

***E. coli* O157:H7 Infections Associated with Raw Milk**

May-June

Sibley County

On May 18, 2010, the Minnesota Department of Health (MDH) Public Health Laboratory (PHL) notified MDH epidemiology staff of two *Escherichia coli* O157:H7 (O157) isolates with indistinguishable pulsed-field gel electrophoresis (PFGE) patterns that were identified through routine surveillance. The PFGE subtype was designated MN1138ECB265 and had never been identified in Minnesota prior to this. Both cases were interviewed using a standard MDH surveillance questionnaire by the following morning (May 19). The routine surveillance interviews indicated that one case might have consumed raw milk at home in the 7 days prior to illness onset. The raw milk had been purchased at Farm A in Gibbon, Minnesota. The second case did not report raw milk consumption during the initial interview, but upon subsequent interviews reported consuming milk from an organic farm in Gibbon at a family gathering held during the 7 days prior to illness onset. When this case was explicitly asked if the milk came from Farm A, she confirmed that it had. She also reported that other individuals who attended the family gathering became ill with gastrointestinal symptoms following the event, but this could not be confirmed through contact with the other attendees. On May 20, the MDH PHL notified epidemiology staff that another O157 isolate with the PFGE subtype MN1138ECB265 had been received through surveillance. The case was interviewed immediately using the standard questionnaire and denied consuming raw milk or raw milk products. However, the case did report attending a non-traditional school that had been associated with Farm A in the past in that it was a drop-off site where customers would purchase raw milk and other items from the farm. The Minnesota Department of Agriculture (MDA) was notified, and an investigation was initiated.

All O157 cases reported to MDH are interviewed by phone about potential exposures during the 7 days prior to illness onset, including food consumption in and outside of the home, as part of routine disease surveillance in Minnesota. Clinical laboratories are required to submit all O157 isolates to the MDH PHL for confirmation, serotyping, and routine PFGE subtyping using the enzymes *Xba*I and *Bln*I. Interviews of cases in cluster investigations are conducted using an iterative process. Using this dynamic model, suspicious exposures that are reported by initial cases are added to the standard interview for

subsequent cases. Additionally, initial cases may also be re-interviewed regarding suspicious exposures mentioned by subsequent cases.

Cases were defined as individuals with a laboratory-confirmed infection with O157 PFGE subtype MN1138ECB265 with illness onsets in May or June. Additional outbreak cases were identified through routine laboratory surveillance. Epidemiologists reviewed the information gathered during the interviews of O157 cases to identify other cases associated with Farm A. Customer lists were collected from Farm A to further identify any potential cases and to determine the extent of the outbreak.

When available, leftover products purchased from Farm A were collected from case households. The MDA Laboratory tested each submitted product for the presence of a variety of enteric pathogens, including O157 and other Shiga toxin-producing *E. coli* (STEC), *Campylobacter*, *Cryptosporidium*, *Listeria*, *Salmonella*, *Shigella*, and *Yersinia*, by polymerase chain reaction (PCR) and culture. If O157 or other STEC were isolated, isolates were submitted to the MDH PHL for serotyping and PFGE subtyping.

An inspection of the kitchen at the school attended by one of the cases was conducted by MDA on May 25, 2010, to determine if products from Farm A were served at this facility. MDA and MDH officials inspected Farm A on May 26 to document conditions at the farm and collect food, environmental, and animal samples. These samples were tested for the same pathogens and using the same methods described above. The MDA Laboratory tested the food samples, and the MDH PHL tested the environmental and animal samples.

On May 25, MDH epidemiologists were notified that a fourth O157 isolate with PFGE pattern MN1138ECB265 had been received through surveillance. This case was interviewed the following morning (May 26). At that time, a parent reported that the case had consumed raw milk and other products from Farm A prior to onset of illness. Because of the cumulative information at that time, MDH and MDA issued a health alert and press release on May 26 to notify the health care community and the public of the link between the O157 cases and raw milk from Farm A.

Case identification continued after the press release had been issued. In total, eight cases were identified in Minnesota. The median age was 12 years (range, 4 months to 78 years), and six (75%) cases were male. Illness onset dates ranged from May 1 to June 1, 2010. All cases had diarrhea, six (75%) had bloody diarrhea, five (63%) had abdominal pain or cramping, three (38%) had fever, and three (38%) had vomiting. Five (63%) of the cases were hospitalized for their illness, and one (13%) developed hemolytic uremic syndrome (HUS). The median duration of hospitalization was 3 days (range, 2 to 13 days). Only two of the cases had recovered at the time of interview; the duration of illness for these two cases was 10 and 14 days, respectively.

Of the eight O157 cases with isolates of the outbreak PFGE subtype reported to the MDH during the investigation, six (75%) reported consuming raw milk and/or raw milk products from Farm A prior to illness onset. However, one of the eight cases who reported not consuming raw milk products had onset of illness after that of a sibling who was a case who did consume raw milk from Farm A; this case was classified as a secondary infection. Therefore, six (86%) of the seven cases with primary infection reported consuming raw Farm A milk products prior to becoming ill. Three of these cases (7- and 15-year old males and a 78-year old female) consumed raw milk outside of the home, including two while at a friend's house and one at a family member's house. Of cases with Farm A product exposures in their

own household, one reported purchasing the products directly from the farm, one reported getting the products at a drop-off site, and one refused to provide information on how the product was acquired.

Thirty-five individuals were contacted from the customer list. Of these, three reported experiencing illness compatible with O157 and were sent stool specimen collection kits. The first was a 6 year-old female who experienced bloody diarrhea, fever, and nausea starting around April 25. The case's family reported purchasing raw milk, skim milk, eggs, and ground beef from the farm on a weekly basis. The second individual was a 43 year-old female who reported bloody diarrhea which began on May 20. The third individual was this second individual's spouse and was a 53 year-old male who reported experiencing diarrhea that started on May 31. This household reported purchasing skim milk and eggs on a weekly basis from Farm A. Two of the kits (from the two from the same household) were returned to MDH PHL and were screened for the presence of *Campylobacter*, *Cryptosporidium*, *Listeria*, O157, STEC, *Salmonella*, *Shigella*, and *Yersinia*. No pathogens were identified in either sample.

On the May 25 inspection of the school, MDA was informed that the school does not provide any food or drinks to the students except for bottled water and pizza from a local restaurant 1 day a week. The school administrator reported that some of the parents of children who attend the school do purchase raw Farm A dairy products, and that it was possible that the case who attended this school either had consumed items at a friend's home unknowingly or that he represented a secondary infection.

Two cases had leftover products that they were willing to submit to MDA for testing. One case had only raw cheddar cheese, but it was product that the case consumed prior to illness onset. The other case had raw milk, raw cheddar cheese curds, raw cheddar cheese, and multiple meat products. The raw milk collected was not the same bottle that was consumed by the case prior to illness onset, but it was purchased at the same time. None of the product samples collected from case households were positive for O157 or other enteric pathogens.

During the May 26 inspection of Farm A, 80 environmental and animal samples were collected by MDH staff. Of these, O157 was identified in 28 samples, including the outbreak PFGE subtype of O157 in 26 of the 28 samples. Additionally, 33 environmental or animal samples were positive for non-O157 STEC, 16 for *Cryptosporidium*, 12 for *Campylobacter jejuni*, 1 for *Yersinia enterocolitica*, and 1 for enterotoxigenic *E. coli* (Table 1).

Twenty-four food or food production area samples were collected by MDA during the farm inspection. O157 was not detected in any of the samples. Three samples were positive for non-O157 STEC: raw cheddar cheese, raw herb and spice Gouda cheese, and bulk vat rinse water. Two of these three positives yielded non-O157 STEC isolates; a Shiga toxin-producing colony could not be isolated in the rinse water sample. Serotype could not be determined at the MDH PHL for the two non-O157 STEC isolates; as a result, they were sent to the Centers for Disease Control and Prevention (CDC) for further workup. CDC determined the serotypes to be O109:NM and O100:NM. PFGE was performed on the two food isolates; they yielded unique patterns that differed from each other. No other human clinical isolates of non-O157 STEC in Minnesota or nationwide were found to have indistinguishable PFGE patterns during the time frame of the investigation.

This was an outbreak of *E. coli* O157:H7 infections associated with the consumption of raw milk and/or raw milk products from Farm A in Gibbon, Minnesota. Eight cases were identified, including one case of HUS. The outbreak PFGE subtype of O157 was found in numerous animal and environmental samples

taken from various areas on the farm. Routine PFGE subtyping of O157 isolates combined with routine interviewing of cases enabled identification of the source of the outbreak with a small number of cases.

Table 1. Results of enteric pathogen testing of animal and environmental samples.*

Source/Site	<i>E. coli</i> O157:H7	O157:H7 PFGE	Shiga toxin genes	Non-O157 STEC**	<i>Campylobacter</i>	<i>Cryptosporidium</i>
Calf in hutch	-		stx1 and stx2	+	-	<i>C. ryanae</i>
Calf in hutch	-		stx1 and stx2	+	<i>C. jejuni</i>	<i>C. parvum</i>
Calf in hutch	-		stx1 and stx2	+	-	-
Dairy barn #1	-		stx1	+	-	-
Dairy barn #2	-		-	-	-	-
Dairy barn #3	-		stx1	+	-	Oocysts found
Dairy barn #4	-		stx1	+	<i>C. jejuni</i>	-
Dairy barn #5	+	MN1138ECB265	stx1 and stx2	+	-	Oocysts found
Dairy barn #6	-		-	+	-	-
Dairy barn #7	+	MN1138ECB265	stx1 and stx2	-	-	Oocysts found
Dairy barn #8	-		-	-	-	-
Dairy barn #9	-		stx1	+	-	-
Dairy barn #10	+	MN1138ECB265	stx1 and stx2	-	-	-
Dairy barn #11	-		stx1 and stx2	+	-	Oocysts found
Calves in pen 3 #1	-		stx1 and stx2	+	-	-
Calves in pen 3 #2	-		-	-	<i>C. jejuni</i>	-
Calves in pen 2 #1	+	MN1138ECB265	stx1 and stx2	Not cultured	-	Oocysts found
Calves in pen 2 #2	+	MN1138ECB265	stx1 and stx2		-	-
Calves in pen 1 #1	+	MN1143ECB265	stx1 and stx2	Not cultured	-	Oocysts found
Calves in pen 1 #2	+	MN1138ECB265	stx1 and stx2	+	<i>C. jejuni</i>	-
Calf in front tie stall	-		stx1 and stx2	+	<i>C. jejuni</i>	-
Bedding in cow pen 1 #1	-		stx2	+	-	-
Bedding in cow pen 1 #2	-		stx1 and stx2	+	<i>C. jejuni</i>	Oocysts found
Manure in cow pen 2 #1	+	MN1138ECB265	stx1 and stx2	-	<i>C. jejuni</i>	-
Cow pen 2#2	+	MN1138ECB265	stx1 and stx2	Not cultured	-	-
Cow pen 2#3	-		stx2	+	-	Oocysts found
Cow yard #1	-		stx1 and stx2	+	-	-
Cow yard #2	-		stx1 and stx2	+	-	Oocysts found
Cow yard #3	-		stx2	+	-	-
Cow yard #4	-		-	-	-	-

Source/Site	<i>E. coli</i> O157:H7	O157:H7 PFGE	Shiga toxin genes	Non-O157 STEC**	<i>Campylobacter</i>	<i>Cryptosporidium</i>
Cow yard #5	-		-	-	-	-
Cow yard #6	-		stx1 and stx2	+	-	-
Cow yard #7	-		-	-	<i>C. jejuni</i>	-
Cow yard #8	-		stx1 and stx2	+	<i>C. jejuni</i>	-
Cow yard #9	+	MN1144ECB265	stx1 and stx2	-	-	-
Cow yard #10	-		-	-	-	Oocysts found
Cow yard #11	-		-	-	-	-
Cow yard #12	-		stx1	+	-	-
Manure pile #1	-		-	-	-	-
Manure pile #2	-		stx2	+	-	Oocysts found
Manure pile #3	+	MN1138ECB265	stx1 and stx2	-	-	-
Manure pile #4	+	MN1138ECB265	stx1 and stx2	-	<i>C. jejuni</i>	-
Cow pasture #1	-		-	-	-	-
Cow pasture #2	-		stx1	+	-	-
Cow pasture #3	-		-	-	-	-
Cow pasture #4	-		-	-	-	-
Cow pasture #5	-		stx1 and stx2	+	-	-
Cow pasture #6	+	MN1138ECB265	stx1 and stx2	-	-	-
Cow pasture #7	-		-	-	-	-
Cow pasture #8	-		-	-	-	-
Cow pasture #9	-		-	-	-	Oocysts found
Cow pasture #10	-		-	-	-	-
Cow pasture #11	-		-	-	-	-
Cow pasture #12	-		-	-	-	-
Cow pasture #13	-		-	-	-	-
Cow pasture #14	-		-	-	-	-
Steer yard #1	-		-	-	-	-
Steer yard #2	+	MN1138ECB265	stx1 and stx2	-	<i>C. jejuni</i>	-
Steer yard #3	-		-	-	-	-
Steer yard #4	+	MN1138ECB265	stx1 and stx2	-	-	-
Steer yard #5	+	MN1138ECB265	stx1 and stx2	-	-	Oocysts found
Steer yard #6	+	MN1138ECB265	stx1 and stx2	-	-	-
Steer yard #7	+	MN1138ECB265	stx1 and stx2	-	-	-
Steer yard #8	+	MN1138ECB265	stx1 and stx2	-	-	-
Sheep #1	+	MN1138ECB265	stx1 and stx2	+	-	-
Sheep #2	+	MN1138ECB265	stx1 and stx2	+	<i>C. jejuni</i>	-
Sheep #3	-		stx1	+	-	-
Sheep #4	+	MN1138ECB265	stx1 and stx2	-	-	-

Source/Site	<i>E. coli</i> O157:H7	O157:H7 PFGE	Shiga toxin genes	Non-O157 STEC**	<i>Campylobacter</i>	<i>Cryptosporidium</i>
Sheep #5	+	MN1138ECB265	stx1 and stx2	+	-	-
Sheep #6	+	MN1138ECB265	stx1 and stx2	Not cultured	-	-
Pig #1	-		-	-	-	Oocysts found
Pig #2	-		stx2	+	-	-
Pig #3	-		stx2	+	-	-
Pig #4	-		stx2	+	-	-
Pig #5	-		Not tested	-	-	-
Heifer #1	-		stx1 and stx2	+	-	-
Heifer #2	+	MN1138ECB265	stx1 and stx2	-	-	-
Heifer #3	+	MN1138ECB265	stx1 and stx2	-	-	-
Heifer #4	+	MN1138ECB265	stx1 and stx2	Not cultured	-	-
Heifer #5	+	MN1138ECB265	stx1 and stx2	-	-	-

* All samples negative for *Listeria*, *Salmonella*, and *Shigella*. *Yersinia enterocolitica* was identified in Steer yard #8, and enterotoxigenic *E. coli* was identified in Pig #4.

**Samples were considered positive for non-O157 STEC if: 1) non-O157 STEC was isolated by culture; or 2) Shiga toxin genes were identified but the sample was negative for *E. coli* O157 by culture.