

Shiga Toxin-Producing *Escherichia coli* Infections Associated with a Campground Petting Zoo

August

Le Sueur County

On August 2, 2017, Minnesota Department of Health (MDH) staff interviewed a case of Shiga toxin-producing *Escherichia coli* (STEC) infection who reported staying at a campground, in Waterville, Minnesota, during the week prior to his illness. On August 4 and 6, MDH interviewed two additional cases of STEC infection who reported staying at the same campground during the week prior to their illnesses. The illness onsets were July 25, July 29, and July 19, respectively. All three cases reported visiting both the waterpark and the petting zoo at the campground. There were no other commonalities noted among the three STEC cases. Serotyping and pulsed-field gel electrophoresis (PFGE) had not yet been completed on the case-isolates. Based on three cases of STEC infection associated with one campground, MDH contacted the campground management and initiated immediate public health interventions by asking them to remove the calf from display at the petting zoo, discontinue hand feeding of animals, keep walkways free of manure and clean railings, and ensure that petting zoo handwashing stations were fully stocked and easily accessible. On August 8, serotyping of the three isolates was finalized and identified two *E. coli* O111 isolates (both determined to be Minnesota PFGE pattern ECM996) and one *E. coli* O26 isolate. At this point a full outbreak investigation was initiated. On August 8, MDH epidemiologists traveled to the campground and took samples from the mammals (except the calf, which was no longer on site) at the petting zoo as well as two adult steers near the petting zoo. The samples were tested for STEC at MDH Public Health Laboratory (MDH-PHL). That same day the Le Sueur County environmental health sanitarian inspected the waterpark, food stand, and wells onsite. Campground management provided MDH staff with reservation

information for July 15–August 8. Campground management closed the petting zoo and removed the steers from the property, compliant with MDH recommendations while the investigation continued.

A case was defined as a person who visited the campground on, or after, July 15 and subsequently developed a laboratory-confirmed STEC infection, or who reported bloody stools of any duration or diarrhea (≥ 3 loose stools in a 24-hour period) of ≥ 3 -days duration, with illness onset ≤ 10 days since their campground stay.

A sample of people with reservations at the campground were contacted by MDH staff either by phone or by a REDCap survey distributed by email. Groups with children and dates overlapping with the three surveillance cases, and groups that were not seasonal campers were prioritized for contact. Consenting persons were interviewed with or completed a standard questionnaire about demographic information, illness history, food exposures, and activities at the campground including visiting the petting zoo, waterpark, and lake. Stool samples from consenting cases were submitted to the MDH PHL for STEC polymerase chain reaction (PCR) and isolation, enteric bacterial culture, and *Cryptosporidium* PCR.

The environmental health assessment by the sanitarian did not identify any concerns with the food stand or the waterpark. The total coliform testing was positive on one of the well water samples, and normal protocol for isolating and disinfecting the well water was followed; no STEC was found by PCR on this water sample at the PHL.

A total of 284 people were contacted and consented to interview; 166 people were contacted by phone, and 118 (31%) of approximately 384 people responded to the REDCap survey. Twenty-one (7%) people reported illnesses that met the case definition, including the three surveillance cases. Seven additional people reported diarrheal illnesses but did not fit the case definition and were excluded from the case-control analyses. Information was available from 256 controls.

Of the 21 people who met the case definition, 15 (71%) were female. All 21 cases reported diarrhea, 18 (86%) reported abdominal cramping, eight (38%) reported fever (temperatures ranging from 100° F to 103.7° F), five (24%) reported vomiting, and five (24%) reported bloody stools. The median duration of diarrhea, for those who had recovered at time of interview, was 5 days (range, 3 to 25 days). Four cases were still ill at time of interview (minimum duration of illness, 19 days). Six (29%) cases sought healthcare related to their illness, including three who were evaluated in an emergency department; two (10%) cases were hospitalized, for 2 and 3 days. Onset dates of cases ranged from July 8 to August 1. Stool kits were sent to 10 cases (not including the three surveillance cases), six (60%) kits were returned to the MDH PHL. All six returned stool kits tested negative for Shiga toxin and *Cryptosporidium* DNA by PCR, and no enteric bacteria were found on stool culture.

A total of 24 animal samples were collected and tested at the MDH PHL. Direct fecal samples were collected from five short-haired goats, four angora goats, four sheep, two alpacas, and one llama. Fecal samples were also collected from the ground in the pens of the short-haired goats (n=2), steers (n=2), fawns (n=2), angora goats (n=1), and the miniature horse (n=1). Twelve (50%) of the animal samples were positive for STEC. *E. coli* O145 was isolated from two goats, one sheep, and one angora goat. *E. coli* O26 was isolated from one angora goat; however, this isolate was a different pattern than the *E. coli* O26 case-isolate. *E. coli* O-undetermined was isolated from three additional goats, one additional

sheep, the llama, one additional angora goat, and from one sample collected from the ground of the short-haired goat pen. None of the STECs found matched either outbreak strain.

The median age of cases was 37 years (mean, 32 years; range, 1 to 51 years), the median age of controls was 38 years (mean, 36 years; range, 0 to 73 years) ($p = 0.78$). Fifteen (71%) cases and 173 (68%) controls were female ($p = 1.0$). Purchasing food from the food stand, riding the ponies, visiting the lake, and source of drinking water were not associated with illness. Of the 277 cases and controls, 210 people reported visiting the petting zoo (17 [81%] of 21 cases, and 193 [76%] of 254 controls) and 267 people reported visiting the waterpark (21 [100%] cases, and 246 [96%] of 255 controls) while at the campground; no significant difference was found in the proportion of cases visiting the petting zoo or the waterpark. When considering only people who reported feeding the animals in the petting zoo, feeding angora goats (8 [89%] of 9 cases vs. 60 [52%] of 116 controls; odds ratio [OR], 7.5; 95% confidence interval [CI], 0.9 to 61.6; $p = 0.04$), feeding sheep (9 [100%] of 9 cases vs. 58 [50%] of 116 controls; OR, 19.0; 95% CI, 1.1 to 334.0; $p < 0.003$), and feeding alpacas (7 of 9 [78%] cases vs. 40 [34%] of 116 controls; OR, 6.7; 95% CI, 1.3 to 33.5; $p = 0.03$) were significantly associated with illness. Feeding other animals, general contact with the animals, contact with the animal environment, and eating while in the petting zoo were not significantly associated with illness. Using hand sanitizer (14 [88%] of 16 cases vs. 135 [81%] of 167 controls) and washing hands with soap and water (8 [53%] of 15 cases vs. 96 [60%] of 159 controls) after visiting the petting zoo were not significantly different between cases and controls.

This was an outbreak of gastroenteritis, including at least STEC, linked to a campground petting zoo. Illness was significantly associated with feeding angora goats, sheep, and alpacas. Hand feeding increases contact with animals, therefore increasing the risk of zoonotic pathogen transmission.

Although neither outbreak strain of STEC was found in any of the animals tested, multiple pathogenic strains of STEC were found in the animals, and epidemiologic analysis linked illness to hand feeding of certain animals. Recommendations for the campground management to reopen the petting zoo for the remainder of the season (approximately 2 weeks) included:

1. Rent portable handwashing stations (with soap and water) for outside the entrances to the animal area.
 - a. Either one at each entrance, or change the visitor flow to create a one-way direction and have a sink at the exit.
2. Require shoes for everyone to enter the petting zoo and not allow food/drinks inside.
3. Have a staff person(s) at the petting zoo to enforce the above recommendations and remind people to wash their hands.
 - a. If it cannot be staffed all day, consider having hours during the day when the petting zoo is open and can be staffed.
4. Close the petting zoo at night.
5. Discontinue hand feeding.
 - a. Consider indirect feeding mechanisms.
6. Put up prominent signage at all the entrances and near the hand washing sinks to remind people to not bring food into the petting zoo, to wash hands, and how to prevent illness in animal venues.

Recommendations for next season and farther into the future include compliance with the Compendium of Measures to Prevent Disease Associated with Animals in Public Settings (<http://nasphv.org/Documents/AnimalContactCompendium2013.pdf>) as well as implementing indirect feeding mechanisms instead of hand feeding.

Addendum: One of the laboratory confirmed *E. coli* O111 cases had an additional stool collection of August 8, 2017, (collected in order to return to childcare) this stool was confirmed as *E. coli* O26 (local PFGE pattern ECM1338SB1246), matching the initial *E. coli* O26 case by PFGE.