

First Known Outbreak of *E. Coli* (ETEC) in Connecticut, May 2022

Background

In May 2022, the Connecticut Department of Public Health (DPH) was notified of a possible foodborne outbreak among attendees of two luncheons. The events were catered by the same food service establishment (FSE). Both luncheons occurred on May 4th, 2022; sixty individuals attended Event A and sixteen attended Event B. Other complaints of illness were received from patrons of the same FSE who ordered take-out for a private party (Event C) on May 3rd, 2022. Staff from the DPH Epidemiology and Emerging Infections Program, the Yale Emerging Infections Program, the DPH Food Protection Program (FPP), and the local health department (LHD) performed a joint investigation to implement control measures and investigate the extent and cause of illnesses. This report summarizes the investigation's epidemiologic, environmental, and laboratory findings.

Epidemiological Investigation

A cohort study was conducted among luncheon attendees. DPH epidemiologists created a standardized questionnaire in SurveyMonkey®, which assessed symptom and exposure information. Of the 76 total luncheon attendees, 54 (71%) completed the survey: 49 of 60 (82%) from Event A and 5 of 16 (31%) from Event B. Seventeen responses were excluded due to incompleteness (14) or pre-existing gastrointestinal symptoms (3), leaving 37 surveys for analysis. A case-patient was defined as an individual with no prior gastrointestinal illness who ate food from the luncheons and experienced diarrhea (≥ 3 stools in a 24-hour period) within three days. In total, 26 case-patients were

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identified (Event A: 24, Event B: 2).

The median age of case-patients was 39.5 years (range 22-64) and 19 (73.1%) were female. Symptom onset occurred May 5-7 (Figure 1), with a median incubation period of 31 hours (range 12-73). Median illness duration was 72 hours (range 12-216). Thirteen case-patients (50%) remained ill at survey completion. In addition to diarrhea, other reported symptoms included cramps (92%), nausea (61%), headache (50%), muscle aches (50%), chills (38%), fever (16%), and vomiting (15%). Six case-patients sought outpatient medical care. None were hospitalized.

Food consumption analysis suggested that ingestion of sour cream was associated with illness (Relative Risk= 2.00, 95% CI: 1.26-3.17, $p < 0.01$). There was a 100% (10/10) attack rate among those who reported sour cream consumption, compared to 50% (9/18) among those who did not report sour cream. No other menu items were significantly associated with illness (Table 1).

Staff were only able to interview one attendee of Event C, who reported that 3 of the 4 patrons became ill after the event. The attendee reported

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that ill patrons experienced symptoms including diarrhea, vomiting, and fever. Without direct interviews, the case definition criteria and consumption of specific foods, including sour cream, could not be ascertained; these patrons were excluded from the cohort analysis.

Environmental Investigation

On May 9th, LHD staff visited the FSE. The team at the FSE interviewed 15 food workers (FWs) engaged in food preparation, provided stool collection kits for FWs, and collected information on the food items served, food handling procedures, catering invoices, and FW contact information. Only one FW reported symptoms; this FW worked on May 2nd and May 4th, prepared the guacamole for the event, later experienced diarrhea on May 8th, and came to work the following day.

The LHD did not observe any hot or cold temperature holding issues. There was

documentation of employee training which included the policy that employees should not work if ill; however, a poster intended to remind FWs to abstain from work while sick was not posted. Food items were prepared up to 2 days before catered events, packaged on trays or in containers, transported in insulated bags, delivered to the sites, and set up for self-service. Hot food was set up with chafing dishes.

DPH FPP staff visited the FSE on May 11th for an Environmental Assessment. This FSE opened a few weeks prior to the events, thus there was no inspection history to review. All holding and cooking temperatures met required levels with no signs of contamination. Staff were observed wearing gloves when handling ready-to-eat foods and following proper procedure for changing gloves and handwashing. Contributing factors could not be determined for this outbreak.

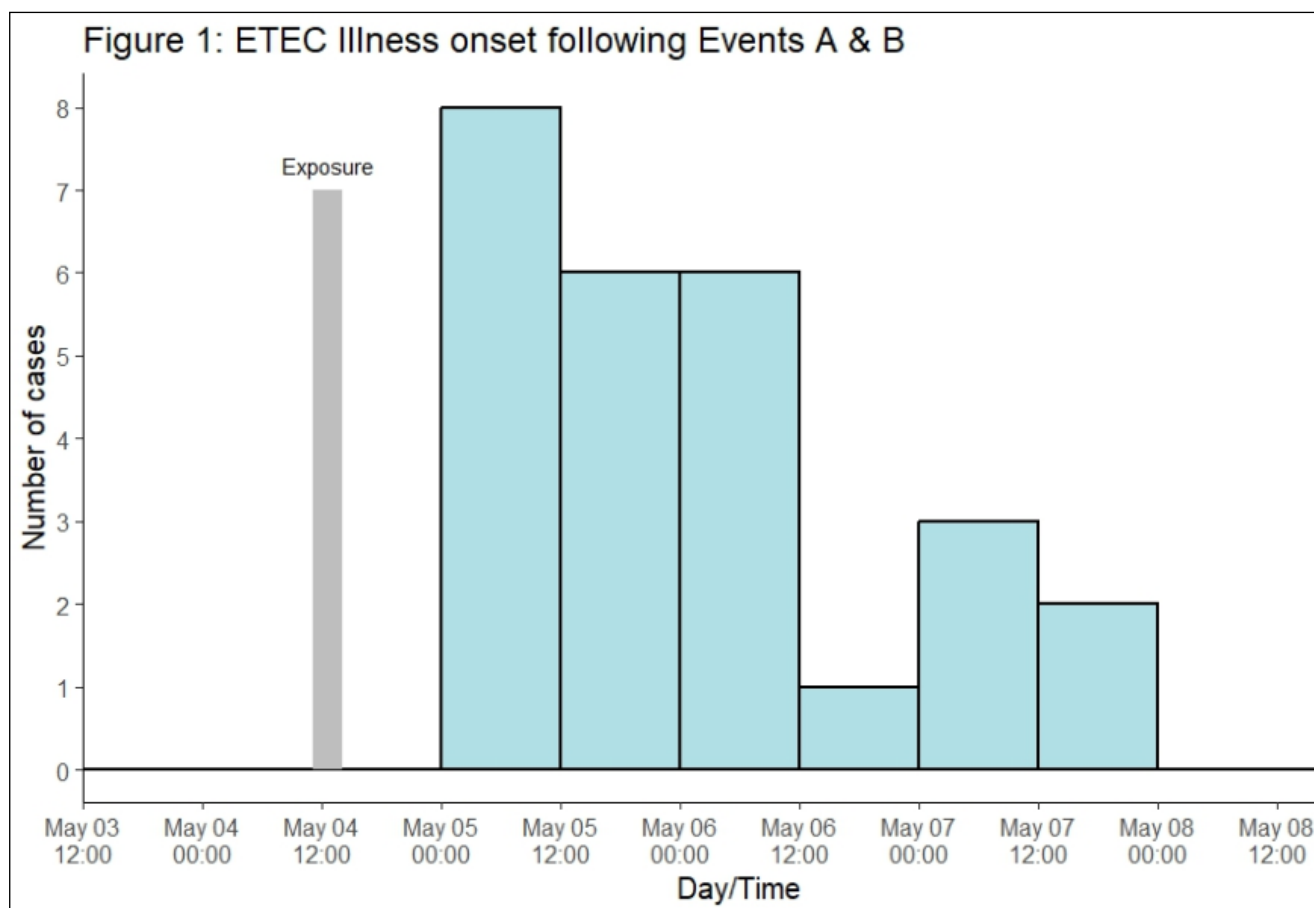


Table 1: Food items served at Events A & B with highest risk of ETEC illness, Connecticut, May 2022

Food item	Eaten			Not eaten			Relative Risk	p-value
	Cases	Total	%	Cases	Total	%		
Sour cream	10	10	100.0	9	18	50.0	2.00 (1.26-3.17)	<0.01
Guacamole	22	30	73.3	2	5	40.0	1.83 (0.61-5.48)	0.30
Beef tacos	14	17	82.4	8	15	53.3	1.54 (0.92-2.60)	0.13
Salad w/ corn	7	8	87.5	11	19	57.9	1.51 (0.95-2.40)	0.20
Chicken tacos	14	19	73.7	6	11	54.6	1.35 (0.74-2.47)	0.43

P-values generated from Chi-square tests or Fisher's exact tests.

Laboratory Investigation

Stool specimens were collected from luncheon attendees (9), a private party attendee (1), and FWs (13). Samples were tested using the BioFire GI panel at the Connecticut State Public Health Laboratory (SPHL). In total, eight patrons (7 luncheon attendees, 1 private party attendee) and five FWs tested positive for ETEC; these samples were sent to the Minnesota Department of Public Health Laboratory (MN DPHL) for culture testing and whole genome sequencing (WGS).

The symptomatic FW tested positive for ETEC at SPHL, but the sample did not get forwarded to MN DPHL. Instead, one FW sample initially negative for ETEC was inadvertently sent to MN DPHL, where it tested positive via their lab-developed PCR test and culture. In total, MN DPHL isolated ETEC from 9 of 13 specimens (5 luncheon attendees, 1 private party attendee, 3 FWs). All 9 were serotyped as O169/O183:H41 and were highly related. No environmental samples were tested.

Discussion

In the United States, ETEC is well-understood as a cause of traveler's diarrhea, but domestically acquired cases may be becoming more prevalent (1). Analysis by MN DPH found only 43% of ETEC cases had recently traveled internationally (1). ETEC are gram-negative bacteria known to produce heat-labile toxin (HT) and heat-stable toxin (ST); one or both toxins may be produced, which contributes to

varying illness severity, ranging from mild diarrhea to cholera-like illness characterized by loose, watery stools (2,3).

This investigation of illnesses among patrons of an FSE in May 2022 marked the first known outbreak of ETEC in Connecticut. Consumption of sour cream at the luncheons was statistically associated with illness, but it remains unknown if this was the true food vehicle or how it may have become contaminated. Raw fruits and vegetables are considered high risk foods for domestically acquired ETEC (1,4); pasteurized dairy products are not common sources of infection (4). There were no factors identified from environmental investigations that suggested improper food handling or temperature control practices.

These findings highlight the importance of considering ETEC as an etiologic agent of domestic gastroenteritis outbreaks. Continued surveillance for ETEC is necessary to strengthen the understanding of domestically acquired ETEC risk factors and identify opportunities for prevention.

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Background

Enterotoxigenic *Escherichia coli* (ETEC) causes a toxin-mediated gastrointestinal illness that is characterized by cholera-like watery diarrhea that usually resolves after 3-5 days but may last for several weeks. Complications are mainly from dehydration, which can be life-threatening. It is the most commonly diagnosed cause of diarrhea in US international travelers. Prior to the widespread availability of specific diagnostic tests, it was estimated that in the US there were approximately 40,000 infections annually with the majority related to international travel (1).

In the past 8 years, a culture-independent diagnostic test for ETEC toxins has become readily available to clinical laboratories as part of a multi-pathogen panel using PCR (FilmArray® gastrointestinal panel; BioFire® Diagnostics, Salt Lake City, UT). It has been adopted by some Connecticut (CT) laboratories for routine testing of patients with diarrheal illness. Other laboratories are not able to test for ETEC routinely. Recognizing the opportunity to conduct surveillance to describe the epidemiology of ETEC in CT, ETEC was made laboratory-reportable in 2019.

The objective of this analysis is to describe the epidemiology of detected ETEC cases and to estimate the degree of under detection of ETEC among persons seeking clinical consultation for diarrhea given that a minority of clinical laboratories routinely perform testing that could detect ETEC in CT.

Epidemiologists from the CT Department of Public Health first contact the clinician of record, then the patient for each reported positive ETEC test. Data are collected on patient demographics, symptoms and international travel in the 7 days before the onset of illness using a standardized form. To determine potential under detection of cases, laboratories were classified as those routinely testing for ETEC or not based on an annual laboratory survey conducted by the Connecticut Emerging Infections Program. The average percentage of all statewide reported *Salmonella*, *Campylobacter*, and Shiga toxin-producing *E. coli* (STEC) infections, pathogens for which all CT-based clinical laboratories routinely test, diagnosed at labs testing for ETEC was determined and used to calculate estimates of ETEC under detection statewide. A total of 300 cases of ETEC were reported from 2019-2022 from the five (of 32) clinical laboratories that routinely performed the multiplex test that could detect ETEC. Of the approximately 90% of cases for whom clinical data were available, 96% reported diarrhea, 29% fever and 16% bloody diarrhea; 26% were hospitalized and none died.

Overall four-year incidence was 8.33 per 100,000 population. Groups at highest risk were Hispanics (relative risk [RR] 3.21, 95% confidence interval [CI] 2.49-4.13 vs non-Hispanic White) and those >65 years old (RR 1.43, 95% CI 1.05-1.93 vs 45-64 years old). Children <18 years had the lowest relative risk (RR 0.33, 95%CI 0.20-0.52 compared to 45-64 year olds). Of the 261 cases with travel information, 36.8% had international travel in

7 days before symptom onset and 63.2% did not (Table 1). International travel destinations were mostly (69%) to Mexico, the Dominican Republic or Central and South American countries.

The proportions of Salmonella, Campylobacter, and STEC infections diagnosed at laboratories with ETEC testing capacity averaged 35.1% statewide. There were marked differences in this proportion by county, with the highest proportions in Litchfield (62.3%) and Fairfield (48.0%) and the lowest in New Haven (13.3%) and Middlesex (14.1%) counties (Figure 1).

When the estimate that only 35.1% of diarrheal cases seeking medical attention got tested for ETEC is applied to the 300 cases identified, it is possible that there could have been 855 cases identified statewide had all clinical laboratories been routinely testing diarrheal specimens for it. Of these, 530 (63.2% x 855) would be estimated to be domestically acquired.

Discussion

Recently in CT, domestically-acquired ETEC infection has consistently been more common than travel-associated. A study in Minnesota covering 2016-17 had a similar finding, in which 57% of cases had no international travel; Hispanics and adults were also at highest risk (2).

Although ETEC is well recognized as a cause of traveler's diarrhea, the burden of domestically-acquired cases appears to be underappreciated. The Centers for Disease Control and Prevention ETEC webpage (3) does not mention its possible importance in the US, despite periodic domestically-acquired outbreaks such as the one described in this CT Epidemiologist issue. In CT, with routine testing, domestically acquired ETEC, estimated to be 530 cases, would be more common than STEC (459 cases from 2019-2022) as a cause of diarrhea needing medical attention.

While ETEC is currently under detected throughout Connecticut, testing for it is disproportionately lacking in laboratories serving

residents of New Haven and Middlesex Counties. In these counties, the importance of locally-acquired ETEC is more likely to be unknown, while other diagnoses requiring different treatment unnecessarily entertained, resulting in missed outbreaks.

Based on these findings, ETEC infection should continue to be under public health surveillance in CT. Efforts should be made to increase testing by both clinical laboratories and healthcare providers. Future goals of surveillance would include identification of exposure factors, including why ETEC is more common among Hispanics and less common among children.

ETEC infection occurs when a person eats food, or drinks water or ice contaminated with ETEC bacteria. Human or animal wastes (e.g., feces) are the ultimate source of ETEC contamination (3). Outbreaks in the US have often been attributed to vehicles such as salads, sometimes contaminated by an ill food handler (4). Until more is known about transmission patterns in the US, prevention should include washing all food and vegetables to be consumed raw and exclusion of food preparers with acute gastrointestinal illness, both inside and outside the home, until they are asymptomatic.

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Acknowledgements

*Connecticut FoodNet and FoodCore staff, especially Megan
Fitzsimmons for analytic help.*

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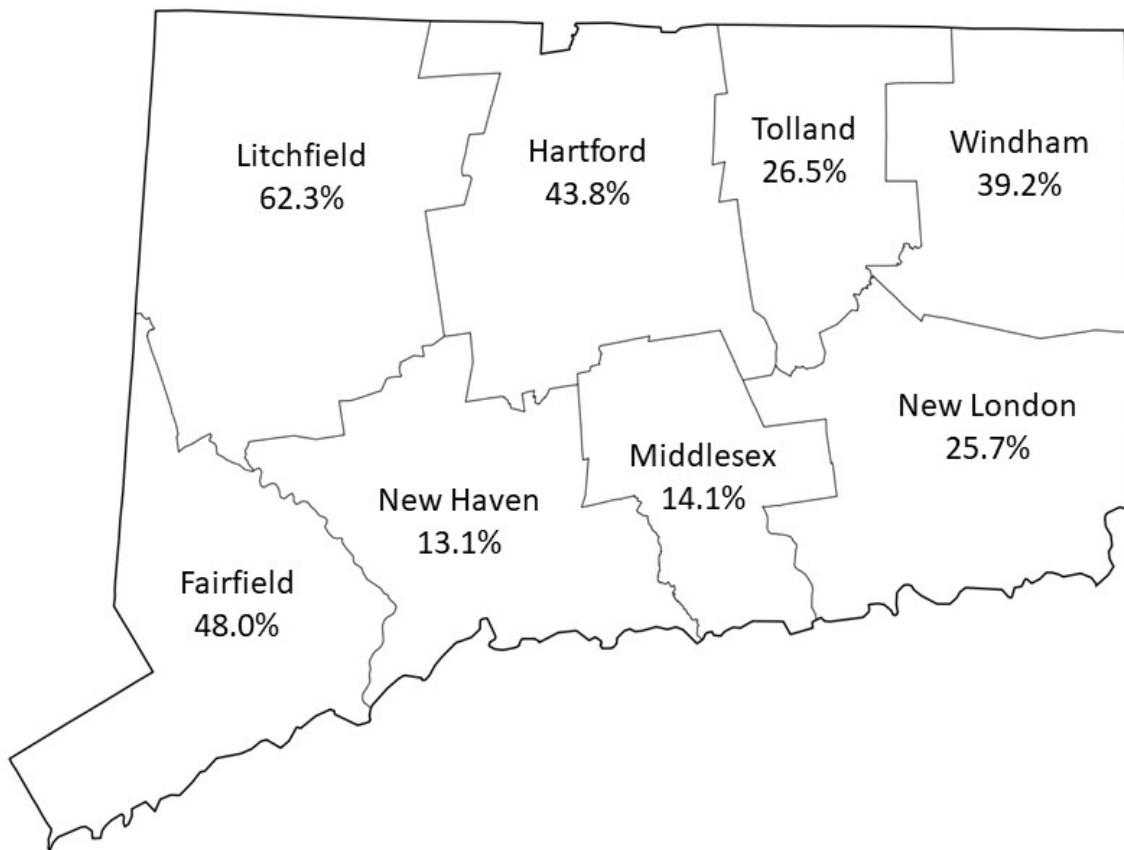
Table 1. Four-year Incidence and Relative Risk of ETEC by Demographic Characteristics and International Travel, Connecticut, 2019-2022

Characteristic	Four-year incidence/100,000 population (no. cases)	Relative Risk (95% CI)
All	8.33 (300)	n.a.
Sex*		
Male	8.54 (151)	1.06 (0.84-1.33)
Female	8.08 (148)	reference
Age Group*		
<18 years	2.85 (21)	0.33 (0.20-0.52)**
18-44 years	9.18 (113)	1.05 (0.80-1.39)
45-64 years	8.73 (87)	reference
≥65 years	12.45 (79)	1.43 (1.05-1.93)**
Race/Ethnicity*		
Hispanic	17.63 (110)	3.21 (2.49-4.13)**
Non-Hispanic White	5.50 (129)	reference
Non-Hispanic Black	3.70 (14)	0.67 (0.39-1.17)
Non-Hispanic Asian	5.11 (9)	0.93 (0.47-1.83)
International Travel*	Percentage (no. cases)	
Yes	36.8% (96)	-
No	63.2% (165)	-

* Missing: Sex (1), Race/ethnicity (38). International Travel (39)

** P<0.05

Figure 1. Estimated Percentage of Diarrheal Stool Specimens Tested for ETEC by County, 2019 - 2022



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The Connecticut Epidemiologist Newsletter - (Telecommunications Relay Service 7-1-1)

Editor: Susan Petit, MPH

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