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State Laws Prohibiting Sales to Minors and Indoor Use of Electronic Nicotine Delivery Systems — United States, November 2014

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Electronic nicotine delivery systems (ENDS), including electronic cigarettes (e-cigarettes) and other devices such as electronic hookahs, electronic cigars, and vape pens, are battery-powered devices capable of delivering aerosolized nicotine and additives to the user. Experimentation with and current use of e-cigarettes has risen sharply among youths and adults in the United States (*1,2*). Youth access to and use of ENDS is of particular concern given the potential adverse effects of nicotine on adolescent brain development (*3*). Additionally, ENDS use in public indoor areas might passively expose bystanders (e.g., children, pregnant women, and other nontobacco users) to nicotine and other potentially harmful constituents (*4,5*). ENDS use could have the potential to renormalize tobacco use and complicate enforcement of smoke-free policies (*1*). State governments can regulate the sales of ENDS and their use in indoor areas where nonusers might be involuntarily exposed to secondhand aerosol (*4,5*). To learn the current status of state laws regulating the sales and use of ENDS, CDC assessed state laws that prohibit ENDS sales to minors and laws that include ENDS use in conventional smoking prohibitions in indoor areas of private worksites, restaurants, and bars. Findings indicate that as of November 30, 2014, 40 states prohibited ENDS sales to minors, but only three states prohibited ENDS use in private worksites, restaurants, and bars. Of the 40 states that prohibited ENDS sales to minors, 21 did not prohibit ENDS use or conventional smoking in private worksites, restaurants, and bars. Three states had no statewide laws prohibiting ENDS sales to minors and no statewide laws prohibiting ENDS use or conventional smoking in private worksites, restaurants, and bars. According to the Surgeon General, ENDS have the potential for public health harm or public health benefit (*1*). The possibility of public health benefit from ENDS could arise only if 1) current smokers use these devices to switch completely from combustible tobacco products and 2) the availability and use of combustible tobacco products are rapidly reduced (*1*). Therefore, when addressing potential public health harms associated with ENDS, it is important to simultaneously uphold and accelerate strategies found by the Surgeon General to prevent and reduce combustible tobacco use, including tobacco price increases, comprehensive smoke-free laws, high-impact media campaigns, barrier-free cessation treatment and services, and comprehensive statewide tobacco control programs (*1*).

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Data on state laws enacted as of November 30, 2014, were obtained from CDC's State Tobacco Activities Tracking and Evaluation (STATE) System for the 50 states and the District of Columbia.* STATE contains tobacco-related state laws collected quarterly from the LexisNexis online legal research database.† This study examined laws that explicitly prohibit: 1) ENDS sales to minors; and 2) ENDS use in indoor areas of private-sector worksites, restaurants, and bars. Laws that made general reference to tobacco products or tobacco consumption, without explicit reference to ENDS, were excluded. State laws covering private-sector worksites, restaurants and bars were assessed to determine whether these laws align with CDC's definition of a comprehensive smoke-free law (i.e., prohibiting smoking in all indoor areas of private worksites, restaurants, and bars) (*6*). U.S. Census Bureau estimates as of July 2013 were used to estimate population coverage.§

A total of 40 state laws prohibit ENDS sales to minors (Table); sales are prohibited to persons aged <18 years in 36 states and <19 years in Alabama, Alaska, New Jersey, and Utah (Figure 1). Twelve states enacted such laws effective during 2010–2012, compared with 12 states in 2013, and 16 states by November 30, 2014 (Table). Approximately 16 million children aged <18 years can legally purchase ENDS in the remaining 11 states, including the District of Columbia.

Whereas 27 states, including the District of Columbia, have comprehensive smoke-free laws that prohibit smoking in restaurants, worksites, and bars, only three limit indoor ENDS use: New Jersey, North Dakota, and Utah (Figure 2). Thus, an estimated 303 million U.S. residents, including 70 million children, live in states in which nonusers of these products can be passively exposed to either secondhand smoke from cigarettes and other combustible tobacco products or ENDS aerosol. No states have enacted comprehensive smoke-free laws or laws prohibiting ENDS use in private worksites, restaurants, and bars since 2012 (Table).

Two states (New Jersey and Utah) prohibit ENDS sales to minors and indoor smoking and indoor ENDS use in private worksites, restaurants, and bars (Table). Three states (Nevada, Pennsylvania, and Texas) have neither type of law (Table). Among the 40 states with laws prohibiting ENDS sales to minors, 21 lack laws that prohibit conventional smoking and ENDS use indoors in private worksites, restaurants, and bars (Table).

Discussion

An increasing number of states have enacted laws prohibiting ENDS sales to minors, but 11 states, including the District of Columbia, have not. Far fewer states have passed laws prohibiting ENDS use indoors, and no states have enacted such laws since 2012. The comparative lack of laws prohibiting ENDS

* Additional information available at http://www.cdc.gov/tobacco/statesystem. (ENDS laws will be added to the STATE System database in 2015.)
† Additional information available at http://www.lexisnexis.com.
§ Additional information available at http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2013_PEPAGESEX&prodType=table.

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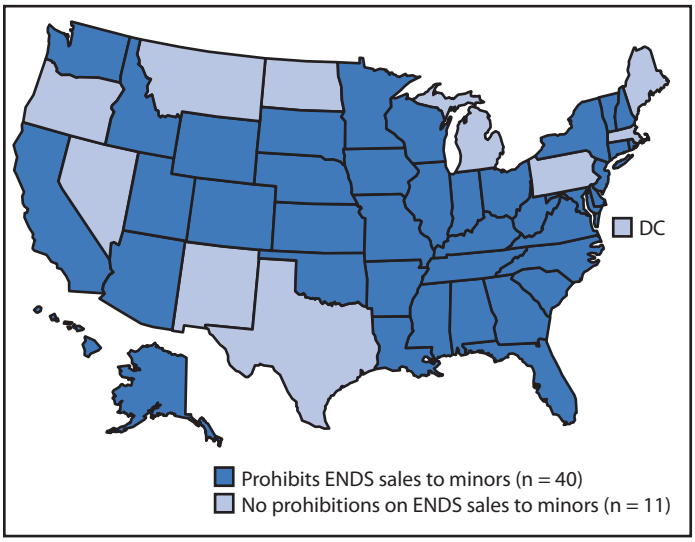
FIGURE 1. States with and without laws prohibiting sales of electronic nicotine delivery systems (ENDS) to minors* — United States, November 30, 2014



* Minors are defined by statute as persons aged <18 years, except in four states where they are defined as persons aged <19 years (Alabama, Alaska, New Jersey, and Utah).

use indoors could be attributable to limited knowledge about the potential health effects of public ENDS use and to the complexities of modifying existing state smoke-free laws (*1*).

Prohibitions on ENDS use in public places might be beneficial in multiple ways. First, prohibitions could preserve clean indoor air because ENDS aerosol can contain harmful and potentially harmful constituents, including nicotine and other toxins (*4,5,7*), and some ENDS can be modified to deliver marijuana and other psychoactive substances (*8*). Second, based on the experience that smoke-free policies result in diminished social acceptability of smoking (*9*), restrictions on ENDS use in public might help support tobacco-free norms. Third, such restrictions could support smoke-free law enforcement because some ENDS use can be difficult to distinguish from conventional smoking, thus complicating smoke-free policy enforcement. Accordingly, it is important that efforts to integrate ENDS into smoke-free laws uphold or strengthen, not weaken, existing protections against secondhand smoke exposure (*1,3*).

The relatively rapid adoption of laws prohibiting ENDS sales to minors compared with the slow adoption of laws prohibiting ENDS use in public indoor spaces might be attributable, in part, to the tobacco industry, which has actively advocated for state legislation to prevent minors from purchasing ENDS.¶ This is of concern because industry-supported youth-access bills have contained provisions that undermine youth prevention efforts, including preemption of stricter local policies and weak enforcement requirements (*9*). Additionally, laws prohibiting sales to minors are likely to have limited effectiveness as a youth tobacco prevention strategy if not coupled with proven interventions such as comprehensive smoke-free laws (*1,9*). Thus, among the 21 states that have laws prohibiting sales of ENDS to minors but do not have comprehensive smoke-free laws, protections against the use of conventional tobacco and ENDS in indoor public places would benefit public health. Laws prohibiting sales of ENDS to minors that allow for local action and feature strong enforcement provisions are more likely to help prevent youth access (*9*).

The recent rapid increase in ENDS use by youth and adults might be partially attributable to increased advertising of these products, particularly on television (*10*). Some marketing suggests that ENDS can be used in places where smoking is not allowed (*1*) or refers customers to advocacy groups that oppose indoor ENDS use prohibitions (*3*).**†† These groups contend that ENDS emit fewer toxins than combustible tobacco, and that public use could encourage smokers to switch to ENDS. However, ENDS aerosol is not as safe as clean air. Nicotine is a psychoactive chemical with known harms and irritant effects (*1*). Research has documented the presence of secondhand nicotine exposure using environmental monitoring and the measurement of biomarkers among exposed nonusers (*5,7*). Moreover, public ENDS use might prolong smoking by facilitating situational substitution of ENDS when smoking is not allowed, rather than complete substitution (*1,3*). Using a public health standard, policies should consider potential adverse impacts on the entire population, particularly children and nonusers (*1*).

The Food and Drug Administration (FDA) has issued a proposal to regulate additional products meeting the legal definition of a tobacco product, including ENDS, through authority granted by the Family Smoking Prevention and Tobacco Control Act.§§ If finalized as written, the rule would establish, among other provisions: restrictions to prevent sales to minors, to prohibit free samples, and to prohibit vending machine sales, unless in a facility that never admits minors. The proposed rule must undergo several steps before becoming final, and during this period there could be further increases in youth ENDS use. Furthermore, FDA regulation will not address certain key policy interventions related to ENDS, such as use in public places. The Family Smoking Prevention and Tobacco Control Act allows states and localities to adopt or continue to enforce additional or more stringent requirements

¶ Additional information available at http://www.commerce.senate.gov/public/?a=Files.Serve&File_id=7e32673d-795b-44ce-979b-cc9d6c4f1d48.

** Additional information available at http://www.howtonjoyvaping.com/home-1.

†† Additional information available at http://sfata.org/calls-to-action.

§§ Additional information available at http://www.gpo.gov/fdsys/pkg/PLAW-111publ31/content-detail.html.

TABLE. State laws prohibiting sales of electronic nicotine delivery systems (ENDS) to minors and laws prohibiting conventional smoking and the use of ENDS in indoor areas of private worksites, restaurants, and bars — United States, November 30, 2014

State	Effective date of law restricting ENDS sales to minors (minimum age allowed [yrs])	State smoke-free law		Summary of laws enacted as of November 30, 2014
		Prohibits conventional smoking in worksites, restaurants, and bars (effective date)	Includes restriction on ENDS use (effective date)	
Alabama	8/1/2013 (19)			YA
Alaska	8/22/2012 (19)			YA
Arizona	9/13/2013 (18)	5/1/2007	No	YA/SF
Arkansas	8/16/2013 (18)			YA
California	9/27/2010 (18)			YA
Colorado	3/25/2011 (18)	7/1/2006	No	YA/SF
Connecticut	10/1/2014 (18)			YA
Delaware	6/12/2014 (18)	12/1/2002	No	YA/SF
District of Columbia		1/1/2007	No	SF
Florida	7/1/2014 (18)			YA
Georgia	7/1/2014 (18)			YA
Hawaii	6/27/2013 (18)	11/16/2006	No	YA/SF
Idaho	7/1/2012 (18)			YA
Illinois	1/1/2014 (18)	1/1/2008	No	YA/SF
Indiana	7/1/2013 (18)			YA
Iowa	7/1/2014 (18)	7/1/2008	No	YA/SF
Kansas	7/1/2012 (18)	7/1/2010	No	YA/SF
Kentucky	4/10/2014 (18)			YA
Louisiana	5/28/2014 (18)			YA
Maine		9/11/2009	No	SF
Maryland	10/1/2012 (18)	2/1/2008	No	YA/SF
Massachusetts		7/5/2004	No	SF
Michigan		5/1/2010	No	SF
Minnesota	8/1/2010 (18)	10/1/2007	No	YA/SF
Mississippi	7/1/2013 (18)			YA
Missouri	9/10/2014 (18)			YA
Montana		10/1/2009	No	SF
Nebraska	4/9/2014 (18)	6/1/2009	No	YA/SF
Nevada				
New Hampshire	7/31/2010 (18)			YA
New Jersey	3/12/2010 (19)	4/15/2006	Yes (7/11/2010)	YA/SF/EF
New Mexico		6/15/2007	No	SF
New York	1/1/2013 (18)	7/24/2003	No	YA/SF
North Carolina	8/1/2013 (18)			YA
North Dakota		12/6/2012	Yes (12/6/2012)	SF/EF
Ohio	8/2/2014 (18)	12/7/2006	No	YA/SF
Oklahoma	11/1/2014 (18)			YA
Oregon		1/1/2009	No	SF
Pennsylvania				
Rhode Island	6/30/2014 (18)	3/1/2005	No	YA/SF
South Carolina	6/7/2013 (18)			YA
South Dakota	7/1/2014 (18)	11/10/2010	No	YA/SF
Tennessee	7/1/2011 (18)			YA
Texas				
Utah	5/11/2010 (19)	1/1/2009	Yes (5/8/2012)	YA/SF/EF
Vermont	7/1/2013 (18)	7/1/2009	No	YA/SF
Virginia	7/1/2014 (18)			YA
Washington	7/28/2013 (18)	12/8/2005	No	YA/SF
West Virginia	6/27/2014 (18)			YA
Wisconsin	4/20/2012 (18)	7/5/2010	No	YA/SF
Wyoming	3/13/2013 (18)			YA
Total	**40**	**27**	**3**	**N/A**

Abbreviations: YA = youth access (state law prohibits sales of ENDS to minors); SF = smoke-free (state has a comprehensive smoke-free law that prohibits smoking in indoor areas of private worksites, restaurants, and bars; EF = ENDS-free (state law prohibits the use of ENDS in indoor areas of private worksites, restaurants, and bars).

What is already known on this topic?

Electronic nicotine delivery systems (ENDS), including electronic cigarettes (e-cigarettes), are battery-powered devices capable of delivering aerosolized nicotine and other additives to the user. State governments play an integral role in regulating the sales of ENDS and ensuring that citizens are protected from involuntary exposure to secondhand smoke, nicotine, and other potentially harmful constituents.

What is added by this report?

As of November 30, 2014, 40 states have enacted laws prohibiting ENDS sales to minors, but only three of the 27 states with comprehensive smoke-free air laws have incorporated ENDS. Approximately 16 million children can legally purchase ENDS, and 303 million U.S. residents, including 70 million children, live in states in which non–tobacco users could be passively exposed to either secondhand smoke from cigarettes and other combustible tobacco products, or ENDS aerosol, in private worksites, restaurants, and bars.

What are the implications for public health practice?

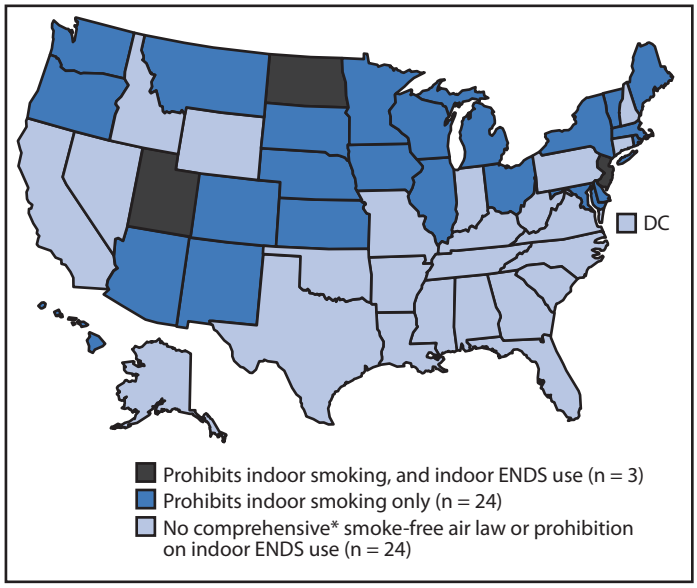
When addressing potential public health harms associated with ENDS, it is critical to simultaneously uphold and accelerate strategies proven to prevent and reduce use of conventional tobacco products, including tobacco price increases, comprehensive smoke-free air laws, high-impact media campaigns, barrier-free cessation treatment and services, and comprehensive statewide tobacco control programs.

than those stipulated. Additional national and state policies addressing retailer licensing, Internet sales, taxation, and marketing could further prevent youth use of ENDS and other tobacco products (*1*,*3*).

The findings in this report are subject to at least two limitations. First, STATE does not contain bills under consideration, regulations, local laws, opinions of attorneys general, or case law decisions for tobacco control topics other than preemption. Importantly, over 200 localities have included ENDS prohibitions in their comprehensive smoke-free laws.¶¶ Second, the strength of each law or the specific language contained in each law was not assessed. Statutory definitions of ENDS (e.g., as a tobacco product) vary across states. For example, some states' statutory definitions of ENDS define the products as alternative nicotine or vapor products that are exempt from regulations or taxes that apply to tobacco products. Including ENDS in the state or local statutory definition of tobacco products could facilitate the extension of additional tobacco control policies to ENDS, such as retailer licensing requirements, taxation, and marketing provisions.

¶¶ Additional information available at http://www.no-smoke.org/pdf/ecigslaws.pdf.

FIGURE 2. States with and without laws prohibiting smoking and use of electronic nicotine delivery systems (ENDS) in indoor areas of private worksites, restaurants, and bars — United States, November 30, 2014



* CDC defines a state smoke-free air law as comprehensive if it prohibits smoking in indoor areas of private worksites, restaurants, and bars.

Although ENDS might have the potential to benefit established adult smokers if used as a complete substitute for all combusted tobacco products, ENDS should not be used by youths and adult nontobacco users because of the adverse effects of nicotine and other risk exposures, as well as the risk for progression to other forms of tobacco use (*1*). The findings in this report suggest that states have additional opportunities to prevent access to ENDS, avoid renormalization of tobacco use, and preserve clean indoor air standards.

Proven tobacco prevention strategies, including comprehensive smoke-free laws and robust prohibitions against sales to minors, could be effective in preventing youth ENDS use and denormalizing tobacco use. Simultaneously upholding and accelerating strategies proven to prevent conventional tobacco use, support tobacco cessation, and prevent secondhand smoke exposure would benefit public health (*1*,*3*).

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Estimated Influenza Illnesses and Hospitalizations Averted by Vaccination — United States, 2013–14 Influenza Season

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The Advisory Committee on Immunization Practices recommends annual influenza vaccination for all persons aged ≥6 months to reduce morbidity and mortality caused by influenza in the United States (*1*). CDC previously developed a model to estimate that annual influenza vaccination resulted in 1.1–6.6 million fewer cases and 7,700–79,000 fewer hospitalizations per season during the 2005–2013 influenza seasons (*2,3*). For the 2013–14 influenza season, using updated estimates of vaccination coverage, vaccine effectiveness, and influenza hospitalizations, CDC estimates that influenza vaccination prevented approximately 7.2 million illnesses, 3.1 million medically attended illnesses, and 90,000 hospitalizations associated with influenza. Similar to prior seasons, fewer than half of persons aged ≥6 months are estimated to have been vaccinated.* If influenza vaccination levels had reached the *Healthy People 2020* target of 70%, an estimated additional 5.9 million illnesses, 2.3 million medically attended illnesses, and 42,000 hospitalizations associated with influenza might have been averted. For the nation to more fully benefit from influenza vaccines, more effort is needed to reach the *Healthy People 2020* target.

The methods used have been described in detail previously (*2*) and are outlined briefly in this report for the 2013–14 season. First, CDC estimated the number of illnesses, medically attended illnesses, and hospitalizations associated with influenza that occurred in the United States during the 2013–14 influenza season. Laboratory-confirmed influenza-associated hospitalization rates by age group were obtained from FluSurv-NET, a collaboration between CDC, the Emerging Infections Program Network, and selected health departments in 13 geographically distributed areas in the United States that conduct population-based surveillance.† Hospitalization rates were adjusted for underreporting based on the frequency and sensitivity of influenza testing in surveillance hospitals during two post-pandemic seasons (*4*); hospitalization rates were multiplied by a factor of 2.1 for ages <20 years, 3.2 for 20–64 years, and 5.3 for ≥65 years. In previous years, influenza hospitalization rates were multiplied by a factor of 2.7 based on data collected during the 2009 influenza pandemic that were not age-specific (*2,3*). Data were collected during two post-pandemic seasons to update these multipliers (*4*) because influenza testing might not be as common as during the pandemic and the previous multipliers might have underestimated hospitalizations in nonpandemic years. The updated multipliers were similar to the previous estimates for children and younger adults, but indicate that estimated hospitalization rates among older adults in recent seasons were too low.

Adjusted rates were applied to the U.S. population by age group to calculate numbers of hospitalizations. The numbers of influenza illnesses were estimated from hospitalizations based on previously measured multipliers that reflect the estimated number of ill persons per hospitalization in each age group: 143.4 for 0–4 years; 364.7 for 5–19 years; 148.2 for 20–64 years, and 11.0 for ≥65 years (*2*). The numbers of persons seeking medical care for influenza were then calculated using age group-specific data on the percentages of persons with a respiratory illness who sought medical attention, which were estimated from results of the 2010 Behavioral Risk Factor Surveillance Survey: 67% for ages 0–4 years; 51% for ages 5–19 years; 37% for ages 20–64 years, and 56% for ages ≥65 years (*2*).

Second, 2013–14 estimates of vaccination coverage through April 2014 and end-of-season vaccine effectiveness data were used to estimate how many persons were not protected by vaccination during the season and thus were at risk for influenza illness, medically attended illness, and influenza-related hospitalization. The rate of each outcome among persons at risk was then used to estimate the number of influenza-associated outcomes that would have been expected in the same population if no one had been protected by vaccination. Estimates of 2013–14 influenza vaccination coverage were based on self-report or parental report of vaccination status using data from the National Immunization Survey for children aged 6 months–17 years and Behavioral Risk Factor Surveillance Survey data for adults aged ≥18 years, and varied from 37% to 70%, depending on the age group (Table 1) (*5*). Vaccine effectiveness estimates for the 2013–14 season were derived from the U.S. Influenza Vaccine Effectiveness Network, a group of five academic institutions that conduct annual vaccine effectiveness studies (*5,6*). The network estimates the effectiveness of vaccination for preventing real-time reverse transcription

* Annual estimates of influenza vaccination coverage in the United States can be viewed at http://www.cdc.gov/flu/fluvaxview/coverage-1314estimates.htm. Methods for estimating season-specific influenza vaccination coverage and descriptions of National Immunization Survey and Behavioral Risk Factor Surveillance Survey data are available at http://www.cdc.gov/mmwr/pdf/ss/ss6204.pdf.

† National, regional, and state influenza surveillance data are available at http://www.cdc.gov/flu/weekly/fluactivitysurv.htm.

TABLE 1. Variables affecting impact of influenza vaccination, by age group — United States, 2013–14 influenza season

Age group	Vaccination coverage*		Vaccine effectiveness†		Total population§	Hospitalization rate (per 100,000)¶	Estimated hospitalizations		Estimated medically attended cases**		Estimated cases††	
	%	(95% CI)	%	(95% CI)			No.	(95% CI)	No.	(95% CI)	No.	(95% CI)
6 mos–4 yrs	70.1	(68.8–71.4)	47	(14–67)	17,762,071	77.8	13,811	(10,589–17,853)	1,327,271	(1,014,859–1,722,629)	1,981,002	(1,518,891–2,560,814)
5–19 yrs	51.2	(50.4–52.0)	56	(37–69)	62,379,999	18.1	11,310	(8,559–14,765)	2,103,728	(1,587,897–2,759,290)	4,124,957	(3,121,675–5,384,883)
20–64 yrs	36.8	(36.4–37.2)	52	(42–61)	189,176,678	96.9	183,320	(145,397–234,061)	10,052,182	(7,883,113–12,806,943)	27,168,060	(21,547,842–34,687,824)
≥65 yrs	64.7	(64.1–65.3)	39	(0–65)	44,704,074	422.3	188,795	(147,987–259,760)	1,162,978	(899,730–1,615,888)	2,076,747	(1,627,860–2,857,358)
All ages					**314,022,822**	**126.5**	**397,236**	**(312,532–526,439)**	**14,646,159**	**(11,385,599–18,904,750)**	**35,350,766**	**(27,816,268–47,490,879)**

Abbreviation: CI = confidence interval.

* Season-cumulative vaccination coverage rates calculated using data from the National Immunization Survey for children aged 6 months–17 years and from the Behavioral Risk Factor Surveillance System for adults aged ≥18 years. Model uses incremental monthly age-specific values. Estimates of the cumulative monthly proportion vaccinated through end of April of each season were developed using the Kaplan-Meier product limit method for receipt of most recent reported influenza vaccination. Negative lower CIs were revised to 0.

† Based on methods for estimating vaccine effectiveness in the United States by age group. Values for the 2013–14 season are updated with data through the end of the season. Negative lower CIs were revised to 0.

§ Calculated from U.S. Census Bureau annual estimates of the resident population by single year of age and sex for April 1, 2010–July 1, 2013, available at http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=PEP_2013_PEPSYASEXN&prodType=table.

¶ Season-cumulative hospitalization rates calculated using data from the CDC Influenza Hospitalization Surveillance Network (FluSurv-NET) and adjusted for underreporting. The underreporting adjustment multiplier was calculated during two post-pandemic seasons: 6 mos–19 yrs: 2.1 (95% CI = 1.8–2.6), 20–64 yrs: 3.2 (95% CI = 2.5–4.3), and ≥65 yrs: 5.3 (95% CI = 4.1–7.8). Model uses month-specific and age-specific values.

** Based on the percentage of persons with an influenza-like illness who reported seeking medical care as reported through the Behavioral Risk Factor Surveillance System.

†† Based on the estimated number of hospitalizations and age-specific case-hospitalization ratios: 143.4 for 0–4 years, 364.7 for 5–19 years, 148.2 for 20–64 years, and 11.0 for adults ≥65 (2,3).

polymerase chain reaction–positive influenza among persons with acute respiratory illness of ≤7 days duration seen in outpatient clinics in communities in five states. Vaccine effectiveness estimates were updated to include data collected through the end of season and ranged from 39% (95% confidence interval [CI] = -6%–65%) for persons aged ≥65 years to 56% (CI = 37%–69%) for persons aged 5–19 years (Influenza Division, National Center for Immunization and Respiratory Diseases, CDC; unpublished data; 2014).

Finally, the averted outcomes attributable to vaccination were calculated as the difference between outcomes in the hypothetical unvaccinated population and the observed vaccinated population. Calculations were stratified by month of the year to account for annual variations in the timing of disease and vaccination and then summed across the whole season. The prevented fraction was calculated as the number of averted illnesses divided by the total illnesses that would have been expected in an unvaccinated population.

During October 2013–May 2014, influenza vaccination resulted in an estimated 7.2 million (CI = 5.1–9.9) fewer illnesses, 3.1 million (CI = 2.1–4.4) fewer medically attended illnesses, and 90,068 (CI = 51,231–144,571) fewer hospitalizations (Table 2) associated with influenza. Overall, 16.9% (CI = 15.3%–18.0%) of these adverse health outcomes associated with influenza were prevented. Using the same model, if vaccination levels had instead reached the *Healthy People 2020* target of 70%,[§] an additional 5.9 million illnesses, 2.3 million medically attended illnesses, and 42,000 hospitalizations might have been averted.

[§] *Healthy People 2020* objectives for increasing the percentage of children and adults vaccinated annually against seasonal influenza (IID-12.11 and IID-12.12) are available at http://www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives.

Although 17% of the averted illnesses and 24% of averted medically attended illnesses were among children aged 6 months–4 years and persons aged ≥65 years (two groups known to be at higher risk for complications), these two age groups accounted for 60% of averted hospitalizations. Persons aged ≥65 years accounted for 55% of all hospitalizations prevented.

Discussion

During the 2013–14 season, influenza activity peaked in late December, and the influenza A (H1N1)pdm09 virus predominated in the United States for the first time since the 2009 pandemic (*7*). There were somewhat fewer estimated influenza-associated hospitalizations overall than during the previous season (*3*), which had been a moderately severe season during which influenza A (H3N2) viruses predominated. In 2013–14, however, rates of hospitalization for adults aged 20–64 years were 1.3–5.5 times higher than during previous reported seasons (*2,3*). In addition, 109 influenza-associated pediatric deaths (deaths among persons aged <18 years) were reported to CDC (*7*), most of which were associated with influenza A (H1N1)pdm09.

During the 2013–14 season, a 17% overall reduction in illnesses resulted in a large number of prevented influenza-associated medical visits and hospitalizations. The prevented fraction was similar to recent seasons (*2,3*) and was highest among children aged <5 years (25%) and lowest for adults aged 20–64 years (15%). Fewer than half of adults aged 20–64 in the United States are vaccinated each season despite a recommendation for universal influenza vaccination for persons aged ≥6 months (*1*). Adults aged 20–64 years make up approximately 60% of the U.S. population and during the 2013–14 season accounted for 77% of estimated influenza illnesses and

TABLE 2. Estimated number and fraction of influenza cases averted by vaccination — United States, 2013–14 influenza season

	Averted cases		Averted medically attended cases		Averted hospitalizations		Fraction prevented	
Age group	No.	(95% CI)	No.	(95% CI)	No.	(95% CI)	%	(95% CI)
6 mos–4 yrs	657,701	(366,554–1,013,644)	440,660	(245,692–680,502)	4,585	(2,555–7,067)	24.9	(18.5–29.3)
5–19 yrs	1,185,034	(837,466–1,638,601)	604,368	(423,423–841,847)	3,249	(2,296–4,493)	22.3	(20.9–23.6)
20–64 yrs	4,786,265	(3,626,912–6,259,499)	1,770,918	(1,331,958–2,330,947)	32,296	(24,473–42,237)	15.0	(14.4–15.3)
≥65 yrs	549,317	(240,964–998,517)	307,618	(134,114–561,318)	49,938	(21,906–90,774)	20.9	(12.1–27.0)
All ages	**7,178,318**	**(5,071,896–9,910,260)**	**3,123,563**	**(2,135,186–4,414,614)**	**90,068**	**(51,231–144,571)**	**16.9**	**(15.3–18.0)**

Abbreviation: CI = confidence interval.

What is already known on this topic?

Influenza vaccination has been a central tool for influenza prevention in the United States for more than 50 years. Previously, CDC estimated that annual influenza vaccination resulted in 1.1–6.6 million fewer cases and 7,700–79,000 fewer hospitalizations annually during the 2005–2013 influenza seasons.

What is added by this report?

Using surveillance data, vaccination coverage survey data, and vaccine effectiveness estimates collected during the 2013–14 season, estimates of the impact of influenza vaccination for the 2013–14 season were generated. Vaccination during the 2013–14 season resulted in an estimated 7.2 million fewer cases of influenza, 90,000 fewer hospitalizations, and 3.1 million fewer medically attended cases than would have been expected without vaccination. If vaccination levels had reached the *Healthy People 2020* target of 70%, an additional 5.9 million illnesses, 2.3 million medically attended illnesses, and 42,000 hospitalizations might have been averted.

What are the implications for public health practice?

Although influenza vaccination prevented millions of illnesses and tens of thousands of hospitalizations in 2013–14, there is a need for increased vaccination coverage and more effective vaccines to further reduce the burden of influenza.

46% of hospitalizations (Table 1). This sizeable population has the lowest influenza vaccination coverage (37%) and therefore the most potential gains through use of strategies known to improve coverage. Such strategies include ensuring that all those who visit a health care provider during the influenza season receive an influenza vaccination recommendation from their provider, using patient reminder/recall systems, using immunization information systems, and expanding access through use of nontraditional settings for vaccination (e.g., pharmacies, workplaces, and schools) to reach persons who might not visit a physician's office during the influenza season.[¶]

During 2013–14, the vaccine effectiveness point estimate was lowest among persons aged ≥65 years (39% [CI = -6%–65%]). Almost half of the 2013–14 estimated hospitalizations (Table 1), and in many years >90% of influenza deaths (*9*), occur among adults aged ≥65 years. A recent study using this same analytic framework showed that even with very low vaccine effectiveness among older adults (10%), current influenza vaccination coverage in older adults can still help to prevent a sizeable number of influenza hospitalizations during moderately severe seasons (*8*). Vaccination coverage rates are relatively high in this vulnerable population; therefore, major gains in preventing severe outcomes in this age group will require vaccines with better efficacy for persons in this age group.

The findings in this report are subject to at least five limitations. First, influenza vaccination coverage estimates were derived from reports by survey respondents, not vaccination records, and are subject to recall bias. Furthermore, these estimates are based on telephone surveys with relatively low response rates; although weighting adjustments were designed to improve representativeness of the sample, they might not completely eliminate nonresponse bias. Estimates of the number of persons vaccinated based on these survey data have exceeded the actual number of doses distributed, indicating that coverage estimates might be somewhat lower than those used in this report and might overestimate the numbers of illnesses and hospitalizations averted by vaccination. Second, this model only calculates outcomes directly averted among persons who were vaccinated. If there is indirect protection from decreased exposure of unvaccinated persons to infectious persons in a partially vaccinated population (i.e., herd immunity), the model would underestimate the number of illnesses and hospitalizations prevented by vaccination. Third, vaccine effectiveness was lower for adults aged ≥65 years; the effectiveness might continue to decrease with age, reaching very low levels among the oldest adults with the highest rates of influenza vaccination; thus, the model might have overestimated the effect in this group. Fourth, this model assumes that vaccine effectiveness is the same for all outcomes. Finally, the fraction of persons with influenza who seek medical care was estimated from data collected during the 2009 pandemic, although the values were similar to those derived from surveys conducted the following season (*10*). If health care seeking differed during the 2013–14 influenza season, the number

[¶] Evidence-based strategies for improving vaccination coverage are described in the *Community Guide for Preventive Services*, available at http://www.thecommunityguide.org/index.html.

of influenza medical visits in the population might have been overestimated or underestimated.

Influenza vaccination prevented a substantial amount of influenza disease in the United States last season, including an estimated 3 million medical visits and 90,000 hospitalizations. Although vaccines with increased effectiveness are needed, much can be done to maximize influenza prevention during the upcoming 2014–15 season. In particular, efforts to increase vaccination coverage will further reduce the burden of influenza, especially among adults aged 20–64 years, who continue to have the lowest influenza vaccination coverage. Although the timing and intensity of influenza virus circulation for the 2014–15 season cannot be predicted, peak weeks of influenza activity have occurred in January through March in >75% of seasons during the past 30 years, and significant circulation can occur as late as May. Therefore, vaccination should continue to be offered through the peak periods of influenza virus circulation and as long as influenza viruses are reported to be circulating for the current season.

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Incidence of Sickle Cell Trait — United States, 2010

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Persons with sickle cell trait (SCT) are heterozygous carriers of an abnormal ß-globin gene that results in the production of an abnormal hemoglobin, Hb S, which can distort red blood cells (http://www.cdc.gov/ncbddd/sicklecell/facts.html). All state newborn screening (NBS) programs have provided universal sickle cell disease (SCD) screening for newborns since 2006. Screening for SCD detects both SCD and SCT. To obtain up-to-date measures of the occurrence of SCT among newborns by race/ethnicity and state of birth, data collected by state NBS programs in 2010 were examined. In 2010, the incidence of SCT in participating states was 15.5 per 1,000 newborns overall; 73.1 among black newborns and 6.9 among Hispanic newborns. Incidence by state ranged from 0.8 per 1,000 screened newborns in Montana to 34.1 per 1,000 in Mississippi. Although the occurrence of SCT varies greatly from state-to-state and among different races and ethnicities, every state and racial/ethnic population includes persons living with the condition. The period immediately following NBS is ideal for primary care providers and genetic counselors to begin educating the families of identified persons with SCT about potential health complications and reproductive considerations.

State NBS programs were requested via e-mail by CDC investigators to provide aggregate data on the total number of infants screened in 2010 and the total number with a positive SCT result. Data were also requested to allow categorizing the births by Hispanic ethnicity* and by race.† At least four attempts were made to obtain the data (three e-mails and one telephone call). A total of 44 states provided data, of which 17 also provided ethnicity and/or race information: 13 states provided ethnicity categories for >90% of the infants, and 13 states provided race categories for >90% of the infants. The incidence of SCT was calculated for each state, overall, and by ethnicity and race, when possible. States did not provide data for combined racial/ethnic categories; that is, Hispanic ethnicity includes all races (e.g., black and white), so that a newborn Hispanic infant with a positive SCT result would be included in the calculations for both Hispanics and its race.

In the 44 states for which data were available, there were 55,258 infants with a positive SCT screening result in 2010 (Table 1), or 1.5% of all infants screened. These states represent approximately 88% of the U.S. population, so it is likely that the total number of incident cases for that year in the United States exceeded 60,000. Montana had the lowest incidence of SCT (0.8 cases per 1,000 screened), and Mississippi had the highest incidence (34.1 cases per 1,000 screened). The overall incidence in the population of the 44 states that provided data was 15.5 cases per 1,000 screened. Idaho, Montana, New Hampshire, North Dakota, and Vermont each had fewer than 50 infants with a positive SCT test result, whereas Florida and New York each had more than 5,000.

A total of 17 states also provided SCT results categorized by ethnicity only, race only, or both race and ethnicity. The overall incidence for the 13 states that provided ethnicity data was 6.9 cases per 1,000 Hispanic infants screened (Table 2). The overall incidence for the 13 states that provided race data was 2.2 cases per 1,000 Asian, Native Hawaiian, or other Pacific Islander infants screened; 73.1 cases per 1,000 black or African American infants screened; and 3.0 cases per 1,000 white infants screened (Table 3).

Discussion

In 1987, the National Institutes of Health convened a consensus development conference on Newborn Screening for Sickle Cell Disease and Other Hemoglobinopathies. The conference attendees, experts in hemoglobinopathies, recommended universal screening for hemoglobinopathies for all U.S. newborns. They also recommended that families of children identified with SCT during the NBS process should receive information to help them understand the differences between carrying one gene (SCT) and carrying two genes (SCD), and that there might be implications for family planning by the parents, and eventually by the newborn (http://consensus.nih.gov/1987/1987ScreeningSickleHemoglobinopathies061html.htm).

There are no standardized methods for reporting positive SCT results to doctors or families of affected persons. A 2007 study found that newborn screening programs provided SCT results to the newborn's primary care provider in 88% of states, to the birth hospital in 63% of states, to the family in 37% of states, and the results were not reported at all in 4% of states. For programs that reported the positive SCT results, 37% had no mechanism to determine whether or not that information was received by the intended recipient (*1*). This suggests that opportunities to educate families about the potential health

* Categories were Hispanic, non-Hispanic, or not available.
† Categories were American Indian/Alaska Native only; Asian or Native Hawaiian or Other Pacific Islander only; black or African American only; white only; more than one race; and other.

TABLE 1. Incidence of sickle cell trait (SCT) — 44 U.S. states, 2010

State	No. of infants screened	No. of infants with a positive SCT screen result	Incidence per 1,000 infants screened
Alabama	58,836	1,923	32.7
Alaska	11,269	56	5.0
Arizona	84,257	477	5.7
Arkansas	39,264	563	14.3
California	498,924	4,113	8.2
Colorado	—	—	—
Connecticut	38,809	648	16.7
Delaware	11,893	258	21.7
District of Columbia	—	—	—
Florida	214,948	5,564	25.9
Georgia	—	—	—
Hawaii	18,940	86	4.5
Idaho	22,803	46	2.0
Illinois	176,634	3,056	17.3
Indiana	84,108	987	11.7
Iowa	37,991	203	5.3
Kansas	41,580	374	9.0
Kentucky	57,977	572	9.9
Louisiana	63,005	1,366	21.7
Maine	—	—	—
Maryland	77,806	2,359	30.3
Massachusetts	72,949	1,042	14.3
Michigan	112,986	2,854	25.3
Minnesota	67,550	535	7.9
Mississippi	39,278	1,341	34.1
Missouri	76,308	1,002	13.1
Montana	11,961	10	0.8
Nebraska	26,176	198	7.6
Nevada	35,687	798	22.4
New Hampshire	13,032	42	3.2
New Jersey	102,660	2,040	19.9
New Mexico	26,146	81	3.1
New York	245,280	5,371	21.9
North Carolina	122,324	2,504	20.5
North Dakota	10,383	21	2.0
Ohio	138,952	2,077	14.9
Oklahoma	—	—	—
Oregon	45,606	177	3.9
Pennsylvania	—	—	—
Rhode Island	11,791	182	15.4
South Carolina	55,813	1,650	29.6
South Dakota	12,334	79	6.4
Tennessee	84,533	2,411	28.5
Texas	390,611	4,972	12.7
Utah	51,486	126	2.4
Vermont	5,702	24	4.2
Virginia	97,528	1,865	19.1
Washington	83,086	448	5.4
West Virginia	29,928	81	2.7
Wisconsin	67,163	676	10.1
Wyoming	—	—	—
Overall (44 states)	**3,576,297**	**55,258**	**15.5**

TABLE 2. Incidence of sickle cell trait (SCT), by Hispanic ethnicity — 13 U.S. states, 2010

State	No. of infants screened	No. of infants with a positive SCT screen result	Incidence per 1,000 infants screened
California	262,238	1,542	5.9
Florida	59,763	582	9.7
Hawaii	252	16	63.5
Idaho	3,696	11	3.0
Kansas	6,479	48	7.4
Louisiana	1,981	19	9.6
Minnesota	4,990	47	9.4
Missouri	3,744	16	4.3
Montana	429	2	4.7
Nevada	12,361	162	13.1
New Hampshire	504	2	4.0
Washington	15,537	115	7.4
West Virginia	239	2	8.4
Overall (13 states)	**372,214**	**2,564**	**6.9**

What is already known on this topic?

The *National Newborn Screening 10-Year Incidence Report* provided an estimated incidence of sickle cell trait, nationally and by state, for the years 1991–2000. The overall U.S. incidence estimate for sickle cell trait was 15.5 cases per 1,000 births.

What is added by this report?

In 2010, the total U.S. incidence estimate was 15.5 cases per 1,000 births, ranging from 0.8 cases per 1,000 births in Montana to 34.1 cases per 1,000 births in Mississippi. The total U.S. incidence estimate by race only (based on information provided by 13 states) was 73.1 cases per 1,000 black births, 3.0 cases per 1,000 white births, 2.2 cases per 1,000 Asian or Native Hawaiian or Other Pacific Islander births, and by ethnicity only (13 states) was 6.9 cases per 1,000 Hispanic births.

What are the implications for public health practice?

The incidence of sickle cell trait greatly varies from state-to-state and among different races and ethnicities; however, every state and racial/ethnic population has persons living with the condition. The period immediately after newborn screening is ideal for primary care providers and genetic counselors to begin educating the families of identified persons with sickle cell trait about potential health complications and reproductive considerations.

effects of SCT and the implications for future reproductive decisions might have been missed. In addition, there might be consequences for the infant's own family planning, and it might also have an impact on other children of those parents or their extended family members (*2*). Each person with SCT identified by screening represents an opportunity to educate a family about the possible health outcomes associated with SCT and the potential for having another child with SCT or SCD. A previous study showed that such families welcomed genetic counseling and health education (*3*).

The *National Newborn Screening 10-Year Incidence Report* provided an estimated incidence of SCT, nationally, and by state, for the years 1991–2000 (http://genes-r-us.uthscsa.edu/newborn_reports). In that report, the estimate of SCT incidence ranged from 0.3 cases per 1,000 births in Kentucky to

TABLE 3. Incidence of sickle cell trait (SCT), by race — 13 U.S. states, 2010

State	Asian, Native Hawaiian, or Other Pacific Islander			Black or African American			White		
	No. of infants screened	No. of infants with a positive SCT screen result	Incidence per 1,000 infants screened	No. of infants screened	No. of infants with a positive SCT screen result	Incidence per 1,000 infants screened	No. of infants screened	No. of infants with a positive SCT screen result	Incidence per 1,000 infants screened
Alabama	567	0	0.0	17,616	1,728	98.1	34,670	145	4.2
California	52,018	54	1.0	30,575	2,103	68.8	384,092	1,551	4.0
Kansas	1,206	2	1.7	3,026	221	73.0	33,979	105	3.1
Louisiana	0	—	—	24,307	1,204	49.5	35,632	124	3.5
Michigan	2,384	74	31.0	20,315	2,048	100.8	71,295	263	3.7
Minnesota	4,167	15	3.6	5,356	331	61.8	48,484	71	1.5
Mississippi	274	3	10.9	17,675	1,255	71.0	19,500	64	3.3
Missouri	940	2	2.1	11,059	805	72.8	56,254	79	1.4
Montana	138	0	0.0	74	3	40.5	10,331	5	0.5
New Hampshire	421	1	2.4	182	8	44.0	11,623	27	2.3
Ohio	2,565	10	3.9	21,401	1,541	72.0	100,116	226	2.3
Washington	8,433	2	0.2	4,221	175	41.5	67,391	56	0.8
West Virginia	137	1	7.3	925	39	42.2	26,319	13	0.5
Total (13 states)	**73,250**	**164**	**2.2**	**156,732**	**11,461**	**73.1**	**899,686**	**2,729**	**3.0**

48.2 cases per 1,000 births in the District of Columbia; the total U.S. incidence estimate was 15.5 cases per 1,000 births (based on data from 45 states and the District of Columbia). As of May 1, 2006, all 50 states and the District of Columbia had implemented universal newborn screening for sickle cell disease and, consequently, SCT (*4*). This *MMWR* report updates the data that were previously available in the National Newborn Screening Report and estimates that over 60,000 infants were born with SCT in 2010.

Previous studies using data from a single state (*5*) or from a few counties (*6*) estimated that SCT was present in approximately 7% of blacks or African Americans. These NBS results show that the incidence ranged from 4.0% of black births in Montana to 10.1% in Michigan and was 7.3% overall in the 13 participating states. Also in comparison with single-state statistics showing an incidence of 0.2% in white infants and 0.5% in Hispanic newborns (*5*), these results ranged from zero to 0.4% in whites and 0.2% to 6.3% in Hispanics. These NBS results underscore the differences between states that reflect the ancestry of their inhabitants. The incidence varies greatly, depending upon the region of the country and the immigration patterns of that location.

The findings in this report are subject to at least four limitations. First, it was not possible to verify the information that was reported from state NBS programs. Second, complete data were not received from all states, so the findings are only an estimate of the incidence of SCT in the United States. Third, the part of the study that focused on incidence for different races and ethnicities is limited by how accurately the NBS data reflect the actual race/ethnicity of the infants. Finally, the information that the states provided was based on newborn screening results only. These results were not confirmed diagnoses, and so there might be a small number of incorrect results.

This study shows that as many as 1.5% of infants born in the United States have SCT. SCT is benign for most carriers; however, studies have been published suggesting its association in some persons with various conditions, including renal medullary carcinoma, hematuria, renal papillary necrosis, hyposthenuria, splenic infarction, exercise-related deaths, thromboembolic disease, pregnancy-related complications, complicated hyphema, and acute chest syndrome (*7*). In addition, persons with SCT are at risk for having children with SCD if their partner also has SCT or one of several other abnormal hemoglobin genes, including Hb C and Hb ß-thalassemia. Persons with SCD, in contrast to SCT, are at risk for several serious complications, including hemolytic anemia, bacterial infections, vaso-occlusive pain crisis, stroke, chronic organ damage, and pulmonary hypertension (*8*). Based on previous studies, there are no standardized methods or protocols for alerting families or health care providers to this information, educating them about the potential health outcomes that might be associated with the condition, or counseling them about the impact that this might have on the family's future reproductive choices. By including educational materials and providing genetic counseling at the same time that families are provided positive SCT results, the occurrence and public health burden of SCD might be reduced.

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Global Invasive Bacterial Vaccine-Preventable Diseases Surveillance — 2008–2014

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Meningitis and pneumonia are leading causes of morbidity and mortality in children globally infected with *Streptococcus pneumoniae* (pneumococcus), *Neisseria meningitidis,* and *Haemophilus influenzae* causing a large proportion of disease. Vaccines are available to prevent many of the common types of these infections. *S. pneumoniae* was estimated to have caused 11% of deaths in children aged <5 years globally in the pre-pneumococcal conjugate vaccine (PCV) era (*1*). Since 2007, the World Health Organization (WHO) has recommended inclusion of PCV in childhood immunization programs worldwide, especially in countries with high child mortality (*2*). As of November 26, 2014, a total of 112 (58%) of all 194 WHO member states and 44 (58%) of the 76 member states ever eligible for support from Gavi, the Vaccine Alliance (Gavi), have introduced PCV. Invasive pneumococcal disease (IPD) surveillance that includes data on serotypes, along with meningitis and pneumonia syndromic surveillance, provides important data to guide decisions to introduce PCV and monitor its impact.

Sentinel Hospital Surveillance Network for Invasive Bacterial Vaccine-Preventable Diseases

In 2008, WHO brought together 91 sentinel hospital sites in existing regional surveillance networks in 36 WHO member states to strengthen, standardize, and expand a global network conducting sentinel hospital surveillance for invasive bacterial vaccine-preventable diseases (IB-VPD). The objectives of the network were to 1) collect data to describe the epidemiology and estimate the burden of IB-VPD, 2) establish a surveillance platform to measure impact after introduction of *Haemophilus influenzae* type b vaccine or PCV, and 3) detect and characterize the circulating bacterial types.

The global IB-VPD surveillance network includes sentinel hospitals and laboratories that report clinical and laboratory data on cases of suspected meningitis,* pneumonia,† or sepsis§ among children aged <5 years to the national ministries of health and WHO. All sites conduct surveillance for meningitis (Tier 1); some sites also investigate cases of pneumonia and sepsis (Tier 2), and a few conduct population-based surveillance for all three diseases, permitting incidence estimates (Tier 3). At all hospitals, cerebrospinal fluid is collected from suspected meningitis patients per routine clinical practice and tested at the site by Gram stain, culture, and, where available, a rapid diagnostic test (immunochromatographic or latex agglutination). Blood cultures are performed in suspected pneumonia and sepsis cases. Cerebrospinal fluid specimens and isolates are sent to reference laboratories for polymerase chain reaction testing, confirmation, and serotyping.

During 2008–2012, WHO and partners implemented a comprehensive plan to enhance the network's capacity to collect and analyze data, including development of protocols for standardizing surveillance and collaborations with regional and global reference laboratories. WHO worked with ministries of health to coordinate the provision of technical assistance and laboratory supplies to sentinel hospitals with help from various partner organizations. CDC and Johns Hopkins University provided technical assistance in development of protocols and analysis. WHO also provided financial support to Gavi-eligible countries and coordinated an annual external quality assessment program for participating laboratories, consisting of the distribution of external quality assessment panels and confirmatory testing of a subset of samples exchanged between regional and global reference laboratories. Data collected from network participants are shared biannually via global surveillance feedback bulletins (*3*). To provide guidance for improvement and standardization of the global network, WHO established both an informal technical advisory group of experts for new vaccines surveillance and a laboratory technical working group.

* The suspected meningitis case definition is either 1) the sudden onset of fever (>101.3°F [38.5°C] rectal or 100.4°F [38.0°C] axillary) and one of the following signs: neck stiffness, altered consciousness with no other alternative diagnosis, or other meningeal sign in a child aged 0–59 months or 2) a clinical diagnosis of meningitis in a hospitalized child aged aged 0–59 months.

† The suspected pneumonia case definition is coughing or difficulty breathing and tachypnea when calm at a rate of ≥60 breaths/min in an infant aged <2 months, ≥50 breaths/min in an infant aged 2 to <12 months, or ≥40 breaths/min in a child aged 12–59 months.

§ The suspected sepsis case definition is presence of at least two of the following danger signs and without meningitis or pneumonia clinical syndrome in a child aged 12–59 months: inability to drink or breastfeed, vomiting everything, convulsions (except in malaria endemic areas), prostration/lethargy (abnormally sleepy or difficult to wake), severe malnutrition, and hypothermia (≤96.8°F [36.0°C]).

Sentinel Network Review by Technical Advisory Group, 2013

In 2013, WHO, the informal technical advisory group, and partners undertook a strategic review to assess network performance and inform future activities. The review cited progress made while highlighting challenges of conducting IB-VPD surveillance such as low bacterial isolation rates. The network met several of the original objectives: countries established Tier 1 surveillance in all WHO regions, Tier 2 in four, and Tier 3 in two regions (Table 1). The network served as a platform for special studies now being implemented in several countries (e.g., PCV impact on pneumonia diagnosed by chest radiography in Mongolia). Data also were used to support evidence-based decision-making for introduction of PCVs into national immunization programs in several countries.

By 2012, the network had expanded to 150 sites in 58 countries; however, the quality and consistency of the resulting data varied markedly by sentinel site. The review noted that significant changes were necessary to produce data of adequate quality to document vaccine impact, including a more focused approach in both the size and key objectives of the network. The WHO Strategic Advisory Group of Experts on Immunization recommended prioritizing the monitoring of PCV impact and targeting resources to support a smaller number of higher-performing sites, emphasizing quality of surveillance sufficient to monitor PCV impact on disease (*4,5*). Given the challenges of etiologic diagnosis, the WHO Strategic Advisory Group of Experts on Immunization also suggested that additional approaches to ensuring availability of national data for decision-making should be explored, such as data on in-patient pediatric pneumonia.

Network Status, 2014

In response to the WHO Strategic Advisory Group of Experts on Immunization recommendation, the performance of each of the 150 sites reporting data to WHO in 2012 was evaluated to identify higher-performing sites using the following criteria: 1) reporting data to WHO for ≥10 months annually and 2) enrolling ≥100 suspected meningitis cases (Tier 1) or ≥500 suspected meningitis, pneumonia or sepsis cases (Tier 2) annually for ≥2 years during 2010–2012. Based on this evaluation, 56 of the sites in Gavi-eligible countries were selected for targeted technical and financial support. In addition, 10 new or higher performing Gavi-eligible sites were included (Figure, Table 1). Sites not receiving targeted support were encouraged to continue reporting data to WHO as part of the IB-VPD network.

As of July 2014, 130 sites in 57 countries reported 2013 data to WHO, including 63 sites in 38 Gavi-eligible countries selected for targeted support in 2014 and 2015 (Figure, Table 1). Among 38 countries with a site receiving targeted support and reporting 2013 data, nine (24%) have not yet introduced PCV. During 2009–2013, 94,871 hospitalized children were enrolled in surveillance in targeted sites (Table 2). During 2013, a total of 574 children had one of the three potentially vaccine-preventable pathogens detected. Among 511 children with meningitis, 69% were infected with *S. pneumoniae*, 17% *H. influenzae*, and 14% *N. meningitidis*; among 63 children with pneumonia or sepsis, 83% had *S. pneumoniae* and 17% *H. influenzae*.

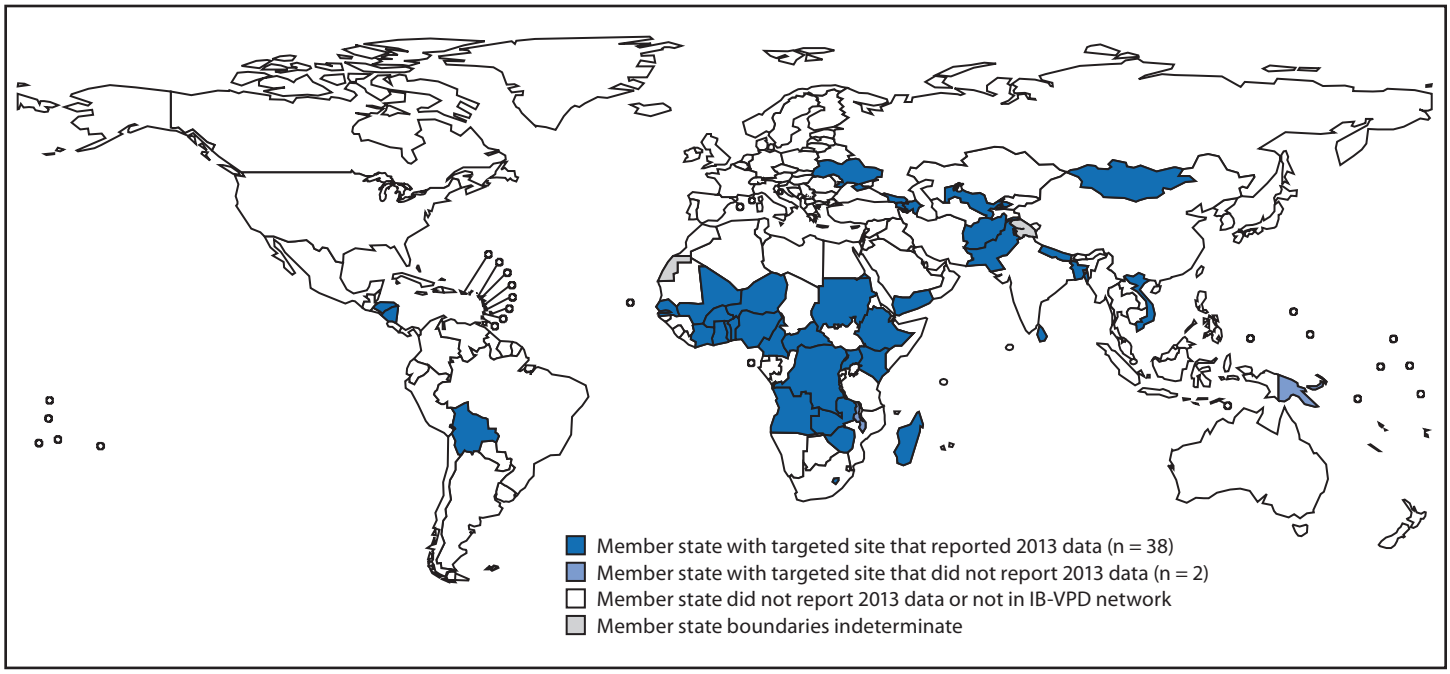
Areas of ongoing work to improve IB-VPD surveillance include 1) uniformly instituting "zero reporting" to differentiate zero cases detected from lack of reporting, 2) moving all

TABLE 1. Characteristics of global invasive bacterial vaccine-preventable diseases (IB-VPD) sentinel surveillance network sites that reported data to the World Health Organization (WHO), by WHO region — 2013*

	All sites reporting 2013 data				Sites targeted for support during 2014 and 2015†							
	Sentinel sites		Member states with a reporting sentinel site		Sentinel sites		Site reported 2013 data					
							Sentinel sites	Member states	Member state introduced PCV	Type of surveillance§		
WHO region	No.	%	No.	%	No.	%	No.	No.	No.	Tier 1	Tier 2	Tier 3
Africa	45	35	29	51	33	50	32	21	19	32	0	0
Americas	29	22	10	18	5	8	5	3	3	0	5	0
Eastern Mediterranean	23	18	6	11	11	17	11	4	4	8	3	0
Europe	14	11	6	11	7	11	7	5	3	7	0	0
South-East Asia	5	4	3	5	6	9	5	3	0	0	4	1
Western Pacific	14	11	3	5	4	6	3	2	0	2	0	1¶
Total	**130**	**100**	**57**	**100**	**66**	**100**	**63**	**38**	**29**	**49**	**12**	**2**

Abbreviation: PCV = pneumococcal conjugate vaccine.
* Data reported at July 2014.
† Higher performing sites located in Gavi-eligible WHO member states targeted to receive technical and financial support.
§ Tier 1: sites conduct surveillance for meningitis cases only (cerebrospinal fluid [CSF] collected). Tier 2: sites conduct surveillance for meningitis, pneumonia, and sepsis cases (CSF and blood collected). Tier 3: sites conduct population-based surveillance for meningitis, pneumonia and sepsis (CSF and blood collected).
¶ Six hospitals in Mongolia comprise one Tier 3 surveillance site.

FIGURE. World Health Organization member states with at least one invasive bacterial vaccine-preventable diseases (IB-VPD) hospital sentinel surveillance site receiving targeted support — 2014 and 2015*



* Data reported at July 2014.

TABLE 2. Characteristics of children aged <5 years who were admitted to sentinel hospitals receiving targeted support in the World Health Organization (WHO) global invasive bacterial vaccine-preventable diseases network, by WHO region — 2009–2013*

WHO region	Tier 1 meningitis surveillance		Tiers 2 and 3† pneumonia and sepsis surveillance	
	No. of children with suspected meningitis who had cerebrospinal fluid collected	Range by site	No. of children with suspected pneumonia and sepsis who had blood collected	Range by site
Africa	31,091	177–4,276	N/A	N/A
Americas	566	1–76	4,839	68–1,027
Eastern Mediterranean	15,058	192–4,038	2,297	151–997
Europe	1,065	16–394	N/A	N/A
South-East Asia	7,064	11–2,705	17,886	183–6,507
Western Pacific	1,794	5–882	13,211	34–3,525
Total	**56,638**	**5–4,485**	**38,233**	**34–6,507**

Abbreviation: N/A = not available.
* Data reported as of July 2014.
† Meningitis cases enrolled at Tier 2 and 3 sites are included in the Tier 1 case counts.

sites from aggregate to case-based reporting, 3) focusing on improved quality assurance in laboratory testing and reporting, 4) piloting a web-based data management system, 5) improving laboratory methods, and 6) collecting serotype/serogroup data to determine what proportions of *S. pneumoniae*, *N. meningitidis*, and *H. influenzae* detected by surveillance are vaccine-preventable. In addition, routine use of unique case identification numbers is being implemented to improve linkage of off-site laboratory data with clinical data.

Discussion

IPD surveillance has provided scientific data needed to advocate for PCV introduction in some countries and will continue to be useful in supporting decision-making in countries that have not yet introduced PCV. The IB-VPD surveillance network has made progress in advancing IPD surveillance but has encountered many challenges. Consistent case reporting and accurate implementation of bacterial diagnostics at hospitals in resource-limited areas, especially culture and isolation of organisms, remains difficult. Further analysis of network data is under way to determine site capacity to identify probable bacterial meningitis cases[¶] and to assess the additional IPD cases identified by polymerase chain reaction testing at reference laboratories.

Surveillance must be consistent for a minimal time period; ideally at least 2 years of data prevaccine and 5 years of data postvaccine introduction are recommended to accurately assess vaccine impact. Many network sites that have not yet introduced PCV have an opportunity to strengthen baseline

[¶] An enrolled suspected meningitis patient with cerebral spinal fluid examination showing turbid appearance or leukocytosis (>100 cells/μL) or both leukocytosis (10–100 cells/μL) and either an elevated protein (>100 mg/dL) or decreased glucose (<40 mg/dL). If protein and glucose results are not available, diagnosis is based on turbid appearance or leukocytosis >100 cells/μL).

surveillance capacity and quality. These sites can document the presence of pneumococcus to build evidence for PCV introduction and to establish a baseline for measuring PCV impact on meningitis and pneumonia syndromes, IPD, and serotype distribution. Limited resources have been focused on carefully selected sentinel hospital sites to increase the chances of success. Most network countries will not be able to assess serotype-replacement, which requires data on the IPD incidence caused by vaccine and nonvaccine serotypes.

Despite the absence of quality baseline surveillance data in some countries that have already introduced PCV, vaccine impact might be estimated using other study designs. Areas with limited laboratory capacity might be able to document impact against the principal clinical syndromes caused by pneumococcus. Sites with consistent pneumonia case enrollment and well-characterized clinical data are assessing the feasibility of special studies to document the impact of PCV on pneumonia incidence. Investigators also might explore PCV impact monitoring by analysis of administrative data tracking hospitalizations for pediatric pneumonia.

The capacity established by the surveillance network to systematically enroll cases, collect clinical information, conduct microbiologic investigation, and analyze data has value beyond the immediate objective of documenting the impact of current vaccines. If the capacity is enhanced, it might facilitate the conduct of other studies and provide a platform at these sentinel hospitals to establish surveillance for other vaccine preventable diseases such as typhoid fever and congenital rubella syndrome.

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What is already known on this topic?

Meningitis and pneumonia are leading causes of morbidity and mortality in children globally. Since 2007, the World Health Organization (WHO) has recommended inclusion of pneumococcal conjugate vaccine (PCV) in childhood immunization programs worldwide, especially in countries with high child mortality.

What is added by this report?

The WHO invasive bacterial and vaccine-preventable disease (IB-VPD) surveillance network includes sentinel hospitals and laboratories that report clinical and laboratory data on cases of suspected meningitis, pneumonia, or sepsis among children aged <5 years to national ministries of health and WHO. As of November 26, 2014, 112 (58%) of all 194 WHO member states and 44 (58%) of the 76 member states ever eligible for support from Gavi have introduced PCV.

What are the implications for public health practice?

IB-VPD sentinel hospital surveillance that includes case-based data with laboratory confirmation information, along with meningitis and pneumonia syndromic surveillance, provides important data to guide decisions to introduce PCV and monitor its impact. The strategic review of the WHO IB-VPD network determined that this program is useful for country decision-making around vaccine usage. As more countries introduce PCV, it is important for this network to continue to improve to be able to assess the impact of this vaccine globally and act as a platform for surveillance of other diseases.

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Airport Exit and Entry Screening for Ebola — August–November 10, 2014

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In response to the largest recognized Ebola virus disease epidemic now occurring in West Africa, the governments of affected countries, CDC, the World Health Organization (WHO), and other international organizations have collaborated to implement strategies to control spread of the virus. One strategy recommended by WHO calls for countries with Ebola transmission to screen all persons exiting the country for "unexplained febrile illness consistent with potential Ebola infection." Exit screening at points of departure is intended to reduce the likelihood of international spread of the virus. To initiate this strategy, CDC, WHO, and other global partners were invited by the ministries of health of Guinea, Liberia, and Sierra Leone to assist them in developing and implementing exit screening procedures. Since the program began in August 2014, an estimated 80,000 travelers, of whom approximately 12,000 were en route to the United States, have departed by air from the three countries with Ebola transmission. Procedures were implemented to deny boarding to ill travelers and persons who reported a high risk for exposure to Ebola; no international air traveler from these countries has been reported as symptomatic with Ebola during travel since these procedures were implemented.

On October 11, 2014, after the first imported Ebola case was identified in the United States, an enhanced U.S. entry screening program was started at five international airports as an added measure to identify travelers from the three countries with widespread Ebola transmission who might have been exposed to Ebola within 21 days before arrival or who currently had signs or symptoms of Ebola. Entry screening first began at John F. Kennedy International Airport (JFK) in New York City, then Newark Liberty International Airport (EWR), Washington-Dulles International Airport (IAD), Chicago O'Hare International Airport (ORD), and Hartsfield-Jackson Atlanta International Airport (ATL). This program also allowed federal authorities to educate travelers, obtain their contact information, and link them with state and local partners to facilitate health monitoring, as appropriate, and prompt referral for care if they became ill. Of 1,993 travelers screened during October 11–November 10, 86 (4.3%) were referred to CDC public health officers for additional evaluation, and seven (8.1%) of the 86 were symptomatic and referred for medical evaluation (Table 1). None of the seven were diagnosed with Ebola.

The 1,993 travelers arrived in the United States after transit in at least one other country and had final destinations in 46 states; the most common destinations were New York (19%), Maryland (12%), Pennsylvania (11%), Georgia (9%), and Virginia (7%) (Figure). Entry screening provided public health departments with contact information for travelers to facilitate monitoring and provided an added layer of protection for the U.S. public.

On August 8, 2014, the International Health Regulations Emergency Committee determined that the Ebola outbreak in West Africa met the conditions for a Public Health Emergency of International Concern (*1*). The committee advised that WHO member states with Ebola transmission "should conduct exit screening of all persons at international airports, seaports and major land crossings, for unexplained febrile illness consistent with potential Ebola infection."

Exit Screening in Three Countries Most Affected

To advise on exit screening and other border control measures, CDC deployed staff members to Liberia and Guinea, beginning August 4, and to Sierra Leone, beginning August 9. In response to the importation of a case of Ebola into Nigeria with subsequent spread among health care workers and in the community, a CDC team was deployed to Nigeria on August 11.

WHO recommends that exit screening consist of a health questionnaire, a temperature measurement, and, if there is a fever, an assessment of the likelihood of the fever being caused by Ebola (*1*). According to WHO recommendations, Ebola patients or contacts, or persons with an illness consistent with Ebola, should not be allowed to travel unless the travel is part of an appropriate medical evacuation.

CDC worked with in-country partners (e.g., ministries of health and airport authorities) to enhance exit screening procedures; recommendations were tailored to each country's needs to address critical gaps identified in their exit screening processes and procedures. Activities included developing and delivering training on the signs and symptoms of Ebola, exit screening procedures and documentation, and appropriate use of personal protective equipment. CDC also worked to conduct train-the-trainer sessions to ensure that the exit screening

TABLE 1. Travelers (N = 1,993) arriving from Guinea, Liberia, and Sierra Leone who were screened for Ebola at U.S. airports and their disposition — October 11–November 10, 2014

Port of entry	No. of passengers screened by customs and border protection officers*	Passengers screened by CDC† No. (%)	Disposition after CDC screening (n = 86)		
			No. referred by CDC for medical evaluation§	No. referred by CDC for coordinated disposition with state and local health departments¶	Passengers released to continue travel No. (%)
New York (JFK)	936	26 (2.8)	0	2	24 (92.3)
Washington (IAD)	507	27 (5.3)	3	6	18 (66.7)
Newark (EWR)	204	13 (6.4)	2	0	11 (84.6)
Atlanta (ATL)	136	14 (10.3)	0	1	13 (92.9)
Chicago (ORD)	132	6 (4.5)	2	0	4 (66.7)
Other**	78	0 (—)	0	0	0 (—)
Total	**1,993**	**86 (4.3)**	**7**	**9**	**70 (81.4)**

* U.S. Customs and Border Protection officers.
† CDC public health officers screen all travelers identified by customs and border protection officers as potentially having risk for exposure to Ebola or signs or symptoms of Ebola.
§ CDC refers all travelers for medical evaluation who meet the clinical criteria defined in CDC's Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure.
¶ The CDC quarantine station coordinates disposition with state and local health departments for travelers who do not meet the clinical criteria for referral for medical evaluation but are categorized as having 1) some risk for exposure to Ebola, or 2) in special circumstances, low (but not zero) risk for exposure.
** Includes travelers who arrived via Anchorage (ANC), Detroit (DTW), Houston (IAH), Los Angeles (LAX), Miami (MIA), Minneapolis/St. Paul (MSP), Montreal (YUL), Ottawa (YOW), Philadelphia (PHL), and Raleigh-Durham (RDU).

activities in place could be sustained. To help countries with no Ebola transmission detect and manage Ebola cases at points of entry, CDC developed templates and materials that other countries could consider and adapt as needed.* To estimate the number of travelers to the United States from the three countries most affected by Ebola, CDC used flight data software from Diio LLC (Reston, Virginia).

During August–October 2014, approximately 80,000 travelers departed the three most affected countries (Guinea, Liberia, and Sierra Leone) by air; approximately 12,000 of these travelers were en route to the United States. Procedures were implemented to deny boarding to ill persons and persons reporting a high risk of exposure to Ebola. No traveler who was denied boarding for fever or other symptoms or reported exposures has been reported as diagnosed with Ebola. Of those who were permitted to travel, none are known to have had Ebola symptoms during travel and none have been subsequently diagnosed with Ebola. Two travelers to the United States, who were not symptomatic during exit screening and travel, became ill with Ebola after arrival.

Enhanced Entry Screening in the United States

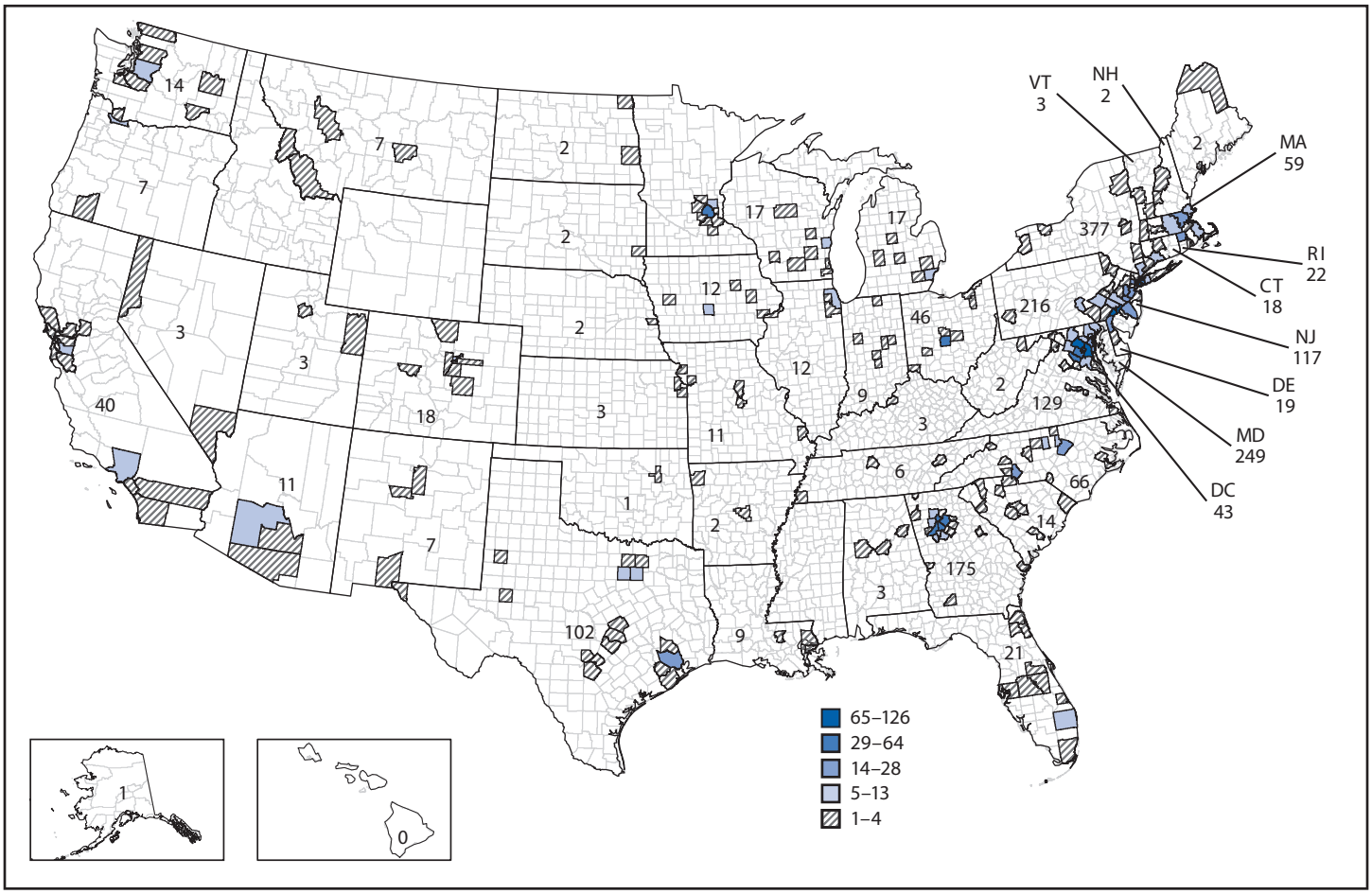
Since July 2014, CDC has enhanced its routine procedures for detecting ill travelers entering the United States at airports by providing additional guidance and training to partners, including U.S. Customs and Border Protection (CBP), which inspects all arriving travelers seeking admission into the United States, airlines, airport authorities, and emergency medical service units at airports; the training covers recognizing possible signs of Ebola in travelers and reporting suspected cases to CDC. On October 11, 2014, CDC, in partnership with CBP, further enhanced efforts to identify ill travelers and travelers possibly exposed to Ebola by initiating an additional screening measure for travelers arriving from Guinea, Liberia, or Sierra Leone. Although identification of ill travelers remains an important goal of U.S. entry screening, enhanced entry screening also has four broader objectives: 1) to identify, on their arrival in the United States, travelers who might be ill with Ebola or who might have had exposure to Ebola, 2) to ensure that these travelers are directed to medical care, if needed, 3) to provide travelers with information on reporting fever and other symptoms to public health authorities, and 4) to rapidly provide the travelers' contact information to public health authorities for active or direct active monitoring.†

CDC and CBP began enhanced entry screening at JFK on October 11 and on October 16 at four other airports (EWR, IAD, ORD, and ATL). Together, the five airports are estimated to handle 94% of all travelers arriving in the United States who had been in Liberia, Sierra Leone, and Guinea within the previous 21 days. Six days later, the Department of Homeland Security exercised its authority to direct passengers flying from the three countries to arrive in the United States at one of the five airports with enhanced screening.

*Available at http://wwwnc.cdc.gov/travel/page/ebola-outbreak-communication-resources.

†With active monitoring a state or local public health authority assumes responsibility for establishing regular communication with persons whom were possibly exposed to Ebola, including checking daily for symptoms and fever. With direct active monitoring the public health authority conducts active monitoring through direct observation.

FIGURE. Number of travelers (N = 1,986*) arriving from Guinea, Liberia, and Sierra Leone who were screened for Ebola at U.S. airports, by state and county of destination — October 11–November 10, 2014



Source: CDC.
* Seven travelers were in transit and did not stay in the United States.

For each person arriving from one of these three countries, CBP provides health information developed by CDC that includes facts about Ebola, symptoms to look for and what to do if symptoms develop, a wallet card, and information for clinicians to manage travelers who seek medical attention. Each traveler also receives a digital thermometer[§] and instructions on how to use it. Travelers are screened with questions about symptoms and potential exposure risks, temperature checks (using noncontact thermometers), and visual observation for other symptoms of Ebola. If travelers have self-reported or measured fever or other symptoms or have been in a situation where exposure to Ebola could have occurred, CBP officers refer them to CDC public health officers stationed at the airport for further evaluation. Public health risk assessment of travelers is based on CDC-issued guidance (*2*), which classifies potentially exposed persons into three risk categories, whether symptomatic or not: high risk, some risk, and low (but not zero) risk. The guidance provides recommendations for the monitoring of these persons and their safe movement to avoid potential exposure of others during commercial travel (e.g., by airplane, ship, train, or long-distance bus). CDC officers determine whether travelers can continue to their destinations, and whether transport to a hospital for medical evaluation of symptomatic travelers is needed. CDC coordinates disposition of symptomatic travelers and those in the high and some risk categories with the appropriate state health department at the time of assessment. Persons identified as at high risk for exposure to Ebola would not be allowed to travel further on public conveyances.

All travelers in the three risk categories are referred for continued monitoring and support to a local health department based

[§] Additional information on the use of thermometers for screening is available at http://wwwnc.cdc.gov/travel/pdf/ebola-non-contact-temperature-measurement-guidance.pdf.

on their travel destination. Contact information for travelers arriving from countries with widespread Ebola transmission is entered into a database and transmitted to states through CDC's Epidemic Information Exchange (Epi-X), a secure notification system. Once the states receive the travelers' contact information, public health authorities can initiate appropriate monitoring and movement restrictions based on risk.

Of the 1,993 arriving in the U.S. from countries with widespread Ebola transmission who have been screened, 85% were adults aged ≥18 years, and 3% had reportedly worked in a health care facility or laboratory in a country with widespread Ebola transmission. According to flight data, it is estimated that less than 0.06% of total arrivals to the U.S. arrive from the three countries.

Among the 1,993 screened travelers, 86 (4.3%) were referred to CDC public health officers; of these, seven (8.1%) were referred for medical evaluation (Table 2). Of the persons interviewed by CDC for evaluation, all 86 were health care workers, of whom 70 were determined to be in the low (but not zero) risk category (*2*); nine of the 86 were laboratory workers, all of whom were placed in the low (but not zero) risk category. Since entry screening started, no traveler has been placed in the high risk category; one person became symptomatic after travel and was diagnosed with Ebola 6 days after arrival in the United States.

As of November 26, 2014, approximately 15,900 cases of Ebola have been reported by WHO. Of the four cases reported by the United States, two were among travelers from countries with widespread Ebola transmission. The first of these was a traveler from Liberia (*3*) who had no fever or declared symptoms or exposures at his exit screening in Liberia, was not symptomatic during travel, and developed symptoms after arrival in the United States. The second travel-related case was in a health care worker who returned from Guinea and who did not have symptoms during exit screening at departure, during travel, or at entry screening on arrival in the United States before developing Ebola.

TABLE 2. Assessment of risk for Ebola among travelers arriving from Guinea, Liberia, and Sierra Leone who were screened by CDC at U.S. airports, by risk category and period — October 11–November 10, 2014

	Risk category*			
Period	High	Some	Low (but not zero)	Total
October 11–17	0	3	11	14
October 18–24	0	6	22	28
October 25–31	0	2	20	22
November 1–7	0	1	13	14
November 8–10†	0	4	4	8
Total	**0**	**16**	**70**	**86**

* Guidelines for categorizing risk for Ebola are available at http://www.cdc.gov/vhf/ebola/exposure/risk-factors-when-evaluating-person-for-exposure.html.
† Partial week.

Discussion

Effective exit screening procedures in countries with widespread transmission of Ebola helped instill confidence that persons symptomatic with Ebola would be unlikely to travel. Humanitarian assistance is vital for combating the Ebola epidemic and reducing the risk for the disease being exported.

Airport exit or entry screening might not identify asymptomatic infected persons without recognized or declared exposures (*4*). Screening of travelers at departure from countries with widespread Ebola transmission and upon arrival in the United States is part of a comprehensive and layered strategy to protect travelers and U.S. communities and also includes 1) communicating to the traveling public by way of travel health alerts and other travel guidance posted online (at http://www.cdc.gov/travel), 2) denial of boarding to ill persons before travel, 3) reporting of persons who become ill onboard U.S.-bound airlines, and 4) monitoring for 21 days after the last possible exposure of persons from countries with widespread Ebola transmission, based on their exposure risk category by U.S. public health authorities.

On November 17, 2014, CDC and CBP also began screening for Ebola travelers from the West African nation of Mali upon entry to the United States after reports of confirmed cases in that country. In the United States, entry screening enables public health authorities to identify persons arriving from countries with widespread Ebola transmission and provide them with public health guidance about how to monitor themselves for symptoms of Ebola, as well as the tools with which to monitor themselves, links to public health authorities, and information needed to contact public health or medical authorities if they develop a fever or other symptoms.

Together, the combined exit and entry screening processes achieve the following six outcomes; they: 1) prevent travel by ill persons from countries with widespread Ebola transmission until they have had appropriate medical evaluation, 2) reduce the likelihood of a traveler from a country with widespread Ebola transmission becoming ill during travel, 3) allow the quick identification of any illness in persons arriving from countries with widespread Ebola transmission, 4) limit contact of persons being evaluated for Ebola with other persons, 5) facilitate rapid and appropriate clinical care for ill travelers, and 6) provide the arriving traveler with public health education and links with public health authorities.

Although the magnitude of the current Ebola outbreak in West Africa has challenged established approaches, isolation of cases and contact tracing remain essential to contain the disease and prevent spread to other counties. Outbreak responses to severe acute respiratory syndrome (*5*), 2009

What is already known on this topic?

The World Health Organization (WHO) recommends that countries with Ebola transmission screen all persons exiting the country for febrile illness consistent with potential Ebola infection. WHO recommends that exit screening consist of a health questionnaire, a temperature measurement, and, if there is a fever, an assessment of the likelihood of the fever being caused by Ebola. According to WHO recommendations, Ebola patients or contacts, or persons with an illness consistent with Ebola, should not be allowed to travel unless the travel is part of an appropriate medical evacuation.

What is added by this report?

This report describes results of the use of exit and entry screening processes as part of a comprehensive strategy to reduce the likelihood that symptomatic travelers board commercial flights and cause transmission of Ebola. To date, there has been no indication of a risk for Ebola disease transmission related to international air travel. Of the 1,993 persons screened for Ebola after arriving in the United States from Guinea, Liberia, and Sierra Leone, none were symptomatic during travel. A total of 86 were referred to CDC public health officers for additional evaluation, and seven of the 86 were found to be symptomatic and referred for medical evaluation; none had Ebola.

What are the implications for public health practice?

These processes help to maintain confidence that air travel is safe from Ebola, identify potentially ill or exposed travelers, educate and inform the traveler, link the traveler with public health authorities for the duration of the incubation period, and facilitate the rapid detection of illness and implementation of appropriate public health control measures. State and local public health authorities are provided with timely information on arrivals from countries with widespread Ebola transmission to facilitate active or direct active monitoring based on travelers' risk categorizations.

pandemic influenza A(H1N1) (*6*,*7*) and Middle East respiratory syndrome-coronavirus (*8*) have demonstrated that, in an increasingly connected world, no destination is safe from the importation of emerging pathogens as long as pathogens are spreading anywhere in the world.

CDC has worked with international partners to establish and strengthen exit screening at ports of departure in-country and with domestic partners to conduct entry screening upon arrival into the United States. The goal and potential benefit of exit and entry screening at international borders encompasses more than identification of ill travelers at those borders. Using these processes to educate each traveler and then link the traveler to public health authorities for the duration of the incubation period is of critical importance to facilitate rapid detection of illness and implementation of appropriate public health control measures.

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Ebola Virus Disease in Health Care Workers — Sierra Leone, 2014

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Health care workers (HCWs) are at increased risk for infection in outbreaks of Ebola virus disease (Ebola) (*1*). To characterize Ebola in HCWs in Sierra Leone and guide prevention efforts, surveillance data from the national Viral Hemorrhagic Fever database were analyzed. In addition, site visits and interviews with HCWs and health facility administrators were conducted. As of October 31, 2014, a total of 199 (5.2%) of the total of 3,854 laboratory-confirmed Ebola cases reported from Sierra Leone were in HCWs, representing a much higher estimated cumulative incidence of confirmed Ebola in HCWs than in non-HCWs, based on national data on the number of HCW. The peak number of confirmed Ebola cases in HCWs was reported in August (65 cases), and the highest number and percentage of confirmed Ebola cases in HCWs was in Kenema District (65 cases, 12.9% of cases in Kenema), mostly from Kenema General Hospital. Confirmed Ebola cases in HCWs continued to be reported through October and were from 12 of 14 districts in Sierra Leone. A broad range of challenges were reported in implementing infection prevention and control measures. In response, the Ministry of Health and Sanitation and partners are developing standard operating procedures for multiple aspects of infection prevention, including patient isolation and safe burials; recruiting and training staff in infection prevention and control; procuring needed commodities and equipment, including personal protective equipment and vehicles for safe transport of Ebola patients and corpses; renovating and constructing Ebola care facilities designed to reduce risk for nosocomial transmission; monitoring and evaluating infection prevention and control practices; and investigating new cases of Ebola in HCWs as sentinel public health events to identify and address ongoing prevention failures.

For this report of Ebola in HCWs in Sierra Leone, data were analyzed on laboratory-confirmed cases in the national Viral Hemorrhagic Fever database, which was created to capture and analyze data from the 2014 Ebola outbreak. Surveillance officers used a standardized case investigation form to collect information from patients with suspected or probable Ebola (*2*) and their family members. Information collected included age, sex, address, occupation, date of onset of symptoms, and potential exposures to other Ebola patients. "Health care worker" was one of the choices listed under a patient's occupation and included clinicians such as doctors and nurses, as well as members of other cadres, including ambulance drivers, hospital cleaners, and burial team members. Vital status and laboratory information were entered into the patient's case record as results were reported to the surveillance team in each health district. District data were merged at the national level. Whole blood from live patients and oral swab specimens from corpses were sent to one of several laboratories in Sierra Leone. Reverse transcription–polymerase chain reaction assays were used to confirm *Ebolavirus* infection. Select characteristics of HCW and non-HCW cases were compared using chi-square tests. P-values <0.05 were considered significant. To inform infection prevention and control efforts and surveillance of Ebola in HCWs, unstructured interviews concerning HCW infections were conducted with HCWs and health facility administrators in the course of site visits to health care facilities in eight districts during August–October 2014.

During May 23 through October 31, 2014, there were 3,854 laboratory-confirmed cases of Ebola reported in Sierra Leone in the Viral Hemorrhagic Fever database, including 199 cases in HCWs (5.2%). Seven additional cases in HCWs and 949 cases in non-HCWs had dates of symptom onset that were missing or outside of May 23 (date of the first documented case) to October 31 and were excluded from analysis. According to the *National Health Strategic Plan 2010–2015*, published in 2009 (*3*), Sierra Leone had a total health workforce of 2,402 persons. Using this denominator, the cumulative confirmed Ebola incidence in HCWs was 8,285 per 100,000. This can be compared with the 2,806 confirmed Ebola cases in non-HCWs in a national population of 3.49 million persons aged ≥15 years, with a cumulative incidence in adult non-HCWs of 80.4 per 100,000 population. Therefore, the confirmed Ebola incidence was 103-fold higher in HCWs than that in the general population in Sierra Leone.

Among confirmed cases in HCWs, 54.8% were in males, compared with 48.2% in non-HCWs (p=0.09). Of 183 (92%) confirmed Ebola cases in HCWs with recorded age, two (1.1%) were reportedly in persons aged <15 years, 82.0% were in persons aged 15–49 years, and 16.9% were in persons aged ≥50 years. There were no confirmed Ebola cases in HCWs reported in May. The number peaked at 65 cases in August and declined to 36 in September and 42 in October (Figure 1). The highest percentage of confirmed Ebola patients that were

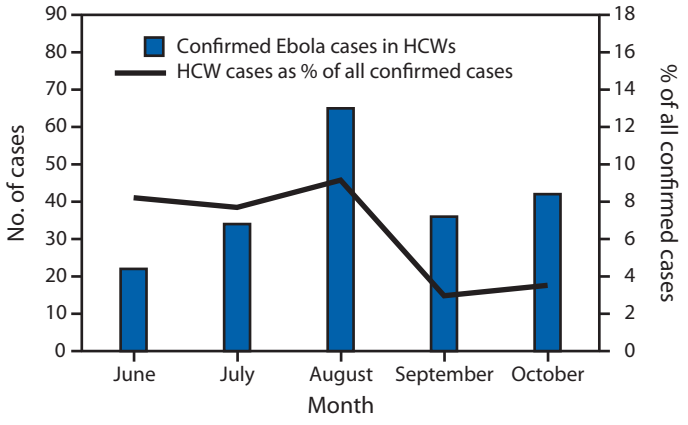
HCWs was in August (9.2%); this declined to 3.5% in October (Figure 1). The number of confirmed Ebola cases in HCW per district ranged from zero in two districts to 65 cases in Kenema District (Figure 2), which also had the highest percentage of all confirmed Ebola patients that were HCWs (12.9%). District of residence was missing in seven cases in HCWs (3.5%).

The surveillance form included questions on potential sources of infection, specifically attendance at a funeral or contact with a person with known or suspected Ebola, with an ill person, or with a corpse in the month before onset of symptoms. Among 159 (80%) confirmed HCW Ebola cases with data on funeral attendance, 13.8% had attended a funeral, compared with 32.3% in non-HCW ($p < 0.001$). Data on contact with a known or suspected Ebola patient or ill person or a corpse was available for 143 (72%) confirmed HCW Ebola cases; 18.2% were in persons who had contact with a person with known or suspected Ebola or an ill person, compared with 12.3% in non-HCWs ($p = 0.05$); 30.1% had contact with a corpse, compared with 34.3% in non-HCWs ($p=0.3$).

Among confirmed HCW Ebola patients, 12.1% were dead at the time of surveillance recording, compared with 15.0% among non-HCW patients ($p=0.3$); other data on vital status, including numbers with missing data at time of surveillance recording and final outcome, are not consistently available in the Viral Hemorrhagic Fever data.

Site visits and unstructured interviews with HCWs and health facility administrators revealed a broad range of circumstances potentially leading to Ebola in HCWs. These included a lack of standard operating procedures and clearly assigned responsibilities for infection prevention and control; overall staff shortages and lack of infection prevention specialists; limited availability of safe transport vehicles for patients and corpses; incorrect triage or recognition of potential Ebola in patients and corpses, including no reassessment of admitted patients to identify new symptoms of Ebola (especially children aged <5 years); delayed laboratory diagnosis of Ebola cases because of long turn-around time for specimen transport and reporting of results; inadequate control of Ebola patient or HCW movement within health facilities; and lack of delineation between high-risk and low-risk Ebola zones. Other findings included limited availability of appropriate personal protective equipment and hand washing facilities, including lack of water and sufficient chlorine supplies; no or inadequate training about and monitoring of personal protective equipment use and hand washing; lack of equipment and materials and no or inadequate training about and monitoring of decontamination of transport vehicles and care facility spaces; limited capacity and no or inadequate training about safe management of contaminated waste; and limited capacity and no or inadequate training about safe management and burial of corpses.

FIGURE 1. Number of laboratory-confirmed Ebola virus disease (Ebola) cases in health care workers (HCWs) and confirmed Ebola cases in HCWs as a percentage of all confirmed cases, by month — Sierra Leone, June–October 2014



Discussion

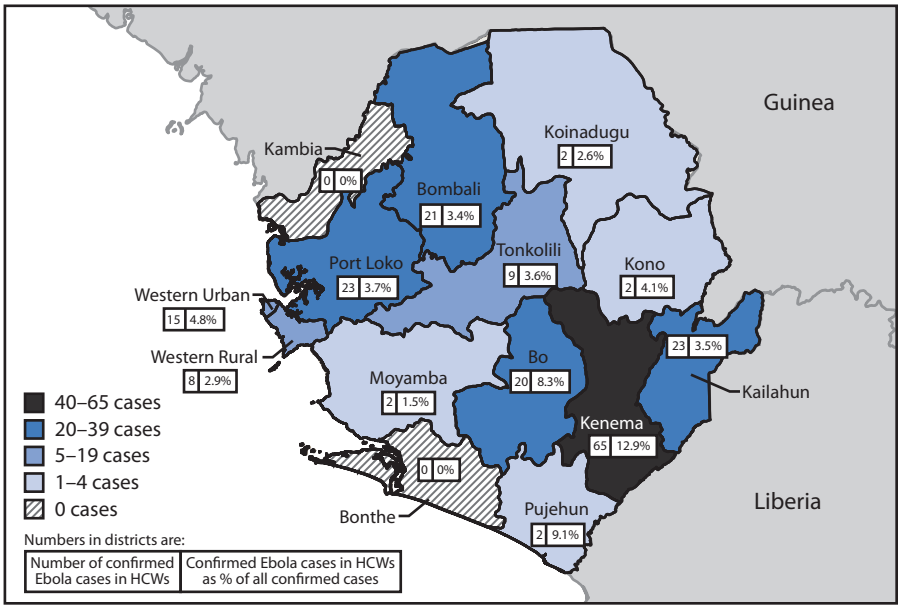
Analysis of the national Viral Hemorrhagic Fever database found 199 cases of Ebola in the Sierra Leone health workforce. Using the number of HCWs reported in 2009 (*3*) as a denominator for HCWs and comparing with infection rates in the general population aged ≥15 years, the estimated confirmed Ebola incidence rate was approximately 100-fold higher in HCWs than in non-HCW adults in Sierra Leone.

The number and proportion of all confirmed Ebola patients that were HCWs peaked in August. The subsequent reductions might be attributable to concurrent implementation of infection prevention and control measures, including training and availability of personal protective equipment, and could reflect a closure of many health facilities and reduction in availability of health care services and HCW exposure as the outbreak progressed. However, many Ebola cases in HCWs continued to be reported in October. The highest number of confirmed Ebola cases and the proportion of all confirmed Ebola case that were HCWs occurred in Kenema District. There were 43 Ebola cases in HCWs in Kenema District in July and August, mostly among Kenema General Hospital staff. Inquiries about breaches of infection prevention and control at Kenema General Hospital indicated, among other problems, challenges with overall site management and administrative controls, such as correct and consistent triage and isolation of Ebola patients. Although some districts, such as Kenema, were more heavily affected, confirmed Ebola cases in HCWs have been reported in 12 of 14 districts in Sierra Leone, including all districts that have reported more than 35 confirmed Ebola cases. Also, although most cases in HCWs occurred in facilities operated by the Ministry of Health and Sanitation, including both general care facilities and those designated for Ebola care, there were a small number of confirmed Ebola cases in HCWs at Ebola care facilities established

and managed by international implementing partners. These findings underscore the widespread challenges with infection prevention and control in Sierra Leone.

Compared with non-HCW patients, HCW patients were less likely to have attended a funeral and were more likely to have had contact with a live Ebola patient or ill person in the 30 days before symptom onset. However, a substantial proportion of both HCW and non-HCW Ebola patients reported funeral attendance or contact with a corpse, highlighting the overall importance of transmission from corpses in this outbreak. HCW patients were not significantly less likely than non-HCW patients to be dead at the time their cases were recorded by the surveillance system. The finding that 12% of HCW patients were dead at the time of recording indicates shortcomings in contact tracing, early case identification, and access to medical care, even in HCWs, who might have been expected to have better awareness and access to health care.

FIGURE 2. Number of laboratory-confirmed Ebola virus disease (Ebola) cases in health care workers (HCWs) and confirmed Ebola cases in HCWs as a percentage of all confirmed cases, by district — Sierra Leone, May–October 2014



The findings in this report are subject to at least four limitations. First, public health surveillance data were incomplete, especially in the context of a health emergency in a resource-poor setting. It has been estimated that overall case numbers represent only one third to one half of all cases (*4*). Second, data on key information such as occupation was missing or might have been incorrect on many case investigation forms, and many cases were not included in the analysis because of missing or out-of-range dates of onset of symptoms. Third, members of some cadres, such as ambulance drivers, burial team members, and community health workers, might not have been consistently recorded as HCWs on case investigation forms or in the Ministry of Health and Sanitation 2009 report on the health workforce (*3*), and the number of health workers might have changed since 2009. As a result, these findings likely undercount the number of *Ebolavirus*-infected HCWs in Sierra Leone. However, Ebola reporting might be more complete for HCWs than non-HCWs, so the ratio of the Ebola cumulative incidence in HCWs compared with non-HCWs might be an overestimate. Finally, data on exposures are also likely to be incomplete. For example, the finding that contact with an Ebola patient or ill person was reported for only 19% of HCWs with Ebola is likely an underestimate.

A broad range of potential problems with infection prevention and control were reported at both general care facilities and those designated for Ebola care. The Ministry of Health and Sanitation, together with Sierra Leonean and international partners, are implementing a wide range of interventions, including policies, training, procurement, renovation, construction, and monitoring and evaluation, in accordance with established recommendations (*5*). As is the case with prevention of nosocomial transmission of tuberculosis (*6*), many observed breaches of infection prevention and control practices appeared to be attributed to failures of administrative controls, such as incorrect triage, or infrastructure limitations of renovated facilities, such as lack of barriers separating Ebola wards, rather than personal protective equipment failures; particular attention to these issues is recommended in the control of Ebola.

Cases of Ebola in HCWs are currently being investigated as sentinel public health events. An infection in an HCW might represent transmission from an Ebola patient in a health care facility, but might also be a signal for transmission to and from HCWs in the community, and for facility-based transmission from patient to patient and from HCWs to patients or to other HCWs. New, high-quality, dedicated Ebola treatment units are being established by international partners in Sierra Leone, but because the number of these beds does not meet the need in high-transmission areas, other, less well-resourced facilities, including Ebola care, holding, and isolation centers, are being established by the Ministry of Health and Sanitation. Given the high risk of nosocomial transmission of *Ebolavirus* (*5*), health authorities must be vigilant in implementation of strict infection prevention and control measures in all health care settings and alert to the possibility that less well-controlled settings might inadvertently act to propagate rather than interrupt transmission. Prevention of Ebola in HCWs is also critical to sustain the health workforce to address all causes of morbidity and mortality in Sierra Leone.

What is already known on this topic?

Health care workers (HCWs) are at increased risk for infection in outbreaks of Ebola virus disease (Ebola). Adherence to good infection prevention and control practices are required to prevent Ebola in HCWs.

What is added by this report?

As of October 31, 2014, of the total of 3,854 laboratory-confirmed Ebola cases reported from Sierra Leone, 199 (5.2%) were in HCWs. This was estimated to be a much higher cumulative incidence of confirmed Ebola in HCWs compared with non-HCWs. A broad range of breaches of good infection prevention and control practices were reported, and Ebola cases in HCW continued to be reported in October.

What are the implications for public health practice?

In Ebola outbreaks, comprehensive programs to reduce the risk for Ebola in HCWs in all health care settings are needed, including development of standard operating procedures (including safe triage), recruiting and training staff, procuring needed commodities and equipment, renovating and constructing safe Ebola care facilities, monitoring and evaluating infection prevention and control practices; and investigating new cases of Ebola in HCWs as sentinel public health events to identify and address ongoing prevention failures.

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Rapid Assessment of Ebola Infection Prevention and Control Needs — Six Districts, Sierra Leone, October 2014

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As of October 31, 2014, the Sierra Leone Ministry of Health and Sanitation had reported 3,854 laboratory-confirmed cases of Ebola virus disease (Ebola) since the outbreak began in May 2014; 199 (5.2%) of these cases were among health care workers. Ebola infection prevention and control (IPC) measures are essential to interrupt Ebola virus transmission and protect the health workforce, a population that is disproportionately affected by Ebola because of its increased risk of exposure yet is essential to patient care required for outbreak control and maintenance of the country's health system at large. To rapidly identify existing IPC resources and high priority outbreak response needs, an assessment by CDC Ebola Response Team members was conducted in six of the 14 districts in Sierra Leone, consisting of health facility observations and structured interviews with key informants in facilities and government district health management offices. Health system gaps were identified in all six districts, including shortages or absence of trained health care staff, personal protective equipment (PPE), safe patient transport, and standardized IPC protocols. Based on rapid assessment findings and key stakeholder input, priority IPC actions were recommended. Progress has since been made in developing standard operating procedures, increasing laboratory and Ebola treatment capacity and training the health workforce. However, further system strengthening is needed. In particular, a successful Ebola outbreak response in Sierra Leone will require an increase in coordinated and comprehensive district-level IPC support to prevent ongoing Ebola virus transmission in household, patient transport, and health facility settings.

Rapid needs assessments were conducted in Bombali, Moyamba, Port Loko, Pujehun, Tonkolili, and Western districts during October 1–5, 2014. These districts varied widely in Ebola case burden (8.3 cumulative confirmed cases per 100,000 population in Pujehun to 115.6 in Bombali [*1*]) and in the number of Ebola care facilities (one in Moyamba to 12 in Western). Data on existing IPC resources and activities currently under way as part of the Ebola response were collected in each district through key informant structured interviews and observations at health facilities using a standardized questionnaire.

The assessment team interviewed the district medical officer or a health management team representative to assess district-twide IPC activities, as well as a senior nursing or physician staff member at a convenience sample of 12 government-run referral health facilities. This included a district hospital as well as one to three Ebola "holding centers" per district (transitional care facilities where suspected Ebola patients are referred for diagnostic testing and supportive care until they can be transferred to a free-standing Ebola treatment unit for isolation and care), except in Tonkolili District where only the district hospital was visited. District hospitals are expected to screen for Ebola and properly isolate suspected patients while awaiting transfer to an Ebola treatment unit. Their Ebola isolation areas can become holding centers by default because of transportation delays and limited Ebola treatment unit bed availability. Standardized interview and assessment tools were based on World Health Organization Ebola infection prevention recommendations (*2*) and included questions on Ebola IPC response plans, procedures, facilities, staffing, transportation teams, and supplies. Interviewee responses were recorded by hand and compiled for qualitative review. Assessment team members were doctoral-level international health professionals from CDC. They did not enter active Ebola care wards to directly observe IPC systems or practices.

Widespread gaps in IPC systems and resources critical for Ebola prevention and response were identified through interviews with key informants in all six districts visited (Table). None of the districts had dedicated infection control focal persons or supervisors within district health management structures to coordinate IPC activities and conduct routine quality assurance at the time of the rapid assessment. Furthermore, no IPC standard operating procedures existed at facility, district, or national levels for proper screening, isolation, care, and transport of suspected, probable, and confirmed Ebola patients.

Ebola screening procedures at all facilities visited were inadequate to facilitate appropriate triage and separation of patients suspected of having Ebola from those not suspected of having Ebola. Overall, there was a need for a standard routine screening protocol to minimize case misclassification, screening positioning at the initial access-controlled point of entry, and proper use of PPE among screeners. PPE supplies were reported to be insufficient for patient care and transport activities in every district, with larger gaps for rural facilities,

clinics, and ambulance teams. Other deficiencies in supplies and infrastructure included lack of running water, working incinerators for burning disposable waste, chlorine, and blood collection supplies. A detailed list of district-specific needs was compiled for presentation to key national stakeholders.

Key informants reported that the availability of hospital and holding center staff competent in IPC practices also was inadequate. The shortage was compounded by deaths of health care workers from Ebola infection and workforce attrition resulting from delays in receiving hazard pay and from staff fatigue (in two districts, medical officers responsible for operating Ebola isolation wards and ensuring staff adherence to IPC had not had a day off in over 2 months). However, the biggest barrier to adequate staffing was that IPC training and mentoring had not yet been uniformly delivered to staff members before the opening of the Ebola care facility. Only three of six districts reported that basic training had been provided to facility health care workers, including PPE use. In two districts, basic training had not been provided to most staff members, although PPE was being used. Ambulance teams and cleaners were reported to have undergone formal IPC training less consistently than burial teams and laboratory technicians, and staff members at peripheral health units (community clinics in Sierra Leone) were not yet routinely trained to safely screen for or isolate persons suspected with Ebola before transport to Ebola care facilities. Overwhelmingly, refresher IPC training and mentorship were desired, even in districts where IPC training activities had taken place.

Finally, delays in Ebola patient transportation and reporting of laboratory results hindered the separation of confirmed Ebola patients from suspected Ebola patients in holding centers, or from their families and communities. In areas distant from Ebola diagnostic laboratories, sample result turnaround time varied and sometimes took as long as 1 week. In two districts, home care was occurring regularly because of delays in patient transport systems and Ebola care bed availability, but without clear guidance for families on how this could be done safely. In all assessed districts, additional all-terrain vehicles and fuel were urgently needed for burial and ambulance teams, as well as specimen transport. No standard operating procedures were readily available for cleaning and decontamination of these vehicles which, in conjunction with limited training, improper use of PPE, and poor separation between clean and contaminated areas in the vehicles, put transport teams and potentially uninfected but suspected Ebola passengers at risk for infection.

Discussion

Based on these findings and key stakeholder input, priority IPC actions for the Ebola response in Sierra Leone were recommended. The Ministry of Health and Sanitation and international Ebola response partners have developed IPC protocols for care and transport procedures for implementation at the district and facility levels. They are increasingly procuring and organizing necessary supplies and support, and prioritizing growth of laboratory and Ebola treatment capacity. Given the lack of a preexisting infection control cadre and the overwhelming need for well-trained staff at all facility levels, the team recommended the rapid establishment of a large-scale Ebola treatment and IPC training program adapted to the varied health responder workforce. This program now exists

TABLE. Infection prevention and control (IPC) response assessment as reported by district medical officers and stakeholders — six districts, Sierra Leone, October 1–5, 2014

	Bombali	Moyamba	Port Loko	Pujehun	Tonkolili	Western
Ebola cumulative incidence per 100,000 population	115.6	34.5	99.8	8.3	48.3	88.7
IPC standard operating procedures in place	No	No	No	No	No	No
IPC practitioner on staff	No	No	No	No	No	No
Proper screening by protocol	No	No	No	No	No	No
Recommended personal protective equipment available*	No	No	No	No	—†	No
Adequate staff	No	No	No	No	No	No
Persons with any IPC training§						
Health care workers	Yes¶	Yes¶	No	No	Yes¶	No
Burial teams	Yes¶	Yes¶	—	Yes¶	—	Yes¶
Ambulance teams	No	No	No	No	—	No
Cleaners	No	Yes¶	Yes¶	No	Yes¶	No
Laboratory technicians	Yes¶	Yes¶	Yes¶	Yes¶	—	—
Refresher training desired	Yes	Yes	Yes	Yes	Yes	Yes
No. of ambulances (% coverage**)	5 (38%)	1 (7%)	3 (27%)	1 (8%)	—	6
Reported no. of days until return of Ebola laboratory results	2–7	2¶	2–5	2¶	2–6	2–3
Care in homes occurring††	Rare¶	Rare¶	50–100	Rare¶	—	Many

* Recommended refers to appropriate quantity and quality.
† Information not available.
§ IPC training was only counted if it included personal protective equipment procedures and participation by the majority of staff members.
¶ Response needs being met.
** Percentage coverage of chiefdoms (assuming goal of one ambulance per chiefdom). There are no chiefdoms in the Western District.
†† Estimated number of known Ebola cases remaining in homes.

and is being scaled up with international partner support. IPC training and delivery of PPE and other supplies to 1,185 peripheral health units is under way with technical support from CDC. Finally, monitoring and evaluation through a comprehensive Ebola IPC quality assurance system, including core IPC metrics, is planned and is expected to reinforce prevention efforts.

Additionally, national Ebola IPC coordination is ensuring that identified IPC gaps are addressed rapidly, correctly, and efficiently. Lead IPC response partners are coordinating standard operating procedure implementation, providing comprehensive IPC assessment and remediation of deficits at health care facilities, implementing routine IPC monitoring, and supporting facility-level commodity management. Strict administrative controls of patient screening and care in facilities continue to be needed to prevent infection of health care workers, uninfected patients, and visitors. Trained IPC specialists embedded within health care facilities and at the district level are recognized as critical to providing oversight of IPC strategy implementation; efforts to train and place these staff are underway.

Moving forward, ongoing IPC refresher training and corrective IPC practice reinforcement will be needed at the facility level following initial training. Ambulance transport capacity should be increased with improved IPC protocols to avoid transportation-related infections and, if care is to take place increasingly in homes, a clear protocol and strategy for this is imperative to prevent further community transmission. Finally, consensus criteria should be established both for IPC standards to be met before Ebola care facility opening and for closing facilities that fail to meet minimum standards.

Results from this rapid assessment were limited by time constraints, absence of assessment in Ebola patient care areas, and potential response bias from interviews administered to district-level stakeholders. In addition, the assessment team had varied success with key informant availabilities and the number of sites visited. Nevertheless, the assessment provides rapid insight into current IPC practices and preparedness in communities, patient transport, and health facility settings.

What is already known on this topic?

Sierra Leone continues to have a large number of Ebola cases. Ebola infection prevention and control (IPC) measures are essential to interrupt Ebola virus transmission and protect the health workforce.

What is added by this report?

A rapid needs assessment of six districts in Sierra Leone identified widespread gaps in IPC systems and resources critical for Ebola prevention and response in communities, patient transport, and health facility settings. In particular, there were shortages of trained staff members, personal protective equipment, safe transport, and standardized IPC protocols.

What are the implications for public health practice?

Based on rapid assessment findings and key stakeholder input, priority IPC actions for the Ebola response in Sierra Leone were recommended. A successful response will require an increase in coordinated and comprehensive district-level IPC support to prevent ongoing Ebola virus transmission in the country.

An increasingly coordinated and comprehensive IPC program with district and health facility level support is urgently needed to prevent Ebola in districts where the prevalence is low and to strengthen the existing IPC response in areas with high prevalence of Ebola.

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Acknowledgments

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Morbidity and Mortality Weekly Report

Clinical Inquiries Regarding Ebola Virus Disease Received by CDC — United States, July 9–November 15, 2014

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On December 5, 2014, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

Since early 2014, there have been more than 6,000 reported deaths from Ebola virus disease (Ebola), mostly in Guinea, Liberia, and Sierra Leone (*1*). On July 9, 2014, CDC activated its Emergency Operations Center for the Ebola outbreak response and formalized the consultation service it had been providing to assist state and local public health officials and health care providers evaluate persons in the United States thought to be at risk for Ebola. During July 9–November 15, CDC responded to clinical inquiries from public health officials and health care providers from 49 states and the District of Columbia regarding 650 persons thought to be at risk. Among these, 118 (18%) had initial signs or symptoms consistent with Ebola and epidemiologic risk factors placing them at risk for infection, thereby meeting the definition of persons under investigation (PUIs). Testing was not always performed for PUIs because alternative diagnoses were made or symptoms resolved. In total, 61 (9%) persons were tested for Ebola virus, and four, all of whom met PUI criteria, had laboratory-confirmed Ebola. Overall, 490 (75%) inquiries concerned persons who had neither traveled to an Ebola-affected country nor had contact with an Ebola patient. Appropriate medical evaluation and treatment for other conditions were noted in some instances to have been delayed while a person was undergoing evaluation for Ebola. Evaluating and managing persons who might have Ebola is one component of the overall approach to domestic surveillance, the goal of which is to rapidly identify and isolate Ebola patients so that they receive appropriate medical care and secondary transmission is prevented. Health care providers should remain vigilant and consult their local and state health departments and CDC when assessing ill travelers from Ebola-affected countries. Most of these persons do not have Ebola; prompt diagnostic assessments, laboratory testing, and provision of appropriate care for other conditions are essential for appropriate patient care and reflect hospital preparedness.

As part of CDC's Emergency Operations Center activation, CDC staff assist state and local health departments to evaluate PUIs for Ebola. PUIs are defined as persons who, based on initial screening and clinical assessment, have 1) signs or symptoms consistent with Ebola* and 2) an epidemiologic risk factor† within the 21 days before symptom onset (*2*,*3*). CDC recommends testing for Ebola virus when persons are confirmed to have compatible clinical presentations and epidemiologic risk factors. For clinical inquiries that resulted in Ebola virus testing, tests were conducted in local or state public health laboratories, most of which are part of the CDC Laboratory Response Network, or in the CDC laboratory (*4*).

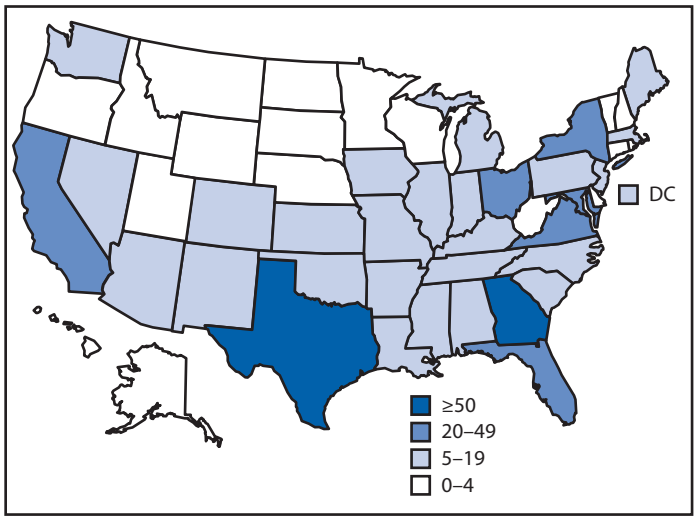
For this report, CDC reviewed inquiries concerning potential PUIs received by CDC during July 9–November 15, 2014, from U.S. health departments or health care providers. Information was compiled from call logs to assess source of inquiry, the person's travel history or other risk factors for Ebola, clinical presentation, and subsequent Ebola test results.

During July 9–November 15, 2014, CDC responded to clinical inquiries regarding 650 persons from 49 states and the District of Columbia (Figure 1); 142 (22%) originated in health departments, and 508 (78%) were originated by clinicians with subsequent notification and engagement of the health department of jurisdiction. Among persons for whom demographic information was provided, 49% were female, median age was 34 years (range = 9 months–90 years), and 16% were aged <18 years (information on sex and age were available for 82% and 66%, respectively). Overall, 138 (21%) persons had traveled to an Ebola-affected country, 22 (3%) had contact with an Ebola patient or patient's body fluids in the United States, and 490 (75%) had neither risk factor. Among the 160 persons who had an epidemiologic risk factor, 118 (74%) had at least one sign or symptom consistent with Ebola and therefore met PUI criteria. Inquiries concerning PUIs originated in 34 states and the District of Columbia. Inquiries averaged 10 per week (range = 1–25) until September 30, 2014, when CDC confirmed the first Ebola case diagnosed in

* Signs and symptoms consistent with Ebola include elevated temperature (or subjective fever), severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage. Many other conditions can cause combinations of these signs and symptoms.

† Epidemiologic risk factors include contact with an Ebola patient or patient's body fluids or travel to an Ebola-affected country within 21 days of symptom onset. Countries with widespread Ebola virus transmission include Guinea, Liberia, and Sierra Leone. Those with localized transmission included Senegal during August 29–September 26 and Nigeria during July 23–September 30. Since October 18, Mali has had cases in urban settings.

FIGURE 1. Number of clinical inquiries from health departments and health care providers regarding persons thought to be at risk for Ebola virus disease, by state — United States, July 9–November 15, 2014



the United States (*7*); after this, the number of weekly clinical inquiries increased, peaking at 227 in mid-October. Most of the increase in inquiries was related to persons with no risk factors for Ebola (Figure 2).

A total of 61 (9%) persons were tested for Ebola virus at CDC's recommendation or by health department request; testing was not always performed for PUIs because alternative diagnoses were made or symptoms resolved. Of the 61 tested, 35 (57%) had traveled to an Ebola-affected country, 16 (26%) reported contact with an Ebola patient or their body fluids in the United States, and 10 (16%) had no Ebola risk factors but were tested at the request of the state or local health department (Table). Symptom history was available for 60 of the 61 persons tested; 56 (93%) had at least one sign or symptom consistent with Ebola. Specimens from 27 (44%) persons were tested at a state or local public health laboratory and confirmed at CDC, 15 (25%) were tested only at a public health laboratory and declared negative, and the remaining 19 (31%) were tested only at CDC.

Four persons were diagnosed in the United States with laboratory-confirmed Ebola; one died (*7,8*). Three were health care workers, two of whom provided intensive care to the first patient diagnosed in the United States. No secondary infections occurred among these four patients' household or community contacts.

Among 33 recent travelers who tested negative for Ebola, alternative diagnoses were available for 13, the most common being malaria (n = 5) and viral illnesses (n = 4), including influenza. At least two persons who tested negative for Ebola died from other causes. Based on reports from health departments and health care providers, in several instances efforts to establish alternative diagnoses were reported to have been hampered or delayed because of infection control concerns. For example, laboratory tests to guide diagnosis or management (e.g., complete blood counts, liver function tests, serum chemistries, and malaria tests) were reportedly deferred in some cases until there were assurances of a negative Ebola virus test result. In other instances, radiologic studies, such as computed tomography and ultrasound scans, or evaluation for noninfectious conditions, such as severe hypertension and tachycardia, were reportedly delayed while a diagnosis of Ebola was under consideration.

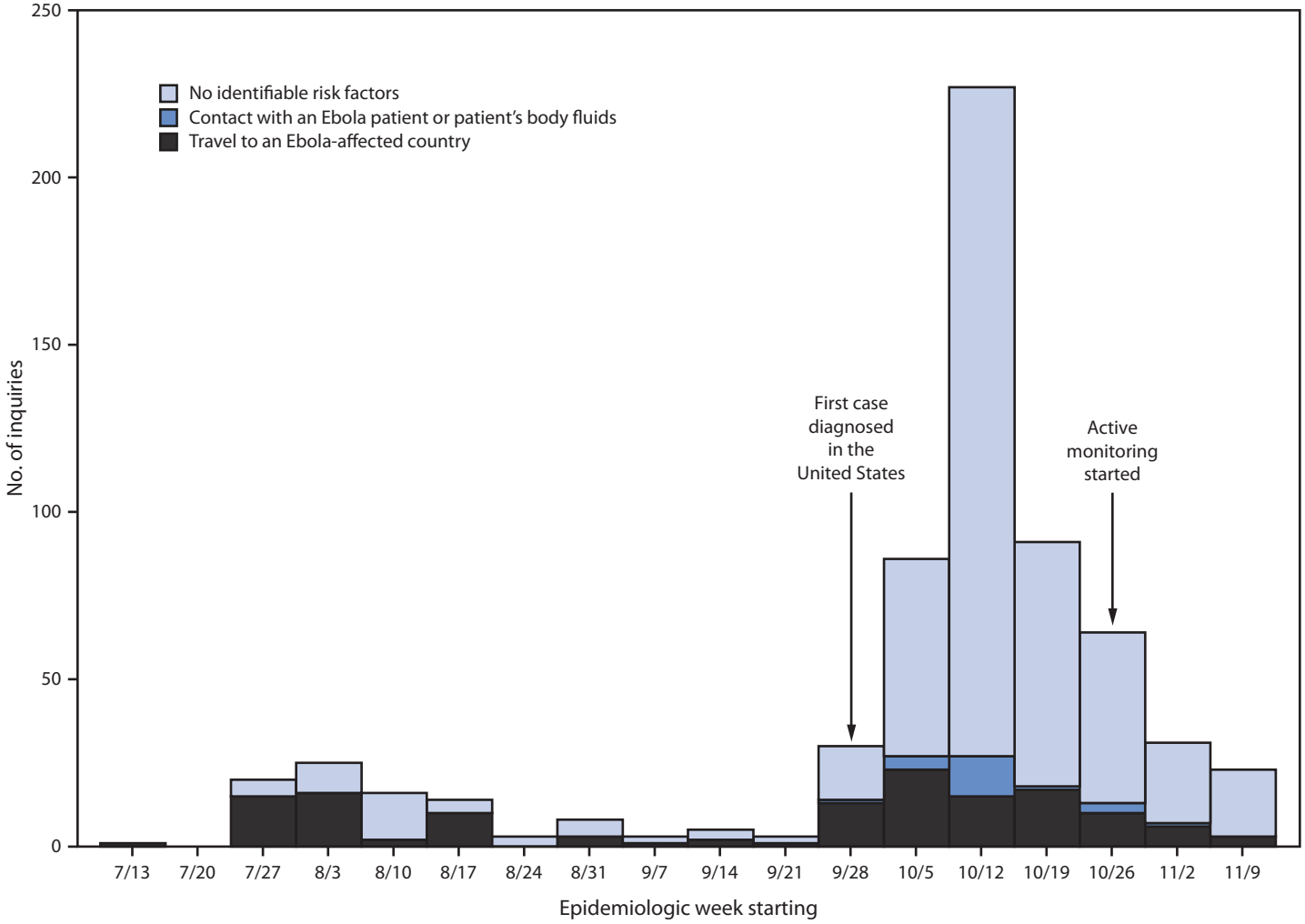
On October 27, 2014, CDC implemented a risk-stratified active monitoring program for all travelers arriving from Ebola-affected countries to facilitate early detection of Ebola if these persons become ill (*5*). After arrival screening at designated U.S. ports of entry, health departments with jurisdiction at the travelers' final destination perform daily active or direct active temperature and symptom monitoring[§] for 21 days after the last possible Ebola exposure (*6,9*). Among the 650 inquiries described in this report, 107 (16%) occurred after active monitoring was instituted, and among these, 60 (56%) concerned persons who had traveled outside the United States, but only 17 (16%) had been to an Ebola-affected country in the preceding 21 days. Among these 17, a total of 14 were considered to be PUIs, because they had at least one sign or symptom consistent with Ebola. Upon evaluation of these 14 persons, nine were tested for Ebola and none were positive. Among the five who were not tested, an alternative diagnosis was made in three persons and symptoms resolved in two.

Discussion

Since July 2014, CDC has provided enhanced consultation regarding potential Ebola cases to state and local health departments and health care providers throughout the United States, and has ensured that Ebola virus testing is widely available. As of December 3, 2014, a total of 44 state and local public health laboratories in 39 states and the District of Columbia are capable of conducting Ebola virus testing. This system of consultation and testing identified all four Ebola patients diagnosed in the United States. Each of these patients had Ebola-compatible clinical features and identifiable risk factors, highlighting the importance of a carefully obtained clinical and travel history. The combination of a high index of clinical suspicion by health care providers with expert consultation by state and local health departments and CDC has resulted in high sensitivity

[§] Under active monitoring, state or local public health officials communicate daily with persons at risk for Ebola to check for the presence of fever or other signs or symptoms consistent with Ebola. Direct active monitoring means health officials conduct active monitoring through direct observation.

FIGURE 2. Number of clinical inquiries from health departments and health care providers regarding persons thought to be at risk for Ebola virus disease (Ebola), by epidemiologic risk factor* and epidemiologic week — United States, July 9–November 15, 2014



* Epidemiologic risk factors include contact with an Ebola patient or patient's body fluids or travel to an Ebola-affected country within 21 days of symptom onset. Countries with widespread Ebola virus transmission include Guinea, Liberia, and Sierra Leone. Those with localized transmission included Senegal during August 29–September 26 and Nigeria during July 23–September 30. Since October 18, Mali has had cases in urban settings.

in detecting cases, which is of paramount importance to public health, especially for a disease as dangerous as Ebola.

The active monitoring program requires that all travelers from affected countries be monitored by local public health authorities for fever or other symptoms that might be early manifestations of Ebola for the duration of a 21-day incubation period. Symptomatic persons are referred and transported per protocols for Ebola (*10,11*) for clinical evaluation to a predetermined hospital that is prepared to assess and care for a PUI, thereby minimizing the possibility of secondary transmission and ensuring prompt evaluation and early initiation of treatment. From October 11, when entry screening began at U.S. airports, through November 15, a total of 2,263 travelers arriving from Guinea, Liberia, and Sierra Leone were screened, and none had symptoms during travel. One of these incoming travelers went on to develop Ebola; this person was asymptomatic at the time of entry screening, underscoring the value of post-arrival active monitoring as currently implemented.

The findings in this report are subject to at least two limitations. First, although this report describes all clinical inquiries received by CDC and accounts for all definitive Ebola virus tests conducted within the United States at public health or CDC laboratories, it does not represent all clinical inquiries received by health departments. Second, because clinical data were not systematically collected, information on certain variables might be incomplete.

A coordinated, national surveillance system facilitating the early detection of Ebola is an important defense against the possibility of importation and transmission within the United States and facilitates patients' early access to medical care. CDC's

TABLE. Clinical presentation and epidemiologic risk factors among persons under investigation for possible Ebola virus disease (Ebola)* who were tested for Ebola virus, by test result — United States, July 9–November 15, 2014

	Test result			
	Positive (n = 4)		Negative (n = 57)*	
Characteristic	No.	(%)	No.	(%)
Clinical presentation				
Subjective fever or core temperature ≥100.4°F (≥38.0°C)	4/4	(100)	40/56	(71)
Vomiting or diarrhea	2/4	(50)	25/56	(45)
At least one sign or symptom consistent with Ebola†	4/4	(100)	52/56	(93)
Risk factor				
Travel to an Ebola-affected country§	2/4	(50)	33/57	(58)
Contact with an Ebola patient or patient's body fluids	2/4	(50)	14/57	(25)
No identifiable risk factors	0/4	(0)	10/57	(18)

* Symptom history was available for 56 of 57 persons who tested negative for Ebola virus.

† Signs and symptoms consistent with Ebola include elevated temperature (or subjective fever), severe headache, fatigue, muscle pain, vomiting, diarrhea, abdominal pain, or unexplained hemorrhage.

§ Countries with widespread Ebola virus transmission include Guinea, Liberia, and Sierra Leone. Those with localized transmission included Senegal during August 29–September 26 and Nigeria during July 23–September 30. Since October 18, Mali has had cases in urban settings.

website provides up-to-date information on which travel areas might pose a risk (*12*). Clinicians should maintain a high index of suspicion and consult their local and state health departments and CDC when ill travelers from Ebola-affected countries are identified, although it is important to recognize that the likelihood of Ebola even among symptomatic travelers returning from these countries is very low. In the hospital setting, where policies and procedures should be in place to safeguard health care workers, consideration of Ebola should not delay diagnostic assessments, laboratory testing, and institution of appropriate care for other, more likely medical conditions.

Acknowledgments

Laboratory/Epidemiology Task Force, 2014 Ebola Response Team, CDC: Alicia Anderson, Justin K. Arnold, John Beltrami, Virginia B. Bowen, Cristina Cardemil, , Joseph Cavanaugh, Steven W. Champaloux, Michelle S. Chevalier, Mary J. Choi, Jennifer R. Cope, Whitni Davidson, Sanjaya Dhakal, Deborah Dowell, Lyn Finelli, Lauren E. Finn, LeAnne M. Fox, Anne Marie France, Alicia Fry, Shikha Garg, Maleeka Glover, Yoni Haber, Konrad Hayashi, Christine Ho, Margaret Honein, Christopher Hsu, Martha Iwamoto, Brendan Jackson, Bob Kirkcaldy, Pallavi A. Kache, Rashon Lane, Shirley Lecher, Rebecca Levine, Benjamin A. Levy, Ryan Maddox, Ellyn Marder, Matthew Moore, Karen Neil, Anna E. Newton, Leisha Nolen, Minal K. Patel, Heather N. Paulin, Nicki Pesik, Brett W. Petersen, Kanta Sircar, Charnetta L. Smith, Rachel M. Smith, Christopher A. Taylor, Naomi Tepper, Sara M. Tomczyk, Timothy M. Uyeki, Matthew Westercamp, Jennifer Williams.

What is already known on this topic?

The 2014 epidemic of Ebola virus disease (Ebola) is the largest Ebola epidemic ever known, with more than 6,000 deaths to date in Guinea, Liberia, and Sierra Leone. CDC offers consultation to state and local health officials and health care providers evaluating persons possibly at risk for Ebola. State-based, active monitoring of travelers arriving from Ebola-affected countries began on October 27, 2014.

What is added by this report?

During July 9–November 15, 2014, CDC responded to clinical inquiries regarding 650 persons in the United States. Sixty-one (9%) were tested for Ebola virus, and four were positive, including two travelers. Of the 17 persons who arrived in the United States from an Ebola-affected country after state-based active surveillance began, none had Ebola. Appropriate medical evaluation and treatment for other conditions were noted in some instances to have been delayed while a person was undergoing evaluation for Ebola.

What are the implications for public health practice?

State-based active monitoring facilitates the early detection of signs and symptoms among incoming travelers with known risk factors for Ebola. Health departments and health care workers should remain vigilant, but consideration of Ebola should not delay other indicated medical care.

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Announcement

Updated Recommendations for HIV Prevention with Adults and Adolescents with HIV in the United States

A new evidence-based guideline, *Recommendations for HIV Prevention with Adults and Adolescents with HIV in the United States, 2014*, is now available online at http://stacks.cdc.gov/view/cdc/26062. This guideline was developed by CDC, the Health Resources and Services Administration (HRSA), the National Institutes of Health (NIH), and five nongovernmental organizations: the American Academy of HIV Medicine, the Association of Nurses in AIDS Care, the International Association of Providers of AIDS Care, the National Minority AIDS Council, and the Urban Coalition for HIV/AIDS Prevention Services. The recommendations are intended to advance the goals of the National HIV/AIDS Strategy for the United States: prevent new HIV infections, increase the proportion of persons with HIV who are aware of their infection, prevent HIV-related illness and death, and reduce HIV-related health disparities (*1*). The guideline updates and expands on the *Recommendations for Incorporating HIV Prevention into the Medical Care of Persons Living with HIV* (*2*) published in 2003 by CDC, HRSA, NIH, and the HIV Medicine Association of the Infectious Diseases Society of America. This updated guideline is a comprehensive compilation of new and longstanding federal recommendations about biomedical, behavioral, and structural interventions to reduce the risk for HIV transmission from persons with HIV by reducing their infectiousness and their risk for exposing others to HIV.

The guideline is directed to three main audiences: clinical providers, nonclinical providers, and staff members of health departments and HIV planning groups. It is published with three companion summaries that list the subset of recommendations for each of these three audiences (*3*–*5*). The guideline might also interest persons with HIV; partners of persons with HIV; specialists in HIV planning, service delivery, policy, and legislation; and managers of medical assistance programs, health insurance plans, and health systems that serve persons with HIV.

A companion resource library web site (available at http://www.cdc.gov/hiv/prevention/programs/pwp) includes dozens of practical decision-support tools, training aids, fact sheets, and other materials that can support implementation of these recommendations.

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Errata

Vol. 63, No. 48

In the report, "Respiratory Syncytial Virus — United States, July 2012–June 2014," two errors occurred. In the figure on page 1135, the line depicting respiratory syncytial virus season duration in Florida should not extend beyond January 25 for the 2013–14 season. Also, in the summary box on page 1136, under the heading "What is already known on this topic?," the first sentence should read, "Respiratory syncytial virus (RSV) circulates in the United States from fall to spring, except in Florida, where circulation **can occur** from summer **into winter**.

Errata

Vol. 63, No. RR-5

In the MMWR Recommendations and Reports "Human Papillomavirus Vaccination: Recommendations of the Advisory Committee on Immunization Practices (ACIP)," an error occurred on page 5. The last sentence of the first full paragraph should read, "Among these six cancers, approximately **21,300** were attributable to HPV16/18 (**7,900 [37%]** among men and **13,400 [63%]** among women) (Table 2)."

In Table 2 on page 6, the average annual numbers of cancers attributable to HPV 16/18 were incorrect. Following is the corrected table:

TABLE 2. Average annual number and percentage of cancer cases attributable to human papillomavirus and to HPV 16 and HPV 18, by anatomic site and sex — United States, 2006–2010.

	Average no. of cancers per year in sites where HPV is often found (HPV-associated cancers)*			Cancers attributable to any HPV				Cancers attributable to HPV 16/18			
					Average no.†				Average no.†		
Anatomic site	Male	Female	Both sexes	%	Male	Female	Both sexes	%	Male	Female	Both sexes
Cervix	0	11,422	11,422	91§	0	10,400	10,400	67	0	**7,700**	**7,700**
Anus	1,549	2,821	4,370	91	1,400	2,600	4,000	**79**	**1,200**	**2,200**	**3,400**
Oropharynx	9,974	2,443	12,417	72	7,200	1,800	9,000	**62**	**6,200**	**1,500**	**7,700**
Penis	1,048	0	1,048	63	700	0	700	48	**500**	0	**500**
Vagina	0	735	735	75	0	600	600	**57**	0	**400**	**400**
Vulva	0	3,168	3,168	69	0	2,200	2,200	49	0	**1,600**	**1,600**
Total	12,571	20,589	33,160		9,300	17,600	26,900		**7,900**	**13,400**	**21,300**

Abbreviation: HPV = human papillomavirus.

* **Sources:** Data come from population-based cancer registries that participate in the National Program of Cancer Registries and/or the Surveillance, Epidemiology, and End Results Program, and meet criteria for high data quality. Cancer Registry Data are from all states meeting USCS publication criteria (http://www.cdc.gov/cancer/npcr/uscs/technical_notes/criteria.htm) for all years 2006–2010 and cover approximately 94.8% of the US population. In order to determine those cancers most likely to be HPV-associated, the following additional criteria were applied to the NPCR/SEER data: all cancers were microscopically confirmed**; c**ervical cancers were limited by histology to carcinomas only (ICD-O-3 histology codes 8010–8671, 8940–8941)**; a**ll other cancer sites were limited by histology to squamous cell carcinomas only (ICD-O-3 histology codes 8050–8084,8120-8131)**; o**ropharyngeal cancers were defined as having the following ICD-O-3 site codes: 19, 24, 28, 90–91, 98–99, 102, 108–109, 140, 142, and 148.

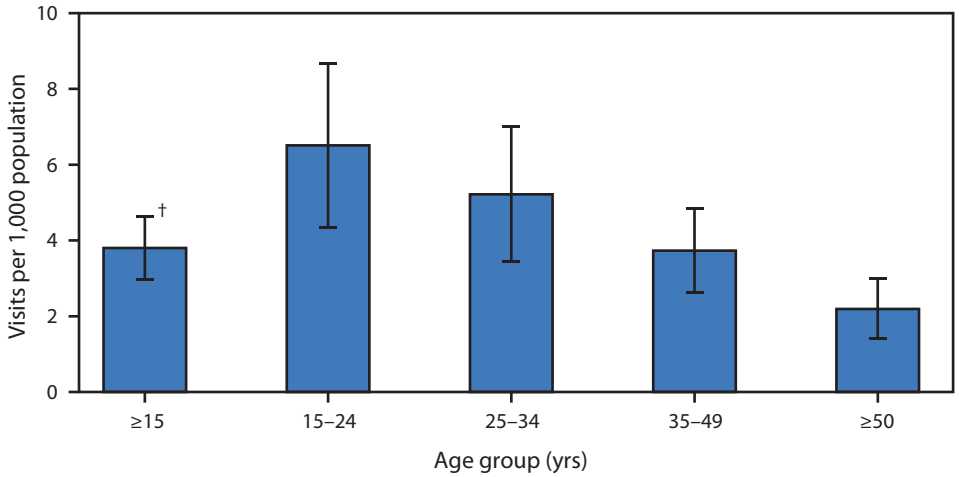
† The estimated number of HPV-attributable or HPV 16/18-attributable cancers was calculated by multiplying the HPV-associated cancer counts by the percentage of each cancer attributable to HPV or HPV16/18. Estimates rounded to the nearest 100.

§ Although HPV is accepted to be a necessary factor in the causal pathway to invasive cervical cancer, HPV is not always detected in tumor specimens from women who receive a diagnosis of invasive cervical cancer due to a variety of reasons, including misclassification of tissue specimens as cervix, quality of tissue specimens, assay sensitivity, and a small proportion of HPV-negative, cervical cancers.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Average Annual Rate of Emergency Department Visits for Bipolar Disorder* Among Persons Aged ≥15 Years, by Age Group — National Hospital Ambulatory Medical Care Survey, United States, 2010–2011



* Per 1,000 population based on the annual average over 2 years. Visits for bipolar disorder were defined as those with any of the following *International Classification of Diseases , Ninth Revision, Clinical Modification* diagnosis codes: 296.0, 296.1, or 296.4–296.8. Up to three diagnoses were recorded for each visit.
† 95% confidence interval.

During 2010–2011, approximately 468,000 emergency department visits were made each year by persons aged ≥15 years with a diagnosis of bipolar disorder, an overall rate of 3.8 visits per 1,000 persons per year. The visit rate declined significantly as age increased. Persons aged 15–24 years had the highest rate (6.5 per 1,000), which was nearly three times the rate for persons aged ≥50 years (2.2 per 1,000).

Source: National Hospital Ambulatory Medical Care Survey, 2010–2011. Available at http://www.cdc.gov/nchs/ahcd.htm.

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