

## Human Case of Eastern Equine Encephalitis – Connecticut, 2013

In the fall of 2013, an adult resident of eastern Connecticut died of eastern equine encephalitis (EEE) virus associated illness. While EEE has been previously identified in Connecticut in animals and mosquitoes, this is the first confirmed human case. The identification of a human case underscores the importance of monitoring mosquito-borne diseases to provide guidance to the public, public health authorities, and health care providers.

The patient presented with a 3 day history of fever and severe headache, and was hospitalized the same day with a preliminary diagnosis of meningitis. Cerebrospinal fluid was collected and tested for West Nile virus specific antibodies; the results were negative. The patient died 5 days after admission to the hospital. Postmortem examination of brain tissue revealed congestion, extensive necrosis, and multifocal glial nodules. Specimens were sent to the Centers for Disease Control and Prevention for arbovirus testing. Immunohistochemical testing and polymerase chain reaction were performed, and both were positive for EEE.

The patient was an otherwise healthy person. Before onset of illness, the patient participated in recreational activities in area locations that may have harbored EEE infected mosquitoes. The patient could have potentially been bitten by mosquitoes during the typical 3-10 day EEE incubation period. The patient reportedly did not use insect repellent.

During 2013, mosquito and veterinary surveillance confirmed the presence of EEE in 9 towns, including 8 towns in eastern New London and Windham counties (Figure 1). Mosquitoes trapped July 10 in Voluntown, were the earliest EEE positive mosquitoes identified in CT since yearly trapping and testing began in 1997. The number of positive mosquitoes trapped in Voluntown increased during August and September. Evidence of EEE circulating in other areas followed, with positive mosquitoes identified in Haddam, Hampton, North Stonington,

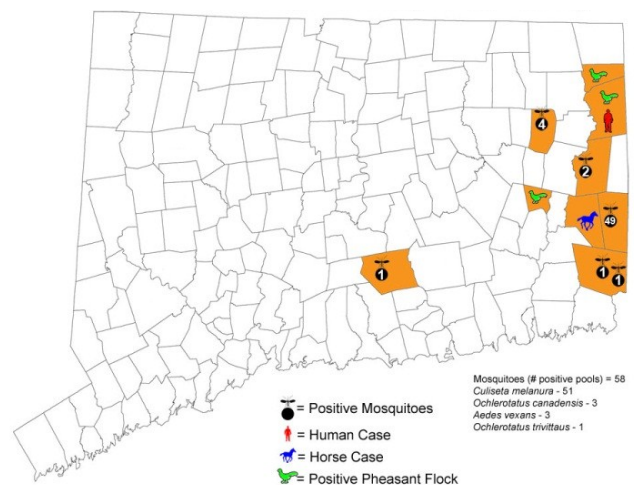
### In this issue...

Human Case of Eastern Equine Encephalitis- Connecticut, 2013	9
<i>Escherichia coli</i> O157:H7 Infections— Connecticut, 2013	10

and Plainfield. Also, die-offs in pheasant flocks occurred in Killingly, Putnam and Sprague, and a horse stabled in Griswold died of EEE infection.

Of the 58 EEE positive mosquito pools identified, 52 (90%) were *Culiseta melanura*, a species that feeds principally on birds. In Voluntown, EEE positive pools of *Ochlerotatus canadensis* were collected on August 13, 22 and 26, and positive pools of *Aedes vexans* were collected on September 12 (2 pools) and October 7. Both of these species feed on mammals and are considered “bridge” species for transmission to people. The numbers and types of EEE infected mosquitoes prompted the Department of Energy and Environmental Protection (DEEP) to close part of the Pachaug State Forest in Voluntown to recreational activities, and two campgrounds on August 21. On August 27, the DEEP conducted ultra-low volume ground spraying to reduce the number of mosquitoes in the forest.

**Figure 1: Eastern equine encephalitis activity, Connecticut, 2013**



**Reported by**

R Nelson DVM, MPH, Epidemiology and Emerging Infections Program, Connecticut Department of Public Health; T Ciesielski, MD, Autopsy and Neuropathology, Hartford Hospital; T Andreadis, PhD, P Armstrong, ScD, Center for Vector Biology & Zoonotic Diseases, The Connecticut Agricultural Experiment Station.

**Editorial Note**

Eastern equine encephalitis (EEE) is a rare but serious mosquito-transmitted viral disease. On average there are 6 cases each year in the United States (1). The virus is found in birds and bird-biting mosquitoes that live near wetland habitats along the eastern seaboard from New England to Florida, and along the gulf coast. In some years, high numbers of birds get infected favoring spread to the types of mosquitoes that bite both mammals and birds creating increased risk of transmission to people.

An increased risk of transmission of EEE to people occurs if EEE is introduced in areas where there are: a) large numbers of bird feeding mosquitoes, b) isolations of EEE from multiple species of mosquitoes, c) isolations that occur during the early part of the season, d) infected mosquitoes found in proximity to residential areas or areas where people recreate, e) susceptible mammals such as horses.

In Connecticut each season, EEE may be present due to overwintering in birds or mosquitoes, or reintroduced by migratory birds (2). It is mostly identified in or near fresh-water swamps or swamp-forest border locations most frequently in the eastern portion of the state. When EEE is identified, it is generally limited geographically. The 91 mosquito trapping and testing sites maintained by the Connecticut Agricultural Experiment Station include locations with habitat that favors EEE circulation among birds, and where the virus has been confirmed historically. Surveillance information data are available online at: [http:// www.ct.gov/mosquito/site/default.asp](http://www.ct.gov/mosquito/site/default.asp). The presence of this virus in Connecticut should also remind clinicians to include EEE, along with WNV, on their list of differential diagnoses so that appropriate tests can be done.

**References**

- Centers for Disease Control and Prevention. Eastern equine encephalitis virus. Available at <http://www.cdc.gov/EasternEquineEncephalitis/index.html>. Accessed June 23, 2014.
- Armstrong, P. M., Andreadis, T. G., Anderson, J. F. and Mores, C. N. 2008. [Tracking eastern equine encephalitis virus perpetuation in the northeastern United States by phylogenetic analysis](#). Am. J. Trop. Med Hyg. 79:291-296.

**Escherichia coli O157:H7 Infections — Connecticut, 2013**

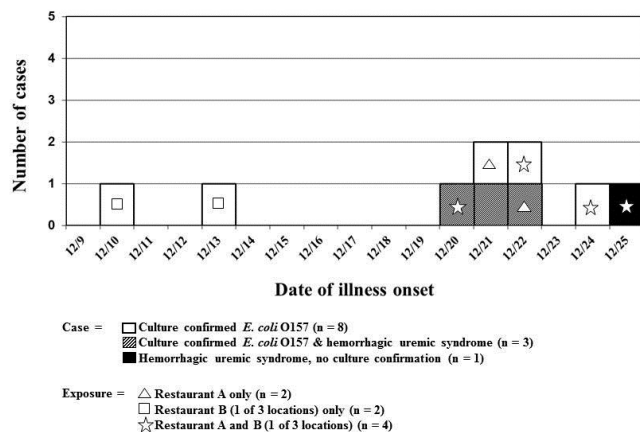
On December 28, 2013, the Connecticut Department of Public Health (DPH) Epidemiology Program was notified by a hospital emergency department (ED) physician of four patients examined in the ED with bloody diarrhea during the previous 48 hours. Two of the four patients were hospitalized with hemolytic uremic syndrome (HUS); a third patient tested positive for *Escherichia coli* O157:H7 (O157) and was hospitalized; and the fourth remained in the ED with bloody diarrhea. Staff from the DPH Epidemiology Program, the DPH Food Protection Program (FPP), and two local health departments (LHDs) conducted an epidemiologic and environmental investigation to determine the source and extent of the illnesses and to recommend control measures. This report summarizes that investigation.

**Epidemiologic investigation**

The three hospitalized patients or their surrogates were interviewed within 1 day of the physician's report to obtain information about onset of illness, symptoms, and recent food consumption. All three reported having consumed multiple meals at take-out and fast-food establishments during the week before illness onset, including Restaurant A and one of two locations of chain Restaurant B. Active case finding was conducted by calling area laboratories and requesting they notify DPH of any new positive Shiga toxin-producing *E. coli* (STEC) test results. A standard STEC questionnaire was used to interview patients, including questions on foods eaten and animal contact in the week prior to becoming ill. The initial patients or their surrogates were reinterviewed, and all new patients with STEC-positive stool samples were interviewed, pending additional microbiologic results.

A confirmed case was defined as laboratory-confirmed *E. coli* O157 infection matched by pulsed-field gel electrophoresis (PFGE) or physician-diagnosed HUS in a Connecticut resident during December 1, 2013–January 15, 2014. A total of 9 confirmed cases were identified; 8 were laboratory-confirmed. Seven of the 9 (78%) patients were female (median age: 31 years; range: 2–78 years). Onset of illness occurred during December 10–25, 2013 (Figure 1, see page 11). The patients resided in two adjacent counties and were geographically clustered. HUS was diagnosed in 4 (44%) patients. Eight (89%) were hospitalized with a median hospital

**Figure 1. *Escherichia coli* O157 cases by date of onset—Connecticut, December 2013.**



stay of 4 days (range: 1–6 days); no deaths occurred. All 9 patients had eaten at multiple restaurants within the 7 days before their illness onset. During their incubation periods, 2 (22%) had eaten at Restaurant A; 2 (22%) at chain Restaurant B; and 4 (44%) at both establishments. Patients had eaten at three different locations of Restaurant B. One reported neither restaurant, but dietary history for that patient was incomplete. Meals at Restaurant A had been consumed during December 15–20; meals at chain Restaurant B had been consumed during December 4–18. The food item most commonly consumed among the patients was lettuce on sandwiches or in salads (n = 7; 78%).

A community case-control study was attempted to determine whether Restaurant A or chain Restaurant B was the likely source of illness and to help focus produce trace back efforts. Reverse address lookup was used to enroll neighborhood and age- and sex-matched control subjects. Approximately 200 calls were attempted without successful enrollment of sufficient control subjects; therefore, the case-control study was not completed.

### **Environmental investigation**

**Restaurant A:** On December 31, 2013, staff from one LHD visited the establishment, obtained environmental samples, embargoed fresh produce pending testing, and interviewed 27 employees. The restaurant voluntarily closed the same day for extensive cleaning and restocking of fresh produce; it reopened January 2, 2014. FPP staff conducted a trace back by examining invoices for iceberg lettuce, baby spinach, and tomatoes purchased and used by the establishment since November 1, 2013. The invoices did not include sufficient data to trace the

produce to a specific producer or growing field. No employees reported illness in November or December, and stool samples submitted by all employees tested negative for enteric pathogens, including *E. coli* O157. Eight food samples, including iceberg and romaine lettuces and tomatoes, and seven environmental samples were also negative for *E. coli* O157.

**Restaurant B:** LHD staff visited the three locations of chain Restaurant B. No common links between locations (i.e., shared owner or food workers) were identified. Produce trace back information was obtained from Restaurant B's corporate buyer and local distribution center; efforts concentrated on shredded iceberg lettuce distributed during November 1–December 25, 2013. Cross-referencing of case consumption dates, distributor purchase orders, and product shelf life revealed two production dates of interest. Because the coding system used by the distributor did not include lot codes from the product supplier, linking lettuce delivered to specific restaurants within individual growing fields or producers was impossible. Forty-one employees at the three locations were interviewed; one employee reported an active gastrointestinal illness and submitted a stool sample that was negative for enteric pathogens, including *E. coli* O157.

### **Laboratory investigation**

Among the 9 cases, 8 (89%) patient stool samples were culture-confirmed with *E. coli* O157. Isolates were forwarded to the Connecticut DPH Katherine A. Kelley State Public Health Laboratory and matched by PFGE. The PFGE pattern matched a multistate cluster with cases in Minnesota (1), Michigan (2), and Texas (1). The PFGE pattern of the cluster strain is rare and has only been reported in association with human cases. Five isolates were forwarded to the Massachusetts State Laboratory for multilocus variable number tandem repeat analysis (MLVA). The Connecticut isolates and the isolate from Minnesota exhibited an indistinguishable MLVA pattern.

### **Reported by**

*J Mullins DVM, MPH, PhD, EIS Officer, CDC; T Rabatsky-Ehr, MPH, J Krasniiski, MPH, J Brockmeyer, MPH, M Maloney, MPH, and Q Phan, MPH Epidemiology and Emerging Infections Program; C Applewhite, RS, T Weeks, MS, Food Protection Program; A Eslinger, L Mank, K Holmes-Talbot, C Nishimura, State Public Health Laboratory,*



*Connecticut Department of Public Health; FoodCORE student interview team, Yale Emerging Infections Program, New Haven, Connecticut; and Local Health Department staff.*

**Editorial**

The epidemiologic and laboratory evidence indicates an outbreak of *E. coli* O157 occurred in Connecticut in December 2013. This outbreak was notable because of the clinical severity and the match to a multistate cluster. Although national surveillance indicates that HUS develops in 4%–15% of *E. coli* O157 cases (1, 2), in this cluster, 44% of patients experienced HUS and 89% were hospitalized, suggesting that the outbreak strain was particularly virulent. In addition, both patients in Michigan with PFGE-matched samples were hospitalized. Interestingly, patients with PFGE matches in Minnesota and Michigan reported having consumed multiple fast-food sandwiches with lettuce and salads during their incubation periods, and the 2 Michigan patients reported having eaten at separate locations of chain Restaurant B in Michigan.

On the basis of foods consumed by patients, lettuce was the most likely vehicle for the pathogen. Although cattle are the major reservoir for *E. coli* O157 and consumption of or contamination from undercooked ground beef are considered major risk factors for illness, the pathogen’s ability to adhere to lettuce has been demonstrated; notable outbreaks have been traced to leafy greens (3). Produce might be contaminated before harvest by water, as irrigation or as run-off from nearby cattle pastures, or after harvest during processing (3).

Trace back efforts were undertaken to identify a possible growing area or farm from which contaminated lettuce delivered to the restaurants might have been harvested. The trace back effort for both restaurants was unsuccessful because of a lack of integrated tracking systems allowing produce to be followed from farm to fork. An additional limitation to this investigation was the inability to recruit neighborhood-matched control subjects to determine the establishment most closely linked to the cluster. Approximately 200 attempts using reverse address lookup failed to enroll a sufficient number of control

subjects, because patients’ neighbors did not have telephone landlines or had moved out of the area or because landlines were out of service or unanswered. The high percentage of households having only wireless phone numbers is an increasing problem in community-based epidemiologic studies (4); alternative approaches for conducting analytic studies need to be considered for future investigations because these challenges will likely remain.

Outbreaks of *E. coli* O157 and other foodborne illnesses continue to be a challenge for public health practice. The best control strategies for this potentially life-threatening pathogen are avoiding consumption of high risk foods, timely culture of patients with acute onset of diarrheal illnesses, and prompt reporting of results to public health officials (2). Prompt identification of this cluster was facilitated by timely communication between ED clinicians and CDPH; testing of stool samples in cases of diarrheal illness is similarly important for early diagnosis and outbreak detection. This cluster emphasizes the importance of complete and transparent tracking systems in the food industry so that the source of outbreaks can be quickly identified and control measures implemented to prevent future illnesses and outbreaks (5).

*Note: The findings and conclusions in this report are those of the author(s) and do not necessarily represent the official position of the Centers for Disease Control and Prevention.*

**References**

1. Rangel, J.M., et al., [Epidemiology of Escherichia coli O157: H7 outbreaks, United States, 1982-2002](#). Emerging infectious diseases, 2005. 11(4).
2. Pennington, H., *Escherichia coli* O157. The Lancet, 2010. 376 (9750): p. 1428-1435.
3. Berger, C.N., et al., [Fresh fruit and vegetables as vehicles for the transmission of human pathogens](#). Environmental microbiology, 2010. 12(9)..
4. Blumberg SJ, Luke JV. [Wireless substitution: Early release of estimates from the National Health Interview Survey, January–June 2013](#). National Center for Health Statistics. December 2013. Available from: <http://www.cdc.gov/nchs/nhis.htm>. Accessed 5/12/2014.
5. Behravesh, C. B., et al. Multistate outbreak of *Salmonella* serotype Typhimurium infections associated with consumption of restaurant tomatoes, USA, 2006: hypothesis generation through case exposures in multiple restaurant clusters. Epidemiology and Infection, 2012;140(11).

<p>Jewel Mullen, MD, MPH, MPA Commissioner of Public Health</p> <p>Matthew L. Cartter, MD, MPH State Epidemiologist</p> <p>Lynn Sosa, MD Deputy State Epidemiologist</p>	<p>Epidemiology and Emerging Infections 860-509-7995</p> <p>Healthcare Associated Infections 860-509-7995</p> <p>HIV &amp; Viral Hepatitis 860-509-7900</p> <p>Immunizations 860-509-7929</p> <p>Sexually Transmitted Diseases (STD) 860-509-7920</p> <p>Tuberculosis Control 860-509-7722</p>	<p><b>Connecticut Epidemiologist</b></p> <p>Editor: Matthew L. Cartter, MD, MPH</p> <p>Assistant Editor &amp; Producer: Starr-Hope Ertel</p>
--	--	--