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Coccidioidomycosis Among Cast and Crew Members at an Outdoor Television Filming Event — California, 2012

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In March 2013, the California Department of Public Health (CDPH) identified two Doctor's First Reports of Occupational Injury or Illness (DFRs)* regarding Los Angeles County residents who had worked at the same jobsite in January 2012 and had been evaluated for possible work-associated coccidioidomycosis (valley fever). Occupational exposure to *Coccidioides*, the causative fungi, typically is associated with soil-disrupting activities (*1*). The physicians noted that both workers were cast or crew members filming a television series episode, and the site of possible exposure was an outdoor set in Ventura County, California. On the basis of their job titles, neither would have been expected to have been engaged in soil-disrupting activities. Los Angeles County Department of Public Health (LACDPH) conducted an outbreak investigation by using CDPH-provided occupational surveillance records, traditional infectious disease surveillance, and social media searches. This report describes the results of that investigation, which identified a total of five laboratory-confirmed and five probable cases linked to this filming event. The employer and site manager were interviewed. The site manager stated that they would no longer allow soil-disruptive work at the site and would incorporate information about the potential risk for *Coccidioides* exposure onsite into work contracts. Public health professionals, clinicians, and the television and film industry should be aware that employees working outdoors in areas where *Coccidioides* is endemic (e.g., central and southern California), even those not engaged in soil-disruptive work, might be at risk for coccidioidomycosis.

* In California, health-care providers who believe a patient's injury or illness might be work-related are required to submit a DFR to the employer or their workers' compensation insurance carrier, who forward it to the California Department of Industrial Relations (*2*). DFRs are provided to CDPH for occupational injury and disease surveillance purposes.

Review of DFRs for coccidioidomycosis diagnoses initially identified two patients who worked for the same employer and listed work-associated coccidioidomycosis as the claimed illness. Patient 1, an actor, sought evaluation at an emergency department on February 28, 2012, after a 2-week history of fever and cough. Patient 1 had received a letter from his employer dated February 17, 2012, stating that a member of the cast or crew present at an outdoor filming event during January 17–19 in Ventura County had a diagnosis of coccidioidomycosis; patient 1 had also worked at this filming

INSIDE

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event. A copy of the letter sent to the employee was included with the DFR. Patient 2, a camera operator who had sought evaluation at an emergency department on February 24 after a 2-week history of cough, joint aches, and muscle pain, was identified by review of the health-care provider's notes as having worked at the same outdoor filming event; patient 2 was not the patient referenced in the original letter.

Subsequent review of information obtained from the California Department of Industrial Relations (DIR) identified six additional workers with the same employer who had sought evaluation for possible work-associated coccidioidomycosis. Because all workers identified were residents of Los Angeles County, CDPH informed LACDPH of the possible outbreak, and LACDPH led the local investigation.

A confirmed outbreak case was defined as a laboratory-confirmed illness (including clinical presentation with an influenza-like illness, pneumonia or pulmonary lesion, erythema nodosum or erythema multiforme rash, or extrapulmonary disease) meeting the 2011 Council of State and Territorial Epidemiologists coccidioidomycosis surveillance case definition (*3*) that occurred in a person who was present at the filming event (performing site preparation work during January 15–16 or at the filming event during January 17–19). A probable case was a clinically compatible illness in a person present at the filming event. Patients were identified through review of DFRs and information obtained from DIR, review of social media, or interview with another patient. LACDPH contacted the employer and obtained cast and crew rosters, which were cross-referenced with the LACDPH coccidioidomycosis surveillance database. Patients, or family contacts of a decedent, were interviewed by LACDPH, and the employer and filming site manager were interviewed by CDPH and LACDPH.

Eight patients initially were identified through review of DFRs and information obtained from DIR. One was identified by review of social media, wherein the patient had posted details about his hospitalization, and one was identified by another patient as a relative (nonemployee) who had been onsite during the filming event. The patient referenced in the employer letter was among those with laboratory-confirmed illness. Of 10 persons identified, seven were interviewed; three could not be contacted. LACDPH ascertained five confirmed and five probable cases. The employee roster indicated 655 workers were associated with that particular television episode. The attack rate for all identified cases was 1.5%.

Median time to symptom onset was 11 days (range = 3–28 days), as determined by interviews of seven patients and medical record review for two patients (Table 1); an estimate could not be made for one patient. Two patients were hospitalized, one for 2 days and one for 4 weeks. The seven interviewed patients reported symptom duration ranging from 1 week to 6 months (Table 2) and reported recovering fully from their illness. One patient had died of an unrelated illness. Five of the interviewed patients reported dry, dusty conditions during the filming event. Only two of the interviewed patients, a construction coordinator and a prop or set maker, engaged in soil-disrupting activities (digging and moving dirt). However,

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TABLE 1. Demographic characteristics and outcomes of coccidioidomycosis patients — California, 2012

Characteristic	No.
Case status	
Confirmed	5
Probable	5
Age (yrs) median (range)	37 (23–58)
Male	7
Race	
White	6
Black	3
Asian	1
Visited emergency department	5
Hospitalized (2–28 days)	2
Time to symptom onset (days) median (range) (9 patients)	11 (3–28)

substantial soil-disruptive work, including grading and digging and filling a mud pit, occurred shortly before the filming event. Furthermore, the site manager reported to LACDPH and CDPH that substantial dust from an adjacent mining company blew onto the site daily. CDPH has not identified any cases among employees of the mine at this time.

The employer responded promptly to the initial identification of one illness among cast and crew by sending the original letter to employees, encouraging anyone with symptoms to seek medical evaluation. After interviewing the employer's environmental health and safety manager and discussing future prevention practices, CDPH provided a "Preventing Work-Related Coccidioidomycosis (Valley Fever)" fact sheet (*4*) to the employer for integration into their Injury and Illness Prevention Program (IIPP). The site owner informed LACDPH and CDPH that they had already halted digging and excavation at the site. After consultation with CDPH, he stated they would no longer allow soil-disruptive work at the site and would advise future film crews of the potential risk for *Coccidioides* exposure onsite. CDPH also advised the site owner to consult the local air pollution control district for assistance in mitigating offsite dust.

Discussion

The outbreak described in this report was identified by review of DFRs, using a pilot occupational coccidioidomycosis surveillance system recently established by CDPH. Title 17 of California's Code of Regulations requires health-care providers to report coccidioidomycosis diagnoses and outbreaks to the local health jurisdiction (*5*). Although coccidioidomycosis diagnoses for four of the five confirmed cases were reported to LACDPH, the outbreak was only detected by use of a nontraditional database for occupational surveillance. CDPH previously had used workers' compensation claims data to identify these industries as having the highest incidence of coccidioidomycosis: mining, quarrying, and oil and gas extraction; public administration; agriculture, forestry, fishing, and hunting; and construction (*1*). Coccidioidomycosis outbreaks among archaeologists (*6,7*), military personnel (*8,9*), and construction workers (*10*) have been described previously. This outbreak investigation identified occupations and an industry not previously known to be at risk.

The outbreak described in this report is illustrative of the risk to employees working outdoors in *Coccidioides*-endemic areas. Although most patients did not engage in soil-disruptive activities, substantial soil disruption immediately preceded the filming event, and the site owner reported ongoing dust intrusion from a neighboring mining company onto the filming site. Because no reliable methods for environmental *Coccidioides* sampling are available, identifying the source of the spores was not possible. CDPH previously had recommended a comprehensive approach to reducing incidence and severity of work-associated coccidioidomycosis (*4*). The approach includes limiting workers' exposure to outdoor dust by controlling dust generation at the source (e.g., continuous soil wetting), providing employee training, and consistently enforcing an IIPP, which includes providing respiratory protection with particulate filters. However, the majority of patients in this outbreak were not involved in excavation or set

TABLE 2. Occupation and outcomes of coccidioidomycosis patients — California, 2012

Patient no.	Confirmed/ Probable	Interviewed	Occupation	Time to illness onset (days)	Hospitalized	Symptom duration	Identification source
1	Probable	No	Actor	28	N/A	N/A	DFR
2	Probable	No*	Sound technician	15	N/A	N/A	DFR
3	Confirmed	Yes	Prop/Set construction	4	No	4 wks	DIR
4	Confirmed	Yes	Actor	6	No	1 wk	DIR
5	Probable	Yes	Actor	3	No	3 wks	DIR
6	Probable	No	Actor	N/A	N/A	N/A	DIR
7	Confirmed	Yes	Camera operator	22	No	6 mos	DIR
8	Probable	Yes	Construction manager	11	No	3 wks	DIR
9	Confirmed	Yes	Actor	7	4 wks	4 wks	Social media
10	Confirmed	Yes	N/A (visitor)	15	2 days	3 wks	Patient interview

Abbreviations: DFR = Doctor's First Report of Occupational Injury or Illness; DIR = California Department of Industrial Relations; N/A = not available.
* Deceased from unrelated illness; family contacts interviewed.

What is already known on this topic?

Work-associated *Coccidioides* infections and outbreaks have been linked to soil-disrupting activities, including construction, in areas where *Coccidioides* is endemic.

What is added by this report?

Occupational surveillance identified an outbreak of coccidioidomycosis in an unexpected industry (i.e., film and television). Employees working outdoors in any industry, even those not actively engaged in soil disruption, might be exposed to *Coccidioides* where it is endemic.

What are the implications for public health practice?

Occupational injury and illness surveillance can identify outbreaks not otherwise detected by traditional infectious disease surveillance. Education about coccidioidomycosis, including signs and symptoms, and exposure prevention measures should be implemented at outdoor worksites in areas where *Coccidioides* is endemic, including worksites of industries and occupations not typically associated with soil-disrupting activities. Health-care providers should consider the possibility of work-relatedness among patients with coccidioidomycosis diagnoses and note employer, work location, industry, and occupation when reporting cases.

construction and might not have been considered at increased risk for coccidioidomycosis in the existing IIPP. Nevertheless, working at a site immediately after soil disturbance might expose workers to *Coccidioides* spores, and a comprehensive IIPP for these employees should include 1) covering spoils piles and wetting disturbed areas, 2) establishing criteria for suspending work on the basis of wind and dust conditions, and 3) prompt disease recognition and referral to occupational medicine clinics for evaluation, treatment, and follow-up (*1,4*). Clinicians, including occupational health providers, should be aware that work-associated coccidioidomycosis can occur among patients who do not actively engage in soil-disruptive activities and include relevant information (e.g., employer, worksite, industry, occupation, and other information on activities or locations that might be related to exposure) when reporting cases to local health officials.

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Assessment of Blood Lead Levels Among Children Aged ≤5 Years — Zamfara State, Nigeria, June–July 2012

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Since 2010, Nigerian state and federal governments and the international community have been responding to an outbreak of lead poisoning caused by the processing of lead-containing gold ore in Zamfara State, Nigeria, that resulted in the deaths of approximately 400 children aged ≤5 years (*1*). Widespread education, surveys of high-risk villages, testing of blood lead levels (BLLs), medical treatment, and environmental cleanup all have been implemented. To evaluate the success of these remediation efforts in reducing the prevalence of lead poisoning and dangerous work practices, a population-based assessment of children's BLLs and ore processing techniques was conducted during June–July 2012. The assessment found few children in need of medical treatment, significantly lower BLLs, and substantially less exposure of children to dangerous work practices. Public health strategies designed to identify and treat children with lead poisoning, clean up existing environmental hazards, and prevent children from being exposed to dangerous ore processing techniques can produce a sustained reduction in BLLs.

The 2010 outbreak of lead poisoning in Zamfara State caused by unsafe processing of lead-containing gold ore resulted in severe neurologic illness and death in children. When processed dry with low technology methods, the gold ore produced fine particles that contaminated water and food crops and were easily inhaled or ingested during normal hand-to-mouth activities common among toddlers (*2*).

When inhaled or ingested, lead can cause damage to the brain, kidneys, bone marrow, and other body systems in young children. In infants and children, BLLs as low as 5 μg/dL have been associated with developmental problems, including impaired cognitive function, behavioral difficulties, impaired hearing, and reduced stature (*3*). BLLs ≥75μg/dL can cause coma, convulsions, and death. No safe BLL has been identified for children (*4*).

During June–July 2012, the Zamfara State Ministry of Health, Nigerian Field Epidemiology and Laboratory Training Program, and CDC collaborated to conduct a representative, cross-sectional, population-based, multistage stratified cluster design survey to estimate the geometric mean (GM) BLLs of children living in Zamfara State aged ≤5 years. Investigators also examined the extent of exposure to ore processing methods that generate dust (i.e., crushing ore, dry grinding ore using power flour grinders, and open air drying of ore), and they examined the ore processing practices among the children's mothers, an important factor because ore processing inside the family compound is a female role in this population. Because mothers also are responsible for child care, ore processing among mothers is a risk factor for young children who eat, sleep, and play within the compound.

To create systematic samples for village-level and family-level surveys, a total of 112 villages initially were selected from among the 14 local government areas in Zamfara State, proportionate to the population of the areas, using ambient population distribution software (*5*). An additional 10 villages were selected as potential replacements should some selected villages be inaccessible or unsafe, bringing the total to 122. To obtain population-based estimates of children's blood and environmental lead levels, one child in each of seven systematically selected families was surveyed in more detail from each of 56 villages systematically selected from among the 122 villages, for a total of 392 children in the study sample.*

Venous blood samples were collected from children aged ≤5 years. BLLs were analyzed using inductively coupled plasma mass spectroscopy, with a lower limit of detection of 0.25 μg/dL. The precision and quality assurance measures used have been described previously (*6*). GM BLLs were analyzed for correlation with exposure to different ore processing methods, with statistical significance determined at $p<0.05$. The study protocol was approved by the National Health Research Ethics Committee of Nigeria and the CDC Institutional Review Board.

Among the 392 children aged ≤5 years, the mean age was 35 months. The mothers of 69 (17.6%) children were involved in ore processing activities. Sixty-one (15.6%) mothers used processing techniques that generated large amounts of dust, and 17 (4.3%) mothers processed ore using dust-generating techniques within the family compound.

A history of convulsions was reported in 90 (23.0%) children. Thirty-four of the children lived in villages that used dust-generating ore processing methods, 40 lived in villages

* A sample size of 46 villages had been determined large enough to estimate the prevalence of elevated BLLs ≥10 μg/dL (then defined as the CDC BLLs of concern). An additional 10 villages were added to the sample in the event some of the 46 selected villages were inaccessible or unsafe, bringing the total to 56 villages, each with seven children, for a total of 392 children in the sample.

that used non–dust-generating methods, and 16 lived in villages that did not do ore processing (Table).

Venous blood samples were collected from 383 (97.7%) of the 392 children. The GM BLL for the 383 children was 6.9 µg/dL (range = 1.6–61.0 µg/dL). A total of 88 children (23.0%) had BLLs ≥10 µg/dL, and four (1.0%) had BLLs ≥45 µg/dL, the threshold for treatment with chelation therapy recommended by CDC (*7*).

The GM BLL of the children whose mothers were involved in dust-generating ore processing activities was 8.5 µg/dL (standard deviation [SD] = 11.1), compared with 6.4 µg/dL (SD = 5.3; p<0.001) among those whose mothers used non–dust-generating ore processing methods (Table). When dust-generating activities were conducted within the family compound, the GM BLL in children was 8.9 µg/dL (SD = 9.8). All four children with BLLs ≥45 µg/dL had mothers involved in dust-generating activities within the family compound.

Although the use of mercury for gold extraction to amalgamate gold was not defined as a dust-generating activity, children living in villages where mercury was used had BLLs significantly higher than children where gold ore was not processed (GM 11.2 µg/dL [SD = 5.1] compared with 3.4 µg/dL [SD = 5.1], p<0.05). Additionally, for children living in villages where excess mercury was burned off the ore, the GM BLL tended to be significantly higher (GM 13.1 µg/dL [SD = 16.6]), compared with children living in villages in which mercury was not used to amalgamate gold.

Discussion

The 2010 outbreak of lead poisoning in Zamfara State was unprecedented in recent decades. In two investigations in 2010 conducted to identify villages where risk for lead poisoning was extremely high, one found that 97% of children had BLLs ≥45 µg/dL, and the second found that, among ore processing

TABLE. Selected characteristics among 392 children aged ≤5 years living in 56 villages in an area where in 2010 fatal lead poisoning was linked to processing gold ore, by village ore activities — Zamfara State, Nigeria, 2012

Characteristic	Living in villages that use dust-generating ore processing* (n = 108)		Living in villages that use non–dust-generating ore processing† (n = 193)		Living in villages that do no ore processing§ (n = 91)		p-value
	No.	(%)	No.	(%)	No.	(%)	
Sex							
Male	50	(46.3)	109	(56.5)	44	(48.4)	
Female	57	(52.8)	83	(43.0)	43	(47.4)	
No response	1	(0.9)	1	(0.5)	4	(4.4)	0.05
Age group (mos)							
<12	5	(4.6)	12	(4.2)	9	(9.9)	
12–23	21	(19.4)	47	(16.7)	14	(15.4)	
24–35	14	(13.0)	47	(16.7)	14	(15.4)	
36–47	23	(21.3)	60	(21.1)	21	(23.1)	
48–60	42	(38.9)	105	(37.0)	28	(30.8)	
No response	3	(2.8)	13	(4.6)	5	(5.5)	0.18
History of convulsions							
Yes	34	(31.5)	40	(20.7)	16	(17.6)	
No	72	(66.7)	150	(77.7)	71	(78.0)	
No response	2	(1.9)	3	(1.6)	40	(4.4)	<0.001
Mother processes ore							
Yes	61	(56.5)	6	(3.1)	2	(2.2)	
No	46	(42.6)	179	(92.1)	85	(93.4)	
No response	1	(0.9)	8	(4.2)	4	(4.4)	<0.001
Mother processes ore within the family compound							
Yes	17	(15.7)	3	(1.2)	0	(0)	
No	91	(84.3)	190	(98.5)	91	(100.0)	<0.001
Ore processing performed outside the family compound							
Yes	40	(37.0)	3	(1.6)	3	(3.3)	
No	68	(63.0)	190	(98.1)	88	(96.7)	<0.001
GM BLL (µg/dL) in children (n = 383)	**GM BLL**	**(SD)**	**GM BLL**	**(SD)**	**GM BLL**	**(SD)**	**p-value**
	8.5	(11.1)	6.4	(5.3)	3.4	(5.1)	<0.001

Abbreviations: GM BLL = geometric mean blood lead level; SD = standard deviation.
* Dust-generating activities include breaking ore, grinding ore, and drying ore.
† Non–dust-generating activities include washing ore and mercury amalgamation.
§ Defined as no ore processing within 1.26 mi (2 km) of the village.

villages, 30% of children had BLLs ≥45 µg/dL, but no children in villages that did not process ore had BLLs this high. (*8*)

Since 2010, a team of international, Nigerian federal, and Nigerian state public health agencies, environmental remediation specialists, health-care providers, and educators has worked to reduce BLLs in young children. These efforts have resulted in identification of lead contamination in approximately 50 villages, cleanup of environmental lead contamination in 11 villages, chelation therapy for children with BLLs ≥45 µg/dL, widespread public education campaigns, and training for local workers responsible for testing and remediation activities (*9*).

In the assessment described in this report, 74% of the 56 villages were involved in the gold trade, and the GM BLL was significantly higher among children whose mothers processed ore using dust-generating methods. Few families (20 [5%] compared with 84 [71%] in 2010) (*1*) were processing ore within the family compound, where children aged ≤5 years spend most of their time, and three of the 20 families used non–dust-generating ore processing methods. However, the highest GM BLLs were found among children who lived in villages where mothers used certain non–dust-generating methods, such as amalgamating ore using mercury or burning excess mercury off the ore; the high GM BLLs might have resulted from toxic lead fumes released during burning.

Although work remains, much has been done to address the problem of lead exposure in Zamfara State. New and safer processing techniques that control dust and residual ore wastes, a better understanding of potential exposure to lead-contaminated foodstuffs, continued BLL surveillance, chelation therapy when warranted, and environmental cleanup of hazardous sites remain critical (*9*). When such strategies are successfully implemented, a sustained reduction of BLLs in children can be achieved.

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What is already known on this topic?

Processing of lead-containing gold ore using dust-generating methods caused the deaths of approximately 400 children from lead poisoning in Zamfara State, Nigeria, in 2010 and left thousands of others with severe disabilities. The Nigerian and Zamfara State governments, in collaboration with international organizations including CDC, have been working to identify and treat affected children, clean up the hazardous processing sites, and educate the community about the dangers of lead.

What is added by this report?

This assessment found that most families are using safer ore processing methods and blood lead levels among young children are lower than those found in 2010. Only 20 families (5%) were processing ore within the family compound, where children aged ≤5 years spend most of their time, compared with 84 families (71%) in 2010.

What are the implications for public health practice?

Collaboration between governments and the international community can prevent lead poisoning in children. When strategies such as use of processing techniques that control dust and residual ore wastes, continued blood lead surveillance, chelation therapy when warranted, and environmental cleanup of hazardous sites are successfully implemented, a sustained reduction of blood lead levels in children can be achieved.

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Incidence and Trends of Infection with Pathogens Transmitted Commonly Through Food — Foodborne Diseases Active Surveillance Network, 10 U.S. Sites, 2006–2013

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Foodborne disease continues to be an important problem in the United States. Most illnesses are preventable. To evaluate progress toward prevention, the Foodborne Diseases Active Surveillance Network* (FoodNet) monitors the incidence of laboratory-confirmed infections caused by nine pathogens transmitted commonly through food in 10 U.S. sites, covering approximately 15% of the U.S. population. This report summarizes preliminary 2013 data and describes trends since 2006. In 2013, a total of 19,056 infections, 4,200 hospitalizations, and 80 deaths were reported. For most infections, incidence was well above national *Healthy People 2020* incidence targets and highest among children aged <5 years. Compared with 2010–2012, the estimated incidence of infection in 2013 was lower for *Salmonella*, higher for *Vibrio*, and unchanged overall.† Since 2006–2008, the overall incidence has not changed significantly. More needs to be done. Reducing these infections requires actions targeted to sources and pathogens, such as continued use of *Salmonella* poultry performance standards and actions mandated by the Food Safety Modernization Act (FSMA) (*1*). FoodNet provides federal and state public health and regulatory agencies as well as the food industry with important information needed to determine if regulations, guidelines, and safety practices applied across the farm-to-table continuum are working.

FoodNet conducts active, population-based surveillance for laboratory-confirmed infections caused by *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria*, *Salmonella*, Shiga toxin–producing *Escherichia coli* (STEC) O157 and non-O157, *Shigella*, *Vibrio*, and *Yersinia* in 10 sites covering approximately 15% of the U.S. population (an estimated 48 million persons in 2012).§ FoodNet is a collaboration among CDC, 10 state health departments, the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS), and the Food and Drug Administration (FDA). Hospitalizations occurring within 7 days of specimen collection are recorded, as is the patient's vital status at hospital discharge, or at 7 days after specimen collection if the patient was not hospitalized. Hospitalizations and deaths that occur within 7 days are attributed to the infection. Surveillance for physician-diagnosed postdiarrheal hemolytic uremic syndrome (HUS), a complication of STEC infection characterized by renal failure, is conducted through a network of nephrologists and infection preventionists and by hospital discharge data review. This report includes 2012 HUS data for persons aged <18 years.

Incidence was calculated by dividing the number of laboratory-confirmed infections in 2013 by U.S. Census estimates of the surveillance area population for 2012.¶ Incidence of culture-confirmed bacterial infections and laboratory-confirmed parasitic infections (e.g., identified by enzyme immunoassay) are reported. A negative binomial model with 95% confidence intervals (CIs) was used to estimate changes in incidence from 2010–2012 to 2013 and from 2006–2008 to 2013 (*2*). Change in the overall incidence of infection with six key foodborne pathogens was estimated (*3*). For STEC non-O157, only change since 2010–2012 was assessed because diagnostic practices changed before then; for *Cyclospora*, change was not assessed because data were sparse. For HUS, incidence was compared with 2006–2008. The number of reports of positive culture-independent diagnostic tests (CIDTs) without corresponding culture confirmation is included for *Campylobacter*, *Listeria*, *Salmonella*, *Shigella*, STEC, *Vibrio*, and *Yersinia*.

Cases of Infection, Incidence, and Trends

In 2013, FoodNet identified 19,056 cases of infection, 4,200 hospitalizations, and 80 deaths (Table). The number and incidence per 100,000 population were *Salmonella* (7,277 [15.19]), *Campylobacter* (6,621 [13.82]), *Shigella* (2,309 [4.82]), *Cryptosporidium* (1,186 [2.48]), STEC non-O157

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

† The overall incidence of infection combines data for *Campylobacter*, *Listeria*, *Salmonella*, STEC O157, *Vibrio*, and *Yersinia*, six key bacterial pathogens for which >50% of illnesses are estimated to be transmitted by food.

§ FoodNet personnel regularly contact clinical laboratories to ascertain all laboratory-confirmed infections in residents of the surveillance areas.

¶ Final incidence rates will be reported when population estimates for 2013 are available.

TABLE. Number of cases of culture-confirmed bacterial and laboratory-confirmed parasitic infection, hospitalizations, and deaths, by pathogen — Foodborne Diseases Active Surveillance Network, United States, 2013*

	Cases			Hospitalizations		Deaths	
Pathogen	**No.**	**Incidence†**	**Objective§**	**No.**	**(%)**	**No.**	**(%)**
Bacteria							
Campylobacter	6,621	13.82	8.5	1,010	(15)	12	(0.2)
Listeria	123	0.26	0.2	112	(91)	24	(19.5)
Salmonella	7,277	15.19	11.4	2,003	(28)	27	(0.4)
Shigella	2,309	4.82	N/A¶	450	(19)	3	(0.1)
STEC O157	552	1.15	0.6	210	(38)	2	(0.4)
STEC non-O157	561	1.17	N/A	76	(14)	2	(0.4)
Vibrio	242	0.51	0.2	55	(23)	2	(0.8)
Yersinia	171	0.36	0.3	55	(32)	4	(2.3)
Parasites							
Cryptosporidium	1,186	2.48	N/A	227	(19)	4	(0.3)
Cyclospora	14	0.03	N/A	2	(14)	0	(0.0)
Total	**19,056**			**4,200**		**80**	

Abbreviations: N/A = not available; STEC = Shiga toxin–producing *Escherichia coli*.
* Data for 2013 are preliminary.
† Per 100,000 population.
§ *Healthy People 2020* objective targets for incidence of *Campylobacter*, *Listeria*, *Salmonella*, STEC O157, *Vibrio*, and *Yersinia* infections per 100,000 population.
¶ No national health objective exists for these pathogens.

(561 [1.17]), STEC O157 (552 [1.15]), *Vibrio* (242 [0.51]), *Yersinia* (171 [0.36]), *Listeria* (123 [0.26]), and *Cyclospora* (14 [0.03]). Incidence was highest among persons aged ≥65 years for *Cyclospora*, *Listeria*, and *Vibrio* and among children aged <5 years for all the other pathogens.

Among 6,520 (90%) serotyped *Salmonella* isolates, the top serotypes were Enteritidis, 1,237 (19%); Typhimurium, 917 (14%); and Newport, 674 (10%). Among 231 (95%) speciated *Vibrio* isolates, 144 (62%) were *V. parahaemolyticus*, 27 (12%) were *V. alginolyticus*, and 21 (9%) were *V. vulnificus*. Among 458 (82%) serogrouped STEC non-O157 isolates, the top serogroups were O26 (34%), O103 (25%), and O111 (14%).

Compared with 2010–2012, the 2013 incidence was significantly lower for *Salmonella* (9% decrease; CI = 3%–15%), higher for *Vibrio* (32% increase; CI = 8%–61%) and not significantly changed for other pathogens (Figure 1). Compared with 2006–2008, the 2013 incidence was significantly higher for *Campylobacter* and *Vibrio* (Figure 2). The overall incidence of infection with six key foodborne pathogens was not significantly different in 2013 compared with 2010–2012 or 2006–2008.

Compared with 2010–2012, the 2013 incidence of infection with specific *Salmonella* serotypes was significantly lower for Enteritidis (14% decrease; CI = 0.2%–25%) and Newport (32% decrease; CI = 17%–44%) and not significantly changed for Typhimurium. Compared with 2006–2008, however, the 2013 incidence of infection was significantly changed only for Typhimurium (20% decrease; CI = 10%–28%).

Among 62 cases of postdiarrheal HUS in children aged <18 years (0.56 cases per 100,000) in 2012, 38 (61%) occurred in children aged <5 years (1.27 cases per 100,000). Compared with 2006–2008, the incidence was significantly lower for children aged <5 years (36% decrease; CI = 9%–55%) and for children aged <18 years (31% decrease; CI = 7%–49%).

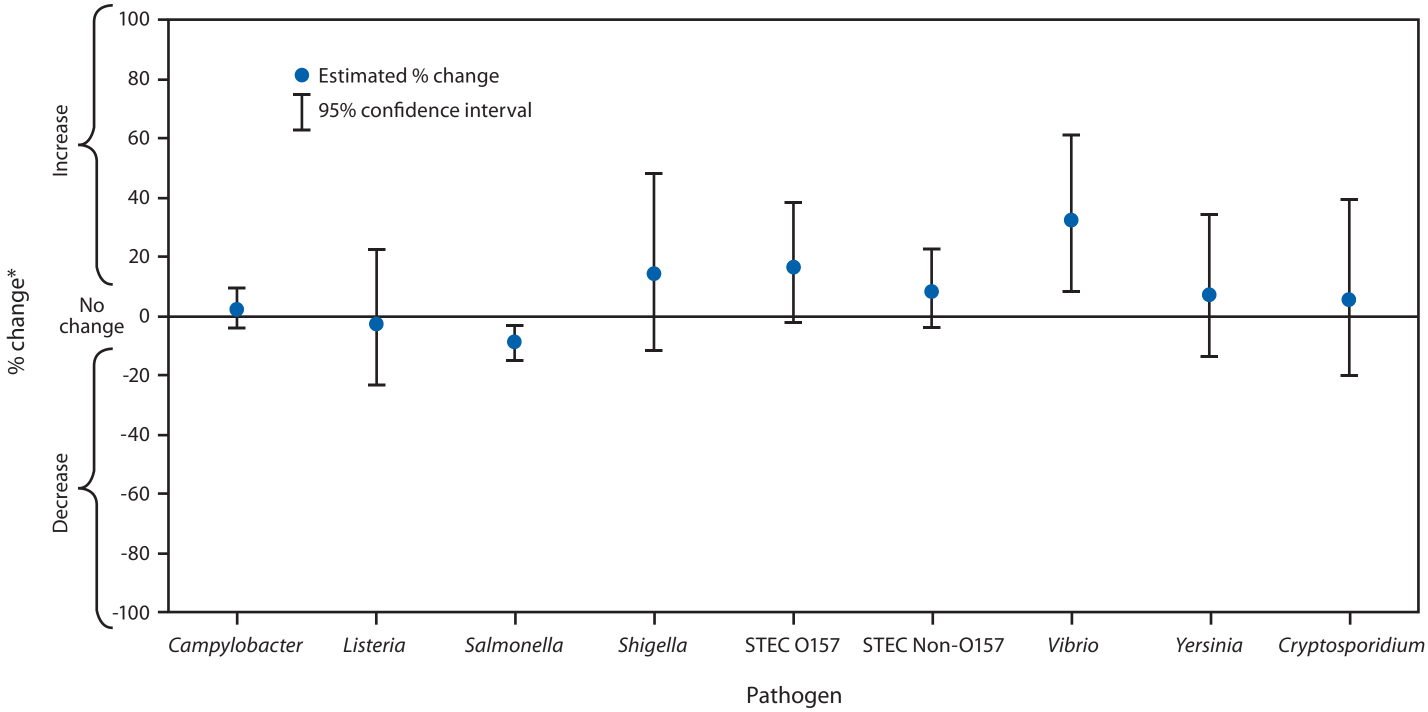
In addition to culture-confirmed infections (some with a positive CIDT result), there were 1,487 reports of positive CIDTs that were not confirmed by culture, either because the specimen was not cultured at either the clinical or public health laboratory or because a culture did not yield the pathogen. For 1,017 *Campylobacter* reports in this category, 430 (42%) had no culture, and 587 (58%) were culture-negative. For 247 STEC reports, 59 (24%) had no culture, and 188 (76%) were culture-negative. The Shiga toxin–positive result was confirmed for 65 (34%) of 192 broths sent to a public health laboratory. The other reports of positive CIDT tests not confirmed by culture were of *Shigella* (147), *Salmonella* (69), *Vibrio* (four), *Listeria* (two), and *Yersinia* (one).

Discussion

The incidence of laboratory-confirmed *Salmonella* infections was lower in 2013 than 2010–2012, whereas the incidence of *Vibrio* infections increased. No changes were observed for infection with *Campylobacter*, *Listeria*, STEC O157, or *Yersinia*, the other pathogens transmitted commonly through food for which *Healthy People 2020* targets exist. The lack of recent progress toward these targets points to gaps in the current food safety system and the need for more food safety interventions.

Although the incidence of *Salmonella* infection in 2013 was lower than during 2010–2012, it was similar to 2006–2008, well above the national *Healthy People* target. *Salmonella* organisms live in the intestines of many animals and can be transmitted to humans through contaminated food or water or through

FIGURE 1. Estimated percentage change in incidence of culture-confirmed bacterial and laboratory-confirmed parasitic infections in 2013 compared with average annual incidence during 2010–2012, by pathogen — Foodborne Diseases Active Surveillance Network, United States



Abbreviations: CI = confidence interval; STEC = Shiga toxin–producing *Escherichia coli*.

* *No significant change* = 95% CI is both above and below the no change line; *significant increase* = estimate and entire CI are above the no change line; *significant decrease* = estimate and entire CI are below the no change line.

direct contact with animals or their environments; different serotypes can have different reservoirs and sources. Enteritidis, the most commonly isolated serotype, is often associated with eggs and poultry. The incidence of Enteritidis infection was lower in 2013 compared with 2010–2012, but not compared with 2006–2008. This might be partly explained by the large Enteritidis outbreak linked to eggs in 2010.** Ongoing efforts to reduce contamination of eggs include FDA's Egg Safety Rule, which requires shell egg producers to implement controls to prevent contamination of eggs on the farm and during storage and transportation.†† FDA required compliance by all egg producers with ≥50,000 laying hens by 2010 and by producers with ≥3,000 hens by 2012. Reduction in Enteritidis infection has been one of five high-priority goals for the U.S. Department of Health and Human Services since 2012.§§

In 2013, the incidence of *Vibrio* infections was the highest observed in FoodNet to date, though still much lower than that of *Salmonella* or *Campylobacter*. *Vibrio* infections are most common during warmer months, when waters contain more *Vibrio* organisms. Many infections follow contact with seawater (*4*), but about 50% of domestically acquired infections are transmitted through food, most commonly oysters (*5*). Foodborne infections can be prevented by postharvest treatment of oysters with heat, freezing, or high pressure, by thorough cooking, or by not eating oysters during warmer months (*6*). During the summers of 2012 and 2013, many *V. parahaemolyticus* infections of a strain previously traced only to the Pacific Northwest were associated with consumption of oysters and other shellfish from several Atlantic Coast harvest areas.¶¶ *V. alginolyticus*, the second most common *Vibrio* reported to FoodNet in 2013, typically causes wound and soft-tissue infections among persons who have contact with water (*7*).

The continued decrease in the incidence of postdiarrheal HUS has not been matched by a decline in STEC O157 infections. Possible explanations include unrecognized changes in surveillance, improvements in management of STEC O157 diarrhea, or an actual decrease in infections with the most

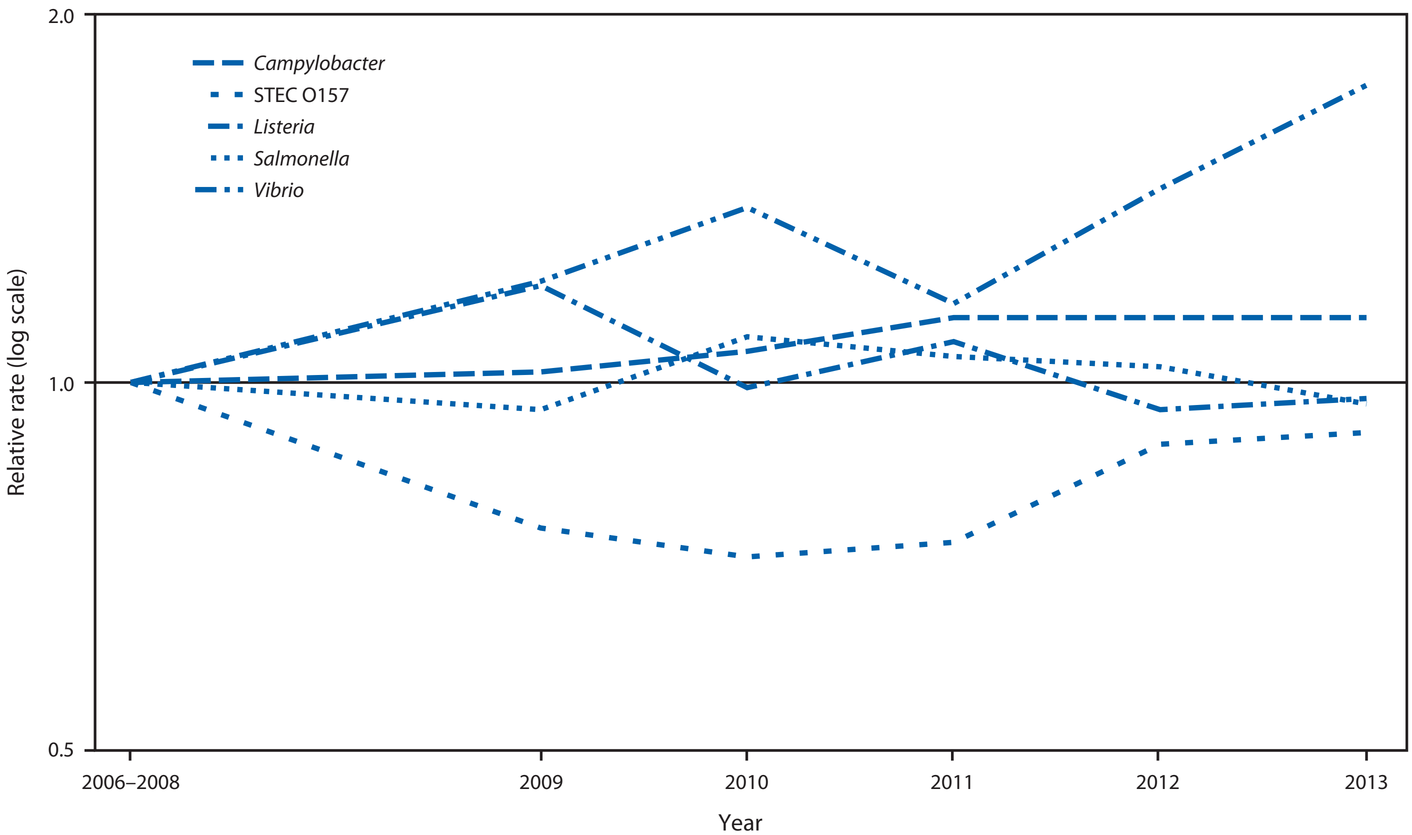
** Additional information available at http://www.cdc.gov/salmonella/enteritidis/index.html.

†† Additional information available at http://www.fda.gov/food/guidanceregulation/guidancedocumentsregulatoryinformation/eggs/ucm170615.htm.

§§ Additional information available at http://www.hhs.gov/strategic-plan/appendixb3.html.

¶¶ Additional information available at http://www.cdc.gov/vibrio/investigations/index.html.

FIGURE 2. Relative rates of culture-confirmed infections with *Campylobacter*, STEC* O157, *Listeria*, *Salmonella*, and *Vibrio* compared with 2006–2008 rates, by year — Foodborne Diseases Active Surveillance Network, United States, 2006–2013†



* Shiga toxin–producing *Escherichia coli*.
† The position of each line indicates the relative change in the incidence of that pathogen compared with 2006–2008. The actual incidences of these infections cannot be determined from this figure.

virulent strains of STEC O157. It is possible that more stool specimens are being tested for STEC, resulting in increased detection of milder infections than in the past. Continued surveillance is needed to determine if this pattern holds.

CIDTs are increasingly used by clinical laboratories to diagnose bacterial enteric infections, a trend that will challenge the ability to identify cases, monitor trends, detect outbreaks, and characterize pathogens (*8*). Therefore, FoodNet began tracking CIDT-positive reports and surveying clinical laboratories about their diagnostic practices. The adoption of CIDTs has varied by pathogen and has been highest for STEC and *Campylobacter*. Positive CIDTs frequently cannot be confirmed by culture, and the positive predictive value varies by the CIDT used. For STEC, most specimens identified as Shiga toxin–positive were sent to a public health laboratory for confirmation. However, for other pathogens the fraction of specimens from patients with a positive CIDT sent for confirmation likely is low because no national guidelines regarding confirmation of CIDT results currently exist. As the number of approved CIDTs increases, their use likely will increase rapidly. Clinicians, clinical and public health laboratorians, public health practitioners, regulatory agencies, and industry must work together to maintain strong surveillance to detect dispersed outbreaks, measure the impact of prevention measures, and identify emerging threats.

The findings in this report are subject to at least five limitations. First, health-care–seeking behaviors and other characteristics of the population in the surveillance area might affect the generalizability of the findings. Second, some agents transmitted commonly through food (e.g., norovirus) are not monitored by FoodNet because clinical laboratories do not routinely test for them. Third, the proportion of illnesses transmitted by nonfood routes differs by pathogen; data provided in this report are not limited to infections from food. Fourth, in some fatal cases, infection with the enteric pathogen might not have been the primary cause of death. Finally, changes in incidence between periods can reflect year-to-year variation during those periods rather than sustained trends.

Most foodborne illnesses can be prevented, and progress has been made in decreasing contamination of some foods and reducing illness caused by some pathogens since 1996, when FoodNet began. More can be done; surveillance data provide information on where to target prevention efforts. In 2011, USDA-FSIS tightened its performance standard for *Salmonella* contamination of whole broiler chickens; in 2013, 3.9% of samples tested positive (Christopher Aston, USDA-FSIS, Office of Data Integration and Food Protection; personal communication; 2014). Because most chicken is purchased as cut-up parts, USDA-FSIS conducted a nationwide survey of raw chicken parts in 2012 and calculated an estimated 24% prevalence of *Salmonella* (*9*). In 2013, USDA-FSIS released its *Salmonella Action Plan* that indicates that USDA-FSIS will conduct a risk assessment and develop performance standards for poultry parts during 2014, among other key activities (*10*). The Food Safety Modernization Act of 2011 gives FDA additional authority to regulate food facilities, establish standards for safe produce, recall contaminated foods, and oversee imported foods; it also calls on CDC to strengthen surveillance and outbreak response (*1*). For consumers, advice on safely buying, preparing, and storing foods prone to contamination is available online.

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What is already known on this topic?

The incidences of infection caused by *Campylobacter*, *Salmonella*, Shiga toxin–producing *Escherichia coli* O157, and *Vibrio* are well above their respective *Healthy People 2020* targets. Foodborne illness continues to be an important public health problem.

What is added by this report?

In 2013, a total of 19,056 infections, 4,200 hospitalizations, and 80 deaths were reported to the Foodborne Diseases Active Surveillance Network (FoodNet). For most infections, incidence was highest among children aged <5 years. In 2013, compared with 2010–2012, the estimated incidence of infection was unchanged overall, lower for *Salmonella*, and higher for *Vibrio* infections, which have been increasing in frequency for many years. The number of patients being diagnosed by culture-independent diagnostic tests (CIDT) is increasing.

What are the implications for public health practice?

Reducing the incidence of foodborne infections requires greater commitment and more action to implement measures to reduce contamination of food. Monitoring the incidence of these infections is becoming more difficult because some laboratories are now using CIDTs, and some do not follow up a positive CIDT result with a culture.

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Concerns Regarding a New Culture Method for *Borrelia burgdorferi* Not Approved for the Diagnosis of Lyme Disease

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In 2005, CDC and the Food and Drug Administration (FDA) issued a warning regarding the use of Lyme disease tests whose accuracy and clinical usefulness have not been adequately established (*1*). Often these are laboratory-developed tests (also known as "home brew" tests) that are manufactured and used within a single laboratory and have not been cleared or approved by FDA. Recently, CDC has received inquiries regarding a laboratory-developed test that uses a novel culture method to identify *Borrelia burgdorferi*, the spirochete that causes Lyme disease. Patient specimens reportedly are incubated using a two-step pre-enrichment process, followed by immunostaining with or without polymerase chain reaction (PCR) analysis. Specimens that test positive by immunostaining or PCR are deemed "culture positive" (*2*). Published methods and results for this laboratory-developed test have been reviewed by CDC. The review raised serious concerns about false-positive results caused by laboratory contamination and the potential for misdiagnosis (*3*).

CDC recommends that laboratory tests cleared or approved by FDA be used to aid in the routine diagnosis of Lyme disease. A complete searchable list of such tests is available online (*4*).

When evaluating testing options, providers and their patients might be confused by the distinction between Clinical Laboratory Improvement Amendments (CLIA) certification of laboratories and FDA clearance or approval of specific tests. CLIA certification of a laboratory indicates that the laboratory meets a set of basic quality standards.* It is important to note, however, that the CLIA program does not address the clinical validity of a specific test (i.e., the accuracy with which the test identifies, measures, or predicts the presence or absence of a clinical condition in a patient).† FDA clearance/approval of a test, on the other hand, provides assurance that the test itself has adequate analytical and clinical validation and is safe and effective.§

* 42 U.S.C. §263a; 42 CFR Part 493.

† Additional information available at http://www.cms.gov/regulations-and-guidance/legislation/clia/downloads/ldt-and-clia_faqs.pdf.

§ 21 U.S.C. §§360c, 360e and 21 CFR814.20, 860.7.

When laboratory testing is indicated, CDC recommends two-tier serologic testing for the diagnosis of Lyme disease. Two-tier testing consists of an FDA-cleared enzyme immunoassay (EIA) that, if positive or equivocal, is followed by an FDA-cleared immunoblot test, commonly known as a "Western blot" test. Results are considered positive only when both the EIA and Western blot are positive (*5*). Culture and PCR of clinical specimens are recommended only in certain rare circumstances (*6*).

CDC encourages researchers to work with FDA to develop new or improved tests for the diagnosis of Lyme disease. As with any diagnostic test, it is critical that new tests for Lyme disease have adequate analytical and clinical validation to avoid misdiagnosis and improper treatment of patients.

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Notes from the Field

Assessment of Potential Zoonotic Disease Exposure and Illness Related to an Annual Bat Festival — Idanre, Nigeria

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Bats provide vital ecologic services that humans benefit from, such as seed dispersal and pest control, and are a food source for some human populations. However, bats also are reservoirs for a number of high-consequence zoonoses, including paramyxoviruses, filoviruses, and lyssaviruses (*1*). The variety of viruses that bats harbor might be related to their evolutionary diversity, ability to fly large distances, long lifespans, and gregarious roosting behaviors (*1,2*). Every year a festival takes place in Idanre, Nigeria, in which males of all ages enter designated caves to capture bats; persons are forbidden from entering the caves outside of these festivities. Festival participants use a variety of techniques to capture bats, but protective equipment rarely is used, placing hunters at risk for bat scratches and bites. Many captured bats are prepared as food, but some are transported to markets in other parts of the country for sale as bushmeat. Bats also are presented to dignitaries in elaborate rituals. The health consequences of contact with these bats are unknown, but a number of viruses have been previously identified among Nigerian bats, including lyssaviruses, pegiviruses, and coronaviruses (*2–4*). Furthermore, the caves are home to *Rousettus aegyptiacus* bats, which are reservoirs for Marburg virus in other parts of Africa (*5*).

In February 2013, a team composed of members of the Nigerian Field Epidemiology and Laboratory Training Program (FELTP), the Nigerian Federal Ministry of Health, and CDC traveled to Idanre to assess potential zoonotic disease exposures and illnesses related to the festival. Interviews conducted with 54 persons who have participated in the festival as bat hunters revealed that 43 (80%) had a history of bat scratches and 39 (72%) had a history of bat bites. Only one (1.9%) hunter reported ever having received rabies vaccine. None of the hunters knew of a person who had acquired a fatal illness as a result of contact with bats or entering the caves. Additional data analyses and serologic assays are pending.

Driven by socioeconomic and environmental factors, the emergence of infectious diseases has accelerated in recent years. Most emerging infectious diseases are zoonotic, and many have wildlife origins (*1,6*). Investigations of newly identified infectious diseases, such as severe acute respiratory syndrome (SARS) and Nipah virus infection, have historically been reactive, requiring the sudden application of resources to the investigation and control of an outbreak. A proactive approach involving enhanced scientific and surveillance efforts in areas identified as emerging infectious disease "hotspots" during periods when there is no known epidemic might improve the detection of novel pathogens or recognition of outbreaks.

Through programs such as the Nigerian FELTP, the epidemiologic and laboratory resources needed to identify pathogens and outbreaks are now reaching areas of the world where resources have previously been limited. The investigation in Idanre is an example of an FELTP investigation of an activity that puts persons at risk for pathogen exposure. Particular topics for further evaluation include the factors that promote pathogen transmission from bats to humans, such as habitat encroachment and trade in bushmeat (*1*). Public health interventions to improve access to rabies vaccine and personal protective equipment for persons at risk for bat exposures are likely to be beneficial.

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Notes from the Field

Increase in *Vibrio parahaemolyticus* Infections Associated with Consumption of Atlantic Coast Shellfish — 2013

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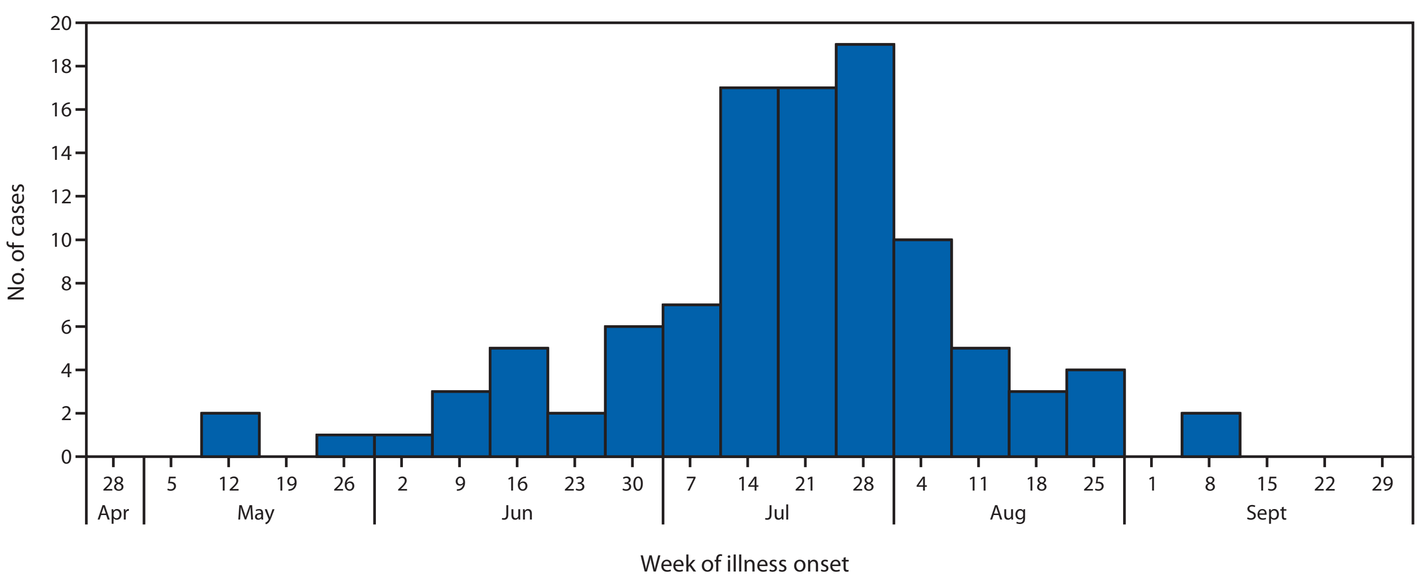
Vibrio parahaemolyticus (*Vp*) is found naturally in coastal saltwater. In the United States, *Vp* causes an estimated 35,000 domestically acquired foodborne infections annually (*1*), of which most are attributable to consumption of raw or undercooked shellfish. Illness typically consists of mild to moderate gastroenteritis, although severe infection can occur. Demographic, clinical, and exposure information (including traceback information on implicated seafood) for all laboratory-confirmed illnesses are reported by state health departments to CDC through the Cholera and Other *Vibrio* Surveillance system. *Vp* isolates are distinguished by serotyping (>90 serotypes have been described) and by pulsed-field gel electrophoresis (PFGE).

Vp serotypes O4:K12 and O4:K(unknown) comprise the Pacific Northwest (PNW) strain and, within the United States, had not been associated with shellfish outside the Pacific Northwest before 2012. During May–July 2012, *Vp* of the PNW strain associated with shellfish from Oyster Bay Harbor in New York caused an outbreak of 28 illnesses in nine states. Simultaneously, *Vp* of the PNW strain caused an outbreak of illnesses on a cruise ship docked on the Atlantic Coast of Spain; illness was associated with cooked seafood cooled with ice made from untreated local seawater. All *Vp* isolates from ill persons in the U.S. and Spanish outbreaks that were further subtyped were indistinguishable by PFGE (*2*).

In 2013, this same indistinguishable strain was traced from shellfish consumed by ill persons to a larger area of the U.S. Atlantic Coast, causing illness in 104 persons from 13 states during May–September (Figure). The median age of patients was 51 years (range = 22–85 years); 62% were male. Six (6%) patients were hospitalized; none died. Multiple outbreaks appeared to be occurring, accounting for many of these illnesses. Illness was associated with consumption of raw shellfish and seafood traceback was reported for 59 (57%) illnesses. Of these illnesses, 51 (86%) involved seafood that could be definitively traced to a single harvest area. The implicated harvest areas were located in Connecticut (20 illnesses), Massachusetts (15), New York (10), Virginia (four), Maine (one), and Washington (one). The remaining eight illnesses with traceback information involved seafood that could not be definitively traced to a single harvest area (locations reported included harvest areas of the Atlantic Coast of the United States and Canada). In response to the illnesses, four Atlantic Coast states closed implicated harvest areas; two issued shellfish recalls (*3*). The number of foodborne *Vp* cases in the United States traced to Atlantic Coast shellfish was threefold greater

FIGURE. ***Vibrio parahaemolyticus*** **illnesses (N = 104) associated with consumption of shellfish from Atlantic Coast harvest areas, by week of onset — United States, 2013**



in 2012 and 2013 compared with the annual average number reported during 2007–2011.

This PNW strain is possibly becoming endemic in an expanding area of the Atlantic Ocean. The mechanisms for this introduction are not known. During the 2014 *Vibrio* season, beginning in the spring, clinicians, health departments, and fisheries departments should be prepared for the possibility of shellfish-associated diarrheal illness caused by this strain again. Appropriate actions, such as quick closure of implicated harvest areas, will help prevent additional illnesses. The Interstate Shellfish Sanitation Conference maintains a list of shellfish harvest area closures and recalls.* Clinicians seeking an etiology of diarrhea in a patient who has recently consumed raw or undercooked shellfish should notify the microbiology laboratory that *Vp* is suspected; the use of special culture media (thiosulfate citrate bile salts sucrose) facilitates identification of *Vibrio* species. Consumers can reduce their risk for *Vp* infection by avoiding eating raw or undercooked shellfish, especially oysters and clams.†

* Available at http://www.issc.org/closuresreopenings.aspx.
† Additional information available at http://www.cdc.gov/vibrio/investigations/vibriop-09-13/advice-consumers.html.

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Announcement

Recommendation Regarding Reducing Alcohol-Impaired Driving — Community Preventive Services Task Force

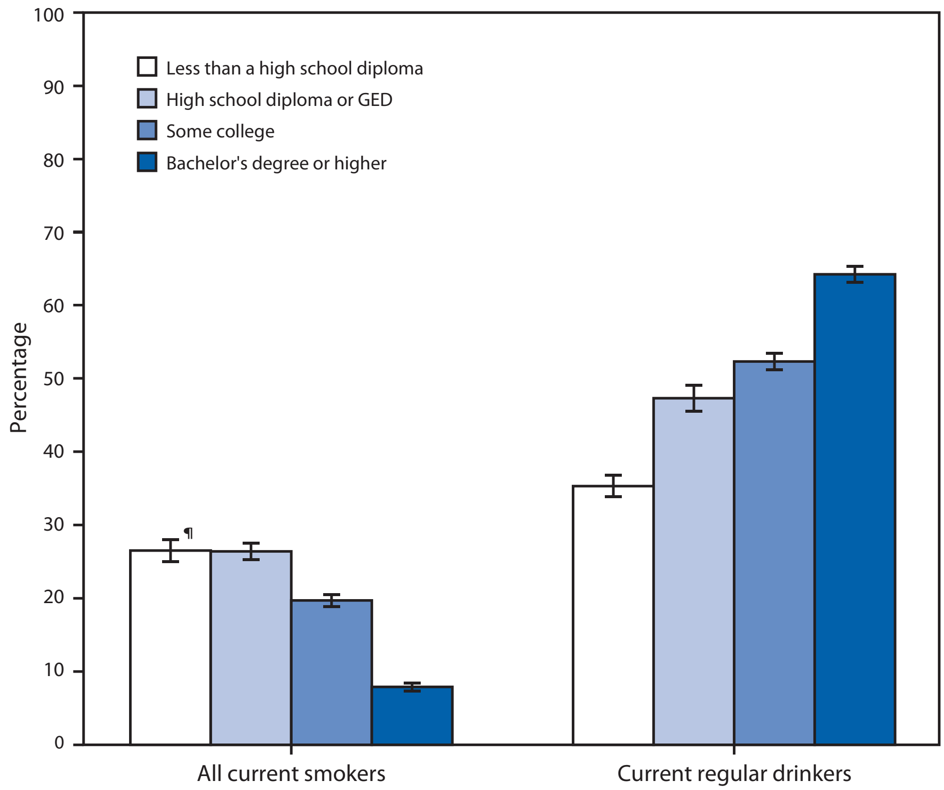
The Community Preventive Services Task Force has posted new information on its website: "Reducing Alcohol-Impaired Driving: Publicized Sobriety Checkpoint Programs." The information is available at http://www.thecommunityguide.org/mvoi/aid/sobrietyckpts.html.

Established in 1996 by the U.S. Department of Health and Human Services, the task force is an independent, nonfederal, uncompensated panel of public health and prevention experts whose members are appointed by the Director of CDC. The task force provides information for a wide range of decision makers on programs, services, and policies aimed at improving population health. Although CDC provides administrative, research, and technical support for the task force, the recommendations developed are those of the task force and do not undergo review or approval by CDC.

QuickStats

FROM THE NATIONAL CENTER FOR HEALTH STATISTICS

Percentage of Adults Aged ≥25 Years Who Were Current Smokers or Current Regular Drinkers,* by Education Level† — National Health Interview Survey, United States, 2012§



Abbreviation: GED = general equivalency diploma.

* Based on responses to separate questions that asked, "Have you smoked at least 100 cigarettes in your entire life?" Respondents answering "yes" were then asked, "Do you now smoke cigarettes every day, some days, or not at all?" Current smokers have smoked at least 100 cigarettes in their lifetime and currently smoke every day or some days. Respondents were also asked "In any 1 year, have you had at least 12 drinks of any type of alcoholic beverage?"; "In your entire life, have you had at least 12 drinks of any type of alcoholic beverage?"; and "In the past year, how often did you drink any type of alcoholic beverage?" A current regular drinker had at least 12 drinks in his or her lifetime and at least 12 drinks in the past year.

† Highest education completed consists of four categories: 1) adults with less than a high school diploma, 2) adults with a high school diploma or GED, 3) adults who attended some college including those receiving associate's degrees ("some college"), and 4) adults who completed a bachelor's degree or higher.

§ Estimates are based on household interviews of a sample of the noninstitutionalized U.S. civilian population. Unknowns were not included in the denominators when calculating percentages. Percentages are age adjusted to the projected 2000 U.S. population as the standard population using four age groups: 18–44, 45–64, 65–74, and ≥75 years.

¶ 95% confidence interval.

Among adults aged ≥25 years in 2012, 26.5% of those who did not graduate from high school and 26.4% who had a high school diploma or GED were current smokers, compared with 19.7% who had attended some college and 7.9% with a college degree. In contrast, 64.2% of college graduates were current regular drinkers, compared with 52.3% of adults with some college, 47.3% of high school graduates or GED recipients, and 35.3% of adults who did not finish high school.

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

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