

Using Online Reviews by Restaurant Patrons to Identify Unreported Cases of Foodborne Illness — New York City, 2012–2013

Cassandra Harrison, MSPH^{1,2}, Mohip Jorder, MS³, Henri Stern³, Faina Stavinsky, MS¹, Vasudha Reddy, MPH¹, Heather Hanson, MPH¹, HaeNa Waechter, MPH¹, Luther Lowe⁴, Luis Gravano, PhD³, Sharon Balter, MD¹ (Author affiliations at end of text)

While investigating an outbreak of gastrointestinal disease associated with a restaurant, the New York City Department of Health and Mental Hygiene (DOHMH) noted that patrons had reported illnesses on the business review website Yelp (<http://www.yelp.com>) that had not been reported to DOHMH. To explore the potential of using Yelp to identify unreported outbreaks, DOHMH worked with Columbia University and Yelp on a pilot project to prospectively identify restaurant reviews on Yelp that referred to foodborne illness. During July 1, 2012–March 31, 2013, approximately 294,000 Yelp restaurant reviews were analyzed by a software program developed for the project. The program identified 893 reviews that required further evaluation by a foodborne disease epidemiologist. Of the 893 reviews, 499 (56%) described an event consistent with foodborne illness (e.g., patrons reported diarrhea or vomiting after their meal), and 468 of those described an illness within 4 weeks of the review or did not provide a period. Only 3% of the illnesses referred to in the 468 reviews had also been reported directly to DOHMH via telephone and online systems during the same period. Closer examination determined that 129 of the 468 reviews required further investigation, resulting in telephone interviews with 27 reviewers. From those 27 interviews, three previously unreported restaurant-related outbreaks linked to 16 illnesses met DOHMH outbreak investigation criteria; environmental investigation of the three restaurants identified multiple food-handling violations. The results suggest that online restaurant reviews might help to identify unreported outbreaks of foodborne illness and restaurants with deficiencies in food handling. However, investigating reports of illness in this manner might require considerable time and resources.

Project Protocol

Beginning in April 2012, Yelp provided DOHMH with a private data feed of New York City restaurant reviews. The feed provided

data publicly available on the website but in an XML format, and text classification programs were trained to automatically analyze reviews. For this pilot project, a narrow set of criteria were chosen to identify those reviews with a high likelihood of describing foodborne illness. Reviews were assessed retrospectively, using the following criteria: 1) presence of the keywords “sick,” “vomit,” “diarrhea,” or “food poisoning” in contexts denoting foodborne illness; 2) two or more persons reported ill; and 3) an incubation period ≥ 10 hours. Ten hours was chosen because most foodborne illnesses are not caused by toxins but rather by organisms with an incubation period of ≥ 10 hours (1). Data mining software was used to train the text classification programs (2). A foodborne disease epidemiologist manually examined output results to determine whether reviews selected by text classification met the criteria for inclusion, and programs with the highest accuracy rate were incorporated into the final software used for the pilot project to analyze reviews prospectively.

The software program downloaded weekly data and provided the date of the restaurant review, a link to the review, the full

INSIDE

- 446 Rabies Death Attributed to Exposure in Central America with Symptom Onset in a U.S. Detention Facility — Texas, 2013
- 450 Notes from the Field: *Coccidioides immitis* Identified in Soil Outside of Its Known Range — Washington, 2013
- 451 Notes from the Field: Trichinellosis Caused by Consumption of Wild Boar Meat — Illinois, 2013
- 452 Announcement
- 453 QuickStats

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



review text, establishment name, establishment address, and scores for each of three outbreak criteria (i.e., keywords, number of persons ill, and incubation period), plus an average of the three criteria. Scores for individual criteria ranged from 0 to 1, with a score closer to 1 indicating the review likely met the score criteria.

Reviews submitted to Yelp during July 1, 2012–March 31, 2013 were analyzed. All reviews with an average review score of ≥ 0.5 were evaluated by a foodborne disease epidemiologist (Figure). Because the average review score was calculated by averaging the individual criteria scores, reviews could receive an average score of ≥ 0.5 without meeting all individual criteria. Reviews with an average review score of ≥ 0.5 were evaluated for the following three criteria: 1) consistent with foodborne illness occurring after a meal, rather than an alternative explanation for the illness keyword; 2) meal date within 4 weeks of review (or no meal date provided); 3) two or more persons ill or a single person with symptoms of scombroid poisoning or severe neurologic illness. Reviews that met all three of these criteria were then investigated further by DOHMH. In addition, reviews were investigated further if manual checking identified multiple reviews within 1 week that described recent foodborne illness at the same restaurant.

To identify previously reported complaints of foodborne illness, reviews were compared with complaints reported to DOHMH by telephone or online at 311, New York City's non-emergency information service that can be used by the public to report suspected foodborne illness (3). Yelp reviews categorized

as indicating recent or potentially recent illness were compared with complaints from the previous 4 weeks in the 311 database. To follow up with reviewers, DOHMH created a Yelp account to send private messages to reviewers' Yelp accounts. Reviewers needed to log in at Yelp to view their messages.

For reviews not requiring further investigation and not found in the 311 database, DOHMH sent messages advising reviewers of the availability of 311 reporting. For reviews requiring further investigation, DOHMH sent messages requesting telephone interviews. Reviewers consenting to interviews were asked to provide details about the restaurant visit, meal date, foods consumed during the meal, party size, illness symptoms, and a history of foods consumed in the 3 days before symptom onset.

Review-Based Findings

During July 1, 2012–March 31, 2013, the software system screened approximately 294,000 reviews and identified 893 with an average score of ≥ 0.5 , indicating possible foodborne illness (Figure). Of these reviews, 499 (56%) described an event consistent with foodborne illness, as determined by the manual checking of a foodborne epidemiologist. This equated to an average of 23 reviews evaluated by a foodborne epidemiologist each week, with an average of 13 reviews categorized as consistent with foodborne illness. The remaining 394 (44%) reviews contained keywords but did not suggest foodborne illness (e.g., “I didn't get sick at all after my meal”).

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

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

Centers for Disease Control and Prevention

Thomas R. Frieden, MD, MPH, *Director*
 Harold W. Jaffe, MD, MA, *Associate Director for Science*
 Joanne Cono, MD, ScM, *Director, Office of Science Quality*
 Chesley L. Richards, MD, MPH, *Deputy Director for Public Health Scientific Services*
 Michael F. Iademarco, MD, MPH, *Director, Center for Surveillance, Epidemiology, and Laboratory Services*

MMWR Editorial and Production Staff (Weekly)

Charlotte K. Kent, PhD, MPH, *Acting Editor-in-Chief*
 John S. Moran, MD, MPH, *Editor*
 Teresa F. Rutledge, *Managing Editor*
 Douglas W. Weatherwax, *Lead Technical Writer-Editor*
 Donald G. Meadows, MA, Jude C. Rutledge, *Writer-Editors*

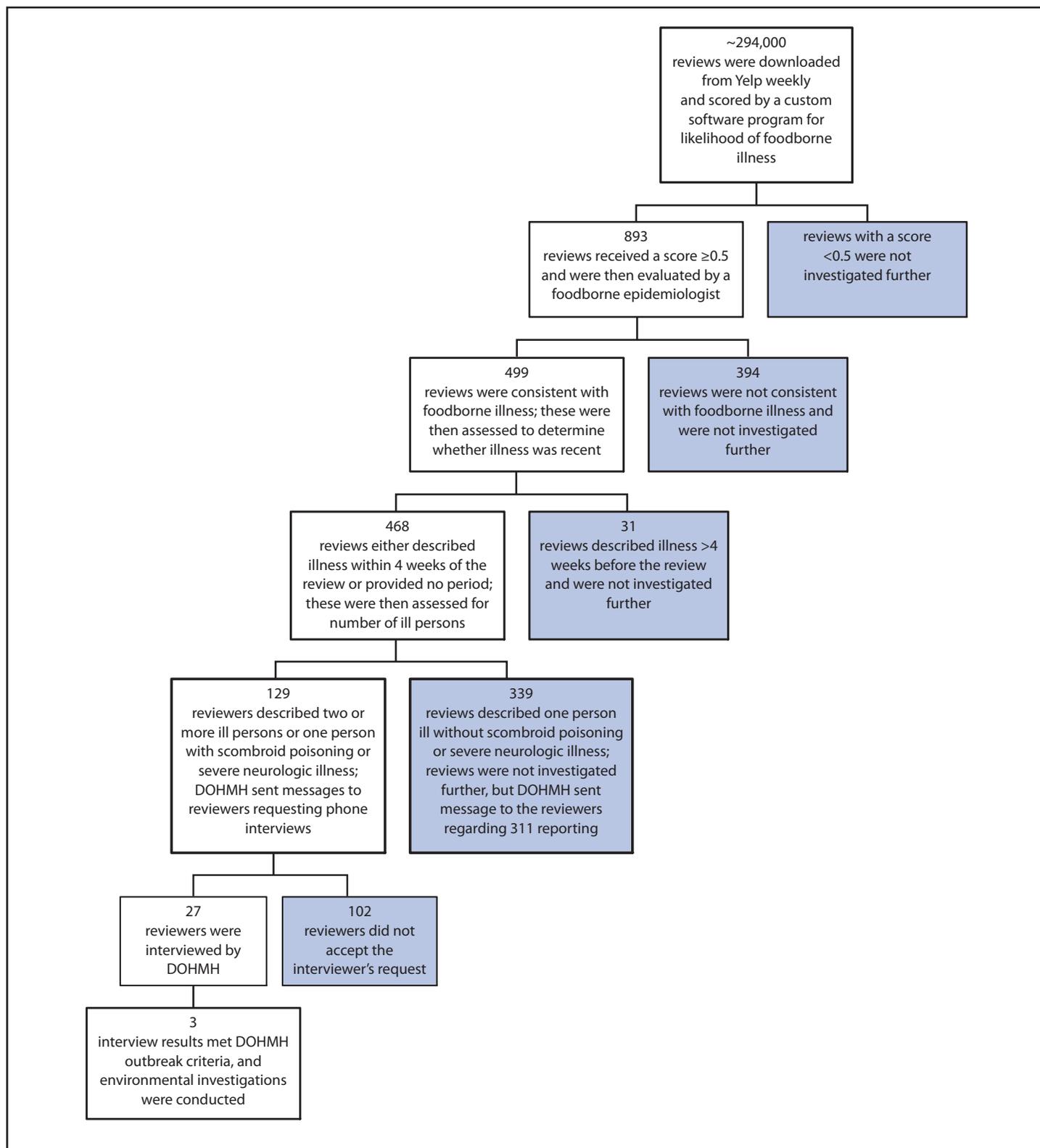
Martha F. Boyd, *Lead Visual Information Specialist*
 Maureen A. Leahy, Julia C. Martinroe,
 Stephen R. Spriggs, Terraye M. Starr
Visual Information Specialists
 Quang M. Doan, MBA, Phyllis H. King
Information Technology Specialists

MMWR Editorial Board

William L. Roper, MD, MPH, Chapel Hill, NC, *Chairman*
 Matthew L. Boulton, MD, MPH, Ann Arbor, MI
 Virginia A. Caine, MD, Indianapolis, IN
 Barbara A. Ellis, PhD, MS, Atlanta, GA
 Jonathan E. Fielding, MD, MPH, MBA, Los Angeles, CA
 David W. Fleming, MD, Seattle, WA
 William E. Halperin, MD, DrPH, MPH, Newark, NJ
 King K. Holmes, MD, PhD, Seattle, WA

Timothy F. Jones, MD, Nashville, TN
 Rima F. Khabbaz, MD, Atlanta, GA
 Dennis G. Maki, MD, Madison, WI
 Patricia Quinlisk, MD, MPH, Des Moines, IA
 Patrick L. Remington, MD, MPH, Madison, WI
 William Schaffner, MD, Nashville, TN

FIGURE. Results of investigation of online reviews by restaurant patrons that referred to possible foodborne illness — pilot project, New York City, July 1, 2012–March 31, 2013



Abbreviation: DOHMH = Department of Health and Mental Hygiene.

Of the 499 reviews describing an event consistent with foodborne illness, 468 (94%) indicated recent or potentially recent illness. Of these 468 reviews, only 15 (3%) were also reported to 311 during the same period. A total of 339 reviews that indicated only one person became ill and had no scombroid poisoning or severe neurologic symptoms were excluded, leaving 129 reviews that required further investigation (Figure). Of the 129, a total of 27 (21%) reviewers completed a telephone interview inquiring about meals and illnesses. The median time from review date to DOHMH contact to schedule a telephone interview was 8 days. The interviews provided information on 27 restaurants, and 24 restaurants were identified as potential locations of recent exposure because the meal dates were within 4 weeks of the interview.

From the 27 interviews, DOHMH determined whether the complaints warranted an outbreak investigation by considering the following criteria: 1) more than one person became ill, 2) no other common meals were suspected, 3) ill persons lived in different households, and 4) the cases had similar onset periods (indicating a likely foodborne cause rather than person-to-person transmission). For scombroid poisoning or neurologic symptoms, DOHMH considered whether symptoms and onset were consistent with scombrototoxin, ciguatera toxin, or botulism poisoning.

Three outbreaks meeting DOHMH outbreak investigation criteria were identified, accounting for 16 illnesses not previously reported to DOHMH. Interviews with reviewers identified likely food items associated with illness at each of the three restaurants: house salad, shrimp and lobster cannelloni, and macaroni and cheese spring rolls (Table). The reviews of the three restaurants had been posted on Yelp 2–5 days after the meals. Environmental investigations were conducted at two of the three restaurants during the week after the interviews; a

routine DOHMH inspection had already been conducted at the other restaurant 2 days after the meal. The two investigations and the routine inspection identified multiple violations at each of the outbreak restaurants (Table). Investigators were unable to obtain laboratory data that might have identified the infectious agents.

Discussion

In a New York City DOHMH pilot project, of 468 recent or potentially recent online foodborne illness complaints posted on Yelp and reviewed by foodborne epidemiologists, three previously unreported restaurant outbreaks were identified. Because foodborne cases have a common exposure, a restaurant patron review-based system can identify small, point-source outbreaks that are not easily found by systems reviewing large sources of data, such as syndromic surveillance of emergency department visits (4), Google Flu Trends (5), and analysis of Twitter data for influenza and other public health trends (6–8). Most importantly, foodborne epidemiologists can confirm reports because Yelp offers a way to follow-up with reviewers for interview.

In this project, only 15 (3%) of the 468 recent or potentially recent illnesses identified on Yelp were also reported directly to New York City's nonemergency 311 service, suggesting that knowledge about 311 reporting is limited. Of further note, after messages regarding the availability of 311 were sent to 290 reviewers who did not meet the project criteria, 32 responded, of whom 25 (78%) said they were unaware of the 311 system or would keep 311 in mind for the future. The 311 service receives approximately 3,000 food poisoning complaints each year, and from that number, about 1% are identified as outbreak-related (DOHMH, unpublished data, 2014).

As social media usage continues to grow among U.S. adults (9), health departments might consider additional surveillance

TABLE. Unreported outbreaks of foodborne illness identified by investigation of online restaurant patron reviews — pilot project, New York City, July 1, 2012–March 31, 2013

Outbreak	Month of meal	Likely food vehicle	No. of persons ill/ No. in reviewer's party	Public health action	Environmental findings
Outbreak A	December 2012	House salad	7/9	Environmental investigation and food preparation review conducted in response to interview with reviewer	Cross-contamination in refrigerator Bare-hand contact with ready-to-eat food Improperly sanitized work surfaces No washing of ready-to-eat vegetables
Outbreak B	January 2013	Shrimp and lobster cannelloni	3/5	Routine inspection conducted 2 days after meal	Improper cold food storage Improper thawing procedures Food contact surface not maintained properly Food dispensing utensils stored improperly Mouse activity present Live roaches present
Outbreak C	March 2013	Macaroni and cheese spring rolls	6/6	Environmental investigation and food preparation review conducted in response to interview with reviewer	Bare-hand contact with ready-to-eat food Cold storage temperatures not taken during cold holding of pre-prepared food

What is already known on this topic?

Health departments rely on the public to report restaurant-related foodborne illness directly to them, yet many outbreaks go unreported. A large amount of publicly reported information about foodborne illness is available on restaurant review websites.

What is added by this report?

During a 9-month period, approximately 294,000 reviews of New York City restaurants posted on Yelp.com were screened by software programs for possible cases of foodborne illness. The software flagged 893 reviews for evaluation by an epidemiologist, resulting in the identification of 468 reviews that were consistent with recent or potentially recent foodborne illness. Only 15 (3%) of these reviews described events that had been reported to the health department. After further evaluation of reviews and interviews with 27 reviewers, three previously unreported restaurant-related outbreaks were identified.

What are the implications for public health practice?

Review websites might be a valuable source of data in the public health setting. Restaurant patron reviews can help identify small, point-source outbreaks of foodborne illness because cases have a known common exposure. Such reviews might be particularly useful if the website offers a way to reach reviewers for follow-up interviews.

methods to capture illness reports from those more likely to post a restaurant review online than to contact a health department. By incorporating website review data into public health surveillance programs, health departments might find additional illnesses and improve detection of foodborne disease outbreaks in the community. Similar programs could be developed to identify other public health hazards that reviewers might describe, such as vermin in food establishments.

The findings in this report are subject to at least four limitations. First, to increase the likelihood of identifying true foodborne illness, a narrow focus was chosen for the individual criteria used to score reviews. Therefore, it is possible that some foodborne illnesses were not picked up by the screening software because of low average review scores (e.g., because of illnesses resulting from toxins with short incubation periods). Second, personal contact information for reviewers was unavailable, requiring reviewers to check their Yelp accounts and provide a telephone number to participate, which extended the time from review to interview and might have affected the response rate. Third, investigators were not able to identify any of the infectious agents in the outbreaks. Finally, the system required substantial resources; in addition to programming expertise, staff members were needed to read reviews, send e-mails, interview reviewers, and perform follow-up inspections.

Additional work using social media might improve health department abilities to use the Internet for disease detection. Working with the Chicago Department of Public Health, the

Smart Chicago Collaborative recently developed a system to contact those who post foodborne illness complaints either on its website or on Twitter.* For health departments looking for an alternative to analyzing review data weekly, creating an illness-reporting vehicle such as the Utah Department of Health's "I Got Sick" website (10) could be a more practical solution, although it might be less widely used than a review website such as Yelp. Review websites could assist by offering a link to the reviewer's local health department's reporting system at the time of review posting.

DOHMH plans to continue to refine this project. To shorten the time from review to investigation, Yelp will provide daily instead of weekly review feeds, and, to increase sensitivity, the project will be expanded to include additional review websites. To improve response rates, DOHMH will offer a link to an electronic survey. Finally, DOHMH is exploring the possibility of linking multiple complaints pertaining to the same restaurant, using data from different review websites and DOHMH databases.

* Available at <https://foodborne.smartchicagoapps.org>.

¹New York City Department of Health and Mental Hygiene; ²CDC/CSTE Applied Epidemiology Fellow; ³Columbia University; ⁴Yelp (Corresponding author: Vasudha Reddy, vreddy@health.nyc.gov, 347-396-2676)

References

1. Scallan E, Hoekstra RM, Angulo FJ, et al. Foodborne illness acquired in the United States—major pathogens. *Emerg Infect Dis* 2011;17:7–15.
2. Hall M, Frank E, Holmes G, Pfahringer B, Reutemann P, Witten IH. The WEKA data mining software: an update. *ACM SIGKDD Explorations* 2009;11:10–8.
3. The City of New York. NYC 311. New York, NY: The City of New York; 2014. Available at <http://www.nyc.gov/311>.
4. CDC. Three years of emergency department gastrointestinal syndromic surveillance in New York City: what have we found? In: *Syndromic surveillance: reports from a national conference, 2004*. *MMWR* 2005;54(Suppl):175–80.
5. Carneiro H, Mylonakis E. Google Trends: a web-based tool for real-time surveillance of disease outbreaks. *Clin Infect Dis* 2009;49:1557–64.
6. Culotta A. Towards detecting influenza epidemics by analyzing Twitter messages. In: *Proceedings of the First Workshop on Social Media Analytics*, July 25, 2010; Washington, DC. New York, NY: Association for Computing Machinery; 2010. Available at http://snap.stanford.edu/soma2010/papers/soma2010_16.pdf.
7. Paul M, Dredze M. You are what you tweet: analyzing Twitter for public health. In: *Proceedings of the Fifth International AAAI Conference on Weblogs and Social Media*, July 17–21, 2011; Barcelona, Spain. Palo Alto, CA: AAAI Press; 2011:265–72.
8. Sadilek A, Brennan S, Kautz H, Silenzio V. nEmesis: which restaurants should you avoid today? In: *Proceedings of the First AAAI Conference on Human Computation and Crowdsourcing*, November 6–9, 2013; Palm Springs, California. Available at <http://www.aaai.org/ocs/index.php/HCOMP/HCOMP13/paper/viewFile/7475/7413>.
9. Fox S, Rainie L, Pew Research Center. Pew Internet research project: the Web at 25 in the U.S.; 2014. Available at <http://www.pewinternet.org/2014/02/27/the-web-at-25-in-the-u-s>.
10. Utah Department of Health. Report a foodborne illness. Salt Lake City, UT: State of Utah, Utah Department of Health; 2012. Available at <http://igotsick.health.utah.gov>.

Rabies Death Attributed to Exposure in Central America with Symptom Onset in a U.S. Detention Facility — Texas, 2013

Ryan M. Wallace, DVM¹, Darlene Bhavnani, PhD², John Russell, DO³, Sherif Zaki, MD⁴, Atis Muehlenbachs, MD⁴, Kathryn Hayden-Pinneri, MD⁵, Ricardo Mena Aplicano, MD⁶, Leonard Peruski, PhD⁷, Neil M. Vora, MD¹, Diana Elson, DrPH⁸, Edith Lederman, MD⁸, Ben Leeson, MD³, Thomas McLaughlin, DO³, Steve Waterman, MD⁴, Maureen Fonseca-Ford, MPH², Jesse Blanton, MPH², Richard Franka, DVM⁴, Andres Velasco-Villa, PhD⁴, Michael Niezgodá⁴, Lillian Orciari, MS⁴, Sergio Recuenco, MD⁴, Inger Damon, MD⁴, Cathleen Hanlon, VMD⁴, Felix Jackson⁴, Jessie Dyer, MPH⁴, Ashutosh Wadhwa, PhD⁴, Laura Robinson, DVM⁹ (Author affiliations at end of text)

On June 7, 2013, a man was diagnosed in a Texas hospital with rabies. He had been detained in a U.S. detention facility during his infectious period. To identify persons exposed to rabies who might require rabies postexposure prophylaxis (PEP), CDC and the Texas Department of State Health Services (DSHS) conducted investigations at four detention facilities, one medical clinic, and two hospitals. In all, 25 of 742 persons assessed for rabies exposure were advised to receive PEP. Early diagnosis of rabies is essential for implementation of appropriate hospital infection control measures and for rapid assessment of potential contacts for PEP recommendations.

Case Report

On May 9, 2013, a Guatemalan national aged 28 years, was apprehended by the U.S. Border Patrol. Seven days later, while in a U.S. Immigration and Customs Enforcement (ICE) detention facility, he experienced insomnia, anxiety, nausea, dysphagia, and multiple reported instances of hypersalivation and expectoration. He became increasingly agitated, developed tachycardia, and on May 18 was transported to a hospital emergency department where a computed tomography scan of the chest revealed pneumomediastinum. Shortly after assessment, he was transferred to a second hospital for surgery. Although the pneumomediastinum resolved without surgical intervention, his mental and respiratory status deteriorated. Initial laboratory analysis was notable for a peripheral leukocytosis of 27,700 cells/ μ L (82% neutrophils) (normal cell count = 4,800–10,800/ μ L). He was febrile, with a temperature of 103.6°F (39.8°C) and his mental and respiratory status deteriorated, prompting tracheal intubation. Labile blood pressure, hypersalivation, and an abnormal fear of drafts of fresh air were documented. A lumbar puncture was performed 11 days after symptom onset, yielding cerebrospinal fluid (CSF) with 18 white blood cells/ μ L (normal = 0–5/ μ L) and protein of 51 mg/dL (normal = 15–60 mg/dL). Magnetic resonance imaging of the brain showed no intracranial abnormalities.

Serum tested by enzyme-linked immunosorbent assay (ELISA) at a commercial laboratory detected rabies virus antibodies. Based on these results, the Milwaukee protocol

(version 4.0),* an experimental rabies treatment plan, was initiated using ketamine, midazolam, insulin, amantadine, and nimodipine. Specimens were sent to CDC for confirmatory testing. Rabies virus-specific neutralizing and binding antibodies were detected in serum and CSF by the rapid fluorescent focus inhibition test (RFFIT) and indirect fluorescent antibody test (IFA), respectively.

Treatment was not successful, and the patient was pronounced brain-dead on June 11, hospital day 22, when life support was withdrawn. Nucleic acid amplicons from skin, saliva, and postmortem brain tissue were consistent with a canine rabies virus variant from Central America.

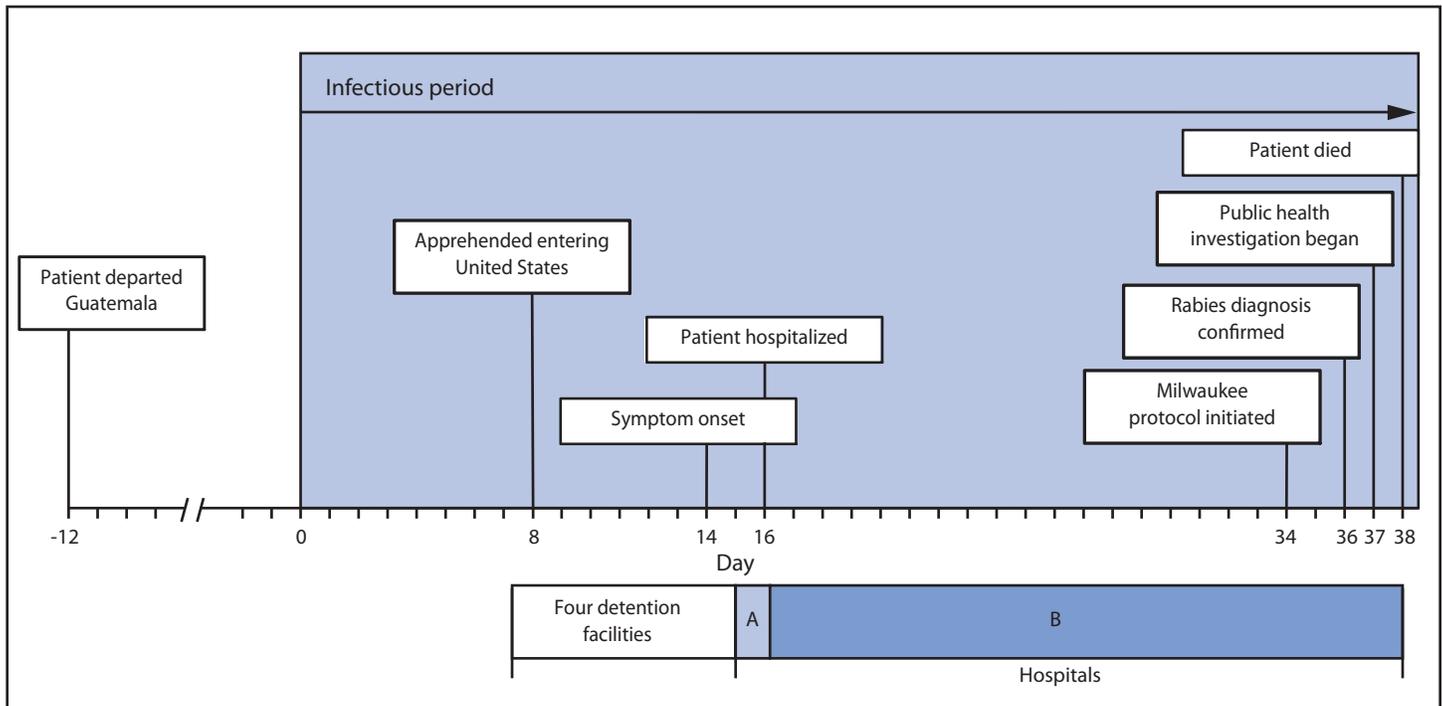
The patient had owned a dog in Guatemala, which died from unknown causes in 2011, but family members reported that they were unaware of any history of animal bites. No animal exposures were reported at the time of hospitalization and autopsy revealed no evidence of bite wounds. At the family's request, the patient's body was returned to his home in Guatemala after being embalmed using enhanced infection control measures under CDC consultation.

Public Health Investigation

In studies of dogs, cats, and ferrets, shedding of rabies virus in saliva and tears occurred up to 10 days before rabies symptom onset (1,2). Shedding of virus has not been adequately described for humans; therefore, the patient was considered potentially infectious from 14 days before symptom onset, which began with anxiety and insomnia on May 16 (Figure). Thirty-seven days after the start of the patient's infectious period, CDC and the Texas DSHS began rabies contact investigations at four detention facilities where he had been housed while under federal custody, a medical clinic at one detention facility, and two hospitals (A and B). All persons potentially in direct physical contact with the patient were considered for rabies risk assessment. Rabies PEP was recommended if there was a high probability of direct contact of saliva or tears with freshly broken skin or mucous membranes (2).

* Available at http://www.mcw.edu/filelibrary/groups/pedsinfectiousdiseases/rabies/milwaukee_protocol_v4_2013.pdf.

FIGURE. Timeline of rabies patient's activities, by day of infectious period — Central America and Texas, 2013



The patient was presumed to be in Mexico for the first 7 days of the potential infectious period. On day 8 he was apprehended while illegally entering the United States. During days 8–16 he was held at four detention facilities. The facilities hold males aged ≥ 18 years separate from juveniles and women. To accommodate routine disinfection of cells and cell capacity limitations, detainees are moved periodically. Records of detainee movements within a facility were not available; therefore, the patient had the opportunity to be housed with any adult male who was in the facility during the same time. On days 15 and 16 of his infectious period, the patient had multiple visits to a detention facility medical clinic. On day 16, the patient was transferred to hospital A and immediately referred to hospital B, where he received care until his death.

ICE records were used to construct a timeline for the period in which the patient was in the detention facilities. This timeline was then used to identify detainees and detention staff members who were in the facility with the patient. Age, sex, cumulative time with the patient, and facility-specific risk factors were used to develop a unique risk scoring system to prioritize rabies contact investigation activities. Risk scores for females and juveniles were zero, because they were not detained with the patient. Detainee contacts entering or exiting a facility with the patient received a risk score of 1 for each such event. Detainee contacts held in specific facilities where food and drink were likely to have been shared received a risk score of 2. Detainee contacts held in facilities when the patient

was symptomatic received a risk score of 3. Detainees held in multiple facilities with the patient received higher cumulative risk scores.

The investigation identified 549 detainees with concordant detention timelines as the patient; 378 were adult males. A cumulative risk score of three or greater was the threshold for conducting a rabies risk assessment. Of the 68 detainees identified for risk assessment, 17 were still in ICE custody and were assessed by local or state health departments; one was recommended for PEP. The 51 remaining detainee contacts had since returned to one of four Latin American countries. The Pan-American Health Organization (PAHO) assisted in the notification process through the International Health Regulations.[†] The Ministry of Health in Guatemala, the patient's country of origin, located 17 of 26 contacts; 13 were recommended for PEP. Officials from country B acknowledged receipt of the names of the 13 contacts recommended for risk assessment but declined to provide information on how investigations were conducted. Health officials from country C informed PAHO that they do not conduct contact investigations for prevention of human-to-human rabies transmission. The ministry of health for country D located all three contacts that were recommended for risk assessment; one was recommended for PEP (Table).

[†] Additional information available at http://www.who.int/topics/international_health_regulations/en.

TABLE. Rabies risk assessments and postexposure prophylaxis (PEP) recommendations associated with exposure to a patient with rabies in detention and medical facilities — Central America and Texas, 2013

Classification/Location	Potentially exposed	Recommended for rabies risk assessment	Risk assessments completed		PEP recommended	
			No.	(%)	No.	(%)
Detainees	378	68	37	(54)	15	(41)
U.S. custody	91	17	17	(100)	1	(6)
Guatemala	98	26	17	(65)	13	(76)
Country B	120	13	—*		—*	
Country C	56	4	—*		—*	
Country D	9	3	3	(100)	1	(33)
United States	4	0	—		—	
Enforcement officers and contract staff members	320 [†]	320 [†]	185	(58)	3	(2)
Medical staff members	44	44	38	(86)	5	(13) [§]
Total	742	432	260	(60)	25	(10)

* Country did not provide information on its activities in response to this event.

[†] Number of potentially exposed and assessment recommendations based on work shift listings; numbers are based on known or suspected contact with the index patient.

[§] Five medical staff members were recommended for PEP. Two additional staff members received PEP at their own request, despite no evidence of a rabies exposure.

Texas DSHS and local health department staff members interviewed 185 law enforcement officers and contract staff members. Officers reported a physical altercation during the patient's arrest. At the time of risk assessment (35 days after exposure), the officers could not recall if saliva from the patient made contact with open wounds or mucous membranes. PEP was recommended for the three officers involved in the patient's apprehension. No other officers or contractors were recommended PEP.

Forty-four health-care workers from the detention facility medical unit and hospitals A and B were assessed for rabies virus exposures. Five healthcare workers received PEP because of potential exposure to saliva and tears during medical procedures. Two others received PEP at their own request.

Discussion

Each year, approximately 55,000 persons worldwide die from rabies, a progressive encephalitic disease with a near 100% mortality rate. More than 98% of human rabies deaths are the result of transmission from the bite of a rabid dog, and nearly half of the world's population currently live in countries in which canine rabies is endemic. In the United States, only 34 human rabies cases were reported during 2003–2013, of which 10 (29%) were attributed to rabid animal exposures abroad.

This investigation describes the first reported case of a person in federal custody while potentially infectious with rabies. Screening by ELISA detected rabies virus-specific binding antibodies for this patient, despite it not being a recommended assay for human rabies diagnosis (3). In the United States, ante-mortem rabies testing requires four specimens (serum, CSF, nuchal skin biopsy, and saliva), with serum and CSF tested by IFA and RFFIT. All persons potentially exposed to rabies virus should receive an individual risk assessment to determine if PEP is indicated. However, for rabies contact investigations

occurring in large communal settings or multinational in scope, this might not be possible. In these circumstances, consultation with public health authorities regarding alternative options for risk assessment should be undertaken. To facilitate the contact investigation and prevent human-to-human rabies virus transmission, a unique risk scoring system was used for the first time to prioritize persons at highest risk for exposure in this specific instance.

Theoretically, human-to-human transmission can occur through exposure of mucous membranes or open wounds with saliva, tears, or nervous tissue from the infected patient. Detention facilities have increased potential for rabies virus exposures through close contact during confinement, as might have occurred when this patient began hypersalivating and expectorating in his cell (4). As a result of these circumstances, 15 of 37 (41%) detainees received PEP. In comparison, only three of 185 (2%) detention facility staff members and five of 44 (13%) medical staff members received PEP based on public health recommendations. Although human-to-human transmission of rabies is rare, the detention setting provides extensive opportunities for exposure.

Cremation is recommended for patients who have died from rabies. If cremation is not desired, the body should be permanently sealed in a closed casket without embalming. If the body must be prepared for public viewing, it should be embalmed using formalin with a concentration $\geq 2\%$, which has been shown to inactivate other enveloped RNA viruses (5,6). Although there is no evidence for aerosolization of rabies virus during routine embalming procedures, manipulation of the body and methods that use embalming fluids under pressure could potentially release infectious materials, particularly if organs and other tissues were removed during autopsy. The embalmer should use an N95 respirator, face shield, and puncture-resistant gloves in addition to standard

What is already known on this topic?

Each year approximately 55,000 persons worldwide die from rabies, a progressive encephalitic disease with a near 100% mortality rate. More than 98% of human rabies deaths are the result of transmission from the bite of a rabid dog. Nearly half of the world's population currently lives in countries in which canine rabies is endemic. In the United States, only 34 human rabies cases were reported during 2003–2013, of which 10 (29%) were attributed to rabid animal exposures abroad.

What is added by this report?

In June 2013, a Guatemalan national aged 28 years was the first person known to have developed symptoms of rabies while in a United States detention facility. He developed insomnia, anxiety, nausea, dysphagia, and hypersalivation while detained. After hospitalization, his mental and respiratory status deteriorated, and 24 days after hospitalization he was declared brain dead. No animal exposures were reported, but phylogenetic analysis determined that the virus variant was associated with a canine variant found in Latin America. Of 742 detainee, enforcement officer, and medical contacts, 25 were recommended for and received postexposure prophylaxis.

What are the implications for public health practice?

Detention facility settings provide extensive opportunities for disease transmission, including rabies, and a complex network of potential disease contacts. Law enforcement and public health officials, when working cohesively, can quickly identify potentially exposed persons and provide life-saving medical recommendations. A diagnosis of rabies should be considered in patients hospitalized with unexplained acute progressive encephalitis, especially when the patient comes from a region with endemic rabies or has a known history of animal exposure.

infection control measures. Before dressing, the body should be disinfected with a 10% solution of sodium hypochlorite or equivalent disinfectant (7). Family members of rabies patients should avoid contact with the deceased body.

Ministries of health responses to the International Health Regulations notification of potential human-to-human rabies transmission varied. Several countries attempted to locate all persons recommended for risk assessment; however, one country chose not to conduct an investigation and another did not provide details on how it responded. The outcome of these differing responses resulted in a low (54%) completion rate of confirmed rabies risk assessment among detainees. Human-to-human transmission of rabies is rare, and as such, public health programs must consider the costs and benefits

of large-scale investigations. In countries where public health infrastructure can efficiently locate and treat contacts of rabies patients, this vaccine-preventable, fatal disease is usually thoroughly investigated. Development of streamlined approaches to human rabies contact investigations can enhance public health infrastructure and support best practices for use of public health and vaccine resources even in resource-limited countries.

Acknowledgments

Pan-American Health Organization. Tom Sidwa, DVM, Linda Gaul, Lisa Cornelius, Nicole Evert, James Merton, Texas Department of State Health Services. Janey Roblez, Linda Simmons, Corpus Christi-Nueces County Public Health District. Roman Abeyta, Omar Fritzler, Cameron County Department of Health and Human Services, Lauren Garcia, Maira Barrera, Hidalgo County Health and Human Services Department. Robert Paez, Christopher Ott, Customs and Border Patrol. Angelica Galindo-Sanchez, US Public Health Service. Rachel Joseph, MD, Clare Dykewicz, MD, Francisco Alvarado-Ramy, MD, Denise Borntreger, MD, Katrin Kohl, MD, Division of Global Migration and Quarantine, National Center for Emerging and Zoonotic Infectious Diseases, CDC.

¹EIS officer, CDC; ²Division of Global Migration and Quarantine, National Center for Emerging and Zoonotic Infectious Diseases, CDC; ³Texas A&M Health Science Center, Christus Spohn Hospital, Corpus Christi, Texas; ⁴Division of High-Consequence Pathogens and Pathology, National Center for Emerging and Zoonotic Infectious Diseases, CDC; ⁵Harris County Medical Examiner's Office, Texas; ⁶Guatemala Ministry of Health; ⁷Division of Global Health Protection, Center for Global Health, CDC; ⁸Public Health, Safety, and Preparedness Unit, Immigrations and Customs Enforcement; ⁹Texas Department of State Health Services (Corresponding author: Ryan M. Wallace, euk5@cdc.gov, 404-639-2018)

References

1. Niezgoda M, Briggs DJ, Shaddock J, Rupprecht CE. Viral excretion in domestic ferrets (*Mustela putorius furo*) inoculated with a raccoon rabies isolate. *Am J Vet Res* 1998;59:1629–32.
2. CDC Human rabies prevention—United States, 2008: recommendations of the Advisory Committee on Immunization Practices. *MMWR* 2008;57(No. RR-3).
3. Bahloul C, Taieb D, Kaabi B, et al. Comparative evaluation of specific ELISA and RFFIT antibody assays in the assessment of dog immunity against rabies. *Epidemiol Infect* 2005;133:749–57.
4. Hammett, TM. Making the case for health interventions in correctional facilities. *J Urban Health* 2001;78:236–40.
5. Greene CE. *Infectious diseases of the dog and cat*. 4th ed. St. Louis, MO: Elsevier/Saunders; 2012.
6. Watanabe Y, Miyata H, Sato H. Inactivation of laboratory animal RNA-viruses by physicochemical treatment. *Jikken Dobutsu* 1989;38:305–11.
7. CDC. Human rabies—Kentucky/Indiana, 2009. *MMWR* 2010;59:393–6.

Notes from the Field

Coccidioides immitis Identified in Soil Outside of Its Known Range — Washington, 2013

Nicola Marsden-Haug, MPH¹, Heather Hill², Anastasia P. Litvintseva, PhD³, David M. Engelthaler, MS⁴, Elizabeth M. Driebe, MS⁴, Chandler C. Roe, MS⁴, Cindy Ralston², Steven Hurst, MS³, Marcia Goldoft, MD¹, Lalitha Gade, MPharm³, Ron Wohrle, DVM¹, George R. Thompson III, MD⁵, Mary E. Brandt, PhD³, Tom Chiller, MD³ (Author affiliations at end of text)

Coccidioidomycosis (“valley fever”) is caused by inhaling spores of the soil-dwelling fungi *Coccidioides immitis* or *Coccidioides posadasii*. Most infections are subclinical. When clinical manifestations do occur (typically 1–4 weeks after exposure), they are similar to those associated with influenza or community-acquired pneumonia. Disseminated disease is rare. Residual pulmonary nodules can lead to chronic lung disease. Fluconazole or other triazoles often are used for treatment, but mild cases often resolve without specific therapy. A total of 17,802 cases were reported in the United States in 2012.

Coccidioidomycosis is endemic to the hot, arid regions of the southwestern United States and Central and South America; Washington state is far north of its recognized range. However, three acute coccidioidomycosis cases among residents of south central Washington reported during 2010–2011 were suspicious for local acquisition; none of the three patients had traveled within 22 months of illness onset to an area where coccidioidomycosis is known to be endemic (1).

In November 2010, during the investigation of the Washington cases, soil was collected from two locations in Benton County, Washington. Although no reliable test for identifying *Coccidioides* in soil existed at that time, environmental testing methods were being studied by CDC and its partners. Sampling sites on public lands were identified by interviewing two patients; one site was a dirt track used for all-terrain vehicle riding and the other was near a residential complex. Soil samples were obtained from locations where patients described falling or playing in the dirt and from nearby rodent burrows and snake holes.

Soil samples were refrigerated at the Washington State Public Health Laboratories until August 2013, when they were sent to CDC’s Mycotic Diseases Laboratory. A novel real-time polymerase chain reaction assay developed by the Translational Genomics Research Institute was used to detect *Coccidioides* DNA in six of 22 soil samples. Viable *C. immitis* was isolated from four of the six soil samples using a modified yeast extract medium. Sequencing of rDNA and three other genes confirmed the isolates as *C. immitis*. The environmental isolate genotypes were identical to a clinical isolate from one patient by whole genome sequencing. This is new direct evidence that the infections were acquired in Washington and that *C. immitis* exists in this environment clearly outside the recognized endemic area.

Health-care providers should be aware that *C. immitis* is present in south central Washington, and should consider the diagnosis in patients with clinically compatible illness who reside or have traveled in this area. Furthermore, health-care providers in surrounding regional areas should consider testing for coccidioidomycosis if clinically warranted and exposures like those described exist. Similarly, veterinarians should be aware of the possibility of *Coccidioides* infection outside its recognized range. Further work to understand the geographic range of this disease is underway. Coccidioidomycosis is a nationally notifiable disease; reporting to public health authorities helps describe the occurrence of cases in new areas.

¹Washington State Department of Health; ²Benton-Franklin Health District, Kennewick, Washington; ³Division of Foodborne, Waterborne, and Environmental Diseases, National Center for Emerging and Zoonotic Infectious Diseases, CDC; ⁴Translational Genomics Research Institute, Flagstaff, Arizona; ⁵Coccidioidomycosis Serology Laboratory, University of California–Davis (Corresponding author: Nicola Marsden-Haug, nicola.marsden-haug@doh.wa.gov, 206-418-5429)

Reference

1. Marsden-Haug N, Goldoft M, Ralston C, et al. Coccidioidomycosis acquired in Washington state. *Clin Infect Dis* 2013;56:847–50.

Notes from the Field

Trichinellosis Caused by Consumption of Wild Boar Meat — Illinois, 2013

Yoran Grant Greene, PhD^{1,2}, Thomas Padovani³, Jo Ann Rudroff⁴, Rebecca Hall, MPH⁵, Connie Austin, DVM, PhD², Michael Vernon, DrPH² (Author affiliations at end of text)

On March 6, 2013, the Cook County Department of Public Health (Chicago, Illinois) contacted the Illinois Department of Public Health regarding a diagnosis of trichinellosis in a patient who had consumed wild boar and deer meat obtained by hunting at a Missouri ranch January 16–18. Trichinellosis is a parasitic infection caused by consumption of undercooked infected meat, most commonly from carnivorous or omnivorous animals (1).

The Cook County and Illinois health departments and the Missouri Department of Health and Senior Services queried the Illinois and Missouri electronic reportable disease registries and interviewed patients to identify additional cases and describe patients' clinical characteristics. CDC performed immunoglobulin G enzyme-linked immunosorbent assay testing of patient serum and microscopically examined the meat for evidence of *Trichinella* larvae.

Patient interviews revealed that the index patient had ground the wild boar and deer meat into sausage and served it to three family members who had participated in the hunt. The sausage was shared with a friend and the friend's four family members, none of whom had participated in the hunt. A case was defined as illness in a person who consumed the implicated meat and had positive serology or myalgias. Nine cases were identified. All nine persons had consumed the implicated sausage during January 20–February 16 and experienced illness compatible with trichinellosis during February 13–March 4; three of six tested had a positive serologic test for antibodies specific to *Trichinella* within 7 days of symptom onset. No one else consumed the sausage, and no additional cases were identified from electronic disease registries.

Among the nine cases, five occurred among men (median age = 35 years; range = 20–54 years), and the median incubation period was 16 days (range = 4–24 days). All patients reported myalgias, eight had periorbital edema, and seven had both fever and eosinophilia. *Trichinella spiralis* larvae were identified microscopically in the sausage but not in the deer meat, indicating that the boar meat was the likely source. All patients were treated solely with albendazole and recovered without complications.

Trichinellosis cases remain infrequent in the United States because of state and federal laws preventing feeding of uncooked swill to commercial swine and public awareness of the danger of eating raw or undercooked game meat. The Missouri Department of Health and Senior Services provided additional education to employees of the ranch about the risk for *Trichinella* ingestion and the need to inform hunting patrons. The Illinois Department of Public Health recommends posting advisories at hunting ranches that inform hunters of the importance of cooking game meat to the cooking temperature of 71°C (160°F) recommended by the U.S. Department of Agriculture and CDC before consuming it (2).

¹EIS officer, CDC; ²Illinois Department of Public Health; ³Cook County Department of Public Health, Chicago, Illinois; ⁴Missouri Department of Health and Senior Services; ⁵Division of Parasitic and Malarial Diseases, Center for Global Health, CDC (Corresponding author: Yoran Grant Greene, exu4@cdc.gov, 404-952-5543)

References

1. CDC. Parasites: trichinellosis (also known as trichinosis). Trichinellosis FAQs. Atlanta, GA: US Department of Health and Human Services, CDC; 2012. Available at http://www.cdc.gov/parasites/trichinellosis/gen_info/faqs.html.
2. CDC. Parasites: trichinellosis (also known as trichinosis). Prevention and control. Atlanta, GA: US Department of Health and Human Services, CDC; 2013. Available at <http://www.cdc.gov/parasites/trichinellosis/prevent.html>.

Announcement

Recommendations Regarding Skin Cancer Prevention from the Community Preventive Services Task Force

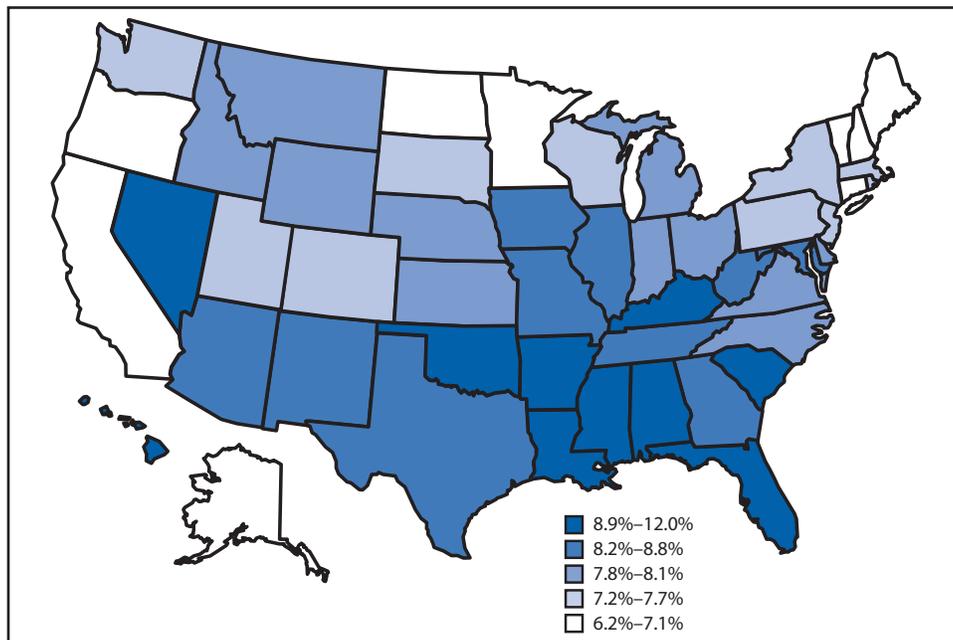
The Community Preventive Services Task Force has posted new information online regarding prevention of skin cancer. Recommendations are offered regarding interventions for child care centers, primary and middle schools, high schools and colleges, outdoor occupational or recreational and tourism settings, and mass media and multicomponent communitywide campaigns. Summaries and links to the individual recommendations are available at <http://www.thecommunityguide.org/cancer/skin/education-policy/index.html> and <http://www.thecommunityguide.org/cancer/skin/community-wide/index.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 Infants Born Late Preterm,* by Mother's State of Residence — National Vital Statistics System, United States, 2012



* Defined as a gestational age (interval between the date of the mother's last normal menses and the date of birth) of 34–36 completed weeks. Late preterm births accounted for 70% of all preterm births in 2012 and are considered to be at less risk than births at <34 weeks (early preterm) but at greater risk for birth complications and subsequent health or medical problems than full-term births.

In 2012, 8.1% of births in the United States were late preterm births. The percentage of births that were late preterm varied by state and ranged from 6.2% in Vermont to 12.0% in Mississippi.

Sources: Martin JA, Hamilton BE, Osterman, MJK, Curtin SC, Mathews T. Births: final data for 2012. Natl Vital Stat Rep 2013;62(9). Available at http://www.cdc.gov/nchs/data/nvsr/nvsr62/nvsr62_09.pdf.

US Department of Health and Human Services. Health indicators warehouse. Hyattsville, MD: US Department of Health and Human Services; 2013. Available at <http://www.healthindicators.gov>.

Reported by: Kate M. Brett, PhD, kbrett@cdc.gov, 301-458-4113; Li-Hui Chen, PhD.

Morbidity and Mortality Weekly Report

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

Data presented by the Notifiable Disease Data Team and 122 Cities Mortality Data Team in the weekly *MMWR* are provisional, based on weekly reports to CDC by state health departments. Address all inquiries about the *MMWR* Series, including material to be considered for publication, to Editor, *MMWR* Series, Mailstop E-90, CDC, 1600 Clifton Rd., N.E., Atlanta, GA 30329-4027 or to mmwrq@cdc.gov.

All material in the *MMWR* Series is in the public domain and may be used and reprinted without permission; citation as to source, however, is appreciated.

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

References to non-CDC sites on the Internet are provided as a service to *MMWR* readers and do not constitute or imply endorsement of these organizations or their programs by CDC or the U.S. Department of Health and Human Services. CDC is not responsible for the content of these sites. URL addresses listed in *MMWR* were current as of the date of publication.

U.S. Government Printing Office: 2014-723-032/01058 Region IV ISSN: 0149-2195