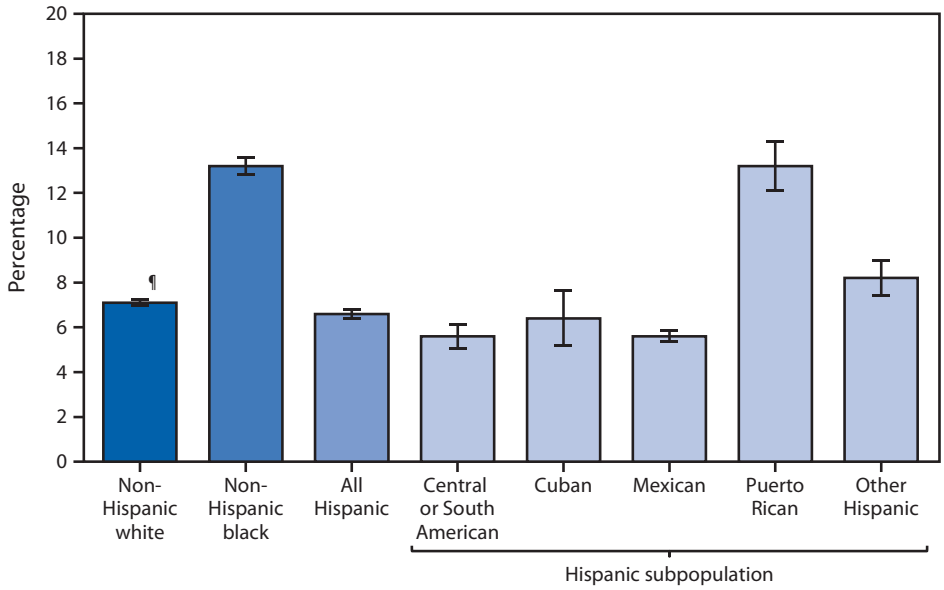
References

1. Blumberg S, Luke J. Wireless substitution: early release of estimates from the National Health Interview Survey, July–December 2011. Atlanta, GA: US Department of Health and Human Services, CDC; 2012. Available at http://www.cdc.gov/nchs/nhis.htm. Accessed August 24, 2012.
2. CDC. National and state vaccination coverage among adolescents aged 13 through 17 years—United States, 2010. MMWR 2011;60:1117–23.
3. CDC. National and state vaccination coverage among children aged 19–35 months—United States, 2010. MMWR 2011;60:1157–63.
4. CDC. National and state vaccination coverage among adolescents aged 13 through 17 years—United States, 2011. MMWR 2012;61:671–7.
5. CDC. National and state vaccination coverage among children aged 19–35 months—United States, 2011. MMWR 2012. In press.
6. CDC. Methodologic changes in the Behavioral Risk Factor Surveillance System in 2011 and potential effects on prevalence estimates. MMWR 2012;61:410–3.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged 18–64 Years Who Made Two or More Visits to an Emergency Department in the Preceding 12 Months,* by Black or White Race and Hispanic Subpopulation† — National Health Interview Survey, United States, 2009–2011§



* Based on a survey question that asked respondents, "During the past 12 months, how many times have you gone to a hospital emergency room about your own health? (This includes emergency room visits that resulted in a hospital admission.)" Unknowns were not included in the denominators when calculating percentages.
† Persons of Hispanic ethnicity might be of any race or combination of races. Non-Hispanic persons are those who are not of Hispanic ethnicity, regardless of race.
§ Estimates are based on household interviews of a sample of the U.S. civilian, noninstitutionalized population.
¶ 95% confidence interval.

During 2009–2011, Hispanic adults aged 18–64 years were less likely (6.6%) than non-Hispanic blacks (13.2%) and about as likely as non-Hispanic whites (7.1%) to have made two or more visits to an emergency department in the preceding 12 months. Among Hispanic subpopulations, Puerto Rican adults had the highest percentage (13.2%) of two or more emergency department visits in the preceding 12 months, followed by other Hispanic adults (8.2%), Cuban adults (6.4%), Mexican adults (5.6%), and Central or South American adults (5.6%).

Source: National Health Interview Survey, 2009–2011 Sample Adult Core component. Available at http://www.cdc.gov/nchs/nhis.htm.

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