Shiga Toxin-Producing *Escherichia coli* O157 Outbreak in South Central Kansas — May 2014

Kansas Department of Health and Environment
Division of Public Health

Background

On May 13, 2014, the Kansas Department of Health and Environment's Infectious Disease Epidemiology and Response section (KDHE) was notified by a county health department of two children with illness caused by Shiga toxin-producing *Escherichia coli* (STEC) who reported attending a house party on May 5, 2014. The individuals' exposure was identified during routine disease investigations by the county health department. Additional ill individuals were reported among the party attendees; ill persons resided in two Kansas counties. KDHE notified the second county health department, and an outbreak investigation was initiated to determine the cause and scope of illness and to implement appropriate prevention and control measures.

Methods

Epidemiologic Investigation

The families of all ill individuals were interviewed in person by KDHE and investigators from the two county health departments. A special standardized questionnaire was utilized in order to obtain demographic information, clinical information, and exposure history.

For this investigation, a confirmed case was defined as laboratory evidence of STEC serotype O157 with a pulsed-field gel electrophoresis (PFGE) pattern indistinguishable from the other confirmed cases. A probable case was defined as diarrhea in an individual who was epidemiologically linked to a person with a confirmed case. A person with a primary case attended the house party on May 5, 2014; persons with secondary cases became symptomatic with diarrhea one to ten days after having contact with an ill person.

Laboratory Analysis

Initial testing on stool specimens was performed at hospital and reference laboratories; results on all specimens were confirmed by culture at the Kansas Health and Environmental Laboratories (KHEL). Toxin testing, serotyping and Pulsed-field gel electrophoresis (PFGE) were performed at KHEL on the bacterial isolates to determine the PFGE pattern of the outbreak strain of STEC O157.

Environmental Assessment

Stool samples were collected from the calf that was present at the house party and were tested for STEC O157 by the United States Department of Agriculture's Agricultural Research Service in Lincoln, Nebraska.

Results

Epidemiologic Investigation

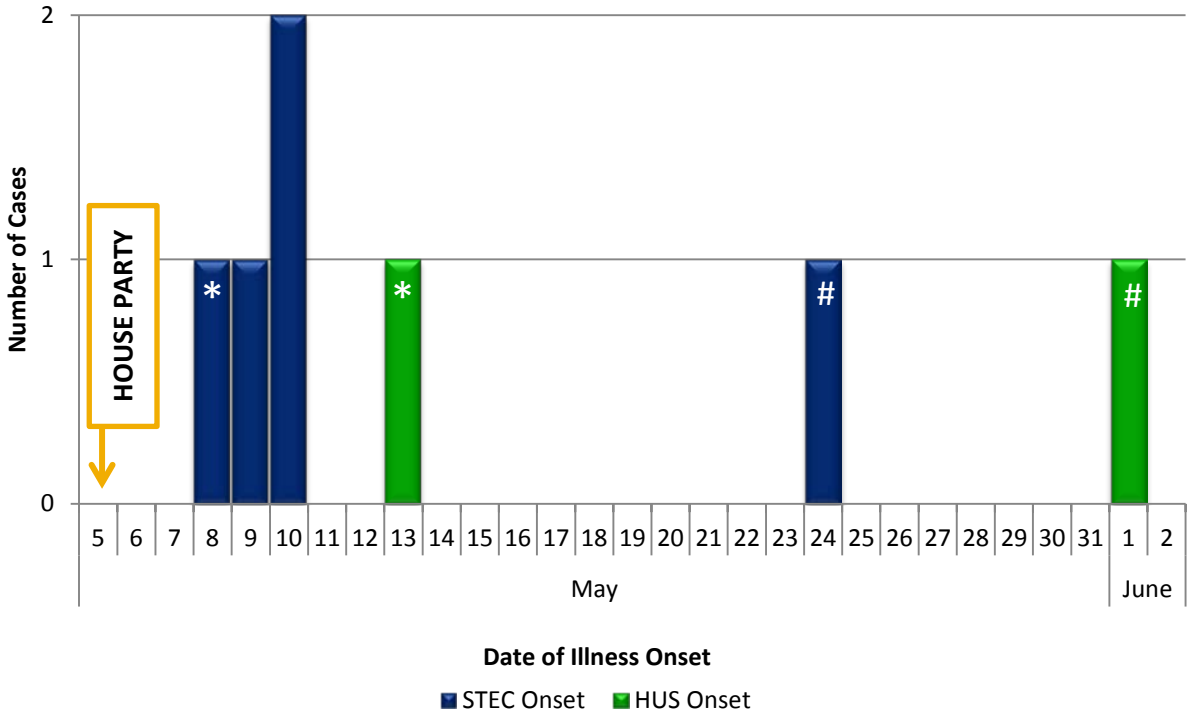
Multiple families with children attended the house party; no other common exposures were identified among primary cases during the exposure period. Four children who were present at the house party tested positive for STEC O157 and had confirmed primary cases; one child who did not attend the house party but later had contact with a confirmed case tested positive for STEC O157 and had a confirmed secondary case. Two (40%) of the ill persons were female and three (60%) were male. Individuals with confirmed STEC infection ranged in age from 2 to 3 years (median: 2 years).

The most common symptom was diarrhea, which was experienced by all (100%) confirmed cases [Table 1]. Bloody stool and vomiting were also reported. Three (60%) children were hospitalized, and two (40%) developed hemolytic uremic syndrome (HUS). The incubation period for primary confirmed cases ranged from three days to five days (median: 4.5 days) [Figure 1]. Four probable secondary cases were identified during case-patient interviews.

Table 1: Symptoms reported among confirmed cases (n=5)

Clinical Information	# of Confirmed Cases	% of Confirmed Cases
Diarrhea	5	100%
Bloody Stool	4	80%
Vomiting	3	60%
Fever	1	20%
Hemolytic Uremic Syndrome (HUS)	2	40%

Figure 1: Number of confirmed cases by illness onset date (n=5)



*HUS illness onset was 5/13/2014 for the case with STEC illness onset 5/8/2014

#HUS illness onset was 6/1/2014 for the case with STEC illness onset 5/24/2014

Laboratory Analysis

Stool specimens were submitted by five individuals. All tested positive for Shiga toxin-producing *Escherichia coli* serotype O157 and Shiga toxin type 2. The five STEC O157 isolates from each of the ill children were indistinguishable by PFGE.

Environmental Assessment

No STEC O157 was isolated from the calf fecal samples.

Conclusions

Four confirmed primary cases of STEC O157 were associated with attendance at a house party held on May 5, 2014 in south central Kansas. One confirmed and four probable secondary cases were identified among contacts of primary cases. Three children were hospitalized, and two developed hemolytic uremic syndrome (HUS).

Multiple families with children, including all individuals who had primary cases, attended the house party. Many of the children present were less than 5 years old. Reported activities at the event included playing with baby chicks, bottle feeding a calf that was being kept in a pen in the yard during the house party, and playing in a small "kiddie" pool that was purchased and filled the day of the event. Attendees ate a picnic lunch; each individual ate food that was brought to the party by his or her own family. Parents of the ill children reported that not all of them had direct contact with the calf. However, attendees did report that there was calf manure in the yard where the children were playing, outside of the pen where the calf was held for the duration of the party. The four primary cases all reported playing in the "kiddie" pool and getting splashed in the face and mouth.

Contact with calves or their feces is a known risk factor for STEC infection[1,2,3]. In this outbreak, the four primary cases were among the children at the house party with exposure to water in the pool. The ill children did not all report having direct contact with the calf, did not eat the same foods at the party, and had no other commonalities during their exposure period. Therefore, the investigators hypothesize that accidental ingestion of water that was contaminated with calf feces could have caused this outbreak. STEC infection can cause severe illness including diarrhea that is often bloody, vomiting, and stomach cramps[4]. The toxin produced by this particular strain of STEC O157, toxin 2, is more likely to lead to hemolytic uremic syndrome (HUS) than are strains of STEC that produce only toxin 1; this could account for the severity of illness experienced by affected individuals in this outbreak[5].

The investigation was limited by several factors. Not all party attendees were interviewed; individuals who were less severely ill may not have been reported or sought medical care. Also, separate interviews were not conducted for all reported secondary outbreak cases of STEC as they were known contacts or family members of primary cases. Therefore, additional cases may exist. The environmental investigation was limited by the difficulty in isolating STEC O157 from bovine fecal samples and due to intermittent shedding of STEC in feces[6]. The calf was moved to pasture shortly after the house party and investigators were not able to obtain additional environmental samples.

This epidemiological investigation was aided by quick response of and cooperation between the county health departments and KDHE, which allowed for timely initiation of the outbreak investigation. The use of in-person interviews allowed for a good response rate among families of ill individuals and improved quality of information collected by investigators. Families of ill children were provided illness prevention education and recommendations to prevent future transmission of STEC in person-to-person and animal contact settings.

Discussion

STEC was first identified as a pathogen in 1982, and is a type of bacteria that causes disease by producing a toxin; one serotype of STEC is O157[7]. STEC O157 accounts for approximately 36% of the 265,000 STEC infections annually in the United States, and most of the identified STEC outbreaks in the United States have been caused by STEC O157. About 20% of reported STEC cases are associated with a recognized outbreak[8]. Infection with STEC O157 can cause serious illness characterized by severe and often bloody diarrhea. Vomiting may also be present; fever occurs less often. Symptoms occur one to ten days (usually three to five days) after exposure; duration of illness is usually about one week[9].

Hemolytic uremic syndrome (HUS) is a complication of STEC infection that occurs when the toxin produced by the bacteria causes damage to the red blood cells leading to kidney injury[10]. HUS develops in about 5% of sporadic STEC cases, but in up to 20% of infections with outbreak strains of STEC[11]. If HUS develops, symptoms usually begin about one week following the onset of illness, often when diarrheal symptoms are beginning to resolve. HUS is characterized by acute onset of anemia (destruction of red blood cells) and renal injury or failure. Symptoms include low or no urine output, fatigue, unexplained bruising, and decreased consciousness. Young children who become infected with STEC are most at risk for developing HUS[12]. Many patients with HUS require blood transfusions (about 70% of cases) or dialysis (50%); up to a quarter have neurological symptoms including stroke, seizure, or coma[13]. Kidney function

returns in up to 70% of HUS cases, but some individuals can experience permanent kidney failure. HUS is fatal in about 5% of cases[14].

STEC is spread through fecal-oral transmission[15]. STEC lives in the intestines of cattle and other animals including deer, goats, and horses. Animals can carry the bacteria and shed it in their feces without being ill. People become exposed to STEC by having contact with infected animals or their feces, ingesting contaminated food or beverages, or coming into contact with fecal matter from other people who are infected[16,17,18]. People who have experienced illness caused by STEC, especially children less than five years of age, can shed the bacteria in their feces for several weeks following the resolution of symptoms[19]. High risk exposures include contact with cattle, changing diapers of an infected child, and consuming unpasteurized (raw) milk, cheese, or apple cider[20]. Outbreaks of STEC have been caused by a variety of exposures[21].

Following these guidelines can help to prevent STEC infections:

- WASH YOUR HANDS thoroughly after using the bathroom or changing diapers and before preparing or eating food.
- WASH YOUR HANDS after contact with animals or their environments (at farms, petting zoos, fairs, your own backyard).
- COOK meats thoroughly. Ground beef and meat that has been needle-tenderized should be cooked to a temperature of at least 160°F/70˚C. It's best to use a thermometer, as color is not a very reliable indicator of "doneness."
- AVOID raw milk, unpasteurized dairy products, and unpasteurized juices (like fresh apple cider).
- AVOID swallowing water when swimming or playing in lakes, ponds, streams, swimming pools, and backyard "kiddie" pools.
- PREVENT cross contamination in food preparation areas by thoroughly washing hands, counters, cutting boards, and utensils after they touch raw meat[22].

Reported by:

Lindsey Martin Webb, MPH
Sheri Tubach, MPH, MS
Kansas Department of Health and Environment
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Investigated by:

County Health Departments

Kansas Department of Health and Environment
Bureau of Epidemiology and Public Health Informatics
1000 SW Jackson Street, Suite 075
Topeka, Kansas 66612
http://www.kdheks.gov/epi

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