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Increases in Heroin Overdose Deaths — 28 States, 2010 to 2012

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Nationally, death rates from prescription opioid pain reliever (OPR) overdoses quadrupled during 1999–2010, whereas rates from heroin overdoses increased by <50%.* Individual states and cities have reported substantial increases in deaths from heroin overdose since 2010. CDC analyzed recent mortality data from 28 states to determine the scope of the heroin overdose death increase and to determine whether increases were associated with changes in OPR overdose death rates since 2010. This report summarizes the results of that analysis, which found that, from 2010 to 2012, the death rate from heroin overdose for the 28 states increased from 1.0 to 2.1 per 100,000, whereas the death rate from OPR overdose declined from 6.0 per 100,000 in 2010 to 5.6 per 100,000 in 2012. Heroin overdose death rates increased significantly for both sexes, all age groups, all census regions, and all racial/ethnic groups other than American Indians/Alaska Natives. OPR overdose mortality declined significantly among males, persons aged <45 years, persons in the South, and non-Hispanic whites. Five states had increases in the OPR death rate, seven states had decreases, and 16 states had no change. Of the 18 states with statistically reliable heroin overdose death rates (i.e., rates based on at least 20 deaths), 15 states reported increases. Decreases in OPR death rates were not associated with increases in heroin death rates. The findings indicate a need for intensified prevention efforts aimed at reducing overdose deaths from all types of opioids while recognizing the demographic differences between the heroin and OPR-using populations. Efforts to prevent expansion of the number of OPR users who might use heroin when it is available should continue.

In February, 2014, CDC invited state health departments to submit data from their mortality files for the period 2008–2012 if they judged those files to be substantially complete and if the causes of death had been coded by the *International Classification of Diseases, 10th Revision*. Participating states had the option of submitting resident deaths or deaths that occurred in the state. States submitted annual counts of deaths with an underlying cause of drug overdose of any intent (codes X40–X44, X60–X64, X85, Y10–Y14). They also submitted counts of subsets of the overdose deaths, those involving heroin (T40.1) and those involving OPR (T40.2–T40.4).

Continuing Education examination available at http://www.cdc.gov/mmwr/cme/conted_info.html#weekly.

* Additional information available at http://wonder.cdc.gov/mcd.html.

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States also provided the demographic distributions of these types of overdoses.

CDC calculated annual heroin and OPR death rates per 100,000 using bridged-race population estimates[†] for each state and for the combined 28 participating states.[§] Because examination of state rates revealed pronounced increases in heroin death rates for most states in the study after 2010, CDC calculated changes in rates by demographic characteristics for the period of increasing rates only from 2010 to 2012. The correlation of change in state heroin overdose death rates with change in state OPR overdose death rates was examined both overall and for specific demographic subgroups. Statistical significance of changes in rates was tested using z-tests when rates were based on 100 or more deaths and examination of confidence intervals from gamma distributions when rates were based on fewer than 100 deaths. A weighted Pearson's correlation coefficient was used to examine the correlation between state level heroin and OPR death rate changes, with weights proportional to the state's 2012 population. Test results with $p \leq 0.05$ were considered statistically significant.

The death rate from heroin overdose doubled in the 28 states from 2010 to 2012, increasing from 1.0 to 2.1 per 100,000 population, reflecting an increase in the number of deaths from 1,779 to 3,635 (Table). Comparing the same years, the death rate from OPR overdose declined 6.6%, from 6.0 to 5.6 per 100,000, a decline from 10,427 to 9,869 deaths. The overall drug overdose death rate increased 4.3%, from 13.0 to 13.6. Heroin death rates increased after 2010 in every subgroup examined. Heroin death rates doubled for males and females, whereas OPR death rates declined 12.4% in males and were unchanged in females. Heroin death rates increased for all age groups, whereas OPR death rates declined for age groups <45 years. OPR death rates increased for persons aged 55–64 years. Heroin death rates doubled in non-Hispanic whites and Hispanic whites, and nearly doubled in blacks. OPR death rates decreased 8% in non-Hispanic whites and remained level in all other races/ethnicities. The Northeast and South had much larger heroin overdose death increases (211.2% and 180.9%, respectively), than the Midwest and West (62.1% and 90.7%, respectively). OPR death rates declined only in the South.

Comparing 2010 to 2012, trends in heroin and OPR overdose death rates varied widely by state. Of the 28 states, five states had increases in OPR death rates, seven states had decreases, and 16 states had no change in the OPR death rate. Of the 18 states with heroin overdose death rates based on at least 20 deaths, none had a decline (Figure 1). Increases in heroin overdose death rates were significantly associated with increases in OPR death rates ($r = 0.47$, $p = 0.05$). Similar patterns in the death rates for males and non-Hispanic whites, the two populations with the largest numbers of heroin deaths, also were observed, but the associations were not significant.

[†] Additional information available at http://wonder.cdc.gov/bridged-race-v2012.html.

[§] Alabama, Arizona, Colorado, Florida, Illinois, Indiana, Iowa, Kansas, Kentucky, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Rhode Island, South Carolina, Utah, Virginia, Washington.

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TABLE. Annual number of deaths and death rates* from overdoses of heroin or prescription opioid pain relievers (OPRs), by selected characteristics — 28 states, 2008–2012

Characteristic	Year					Change from 2010 to 2012†	
	2008	2009	2010	2011	2012	Absolute rate change	% change
No. of drug overdose deaths§ overall	21,922	22,787	22,472	23,792	23,732	—	—
Heroin	1,786	2,058	1,779	2,679	3,635	—	—
OPR	9,480	10,303	10,427	10,393	9,869	—	—
Drug overdose death rates overall	12.9	13.3	13.0	13.7	13.6	**0.6**	**4.3**
Heroin¶	1.0	1.2	1.0	1.5	2.1	**1.0**	**101.7**
OPR**	5.6	6.0	6.0	6.0	5.6	**-0.4**	**-6.6**
Sex							
Male							
Heroin	1.7	2.0	1.7	2.5	3.3	**1.7**	**99.0**
OPR	7.0	7.3	7.4	7.1	6.5	**-0.9**	**-12.4**
Female							
Heroin	0.4	0.4	0.4	0.6	0.9	**0.5**	**110.9**
OPR	4.2	4.8	4.7	4.9	4.8	0.1	2.2
Age group (yrs)							
15–24							
Heroin	1.2	1.3	1.2	1.9	2.3	**1.1**	**86.3**
OPR	4.1	4.2	4.3	3.8	3.1	**-1.2**	**-28.1**
25–34							
Heroin	2.2	2.7	2.4	3.7	5.1	**2.7**	**109.1**
OPR	8.6	9.2	9.8	9.5	8.4	**-1.4**	**-14.5**
35–44							
Heroin	1.8	2.0	1.8	2.6	3.5	**1.7**	**92.6**
OPR	9.7	10.6	10.5	10.5	9.9	**-0.6**	**-5.9**
45–54							
Heroin	1.8	2.1	1.5	2.2	3.2	**1.8**	**119.6**
OPR	12.0	12.5	12.2	12.3	11.9	-0.3	-2.5
55–64							
Heroin	0.7	0.8	0.7	1.0	1.3	**0.7**	**102.1**
OPR	5.2	6.4	6.7	6.7	7.3	**0.6**	**8.7**
Race/Ethnicity††							
White, non-Hispanic							
Heroin	1.1	1.3	1.2	1.8	2.4	**1.2**	**101.9**
OPR	6.9	7.4	7.6	7.5	7.0	**-0.6**	**-8.0**
White, Hispanic							
Heroin	1.0	1.0	0.7	1.0	1.4	**0.7**	**102.6**
OPR	2.8	2.5	2.6	2.6	2.5	0.0	-0.6
Black							
Heroin	0.8	0.9	0.7	1.0	1.4	**0.7**	**89.3**
OPR	1.8	2.2	2.1	2.0	2.2	0.1	2.7
American Indian/Alaska Native							
Heroin	0.9	1.0	0.9	1.2	1.4	0.6	63.9
OPR	6.2	7.1	6.0	6.2	6.2	0.3	4.5

See table footnotes on page 852.

In 2012, the age group with the highest heroin overdose death rate was aged 25–34 years, and the age group with the highest OPR overdose death rate was aged 45–54 years. The racial/ethnic population with the highest death rate for both heroin and OPR was non-Hispanic whites (Figure 2). The death rate for heroin among males in 2012 was almost four times that among females, whereas the death rate for OPR among males was 1.4 times that among females.

Discussion

Combined mortality data from 28 states, encompassing 56% of the U.S. population, indicate an increasing problem with fatal overdoses from heroin from 2010 to 2012. Death rates from OPR declined overall but remained more than twice as high as heroin overdose death rates. Changes in heroin death rates were positively correlated with changes in OPR death rates. Mortality from overdoses of any type of drug rose slightly.

The increase in heroin deaths parallels increases seen in individual states reported previously (*1*–*3*). Kentucky reported a 279% increase in heroin deaths from 2010 to 2012 (*1*). In Ohio, the number of heroin deaths increased approximately 300% from 2007 to 2012, with men aged 25–34 years at highest risk for fatal heroin overdoses (*3*). Mortality data for the United States show a 45% increase in heroin deaths from

TABLE. (*Continued*) Annual number of deaths and death rates* from overdoses of heroin or prescription opioid pain relievers (OPRs), by selected characteristics — 28 states, 2008–2012

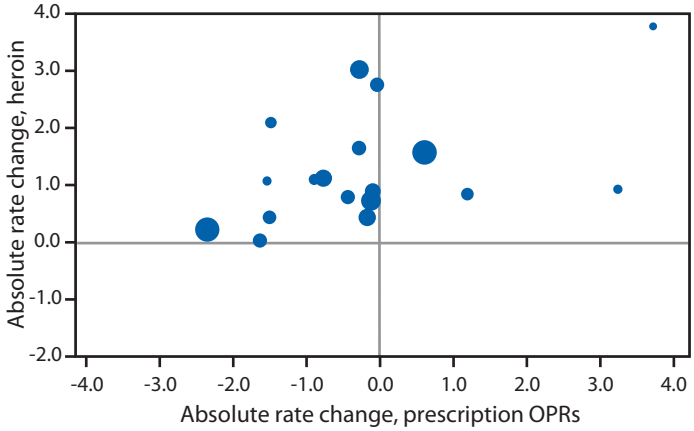
Characteristic	Year					Change from 2010 to 2012†	
	2008	2009	2010	2011	2012	Absolute rate change	% change
U.S. Census region§§							
Northeast							
Heroin	1.0	1.2	0.9	1.8	2.7	**1.9**	**211.2**
OPR	4.1	4.3	4.3	4.8	4.6	0.3	7.5
Midwest							
Heroin	1.3	1.5	1.6	2.0	2.6	**1.0**	**62.1**
OPR	3.7	4.2	4.3	4.2	4.1	-0.2	-4.7
West							
Heroin	1.5	1.6	1.2	2.1	2.3	**1.1**	**90.7**
OPR	8.2	8.5	7.9	8.2	7.9	0.1	0.7
South							
Heroin	0.6	0.7	0.4	0.6	1.0	**0.7**	**180.9**
OPR	6.9	7.6	7.9	7.2	6.6	**-1.3**	**-16.3**

* Crude rate per 100,000 population. Based on bridged-race population estimates for 28 states, available at http://wonder.cdc.gov/bridged-race-v2012.html. Because deaths might involve both heroin and OPRs, some deaths are included in both categories.
† Change is in bold if statistically significant (p<0.05). Rate and percentage change might not match calculations based on table data because of rounding.
§ Deaths with underlying causes of unintentional drug poisoning (X40–X44), suicide drug poisoning (X60–X64), homicide drug poisoning (X85), or drug poisoning of undetermined intent (Y10–Y14), as coded in the *International Classification of Diseases, 10th Revision*.
¶ Drug overdose deaths, as defined, that had heroin (T40.1) as a contributing cause.
** Drug overdose deaths, as defined, that had other opioids (T40.2), methadone (T40.3), or other synthetic narcotics (T40.4) as contributing causes.
†† Persons of black and American Indian/Alaska Native race include Hispanic and non-Hispanic ethnicity. Persons of other races/ethnicities or with missing race information on the death certificate are not included.
§§ *Northeast*: Massachusetts, New Hampshire, New York, Rhode Island. *Midwest*: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio. *West*: Arizona, Colorado, Montana, Nevada, New Mexico, Oregon, Utah, Washington. *South*: Alabama, Florida, Kentucky, North Carolina, Oklahoma, South Carolina, Virginia.

2010 to 2011, the largest annual percentage increase since 1999. The increasing death rate from heroin also is consistent with the 74% increase in the number of current heroin users among persons aged ≥12 years in the United States during 2009–2012 (*4*). Nationally, OPR death rates from 2010 to 2011 were stable (5.4 per 100,000), although there was a slight increase in the number of OPR deaths.

The rapid rise in heroin overdose deaths follows nearly 2 decades of increasing drug overdose deaths in the United States, primarily driven by OPR drug overdoses (*5*). The number of persons using OPR nonmedically on a frequent basis also has grown (*6*). From 2002–2004 to 2008–2010, past year heroin use increased among persons reporting frequent nonmedical use of OPR, from 62.0 to 94.7 per 1,000. Moreover, the only increases in past year heroin use were observed among persons who reported past year nonmedical use of OPR (*7*). In a sample of heroin users in a treatment program, 75% of those who began opioid abuse after 2000 reported that their first regular opioid was a prescription drug. In contrast, among those who began use in the 1960s, more than 80% indicated that they initiated their abuse with heroin (*8*). Persons who initiated heroin use after 2000 have reported that heroin often is more readily accessible, less expensive, and offers a more potent high than prescription opioids (*8*). Although some persons might be discontinuing prescription opioids and initiating heroin use as a replacement, results from this study indicate that recent heroin death rate increases were not significantly associated with decreases in OPR overdose mortality. Numerous risk factors contribute to drug-specific use and overdose death rates (*3,8*). For example, an increase in overall heroin supply and greater availability of heroin in some parts of the country might contribute to the trend and variation observed in heroin mortality.¶

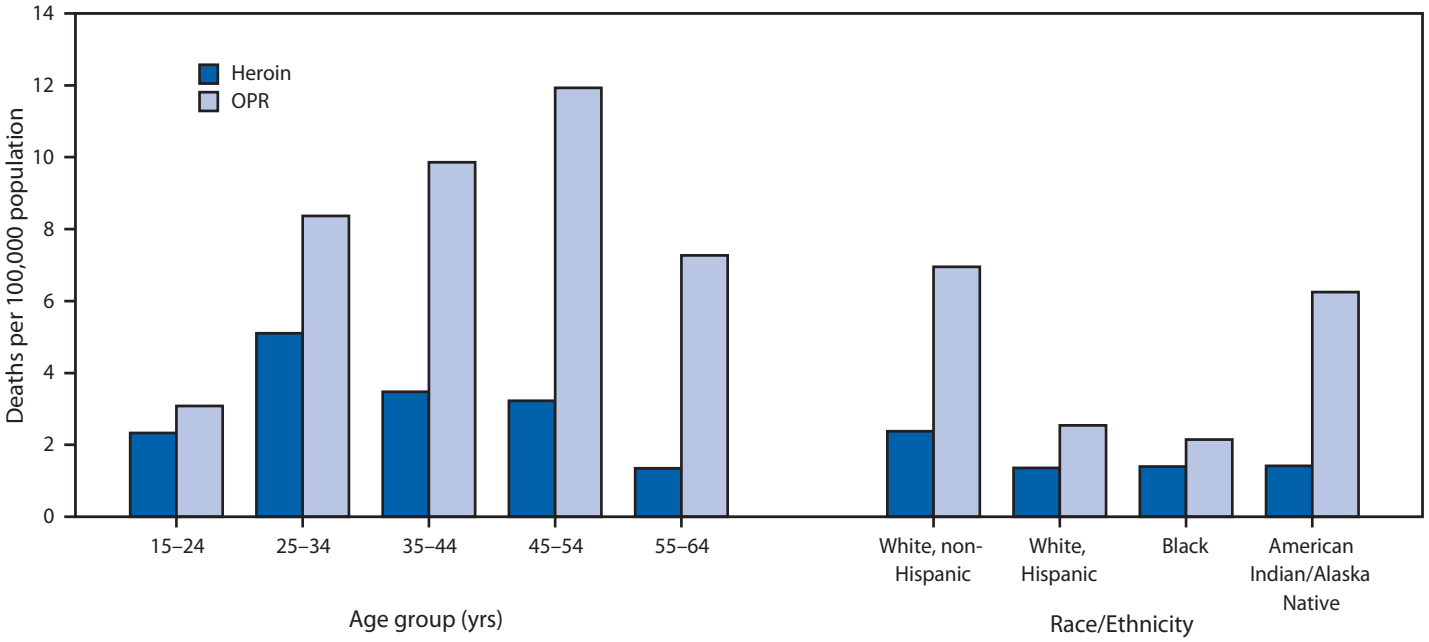
FIGURE 1. Absolute change in heroin overdose death rates* compared with change in prescription opioid pain reliever (OPR) overdose death rates — 18 states, 2010 to 2012†



* Rate change per 100,000 persons (r = 0.47, p = 0.05). Rates based on fewer than 20 deaths in a year are considered unstable and not shown. Marker is proportional in size to the 2012 population of the state it represents.
† Arizona, Colorado, Florida, Illinois, Indiana, Kentucky, Massachusetts, Michigan, Missouri, Nevada, New Mexico, New York, North Carolina, Ohio, Oregon, Utah, Virginia, and Washington.

¶ Additional information available at http://www.justice.gov/dea/resource-center/DIR-017-13%20NDTA%20Summary%20final.pdf.

FIGURE 2. Death rates* from overdoses of heroin or prescription opioid pain relievers (OPRs), by age group and race/ethnicity — 28 states, 2012



* Crude (unadjusted) rate per 100,000 population. Based on bridged-race population estimates for 28 states, available at http://wonder.cdc.gov/bridged-race-v2012.html.

The findings in this report are subject to at least five limitations. First, death certificates from these states fail to specify the drugs involved in 22% of overdose deaths, so drug-specific overdose rates are underestimated (*9*). Second, death certificate data might misclassify heroin deaths as OPR deaths if the heroin metabolite morphine is listed on the certificate rather than heroin itself (*10*). Misclassifications of this type have been demonstrated in several states. However, for this report, this problem is more likely to affect the rates than the percentage changes in those rates. Third, for the 2012 data, six states reported provisional data, and five states reported only deaths that occurred within the state, so the actual rates might vary slightly from those shown. Fourth, the data might reflect fewer than the actual number of deaths for certain racial/ethnic populations because of misclassified, unspecified, or unclassifiable races or ethnicities. In particular, rates by American Indian/Alaska Native populations should be interpreted with caution because of underreporting of these populations. Finally, the data are not necessarily representative of the United States as a whole. Although the distribution of the study population by age, race/ethnicity, and sex closely matched the distribution of the U.S. population, the study population was overrepresented in the Midwest and underrepresented in the West. Because drug overdose death rates vary geographically, trends in this report might differ slightly from overall U.S. trends. Analysis of U.S. trends can be made when mortality files from all 50 states become available.

The findings in this report indicate a growing problem with heroin overdoses superimposed on a continuing problem with OPR overdoses. Increasing use of heroin is especially concerning because it might represent increasing injection drug use. The small decline in OPR overdose mortality is encouraging given its steep increase during 1999–2010 (*5*), but efforts to address opioid abuse need to continue to further reduce overdose mortality and avoid further enlarging the number of OPR users who might use heroin when it is available. Clinical interventions that might address abuse of both OPR and heroin include screening for substance abuse, urine testing for drug use, and referral to substance abuse treatment. The use of prescription drug monitoring programs can address inappropriate opioid prescribing and further prevent OPR abuse. State policies that increase access to naloxone, a drug that can reverse potentially fatal respiratory depression in persons who have overdosed from either OPRs or heroin, or policies that reduce or eliminate penalties when someone reports an overdose, are potentially useful strategies.** Given the rapid changes in drug overdose epidemiology, timely, drug-specific fatal and nonfatal surveillance data at the local, state, and regional level will be necessary to target prevention efforts.

** Additional information available at http://www.cdc.gov/homeandrecreationalsafety/poisoning/laws/index.html.

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Craig Ward, Bryan Angell, Missouri Department of Health and Senior Services.

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What is already known on this topic?

A number of jurisdictions in the United States have reported substantial increases in heroin overdose death rates since 2010. Some persons using prescription opioid pain relievers (OPRs) nonmedically have reported switching to or also using heroin.

What is added by this report?

In 28 selected states, representing 56% of the U.S. population, heroin overdose death rates doubled from 2010 to 2012. At the same time, OPR overdose death rates declined 6.6%, and the death rate for drug overdose deaths overall rose 4.3%. Changes in state heroin overdose rates were associated with increases rather than decreases in state OPR overdose death rates.

What are the implications for public health practice?

Timely national, regional, and state surveillance data are necessary to target prevention efforts in the face of rapid changes in drug use patterns that vary across the country. Prevention, treatment, and response strategies that help reduce both heroin and OPR overdose deaths are indicated. Clinical interventions that focus on opioid prescribing, such as screening for substance abuse history and urine testing for drug use, can prevent opioid misuse, particularly for those at high risk for abuse.

Typhoid Fever Surveillance and Vaccine Use — South-East Asia and Western Pacific Regions, 2009–2013

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Typhoid fever is a serious, systemic infection resulting in nearly 22 million cases and 216,500 deaths annually, primarily in Asia (*1*). Safe water, adequate sanitation, appropriate personal and food hygiene, and vaccination are the most effective strategies for prevention and control. In 2008, the World Health Organization (WHO) recommended use of available typhoid vaccines to control endemic disease and outbreaks and strengthening of typhoid surveillance to improve disease estimates and identify high-risk populations (e.g., persons without access to potable water and adequate sanitation). This report summarizes the status of typhoid surveillance and vaccination programs in the WHO South-East Asia (SEAR) and Western Pacific regions (WPR) during 2009–2013, after the revised WHO recommendations. Data were obtained from the WHO/United Nations Children's Fund (UNICEF) Joint Reporting Form on Immunization, a supplemental survey of surveillance and immunization program managers, and published literature. During 2009–2013, 23 (48%) of 48 countries and areas of SEAR (11) and WPR (37) collected surveillance or notifiable disease data on typhoid cases, with most surveillance activities established before 2008. Nine (19%) countries reported implementation of typhoid vaccination programs or recommended vaccine use during 2009–2013. Despite the high incidence, typhoid surveillance is weak in these two regions, and vaccination efforts have been limited. Further progress toward typhoid fever prevention and control in SEAR and WPR will require country commitment and international support for enhanced surveillance, targeted use of existing vaccines and availability of newer vaccines integrated within routine immunization programs, and integration of vaccination with safe water, sanitation, and hygiene measures.

Typhoid fever is caused by the bacterium *Salmonella enterica* serovar Typhi (Typhi). Infection is transmitted via the fecal-oral route with most cases and deaths occurring among populations that lack access to safe drinking water and adequate sanitation and hygiene. The illness has nonspecific symptoms, making it difficult to distinguish clinically from other febrile illnesses (*2*) that might be endemic or cause epidemics in the same geographic areas, such as paratyphoid fever, dengue, and malaria. Severe systemic complications, including intestinal perforation and neurologic manifestations, have been well documented, and intestinal perforation is the most common cause of death from typhoid (*3*). Bacterial culture (of blood, bone marrow, or other sterile sites) is the gold standard for laboratory confirmation and antimicrobial susceptibility testing. Rapid antibody-based serologic tests are available (e.g.,Widal test, Tubex TF, and TyphiDot), but are less sensitive and less specific than bacterial culture (*4*). Appropriate antibiotics shorten the duration of fever and bacterial shedding and reduce the case-fatality rate. However, resistance to available antibiotics is common, and the prevalence of resistance is increasing (*3*). Humans are the only reservoir for Typhi, and a long-term carrier state occurs.

Two safe and effective typhoid vaccines are licensed and marketed internationally, an injectable polysaccharide vaccine based on the purified Typhi Vi antigen (ViPS vaccine) for persons aged ≥2 years, and a live attenuated oral Ty21a vaccine available in capsule formulation for persons aged ≥5 years. One ViPS vaccine (Sanofi Pasteur) was prequalified by the World Health Organization (WHO) in 2011, enabling purchase by United Nations agencies; Gavi, the Vaccine Alliance (Gavi); and some international donors.* In 2008, WHO updated its position paper on typhoid vaccines and recommended programmatic use of the existing ViPS and Ty21a vaccines for endemic and epidemic disease control (Box). For this report, the status of typhoid surveillance and vaccine use in the 5-year period after the updated WHO recommendations was reviewed, focusing on SEAR and WPR, which had the highest estimated incidence rates at the time of the updated recommendations (*1*).

Information on typhoid surveillance during 2009–2013 was obtained from a supplemental survey of surveillance officers and from published reports. Data included information on type of surveillance, level at which surveillance is conducted (national versus subnational), age groups, case definitions, and laboratory confirmation. Typhoid vaccination information was obtained from the WHO/UNICEF Joint Reporting Form on Immunization data for 2009–2013, a survey of immunization program managers, and published literature. Data were collected on vaccines used, target populations (excluding travelers) and program strategies. Selected examples of large-scale typhoid vaccination programs also were reviewed. The information

*Additional information available at http://www.who.int/immunization_standards/vaccine_quality/pq_system/en.

available varied in detail, and might not represent current and comprehensive data for all countries reviewed. Data on typhoid surveillance and vaccine use, respectively, were available from 30 (63%) and 31 (65%) of the 48 countries and areas of SEAR and WPR.

Typhoid Surveillance Programs

Overall, 23 (48%) of 48 countries and areas of SEAR and WPR collected data on typhoid cases. Of these, 22 reported that typhoid was a notifiable disease, and 20 conducted surveillance activities, most through passive reporting at the national level (Table 1). Among the 14 countries that reported the year when surveillance started, almost all had existing systems before 2008. Six countries reported surveillance in selected sentinel sites (Table 1). Overall, 15 countries reported having standard case definitions, which varied widely by country. For example, case definitions included different durations of fever, ranging from "no duration specified" to "fever for at least 1 week." Five of eight countries that provided case definitions included "bradycardia" (reduced heart rate), a relatively nonsensitive and nonspecific sign, for classifying a case as suspected or probable typhoid. Laboratory testing was reported by 19 countries; 17 countries reported conducting laboratory confirmation (blood culture [17 of 19], stool culture [15 of 19]), 10 countries reported use of Widal serologic testing, and one reported use of other rapid tests. Data regarding proficiency testing of the laboratories were unavailable. In India and Bangladesh, blood culture data on typhoid cases were available through invasive bacterial disease surveillance sites for pneumonia and meningitis.

Typhoid Vaccination Programs

During 2009–2013, nine (19%) of 48 countries and areas in SEAR and WPR implemented a typhoid vaccination program or recommended vaccine use (excluding vaccination of travelers) (Table 2). In most countries that reported a typhoid vaccination program, vaccination (using ViPS vaccine) was targeted toward high-risk groups and/or food handlers. In addition, 11 countries (Australia, Cambodia, Fiji, India, Indonesia, Nepal, New Zealand, Philippines, Singapore, Sri Lanka and Thailand) reported typhoid vaccine use (ViPS or Ty21a) in the private sector.

China, India, and Vietnam initiated public sector typhoid vaccination programs before 2008, targeting preschool or school-aged children in selected geographic areas (Table 2). Nepal implemented a school-based ViPS vaccine demonstration program in the Kathmandu Valley in 2011 (Table 2), and efforts are ongoing to expand the program to school-aged children and food handlers as recommended by Nepal's National Committee for Immunization. In addition, a mass typhoid vaccination campaign using the ViPS vaccine was conducted in Fiji in cyclone-affected and high-risk areas in 2010; >64,000 ViPS doses were administered, covering 7% of the total Fiji population (*5*). Approximately 10,000 vaccine doses were used to respond to a concurrent outbreak.

BOX. World Health Organization (WHO) recommendations on typhoid vaccine use, 2008

Countries should consider the programmatic use of typhoid vaccines for controlling endemic disease.

- In most countries, only targeted vaccination of high-risk groups and populations will be required.
- Where appropriate, vaccine use should be harmonized with routine immunization programs.
- Immunization of preschool and school-aged children is recommended in areas where typhoid is a significant public health problem in these age groups.

Given the epidemic potential, typhoid vaccination is recommended for outbreak control.

Decisions regarding programmatic use should be based on a detailed knowledge of the local epidemiologic situation and other local factors, such as school enrollment rates, sensitivity of prevailing strains to relevant antimicrobials, and cost-effectiveness analyses.

Priority should be given to strengthening surveillance systems for typhoid fever, including sentinel-site surveillance for preschool and school-aged children.

Typhoid vaccination programs should be implemented in the context of other control efforts.

- Health education and health promotion.
- Training of health professionals in diagnosis and treatment.
- Improvements in water quality and sanitation.

Source: WHO position paper on typhoid vaccines (2008).

Discussion

Despite the substantial and recognized disease burden (*1*), progress in typhoid disease surveillance and use of typhoid vaccine in SEAR and WPR has been limited during the 5 years since revision of the WHO recommendations for typhoid vaccines in 2008. Most countries had passive reporting systems, primarily through existing surveillance programs established before 2008, and culture-based surveillance was conducted in fewer than half of countries. Similarly, despite the establishment of typhoid vaccination programs in some countries in SEAR and WPR before 2008, only two instances of large-scale typhoid vaccination were noted since 2008.

TABLE 1. Characteristics of typhoid fever surveillance programs, by country or area* — WHO South-East Asia and Western Pacific regions, 2009–2013

Country or area	Type of program	Age groups under surveillance	Typhoid fever as a notifiable disease	Standard case definition in use	Laboratory confirmation of cases	Part of the Health Management Information system or integrated disease surveillance systems
South-East Asia Region						
Bangladesh	Details of national surveillance not available; surveillance data available through invasive bacterial disease surveillance†	Not available	Not available	Not available	Not available	Not available
Bhutan	Passive national reporting	NA	Yes	NA	NA	Yes
India	Passive national reporting as part of integrated disease surveillance program; additional surveillance at subnational levels in selected sites; surveillance data available through invasive bacterial disease surveillance§	All ages	Yes	Yes	Yes	Yes
Indonesia	Passive national reporting; additional reporting of suspected cases through an early warning system implemented in 24 provinces	All ages	Yes	No	Yes	Yes
Nepal	Passive national reporting; sentinel site surveillance (two sites)	All ages	Yes¶	No	Yes	Yes
Sri Lanka	Passive national reporting; sentinel site surveillance (six sites)	All ages	Yes	Yes	Yes	Yes
Thailand	Passive national reporting integrated with general infectious disease/vaccine preventable disease surveillance	All ages	Yes	Yes	Yes	Yes
Western Pacific Region						
Australia	Passive national reporting	All ages	Yes¶	Yes	Yes	Yes
Brunei	Passive national reporting	All ages	Yes¶	No	Yes	Yes
Cambodia	No systematic surveillance	NA	Yes	NA	NA	Yes
China	Passive national reporting; sentinel site surveillance in seven high-risk provinces (13 sites)	All ages	Yes¶	Yes	Yes	Yes
China, Hong Kong SAR	Passive reporting	All ages	Yes	Yes	Yes	No
Cook Islands	No systematic surveillance	NA	Yes¶	NA	NA	Yes
Fiji	Passive national reporting; additional national level laboratory-based surveillance system	All ages	Yes	Yes	Yes	Yes
Japan	Passive national reporting	All ages	Yes¶	Yes	Yes	Yes
Laos	Passive national reporting	All ages	Yes	Yes	Yes	No
New Zealand	Passive national reporting	All ages	Yes	Yes	Yes	Yes
Palau	Passive national reporting	All ages	Yes	Yes	Yes	Yes
Papua New Guinea	No systematic surveillance	NA	Yes	NA	NA	Yes
Philippines	Passive national reporting	All ages	Yes	Yes	Yes	Yes
Samoa	Passive national reporting	All ages	Yes	Yes	Yes	Yes
Singapore	Passive national reporting	All ages	Yes¶	Yes	Yes	Yes
Vietnam	Passive national reporting; additional sentinel surveillance with laboratory confirmation of cases (3 sites)	All ages	Yes¶	Yes	Yes	Yes

Abbreviations: WHO = World Health Organization; NA = not applicable; SAR = Special Administrative Region.

* Countries or areas for whom data were available. The following countries and areas reported having no typhoid surveillance and typhoid as not being a notifiable disease: Kiribati, Nauru, Nuie, Solomon Islands, Timor Leste, Tokelau and Tuvalu.

† Additional information available at http://www.coalitionagainsttyphoid.org/wp-content/uploads/2014/09/05.Saha_.8TC.pdf.

§ Source: Pitzer VE, Bowles CC, Baker S, Kang G, Balaji V, Farrar JJ, et al. Predicting the impact of vaccination on the transmission dynamics of typhoid in South Asia: a mathematical modeling study. PLoS Negl Trop Dis 2014;8:e2642.

¶ System captures both typhoid fever and enteric fever overall.

TABLE 2. Summary of typhoid vaccination programs or recommended use (excluding vaccination of travelers), by country or area — WHO South-East Asia and Western Pacific regions, 2009–2013*

Country or area	National policy (year issued)	Targets for vaccination (excluding travelers)	Type of vaccine(s)
South-East Asia Region			
India	No	State of Delhi incorporated into the routine immunization program; since 2005, approximately 300,000 children aged 2–5 years vaccinated with a locally produced ViPS vaccine†	ViPS
Nepal	Yes (2012)	Subnational; school-aged children, food handlers In 2011, approximately 150,000 schoolchildren vaccinated with ViPS; estimated coverage of 65%§	ViPS
Sri Lanka	Yes (circa 1970)	National; food handlers, high-risk groups	ViPS
Western Pacific Region¶			
Australia	Yes (2008)	National; military personnel, laboratory workers routinely working with Typhi	Ty21a and ViPS
Brunei	No	Food handlers	ViPS
China	No	Subnational; selected high-risk groups**	ViPS
South Korea	Not available	National; high-risk groups	ViPS
Malaysia	Not available	Subnational; food handlers	ViPS
Vietnam	Yes (1997)	Subnational (selected high-risk provinces); during 2000–2013, more than 5.6 million doses of domestically-produced ViPS vaccine administered to children aged 3–10 years in selected high-risk districts††	ViPS

Abbreviations: WHO = World Health Organization; ViPS = parenteral Vi polysaccharide; Ty21a = live, attenuated mutant strain of Typhi.

* The data presented reflect typhoid vaccination any time during the review period in countries or areas for whom data were available. The following countries and areas reported no typhoid vaccination in either public or private sector: Bhutan, Cook Islands, Japan, Kiribati, Nauru, Nuie, Palau, Papua New Guinea, Samoa, Solomon Islands, Timor Leste, Tokelau and Tuvalu.

† Additional information available at http://www.coalitionagainsttyphoid.org/wp-content/uploads/2014/09/12.DewanByOchiai.8TC.pdf.

§ Source: Sahastrabuddhe S, International Vaccine Institute; personal communication, August 2014.

¶ Mandatory vaccination of food handlers in Singapore (since the 1970s) was rescinded in 2010; therefore, Singapore is not included.

** Not used in national immunization program. Provinces choose their own strategies, including school-based vaccination of children in high-risk areas, vaccination of food handlers, outbreak-response vaccination, and vaccination for a wide age range in high-risk areas of high-risk provinces. Source: Control of typhoid fever through vaccination: China's experience. Workshop report on review of typhoid fever vaccination programs in the People's Republic of China, Guilin 2010. International Vaccine Institute 2010. Available at http://viva.ivi.int/ReportsandDocuments/Workshop%20report%20on%20review%20of%20typhoid%20fever%20vaccination%20programs%20in%20the%20People%27s%20Republic%20of%20China,%20Guilin%20Jun%202010.pdf.

†† Additional information available at http://www.coalitionagainsttyphoid.org/wp-content/uploads/2014/09/43.Cuong_.8TC.pdf.

Establishing and strengthening typhoid surveillance remains a challenge, and subnational variations in typhoid incidence are common. Among countries for which data were available, the majority reported having typhoid surveillance as part of the national notifiable disease surveillance system, although most often typhoid was included as part of passive reporting of acute febrile illnesses or general infectious diseases. Culture confirmation of suspected and probable cases continues to be limited. Although most countries reported using a standard case definition, the case definitions used varied widely. Available serologic tests, including the Widal test, have limited value because of poor sensitivity and specificity for typhoid diagnosis, and difficulty with standardizing reagents and interpreting values across different settings. Given the challenges in the clinical diagnosis of typhoid fever, updated surveillance standards and guidelines, including standard case definitions and quality assurance and quality control protocols for laboratories, need to be widely disseminated and their use encouraged. Culture confirmation remains the gold standard for typhoid diagnosis; laboratory capacity building (including proficiency testing for quality assurance and quality control) is needed to increase the accuracy of disease reporting and to facilitate monitoring of antimicrobial resistance, which is a growing problem.

During 2001–2003, the Diseases of the Most Impoverished Program conducted systematic population-based surveillance across five Asian countries (*6*). The disease burden data and a series of typhoid vaccine studies (*7*) were instrumental in guiding global policy recommendations for vaccine use. More recent high-quality epidemiologic data with culture confirmation and data on risk factors from multiple settings will help guide prevention and control activities in Asia. Opportunities need to be explored to include typhoid in existing laboratory-based surveillance systems with culture confirmation (e.g., invasive bacterial disease networks). Furthermore, newer disease burden estimates (*8*) that account for disease risk and accumulating evidence from other regions such as sub-Saharan Africa (*9*) also warrant an updated, global review of typhoid surveillance and vaccination programs.

Despite experience with large scale typhoid vaccination studies and successful implementation of programs, vaccine adoption

What is already known on this topic?

Typhoid fever is an acute, systemic infection that represents an important cause of morbidity and mortality in the developing world with nearly 22 million cases and 216,500 deaths annually worldwide. Safe drinking water, adequate sanitation, appropriate personal and food hygiene, and typhoid vaccination are the most effective prevention and control strategies.

What is added by this report?

During the 5-year period after revision of the World Health Organization recommendations for typhoid vaccines in 2008, progress in typhoid surveillance and vaccine use has been limited in the South-East Asia and Western Pacific regions. During 2009–2013, surveillance or notifiable disease data on typhoid cases were collected in 23 (48%) of 48 countries and areas, and typhoid vaccination or recommendation for use was reported by nine (19%) of 48 countries and areas in these two regions.

What are the implications for public health practice?

Despite the substantial and recognized disease burden, typhoid fever remains a neglected disease in both the South-East Asia and Western Pacific regions. Coordinated action involving key stakeholders and partners at the regional and national levels is needed to create appropriate typhoid fever prevention and control policies and strategies, especially in settings with high incidence of disease.

since the revised WHO recommendations was limited in SEAR and WPR. In China and Vietnam, two countries with large-scale typhoid vaccination programs, typhoid incidence was reported to have declined steadily since vaccine use was initiated; improvements to water and sanitation infrastructure also were reported in Vietnam during this time (*10*). In Fiji, an evaluation of the disaster-response campaign showed that vaccination was feasible and played a role in reducing typhoid incidence in the vaccinated areas compared with pre-cyclone years (*5*).

Although the reasons for low typhoid vaccine use are not fully documented, multiple factors might have contributed. Countries might require data to ascertain local disease burden and to identify high-risk populations, for whom the recommended vaccination strategies apply, and lack of such data might be an impediment to justify vaccination programs. As countries introduce multiple new vaccines in their national immunization programs, typhoid vaccination might be a lower priority or lack adequate national or donor funding. Vaccine supply might be another potential barrier. For example, in 2012, Sanofi Pasteur recalled certain lots of the ViPS vaccine, which remains the only typhoid vaccine prequalified by WHO. An assessment of vaccine supply from both international and domestic manufacturers in multiple countries and country level policies regarding licensure and use, could help to elucidate supply and use constraints. Evaluation of typhoid vaccine impact in a variety of epidemiologic and programmatic contexts might contribute to the evidence to increase vaccine use.

Newer generation typhoid conjugate vaccines (TCVs) are under development, and when available, will be considered for funding support by Gavi. These vaccines are expected to have several advantages over ViPS and Ty21a vaccines, in particular, the potential to be immunogenic in children aged <2 years (facilitating incorporation in routine childhood immunization programs), to provide a booster effect (currently lacking for the ViPS vaccine), and a longer duration of protection. Two conjugate vaccines are licensed and being used in the private sector in India, and a third is undergoing licensure review in China. Seven additional TCV candidates are currently in different stages of preclinical and clinical development. Ongoing efforts aim to develop bivalent typhoid-paratyphoid vaccines to prevent enteric fever as a whole.

WHO recently convened a group of experts to review the available clinical data on TCVs.[†] It is anticipated that through well-designed research and postlicensure studies, additional data supporting the use of TCV in public health vaccination programs will be available in the next few years. In the meantime, WHO continues to recommend use of the licensed ViPS and Ty21a vaccines. TCV remains in Gavi's investment strategy for potential future funding support when a WHO-prequalified conjugate vaccine becomes available. In addition to global policies, coordinated action involving key stakeholders and partners at the regional and national levels is needed. Review of existing data, establishment of high quality culture-based typhoid fever surveillance at selected sentinel sites, targeted use of existing or newer typhoid vaccines (with evaluation of their impact), and guidance for diagnosis and management of patients will be crucial toward building the evidence for appropriate typhoid prevention and control policies and strategies, especially for settings with high incidence of typhoid fever.

[†] Additional information available at http://www.who.int/immunization/research/meetings_workshops/typhoidvaccines_july14/en.

Acknowledgments

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Update: Influenza Activity — United States and Worldwide, May 18–September 20, 2014

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During May 18–September 20, 2014,* the United States experienced low levels of seasonal influenza activity overall. Influenza A (H1N1)pdm09 (pH1N1), influenza A (H3N2), and influenza B viruses were detected worldwide and were identified sporadically in the United States. In August, two influenza A (H3N2) variant† viruses (H3N2v) were detected in Ohio. This report summarizes influenza activity in the United States and worldwide during May 18–September 20, 2014.

United States

The U.S. influenza surveillance system is a collaboration between CDC and federal, state, local, and territorial partners, and uses eight data sources to collect influenza information (*1*), six of which operate year-round: 1) U.S. World Health Organization (WHO) collaborating laboratories, 2) the National Respiratory and Enteric Virus Surveillance System, 3) reports of human infections with novel influenza A viruses, 4) the U.S. Outpatient Influenza-Like Illness Surveillance Network, 5) the 122 Cities Mortality Reporting System, and 6) the Influenza-Associated Pediatric Mortality Reporting System.§

During May 18–September 20, WHO and National Respiratory and Enteric Virus Surveillance System collaborating laboratories in the United States tested 66,006 specimens for influenza; 3,209 (4.9%) were positive for influenza (Figure). Of the 3,209 specimens positive for influenza during the summer months of 2014, a total of 1,728 (54%) were influenza A viruses, and 1,481 (46%) were influenza B viruses. Influenza B viruses were reported slightly more frequently than influenza A viruses from late May until early July, and influenza A viruses were more commonly reported from mid-July through September. Of the 1,728 influenza A viruses, 1,114 (64%) were subtyped: 45 (4%) were pH1N1 viruses, 1,067 (96%) were influenza A (H3N2) viruses, and two (0.2%) were H3N2v viruses. Influenza viruses were reported from the District of Columbia, Guam, Puerto Rico, and 47 states in all 10 U.S. Department of Health and Human Services regions.¶

During May 18–September 20, data from the U.S. Outpatient Influenza-Like Illness Surveillance Network indicated that the weekly percentage of outpatient visits to health care providers for influenza-like illness (ILI)** remained below the national baseline†† of 2.0%, ranging from 0.8% to 1.4%. The percentage of deaths attributed to pneumonia and influenza (P&I), as reported by the 122 Cities Mortality Reporting System, remained below the epidemic threshold§§ and ranged from 5.2% to 6.0%. Five influenza-associated pediatric deaths occurring during May 18–September 20 were reported; two were associated with an influenza A (H3N2) virus, one was associated with an influenza A virus for which no subtyping was performed, and two were associated with an influenza B virus.

* Data as of September 26, 2014.

† Influenza viruses that circulate in swine are called swine influenza viruses when isolated from swine, but are called variant influenza viruses when isolated from humans. Seasonal influenza A (H3N2) viruses that circulate worldwide in the human population have important antigenic and genetic differences from influenza A (H3N2) viruses circulating in swine. Additional information is available at http://www.who.int/influenza/gisrs_laboratory/terminology_ah3n2v.

§ The CDC influenza surveillance system collects five categories of information from the eight data sources: 1) viral surveillance (WHO collaborating laboratories, the National Respiratory and Enteric Virus Surveillance System, and human infections with novel influenza A viruses); 2) outpatient illness surveillance (U.S. Outpatient Influenza-Like Illness Surveillance Network); 3) mortality (122 Cities Mortality Reporting System and influenza-associated pediatric mortality reports); 4) hospitalizations (FluSurv-NET, which includes the Emerging Infections Program and surveillance in three additional states); and 5) summary of the geographic spread of influenza (state and territorial epidemiologist reports).

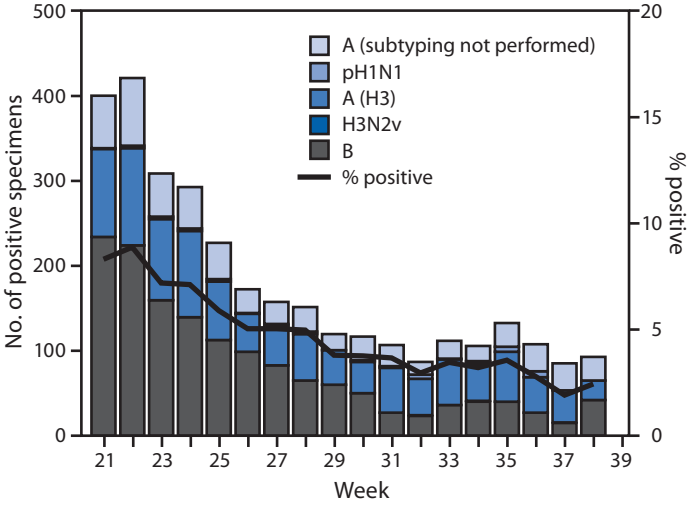
¶ The 10 regions include the following jurisdictions: Region 1: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont; Region 2: New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands; Region 3: Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia; Region 4: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, and Tennessee; Region 5: Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin; Region 6: Arkansas, Louisiana, New Mexico, Oklahoma, and Texas; Region 7: Iowa, Kansas, Missouri, and Nebraska; Region 8: Colorado, Montana, North Dakota, South Dakota, Utah, and Wyoming; Region 9: Arizona, California, Hawaii, Nevada, American Samoa, Commonwealth of the Northern Mariana Islands, Federated States of Micronesia, Guam, Marshall Islands, and Republic of Palau; Region 10: Alaska, Idaho, Oregon, and Washington.

** Defined as a temperature of ≥100°F (≥37.8°C), oral or equivalent, and cough and/or sore throat, without a known cause other than influenza.

†† The national baseline is the mean percentage of visits for ILI during noninfluenza weeks for the previous three seasons plus two standard deviations. Noninfluenza weeks are defined as periods of ≥2 consecutive weeks in which each week accounted for <2% of the season's total number of specimens that tested positive for influenza. The national percentage of patient visits for ILI is weighted on the basis of state population.

§§ The seasonal baseline proportion of P&I deaths is projected using a robust regression procedure in which a periodic regression model is applied to the observed percentage of deaths from P&I that were reported by the 122 Cities Mortality Reporting System during the preceding 5 years. The epidemic threshold is set at 1.645 standard deviations above the seasonal baseline.

FIGURE. Number* and percentage of respiratory specimens testing positive for influenza reported by World Health Organization and National Respiratory and Enteric Virus Surveillance System collaborating laboratories in the United States, by type, subtype, and week — United States, May 18–September 20, 2014†



* N = 3,209.
† As of September 26, 2014.

Novel Influenza A Virus Infection

During May 18–September 20, two human infections with H3N2v viruses were reported by Ohio. Both patients recovered, but one of the two patients was hospitalized as a result of H3N2v illness. In both instances, direct contact with swine in the week preceding illness onset was reported. No ongoing community transmission of these viruses has been detected.

Worldwide

During May 18–September 20, typical seasonal patterns of influenza activity occurred in temperate climate Southern Hemisphere countries. In Australia and New Zealand, influenza activity began to increase in late July and remained elevated through mid-September. Influenza A viruses predominated in both countries. Although pH1N1 viruses were identified more frequently than influenza A (H3N2) viruses, the proportion of influenza A (H3N2) viruses reported in Australia increased during August to mid-September. Influenza B viruses were reported in much smaller numbers from both countries. In South Africa, influenza activity began to increase in late May and decreased in early August. Influenza A (H3N2) viruses predominated in that country, but pH1N1 and influenza B viruses also were reported. In temperate countries of South America, influenza activity began to increase in June, remained elevated through July and mid-August, and decreased in September. Influenza A viruses were reported more frequently than influenza B viruses, and influenza A (H3N2) viruses were predominant in Chile, Argentina, Uruguay, and Paraguay. In temperate climate countries of Europe and North America, influenza activity was low, and small numbers of pH1N1, influenza A (H3N2), and influenza B viruses were identified.

In countries with tropical influenza seasonality, overall influenza activity remained low, and the predominant virus type and subtype varied by country. In the Caribbean and Central America, an increase in the number of influenza B viruses was reported in July and August, particularly in Honduras, Jamaica, and Nicaragua, with influenza A viruses cocirculating in Guatemala and Panama. In tropical South America, influenza A viruses were most commonly reported. Influenza A (H3N2) viruses predominated in Brazil and Columbia, whereas influenza B viruses were more frequently reported in Ecuador. In Peru, influenza A (H3N2) and pH1N1 viruses cocirculated, but influenza B viruses also were identified. In South Asia and Southeast Asia, a decrease in influenza activity was observed during August and September, and influenza A (H3N2) predominated in Cambodia, India, China, and Vietnam, with smaller numbers of influenza B viruses reported. In Thailand, influenza B viruses were more frequently reported in July and August, but influenza A (H3N2) and pH1N1 viruses also were identified. During May 1–June 27, 2014, three laboratory-confirmed human cases of influenza A (H5N1) virus infection were reported to WHO; two from Indonesia and one from Egypt (*2*). During May 1–September 20, 2014, a total of 16 cases of influenza A (H7N9) were identified in China (*3*).

What is already known on this topic?

CDC collects, compiles, and analyzes data on influenza activity year-round in the United States. The influenza season generally begins in the fall and continues through the winter and spring months; however, the timing and severity of disease and the predominant viral strains can vary by geographic location and season.

What is added by this report?

Worldwide, influenza activity during May 18–September 20, 2014, was elevated in the temperate Southern Hemisphere and tropical regions, compared with their levels outside the usual influenza season. In the United States, low levels of seasonal influenza activity were detected. In August, two influenza A (H3N2) variant viruses were detected; both cases were associated with direct contact with swine.

What are the implications for public health practice?

Annual influenza vaccination is recommended in all persons aged ≥6 months to prevent influenza and its associated complications. Although vaccination is the best way to prevent influenza, treatment with influenza antiviral medications can reduce severe outcomes of influenza, especially when initiated as early as possible, in patients with confirmed or suspected influenza.

Antigenic Characterization of Influenza Virus Isolates

The recommended components for the 2014–15 Northern Hemisphere influenza trivalent vaccines are an A/California/7/2009 (H1N1)-like virus, an A/Texas/50/2012 (H3N2)-like virus, and a B/Massachusetts/2/2012-like (B/Yamagata lineage) virus (*4*). For quadrivalent vaccines, an additional component, B/Brisbane/60/2008-like (B/Victoria lineage) virus, is recommended (*4*).

The WHO Collaborating Center for Surveillance, Epidemiology, and Control of Influenza, located at CDC, receives and analyzes influenza virus isolates from laboratories worldwide. CDC antigenically characterized 391 viruses collected during May 18–September 20 from the United States and worldwide, including 70 pH1N1 viruses, 141 influenza A (H3N2) viruses, and 180 influenza B viruses. All 70 (100%) pH1N1 viruses (64 international and six U.S.) were antigenically similar to the A/California/7/2009, the influenza A (H1N1) vaccine component. Of the 141 influenza A (H3N2) viruses characterized (78 international and 63 U.S.), 69 (49%) were antigenically similar to A/Texas/50/2012, the influenza A (H3N2) component of the 2014–15 influenza vaccine for the Northern Hemisphere.

Of the 180 influenza B viruses collected and analyzed during this period (69 international and 111 U.S.), 140 (78%) belonged to the B/Yamagata lineage, and all were antigenically similar to the B/Massachusetts/2/2012 virus, the influenza B component for the 2014–15 Northern Hemisphere trivalent vaccine. The remaining 40 viruses (22%) belonged to the B/Victoria lineage and were antigenically similar to the B/Brisbane/60/2008 virus, the B/Victoria lineage component of the 2014–15 Northern Hemisphere quadrivalent influenza vaccine.

The WHO recommendations for influenza vaccine composition for the 2015 Southern Hemisphere season were made at the WHO Consultation meeting September 22–25, 2014, in Geneva, Switzerland. The recommended components for the 2015 Southern Hemisphere influenza trivalent vaccines are an A/California/7/2009 (H1N1)-like virus, an A/Switzerland/9715293/2013 (H3N2)-like virus, and a B/Phuket/3073/2013-like (B/Yamagata lineage) virus (*5*). For quadrivalent vaccines, an additional component, B/Brisbane/60/2008-like (B/Victoria lineage) virus, is recommended (*5*). This represents a change in the influenza A (H3N2) and influenza B/Yamagata lineage components from the 2014 Southern Hemisphere and 2014–15 Northern Hemisphere influenza vaccine formulation.

Antiviral Resistance Profiles of Influenza Virus Isolates

The WHO Collaborating Center for Surveillance, Epidemiology, and Control of Influenza at CDC tested isolates collected during May 18–September 20 for resistance to influenza antiviral medications. Of the 325 specimens tested for resistance to the neuraminidase inhibitor medications oseltamivir and zanamivir, 111 were collected internationally (16 pH1N1, 61 influenza A [H3N2], and 34 influenza B viruses), and 214 were U.S. specimens (six pH1N1, 99 influenza A [H3N2], and 109 influenza B viruses). None of the tested viruses were found to be resistant to either oseltamivir or zanamivir.

Discussion

During May 18–September 20, 2014, pH1N1, influenza A (H3N2), and influenza B viruses cocirculated worldwide. It is not possible to predict which influenza virus will predominate or how severe influenza-related disease activity will be during 2014–15 influenza season.

Annual influenza vaccination is the best method for preventing influenza and its potentially severe complications (*4*). In the United States, an influenza vaccine is recommended for all persons aged ≥6 months without contraindications and can reduce the likelihood of becoming ill with influenza and transmitting the virus to others. Annual influenza vaccination is recommended for optimal protection regardless of whether the vaccine composition has changed since the previous season because immunity wanes over time. For the 2014–15 influenza season, manufacturers have projected a vaccine supply for the U.S. market ranging between 151 million and 159 million doses of vaccine. Although it is difficult to predict the type and subtype of influenza viruses that might circulate during the 2014–15 season, many of the recently examined influenza A (H3N2) viruses show reduced reactivity with sera produced against the A/Texas/50/2012 (H3N2) vaccine virus (the H3N2 component of the 2014–15 influenza vaccine). Vaccination, which includes three or four different influenza viruses depending on the vaccine formulation, is the first line of defense against influenza. Even during seasons when the match between the vaccine viruses and circulating viruses is less than optimal and protection against illness might be reduced, vaccination can offer substantial benefit and might reduce the likelihood of severe outcomes such as hospitalization and death.

Multiple influenza vaccines are approved for use and are being distributed during the 2014–15 season, including a quadrivalent live attenuated influenza vaccine (LAIV4), trivalent and quadrivalent inactivated influenza vaccines (IIV3 and IIV4, respectively), a trivalent cell culture–based inactivated influenza vaccine (ccIIV3), a high-dose trivalent inactivated influenza vaccine (hd IIV3), an intradermally administered IIV3, and a recombinant trivalent influenza vaccine (RIV3). Although both LAIV and inactivated influenza vaccine have been demonstrated to be effective in children and adults, LAIV is approved for use only in persons aged 2 through

49 years with no contraindications or precautions[¶¶] (*4*). In 2014, the Advisory Committee on Immunization Practices recommended the preferential use of LAIV for healthy children aged 2 through 8 years, when it is immediately available, and when the child has no contraindications or precautions (*4*). However, if LAIV is not immediately available, inactivated influenza vaccine should be used and vaccination should not be delayed to procure LAIV (*4*). Children aged 6 months through 8 years who are being vaccinated for the first time require 2 doses of influenza vaccine, administered ≥4 weeks apart (*6*). For children aged 6 months through 8 years who have received influenza vaccination during a previous season, health care providers should consult Advisory Committee on Immunization Practices guidelines to assess whether 1 or 2 doses are required (*4*).

Although vaccination is the best method for preventing and reducing the impact of influenza, antiviral medications are a valuable adjunct. Treatment with influenza antiviral medications is recommended as early as possible for patients with confirmed or suspected influenza (either seasonal influenza or variant influenza virus infection) who have severe, complicated, or progressive illness; who require hospitalization; or who are at high risk for influenza-related complications[***] (*7*). Antiviral treatment should not be withheld from patients with suspected influenza infection, even if rapid influenza diagnostic test results are negative.

Influenza surveillance reports for the United States are posted online weekly and are available at http://www.cdc.gov/flu/weekly. Additional information regarding influenza viruses, influenza surveillance, influenza vaccines, influenza antiviral medications, and novel influenza A virus infections in humans is available at http://www.cdc.gov/flu.

[¶¶] LAIV should not be used in the following populations: persons aged <2 years or >49 years; those with contraindications listed in the package insert (children aged 2 through 17 years who are receiving aspirin or aspirin-containing products and persons who have experienced severe allergic reactions to the vaccine or any of its components, or to a previous dose of any influenza vaccine); pregnant women; immunosuppressed persons; persons with a history of egg allergy; children aged 2 through 4 years who have asthma or who have had a wheezing episode noted in the medical record within the past 12 months, or for whom parents report that a health care provider stated that the child had wheezing or asthma within the last 12 months; persons who have taken influenza antiviral medications within the previous 48 hours; and persons who care for severely immunosuppressed persons who require a protective environment. Such persons should not receive LAIV, or should avoid contact with immunosuppressed persons for 7 days after receipt, given the theoretical risk for transmission of the live attenuated vaccine virus.

[***] Persons at higher risk include 1) children aged <5 years (especially those aged <2 years); 2) adults aged ≥65 years; 3) persons with chronic pulmonary (including asthma), cardiovascular (except hypertension alone), renal, hepatic, hematologic (including sickle cell disease), metabolic disorders (including diabetes mellitus), or neurologic and neurodevelopment conditions (including disorders of the brain, spinal cord, peripheral nerve, and muscle, such as cerebral palsy, epilepsy [seizure disorders], stroke, intellectual disability [mental retardation], moderate to severe developmental delay, muscular dystrophy, or spinal cord injury); 4) persons with immunosuppression, including that caused by medications or by human immunodeficiency virus infection; 5) women who are pregnant or postpartum (within 2 weeks after delivery); 6) persons aged ≤18 years who are receiving long-term aspirin therapy; 7) American Indians/Alaska Natives; 8) persons who are morbidly obese (i.e., with a body mass index ≥40); and 9) residents of nursing homes and other chronic-care facilities.

Acknowledgments

State, county, city, and territorial health departments and public health laboratories. U.S. World Health Organization collaborating laboratories. National Respiratory and Enteric Virus Surveillance System laboratories. U.S. Outpatient Influenza-Like Illness Surveillance Network sites. 122 Cities Mortality Reporting System.

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Morbidity and Mortality Weekly Report

Ebola Virus Disease Outbreak — West Africa, September 2014

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On September 30, 2014, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

CDC is assisting ministries of health and working with other organizations to control and end the ongoing outbreak of Ebola virus disease (Ebola) in West Africa (*1*). The updated data in this report were compiled from ministry of health situation reports and World Health Organization (WHO) sources. Total case counts include all suspected, probable, and confirmed cases as defined by each country (*2*). These data reflect reported cases, which make up an unknown proportion of all actual cases. The data also reflect reporting delays that might vary from country to country.

According to the latest WHO update (*2*), a total of 6,574 Ebola cases had been reported as of September 23 from five West Africa countries (Guinea, Liberia, Nigeria, Senegal, and Sierra Leone) (Figure 1). The highest reported case counts were from Liberia (3,458 cases), Sierra Leone (2,021), and Guinea (1,074).

Geographic distribution of the number of Ebola cases reported during August 31–September 23 indicates that recent case counts continue to be high in the areas where Liberia, Sierra Leone, and Guinea meet (Figure 2).

Geographic distribution of the cumulative incidence of Ebola, as of September 23, indicates that the highest cumulative incidence (>100 cases per 100,000 population) was found in five districts in Guinea (Boffa, Dubreka, Gueckedou, Macenta, and Telimele), two districts in Liberia (Loffa and Margibi), and two districts in Sierra Leone (Kailahun and Kenema) (Figure 3).

The latest updates on the 2014 Ebola outbreak in West Africa, including case counts, are available at http://www.cdc.gov/vhf/ebola/outbreaks/guinea/index.html. The most up-to-date clinical guidelines on the 2014 Ebola outbreak in West Africa are available at http://www.cdc.gov/vhf/ebola/hcp/index.html.

Acknowledgments

Lagos and Rivers state governments, Nigeria. Nigeria Center for Disease Control. World Health Organization. CDC response teams in country. Geospatial Research, Analysis, and Services Program, CDC. Situational Awareness Team, Office of Public Health Preparedness and Response, CDC.

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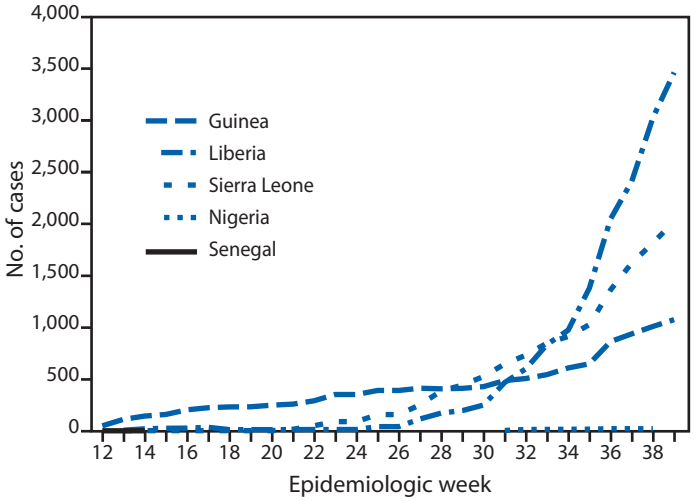
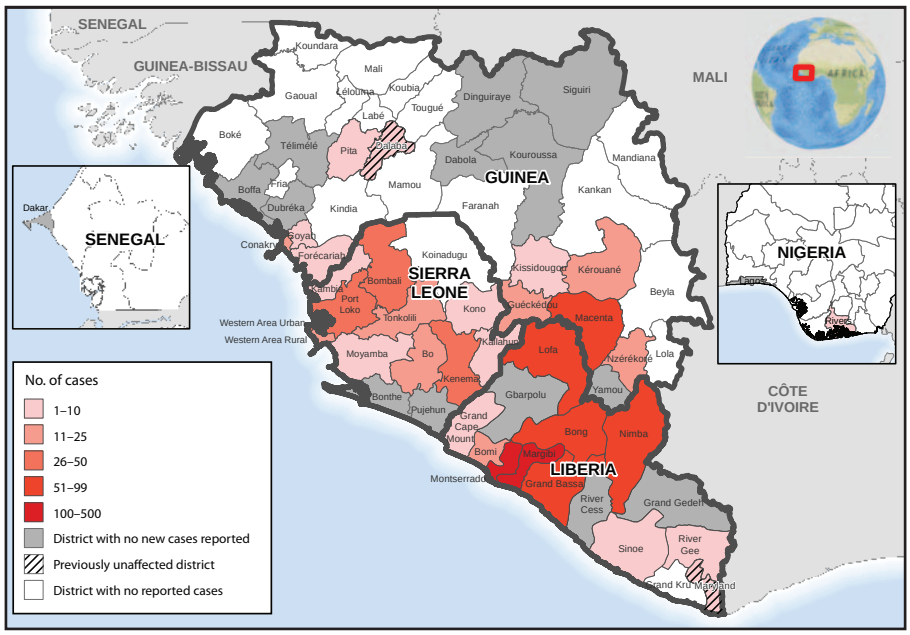
FIGURE 1. Cumulative number of Ebola virus disease cases reported — five countries, West Africa, March 29–September 20, 2014



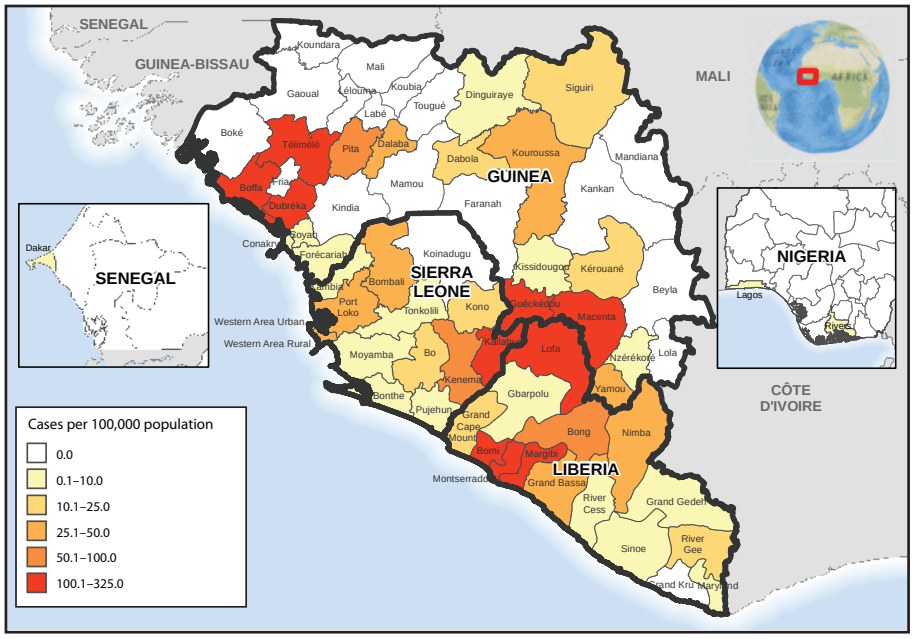
Sources: Situation reports received from the ministries of health of Guinea, Liberia, Nigeria, Senegal, and Sierra Leone, and the World Health Organization.

FIGURE 2. Number of new cases of Ebola virus disease reported — West Africa, August 31–September 20, 2014



Sources: Situation reports received from the ministries of health of Guinea, Liberia, Nigeria, Senegal, and Sierra Leone, and the World Health Organization.

FIGURE 3. Ebola virus disease cumulative incidence* — West Africa, September 20, 2014



* Cumulative number of reported Ebola virus disease cases per 100,000 persons since December 22, 2013.

Ebola Virus Disease Outbreak — Nigeria, July–September 2014

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On September 30, 2014, this report was posted as an MMWR *Early Release on the* MMWR *website (http://www.cdc.gov/mmwr).*

On July 20, 2014, an acutely ill traveler from Liberia arrived at the international airport in Lagos, Nigeria, and was confirmed to have Ebola virus disease (Ebola) after being admitted to a private hospital. This index patient potentially exposed 72 persons at the airport and the hospital. The Federal Ministry of Health, with guidance from the Nigeria Centre for Disease Control (NCDC), declared an Ebola emergency. Lagos, (pop. 21 million) is a regional hub for economic, industrial, and travel activities (*1*) and a setting where communicable diseases can be easily spread and transmission sustained. Therefore, implementing a rapid response using all available public health assets was the highest priority. On July 23, the Federal Ministry of Health, with the Lagos State government and international partners, activated an Ebola Incident Management Center as a precursor to the current Emergency Operations Center (EOC) to rapidly respond to this outbreak. The index patient died on July 25; as of September 24, there were 19 laboratory-confirmed Ebola cases and one probable case in two states, with 894 contacts identified and followed during the response. Eleven patients with laboratory-confirmed Ebola had been discharged, an additional patient was diagnosed at convalescent stage, and eight patients had died (seven with confirmed Ebola; one probable). The isolation wards were empty, and 891 (all but three) contacts had exited follow-up, with the remainder due to exit on October 2. No new cases had occurred since August 31, suggesting that the Ebola outbreak in Nigeria might be contained. The EOC, established quickly and using an Incident Management System (IMS) to coordinate the response and consolidate decision making, is largely credited with helping contain the Nigeria outbreak early. National public health emergency preparedness agencies in the region, including those involved in Ebola responses, should consider including the development of an EOC to improve the ability to rapidly respond to urgent public health threats.

The Ebola Outbreak

The first known case of Ebola in Nigeria was in a traveler exposed in Liberia. On July 17, 2014, while under observation in a Monrovia, Liberia, hospital for possible Ebola, the patient developed a fever and, while symptomatic, left the hospital against medical advice. Despite advice against travel, on July 20 he flew by commercial airline from Monrovia via Accra, Ghana, to Lomé, Togo, then changed aircraft, and flew to Lagos. On arrival the afternoon of July 20, he was acutely ill and immediately transported to a private hospital where he was noted to have fever, vomiting, and diarrhea. During hospital admission, the patient was queried about Ebola and said he had no known exposure; he was initially treated for presumed malaria. Based on the patient's failure to respond to malaria treatment and his travel from an Ebola-affected country in the region (*2*), treating physicians suspected Ebola. The patient was isolated and tested for Ebola virus infection while local public health authorities were alerted about a suspected case of Ebola. A blood specimen sent to Lagos University Teaching Hospital was confirmed positive for acute Ebola virus infection. The patient died on July 25.

Port Health Services conducted early contact tracing at the airport and worked with airlines and partners to ensure notification of the outbreak through International Health Regulations (IHR 2005) mechanisms (*3*). The EOC case-management team took over management of each laboratory-confirmed or suspected case, triaged potential patients, and decontaminated areas inhabited by them. Patients with suspected infection were isolated in the suspected case ward at the Ebola treatment facilities, initially in Lagos and subsequently in Port Harcourt. A contact tracing team staffed and supervised by skilled, dedicated epidemiologists was established to investigate all primary contacts and alert the case management team of symptomatic contacts for assessment and possible reclassification.*A suspected case† was reclassified as a confirmed case if reverse transcription–polymerase chain reaction (RT-PCR) detected Ebola virus in a blood specimen, and was ruled out if RT-PCR testing of two blood specimens collected at least 48 hours

*An Ebola contact was defined as a person who had a known exposure to a confirmed, probable, or suspected case. Contacts were actively monitored for 21 days after the date of last exposure. The contacts were further classified by their exposure to the case as Type 1 (contact with body fluids such as blood, vomit, saliva, urine, or feces of a confirmed patient); Type 2 (direct physical contact with the body of a confirmed patient or decedent); Type 3 (contact with linens, clothes, or dishes/eating utensils); and Type 4 (a history of sleeping, eating, or spending time in the same household or room as a patient). Contacts were reclassified as suspected cases if they reported fever (or were observed to have temperature ≥99.5°F (37.5°C) axillary or ≥100.4°F (38.0°C) core and met one of the following criteria: 1) had vomiting, diarrhea, or bleeding from stool or mucous membranes; or 2) had two additional symptoms including headache, myalgia, arthralgia, or weakness.

apart was negative. Additionally, testing for anti-Ebola virus immunoglobulin G, indicating an immune response to Ebola virus, was added to the testing protocol for PCR-negative suspected cases in persons with some symptoms who were epidemiologically linked to subsequent confirmed cases. When a contact became ill with a suspected case, the contact tracing team gathered data on persons exposed to that contact from the date of symptom onset in the event the suspected case should become laboratory confirmed. Having the capacity to conduct Ebola laboratory diagnosis in-country at the Lagos University Teaching Hospital facilitated rapid identification of confirmed cases and quick discharge of persons with suspected Ebola who tested Ebola negative.

As of September 24, 19 laboratory-confirmed Ebola cases and one probable case had been identified (Figure 1). A total of 894 contacts were identified, and approximately 18,500 face-to-face visits were conducted by contact tracers to assess Ebola symptom development. Persons with suspected Ebola were transported to a suspected case isolation ward by the case management team, and persons who subsequently tested Ebola positive were moved to the confirmed case ward at the same facility in either Lagos or Port Harcourt. Eleven patients had been discharged, one additional patient had a confirmed diagnosis in the convalescent stage, and eight had died (seven confirmed; one probable) for an overall case fatality ratio of 40%. The isolation and treatment wards were empty, and 891 (all but three) contacts had successfully exited follow up. The remaining three contacts became ill but tested Ebola negative and were released from the isolation ward in Lagos. As is standard practice, upon release, the patients who had been suspected cases started a new 21-day follow-up as contacts because of the possibility that they were exposed in the ward. In this instance, no one was diagnosed with Ebola while these three contacts were in the ward, thus the likelihood of Ebola exposure was very low, and all three are due to exit follow-up on October 2.

Investigation of the index patient and all exposed contacts required coordination between multiple IMS response teams and across several cities in the course of the response. The three-generation spread of Ebola (all 19 confirmed and probable cases) to date can be traced to the index case through contact networks (Figure 1). Twelve of the 20 patients were exposed in two health facilities in Lagos. Four of the cases have been associated with a suspected case in a patient who traveled while ill via commercial aircraft from Lagos to Port Harcourt, Rivers State, and back (Figure 1). After the patient who traveled was discovered, manifests were collected from both flights, and attempts were made to contact passengers to ensure they had not become ill because >21 days had passed since the travel occurred. No ill or deceased passengers were identified. Overall, no new cases have occurred since August 18 in Lagos and August 31 in Port Harcourt, suggesting that the Ebola outbreak in Nigeria might have been contained (Figure 1).

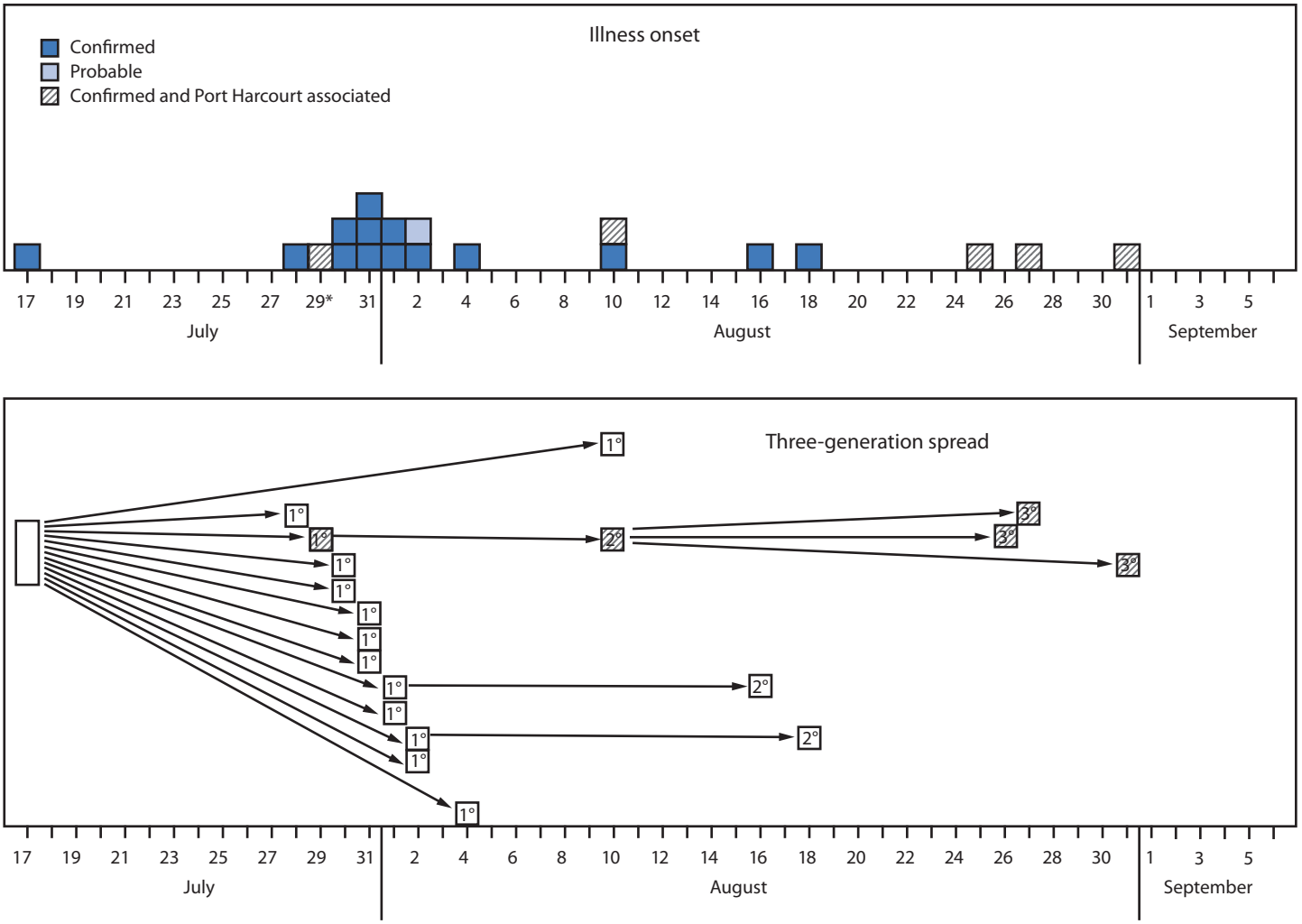
Public Health Response

The threat to Nigeria posed by the arrival in Lagos of a patient acutely ill with Ebola was potentially enormous. Lagos is Africa's largest city and is also a transit hub for the region with air, land, and sea ports of entry (*1*). The dense population and overburdened infrastructure create an environment where diseases can be easily transmitted and transmission sustained. Suboptimal infection control practices in health centers lacking necessary equipment and supplies increase the risk for Ebola transmission to health care workers. Contact tracing efforts are burdened by the complex nature of transit, commercial, and public health notification and reporting mechanisms. The implementation of a rapid response that made use of the available public health assets was the highest priority at the onset of the outbreak, as was organizing the response using proven structures for the delivery of public health in Nigeria. To effectively address Ebola in this complex environment, the response was mounted quickly and used an IMS; both actions are largely credited with helping contain the outbreak early.

Initially, NCDC and the Lagos State Ministry of Health established an Incident Management Center, which served as the overall implementing arm of the national response. The initial Incident Management Center was subsequently recast as the national EOC, in line with IMS nomenclature and national structures aimed at emergency response. The EOC expanded

† The case definition for a suspected case of Ebola in this outbreak was adapted from the World Health Organization recommended case definition (9). An illness in a patient who met all three of the following was a suspected case: a) Fever: The patient either reported having a fever, or if measured, had a temperature of ≥99.5ºF (37.5ºC) axillary or ≥100.4º (38.0ºC) core; b) Exposure: The patient visited an affected area in the preceding 3 weeks or had contact with an ill person who visited an Ebola-affected area within 3 weeks of becoming ill; c) Presence of additional symptoms: The patient had any two of the following: bleeding (at mucous membranes or in stool), vomiting, diarrhea, headache, myalgia, arthralgia, or weakness. In addition, an illness was a suspected case if the patient met these two criteria: a) Fever: The patient either reported having a fever, or if measured, had a temperature of ≥99.5ºF (37.5ºC) axillary or ≥100.4º (38.0ºC) core; b) Higher level exposure: Close contact with a confirmed Ebola case or with a person who died, if the person died from a febrile or unexplained illness and had visited an affected area within 3 weeks of becoming ill, or participation in a funeral within 3 weeks of having a fever in which 1) the funeral was conducted in an affected area, or 2) the deceased person had visited an affected area within 3 weeks of becoming ill (9). Suspected cases were confirmed to be Ebola by laboratory testing using RT-PCR to test blood for the presence of Ebola virus. In situations in which the suspected case was identified during a convalescent period, post-disease immunoglobulin G testing was conducted to assess an immune response to Ebola and/or semen samples were tested using RT-PCR for the presence of Ebola virus. Suspected cases were ruled out as confirmed if two consecutive negative RT-PCR tests spaced ≥48 hours apart were negative.

FIGURE 1. Number of cases of confirmed (n = 19) and probable (n = 1) Ebola virus disease, by date of illness onset and three-generation spread — Nigeria, July–August 2014

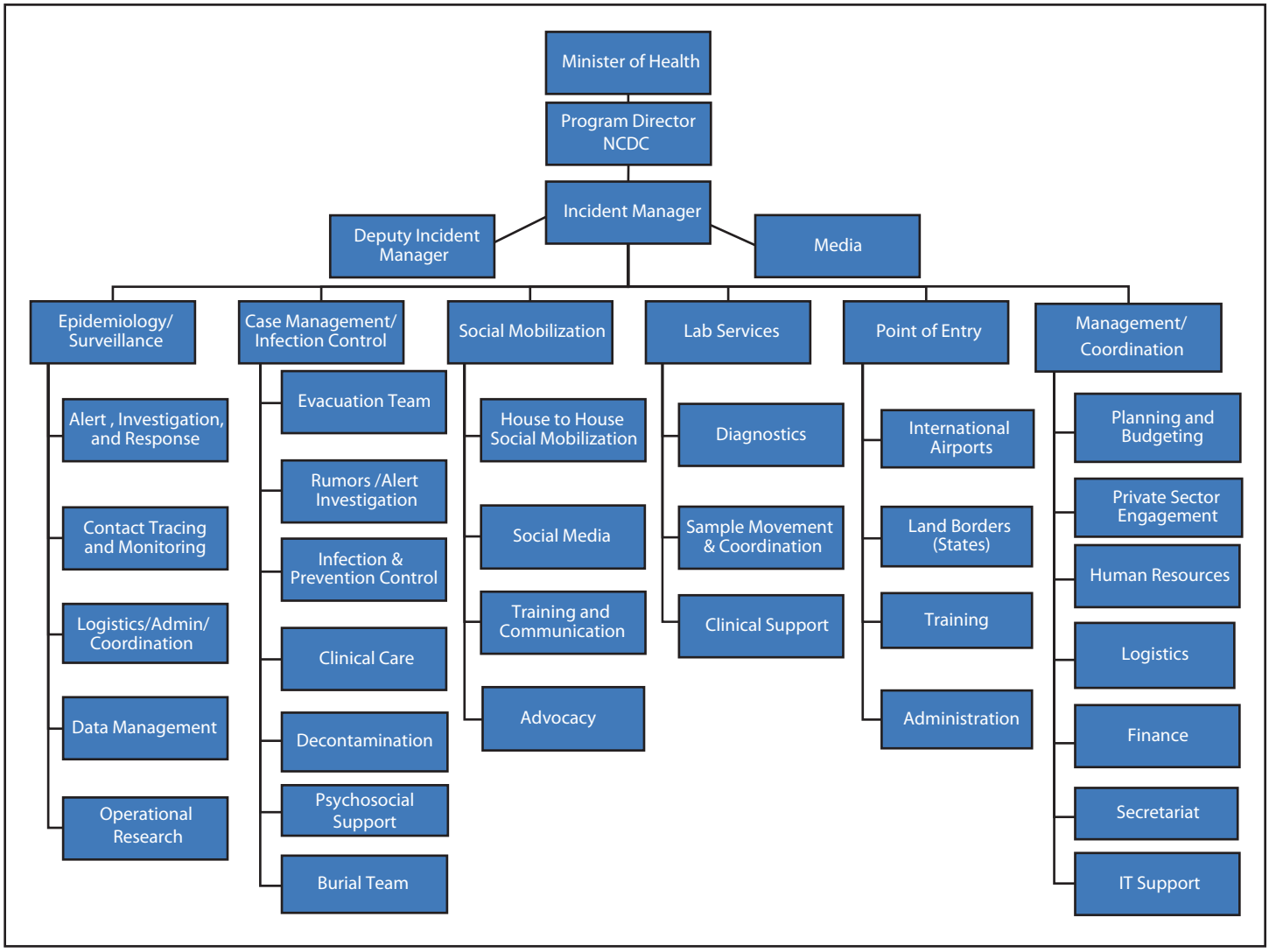


* The patient with July 29 illness onset was exposed in Lagos, traveled to Port Harcourt for treatment and initiated the Port Harcourt case cluster.

its operations to Rivers State when cases emerged there, and oversaw the monitoring of contacts in Enugu State with state health officials as part of the early outbreak response. There was a stated expectation that all partner organizations, donors, and response teams would work through the EOC structure, reporting to an Incident Manager (IM). In turn, the IM would be responsible to deliver accountable and transparent results to the NCDC and the federal Ministry of Health (Figure 2). The IM, responsible for oversight of the response, was selected based on IMS experience and competency rather than rank in government or public service.

Nigeria's response benefited from the rapid use of its national public institution (i.e., NCDC), previous outbreak responses such as a major lead poisoning response in 2010, and its recent experience with polio eradication. In October 2012, responding to the declaration by the World Health Organization of polio eradication as a global public health emergency, and to improve its national response, the Government of Nigeria used the IMS to establish a national EOC as part of a new national emergency plan for the global polio eradication initiative (*3*). The use of IMS through the EOC changed the operational tempo, accountability measures, and programmatic success of the polio program. Indicators and dashboards (electronic displays of high level indicators for each response team monitored at the EOC) were developed to increase accountability of the program staff and spending. Through the EOC and the Nigeria Field Epidemiology and Laboratory Training Program (NFELTP) polio activities, state health system strengthening and preparedness was prioritized (*4–6*).

FIGURE 2. Organizational structure of the Ebola Response Incident Management Center — Nigeria, July–September 2014



With the emerging Ebola outbreak, the Nigerian government moved quickly to enforce coordination of the national and state Ebola response efforts using the IMS/EOC structures and drew from its successful experiences. Specifically, the Ebola EOC IM was the polio EOC Deputy IM, and seeded the Ebola EOC with several secretariat and technical staff members from the National Polio EOC. Critical to demonstrating both national and state commitment, the Deputy IM was a senior member of the Lagos State Ministry of Health (Ebola was imported to Lagos State), with access to human and financial resources within the state health system. Immediately, the EOC developed a functional staff rhythm that facilitated information sharing, team accountability, and resource mobilization while attempting to minimize the distraction of teams from their highest priorities. An "Action Tracker" was developed that included specific tasks arising from each meeting, the person responsible, and the due date.

The overall design of the response rested within a senior strategy team made up of the IM, Deputy IM, and primary partner agencies (Doctors Without Borders, the United Nations Children's Fund, the World Health Organization, and CDC). Six response teams were developed within the EOC specific to an Ebola response, including: 1) Epidemiology/ Surveillance, 2) Case Management/Infection Control, 3) Social Mobilization, 4) Laboratory Services, 5) Point of Entry, and 6) Management/Coordination (Figure 2). Terms of reference and priority activities were developed by the strategy team to guide each operational team's work; operational teams developed their own staffing, lists of material and financial needs, and a goal-oriented operational plan. The strategy group reviewed and approved all of the teams' work and needed

What is already known on this topic?

The ongoing Ebola virus disease (Ebola) outbreak in West Africa has had an enormous negative impact on civil and public health systems in Liberia, Sierra Leone, and Guinea. Nigeria's public health system includes a national public health institute (NCDC) and an Emergency Operations Center (EOC) and Incident Management System (IMS), created in 2012 when Nigeria declared polio a public health emergency and restructured its national polio program.

What is added by this report?

Applying lessons from its NCDC and successful polio EOC, Nigeria quickly established a National Ebola EOC after importation of the disease on July 20, 2014. The early use of the EOC/IMS system enabled the country to streamline a coordinated and effective response in Lagos, (pop. 21 million) and to expand that response to Port Harcourt, another large city. As of September 24, a total of 894 contacts in three states had been monitored, and 20 confirmed or probable Ebola cases identified, of whom eight died. No new cases had occurred since August 31, suggesting that the Ebola outbreak in Nigeria might have been contained.

What are the implications for public health practice?

African nations need to rapidly assess their readiness to manage the importation of Ebola. Preparedness activities could include planning EOC/IMS structures that can guide a coordinated and effective response to Ebola or any other public health threat. Where EOC already exists for other diseases like polio, such structures should be strengthened and used to mount effective responses to new threats like Ebola.

resources. Technical partners assigned staff throughout the operational teams in technical advisory roles aimed at building the capacity of the local teams and ensuring quality work.

As an example of work planning efforts, the EOC Point of Entry team, led and staffed heavily from the Port Health Service, was responsible for identifying, listing, documenting, and risk-ranking of all the contacts of the index patient at the airport, including those on aircraft and those exposed during airport transit/handling of the index patient. Early in the response, this team mobilized to identify and track the index patient's contacts in the airport and outside Nigeria. Port Health Service worked with airline and airport authorities and other stakeholders to gather information about contact passengers, decontaminate affected areas of the airport, and send a notice through the World Health Organization-International Health Regulations system to avoid possible spread of the disease. The Point of Entry team also established entry and exit screening at ports, which is being rolled out at additional ports and will continue for the duration of the regional outbreak to minimize the likelihood of either further importation or exportation of Ebola.

The Epidemiology/Surveillance team was responsible for contact tracing, operational research, management of alerts and rumors, and implementing community-based surveillance. For successful contact tracing, the Epidemiology/Surveillance management team included over a dozen trained, dedicated NFELTP, WHO, and CDC epidemiologists and was provided the target of listing all contacts of the index and subsequent Ebola cases in the response, and monitoring them in person daily to measure body temperature and check for the presence of other Ebola signs and symptoms (e.g., vomiting, diarrhea, and hemorrhage). In response, the team developed a staffing plan for Lagos that included over 150 contact tracers, vehicles, telephones, and mobile data platforms that the contact tracers could use to administer their questionnaires and report contact responses. In addition, the operational research arm of the Epidemiology/Surveillance team conducted a community Ebola assessment that informed training and communication efforts.

Directly linked to the contact tracing was the Social Mobilization strategy. This included teams of three social mobilizers who were trained and deployed to conduct house-to-house, in-person visits within specific radii of the homes of the Ebola contacts. For high-density areas, house-to-house teams covered a 500m radius, 1km in medium density areas and 2km for low density (*7*). As of September 24, approximately 26,000 households of persons living around Ebola contacts had been reached with house-to-house visits in Lagos and Rivers states.

Several issues were observed by the response team during Nigeria's Ebola outbreak that could, in retrospect, have been mitigated through additional preparedness planning for public health emergencies. First, financial resources were slow to arrive at the EOC, a delay that threatened to impede the rapid expansion of containment activities across the response. Early activities were funded by the Lagos State government, international partners, and nongovernmental organizations. National preparedness efforts should consider how resources can be quickly accessible to fund the early stage of the response. Second, there were discrepancies among the levels of political leadership in fully appreciating the enormous consequences that even a small Ebola outbreak could have on civil institutions such as hospitals, airports, and public gatherings. Targeted education about the urgent need to fund, staff, and supply a response effort was provided to political leadership and should be considered for preparedness efforts elsewhere. Similarly, the Nigerian public did not have specific information about Ebola, and early information provided by the press, in advance of official information from the health authorities, was sometimes inaccurate and created a nationwide scare. This scare resulted in some persons resorting to extreme and sometimes harmful and ineffective measures to avoid infection such as consuming large quantities of salt water, even in places distant from the outbreak.

Both issues could have been addressed through preparedness activities that focused on education and planning, as well as explaining Ebola to the public and describing how to respond should Ebola arrive in Nigeria. The Case Management team indicated that early efforts to establish an isolation ward were delayed due to a lack of Nigerian health care workers willing to care for patients with Ebola because of a lack of information and training about how to care for Ebola patients, and because care providers had been disproportionately impacted by Ebola in other affected countries. Preparedness activities should include orientation and training of physicians, nurses, and attendants to safely provide services with attention to infection control procedures and quality Ebola treatment at an appropriately designed facility. Another challenge was ensuring appropriate coordination of private sector engagement. The EOC system facilitated improved coordination through the designation of the Management and Coordination Team Lead as the private sector point of contact. Finally, some partners and parts of government were unfamiliar with the EOC/IMS system and its use as a means of streamlining coordination and response elements into one unified approach. The government-led EOC process could define opportunities for partners to place staff strategically in the national and local response efforts and could encourage this through the EOC response teams and management system. Further, EOC mechanisms should be tested through strategic exercises and use in non-Ebola responses.

Even with these identified challenges, Nigeria's decision to use EOC/IMS to respond to Ebola resulted in a rapid, effective, and coordinated outbreak response. As of September 24, the Nigeria response had successfully limited the outbreak to 20 laboratory confirmed and probable cases (in two states) with the last cases occurring on August 18 and August 31 in Lagos and Port Harcourt, respectively. This limited spread and the rapid scale-up against the backdrop of the large, dense, urban environments of Lagos and Port Harcourt suggest early response efforts were successful; this is likely directly attributable to the Nigerian government's strategic use of its public health institutions and the EOC/IMS structure to manage the response. The EOC/IMS approach should be a central part of national and subnational preparedness efforts for public health threats. EOC/IMS is a key component of the global health security agenda, along with Integrated Disease Surveillance and Response/International Health Regulations (IHR 2005).

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Importation and Containment of Ebola Virus Disease — Senegal, August–September 2014

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On August 29, 2014, Senegal confirmed its first case of Ebola virus disease (Ebola) in a Guinean man, aged 21 years, who had traveled from Guinea to Dakar, Senegal, in mid-August to visit family. Senegalese medical and public health personnel were alerted about this patient after public health staff in Guinea contacted his family in Senegal on August 27. The patient had been admitted to a referral hospital in Senegal on August 26. He was promptly isolated, and a blood sample was sent for laboratory confirmation; Ebola was confirmed by reverse transcriptase–polymerase chain reaction at Institut Pasteur Dakar on August 29. The patient's mother and sister had been admitted to an Ebola treatment unit in Guinea on August 26, where they had named the patient as a contact and reported his recent travel to Senegal. Ebola was likely transmitted to the family from the brother of the patient, who had traveled by land from Sierra Leone to Guinea in early August seeking treatment from a traditional healer. The brother died in Guinea on August 10; family members, including the patient, participated in preparing the body for burial.

Although details about the timing of disease progression obtained by interviewing the patient and the family were inconsistent, the best information suggests that the patient arrived in Senegal by seven-person taxi, on or around August 14 and began experiencing fever, diarrhea, and vomiting on August 16. He initially sought care at a neighborhood health post on or around August 18, where he continued follow-up as an outpatient until August 25. During this time, he received intravenous fluids and other symptomatic treatment. On August 26, he was admitted to the University Hospital Fann, a tertiary care hospital in Dakar. The patient did not disclose a history of travel or contact with any Ebola patients.

Before this occurrence of the first confirmed case of Ebola in Senegal, the Senegal Ministry of Health had been preparing for the possible introduction of an imported case. Training of health care staff had been conducted on Ebola and infection control, laboratory testing, case investigation, and contact tracing, with an oversight committee organized for response. A total of 67 contacts of the patient were initially identified: 34 residents of the home where the patient stayed and 33 health care workers. Because of uncertainty regarding the timeline of the patient's illness, all contacts were subjected to a 21-day monitoring period beginning on August 29. Contacts were requested to submit to in-home voluntary quarantine and be seen twice daily by Red Cross volunteers mobilized as contact monitors. Symptoms and temperatures were recorded twice daily. Food was provided for the household contacts.

On the first day of monitoring, 51% of contacts were seen; this increased to over 90% by day 5. Household member contacts complied with monitoring throughout the quarantine period, but some health care worker contacts resisted monitoring by Red Cross volunteers. Discussion with health care worker contacts suggested that some of them opposed in-person temperature monitoring by Red Cross volunteers. Alternative solutions were sought, and monitoring was reassigned to University Hospital Fann's personnel for resistant health care worker contacts, which resulted in increased compliance. On day 13 of follow-up, an additional seven exposed workers from University Hospital Fann self-identified during training on infection control, and they underwent voluntary restriction of movement and temperature monitoring through the 21st day after exposure. During monitoring, four contacts developed transient symptoms suggestive of Ebola, but Ebola was ruled out by laboratory testing. All 67 contacts completed the 21-day follow-up on September 18 with no further confirmed Ebola cases. The patient recovered and was released from isolation on September 19. Before the confirmation of this case and during the contact follow-up, numerous unrelated suspected cases were identified, tested, and found to be negative.

Prompt notification of health personnel in Senegal about the case by health personnel in Guinea, and early preparations by the Ministry of Health and partners in Senegal for anticipated imported cases of Ebola, resulted in a rapid containment response. Prompt notification through an interagency collaboration in Guinea was crucial in this case because the patient did not report recent travel or contact with an Ebola patient. An incident command structure is being adopted by the Senegal Ministry of Health to prepare for any additional cases, and surveillance systems continue to be strengthened.

The current Ebola epidemic in West Africa is unprecedented. As of September 23, 2014, the World Health Organization reported 6,574 cases with 3,091 deaths (*1*). Currently, the epidemic is primarily affecting Guinea, Liberia, and Sierra Leone; however, active trade and ease of travel in West Africa leave neighboring countries at risk for Ebola importation.

Nigeria reported its first imported case of Ebola in July (*2*), and Senegal was the fifth West African country to be affected.

Ebola is a serious threat to West Africa, especially countries that border the heavily affected areas. Although there are systems in place for health screening at international airports in Ebola-affected countries, land border crossings do not provide the same limited points of departure and entry and associated opportunities for health screening. A framework for rapid Ebola identification and containment is needed urgently in all West African countries, including a strong system for cross-border communication. Difficulties related to coordination and implementation of policies and procedures are likely to occur, necessitating thorough planning and rapid troubleshooting. To prepare for a possible Ebola importation, it is important for bordering countries to have an active Ebola health care surveillance system and establish an incident command structure that is ready to be activated if necessary. It is important for neighboring countries to anticipate imported cases and define success as containment rather than exclusion of imported Ebola cases.

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Erratum

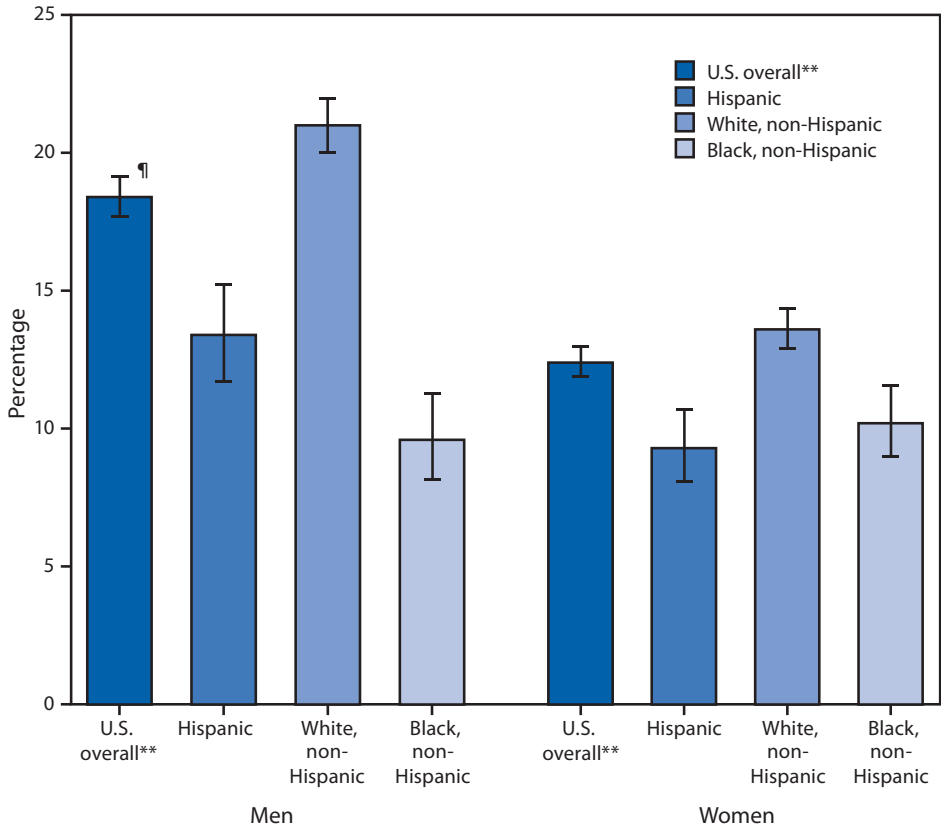
Vol. 61, No. 53

In the *MMWR* report "Summary of Notifiable Diseases — United States, 2012," the Internet link on page 2, second column, line four was incorrect. It should read as follows: **http://wwwn.cdc.gov/nndss/script/history.aspx**.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged ≥18 Years with Trouble Hearing,* by Sex and Race/Ethnicity† — National Health Interview Survey, United States, 2012§



* Based on responses to the following question: "Without the use of hearing aids or other listening devices, is your hearing excellent, good, a little trouble hearing, moderate trouble, a lot of trouble, or are you deaf?" For this figure, "a little trouble hearing," "moderate trouble," "a lot of trouble, " and "deaf" are combined into a single category, "trouble hearing." Unknowns were not included in the denominators when calculating percentages of "trouble hearing."

† Refers to persons who are of Hispanic ethnicity and might be of any race or combination of races. "Non-Hispanic" refers to all persons who are not of Hispanic ethnicity, regardless of race.

§ Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population and are age adjusted to the projected 2000 U.S. population as the standard population using four age groups: 18–44, 45–64, 65–74, and ≥75 years.

¶ 95% confidence interval.

** Includes other races/ethnicities not shown separately.

Overall, in 2012, non-Hispanic white adults were more likely to report having trouble hearing compared with Hispanic adults and non-Hispanic black adults. Men (18%) were more likely to report having trouble hearing than women (12%). Among Hispanic and non-Hispanic white adults, men were more likely to report having trouble hearing; however, this pattern was not observed for non-Hispanic black adults, among whom no statistically significant difference was observed between men and women.

Source: Blackwell DL, Lucas JW, Clarke TC. Summary health statistics for U.S. adults: National Health Interview Survey, 2012. Vital Health Stat 2014;10(260). Available at http://www.cdc.gov/nchs/data/series/sr_10/sr10_260.pdf.

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