



## A LARGE RESTAURANT-ASSOCIATED OUTBREAK OF *SALMONELLA* HEIDELBERG

### BACKGROUND

On March 4, 2004, ACDC received a Food-Borne Illness Report (FBIR) from a local resident stating that he had been hospitalized for salmonellosis. He believed that his illness was connected to dining at a restaurant, Manhattan Beach, California (Restaurant C). Over the next few days, two additional FBIRs were received by ACDC implicating the same restaurant. The potential for a wide-scale outbreak was heightened since Restaurant C serves over 1,000 customers daily.

### METHODS

The Food and Milk (FM) Program of the Environmental Health Division of the Los Angeles County Department of Health Services (LACDHS) responded to the initial FBIR with a restaurant inspection on March 5, 2004. On March 9, ACDC initiated an epidemiological investigation to determine the extent of the outbreak, risk factors for disease acquisition, and steps necessary to control and prevent further infections. For case finding, a press release was issued on March 11 notifying the public of the *Salmonella* outbreak and requesting that patrons who dined at the restaurant between February 25, 2004 and March 5, 2004 and became ill contact ACDC. Public callers, their dining partners and identified ill individuals were interviewed for a case-control study.

Case-Control Study—Outbreak Case Definitions and Case Finding: A case-patient was defined as: 1) a person who ate at or ate food from Restaurant C from February 25, 2004 to March 5, 2004, and 2) who developed diarrhea (>2 loose stool over 24 hrs) and fever, or diarrhea and at least two other symptoms (abdominal cramps, vomiting, nausea), within 6–72 hours after eating. Culture-confirmed case-patients had stool specimens positive for *Salmonella* with an indistinguishable pulsed-field gel electrophoresis (PFGE) pattern to the outbreak strain. All other case-patients were considered as presumptive. Case finding was conducted through notification of the public via the press release or media reports, review of *Salmonella* positive cultures from local laboratories, and interview of ill patrons to identify their dining partners. Reservation lists or credit card receipts were unavailable as these records were either not kept or not accessible.

An unmatched case-control study was conducted using a standardized, telephone-administered questionnaire. Asymptomatic persons who ate at the restaurant during the outbreak period and called ACDC were included as controls. Employees, including food handlers, were also interviewed and included in the study. Participants were questioned about their demographics, dining exposure, symptoms, and treatment. The Fisher's Exact Test was used to calculate odds ratios (OR) and 95% confidence intervals (95%CI). Only culture-confirmed case-patients were included in the analysis. "Case-patients" hereafter will only refer to culture-confirmed individuals.

Laboratory Study: Callers who were still ill were offered stool cultures. Stool specimens were also collected from all food handlers regardless of symptoms—persons who handled food products or food utensils (e.g., cooks, dishwashers, etc.). Environmental samples from Restaurant C were collected for culture as well. Cultures were tested in the LAC Public Health Laboratory (PHL) or retrieved from local laboratories for additional analysis. *Salmonella* isolates from case-patients and food handlers were serotyped by the PHL. In addition, isolates were characterized by pulsed-field gel electrophoresis (PFGE) using the restriction enzymes Xba1 and Bln1 to determine genotypic relatedness. Antibiotic susceptibility patterns were also reviewed.



## RESULTS

**Restaurant Inspection:** The inspection by FM revealed two main problems. First as reported by the restaurant manager, the slow-cooking Alto Sham<sup>®</sup> oven, which is used primarily for cooking turkey breast meat, had malfunctioned. The thermostat was not correlating with internal cooking temperature, causing the staff to arbitrarily set the oven temperature for cooking. This turkey meat was used in all dishes containing turkey in the restaurant. During the inspection, FM did not check the oven's temperature; however, the recorded temperature of the turkey meat in the holding compartment of the oven at the time of the inspection was 96–111°F. Second, at the time of the inspection an electric slicer was crusted with debris. This slicer was used to cut both meats and produce and in close proximity to food preparation areas for other food products such as produce.

**Descriptive Epidemiology:** In response to the press release, over 80 case-patients were identified by ACDC. As of June 4, 2004, 23 culture-confirmed case-patients and 55 presumptive cases were identified. Case-patients resided in Los Angeles, New York, Chicago, Canada, and Wales. The majority of case-patients (n=21, 91%) and 39 controls completed the questionnaire. The median age for case-patients was 33 years (range 12–67) and about half (52%) were male (Table 1). The median age for controls was 37 years (range 2–72) and a little more than half (56%) were male. Most cases dined in the restaurant (71%) versus taking food out (29%). Four cases reported eating leftovers from their meals. Related to this incident, health care providers evaluated 17 cases for gastrointestinal symptoms and 14 of these cases gave stool specimens for culture. Other individuals submitted stool specimens upon request of ACDC. Diarrhea was the most common complaint (100%), followed by abdominal cramps (91%), fever (81%), vomiting (52%), nausea (52%), and headache (33%, Table 2). All case-patients ate at the restaurant during February 25 through March 1, 2004, but this did not differ from the control group (Figure 1). Only one case-patient ate at the restaurant on more than one occasion (on February 27, 28, and 29); the onset of his symptoms occurred on March 1. Most case-patients (81%) had onset of symptoms within one day of eating at Restaurant C (range 1–8 days).

**Table 1. Characteristics of Case-Patients and Controls**

Characteristic	Case-Patients* (N=21)		Controls (N=39)	
	no.	%	no.	%
Sex, Male	11	52%	22	56%
Underlying chronic illness	1	5%	N/A	–
Eat in	15	71%	31	80%
Take out	6	29%	5	13%
Ate leftovers	4	19%	2	5%
Seen by health care provider	17	81%	N/A	–
Stool cultured by provider	14	67%	N/A	–

\* Excluded two case-patients: one not available for interview, other did not complete questionnaire.

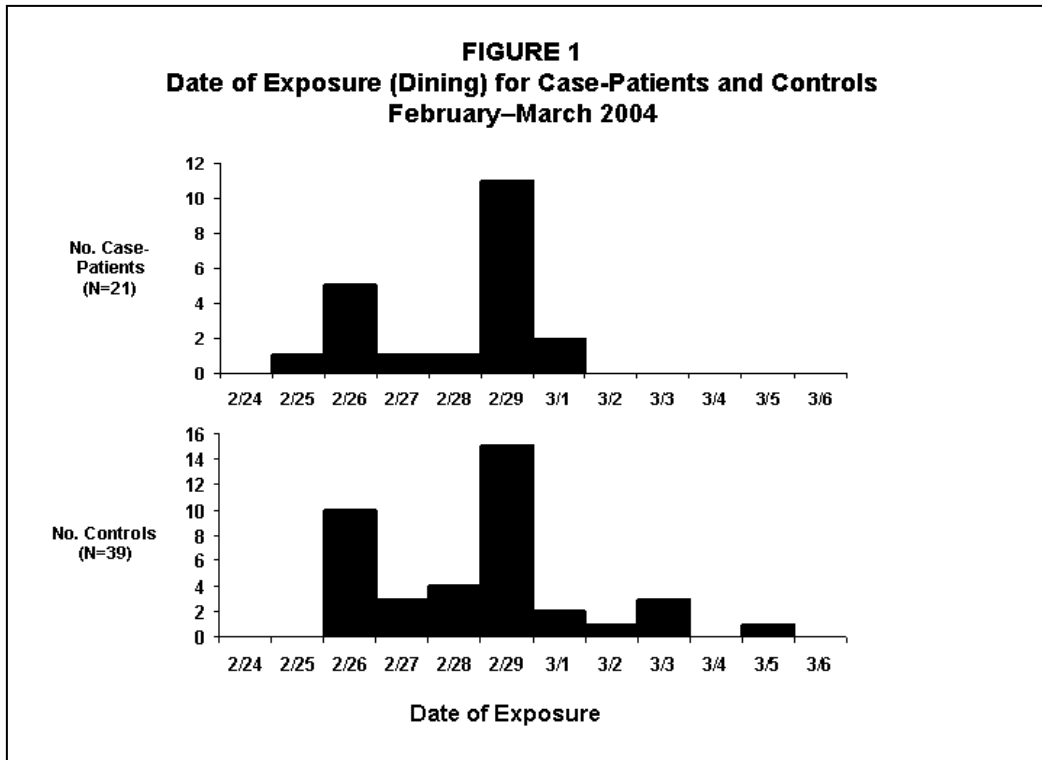
**Table 2. Frequency of Symptoms among Case-Patients**

Symptoms	Case-Patients (N=21)	
	no.	%
Diarrhea	21	100%
Abdominal Cramps	19	91%
Fever	17	81%
Vomiting	11	52%
Nausea	11	52%
Headache	7	33%

In addition, 68 employees, including 19 food handlers, were interviewed. Two food handlers (FH-A and FH-B) reported diarrheal illnesses during February 23 to March 2. FH-A was a male dishwasher who



developed diarrhea and abdominal cramps on March 1. He reported no ill contacts. FH-B was a male cook who developed fever, diarrhea, abdominal cramps, and vomiting on March 1. He also reported no ill contacts. Both had eaten food at the restaurant prior to their onsets of illness, but since only FH-B's illness was culture confirmed, only this worker was counted as a case.



**Case-Control Study:** Ultimately, 21 of 23 culture-confirmed case-patients and 39 controls were included in the study. One case-patient was not available for interview; the other did not complete the questionnaire. Both were excluded. The most common food items consumed by case-patients were the Cobb salad (29%) or turkey sandwich (29%, Table 3). Analyses showed that the consumption of the Cobb salad (OR=Undefined, 95%CI: 2.6–undefined), or the turkey sandwich (OR=Undefined, 95%CI: 2.6–undefined) were statistically associated with illness. Among dishes consumed by case-patients were several salads and sandwiches containing turkey breast, including the chopped salad, Cobb salad, club sandwich and Reuben sandwiches. Consumption of any turkey-containing dish was strongly associated with illness (OR=27.4, 95%CI: 5.5–171).

**Table 3. Case-Control Study Results—Food Item Specific Risk Factors for Illness**

Food Item Consumed	Case-Patients (N=21)		Controls (N=39)		Odds Ratio	(95% CI)
	no.	%	no.	%		
Turkey breast meat**	18	86%	7	18%	27.4	(5.5–171)
Cobb salad	6	29%	0	0%	Ø*	(2.6– Ø*)
Turkey sandwich	6	29%	0	0%	Ø*	(2.6– Ø*)
Club sandwich	4	19%	2	5%	4.4	(0.5–51)
Bran muffin	2	10%	1	3%	4.0	(0.2–242)
Chopped salad	2	10%	3	8%	1.3	(0.1–12)
Steak fries	3	14%	4	10%	1.5	(0.2–10)
Turkey-walnut sandwich	0	0%	1	3%	0	(0–72)
Reuben sandwich	0	0%	2	5%	0	(0–10)

\* Ø=undefined.

\*\* \* Includes chopped/Cobb salads, club/turkey/turkey-walnut/Reuben sandwiches—all contain turkey breast meat.



**Laboratory:** All 23 *Salmonella* isolates from case-patients were serotyped as *S. Heidelberg* with indistinguishable PFGE. Antibiotic susceptibilities reports were received on 17 isolates—all displayed sensitivity to the tested antibiotics and showed no multi-drug resistance patterns. Only 1 of the 19 stool cultures from food handlers was positive for *Salmonella*—it belonged to FH-B.

On March 10, 2004, ACDC accompanied FM on a repeat inspection. Environmental samples were obtained from: plastic containers used to defrost turkey meat, electric slicer, produce boxes, and a magnetic knife holder. In total, nine samples were collected. None of the cultures was positive for *Salmonella* species.

**Interventions:** The investigated restaurant was not closed because control measures were implemented as soon as the outbreak was recognized and there was no indication that the outbreak was ongoing. Many infection control improvements were implemented: use of the malfunctioning oven was discontinued, the contaminated slicer was disassembled and cleaned, a new slicer was purchased for future use, the slicers were relocated away from food preparations areas, and produce was re-washed. Remaining turkey meat that had been prepared in the malfunctioning oven was disposed of. In addition, there was increased adherence to cleaning protocols in the kitchen and preparation of meat products was moved to a separate location away from produce preparation sites. The manager held meetings to discuss food safety protocols including checking internal food temperature and related issues with the entire staff.

## DISCUSSION

A food-borne illness outbreak due to *S. Heidelberg* occurred at a restaurant in LAC during February to March 2004. We confirmed that 23 individuals who dined the restaurant during that time period subsequently developed salmonellosis. In addition, 55 more persons developed clinical symptoms compatible with salmonellosis and were considered presumptive cases. Our investigation indicates that the most likely contaminated food item was turkey breast meat and dishes containing turkey meat. Although several employees reported gastrointestinal illnesses, they likely became ill after consuming food from the restaurant and were not the source of the outbreak. Contributing factors assumed to have facilitated this outbreak include the malfunctioning oven, which may have resulted in under-cooked turkey meat, and cross contamination from the electric slicer. Our investigation was limited by the lack of implicated turkey meat prepared during the outbreak period for laboratory testing. In addition, documentation (i.e., reservations or credit card receipts) was not available to confirm exposure dates, so reporting and recall biases may have occurred among interviewees. The restaurant management demonstrated improved adherence to proper food preparation protocols such as checking internal temperature of the turkey meat and other improvements to resolve unhygienic food handling practices.