

Outbreaks of Unexplained Neurologic Illness — Muzaffarpur, India, 2013–2014

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Outbreaks of an unexplained acute neurologic illness affecting young children and associated with high case-fatality rates have been reported in the Muzaffarpur district of Bihar state in India since 1995. The outbreaks generally peak in June and decline weeks later with the onset of monsoon rains. There have been multiple epidemiologic and laboratory investigations of this syndrome, leading to a wide spectrum of proposed causes for the illness, including infectious encephalitis and exposure to pesticides. An association between illness and litchi fruit has been postulated because Muzaffarpur is a litchi fruit-producing region (Figure 1). To better characterize clinical and epidemiologic features of the illness that might suggest its cause and how it can be prevented, the Indian National Centre for Disease Control (NCDC) and CDC investigated outbreaks in 2013 and 2014. Clinical and laboratory findings in 2013 suggested a noninflammatory encephalopathy, possibly caused by a toxin. A common laboratory finding was low blood glucose (<70 mg/dL) on admission, a finding associated with a poorer outcome; 44% of all cases were fatal. An ongoing 2014 investigation has found no evidence of any infectious etiology and supports the possibility that exposure to a toxin might be the cause. The outbreak period coincides with the month-long litchi harvesting season in Muzaffarpur. Although a specific etiology has not yet been determined, the 2014 investigation has identified the illness as a hypoglycemic encephalopathy and confirmed the importance of ongoing laboratory evaluation of environmental toxins to identify a potential causative agent, including markers for methylenecyclopropylglycine (MCPG), a compound found in litchi seeds known to cause hypoglycemia in animal studies (1–3). Current public health recommendations are focused on reducing mortality by urging affected families to seek prompt medical care, and ensuring rapid assessment and correction of hypoglycemia in ill children.

2013 Outbreak Investigation

During May 17–July 22, 2013, a total of 133 children were admitted to the two main referral hospitals in Muzaffarpur with illnesses that met the investigation case definition of acute onset seizures or altered mental status within 7 days of admission in a child aged <15 years. Of these, 94 (71%)

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patients were from Muzaffarpur; other patients were from six neighboring districts. Among the 133 patients, 71% were aged 1–5 years, 94% had generalized seizures, and 93% had altered mental status. Most (61%) were afebrile at admission; the case fatality rate was 44%. Among 56 patients with cerebrospinal fluid (CSF) examined, 31 (55%) had normal cytology (white blood cell [WBC] count = $<5/\text{mm}^3$); 48 of 59 (81%) had CSF normal protein ($<45 \text{ mg/dL}$), and 46 of 61 (75%) had normal CSF glucose ($>45 \text{ mg/dL}$) levels. At admission, 20 (21%) of 94 patients had hypoglycemia (blood glucose $<70 \text{ mg/dL}$).

CSF samples were tested at NCDC for selected infectious pathogens known to cause encephalitis in the region. Of 60 CSF specimens tested for Japanese encephalitis virus by immunoglobulin M (IgM) capture enzyme-linked immunosorbent assay, 33 by polymerase chain reaction, and 33 by virus isolation, all were negative. Sixteen convalescent serum specimens, collected 14 days after illness onset, also were negative for Japanese encephalitis virus by IgM assay. Thirty CSF specimens examined by reverse transcription–polymerase chain reaction for flaviviruses and 13 examined more specifically for West Nile virus also were negative, as were 23 evaluated for Chandipura virus. Fourteen CSF specimens evaluated by polymerase chain reaction and virus isolation for enteroviruses did not demonstrate evidence of infection.

Analysis of risk factors for death among 94 affected children showed that low blood glucose at admission was more common among those who died (odds ratio = 2.6; 95% confidence

interval [CI] = 1.0–7.2). A case-control study enrolled 101 case-patients and 202 age-matched controls, 101 from the hospital and 101 from the community. Ill children had spent a greater amount of time in agricultural fields or orchards (matched odds ratio = 2.6; CI = 1.2–5.2) than controls. Anthropometric data on 24 patients suggested that younger patients (those aged <5 years) were more likely to have wasting (>2 standard deviations below the median weight for height of the reference population) than controls in the same age group ($p = 0.03$).

Data collected during the 2013 investigation suggested that the illness was more likely to be a noninflammatory encephalopathy than an infectious encephalitis, and raised concern for the possibility of a toxin-mediated illness. Although the 2013 investigation did not identify a specific etiology, key recommendations shared with state and district health officials focused on reduction of mortality, including provision of glucometers for hospitals and peripheral health facilities and rapid assessment and treatment of hypoglycemia in children with suspected illness.

2014 Outbreak Investigation

Building on the 2013 findings, NCDC and CDC again investigated this syndrome in 2014, using 1) facility-based clinical surveillance, 2) epidemiologic case-control and environmental studies to examine risk factors for illness, including toxin exposures and nutritional indices, and 3) comprehensive

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 Morb Mortal Wkly Rep* 2015;64:[inclusive page numbers].

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FIGURE 1. Litchi fruit orchards have been a focus of the investigation into outbreaks of unexplained neurologic illness among children — Muzaffarpur, India, 2013–2014



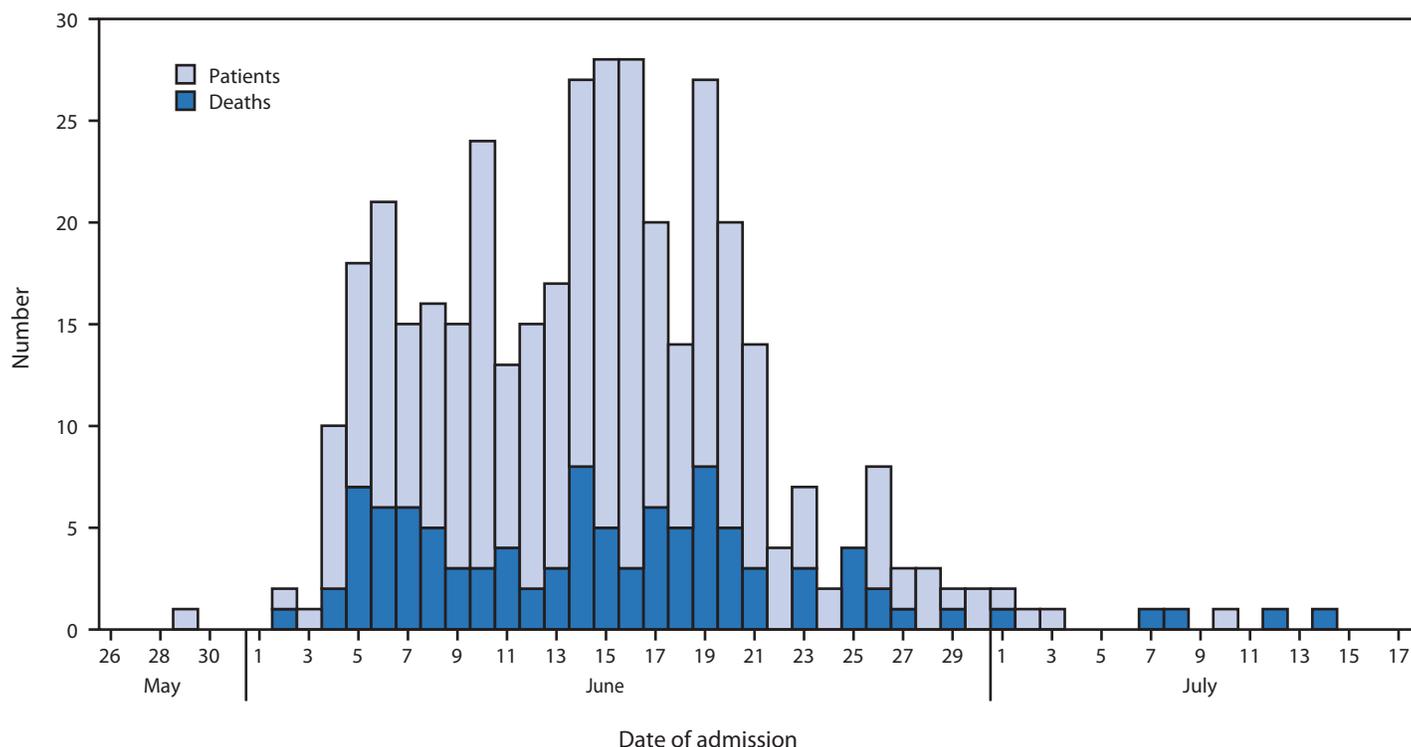
laboratory evaluation of patient specimens and environmental samples to search for infectious pathogens as well as selected pesticides, heavy metals, and naturally occurring plant or fruit toxins. Suspected patients were promptly tested for hypoglycemia on arrival at the hospital, before being given any treatment. Patients admitted with the suspected outbreak

illness were recommended to receive immediate intravenous dextrose therapy.

During May 26–July 17, 2014, a total of 390 patients admitted to the two referral hospitals in Muzaffarpur with illnesses that met the same case definition used in 2013 were evaluated by the NCDC/CDC investigation team. Among the patients, 213 (55%) were male, the median age was 4 years (range = 6 months–14 years), and 280 (72%) were aged 1–5 years. Most patients were from Muzaffarpur district (70%), although patients also were reported from six surrounding districts. As in previous years, clustering of cases was not observed; the illness of each affected child appeared to be an isolated case in various villages (approximate population per village = 1,000). The outbreak peaked in mid-June, with 147 cases reported during June 8–14, 2014. The number of cases declined significantly after the onset of monsoon rains on June 21, 2014 (Figure 2).

Caregivers reported that affected children were previously healthy and experienced an acute onset of convulsions, often between 4:00 a.m. and 8:00 a.m., frequently followed by a decreased level of consciousness. Of 345 patients with recorded data, 324 (94%) had seizures on admission, and 267 (77%) had altered mental status. Of 357 patients with body temperature measured on admission, 219 (61%) were afebrile ($\leq 99.5^{\circ}\text{F}$ [$\leq 37.5^{\circ}\text{C}$]). The case-fatality rate was 31%.

FIGURE 2. Number of patients admitted to two referral hospitals with unexplained acute neurologic illness, by date of admission — Muzaffarpur, India, May 26–July 17, 2014



Detailed clinical evaluation of 52 patients within 12 hours of admission elicited a history of generalized tonic or tonic-clonic seizures in 100%. Upper motor neuron findings of generalized hypertonia and Babinski's sign were observed in approximately one third of patients; focal neurologic deficits were rare. Brain magnetic resonance imaging of 16 patients selected at random revealed no focal abnormalities or changes suggestive of inflammation; eight patients (50%) showed mild to moderate cerebral edema. Electroencephalography in 30 cases demonstrated findings consistent with generalized encephalopathy in 22 (73%); seven demonstrated epileptiform discharges. Overall, neurologic findings suggested a diffuse encephalopathy with seizures and cerebral edema.

Of 62 patients with CSF collected for analysis, 52 (84%) had normal WBC counts, 58 (94%) had normal protein, and 49 (79%) had normal glucose levels. Of 327 patients with blood glucose measurement on admission, the median blood glucose level was 48 mg/dL, and 171 (52%) and 204 (62%) patients had glucose levels of ≤ 50 mg/dL and ≤ 70 mg/dL, respectively. Laboratory diagnostic testing of 17 CSF specimens for Japanese encephalitis virus and West Nile virus by polymerase chain reaction was negative. Additionally, evaluation of 12 CSF specimens with a multiplex polymerase chain reaction platform assay with the capacity to detect 11 viruses* also was negative.

Discussion

The 2013 and 2014 Muzaffarpur investigations indicate that this outbreak illness is an acute noninflammatory encephalopathy. This is supported by clinical and laboratory findings, inclusive of negative diagnostic results for the most common pathogens that cause infectious encephalitis in this region. Laboratory data indicate that significant hypoglycemia is an important presenting feature of illness. Furthermore, the implementation of the 2013 recommendations for rapid assessment and correction of hypoglycemia might, in part, have helped to reduce mortality (44% in 2013 versus 31% in 2014).

Although the underlying cause of this illness remains unknown, initial clinical and laboratory results of the 2014 investigation confirm the importance of systematically evaluating toxins and agents with the potential to cause acute encephalopathy. Furthermore, the consistent finding of hypoglycemia among affected children underscores the importance of examining the possible role of compounds that might acutely result in low blood sugar, seizures, and encephalopathy, including the possible role of MCPG in litchis. Outbreaks of similar acute neurologic illnesses occurring in litchi-growing regions

What is already known on this topic?

Seasonal outbreaks of an unexplained acute neurologic illness affecting young children and associated with high case fatality have been reported from Muzaffarpur, India, since 1995. Multiple potential etiologies have been proposed, including infectious encephalitis and pesticide exposure, but not systematically assessed.

What is added by this report?

Outbreak investigations in 2013 and 2014 helped to classify this illness as a noninflammatory encephalopathy. Approximately 60% of patients had low blood glucose (<70 mg/dL) on admission, which was associated with poorer outcomes and prompted recommendations for rapid assessment and treatment of low blood glucose. The low blood glucose raised the possibility that exposure to a toxin could result in low blood glucose, seizures, and encephalopathy. One specific hypothesis was that exposure to MCPG, a toxin in litchis, might cause acute hypoglycemia and encephalopathy in some children. Laboratory investigations to assess this possibility and understand why only some children are affected are ongoing.

What are the implications for public health practice?

A collaborative, multidisciplinary systematic investigation of this outbreak has been essential to correctly classify this illness and focus analytic efforts on evaluation of testable data-driven hypotheses to identify a potential etiology. The implementation of the 2013 recommendations for rapid assessment and correction of hypoglycemia might, in part, have helped to reduce mortality (44% in 2013 compared with 31% in 2014). Public health recommendations are focused on advising affected families to seek prompt medical attention, and advising healthcare providers to rapidly assess and correct hypoglycemia in ill children.

of Bangladesh and Vietnam have been reported (4,5) raising further interest in a possible association between litchis and this illness. The investigation in Bangladesh focused primarily on the possibility that pesticides used seasonally in litchi orchards might be involved, but no specific pesticide was implicated. The investigation in Vietnam focused primarily on possible infectious agents that might be present seasonally near litchi fruit plantations but found none to explain the outbreak. In Muzaffarpur, MCPG is hypothesized to cause acute hypoglycemia and illness through a similar mechanism to hypoglycin A, a toxin that has been reported to cause acute encephalopathy in the West Indies and West Africa after consumption of unripe ackee, a fruit in the same botanical family as litchi (6–9).

As part of the collaborative investigation, blood and urine specimens of affected children are being systematically assayed by the Indian National Institute for Occupational Health and CDC for pesticide metabolites, heavy metals, and markers for MCPG and its metabolites. Litchi fruits collected from orchards that border the homes of affected children are being

* Herpes simplex viruses 1 and 2, human herpes viruses 6 and 7, cytomegalovirus, varicella zoster virus, Epstein-Barr virus, parechovirus, adenovirus, enteroviruses, and parvovirus B19.

examined for MCPG markers, and environmental samples (local vegetation, food grains, and water) collected from homes of patients and controls are being evaluated for pesticide residues. Additionally, analysis of epidemiologic data collected in the 2014 case-control study, including detailed histories regarding consumption of litchis or exposure to pesticides, might elucidate potential risk factors for illness among these children.

Analysis of nutritional indices and other host factors is planned to search for an explanation for the lack of clustering of cases in these outbreaks. Until an etiology for this illness is identified, current public health and clinical recommendations are focused on reducing mortality by ensuring families with affected children rapidly access medical attention, and health care providers promptly assess for and correct hypoglycemia.

Acknowledgments

P.K. Sen, MD, R. Jaiswal, MD, and other officials of the National Vector Borne Disease Control Programme, India. B. Mohan, MD, A. Kumar, MD, G.S. Sahni, MD, Rajiva Kumar MD, and other pediatricians at participating hospitals.

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Fetal Alcohol Syndrome Among Children Aged 7–9 Years — Arizona, Colorado, and New York, 2010

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Fetal alcohol syndrome (FAS) is a serious birth defect and developmental disorder caused by in utero exposure to alcohol (1). Assessment of the public health burden of FAS through surveillance has proven difficult; there is wide variation in reported prevalence depending on the study population and surveillance method. Generally, records-based birth prevalence studies report estimates of 0.2–1.5 per 1,000 live births (2), whereas studies that use in-person, expert assessment of school-aged children in a community report estimates of 6–9 per 1,000 population (3). The Fetal Alcohol Syndrome Surveillance Network II addressed some of the challenges in records-based ascertainment by assessing a period prevalence of FAS among children aged 7–9 years in Arizona, Colorado, and New York (4). The prevalence across sites ranged from 0.3 to 0.8 per 1,000 children. Prevalence of FAS was highest among American Indian/Alaska Native children and lowest among Hispanic children. These estimates continue to be much lower than those obtained from studies using in-person, expert assessment. Factors that might contribute to this discrepancy include 1) inadequate recognition of the physical and behavioral characteristics of FAS by clinical care providers; 2) insufficient documentation of those characteristics in the medical record; and 3) failure to consider prenatal alcohol exposure with diagnoses of behavioral and learning problems. Addressing these factors through training of medical and allied health providers can lead to practice changes, ultimately increasing recognition and documentation of the characteristics of FAS.

In 2009, CDC funded three sites, Arizona (statewide), Colorado (Denver-Boulder Consolidated Metropolitan Statistical Area), and New York (nine western counties), to conduct population-based surveillance of FAS in children aged 7–9 years who resided within the catchment areas in 2010. The surveillance methodology used by the sites is described in detail elsewhere (4). Sites used the standardized, multiple-source methodology developed by the Fetal Alcohol Syndrome Surveillance Network (2) that relied on passive reporting and active review of records from various sources to identify children with suspected FAS. Data from sources such as genetic and developmental clinics, hospital discharge files, Medicaid claims, health maintenance organization records, and the juvenile justice system were used for case finding.

A surveillance case definition (Table 1) was developed based on the 1996 Institute of Medicine report on FAS (1) and refined to reflect the older ages of the children in this cohort. Documentation of the features characteristic of FAS formed the basis of the case definition: facial dysmorphology, central nervous system (CNS) abnormalities, and growth deficiency. Maternal alcohol use during pregnancy was abstracted when available, but because of difficulty in obtaining reliable and valid documentation of this information, it was not required to meet the surveillance case definition. A confirmed case of FAS had documentation of facial features, CNS abnormalities, and growth deficiency; a probable case of FAS had documentation of facial features and either CNS abnormalities or growth deficiency (Table 1). Confirmed and probable cases were combined to estimate the prevalence of FAS. The denominator was the total number of children aged 7–9 years who resided in the catchment areas based on 2010 census estimates (5). Child’s race/ethnicity was reported if available; if the child’s race/ethnicity was missing, the race/ethnicity of the birth mother was used. Hispanic ethnicity was given priority over race, consistent with CDC’s National Center for Health Statistics guidelines.

The overall prevalence of FAS was 0.3 (95% confidence interval [CI] = 0.3–0.4) per 1,000 children aged 7–9 years; the site specific prevalence was 0.3 (CI = 0.2–0.3) in Arizona, 0.3 (CI = 0.2–0.4) in Colorado, and 0.8 (CI = 0.6–1.0) in New York (Table 2). Prevalence of FAS was highest among American Indian/Alaska Native children (2.0 [CI = 1.4–2.8] per 1,000 children aged 7–9 years) and lowest among Hispanic children (0.2 [CI = 0.1–0.2]). There were no differences in the prevalence of FAS by child’s age or sex.

Discussion

Despite the older age cohort and focus on a period prevalence, the prevalence estimates obtained from the Fetal Alcohol Syndrome Surveillance Network II are similar to previously reported birth prevalence estimates using records-based methodology and much lower than those estimated by in-person, expert assessment of children (3). Factors that might contribute to this discrepancy include 1) inadequate recognition of the physical and behavioral characteristics of FAS by clinical care providers; 2) insufficient documentation of those characteristics

TABLE 1. Fetal alcohol syndrome (FAS) surveillance case definition* — Fetal Alcohol Syndrome Surveillance Network II, 2009–2014

Diagnostic category	Phenotype positive		
	Face	Central nervous system (CNS)	Growth
Confirmed FAS phenotype with or without documentation [†] of in utero alcohol exposure	Abnormal facial features consistent with FAS as reported by a physician or Two of the following: • short palpebral fissures • abnormal philtrum • thin upper lip	At least one structural or functional anomaly Structural Head circumference \leq 10th percentile at birth or any age or Functional Standardized measure of functioning in at least two of nine domains \geq 1 standard deviations below the mean or diagnosis of developmental delay by a qualified examiner or Standardized measure of IQ \geq 2 standard deviations below the mean on a standardized test or diagnosis of intellectual disability by a qualified examiner or ADD or ADHD diagnosed by a qualified evaluator	Growth delay indicated in at least one of the following: Intrauterine Weight or height corrected for gestational age \leq 10th percentile or Postnatal Weight or height \leq 10th percentile for age or Weight for height \leq 10th percentile
Probable FAS phenotype with or without documentation [†] of in utero alcohol exposure	Same as confirmed	Must meet either CNS or growth criteria as outlined in the confirmed phenotype	
Suspected	All children referred into the surveillance system.		

Abbreviations: IQ = intelligence quotient; ADD = attention deficit disorder; ADHD = attention deficit hyperactivity disorder.

* Operationalized from the recommendations of the Institute of Medicine (Fetal alcohol syndrome: diagnosis, epidemiology, prevention, and treatment. Washington, DC: National Academy Press; 1996).

[†] Documentation in any abstracted record of maternal alcohol use during the index pregnancy.

TABLE 2. Prevalence (per 1,000) of fetal alcohol syndrome among children aged 7–9 years, by sex, race/ethnicity, and age — Arizona, Colorado, and New York,* 2010

Characteristic	Arizona			Colorado			New York			Total		
	Population	No. of cases	Prevalence (95% CI)	Population	No. of cases	Prevalence (95% CI)	Population	No. of cases	Prevalence (95% CI)	Population	No. of cases	Prevalence (95% CI)
Total	271,895	67	0.3 (0.2–0.3)	117,638	29	0.3 (0.2–0.4)	82,924	65	0.8 (0.6–1.0)	472,457	161	0.3 (0.3–0.4)
Sex												
Male	138,469	36	0.3 (0.2–0.4)	60,008	15	0.3 (0.1–0.4)	42,292	35	0.8 (0.6–1.1)	240,769	86	0.4 (0.3–0.4)
Female	133,426	31	0.2 (0.2–0.3)	57,630	14	0.2 (0.1–0.4)	40,632	30	0.7 (0.5–1.0)	231,688	75	0.3 (0.3–0.4)
Race/Ethnicity												
White, non-Hispanic	112,784	14	0.1 (0.1–0.2)	62,672	17	0.3 (0.2–0.4)	57,753	29	0.5 (0.3–0.7)	233,209	60	0.3 (0.2–0.3)
Black, non-Hispanic	10,756	4	0.4 (0.1–0.9)	6,197	3	0.5 (0.1–1.3)	12,014	22	1.8 (1.2–2.7)	28,967	29	1.0 (0.7–1.4)
AI/AN, non-Hispanic	12,956	25	1.9 (1.3–2.8)	458	1	2.2 (0.1–9.6)	524	2	3.8 (0.6–11.7)	13,938	28	2.0 (1.4–2.8)
A/PI, multiple, or other, non-Hispanic	16,607	3	0.2 (0.1–0.5)	9,694	0		5,478	2	0.4 (0.1–1.1)	31,779	5	0.2 (0.1–0.3)
Hispanic	118,792	12	0.1 (0.1–0.2)	38,617	7	0.2 (0.1–0.4)	7,155	6	0.8 (0.3–1.7)	164,564	25	0.2 (0.1–0.2)
Missing		9			1			4			14	
Age (yrs)												
7	90,407	26	0.3 (0.2–0.4)	39,795	10	0.3 (0.1–0.4)	27,225	13	0.5 (0.3–0.8)	157,427	49	0.3 (0.2–0.4)
8	89,191	21	0.2 (0.2–0.4)	38,806	11	0.3 (0.2–0.5)	27,519	26	0.9 (0.6–1.4)	155,516	58	0.4 (0.3–0.5)
9	92,297	20	0.2 (0.1–0.3)	39,037	8	0.2 (0.1–0.4)	28,180	26	0.9 (0.6–1.3)	159,514	54	0.3 (0.3–0.4)

Abbreviations: CI = confidence interval; AI/AN = American Indian/Alaska Native; A/PI = Asian/Pacific Islander.

* Surveillance areas: Arizona, statewide; Colorado, Denver-Boulder Consolidated Metropolitan Statistical Area; New York, nine western counties.

in the medical record and; 3) failure to consider prenatal alcohol exposure with diagnoses of behavioral and learning problems.

That these factors might contribute to the discrepancy is supported by the findings of a survey of pediatricians published in 2006 in which more than two-thirds of respondents reported a lack of training as the primary reason for not making a FAS diagnosis (6). More than half of respondents indicated that they had no formal training on the recognition, diagnosis, or treatment of FAS, and two-thirds thought this diagnosis would stigmatize the family and child (6). The lack of training has a cascading effect: clinicians do not recognize and document physical and behavioral characteristics that might lead to a more complete clinical evaluation or that would serve as a trigger for a records-based surveillance system to identify the child as potentially having FAS. Further, maternal prenatal records are not routinely linked to a child's birth or neonatal record at the hospital, meaning that prenatal alcohol exposure, if documented in the maternal record, is not known to pediatric clinicians when interpreting physical or behavioral characteristics of the child. Finally, some clinicians are hesitant to consider possible prenatal alcohol exposure in the diagnosis of behavioral and learning problems because services or interventions specific to FAS are not available in their community or clinicians are unaware of such services in their community (6).

In 2014, CDC funded six Fetal Alcohol Spectrum Disorders (FASD) Practice and Implementation Centers.* These centers are designed to promote practice change among providers in the areas of FASD prevention, identification, and treatment. Two of the six centers will focus on pediatricians and are partnering with the American Academy of Pediatrics. Focused development of practice guidelines for pediatric clinicians through these Practice and Implementation Centers along with the broad-based dissemination capabilities of the American Academy of Pediatrics can improve identification, documentation, and clinical management of children with FAS, thereby strengthening the infrastructure needed for FAS records-based surveillance.

Collection of accurate population-based surveillance data for FAS is an important public health activity. In addition to providing an estimate of the public health burden of FAS, these data provide critical information to those planning clinical, behavioral, and educational interventions to support children with FAS and their families. Such services have been shown to reduce the risk for secondary conditions in this vulnerable population (7). Because many communities plan for service provision based on the prevalence estimates from records-based

What is already known on this topic?

Fetal alcohol syndrome (FAS) is a serious birth defect and developmental disorder caused by in utero exposure to alcohol. Its reported prevalence varies widely, reflecting differences in study populations and surveillance methods.

What is added by this report?

The prevalence of FAS in children aged 7–9 years in 2010 was 0.3 per 1,000 children in Arizona, 0.3 in Colorado, and 0.8 in New York, with a pooled prevalence of 0.3. These estimates are consistent with previous records-based surveillance estimates but substantially lower than estimates obtained from in-person, expert assessment of school-aged children in the community.

What are the implications for public health practice?

The lower estimates from records-based surveillance might be attributable to the following factors: 1) inadequate recognition of the physical and behavioral characteristics of FAS by clinical care providers; 2) insufficient documentation of those characteristics in the medical record; and 3) failure to consider prenatal alcohol exposure with diagnoses of behavioral and learning problems. Addressing these factors through training of medical and allied health providers can lead to practice changes, ultimately increasing recognition and documentation of the characteristics of FAS.

systems, the need for FAS specific treatments, interventions, and services might not be recognized.

Surveillance of FAS also provides the opportunity to measure the effectiveness of public health interventions aimed at reducing the number of children at risk for FAS because of in utero alcohol exposure. Alcohol consumption during pregnancy is common. During 2006–2010, 7.6% of pregnant women reported drinking alcohol, with 1.4% reporting binge drinking (8). Further, over 50% of pregnancies are unplanned (9), and alcohol exposure can harm the fetus even before the pregnancy is recognized (1). FAS surveillance could provide evidence of the effectiveness of approaches to reduce alcohol consumption during pregnancy. One primary prevention strategy is alcohol screening and brief intervention. A California study found that pregnant women who received alcohol screening and brief intervention at a social service agency were five times more likely to abstain from alcohol during the remainder of their pregnancy and delivered infants who were healthier on several newborn measures (10).

Recognition of children with FAS is critically important to ensure their access to appropriate services and interventions. However, identifying affected children through population-based surveillance continues to be a challenge. Prevalence estimates from the Fetal Alcohol Syndrome Surveillance Network II demonstrate that FAS is still underrecognized. Efforts

*Additional information about this initiative available at <http://www.cdc.gov/ncbddd/fasd/training.html>.

that address the factors that contribute to this underrecognition might lead to practice changes, ultimately increasing recognition and documentation of the physical and behavioral characteristics of FAS. With increased recognition and documentation, records-based surveillance of FAS might yield estimates more similar to those based on in-person, expert assessment of school-aged children in a community.

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Tickborne Relapsing Fever — United States, 1990–2011

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Tickborne relapsing fever (TBRF) is a zoonosis caused by spirochetes of the genus *Borrelia* and transmitted to humans by ticks of the genus *Ornithodoros*. TBRF is endemic in the western United States, predominately in mountainous regions. Clinical illness is characterized by recurrent bouts of fever, headache, and malaise. Although TBRF is usually a mild illness, severe sequelae and death can occur (1–4). This report summarizes the epidemiology of 504 TBRF cases reported from 12 western states during 1990–2011. Cases occurred most commonly among males and among persons aged 10–14 and 40–44 years. Most reported infections occurred among nonresident visitors to areas where TBRF is endemic. Clinicians and public health practitioners need to be familiar with current epidemiology and features of TBRF to adequately diagnose and treat patients and recognize that any TBRF case might indicate an ongoing source of potential exposure that needs to be investigated and eliminated.

TBRF is not nationally reportable, and there is no standard case definition. For the purpose of this report, a TBRF case was defined as a clinically compatible illness with laboratory confirmation of infection or a clinically compatible illness epidemiologically linked to a laboratory-confirmed case. In 2011, TBRF was reportable in 12 states: Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, North Dakota, Oregon, Texas, Utah, and Washington. TBRF case data for these 12 states for the period 1990–2011 were compiled, along with a single case reported to CDC from Wyoming, yielding 504 cases. Three states accounted for approximately 70% of all reported TBRF cases (California, 33%, Washington, 25%, and Colorado, 11%); the remainder were reported from Idaho, 7%, Nevada, 5%, Oregon, 4%, Arizona, 4%, Texas, 4%, New Mexico, 3%, Montana, 2%, Utah, 2%, and Wyoming, <1% (Figure). No cases were reported from North Dakota. County of residence and county of exposure were known for 325 (64%) cases; 215 (66%) of these cases were reported among nonresident visitors to the counties of exposure (Table).

The median number of cases per year was 20, with a range of 14 in 1993 to 45 in 2002. Median age of patients was 38 years (range = 1–91 years). The age distribution was bimodal, with peaks among persons aged 10–14 years and 40–44 years;

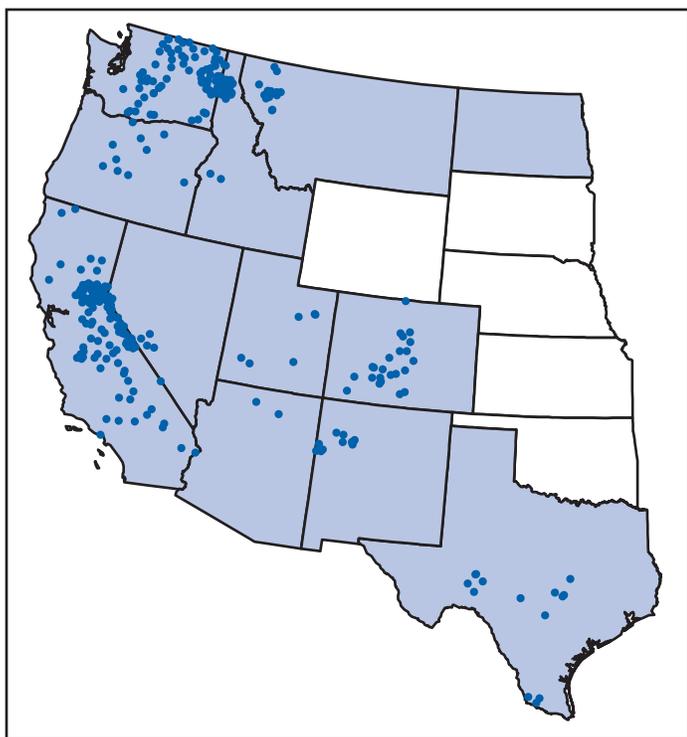
278 (57%) of the patients were male. Race information was not available in the reported data.

Blood smear was indicated as the method of diagnosis for 184 (76%) of 243 cases for which diagnostic information was available. Most (74%) patients had onset of illness during June–September with a peak during July–August (52%). In Texas, cases occurred more frequently (67%) during November–March, and 11 cases (61%) were associated with spelunking.

Most TBRF cases in the United States are caused by *Borrelia hermsii* and transmitted by *Ornithodoros hermsi* ticks. These soft ticks typically live in the nests of rodents such as ground squirrels, tree squirrels, and chipmunks in coniferous forests at elevations between 1,500 and 8,000 feet (457 and 2,438 meters) (5). Soft ticks can acquire TBRF *Borrelia* by feeding on infected rodents, the reservoir hosts; once infected, soft ticks remain infectious for life (6,7). The spirochete, which resides in the salivary gland of the soft tick, can be transmitted within 30 seconds of initiation of a blood meal (5). If the rodent reservoir host dies or vacates the nest, soft ticks seek other sources of blood. In locations where rodents and humans are in close proximity (e.g., seasonally occupied lake or mountain cabins infested by rodents), human infections can occur (8,9). Unlike hard ticks that embed in the host, soft ticks feed briefly (up to 30 minutes) and typically at night, so most patients are unaware that they have been bitten (5,6).

The characteristic clinical feature of TBRF is the occurrence of febrile episodes lasting 3–5 days, with relapses after 5 to 7 days of apparent recovery. This pattern is the result of antigenic variation in spirochete outer surface proteins, temporarily evading the host immune response and allowing spirochete numbers to rebound (5). TBRF is treated with antibiotics, which typically results in cure without sequelae (5). However, complications such as acute respiratory distress syndrome have been described (1,3). The risk for transplacental transmission has been documented and pregnant women might be more susceptible to severe complications such as spontaneous abortion, preterm delivery, and perinatal mortality (2,4). Clinicians need to consider TBRF in patients with compatible clinical illness and a history of residence in or recent travel to areas that are known foci for TBRF. A diagnosis of TBRF can be confirmed by observation of spirochetes in a blood smear taken

FIGURE. Number of reported cases of tickborne relapsing fever — United States, 1990–2011*



* One dot was placed randomly in the county of exposure where known. Clinicians can contact county or state health departments to learn whether tickborne relapsing fever has been reported in a particular county. Shading indicates those states where tickborne relapsing fever was reportable. No cases were reported from North Dakota.

during a febrile episode and either stained with Wright-Giemsa stain or examined with dark field microscopy (5,10). Testing for serum antibodies is not valuable in the acute setting but might be useful for retrospective identification in convalescent patients (5).

No overall increase or decrease in the annual number of cases reported was observed during the reviewed time period. The bimodal age distribution could reflect differences in clinical manifestations, health care seeking behavior, or exposure to infected ticks. Most cases occurred during the summer months, consistent with arthropod vector biology, reservoir host biology, human outdoor activity, and vacation seasons (5). Outbreaks have been reported among groups of young persons on trips, particularly those sleeping on floors, which might further explain the age distribution (9). Notably, cases in Texas occurred more frequently in winter months and were associated with time spent in caves, which likely represents infection with *Borrelia turicatae*, another species of TBRF *Borrelia* transmitted by *Ornithodoros turicata* ticks (5).

TABLE. Ten counties with the greatest numbers of reported cases of tickborne relapsing fever, and the percentage of cases that occurred among nonresidents of the county — United States, 1990–2011

County*	Total no.	Nonresidents	
		No.	(%)
Kootenai, Idaho	29	29	(100)
Mono, California	23	14	(60.9)
Nevada, California	20	15	(75.0)
Spokane, Washington	20	1	(5.0)
Okanogan, Washington	15	5	(33.3)
Placer, California	15	13	(86.7)
El Dorado, California	14	10	(71.4)
Lake, Colorado	13	8	(61.5)
Fresno, California	11	5	(45.5)
McKinley, New Mexico	11	7	(63.6)

* Median elevation of the 10 counties was 3,840 feet (range = 1,178–7,562 feet) (1,170 meters [range = 359–2,305 meters]).

This report is subject to at least two limitations. First, case ascertainment depends upon state-specific practices, and there is no standard surveillance case definition in the 12 western states where TBRF is reportable. Differences in case definitions could lead to ascertainment and reporting bias. Second, TBRF cases likely represent a fraction of the actual incidence because many patients might experience mild, self-limited illness that goes undiagnosed.

Because tick-infested buildings can serve as a source of infection for years, it is important to investigate all TBRF cases to identify the likely location of exposure and guide remediation of rodent and tick infestations. Rodent control alone can increase human risk because any remaining ticks, which can be long-lived, will repeatedly search for alternative hosts. Therefore, it is important to consider tick control in concert with rodent control. Personal preventive practices can include sleeping off the floor and away from walls in rodent-infested buildings and eliminating incentives for rodent residence (e.g., by storing food in tightly sealed containers).* Homeowners in areas where TBRF is endemic can consult with local environmental health specialists and pest removal services on strategies to discourage rodent activity in homes. Persons living in or vacationing in areas where TBRF has been reported need to be aware of the disease and seek medical attention if they develop febrile illness.† Educational outreach would further public health objectives to increase awareness of TBRF prevention measures and clinical signs and symptoms of disease.‡

* Additional information available at <http://www.cdc.gov/relapsing-fever/prevention>.

† Additional information available at <http://www.cdc.gov/relapsing-fever/symptoms>.

‡ Additional information available at <http://www.cdc.gov/relapsing-fever/clinicians>.

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What is already known on this topic?

Tickborne relapsing fever (TBRF) is an uncommon cause of febrile illness in the western United States. The most significant risk factor for infection is sleeping in a rodent-infested cabin or house. In 2011, TBRF was reportable in 12 states.

What is added by this report?

During 1990–2011, a total of 504 cases of TBRF were reported to CDC. Cases occurred most commonly among males and among persons aged 10–14 and 40–44 years. Three states, California, Washington, and Colorado, accounted for approximately 70% of all reported cases. In counties where most reported TBRF exposures occurred, most infections were among visitors to the counties. Most TBRF infections occur during the summer months during peak arthropod, host, and human activity.

What are the implications for public health practice?

Public health practitioners need to be aware of TBRF in locations where it is endemic, and the importance of recognizing and eliminating foci of transmission. Clinicians need to consider TBRF as a cause of febrile illness in visitors to, and persons living in, areas where TBRF is endemic.

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Update on the Epidemiology of Middle East Respiratory Syndrome Coronavirus (MERS-CoV) Infection, and Guidance for the Public, Clinicians, and Public Health Authorities — January 2015

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CDC continues to work with the World Health Organization (WHO) and other partners to closely monitor Middle East respiratory syndrome coronavirus (MERS-CoV) infections globally and to better understand the risks to public health. The purpose of this report is to provide a brief update on MERS-CoV epidemiology and to notify health care providers, public health officials, and others to maintain awareness of the need to consider MERS-CoV infection in persons who have recently traveled from countries in or near the Arabian Peninsula.*

MERS-CoV was first identified and reported to WHO in September 2012 (1). As of January 23, 2015, WHO has confirmed 956 laboratory-confirmed[†] cases of MERS-CoV

*Countries considered in the Arabian Peninsula and neighboring include: Bahrain; Iraq; Iran; Israel, the West Bank and Gaza; Jordan; Kuwait; Lebanon; Oman; Qatar; Saudi Arabia; Syria; the United Arab Emirates; and Yemen.

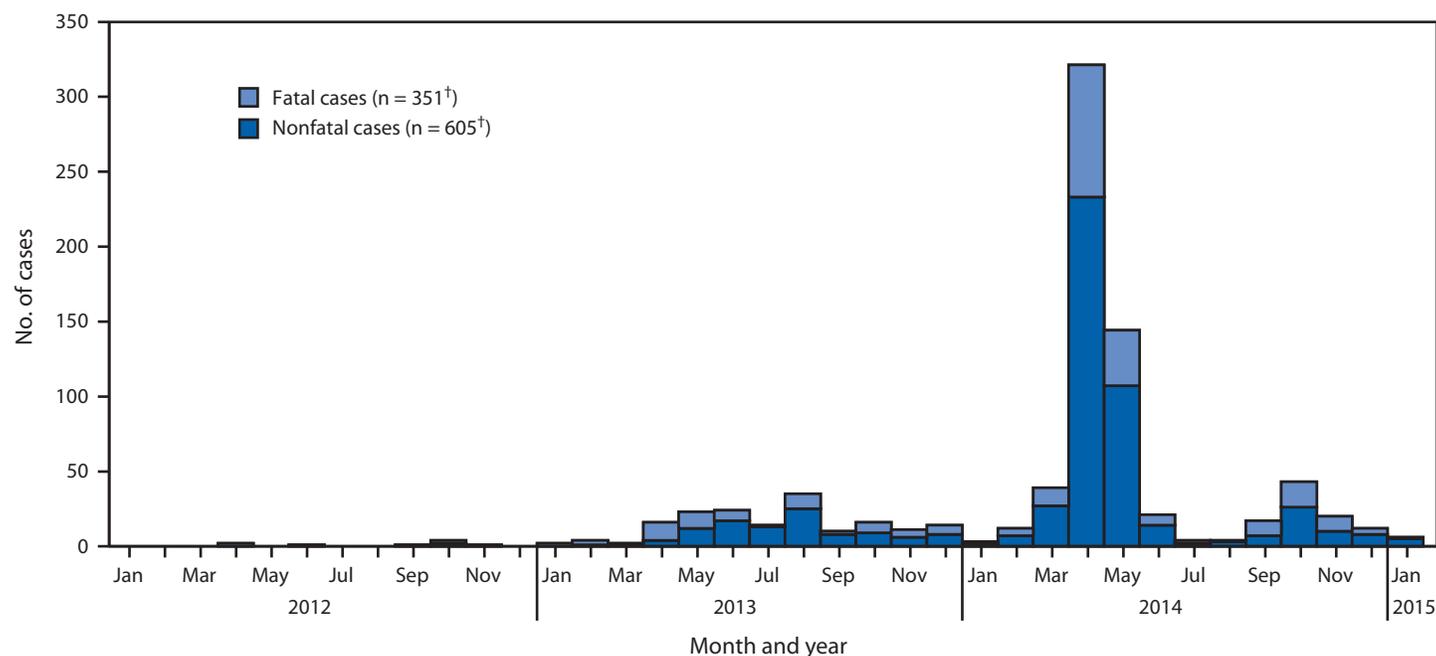
[†]Confirmatory laboratory testing requires a positive polymerase chain reaction test result on at least two specific genomic targets for MERS-CoV or a single positive target with sequencing on a second.

infection, which include at least 351 deaths. All reported cases have been directly or indirectly linked through travel or residence to nine countries: Saudi Arabia, the United Arab Emirates, Qatar, Jordan, Oman, Kuwait, Yemen, Lebanon, and Iran. In the United States, two patients tested positive for MERS-CoV in May 2014, each of whom had a history of fever and one or more respiratory symptoms after recent travel from Saudi Arabia (2). No further cases have been reported in the United States despite nationwide surveillance and the testing of 514 patients from 45 states to date.

The majority (504) of the 956 MERS cases were reported to have occurred during March–May 2014 (Figure). However, WHO continues to receive reports of MERS cases, mostly from Saudi Arabia.[§] From August 1, 2014, through January 23, 2015, WHO confirmed 102 cases, 97 of which occurred in

[§]Additional information available at http://www.who.int/csr/don/archive/disease/coronavirus_infections/en.

FIGURE. Number of cases of Middle East respiratory syndrome coronavirus infection reported by the World Health Organization,* by month of illness onset — worldwide, 2012–2015



* Data as of January 23, 2015, available at http://www.who.int/csr/don/archive/disease/coronavirus_infections/en.

[†] During June 3–October 16, 2014, a total of 130 additional cases and 84 deaths were reported with insufficient information to determine month of onset. These cases and deaths are not included in the figure but are included in the total cases and deaths counts.

persons with residence in Saudi Arabia, including three travel-associated cases reported by Austria, Turkey, and Jordan; of the remaining cases, two cases were in persons from Qatar, and three cases were in persons from Oman.

CDC continues to recommend that U.S. travelers to countries in or near the Arabian Peninsula protect themselves from respiratory diseases, including MERS, by washing their hands often and avoiding contact with persons who are ill. If travelers to the region have onset of fever and symptoms of respiratory illness during their trip or within 14 days of returning to the United States, they should seek medical care. They should call ahead to inform their health care provider of their recent travel so that appropriate isolation measures can be taken in health care settings. Health care providers and health departments throughout the United States should continue to consider a diagnosis of MERS-CoV infection in persons who develop fever and respiratory symptoms within 14 days after traveling from countries in or near the Arabian Peninsula, and be prepared to detect and manage cases of MERS.

Recommendations might change and be updated as additional data become available. More detailed travel recommendations related to MERS, including general precautions posted by WHO for anyone visiting farms, markets, barns, or other places where animals are present, are available at <http://wwwnc.cdc.gov/travel/notices/alert/coronavirus-arabian-peninsula>. The website also lists more specific WHO recommendations for persons with diabetes, kidney failure,

or chronic lung disease, and immunocompromised persons, that include avoiding contact with camels.[¶] Guidance on the evaluation of patients for MERS-CoV infection, infection control, home care and isolation, and clinical specimen collection and testing is available on the CDC MERS website at <http://www.cdc.gov/coronavirus/mers/index.html>. Treatment is supportive; no specific treatment for MERS-CoV infection is available. WHO has posted guidance for clinical management of MERS patients at http://www.who.int/csr/disease/coronavirus_infections/InterimGuidance_ClinicalManagement_NovelCoronavirus_11Feb13u.pdf?ua=1.

[¶]Additional information available at http://www.who.int/csr/disease/coronavirus_infections/MERS_CoV_RA_20140613.pdf?ua=1.

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Public Health Response to Commercial Airline Travel of a Person with Ebola Virus Infection — United States, 2014

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On January 23, 2015, this report was posted as an MMWR Early Release on the MMWR website (<http://www.cdc.gov/mmwr>).

Before the current Ebola epidemic in West Africa, there were few documented cases of symptomatic Ebola patients traveling by commercial airline (1,2), and no evidence of transmission to passengers or crew members during airline travel. In July 2014 two persons with confirmed Ebola virus infection who were infected early in the Nigeria outbreak traveled by commercial airline while symptomatic, involving a total of four flights (two international flights and two Nigeria domestic flights). It is not clear what symptoms either of these two passengers experienced during flight; however, one collapsed in the airport shortly after landing, and the other was documented to have fever, vomiting, and diarrhea on the day the flight arrived. Neither infected passenger transmitted Ebola to other passengers or crew on these flights (3,4). In October 2014, another airline passenger, a U.S. health care worker who had traveled domestically on two commercial flights, was confirmed to have Ebola virus infection. Given that the time of onset of symptoms was uncertain, an Ebola airline contact investigation in the United States was conducted. In total, follow-up was conducted for 268 contacts in nine states, including all 247 passengers from both flights, 12 flight crew members, eight cleaning crew members, and one federal airport worker (81 of these contacts were documented in a report published previously [5]). All contacts were accounted for by state and local jurisdictions and followed until completion of their 21-day incubation periods. No secondary cases of Ebola were identified in this investigation, confirming that transmission of Ebola during commercial air travel did not occur.

Investigation Protocols

On October 14, 2014, the health care worker, who was among those who had cared for a patient with confirmed Ebola in the United States (6), experienced fever and rash and sought medical care. On October 15, Ebola virus infection was confirmed in this health care worker, who had traveled by commercial airline from Dallas, Texas, to Cleveland, Ohio, on October 10, 2014, and from Ohio to Texas on October 13, 2014 (Figure). The date of symptom onset was uncertain;

however, based on medical history and clinical and laboratory findings, CDC determined that a contact investigation should be performed for persons aboard either flight (5).

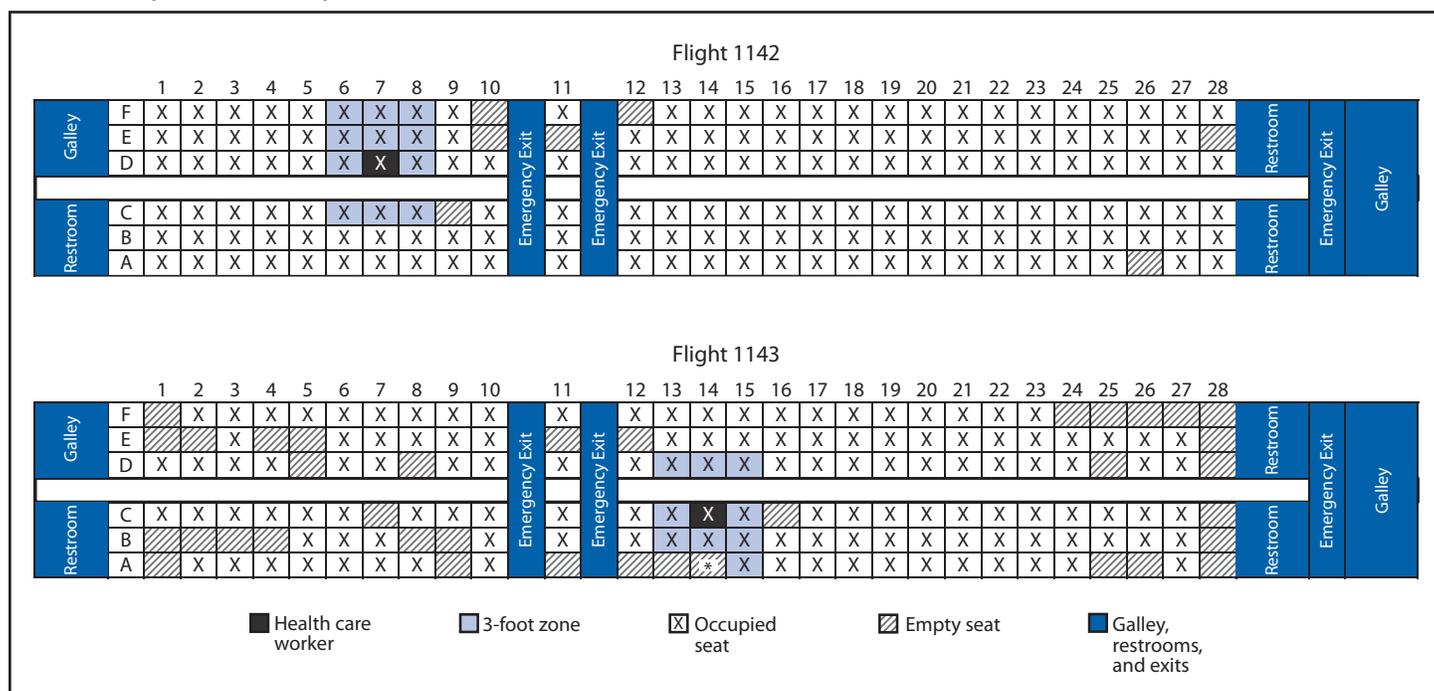
The CDC public health response protocol for airline contact investigations involving viral hemorrhagic fevers such as Ebola involves using brief interviews about exposures and events on the flight to determine risk categories. Previously, the investigation was limited to the flight attendants and cleaning crew members who serviced the flight and to passengers seated for an extended time within 3 feet of the symptomatic passenger. This earlier protocol recommended that contacts self-monitor for fever or other symptoms for 21 days and check in weekly with the local health department, but did not recommend restrictions on travel or other activities for contacts who were asymptomatic.

Because of concern after transmission of Ebola to health care workers in Texas and recognition that data on transmission risk aboard aircraft were limited, all passengers and crew were investigated, and CDC issued additional recommendations for the investigation of the two flights between Texas and Ohio. Within 48 hours after onset of the investigation for each flight, all passengers and flight crew had been notified about the health care worker with Ebola and the ongoing investigation (Table 1). All cleaning crew members were contacted and interviewed by October 21.

Categorization of Contacts

At the beginning of the investigation, the recommendations from CDC to state and local health departments categorized all passengers seated within 3 feet of the traveler with confirmed Ebola (the 3-foot zone) as having “some risk” (Figure). Four public health actions were recommended for these passengers. First, interview these passengers using the standard interview form. Second, initiate active, twice-daily monitoring for symptoms and fever for the 21 days following the flight; passengers were required to take their own temperature twice daily and report it to the health department once a day. Third, place these passengers in quarantine; the specific terms of quarantine were left to the discretion of the state and local jurisdictions. Fourth, place these passengers on federal public health travel

FIGURE. Seating charts for commercial airline flights 1142 and 1143 taken by a health care worker later diagnosed with Ebola, which became the focus of a public health response — United States, October 10 and 13, 2014



* One passenger on flight 1143 was in the 3-foot zone for only 15 minutes before exiting the plane before takeoff.

restrictions (the Do Not Board list) to ensure they could not travel commercially.

Travelers seated outside the 3-foot (approximately 1 meter) zone were considered at a lower risk of exposure and were categorized in the “uncertain risk” group. Flight attendants who reported they had no known direct contact with the Ebola patient also were categorized as uncertain risk. CDC recommended that state and local health departments initiate active, twice-daily monitoring for fever and symptoms for passengers in the uncertain risk group. If people in this risk group developed symptoms, health departments were asked to complete the standard passenger or flight crew interview and contact CDC. CDC did not recommend movement or travel restrictions for passengers in the uncertain risk group, and specific guidance was at the discretion of the health departments.

If it was determined that there was no environmental contamination of the aircraft related to the Ebola patient (e.g., diarrhea or vomiting), persons who had no contact with the Ebola patient and were not within the passenger cabin (i.e., were in the cockpit) would be categorized in the “no known risk” group. This would also include the cleaning crews if no additional potential exposures were reported. The no known risk group would not require active monitoring, occupational restrictions, or travel restrictions.

In this investigation, CDC recommended that all passengers and crew members, including persons in the no known risk and uncertain risk groups, be contacted by state or local public health authorities at the end of 21 days to ensure that 1) they had remained symptom-free throughout the incubation period, or 2) any symptoms experienced were properly reported, assessed, and determined not to be caused by Ebola.

Public health actions varied by state and local jurisdiction. Many jurisdictions chose to have frequent follow-up with contacts, including those in the uncertain risk group, which in some cases included daily interaction with contacts. Other variations included requiring direct active monitoring of passengers in the 3-foot zone, which included twice-daily check-ins (once in person, and once by phone) (5,6). Although states could have issued quarantine orders for passengers in the “some risk group,” they all chose the less restrictive option of issuing guidelines to these contacts for social distancing, which typically involved avoiding congregate settings and maintaining a 3-foot distance from others.

All 268 passengers and members of the flight and cleaning crews from the two flights were contacted, interviewed, and categorized into risk groups (Table 1). Mean age of the 268 contacts was 41.4 years (range = 6 months–90 years). Of the 268 contacts, 21 (7.8%) passengers were classified as “some risk.” These included 20 passengers seated in the 3-foot contact zone

TABLE 1. Number of contacts (N = 268) followed from two flights taken by a health care worker later diagnosed with Ebola, by flight role — United States, October 10 and 13, 2014

Flight role	Flight 1* (Oct 10, 2014)	Flight 2† (Oct 13, 2014)	Total contacts
Passengers	164	134	247 [§]
Flight crew	6	6	12
Cleaning crew	5	3	8
Airport staff	1	0	1
Total contacts	176	143	268

* Contacts by state of location on day 21 (Texas 122 persons, Ohio 46, Colorado 5, Illinois 1, Maryland 1, and North Carolina 1).

† Contacts by state or country of location at day 21 (Texas 93 persons, Ohio 36, Colorado 5, Ireland 2, Illinois 1, Maryland 1, Nevada 1, and North Carolina 1).

§ 51 passengers traveled on both flights.

during the flight and one passenger who sat within the zone for 15 minutes before exiting the aircraft (Figure). CDC placed the 20 passengers who were seated in the 3-foot contact zone during the flight on the federal Do Not Board list, and a 21-day monitoring period was initiated by their respective state public health authorities. The passenger in the some risk group because of the 15-minute exposure was not placed on the Do Not Board list; however, this person did not travel and received the same monitoring by public health authorities as others in the group. On October 27 (day 17 of monitoring for the first flight, and day 14 for the second flight), CDC's categorization guidance was changed such that federal travel restrictions were no longer required for the passengers in the some risk group, and the 20 were removed from the Do Not Board list.

Findings

There were no reports from the Ebola patient, flight attendants, or passengers that the patient had vomited or had diarrhea during the two flights resulting in contamination of the plane. Of the 12 persons involved in serving or cleaning the cabin, six reported wearing gloves, and one reported using hand sanitizer after picking up a few items in the cabin without wearing gloves.

Of the 268 contacts, 32 (11.9%), including 28 passengers, three flight crew members, and one member of the cleaning crew, reported within 21 days of the flight one or more symptoms that can occur with Ebola (Table 2). One passenger in the uncertain risk category experienced a fever (defined as a temperature of $\geq 100.4^{\circ}\text{F}$ [$\geq 38^{\circ}\text{C}$]) on day 21 of monitoring and was hospitalized the same day. The fever was accompanied by respiratory symptoms and continued for several days without a confirmed alternative diagnosis, resulting in Ebola testing on days 1 and 3 of symptoms. Both tests were negative. There were 19 passengers who had temperatures of 99.0°F (37.2°C) or higher, but $<100.4^{\circ}\text{F}$. Of these 19 with elevated temperatures, 13 had a single episode of elevated temperature,

What is already known on this topic?

Given that transmission of Ebola occurs through direct contact with body fluids of symptomatic or deceased patients, the probability of contracting Ebola during commercial air travel is thought to be low. There have been few documented cases of Ebola patients traveling by commercial aircraft while symptomatic, and limited detail in scientific reports regarding these cases or the public health response.

What is added by this report?

A health care worker infected with Ebola virus traveled on two commercial flights within the United States before being diagnosed with Ebola. A total of 268 contacts in nine states (all 247 passengers, 12 flight crew, eight cleaning crew, and one federal airport worker) were notified and monitored for 21 days. Thirty-two persons had one or more symptoms that can occur with Ebola, but only one had symptoms that prompted Ebola testing, which was negative. No transmission of Ebola occurred on either flight.

What are the implications for public health practice?

The more inclusive approach in this investigation provided evidence that the risk for transmission of Ebola is likely low if the patient's symptoms do not include vomiting, diarrhea, or bleeding. In cases where there is little or no environmental contamination of the aircraft, an investigation that is limited to passengers seated within 3 feet of the patient might be appropriate.

and six had multiple episodes. Although some passengers experienced symptoms that can occur with Ebola illness during their 21-day monitoring period, the monitoring period passed with no secondary cases of Ebola found.

Discussion

No secondary cases of Ebola were found in this investigation, and to date, no other airline contact investigations involving travelers with confirmed Ebola have found secondary cases among passengers or crew members (1–3,7). Guidelines for airline contact investigations for viral hemorrhagic fevers vary among countries and typically do not include notification of every passenger (7,8). When it was first learned that two U.S. health care workers using personal protective equipment had become infected with Ebola virus, CDC adopted a conservative approach for the airline contact investigation until additional information could be obtained. CDC expanded its existing airline contact investigation protocol to include all passengers, rather than limit the investigation to passengers who had been within 3 feet of the Ebola patient for a prolonged time. CDC guidance and contact investigation protocols were adapted to best protect the health of the public and address public concerns. As it became increasingly clear that Ebola transmission dynamics had not changed and transmission to passengers was not likely, the recommendations were modified to decrease restrictions on passengers within the 3-foot zone by no longer

TABLE 2. Symptoms reported by contacts (n = 32) from two flights within 21 days of exposure to a health care worker later diagnosed with Ebola — United States, 2014

Symptom*	Symptoms reported by 32 contacts	Symptoms reported by 21 contacts in 3-foot zone
Fever ($\geq 100.4^{\circ}\text{F}$ [$\geq 38^{\circ}\text{C}$])	1	0
Abdominal pain	3	0
Unusual bleeding	0	0
Body aches	6	2
Diarrhea	2	0
Headache	24	3
Hiccups	0	0
Rash	1	0
Sore throat	14	2
Vomiting	0	0
Weakness	2	0

* Contacts could report more than one type of symptom.

recommending that these passengers be issued quarantine orders or be added to the Do Not Board list.

Although no Ebola virus transmission occurred on these two domestic commercial flights, these findings might not be applicable to all airline contact investigations. For example, transmission during airline travel might be more likely if an exposure to body fluids from a passenger with more severe symptoms such as vomiting, diarrhea, or bleeding was to occur. In addition, both flights in this investigation were <4 hours in duration; longer flights might pose a greater risk for transmission. Previous airline contact investigations have not found evidence of Ebola transmission on commercial flights; however information about the symptoms experienced by Ebola patients aboard the aircraft in these few cases is limited (1–3,7).

This airline contact investigation provides additional evidence that the risk for Ebola transmission on commercial aircraft is likely very low when there is no evidence of blood or other body fluid exposure. Additional public health investigations and statistical modeling might be helpful to further define the possible risk for Ebola transmission on commercial

flights. In future commercial flights involving Ebola-infected passengers, circumstances such as duration of exposure and degree of environmental contamination should be taken into consideration. Depending on these circumstances, limiting contact tracing to the flight crew and passengers seated within 3 feet of the Ebola patient might be appropriate.

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Effectiveness of Ebola Treatment Units and Community Care Centers — Liberia, September 23–October 31, 2014

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On January 23, 2015, this report was posted as an MMWR Early Release on the MMWR website (<http://www.cdc.gov/mmwr>).

Previous reports have shown that an Ebola outbreak can be slowed, and eventually stopped, by placing Ebola patients into settings where there is reduced risk for onward Ebola transmission, such as Ebola treatment units (ETUs) and community care centers (CCCs) or equivalent community settings that encourage changes in human behaviors to reduce transmission risk, such as making burials safe and reducing contact with Ebola patients (1,2). Using cumulative case count data from Liberia up to August 28, 2014, the EbolaResponse model (3) previously estimated that without any additional interventions or further changes in human behavior, there would have been approximately 23,000 reported Ebola cases by October 31, 2014. In actuality, there were 6,525 reported cases by that date. To estimate the effectiveness of ETUs and CCCs or equivalent community settings in preventing greater Ebola transmission, CDC applied the EbolaResponse model (3) to the period September 23–October 31, 2014, in Liberia. The results showed that admitting Ebola patients to ETUs alone prevented an estimated 2,244 Ebola cases. Having patients receive care in CCCs or equivalent community settings with a reduced risk for Ebola transmission prevented an estimated 4,487 cases. Having patients receive care in either ETUs or CCCs or in equivalent community settings, prevented an estimated 9,100 cases, apparently as the result of a synergistic effect in which the impact of the combined interventions was greater than the sum of the two interventions. Caring for patients in ETUs, CCCs, or in equivalent community settings with reduced risk for transmission can be important components of a successful public health response to an Ebola epidemic.

One component of the national strategy in Liberia for responding to the ongoing Ebola epidemic is to isolate persons with suspected, probable, or confirmed Ebola in ETUs or, when ETUs are full or otherwise not available, in community-based settings such as CCCs, where there also is a reduced risk for Ebola transmission (4). The EbolaResponse model was used to estimate how many Ebola cases were averted in Liberia during September 23–October 31, 2014, because of the use of ETUs, CCCs, and equivalent community settings. This period was selected for study because there was a notable increase in interventions during that period that correlated with a decrease in cases (4,5).

The spreadsheet-based EbolaResponse modeling tool tracks patients through the following states of Ebola virus infection and disease: susceptible to disease, infected, incubating, infectious, and recovered. Data from reports of previous Ebola outbreaks were used to model the daily change of patients' status between the disease states. For example, a probability distribution to characterize the likelihood of incubating a given number of days was built using previously published data (3). Patients in the modeled population were distributed into three categories: 1) hospitalized in an ETU; 2) placed into a CCC or a home in a community setting where there was a reduced risk for disease transmission and an emphasis on changing human behaviors with regard to safe burials and reducing contact with patients; and 3) left at home with no effective isolation or safe burials. Both the risk for onward disease transmission by patient category and the percentage of patients in each category were calculated by altering these values until the estimates of cumulative cases over time produced by the model (the model "fit" [3]) closely matched those of the actual data.

An initial estimate of cumulative cases was made by fitting the EbolaResponse model to cumulative Liberian case count data (i.e., confirmed, probable, and suspected cases) from March 27 to November 15, 2014 (6). A good fit of the estimated cases to actual cases was obtained when patients were distributed, for the period September 23–October 31, 2014, into the three categories as follows: 20% of Ebola cases in ETUs, 35% in CCCs or equivalent community settings with a reduced risk for Ebola transmission, and 45% at home without effective isolation or safe burials. Three scenarios were then built to estimate the impact of ETUs and CCCs during the study period.

Three Estimation Scenarios

In scenario 1, to estimate the impact of placing Ebola patients in ETUs, for the period September 23–October 31, 2014, the 20% of all Ebola patients calculated to be in ETUs were moved to the category of patients who were at home without effective isolation or safe burials. The 35% of patients calculated to be in CCCs or equivalent community settings with reduced risk were unchanged. The model was refitted to produce estimates of cases that would have occurred without any patients in ETUs.

In scenario 2, to estimate the impact of the 35% of Ebola patients calculated to be in CCCs or equivalent community

settings with reduced risk for Ebola, the 35% were moved to the category of patients who were at home without effective isolation or safe burials. The 20% of patients in ETUs were unchanged, and the model was refitted to provide estimates of cases that would have occurred without any patients in CCCs or equivalent community settings.

In scenario 3, to measure the impact of placing patients in either ETUs or CCCs, the 55% of patients calculated to be in either ETUs or CCCs or equivalent community settings were moved to the category of patients who were at home without effective isolation or safe burials. The model was then refitted to provide estimates of cases without any patients in either ETUs or CCCs (Table 1).

Number of Ebola Cases Averted

The cumulative number of estimated cases during March 27–October 31, 2014, based on model assumptions, was 6,218, compared with 6,525 cumulative cases reported in Liberia (6). If no patients had been hospitalized in ETUs starting on September 23, 2014, (scenario 1), there would have been an estimated additional 2,244 cases by October 31, 2014 (Figure, Table 2). If no patients had been placed into CCCs or equivalent community settings with reduced risk for transmission, there would have been an estimated additional 4,487 cases by October 31, 2014. If no patients were placed into either ETUs or CCCs or the equivalent settings with reduced risk for Ebola transmission (scenario 3), there would have been an estimated additional 9,097 cases by October 31, 2014 (Figure).

TABLE 1. Percentage of Ebola cases in each category of patient care, by three scenarios used to estimate the impact if there were no Ebola treatment units (ETUs) and community care centers (CCCs)* — Liberia, September 23–October 31, 2014

Patient care category	Initial estimates of % of patients by category [†]	% estimates if no ETUs (scenario 1)	% estimates if no CCCs (scenario 2)	% estimates if no ETUs or CCCs (scenario 3)
ETUs	20	0	20	0
CCCs	35	35	0	0
At home without effective isolation [§]	45	65	80	100

* CCCs or equivalent community settings with a reduced risk for Ebola transmission (including safe burial and community-based programs to change human behavior to reduce contact with patients).

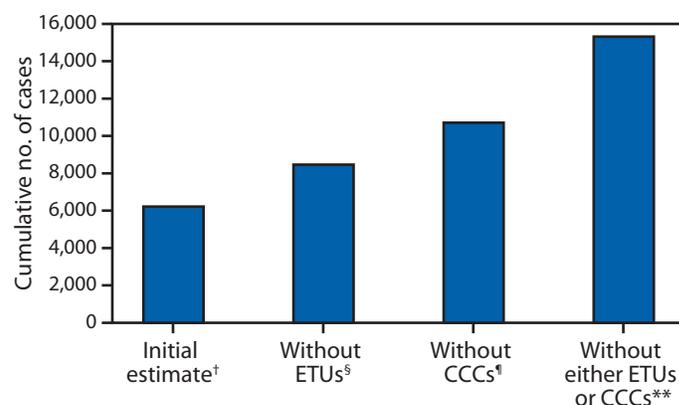
[†] The initial estimates were calculated by fitting the EbolaResponse model to cumulative cases in Liberia for the period March 27–November 15, 2014. From this fit, 6,218 cumulative cases were estimated to have occurred by October 31, 2014. During September 23–October 31, 2014, it was calculated that 20% of Ebola patients were in ETUs, 35% were in CCCs or equivalent community settings with a reduced risk for Ebola transmission (including safe burial), and, 45% were at home without effective isolation, resulting in an increased risk for Ebola transmission (including unsafe burials).

[§] Resulting in an increased risk for Ebola transmission (including unsafe burials).

Also estimated were the number of Ebola cases that would be averted for the period September 23–October 31, 2014, by placing only 1% of patients in either an ETU or a CCC or both. This calculation assumed that the number of cases averted per 1% of patients placed into ETUs or CCCs did not change as the total percentage of patients in these care settings increased (i.e., a linear correlation was assumed between cases averted and percentage of patients in the care settings).

During September 23–October 31, 2014, for every 1% of patients placed into ETUs, an estimated 112 cases would have been averted (Table 2). Similarly, for every 1% of patients placed into CCCs or equivalent settings with reduced risk for transmission, an estimated 128 cases would have been averted. For every 1% increase in patients placed into ETUs or CCCs or equivalent settings, an estimated 165 cases would have been averted (Table 2).

FIGURE. Estimates of the cumulative number of Ebola cases with and without Ebola treatment units (ETUs) and community care centers (CCCs)* — Liberia, September 23–October 31, 2014



* CCCs or equivalent community settings with a reduced risk for Ebola transmission (including safe burial and community-based programs to change human behavior to reduce contact with patients).

[†] The initial estimate was calculated by fitting the EbolaResponse model to cumulative cases in Liberia for the period March 27–November 15, 2014. From this fit, 6,218 cumulative cases were estimated to have occurred by October 31, 2014. During September 23–October 31, 2014, it was calculated that 20% of Ebola patients were in ETUs, 35% were in CCCs or equivalent community settings with a reduced risk for Ebola transmission (including safe burial), and, 45% were at home without effective isolation, resulting in an increased risk for Ebola transmission (including unsafe burials).

[§] The impact if there were no ETUs was calculated by moving the 20% of Ebola patients in ETUs in the initial estimate to the category of patients who were at home without effective isolation (including unsafe burials).

[¶] The impact if there were no CCCs, safe burials, and other community-based interventions to reduce the risk for transmission was calculated by moving the 35% of patients in CCCs or equivalent community settings to the category of patients who were at home without effective isolation (including unsafe burials).

^{**} The combined impact if there were no ETUs and CCCs, safe burials and other community-based interventions to reduce the risk for transmission was calculated by moving both the 20% of patients in ETUs and 35% of patients in CCCs or equivalent community settings to the category of patients who were at home without effective isolation (including unsafe burials).

TABLE 2. Estimated number of Ebola cases averted per 1% change in the number of patients in Ebola treatment units (ETUs) and community care centers (CCCs)* — Liberia, September 23–October 31, 2014

Patient care category	No. of cases averted	No. of cases averted per 1% change in patients [†]
ETUs	2,244	112
CCCs	4,487	128
Patients in either ETUs or CCCs	9,097	165

* CCCs or equivalent community settings with a reduced risk for Ebola transmission (including safe burial and community-based programs to change human behavior to reduce contact with patients).

[†] For every 1% of patients placed into the relevant patient care category (ETUs, CCCs, or either), the number of cases that would be averted (assuming a linear correlation between cases averted and patients in ETUs or CCCs or either).

Also calculated were the numbers of days required in each scenario for the number of cases to double (doubling time). For the study period, under scenario 1 (no ETUs operating) and scenario 2 (no CCCs or equivalent settings), cases doubled in 23 and 20 days, respectively. Under scenario 3 (neither ETUs nor CCCs operating), cases doubled in 18 days.

Discussion

During September 23–October 31, 2014, placing Ebola patients into ETUs or CCCs or equivalent settings with reduced transmission risk prevented an estimated 9,097 cases of Ebola in Liberia. The findings in this report support those from an earlier report on Lofa County, Liberia, that found ETUs played a major role in reducing the number of cases in October (5).

Of note is the finding that scenario 3 (combined effect of ETUs and CCCs) resulted in more cases averted than the sum of the estimated cases averted from scenario 1 (patients in ETUs) and scenario 2 (patients in CCCs and equivalent community settings). This apparent synergistic effect from having both ETUs and CCCs operating in a community during an Ebola epidemic might have resulted from the alteration of the doubling time.

The findings in this report are subject to at least two limitations. First, the findings are limited by the previously described limitations associated with using the EbolaResponse model (3). Second, the study is limited by the implicit assumption of a constant relationship (i.e., linear correlation) between patients in ETUs or CCCs and cases averted. In reality, such relationships most likely vary with changes in the number of total cases and the number of patients in ETUs or CCCs. Thus, caution should be exercised when using these results to estimate the potential impact of ETUs and CCCs in other settings.

The results of this study demonstrate the importance of effective isolation of Ebola patients in ETUs and CCCs in controlling an Ebola outbreak. At the peak of an Ebola outbreak

What is already known on this topic?

Previous studies have documented the decline in the number of Ebola cases in the Liberian counties of Montserrado and Lofa resulting from public health interventions. These measures included the establishment of Ebola treatment centers (ETUs) and community care centers (CCCs) and the provision of community-based education to encourage changes in human behaviors, such as providing safe burials and reducing contact with patients.

What is added by this report?

This report provides estimates of the relative impact ETUs and CCCs and equivalent community settings with reduced risk for Ebola transmission. The findings indicate that during September 23–October 31, 2014, hospitalizing approximately 20% of all Ebola patients in ETUs prevented an estimated 2,244 cases, and placing 35% of patients in CCCs or equivalent community settings that encourage safe burials and reduced contact with patients prevented an estimated 4,487 cases. Together, these interventions prevented an estimated 9,097 cases; the impact of the combined interventions was greater than the sum of the individual interventions.

What are the implications for public health practice?

These data demonstrate that, when responding to large-scale outbreaks of Ebola, rapid initiation of both ETUs and CCCs can avert cases of Ebola.

in a community, there might be insufficient ETU capacity to accommodate all Ebola patients (4). Under such circumstances, provision of CCCs and community-based programs that encourage safe burials and reduced contact with Ebola patients should be established at least as interim measures until adequate treatment capacity is available. These data indicate that the rapid initiation of a multifaceted response to a large Ebola outbreak in Liberia was warranted.

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A Plan for Community Event-Based Surveillance to Reduce Ebola Transmission — Sierra Leone, 2014–2015

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On January 23, 2015, this report was posted as an MMWR Early Release on the MMWR website (<http://www.cdc.gov/mmwr>).

Ebola virus disease (Ebola) was first detected in Sierra Leone in May 2014 and was likely introduced into the eastern part of the country from Guinea (1). The disease spread westward, eventually affecting Freetown, Sierra Leone's densely populated capital. By December 2014, Sierra Leone had more Ebola cases than Guinea and Liberia, the other two West African countries that have experienced widespread transmission (2). As the epidemic intensified through the summer and fall, an increasing number of infected persons were not being detected by the county's surveillance system until they had died (Figures 1 and 2). Instead of being found early in the disease course and quickly isolated, these persons remained in their communities throughout their illness, likely spreading the disease.

In October 2014, members of the International Rescue Committee (IRC), Sierra Leone's Bo District Health Management Team (DHMT), and CDC developed the Community Event-Based Surveillance (CEBS) system* to help strengthen the country's Ebola surveillance and response capabilities. It consists of community health monitors who are trained to detect trigger events (Box) thought to be associated with Ebola transmission to find possible cases early in the course of disease, and surveillance supervisors who investigate reported events and isolate and begin treating persons with suspected Ebola.† It is not intended to replace the current system, but to supplement case-finding and contact tracing, the core of Ebola surveillance in the West African response (5,6). CEBS is being pilot tested in Sierra Leone's Bo District and recently has been adopted as part of Sierra Leone's national surveillance strategy in low- and medium-transmission districts.§ It will

* This type of surveillance has been used in previous Ebola outbreaks in Uganda (3,4) in addition to outbreaks of other infectious diseases, such as polio and influenza, throughout the world.

† In Sierra Leone, there are three ways to meet the suspected case definition: 1) a person must have a temperature >100.4°F (>38.0°C) and three or more symptoms associated with Ebola, such as vomiting, diarrhea, abdominal pain, headache, joint pain, fatigue, or unusual bleeding; 2) a person must have a fever and have been in contact with a confirmed case in the preceding 3 weeks; or 3) a person must be bleeding for an unexplained reason.

§ Sierra Leone has 14 districts, which comprise 149 chiefdoms. Each chiefdom is further divided into sections and then into villages. Bo District consists of 15 chiefdoms and approximately 1,000 villages and has both rural and urban areas. The second largest city in the country, Bo Town, is located in Bo District. Bo District has one Ebola holding center, one Ebola treatment unit, and a CDC laboratory that tests for Ebola.

be deployed to other parts of the country soon. This report describes the CEBS system, plans for its evaluation, and some expected benefits and challenges.

Pilot Overview

In November 2014, the IRC implementation team chose two chiefdoms (Gbo and Selenga) in Bo District as pilot areas to assess the feasibility and acceptability of CEBS.¶ Local community health officers, who serve as clinical staff and health care facility administrators, consulted with the Gbo and Selenga paramount chiefs and chose community health monitors (e.g., teachers, farmers, or other community members who are knowledgeable about their village and its inhabitants) from participating villages.

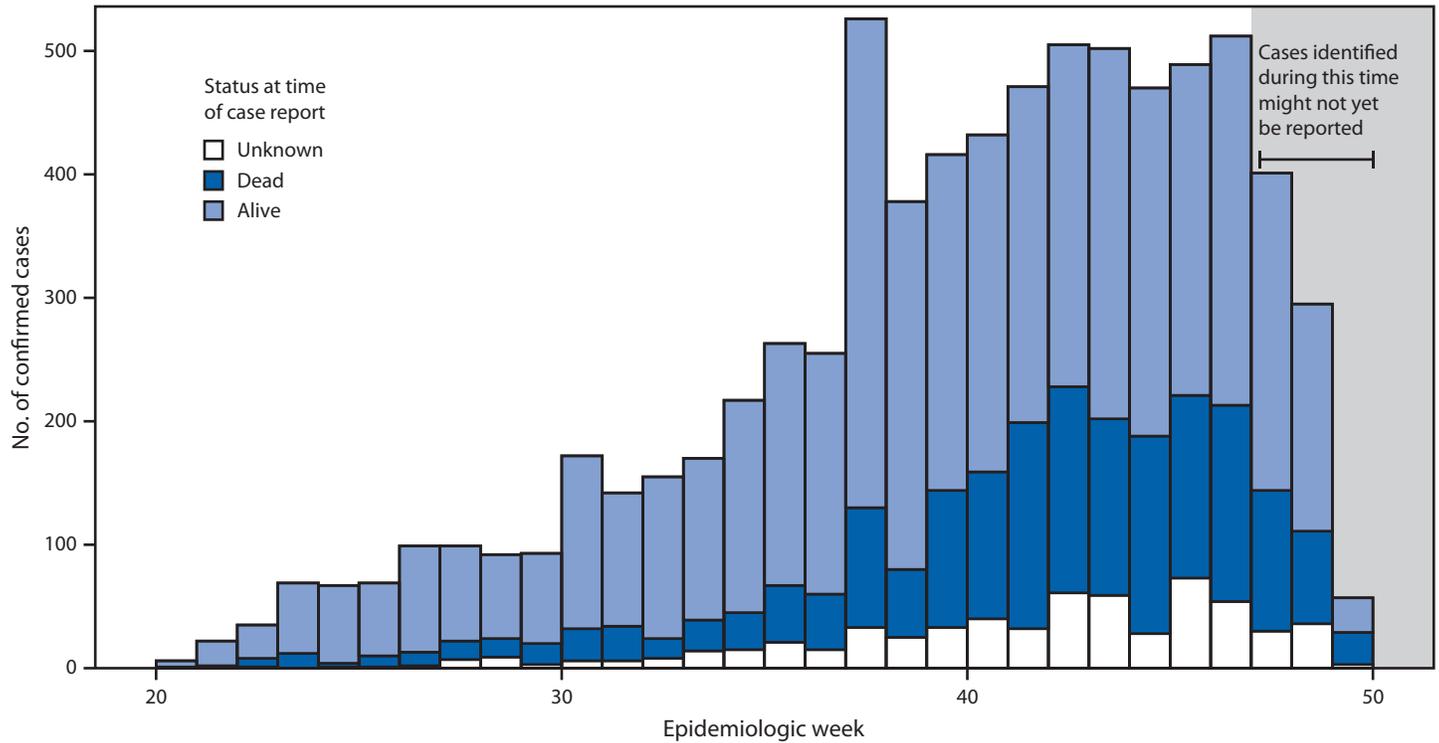
Monitors are trained to detect and to report trigger events selected by the Bo District community health officers that might indicate introduction or presence of Ebola in a village, such as signs of illness among family members, friends, health care workers, funeral attendees, or travelers. Monitors function alongside the district contact tracers, but focus on detecting trigger events, which might involve previously unknown contacts. Monitors are provided with cellphones in a closed user group to facilitate communication, and receive a stipend to compensate for time spent away from their regular work.

When a monitor learns of a trigger event in the village, he or she reports the event to a local community surveillance supervisor. Supervisors are responsible for investigating trigger events and determining whether these indicate suspected Ebola cases. The supervisor must visit the affected village and conduct the investigation within 24 hours of the initial call. To ensure timely and consistent reporting, supervisors call monitors every week to check for missed alerts and to confirm that the monitors did not detect any Ebola trigger events. The supervisors document all calls with monitors, including those that do not result in detection of a suspected case.

If, after reviewing the monitor's notification and conducting an investigation, the supervisor suspects that there might be an Ebola case in a village, the supervisor contacts the local community health officer for guidance. Community health

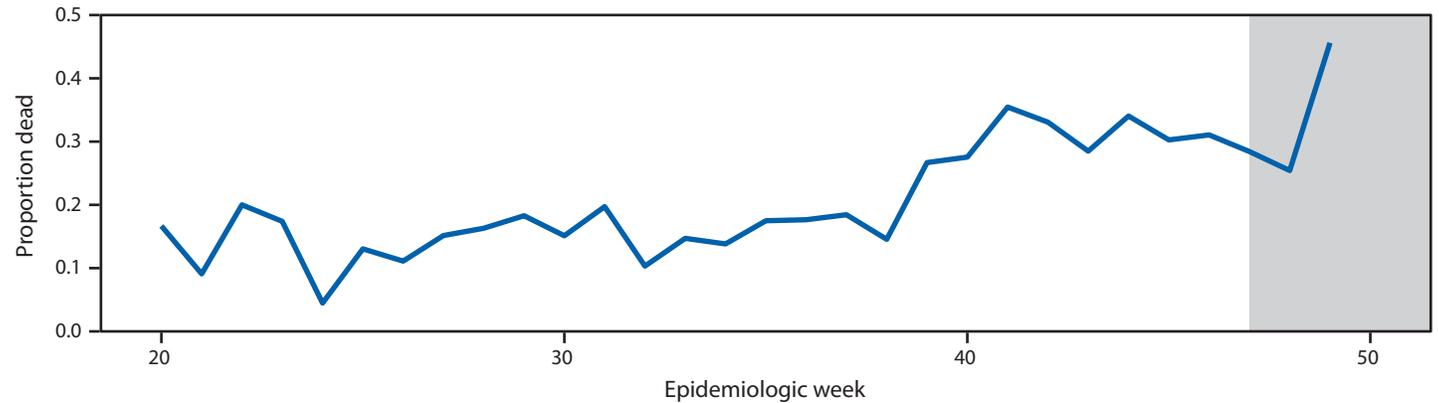
¶ There are 43 villages in Gbo and 32 in Selenga, with a combined estimated population in the two chiefdoms of approximately 13,000. All 75 villages in Gbo and Selenga are participating in the pilot.

FIGURE 1. Number of confirmed cases of Ebola virus disease, by epidemiologic week and status at time of case report — Sierra Leone, May–December 2014



Source: Sierra Leone’s Epi Info Viral Hemorrhagic Fever database.

FIGURE 2. Proportion of persons with confirmed cases of Ebola virus disease who were already dead at time of case report, by epidemiologic week — Sierra Leone, May–December 2014



Source: Sierra Leone’s Epi Info Viral Hemorrhagic Fever database.

officers might visit affected villages to assist the monitor and supervisor in complicated or sensitive situations. When a supervisor finds a suspected Ebola case, he or she isolates the person at the periphery of the village, notifies the district Ebola surveillance office, and requests transportation for that person to a holding center, where staff collect blood specimens

for Ebola virus testing. The supervisors carry sachets of oral rehydration salts to initiate early treatment, and packets of powdered bleach (with instructions for use) to provide to households with suspected cases to disinfect surfaces possibly contaminated with infected body fluids. With the assistance

BOX. Ebola trigger events for community health monitors — Community Event-Based Surveillance system, Sierra Leone, 2014–2015

- Two or more ill or dead family members, household members, or friends.
- One ill or dead traveler in the village (the traveler could be someone from the village who left and returned or someone who is not from the village).
- One ill or dead health care worker in the village.
- One ill or dead person who was a contact of a suspected Ebola case and was not known to be tracked by a contact tracing team.
- One ill or dead person who attended a funeral within the preceding 3 weeks.
- Any traditional burial that took place in the village or surrounding community (this event trigger will not generate a suspected case investigation, but will alert the surveillance and response team that there might be multiple cases in the near future).

of the patient, the supervisor creates a line list of contacts and provides it to the district contact tracing team for follow-up.

Evaluation Plan

Preliminary assessments in December 2014 indicated that the pilot implementation in Bo District has had a high level of acceptance by key community leaders, villagers, and the case detection and response team members. Plans are being developed to expand CEBS to other chiefdoms in Bo District and other districts in Sierra Leone in the near future, making it possible to conduct an evaluation of its effectiveness in different parts of the country. The evaluation will include an assessment of the following system attributes: 1) the sensitivity and specificity of case detection (the number of cases detected by CEBS that were not found by contact tracers and did not generate alerts through the existing system, and the proportion of actual alerts); 2) the positive predictive value of the trigger events (the proportion of suspected cases detected by each trigger event that are confirmed to be actual cases); 3) the timeliness of reporting and response (the mean and median number of days from illness onset to specimen collection among detected cases before and after implementation of the system); and 4) the acceptability of the system, based on interviews of key informants in a sample of villages.

Expected Benefits and Challenges

Prompt detection and isolation of persons with Ebola is expected to lead to a number of key public health benefits. First, immediate isolation of infected persons and provision of bleach to affected households should reduce household contact with infectious body fluids and thereby limit disease spread (7). Second, decreasing the number of persons who die from Ebola in the community will also decrease the occurrence of burials by relatives, friends, and neighbors, which can address another route of Ebola virus transmission (8). Third, conducting investigations within 24 hours of case detection should help find patients at an earlier stage of illness and result in their arriving at an Ebola treatment unit much sooner. Fourth, initiating early oral rehydration therapy should help reduce dehydration, and might improve clinical outcomes (9). Fifth, training local Sierra Leoneans to monitor their villages for signs of disease spread can create a community-level surveillance infrastructure that can be used even after the epidemic in West Africa ends. This infrastructure, if established throughout the country, could help detect residual Ebola transmission and future Ebola outbreaks, and could even be used for other infectious diseases (3). In addition to these benefits, the system would likely increase community involvement and participation in the Ebola response, resulting in ownership of Ebola prevention activities and enhanced acceptance of key prevention messages.

Despite these benefits, challenges associated with implementation of CEBS will include recruiting and training staff, maintaining the communication and response network, monitoring participating villages for any concerns with CEBS operations, ensuring adequate transportation for the anticipated increased number of patients to the holding centers, and working with the holding centers to manage the expected increase in false-positive suspected cases. The implementation team will be monitoring these and other challenges throughout the pilot and as the system is expanded into other areas.

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Notes from the Field

Identification of a *Taenia* Tapeworm Carrier — Los Angeles County, 2014

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Carriers of the pork tapeworm, *Taenia solium*, are the sole source of cysticercosis, a parasitic tissue infection (1). When tapeworm eggs excreted by the carrier are ingested, tapeworm larvae can form cysts. When cysts form in the brain, the condition is called neurocysticercosis and can be especially severe. In Los Angeles County an average of 136 county residents are hospitalized with neurocysticercosis each year (2). The prevalence of *Taenia solium* carriage is largely unknown because carriage is asymptomatic, making detection difficult. The identification and treatment of tapeworm carriers is an important public health measure that can prevent additional neurocysticercosis cases (1).

On June 6, 2012, a woman aged 33 years in Los Angeles County who had emigrated from El Salvador in 2004 was diagnosed with hydrocephalus caused by a ventricular cystic lesion identified by magnetic resonance imaging. A ventriculo-peritoneal shunt was required. Neurocysticercosis was included in the differential diagnosis in 2012, but was not confirmed until July 21, 2014, when the patient had a positive serology for cysticercosis after testing by a CDC reference diagnostic laboratory.

A public health investigation identified seven persons who shared the woman's household and who were screened for tapeworms. Each household member submitted three stool specimens for examination. A public health nursing practice model, based on nationally recognized components and using a population-based, team approach, was used to ensure compliance with stool specimen collection (3).

One household member, a woman aged 37 years, was identified as a *Taenia* tapeworm carrier. *Taenia* eggs were identified by light microscopy in one of her three stool specimens at the county public health laboratory. *Taenia* eggs of different species are morphologically indistinguishable. The carrier was in good health and reported no symptoms. She worked as a cashier at a bakery, but did not handle food. She reported

no foreign travel since emigrating from Guatemala in 2005. The carrier was evaluated by an infectious disease physician and treated with a single, 600-mg dose of praziquantel. She was instructed to collect any worm segments from her stool within 3 days after treatment so that the *Taenia* species could be identified; however, no tapeworm segments were identified. One month after treatment, the carrier was again screened for *Taenia*. No evidence of *Taenia* was found in any of the three stool specimens examined, and the carrier was considered cleared of infection.

Identification of *Taenia* tapeworm carriers by screening household members (including housekeepers) of patients with neurocysticercosis in the United States has been reported (4–7). Clinicians need to consider neurocysticercosis in patients with cystic cerebral lesions and report neurocysticercosis cases to their local health department so that they can investigate the cases and screen all household members for tapeworms.

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Notice to Readers

Changes in the Presentation of Infectious Disease Data in the National Notifiable Diseases Surveillance System — January 2015

This issue of *MMWR* incorporates changes to Table I (Provisional cases of selected infrequently reported notifiable diseases [$<1,000$ cases reported during the preceding year], United States) and Table II (Provisional cases of selected notifiable diseases [$>1,000$ cases reported during the preceding year] and selected low frequency diseases, United States). This year, the Table I and Table II modifications add conditions designated or proposed as nationally notifiable by the Council of State and Territorial Epidemiologists (CSTE) and CDC (1–5). In addition, the presentation of viral hemorrhagic fevers data in Table I reflects recent enhancements made to the National Notifiable Diseases Surveillance System (NNDSS) to enable reporting jurisdictions to submit electronic case notifications for specific viral hemorrhagic fevers.

Modifications to Tables I and II

Campylobacteriosis has been added to the list of nationally notifiable infectious diseases and conditions. Incidence data for campylobacteriosis will appear in Table II. CSTE requested chikungunya virus disease, dengue-like illness, and non-hantavirus pulmonary syndrome (non-HPS) hantavirus infection be added to the list of nationally notifiable infectious diseases and conditions. (In the past, HPS has been nationally notifiable, but hantavirus infections not complicated by the pulmonary syndrome were not.) Incidence data for chikungunya virus disease and “hantavirus infection, non-HPS” will appear in Table I, whereas dengue-like illness will appear in Table II, after CDC obtains Office of Management and Budget Paperwork Reduction Act approval to receive data for these conditions. The national surveillance case definitions for these

diseases and conditions are listed in their respective CSTE position statements (2–4) and are posted in the case definitions section of the NNDSS website (1). Three low-incidence conditions (rubella, rubella congenital syndrome, and tetanus) have been moved from Table I to Table II to facilitate monitoring incident case counts by reporting jurisdiction. Vibriosis also has been moved to Table II; the number of cases reported for this condition during each of the previous 3 years was $>1,000$.

Previously, NNDSS did not receive electronic data about incident cases of specific viral hemorrhagic fevers; instead, data were collected in aggregate and reported in Table 1 as “Viral hemorrhagic fevers.” In response to the need to monitor viral hemorrhagic fevers separately, beginning January 1, 2015, cases of Crimean-Congo hemorrhagic fever, Ebola hemorrhagic fever, Guanarito hemorrhagic fever, Junin hemorrhagic fever, Lassa virus infection, Lujo virus infection, Machupo hemorrhagic fever, Marburg fever, and Sabia-associated hemorrhagic fever will be reported separately.

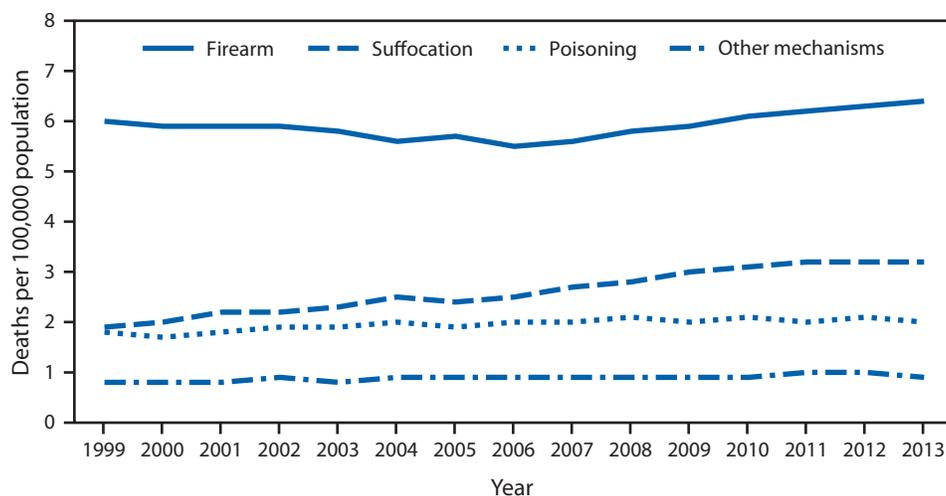
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QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Suicide Rates,* by Mechanism of Injury† — National Vital Statistics System, United States, 1999–2013



* Rates are age-adjusted using the 2000 U.S. standard population.

† Suicide deaths were categorized by mechanism of injury using the following *International Classification of Diseases, 10th Revision* codes: firearm (X72–X74), suffocation (X70), poisoning (X60–X69), and other mechanisms (U03, X71, X75–X84, Y87.0).

From 1999 to 2013, the leading mechanism of injury for suicide for persons aged ≥ 5 years was firearm, followed by suffocation (including hanging) and poisoning (including drug overdose). During this period, the age-adjusted rate of suicide deaths by suffocation increased by nearly 70% from 1.9 per 100,000 in 1999 to 3.2 in 2013. In contrast, the suicide rates by firearm, poisoning, and other mechanisms remained relatively constant (6.0 per 100,000 in 1999 to 6.4 in 2013 for firearm; 1.9 per 100,000 in 1999 to 2.0 in 2013 for poisoning; and 0.8 per 100,000 in 1999 to 0.9 in 2013 for other mechanisms).

Source: National Vital Statistics System mortality data. Available at <http://www.cdc.gov/nchs/deaths.htm>.

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ISSN: 0149-2195