Centers for Disease Control and Prevention
MMWR
Morbidity and Mortality Weekly Report
Weekly / Vol. 63 / No. 43
October 31, 2014

# Incidence of Hansen's Disease — United States, 1994–2011

Leisha Nolen, MD, PhD[1], Dana Haberling, MSPH[1], David Scollard, MD, PhD[2], Richard Truman, PhD[2], Alfonso Rodriguez-Lainz, PhD, DVM[3], Laura Blum, MPH[4], David Blaney, MD[1] (Author affiliations at end of text)

Hansen's disease (HD), or leprosy, is caused by the bacterium *Mycobacterium leprae* and is reportable in many states. It is a chronic disease affecting the skin and nerves, commonly presenting as pale or reddish skin patches with diminished sensation. Without treatment, it can progress to a severely debilitating disease with nerve damage, tissue destruction, and functional loss. An important factor in limiting HD morbidity is early diagnosis and prompt initiation of therapy. Because HD is rare, clinicians in the United States are often unfamiliar with it; however, HD continues to cause morbidity in the United States. To better characterize at-risk U.S. populations, HD trends during 1994–2011 were evaluated by reviewing records from the National Hansen's Disease Program (NHDP). When the periods 1994–1996 and 2009–2011 were compared, a decline in the rate for new diagnoses from 0.52 to 0.43 per million was observed. The rate among foreign-born persons decreased from 3.66 to 2.29, whereas the rate among U.S.-born persons was 0.16 in both 1994–1996 and 2009–2011. Delayed diagnosis was more common among foreign-born persons. Clinicians throughout the United States should familiarize themselves with the signs and symptoms of HD and understand that HD can occur in the United States.

Although not highly contagious, HD is thought to be transmitted through nasal secretions (*1*). The normal incubation period ranges from 3 to 7 years (*2*). Initial presentation is often one or more chronic anesthetic macular or maculopapular skin lesions. HD can progress to involve peripheral nerves, resulting in sensory and motor loss, and ultimately to permanent disability (*3*).* Since 1991, the World Health Organization has led a global campaign to eliminate HD as a public health problem, with elimination defined as a worldwide prevalence of <10 cases per 100,000 persons (*4*).

*Additional information available at http://www.cdc.gov/leprosy.

For this report, the NHDP registry of new HD diagnoses during 1994–2011 was examined. The population was divided into U.S.-born and foreign-born persons. Persons born within the United States and its territories were considered U.S.-born, and those born outside of the United States and its territories were considered foreign-born. Cases among persons listed as living outside of the United States and persons missing the date of diagnosis or the place of birth were excluded from the review; cases missing date of symptom onset or date of entry to the United States were excluded from relevant analyses.

The rates of new diagnoses of HD were calculated by country of birth for each year from the period 1994–2011. Poisson regression was used to compare rates between groups with rate ratios and 95% confidence intervals (CIs) and to analyze rate trends over time. All rates were calculated using population estimates obtained from the U.S. Census Bureau's Current Population Survey (*5*). The annual rate of new diagnosis of HD in persons in the United States from specific regions of the world was analyzed for the period 2007–2011 using

## INSIDE



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

**U.S. Department of Health and Human Services**
Centers for Disease Control and Prevention

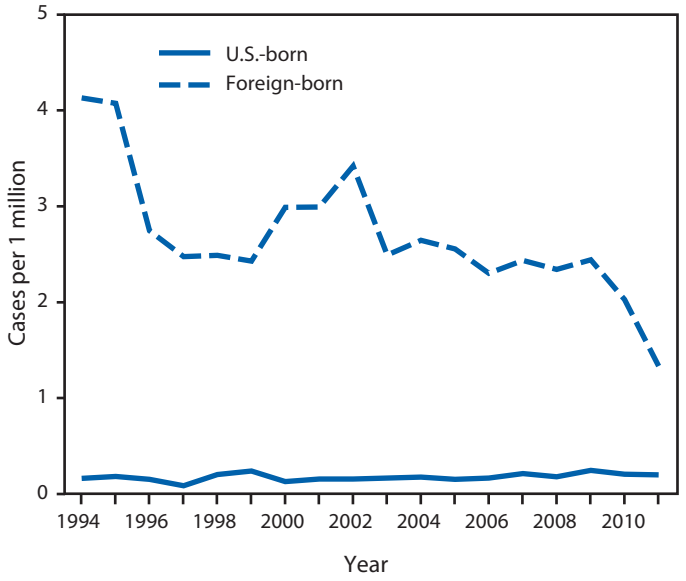
population estimates from the U.S. Census Bureau American Community Survey.

The number of years between onset of symptoms and diagnosis (i.e., the delay), was calculated. The exact reported dates of onset were available, but were found to be significantly biased to January 1 as the onset day and month. This might reflect the ability of patients to identify the year their symptoms started but not the month or day. For this reason, data were analyzed by year alone.

During 1994–2011, there were 2,323 new cases of HD, with an average annual incidence rate of 0.45 cases per 1 million persons (CI = 0.43–0.47). A 17% decrease in the rate of new diagnoses was observed for the U.S. population overall, from 0.52 (CI = 0.47–0.57) during 1994–1996 to 0.43 (CI = 0.39–0.48) during 2009–2011 (Figure 1). During 1994–2011, U.S.-born persons had an average annual rate of 0.13 (CI = 0.12–0.14), but the rate for 1994–1996 was 0.16 (CI = 0.13–0.19) and was the same for 2009–2011 (0.16 [CI = 0.14–0.19]). Foreign-born persons had an average rate of 2.81 (CI = 2.67–2.95) during 1994–2011 but a higher rate (3.66 [CI = 3.23 – 4.15]) for 1994–1996 and a lower rate (2.29 [CI = 2.02–2.58]) for 2009–2011.

The U.S. census began including country of birth in its data in 2007; therefore, the analysis regarding country of birth was limited to 2007–2011. During this 5-year period there were 677 new diagnoses of HD in the United States, of which 461 (68%) included data regarding country of birth (Table). Persons born in Oceania had the highest rate of HD

**FIGURE 1. Rate of new diagnoses of Hansen's disease, by U.S. birth status — United States, 1994–2011**




diagnosis during this period, with an average annual rate of 556.9 cases per 1 million population, more than 10 times the rate observed for any other region. Ninety-seven percent of those diagnosed from Oceania were born in the Federated States of Micronesia or the Marshall Islands, and almost half of these persons (48.9%) were diagnosed in Hawaii.

The number of years from onset of symptoms to HD diagnosis was calculated for 2,124 cases. Most (74%) patients had

The *MMWR* series of publications is published by the Center for Surveillance, Epidemiology, and Laboratory Services, Centers for Disease Control and Prevention (CDC), U.S. Department of Health and Human Services, Atlanta, GA 30329-4027.

**Suggested citation:** [Author names; first three, then et al., if more than six.] [Report title]. MMWR 2014;63:[inclusive page numbers].

**TABLE. Number and rate* of new Hansen's disease diagnoses among foreign-born persons, by region of birth — United States, 2007–2011**

| Region of birth | No. of new diagnoses | Rate | (95% CI) |
|---|---|---|---|
| Europe | 1 | 0.21† | (0.011–1.34) |
| North America | 109 | 5.74 | (4.74–6.96) |
| Asia | 117 | 10.61 | (8.81–12.76) |
| Africa | 22 | 14.47 | (9.30–22.30) |
| South America | 89 | 33.34 | (26.93–41.23) |
| Oceania | 123 | 556.93 | (464.78–666.86) |

**Abbreviation:** CI = confidence interval.
* Rate per 1 million population.
† Rate estimate is limited because there was only one new diagnosis in the European-born population.

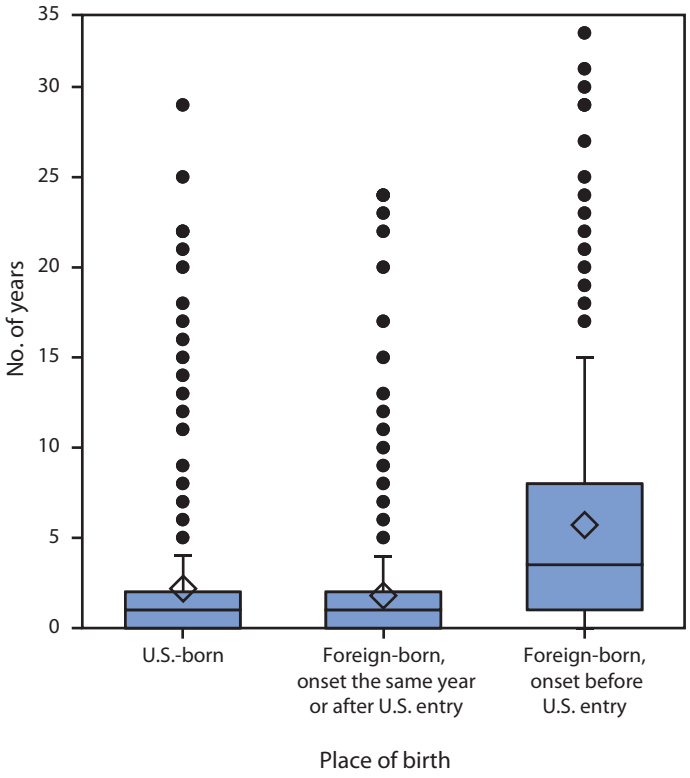
a delay of <3 years between symptom onset and diagnosis; however, some were not diagnosed for many years after the onset of symptoms (Figure 2). The median delay was 1 year, and the mean delay was 2.4 years. Among foreign-born persons, 232 (18%) reported onset of symptoms before their entry into the United States, with a median delay of 2.5 years (mean = 5.7 years). These data differed significantly from the median delay for U.S.-born persons and foreign-born persons who had the onset of symptoms at or after entry, both of whom had a median of 1 year (p<0.001).

## Discussion

HD continues to occur in the United States, both in U.S.-born and foreign-born persons. Many clinicians are not familiar with this disease or its manifestations and treatments, but *M. leprae* is an important pathogen to consider when caring for patients with chronic skin disorders of unknown cause. The rate of diagnosis of HD among foreign-born persons during 2009–2011 was 14 times higher than among U.S.-born persons. From 1994–1996 to 2009–2011, the rate of diagnosis in foreign-born persons decreased by 37%. Although 70% of HD diagnoses occur in persons born outside of the United States, *M. leprae* continues to cause disease in U.S.-born persons, with an average of 56 cases diagnosed in U.S.-born persons in the United States each year during 2009–2011.

Persons born in Oceania were identified as the population with the highest rate of HD within the United States, with a rate of diagnosis >10 times that of any other region, in agreement with previous reports (*6*). This highlights the need for investment in HD-related training, resources, and surveillance in Oceania. Hawaii was identified as the location where most of the patients from Oceania were diagnosed; however, clinicians throughout the United States should be encouraged to consider HD when evaluating chronic skin conditions, especially in patients from this region.

**FIGURE 2. Period from year of symptom onset to Hansen's disease diagnosis, by place of birth — United States, 1994–2011***




* The horizontal line inside each box represents the median, the diamond indicates the mean number of years, and the top and bottom of the box are the first and third quartile. The whiskers are extended to 1.5 and 3.5 quartiles. The dots represent individual outliers. The mean period from symptom onset to diagnosis for foreign-born persons with onset before entering the United States is statistically different from the mean period for foreign-born persons with onset the same year or after entry and the mean period for U.S.-born persons (p<0.001).

HD is one of the diseases for which prospective immigrants to the United States are screened.† However, persons who come to the United States but do not apply for permanent residency or come without authorization do not undergo this screening. In addition, only 18% of foreign-born persons diagnosed with HD in the United States reported having symptoms before their admission into the United States, making it unlikely that many cases will be detected by immigrant screening. Therefore, primary care clinicians need to be aware of HD and its manifestations to adequately monitor recent immigrants.

HD can lead to severe nerve and tissue damage if treatment is delayed for months or years; for this reason it is important to recognize this disease and begin treatment as early as possible. While most patients were diagnosed within 1 year of the

† Additional information available at http://www.cdc.gov/immigrantrefugeehealth/exams/ti/panel/technical-instructions/panel-physicians/hansens-disease.html.

onset of symptoms, many patients had symptoms for many years before diagnosis. Foreign-born persons were at the highest risk for delayed diagnosis.

The findings in this report are subject to at least two limitations. First, data are limited to those patients reported to NHDP.[§] This program not only collects information from outside providers regarding HD diagnoses, but also provides free medications to HD patients within the United States. As a result, it is expected that most patients with HD in the United States are reported to NHDP. Second, data regarding the onset of symptoms are limited by patient recall; many patients report the onset of symptoms many years before contact with NHDP. It is possible that some of the symptoms they attribute to HD might have been caused by other diseases or problems.

To decrease HD in the United States, diagnosis and treatment needs to be improved among persons in the United States who were born in countries where there is a high prevalence of HD and also in those countries themselves. Clinicians throughout the United States should be aware of the signs and symptoms of HD and know that HD exists in the United States. It is important to consider this disease when evaluating chronic skin conditions, especially those with associated loss of sensation. By diagnosing and treating patients early, it is possible to prevent further transmission and lifelong disability.

[§] Additional information available at http://www.hrsa.gov/hansensdisease.

[1]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Diseases, CDC; [2]National Hansen's Disease Programs, Health Resources and Services Administration; [3]Division of Global Migration and Quarantine, CDC; [4]University of California, Berkeley (Corresponding author: Leisha Nolen, lnolen@cdc.gov, 404-718-4671)

### What is already known on this topic?

Hansen's disease (HD), or leprosy, is a reportable disease that can cause significant disability if not diagnosed and treated. During 1994–1996, the annual incidence of newly diagnosed HD in the United States was 0.52 cases per 1 million population. Clinicians in the United States are often unfamiliar with HD, resulting in delayed diagnosis and treatment.

### What is added by this report?

During 2009–2011, the annual incidence of newly diagnosed HD in the United States was 0.43 cases per 1 million population. Foreign-born persons living in the United States had a rate of HD diagnosis 14 times higher than U.S.-born persons, with those born in Oceania having the highest rate of diagnosis. One fourth of HD patients had symptoms for >3 years before they were diagnosed; delayed diagnoses were more common among foreign-born persons. This report helps inform clinicians of the signs and symptoms to be aware of when evaluating at-risk patients for HD.

### What are the implications for public health practice?

HD is an important disease to consider when treating anyone in the United States with a chronic skin condition. Clinicians who routinely treat patients who are foreign-born, especially those from Oceania, should keep HD in mind. Detecting and treating HD in countries where it is most common is one strategy for reducing the incidence of HD in the United States.

## References

1. Scollard DM, Adams LB, Gillis TP, Krahenbuhl JL, Truman RW, Williams DL. The continuing challenges of leprosy. Clin Microbiol Rev 2006;19:338–81.
2. Davey TF, Rees RJ. The nasal dicharge in leprosy: clinical and bacteriological aspects. Lepr Rev 1974;45:121–34.
3. Walker SL, Lockwood DN. The clinical and immunological features of leprosy. Br Med Bull 2006;77–78:103–21.
4. World Health Assembly (WHA) resolution to eliminate leprosy. Geneva, Switzerland: World Health Assembly; 1991. Available at http://www.who.int/lep/strategy/wha/en.
5. US Census Bureau. TheDataWeb: DataFerrett. Current population survey. Available at http://dataferrett.census.gov.
6. Woodall P, Scollard D, Rajan L. Hansen disease among Micronesian and Marshallese persons living in the United States. Emerg Infect Dis 2011; 17:1202–8.

# Progress Toward Poliomyelitis Eradication — Afghanistan and Pakistan, January 2013–August 2014

Noha H. Farag, MD, PhD[1], James Alexander, MD[1], Stephen Hadler, MD[2], Arshad Quddus, MBBS, MSc[3], Elias Durry, MD[1], Mufty Zubair Wadood, MBBS, MMSPH[4], Rudolph H. Tangermann, MD[5], Derek Ehrhardt, MPH[1] (Author affiliations at end of text)

In 2012, the World Health Assembly declared the completion of polio eradication a programmatic emergency for global public health and called for a comprehensive polio endgame strategy (*1*). Afghanistan and Pakistan are two of the three remaining countries (the other is Nigeria) where circulation of indigenous wild poliovirus (WPV) has never been interrupted. This report updates previous reports (*2,3*) and describes polio eradication activities and progress in Afghanistan and Pakistan during January 2013–August 2014. In Afghanistan, 14 WPV cases were reported in 2013, compared with 37 cases in 2012; nine cases were reported during January–August 2014, compared with six cases during the same period in 2013. In Pakistan, 93 WPV cases were reported in 2013, compared with 58 cases in 2012; 170 cases were reported during January–August 2014, compared with 33 cases during the same period in 2013. All WPV cases reported during January 2013–August 2014 were WPV type 1 (WPV1). Vaccination campaigns have been banned since June 2012 in specific areas in Pakistan, where an estimated 300,000 children aged <5 years reside and where 69% of WPV cases have occurred in 2014. To accomplish the objectives of the Polio Eradication and Endgame Strategic Plan for 2013–2018 (*1*) both countries should continue to negotiate access of vaccinators to insecure and temporarily inaccessible areas, improve immunization program performance to reach more children in accessible areas, and ensure that political and health leaders at all levels are fully committed to the program, including being committed to providing financial resources needed to fully implement all the recommendations of external technical advisory groups. Both countries should also continue to strengthen cross-border collaboration to improve surveillance and case detection, coordinate outbreak response, and maximize vaccination coverage of children moving between the two countries.

## Immunization Activities

During 2013, estimated national routine vaccination coverage* of infants with 3 doses of oral poliovirus vaccine (OPV3) was 71% in Afghanistan and 72% in Pakistan (*4*). Routine OPV3 coverage based on parental recall and vaccination cards of children aged 6–23 months with nonpolio acute flaccid paralysis (NPAFP)† was 66% in Afghanistan (30% in the Southern, 80% in the Southeastern, and 75% in the Eastern regions), and 71% in Pakistan (25% in conflict-affected Federally Administered Tribal Areas [FATA], 37% in Balochistan, 64% in Sindh, 68% in Khyber Pakhtunkhwa [KP], and 86% in Punjab provinces).

During January 2013–August 2014, house-to-house supplementary immunization activities (SIAs)§ generally targeted children aged <5 years using different OPV formulations, including bivalent (types 1 and 3), trivalent, and monovalent (type 1) OPV. During this period, 26 SIAs were conducted in Afghanistan, including 7 national immunization days, 6 subnational immunization days, and 13 short-interval additional dose campaigns,¶ and 26 SIAs were conducted in Pakistan, including 7 national immunization days, 9 subnational immunization days, and 10 short-interval additional dose campaigns. In addition, in both Afghanistan and Pakistan, SIAs at transit posts (at border crossings between countries and borders of inaccessible districts to vaccinate children on the move), in camps, and in hosting communities targeted populations displaced by military operations in North Waziristan Agency, Pakistan, where vaccination campaigns have been banned since June 2012. In Pakistan, the number of transit posts increased from 345 in 2013 to 668 in 2014, and SIAs were conducted in Southern KP, Karachi, and Punjab to reach the displaced populations from North Waziristan. Hundreds of thousands of children aged <5 years, as well as many older children and adults, were vaccinated in both countries.

During 2013–2014, insecurity continued to hinder the ability of vaccination teams in Afghanistan and Pakistan to reach children living in temporarily inaccessible areas.** However, in SIAs conducted in 2014 in Afghanistan, the proportion of children estimated to have been missed in accessible areas

* Includes vaccines given through the Expanded Program of Immunization only and not those given through supplemental immunization activities.

† Vaccination histories of children aged 6–23 months with acute flaccid paralysis who do not test WPV-positive are used to estimate OPV coverage of the overall target population and to corroborate national reported routine immunization coverage estimates.

§ Mass campaigns conducted for a brief period (days to weeks) in which 1 dose of OPV is administered to all children aged <5 years, regardless of vaccination history. Campaigns can be conducted nationally or in sections of the country.

¶ Short-interval additional dose campaigns are used for case-response vaccination after WPV cases, or during negotiated periods of nonviolence in otherwise inaccessible areas, to vaccinate children with a monovalent or bivalent OPV dose, which is administered within 1–2 weeks of the previous dose.

** Temporarily inaccessible areas are those where vaccination teams are temporarily unable to operate because of security concerns or bans on vaccination.

(range = 3%–10%) was higher than the proportion missed because of insecurity (range = 0.2%–8.0%). In Pakistan, FATA was the area with the largest proportion of inaccessible children, with 25%–35% of children not accessible during SIAs during 2013–2014. The ability of SIAs to reach and vaccinate the targeted populations is monitored through post-SIA assessments, including lot quality assurance surveys[††] (*5*). Improvements in SIA quality occurred in Afghanistan: lot quality assurance surveys results showed that 70%–77% of districts in 2014 passed at the ≥80% level, compared with 39%–65% of districts in 2013.

During 2013, the proportions of children aged 6–23 months with NPAFP who were "zero dose," (i.e., had never received OPV either through routine immunization or SIAs), were 1.7% and 4.5% in Afghanistan and Pakistan, respectively, with considerable regional variation. In Afghanistan, the proportion of zero-dose children in the Southern Region declined from 14% in 2012 to 5.3% in 2013 but increased in the Eastern Region from 1% in 2012 to 5.9% in 2013; no zero-dose children were among reported NPAFP cases during 2014 to date. In Pakistan, the proportion of zero-dose children in FATA was 18% in 2012, 46% in 2013, and 61% in 2014 to date; the proportion was 1.5% in the rest of the country during 2013 and 2014.

## Poliovirus Surveillance

**Surveillance for acute flaccid paralysis (AFP).** In 2013, the annual national NPAFP rate (per 100,000 population aged <15 years) was 10.0 in Afghanistan (range among eight regions = 5.8–12.8), and 5.9 in Pakistan (range among eight provinces/regions = 1.1–12.7). The percentage of AFP cases for which adequate specimens were collected was 93% in Afghanistan (range = 83%–97%) and 89% in Pakistan (range = 82% –100%) (Table). Despite overall high AFP surveillance performance indicators,[§§] genomic sequencing data indicate surveillance gaps and undetected WPV transmission in both Afghanistan and Pakistan.

[††] Lot quality assurance sampling is a rapid survey method used to assess the quality of vaccination coverage after SIAs in predefined areas, such as a health districts (known as "lots"), using a small sample size. The lot quality assurance sampling method involves dividing the population into "lots" and randomly selecting persons in each lot. If the number of unvaccinated persons in the sample exceeds a preset decision value, then the lot is classified as having an unsatisfactory level of vaccination coverage, and mop-up activities are recommended. If ≥80% of lots meet the cutoff, the area/district is classified as having "passed."

[§§] The quality of AFP surveillance is monitored by performance indicators that include 1) detection rate of NPAFP cases and 2) proportion of AFP cases with adequate stool specimens. World Health Organization (WHO) operational targets for countries with endemic poliovirus transmission are an NPAFP detection rate of at least two cases per 100,000 population aged <15 years and adequate stool specimen collection from >80% of AFP cases, where adequate specimens are two specimens collected ≥24 hours apart, both within 14 days of paralysis onset, and shipped on dry ice or frozen packs to a WHO-accredited laboratory, arriving in good condition (without leakage or desiccation).

### What is already known on this topic?

Afghanistan and Pakistan are two of the three remaining countries (the other is Nigeria) in which indigenous wild poliovirus (WPV) transmission has never been interrupted. Conflict in both countries has made some areas inaccessible for polio eradication activities.

### What is added by this report?

WPV type 1 (WPV1) transmission was highest in the Eastern Region of Afghanistan, bordering conflict-affected areas in Pakistan, including Waziristan. Although genetic sequencing data indicates that cross-border transmission from Pakistan is the biggest problem in Afghanistan, evidence indicates that undetected local transmission is occurring as well. In Pakistan, five times as many cases occurred during January–August 2013 than the same period in 2014. A total of 22 cases of circulating vaccine-derived polio virus type 2 were identified in Pakistan in 2014, signaling substantial immunity gaps. This, in addition to a high proportion of unvaccinated children in both accessible and temporarily inaccessible areas, poses an increasing risk for continued WPV transmission in Pakistan and Afghanistan.

### What are the implications for public health practice?

Ongoing WPV1 transmission in Pakistan and Afghanistan poses a challenge to the achievement of global polio eradication. To achieve the objectives of the Polio Eradication and Endgame Strategic Plan for 2013–2018, both countries need to strengthen surveillance, increase cross border collaborations, use data-driven approaches to reach missed children, and evaluate the effectiveness of such approaches.

**Environmental surveillance.** Environmental surveillance supplements AFP surveillance, with periodic testing of sewage samples for polioviruses. In Afghanistan, sewage sampling for polioviruses began in 2013, and WPV1 was detected for the first time in specimens from Kandahar and Nangarhar provinces in July 2014. In Pakistan, during January 2013–August 2014, a total of 551 sewage samples from 30 sampling sites in all four main provinces were tested for polioviruses. In 2014, a total of 33% (77 of 230) of sewage samples were positive for WPV1, compared with 16% (36 of 227) during the same period in 2013. WPV1 was isolated from sewage samples collected in all major cities during 2014, with the exception of Faisalabad (Punjab Province) and Islamabad. In Gadap Town, Karachi, circulating vaccine-derived poliovirus type 2 (cVDPV2) was isolated from samples collected in March and April 2014.

## WPV and cVDPV Epidemiology

In Afghanistan, 14 WPV1 cases were reported in 2013, compared with 37 cases in 2012; nine cases were reported during January–August 2014, compared with six cases during the same period in 2013 (Table, Figures 1 and 2). Of the 23 WPV1 cases reported during January 2013–August 2014, 19 (82%) were reported among children aged <36 months;

**TABLE. Acute flaccid paralysis (AFP) surveillance indicators and reported cases of wild poliovirus (WPV) and circulating vaccine-derived poliovirus (cVDPV), by region, period, and poliovirus type — Afghanistan and Pakistan, January 2013–August 2014**

| Country/Area | AFP surveillance indicators (2013) | | | Reported WPV1 cases* | | | | Reported cVDPV2 cases* | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | No. of AFP cases | Nonpolio AFP rate† | % with adequate specimens§ | Jan–Jun 2013 | Jul–Dec 2013 | Jan–Aug 2014 | Total WPV1 | Jan–June 2013 | July–Dec 2013 | Jan–Aug 2014 |
| **Afghanistan** | **1,897** | **10.0** | **93** | **3** | **11** | **9** | **23** | **0** | **0** | **0** |
| Badakhshan | 62 | 11.3 | 96 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Northeastern | 252 | 11.7 | 96 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Northern | 279 | 11.9 | 92 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Central | 346 | 8.0 | 96 | 0 | 1 | 0 | **1** | 0 | 0 | 0 |
| Eastern | 176 | 9.3 | 93 | 3 | 9 | 5 | **17** | 0 | 0 | 0 |
| Southeastern | 119 | 5.8 | 94 | 0 | 0 | 2 | **2** | 0 | 0 | 0 |
| Southern | 337 | 10.2 | 83 | 0 | 1 | 1 | **2** | 3 | 0 | 0 |
| Western | 326 | 12.8 | 97 | 0 | 0 | 1 | **1** | 0 | 0 | 0 |
| **Pakistan** | **4,658** | **5.8** | **89** | **21** | **72** | **170** | **263** | **10** | **38** | **22** |
| Azad Jammu Kashmir | 50 | 3.1 | 94 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Gilgit-Baltistan | 8 | 1.1 | 88 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Islamabad | 17 | 2.7 | 100 | 0 | 0 | 0 | **0** | 0 | 0 | 0 |
| Khyber Pakhtunkhwa | 875 | 8.2 | 84 | 5 | 6 | 31 | **42** | 0 | 0 | 3 |
| Punjab | 2,257 | 5.4 | 92 | 2 | 5 | 2 | **9** | 0 | 0 | 0 |
| Balochistan | 195 | 5.1 | 86 | 0 | 0 | 4 | **4** | 2 | 0 | 0 |
| Sindh | 955 | 5.3 | 91 | 2 | 8 | 16 | **26** | 3 | 1 | 0 |
| Federally Administered Tribal Areas | 301 | 12.7 | 82 | 12 | 53 | 117 | **182** | 5 | 37 | 19 |

* Data as of October 17, 2014.
† Per 100,000 children aged <15 years.
§ Two specimens collected ≥24 hours apart, both within 14 days of paralysis onset, and shipped on dry ice or frozen packs to a World Health Organization–accredited laboratory, arriving in good condition (without leakage or desiccation).

of whom seven (37%) had never received OPV, three (16%) had received 1 dose, and nine (47%) received >4 doses. During this period, WPV1 cases were reported in 18 (6%) of 329 districts of Afghanistan. Of the 23 cases reported during January 2013–August 2014, a total of 17 (74%) were caused by WPV1 imported from Pakistan, and six (26%) were caused by "orphan viruses,"¶¶ indicating gaps in the quality of field AFP surveillance and missed WPV1 transmission. Two of these orphan viruses, isolated from children living in the Southern Region, belonged to the endemic Afghanistan virus previously circulating in the Southwestern Region of Afghanistan, indicating that ongoing endemic transmission had not been detected for >20 months. The other four orphan viruses originated in Pakistan. Three cVDPV2 cases were reported in 2013; the last case was reported in March 2013 (Table, Figures 1 and 2).

In Pakistan, 93 WPV1 cases were reported in 2013, compared with 58 cases in 2012; 170 cases were reported during January–August 2014, compared with 33 cases during the same period in 2013. Of the 263 WPV1 cases reported in Pakistan during January 2013–August 2014, a total of 245 (93%) were reported among children aged <36 months; 164 (67%) had never received OPV, 33 (14%) received 1–3 OPV doses, and 48 (20%) received >4 doses. In 2013, WPV1 cases were reported in 16 (10%) of 157 districts of Pakistan, compared with 27 (17%) districts in 2012, and 23 (15%) districts during January–August 2014. Of the 263 WPV1 cases reported during 2013–2014, 69% were from FATA and 16% were from KP (Table); 56% of cases in FATA were from North Waziristan Agency. During 2013–2014, a total of 70 cVDPV2 cases were reported in Pakistan (81% from North Waziristan) (Table, Figures 1 and 2); 94% were reported among children aged <36 months, of whom 68% had never received OPV. WPV type 3 has not been detected in Afghanistan or Pakistan since April 2012.

¶¶ Any wild-type poliovirus that is >1% divergent in the VP1 region from the most closely related isolate is defined as an "orphan" poliovirus and considered indicative of low AFP surveillance sensitivity.

## Discussion

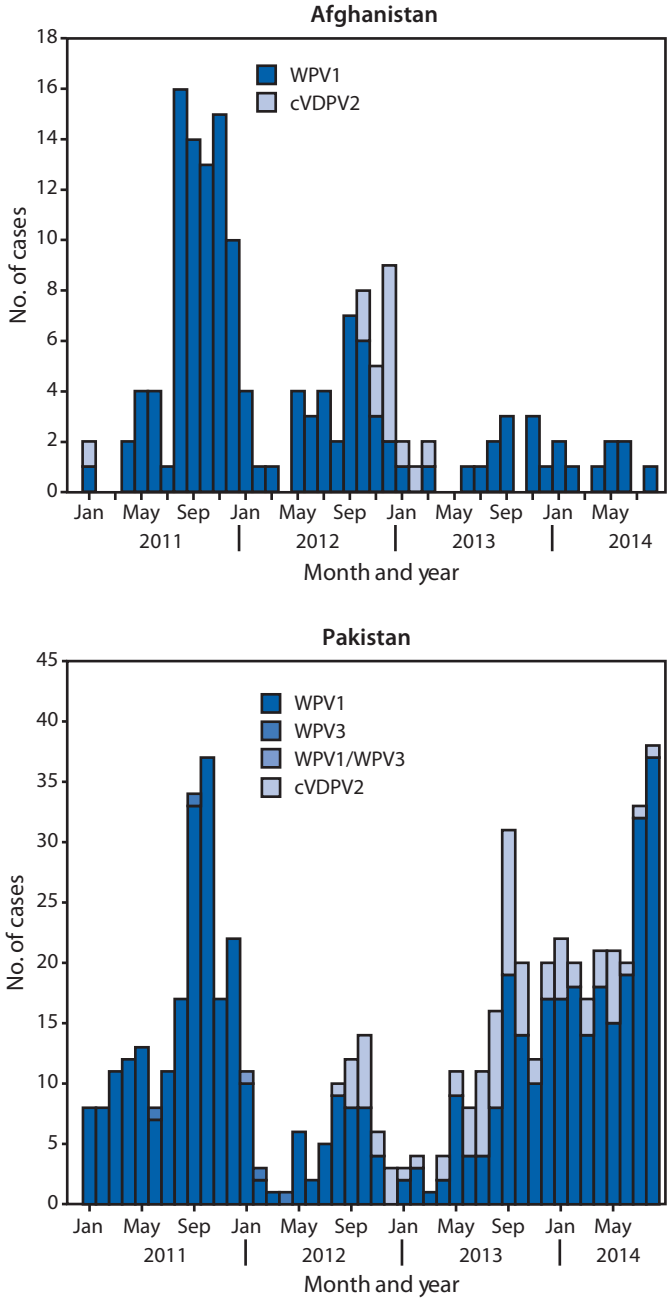
The number of WPV1 cases in Afghanistan decreased substantially from 2012 to 2014, after the implementation of an augmented National Emergency Action Plan in 2012 (*6*), and was facilitated by overall increased access to children in insecure areas. The action plan included strategies to improve program management and performance at the province and district level, including the recruitment of additional staff at district and province level, additional training of staff, and establishing a framework for holding staff accountable for their performance. The action plan also included strategies to increase access to children in insecure areas, such as the use of so-called "permanent polio teams" in the low-performing districts of the Southern Region. These teams, comprised of local staff, deliver OPV on a continuous basis, irrespective of SIAs, by making quarterly visits to all households

in an assigned catchment area to increase OPV coverage. In the Southern Region, a reduction in the proportion of zero-dose children was documented, and no WPV1 cases were detected for 1 year during November 2012-October 2013. However, detection of two indigenous Afghanistan WPVs in the Southern Region in late 2013 and mid-2014, after long periods without detection, indicated ongoing undetected transmission and weaknesses in AFP surveillance. A ban on immunizations in Helmand Province (Southern Region), imposed by local authorities during March–August 2014, was lifted during the last week of August, and a series of SIAs have been conducted in Helmand since then. Undetected local transmission demonstrated by genetic sequence data, ongoing poliovirus transmission in bordering areas of Pakistan, and cross-border movement from Pakistan, place Afghanistan at risk for continued WPV transmission. In addition, access to children during SIAs in certain areas of the Eastern Region, particularly in Kunar Province, remains challenging. Despite these challenges, major improvements were made in vaccination coverage in 2014. Strengthening surveillance in the Southern Region and increasing vaccination coverage in all regions is critical to achieve the goal of interrupting all poliovirus transmission in Afghanistan.

In Pakistan, a five-fold increase in the number of reported WPV1 cases occurred in 2014, compared with the same period in 2013; 87% of cases in 2014 were reported in FATA and KP. The increase in the number of cities with WPV1 and cVDPV2 isolated from sewage samples indicates widespread exportation of poliovirus from FATA and KP; however, increased vaccination coverage through numerous SIAs has prevented outbreaks or sustained transmission elsewhere in Pakistan. To achieve polio eradication, new ways of reaching children living in temporarily inaccessible areas in Pakistan are needed, including negotiating ways to ensure the safety of vaccination teams within conflict-affected areas and continued use of transit vaccination teams at borders of inaccessible areas. In addition, full government ownership of the polio eradication program at all administrative levels in Pakistan is crucial.

Interruption of all circulation of indigenous WPV in Afghanistan is within reach. However, the situation in Pakistan is threatening the global polio eradication efforts. Given the current situation in Pakistan, it is highly unlikely that all necessary programmatic steps can be taken to interrupt WPV transmission during 2014. However, if the government of Pakistan implements all the recommendations provided by the polio technical advisory group and manages the eradication program more effectively, the low season of the last quarter of 2014 and the first quarter of 2015 provides an opportunity to further accelerate activities to limit or stop all WPV transmission. Unless Pakistan makes substantial improvements to its program and controls WPV spread within its borders, the global efforts to eradicate polio will be undermined.

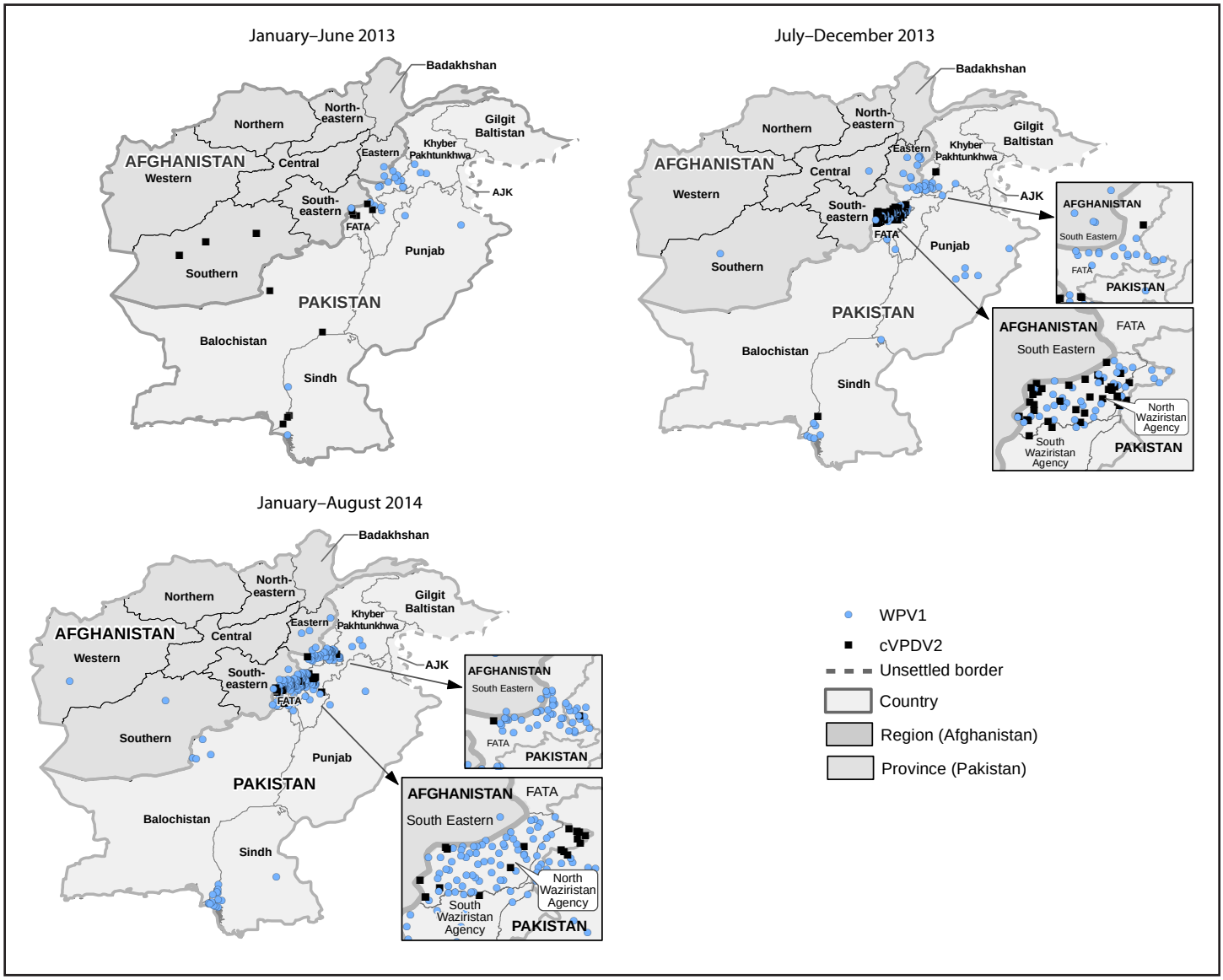
**FIGURE 1. Number of cases of wild poliovirus types 1 (WPV1) and 3 (WPV3) and circulating vaccine-derived poliovirus type 2 (cVDPV2), by month — Afghanistan and Pakistan, 2011–2014**




## Acknowledgments

Muzaffar Khan, Keith Feldon, WHO Country Office, Islamabad, Pakistan. Brian C. Kaplan, MS, MA, Division of Toxicology and Human Health Sciences, Agency for Toxic Substances and Disease Registry. WHO Eastern Mediterranean Regional Office, Cairo, Egypt. WHO Regional Reference Laboratory for Poliovirus, Islamabad, Pakistan. Global Polio Laboratory Network. Polio Eradication Department, WHO, Geneva, Switzerland.

**FIGURE 2. Cases of wild poliovirus type 1 (WPV1) and circulating vaccine-derived poliovirus type 2 (cVDPV2) — Afghanistan and Pakistan, January 2013–August 2014***




**Abbreviations:** AJK = Azad Jammu and Kashmir; FATA = Federally Administered Tribal Areas.
* Each dot represents one case. Dots are drawn at random within second administrative units.

[1]Global Immunization Division, Center for Global Health, CDC; [2]Division of Viral Diseases, National Center for Immunization and Respiratory Diseases, CDC; [3]World Health Organization (WHO) Country Office, Kabul, Afghanistan; [4]WHO Country Office, Islamabad, Pakistan; WHO Headquarters, Geneva, Switzerland (Corresponding author: Noha H. Farag, nfarag@cdc.gov, 404-625-2870)

## References

1. Global Polio Eradication Initiative. Polio eradication and endgame strategic plan 2013–2018. Geneva, Switzerland: World Health Organization; 2014. Available at http://www.polioeradication.org/resourcelibrary/strategyandwork.aspx.
2. CDC. Progress toward poliomyelitis eradication—Afghanistan, January 2012–September 2013. MMWR 2013;62:928–33.
3. CDC. Progress toward poliomyelitis eradication—Pakistan, January 2012–September 2013. MMWR 2013;62:934–8.
4. World Health Organization. WHO vaccine-preventable diseases monitoring system: 2014 global summary. Geneva, Switzerland: World Health Organization; 2013. Available at http://apps.who.int/immunization_monitoring/globalsummary.
5. Global Polio Eradication Initiative. Assessing vaccination coverage levels using clustered lot quality assurance sampling. Geneva, Switzerland: World Health Organization; 2012. Available at http://www.polioeradication.org/portals/0/document/research/opvdelivery/lqas.pdf.
6. Global Polio Eradication Initiative. Afghanistan emergency action plan for polio eradication 2012–2013. Geneva, Switzerland: World Health Organization; 2012. Available at http://www.polioeradication.org/portals/0/document/aboutus/governance/imb/7imbmeeting/3.4_7imb.pdf.

# Update: Ebola Virus Disease Outbreak — West Africa, October 2014

Incident Management System Ebola Epidemiology Team, CDC; Guinea Interministerial Committee for Response Against the Ebola Virus; CDC Guinea Response Team; Liberia Ministry of Health and Social Welfare; CDC Liberia Response Team; Sierra Leone Ministry of Health and Sanitation; CDC Sierra Leone Response Team; Viral Special Pathogens Branch, National Center for Emerging and Zoonotic Infectious Diseases, CDC

*On October 28, 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 situation reports from the Guinea Interministerial Committee for Response Against the Ebola Virus and the World Health Organization, the Liberia Ministry of Health and Social Welfare, and the Sierra Leone Ministry of Health and Sanitation. Total case counts include all suspected, probable, and confirmed cases as defined by each country. These data reflect reported cases, which make up an unknown proportion of all actual cases and reporting delays that vary from country to country.

According to the latest World Health Organization update as of October 22, 2014 (*2*), a total of 9,911 Ebola cases have been reported as of October 19 from three highly affected West African countries (Guinea, Liberia, and Sierra Leone) (Figure 1). The highest reported case counts were from Liberia (4,665 cases), followed by Sierra Leone (3,706) and Guinea (1,540).

The geographic distribution of the number of Ebola cases reported during September 28–October 18 changed from the distribution of cases reported during August 31–September 23 (*3*), when counts were highest in the areas where Liberia, Sierra Leone, and Guinea meet. Counts of Ebola cases reported during September 28–October 18 were highest in the area around Monrovia and in the district of Bong, Liberia; the Freetown area and the northwest districts of Sierra Leone; and the district of Macenta, Guinea (Figure 2).

The map of the cumulative incidence of Ebola, as of October 18, indicates that the highest incidence rate (>100 cases per 100,000 population) was reported by two districts in Guinea (Guéckédou and Macenta), five districts in Liberia (Bomi, Bong, Lofa, Margibi, and Montserrado), and four districts in Sierra Leone (Bombali, Kailahun, Kenema, and Port Loko) (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

World Health Organization. Geospatial Research, Analysis, and Services Program, CDC. Situational Awareness Team, Office of Public Health Preparedness and Response, CDC.

## References

1. Dixon MG, Schafer IJ. Ebola viral disease outbreak—West Africa, 2014. MMWR 2014;63:548–51.
2. World Health Organization. Ebola response roadmap situation report, 22 October 2014. Geneva, Switzerland: World Health Organization; 2014. Available at http://apps.who.int/iris/bitstream/10665/137091/1/roadmapsitrep22Oct2014_eng.pdf?ua=1.
3. Incident Management System Ebola Epidemiology Team, CDC; Ministries of Health of Guinea, Sierra Leone, Liberia, Nigeria, and Senegal; Viral Special Pathogens Branch, National Center for Emerging and Zoonotic Infectious Diseases, CDC. Ebola virus disease outbreak—West Africa, September 2014. MMWR 2014;63:865–6.

**FIGURE 1. Cumulative number of Ebola virus disease cases reported, by epidemiologic week — three countries, West Africa, March 29–October 18, 2014**

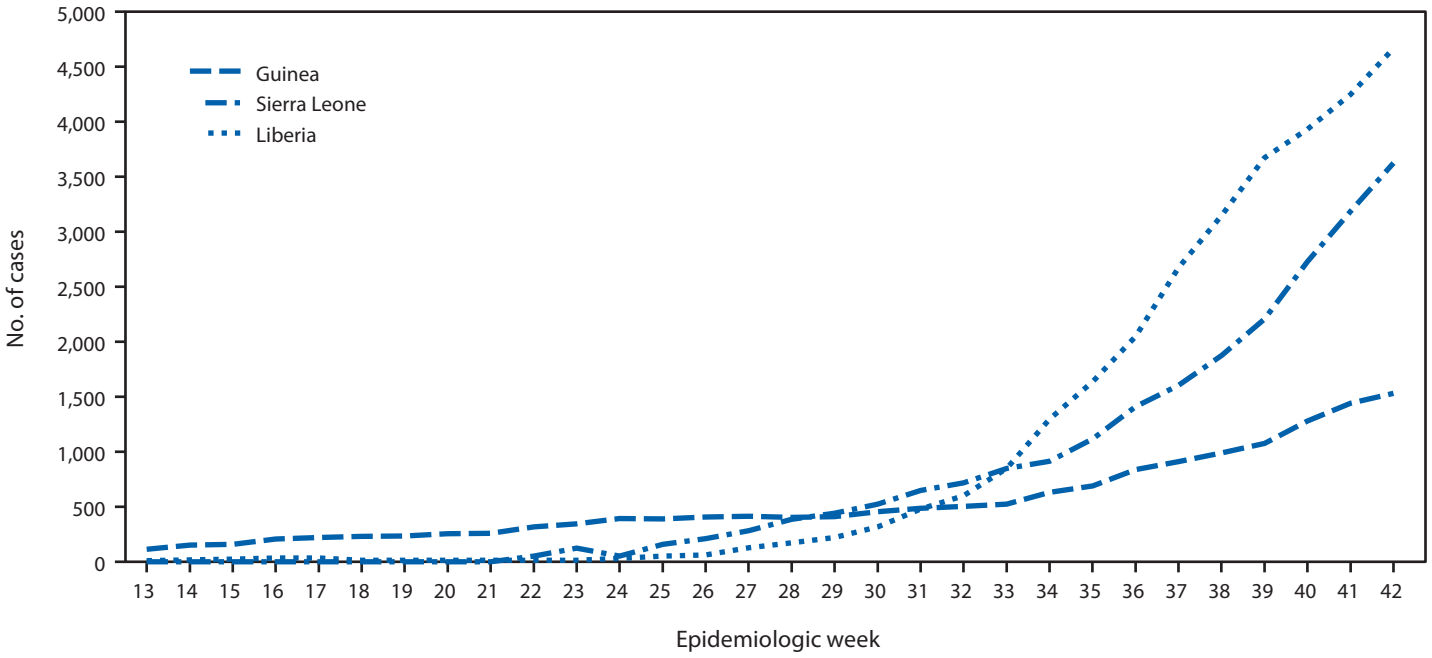


**FIGURE 2. Number of new cases of Ebola virus disease reported — West Africa, September 28–October 18**

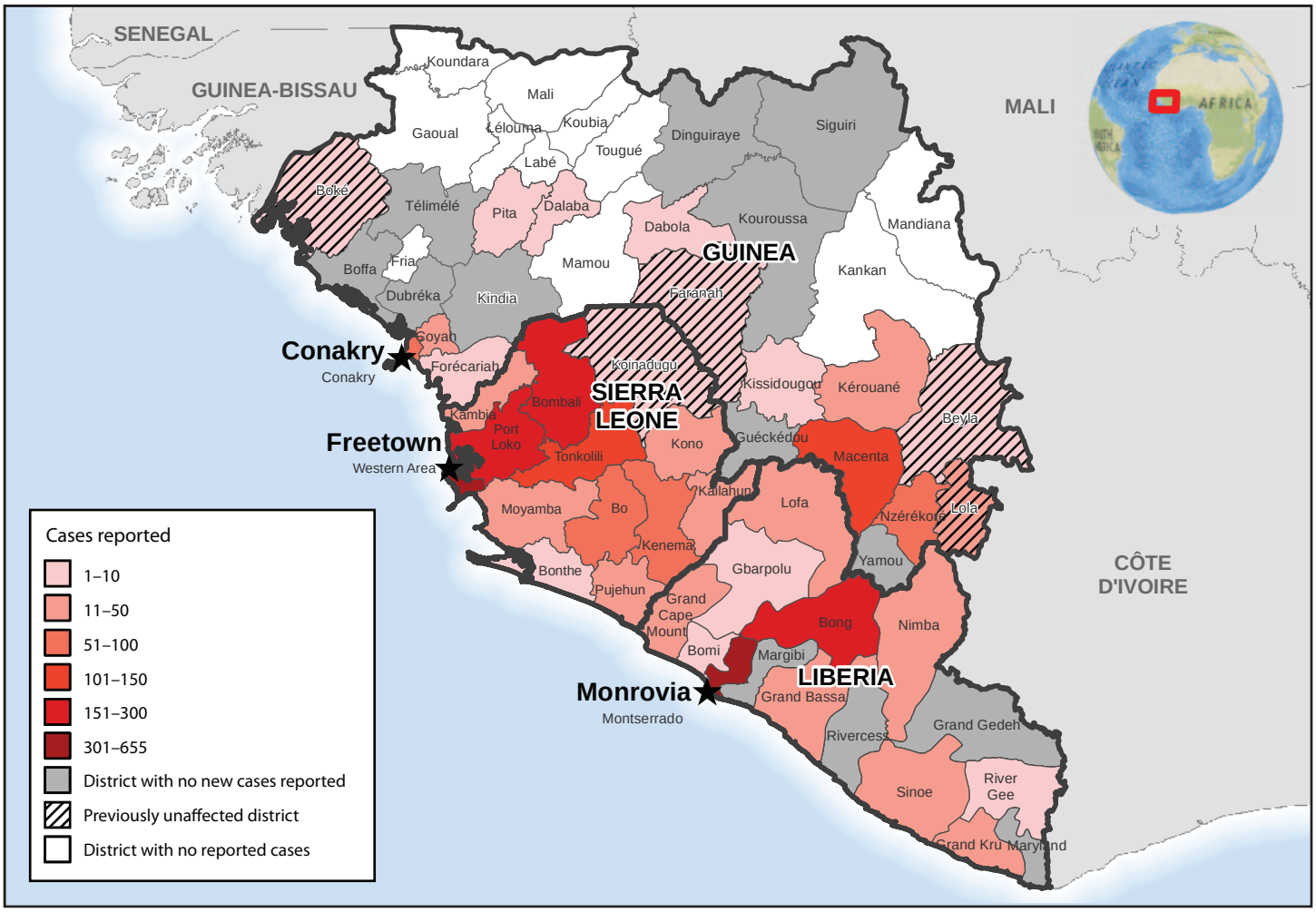
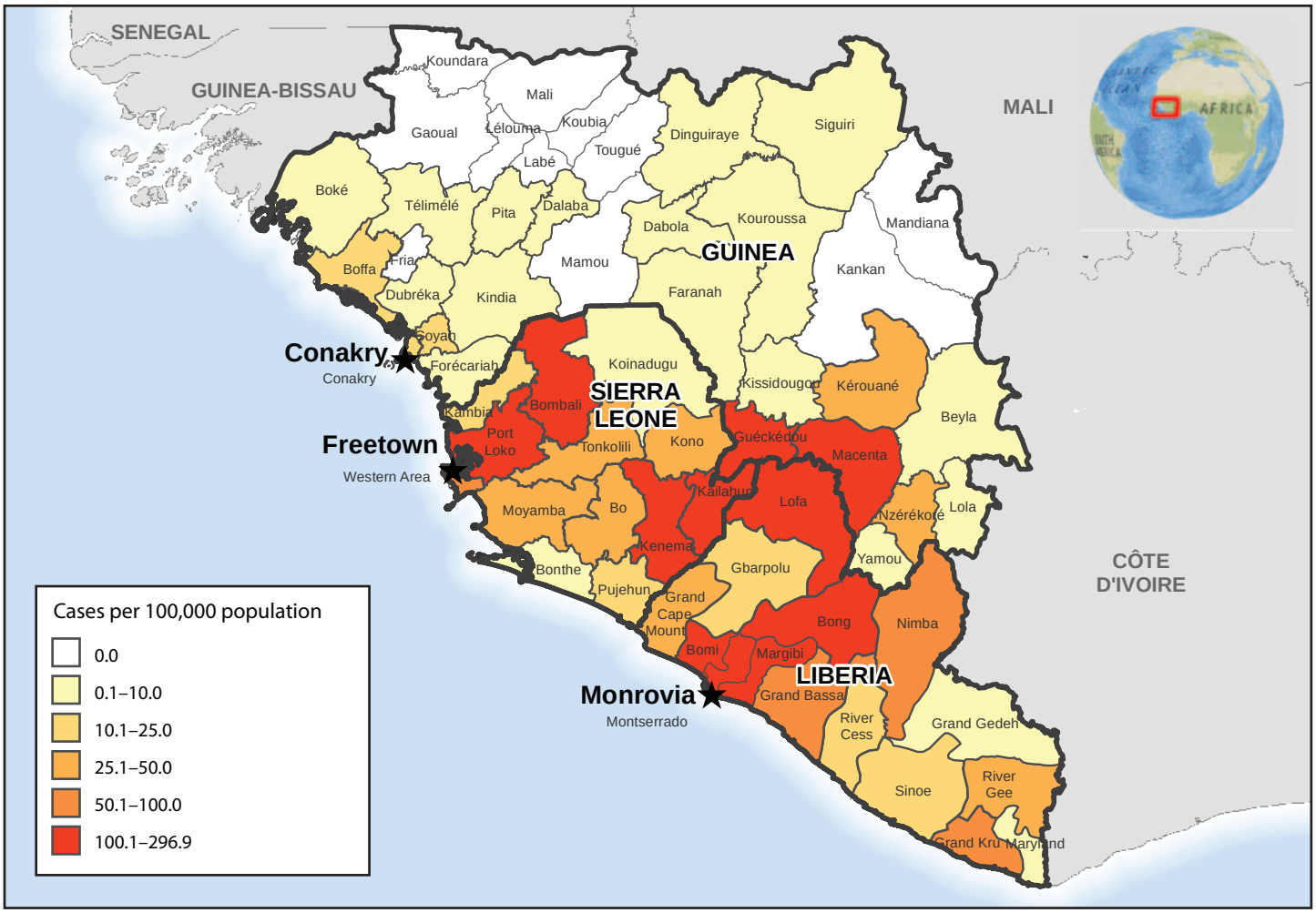


**FIGURE 3. Ebola virus disease cumulative incidence — West Africa, October 18, 2014***




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

# Notes from the Field

## Update on Lyme Carditis, Groups at High Risk, and Frequency of Associated Sudden Cardiac Death — United States

Joseph D. Forrester, MD[1,2], Jonathan Meiman, MD[1,3], Jocelyn Mullins, DVM, PhD[1,4], Randall Nelson, DVM[4], Starr-Hope Ertel[4], Matt Cartter, MD[4], Catherine M. Brown, DVM[5], Virginia Lijewski, MPH[5], Elizabeth Schiffman, MA[6], David Neitzel, MS[6], Elizabeth R. Daly, MPH[7], Abigail A. Mathewson, DVM[7], Whitney Howe, MSPH[7], Lindsay A. Lowe[8], Natalie R. Kratz, MPH[8,9], Shereen Semple, MS[8], P. Bryon Backenson, MS[10], Jennifer L. White, MPH[10], Phillip M. Kurpiel, MPH[10], Russell Rockwell, PhD[10], Kirsten Waller, MD[11], Diep Hoang Johnson[3], Christopher Steward, MPH[3], Brigid Batten, MPH[12], Dianna Blau, DVM, PhD[12], Marlene DeLeon-Carnes[12], Clifton Drew, DVM, PhD[12], Atis Muehlenbachs, MD, PhD[12], Jana Ritter, DVM[12], Jeanine Sanders[12], Sherif R. Zaki, MD, PhD[12], Claudia Molins, PhD[2], Martin Schriefer, PhD[2], Anna Perea, MSc[2], Kiersten Kugeler, PhD[2], Christina Nelson, MD[2], Alison Hinckley, PhD[2], Paul Mead, MD[2]
(Author affiliations at end of text)

On December 13, 2013, *MMWR* published a report describing three cases of sudden cardiac death associated with Lyme carditis (*1*). State public health departments and CDC conducted a follow-up investigation to determine 1) whether carditis was disproportionately common among certain demographic groups of patients diagnosed with Lyme disease, 2) the frequency of death among patients diagnosed with Lyme disease and Lyme carditis, and 3) whether any additional deaths potentially attributable to Lyme carditis could be identified. Lyme disease cases are reported to CDC through the Nationally Notifiable Disease Surveillance System; reporting of clinical features, including Lyme carditis, is optional. For surveillance purposes, Lyme carditis is defined as acute second-degree or third-degree atrioventricular conduction block accompanying a diagnosis of Lyme disease. During 2001–2010, a total of 256,373 Lyme disease case reports were submitted to CDC, of which 174,385 (68%) included clinical information. Among these, 1,876 (1.1%) were identified as cases of Lyme carditis. Median age of patients with Lyme carditis was 43 years (range = 1–99 years); 1,209 (65%) of the patients were male, which is disproportionately larger than the male proportion among patients with other clinical manifestations ($p<0.001$). Of cases with this information available, 69% were diagnosed during the months of June–August, and 42% patients had an accompanying erythema migrans, a characteristic rash. Relative to patients aged 55–59 years, carditis was more common among men aged 20–39 years, women aged 25–29 years, and persons aged ≥75 years (Figure).

To determine the frequency of death among patients with Lyme disease and identify patients in whom carditis might have contributed to death, health officials in seven selected high-incidence Lyme disease states (Connecticut, Massachusetts, Minnesota, New Hampshire, New Jersey, Pennsylvania, and Wisconsin) reviewed convenience samples of cases meeting the surveillance case definition for Lyme disease or Lyme carditis. Patient names were cross-referenced with death certificates to identify patients who died within 1 year of a Lyme disease diagnosis. A suspected case of Lyme carditis–associated mortality was defined as 1) clinically compatible sudden cardiac arrest within 6 months of Lyme disease symptom onset in a person living in, or with recent travel to, a high-incidence Lyme disease area, and 2) detection of antibodies to *Borrelia burgdorferi* in the patient's serum using two-tier testing criteria.* A confirmed case was defined as a suspected case with pathologic evidence of *B. burgdorferi* infection of the heart confirmed by polymerase chain reaction or by seeing spirochetes in cardiac tissue.

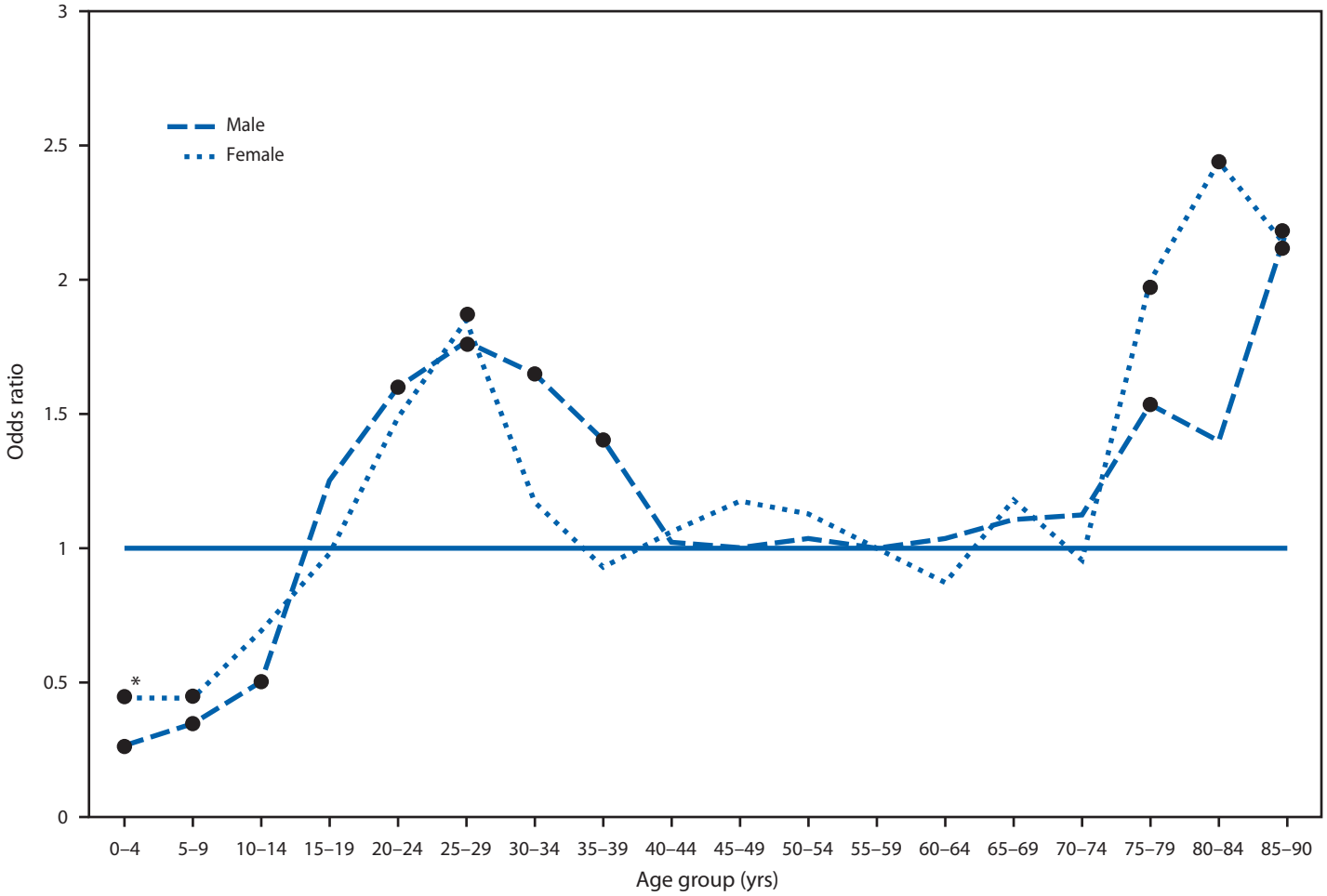
Among 121,894 cases reported during 1995–2013 (120,198 cases with any form of Lyme disease and 1,696 cases with carditis specified), 702 (0.6%) died from all causes within a year of Lyme disease diagnosis. The observed all-cause mortality for these 121,894 patients is below the predicted age-adjusted, all-cause mortality for this population based on national, age-adjusted death rates. Two of these deaths (0.002% of the total) were classified as suspected cases of Lyme carditis–associated mortality after review of available clinical information.

The two suspected cases in this report occurred during June–November in two men in their 40s and 50s. Presenting symptoms included fatigue, malaise, muscle and joint pain, shortness of breath, chest pain, and syncope. Both patients experienced cardiac arrest within 6 weeks of Lyme disease symptom onset. One patient reported erythema migrans, and both had clinical evidence of disseminated infection. Comorbidities included hypertension, diabetes, and hyperlipidemia. Both patients had antibody against *B. burgdorferi* detected by enzyme immunoassay and immunoglobulin M Western blot; one also had antibodies detected by immunoglobulin G Western blot. For neither of these patients was cardiac tissue available for testing.

This report describes the investigation performed by state public health partners and CDC to define high-risk groups and the frequency of death in patients with Lyme carditis. In reported cases, sudden cardiac death remains infrequent when Lyme carditis is recognized and treated with appropriate antibiotic therapy. However, two additional suspected sudden cardiac deaths associated with Lyme carditis were discovered, bringing the total number of cases identified during this investigation to five (three confirmed [*1*] and two suspected). These cases highlight the public health and clinical challenge that Lyme carditis poses and the need for better primary prevention strategies.

* Additional information available at http://www.cdc.gov/lyme/diagnosistesting/labtest/twostep/index.html.

**FIGURE. Odds ratios for carditis among Lyme disease patients, by age group and sex — United States, 2001–2010**




* Black markers represent statistically significant odds ratios (referent = 55–59 year age group for both sexes).

Health care providers should consider Lyme disease as a cause of cardiac symptoms in patients who live in or have visited a high-incidence Lyme disease region, especially during summer and fall months and regardless of whether the patient reports erythema migrans. Additionally, health care providers should investigate the potential for cardiac involvement in patients who have other signs or symptoms of Lyme disease, particularly if they report chest pain, palpitations, lightheadedness, shortness of breath, or syncope. Patients with Lyme carditis should be diagnosed and treated according to current treatment guidelines (*3*). It is recommended that health care providers remind patients at risk for Lyme disease about common signs and symptoms[†] and steps they can take to prevent infection.[§] Patients who think they might have Lyme disease or Lyme carditis are encouraged to see their health care provider promptly.

[†] Additional information available at http://www.cdc.gov/lyme/signs_symptoms/lymecarditis.html.

[§] Additional information available at http://www.cdc.gov/lyme/prev/index.html.

[1]Epidemic Intelligence Service, CDC; [2]Division of Vector-Borne Infectious Diseases, National Center for Emerging and Zoonotic Infectious Disease, CDC; [3]Wisconsin Department of Health Services; [4]Connecticut Department of Public Health; [5]Massachusetts Department of Public Health; [6]Minnesota Department of Health; [7]New Hampshire Department of Health and Human Services; [8]New Jersey Department of Health; [9]CDC/CSTE applied epidemiology fellow assigned to the New Jersey Department of Health; [10]New York State Department of Health; [11]Pennsylvania Department of Public Health; [12]Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Disease, CDC (Corresponding author: Joseph D. Forrester, jforrester@cdc.gov, 970-266-3587)

## References

1. CDC. Three sudden cardiac deaths associated with Lyme carditis—United States, November 2012–July 2013. MMWR 2013;62:993–6.
2. Stanek G, Wormser GP, Gray J, Strle F. Lyme borreliosis. Lancet 2012; 379:461–73.
3. Wormser GP, Dattwyler RJ, Shapiro ED, et al. The clinical assessment, treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: clinical practice guidelines by the Infectious Diseases Society of America. Clin Infect Dis 2006;43:1089–134.

# Announcement

## Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure

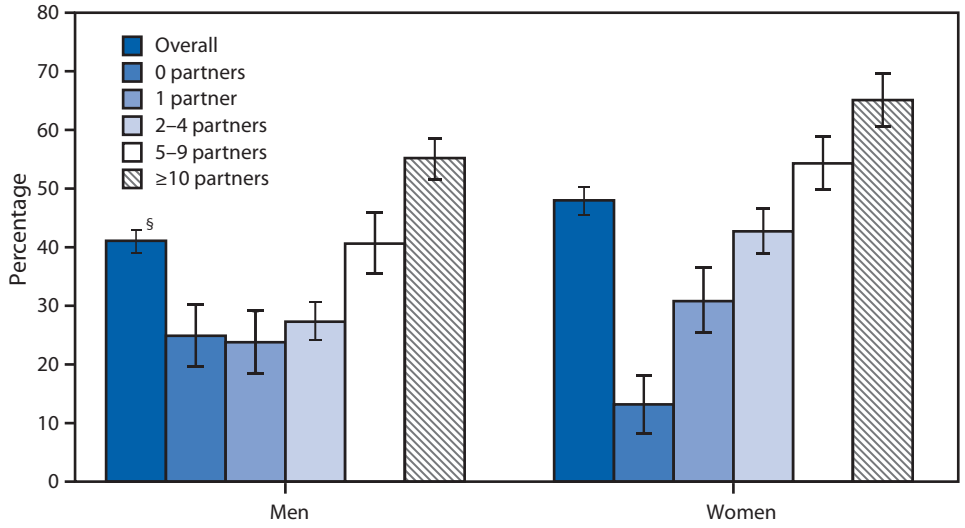
On October 27, 2014, CDC released Interim U.S. Guidance for Monitoring and Movement of Persons with Potential Ebola Virus Exposure (available at http://www.cdc.gov/vhf/ebola/exposure/monitoring-and-movement-of-persons-with-exposure.html). This updated guidance focuses on strengthening the monitoring of persons potentially exposed to Ebola and evaluating their intended travel, including the application of movement restrictions when indicated. This interim guidance has been updated by establishing a "low (but not zero) risk" category; adding a "no identifiable risk" category; modifying the recommended public health actions in the "high risk," "some risk," and "low (but not zero) risk" categories; and adding recommendations for specific groups and settings.

Through these changes, CDC and state and local health departments seek to support persons who might have been exposed to Ebola, while also continuing to stop Ebola at its source in West Africa. These changes will help ensure that health care workers returning to the United States from West Africa are monitored, any symptoms they might develop are quickly identified, and that a system is in place to recognize when they need to be routed to care. These actions will better protect potentially exposed individuals and the U.S. public as a whole. A fact sheet regarding the new interim guidance is available at http://www.cdc.gov/media/releases/2014/fs1027-monitoring-symptoms-controlling-movement.html.

# QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

## Percentage of Adults Aged 18–59 Years Who Have Ever Been Tested for HIV,*† by Number of Lifetime Sex Partners and by Sex — National Health and Nutrition Examination Survey, 2007–2010




**Abbreviation:** HIV = human immunodeficiency virus.
* Based on response to the question, "Except for tests you may have had as part of blood donations, have you ever had blood tested for the AIDS virus infection?"
† Since 2006, CDC has recommended that all patients aged 13–64 years in any health care setting should be tested for HIV, regardless of the number of sex partners.
§ 95% confidence interval.

During 2007–2010, 48% of U.S. women and 41.1% of U.S. men aged 18–59 years reported having ever been tested (outside of blood donations) for HIV infection. For both men and women, an increase in the number of lifetime sexual partners increased the likelihood that they were tested for HIV. Among persons with zero lifetime sex partners, men were more likely to have had HIV testing than women (24.9% compared with 13.2%). However, among persons with 2–4, 5–9, and ≥10 lifetime sex partners, women were more likely than men to have reported any HIV testing.

**Source:** Woodring JV, Kruszon-Moran D, Oster AM, McQuillan GM. Did CDC's 2006 revised HIV testing recommendations make a difference? Evaluation of HIV testing in the U.S. household population, 2003–2010. J Acquir Immune Defic Syndr 2014;67:331–40.

**Reported by:** Joseph V. Woodring, DO, jwoodring@cdc.gov, 301-458-4599; Deanna Kruszon-Moran, MS; Geraldine M. McQuillan, PhD; Alexandra M. Oster, MD; Steven M. Frenk, PhD.

The *Morbidity and Mortality Weekly Report (MMWR)* Series is prepared by the Centers for Disease Control and Prevention (CDC) and is available free of charge in electronic format. To receive an electronic copy each week, visit *MMWR*'s free subscription page at *http://www.cdc.gov/mmwr/mmwrsubscribe.html*. Paper copy subscriptions are available through the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402; telephone 202-512-1800.

If difficulty accessing this PDF file, access the HTML file at http://www.cdc.gov/mmwr/index2014.html. Address all inquiries about the MMWR Series, including material to be considered for publication, to Editor, MMWR Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to mmwrq@cdc.gov.



ISSN: 0149-2195