

## Outbreak of *Escherichia coli* O157:H7 Involving Employees of a Company — Connecticut, 2009

In March 2009, the Connecticut Department of Public Health (DPH) through routine surveillance identified 6 cases of laboratory-confirmed *Escherichia coli* O157:H7 with an identical pulsed-field gel electrophoresis pattern (PFGE) among employees of the same company. Approximately 2500 employees work at its main Connecticut facility (Facility X). All 6 employees consumed at least one meal purchased at the company cafeteria or kiosk located in Facility X in the week before illness onset (March 9 - 13). No other common exposures were identified among these 6 cases. During the same period, no additional laboratory-confirmed cases matching this PFGE pattern were identified nationally or among Connecticut residents who did not work at this company. Staff from the DPH and local health department (LHD) conducted an epidemiological and environmental investigation to determine the source and extent of the outbreak, and to recommend control measures. This report summarizes findings from the investigation.

### Epidemiological Investigation

The epidemiological investigation consisted of two phases. Phase one included 1) active case finding among all employees of this company, 2) a case-control study to determine if consuming a meal purchased at the cafeteria or kiosk of Facility X was the source of infection, and 3) a case-control study to identify a specific meal and date of consumption at Facility X that was associated with developing illness. The second phase of the investigation included several case-control studies among a subset of employees at Facility X to identify a specific food item that might have been the source of infection.

A confirmed case was defined as a laboratory-confirmed *E. coli* O157:H7 infection with the outbreak PFGE pattern in an employee of the company who had onset of illness during March 13 - 23, 2009. A probable case was defined as

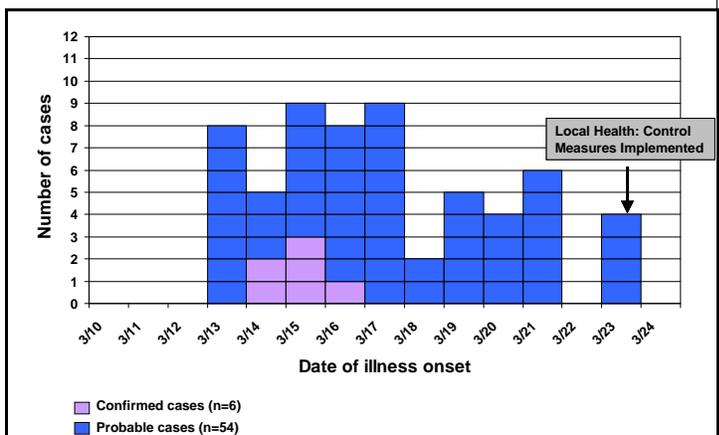
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bloody diarrhea or diarrhea with  $\geq 3$  episodes in a 24-hour period and lasting  $\geq 3$  days in an employee of the company who had onset of illness during March 13 - 23, 2009.

**Phase One.** A DPH-designed online survey that included questions about illness history and dates and location of meal purchases during March 9-13, 2009, was emailed by the company to company employees. Of the 2500 employees at Facility X, 1353 (54%) responded, 66 (5%) cases (6 confirmed, 60 probable) were identified. Among the 66 case-patients, 60 (91%) reported purchasing a meal at the cafeteria of Facility X during March 9 - 13. These 60 cases included all 6 confirmed and 54 probable cases. All 60 case-patients reported having diarrhea; 17 (28%) had bloody diarrhea, 19 (32%) had fever, 15 (25%) sought medical care, and 5 (8%) required hospitalization. Of 44 cases with available demographic data, 36 (82%) were females; the median age was 38 years (range 21-65 years). Dates of illness onset ranged from March 13 - March 23, 2009 (Figure 1).

Figure 1: *E. Coli* O157:H7 Cases Among Employees at Facility X (n=60)



Comparing case-patients with well employees, consumption of a meal purchased at the cafeteria of Facility X during March 9 - 13 was significantly associated with developing illness (91% vs 65%, odds ratio [OR] = 5.31; 95% confidence interval [CI] 2.27-12.42,  $p$ -value [ $p$ ] = <0.0001). Among employees who purchased meals at Facility X during the week of interest, only eating lunch purchased on Wednesday, March 11, was significantly associated with illness (80% vs 60%, OR 2.64; 95% CI 1.34-5.23,  $p$  = 0.004).

*Phase Two.* All 6 confirmed case-patients were interviewed about the meals they consumed at Facility X during March 9 - 13, 2009. Based on their responses, a second online survey was created targeting all Facility X food items, including individual ingredients of a meal eaten by the confirmed case-patients during the period of interest.

Among 1353 respondents from the first survey, a subset of 595 (44%) employees were selected who provided working email addresses and purchased a meal from Facility X during March 9 - 12, 2009. These dates were chosen based on the incubation period of illness of confirmed case-patients. The second online survey was emailed to these 595 employees; 427 (72%) responded and provided sufficient information to link their food responses to their illness information from the first survey.

Initial analysis of the case-control study was confined to the Wednesday lunch because this was the meal statistically implicated from phase one of the epidemiologic investigation. Of the 6 confirmed case-patients, 5 (83%) purchased lunch from the cafeteria on Wednesday. Comparing confirmed case-patients with well employees, consumption of chicken tenders in any meal on Wednesday was significantly associated with developing illness (OR 30.7; 95% CI 1.7-566.2,  $p$  < 0.002). In addition, consumption of any romaine lettuce on Wednesday was significantly associated with developing illness (OR 21.9, 95% CI 1.2-402.7,  $p$  = 0.005). When all case-patients were compared with well employees, consumption of chicken tenders from specifically the salad bar on Wednesday was independently associated with illness (OR 4.6; 95% CI 1.4-15.2,  $p$  = 0.02). However, consumption of romaine lettuce from specifically the salad bar was not associated with illness ( $p$  = 0.13).

Because one confirmed case-patient did not eat lunch on Wednesday at Facility X but reported

purchasing meals there on Tuesday and Thursday, additional analyses for Tuesday and Thursday lunch were performed. Among employees who purchased lunch on Tuesday and Thursday, respectively, developing illness was most significantly associated with consumption of any chicken tenders on Tuesday (OR 38.1, 95% CI 3.7-392.4,  $p$  = 0.002) and Thursday (OR 60, 95% CI 5.7-635.5,  $p$  = 0.0007). Consumption of romaine lettuce on Thursday was not associated with illness. The one confirmed case-patient who did not eat on Wednesday had consumed a meal on Thursday that included chicken tenders but not romaine lettuce. All remaining case-patients who ate on either Tuesday or Thursday, but not Wednesday, also had meals containing chicken tenders.

### **Environmental Investigation**

Facility X had a large cafeteria with several different food stations, including a self-serve salad bar, and a smaller kiosk located in a separate area of the building. Foods sold at the kiosk were prepared in advance in the cafeteria kitchen. Facility X purchased its food ingredients from the same distributor as other facilities operated by this company. Although menus changed daily at Facility X, some meals served on different days were prepared using the same food ingredients. Based on results of the epidemiological investigation, preparations of chicken tenders and romaine lettuce were closely examined.

Chicken tenders prepared in the cafeteria were served either as fried or roasted pieces in the buffalo chicken salad on Wednesdays, roasted pieces on the BBQ chicken pizza everyday at the kiosk, or as roasted pieces in an individual bin at the self-serve salad bar everyday. Chicken tenders were usually delivered raw on Thursday, cut to size and frozen until they were fried on Wednesday mornings for the buffalo chicken salad or roasted on various days as needed. The roasted chicken tenders that were used for the BBQ chicken pizza and placed at the self-serve salad bar on Wednesdays and Thursdays were usually taken from the batch cooked on Tuesday. Although fried and roasted chicken tenders used for the buffalo chicken salad were kept in separate hot holding units, both were briefly heated on the same hot plate immediately before tossing with a commercially prepared buffalo sauce and served on dressed greens.

On one occasion, the sanitarian observed that a sheet pan of uncovered, fully roasted chicken tenders was stored overnight in a cooler directly underneath a sheet pan of uncovered, partially cooked, grill-marked hamburger patties. One sheet pan held approximately 1/5 of a tray of roasted chicken tenders, and the other was almost full with 10-12 beef patties. The pans were 24 inches by 36 inches and had a small lip around the edges approximately 1 inch high. Both sheet pans were placed on a rolling cart and subsequently stored in the cooler. The partially cooked hamburger patties were taken out the following day to be thoroughly cooked in the kitchen ovens.

Romaine lettuce was served as part of the buffalo chicken salad, the Caesar salad at the self-serve salad bar, or by itself in an individual bin at the self-serve salad bar. Heads of romaine were chopped and washed in the produce area of the main cafeteria kitchen. Cutting gloves were always worn and the same knife was consistently used for cutting the romaine lettuce.

A total of 47 food workers were identified at Facility X and interviewed. One food worker reported diarrhea with onset on Thursday, March 12, but was not involved in food preparation duties during the dates of concern.

### Laboratory Investigation

Of the 6 laboratory-confirmed cases of *E. coli* O157:H7, 5 were identified at the onset of the investigation by 4 different clinical laboratories, and 1 was identified during the investigation by the DPH Laboratory. The DPH Laboratory performed PFGE testing that showed identical patterns in isolates from all 6 laboratory-confirmed cases. The DPH laboratory also tested specimens submitted by 11 company employees with gastrointestinal symptoms. All results were negative for *E. coli* O157, except for the individual confirmed case mentioned above. A total of 41 food workers, including the one ill food worker, submitted specimens to the DPH Laboratory; all were negative for *E. coli* O157. These specimens were collected during March 26-31, 2009.

A total of 10 food and 5 environmental samples were tested at the DPH Laboratory. The food samples consisted of roasted chicken tenders, a pre-formed hamburger patty, a bulk ground beef product, a finished chili that had been previously prepared in-house, and romaine lettuce and several

other produce items. The environmental samples were collected from the produce sink, salad spinner, kitchen grill area, cutting boards, and the stainless cart and table. All the food and environmental samples were negative for *E. coli* O157. The prepared chili sample was the only food item collected that would have been served during the week of interest since this chili was prepared ahead of time in 80-lb batches and frozen until use at a later date. All other food samples were comparison samples, due to the fact that raw or fresh leftover foods from the week of interest were not available.

### Control Measures

On March 23, the LHD performed an on site assessment of food preparation activities at Facility X and recommended the following actions until further information was available: suspending service of all self-serve food and raw ready-to-eat produce items, ensuring all food workers involved in food preparation were adequately trained, and having a third party food safety consultant present during daily food service.

During March 28-29, a private environmental services company disinfected all surfaces and equipment used for direct and indirect food service at the cafeteria of Facility X.

No employees with illnesses consistent with the case definition were identified after March 23.

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### Editorial Note

*E. coli* O157 is the most common Shiga toxin-producing *E. coli* strain in the United States (U.S.). Illness ranges in severity from non-bloody and bloody diarrhea to severe complications involving acute kidney failure and death. *E. coli* O157 infections have been estimated to cause 73,000 illnesses annually in the U.S., resulting in more than 2,000 hospitalizations and 60 deaths (1).

Cattle are a major reservoir for this pathogen (2). Although *E. coli* O157:H7 was first recognized as a human pathogen in 1982 during an outbreak of gastrointestinal illness (3), it was not until 1993, after a large multistate outbreak associated with consumption of undercooked ground beef, that the bacteria became widely regarded as a major public

health threat (4). Since then, research has shown that *E. coli* O157:H7 infections can be caused by person-to-person transmission, contact with infected farm animals and the farm environment, and swimming in contaminated recreational water. Consumption of undercooked ground beef or other contaminated foods remains the most common cause of infection.

Several findings from this investigation indicate that consumption of chicken tenders was the most likely cause of this outbreak: 1) the odds of developing illness was consistently greater from consumption of chicken tenders than from romaine lettuce on all dates of interest, 2) consumption of chicken tenders from the salad bar on Wednesday was independently associated with illness, 3) consumption of any chicken tenders on Thursday by employees who did not eat on Wednesday was associated with illness, and 4) one confirmed case-patient had a meal on Thursday that contained chicken tenders but not romaine lettuce.

Although only the lunch served on Wednesday was associated with illness, epidemiological findings indicated that contaminated chicken tenders were also likely served on Tuesday and Thursday. Neither day was statistically implicated because of the small proportion of case-patients who ate only on those days. Findings from the environmental investigation showed that the same batch of roasted chicken tenders can be used on Tuesday, Wednesday, and Thursday, supporting the possibility of exposure to contaminated chicken tenders over a 3-day period.

Because historically, chicken has not been a source of *E. coli* O157, the chicken tenders were most likely cross-contaminated, which could have occurred in several different ways. One source of cross-contamination could be undercooked ground beef that might contain *E. coli* O157. The close proximity of the roasted chicken tenders to undercooked beef patties during storage overnight could have exposed the chicken to drippings from the beef (Connecticut regulations require food

establishments to not store raw or partially-cooked potentially hazardous foods above ready-to-eat foods). Also, a kitchen utensil used to handle undercooked ground beef could have been used to serve or handle chicken tenders. In both scenarios, contaminated roasted chicken tenders could have subsequently cross-contaminated fried chicken tenders through sharing the same hot plate during the serving of the buffalo chicken salad. Another source of contamination could be an ill food worker. Although none of the food workers were ill during the dates of interest, and specimens were all negative for *E. coli* O157, it is conceivable that mild symptoms might have gone unrecognized and testing was not sensitive enough to detect infection many days later.

Diseases spread by contaminated foods continue to challenge the public health system. In Connecticut, foodborne disease outbreaks are reportable to the local health department and to the DPH. Often, a combination of events leads to outbreaks (5). Outbreak investigations are critical in assessing the burden of foodborne disease in Connecticut and nationally. The identification of specific factors during outbreak investigations contributes to the control of the immediate situation and can lead to the development of methods to prevent future outbreaks.

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