

Module 6 – Case Study Exercise

Gastroenteritis at a College

Note: This case study is based on a real-life outbreak investigation undertaken in Texas in 1998. Some aspects of the original outbreak and investigation have been altered, however, to assist in meeting the desired teaching objectives.

It is anticipated that the epidemiologist investigating a foodborne disease outbreak will work within the framework of an "investigation team" and the Foodborne Outbreak Protocols. It is through the collaborative efforts of this team, with each member playing a critical role, that outbreak investigations are successfully completed.

Learning objectives:

- Prioritize the investigation of a suspected foodborne illness or foodborne disease outbreak.
- List clues that might help determine the causative agent in an outbreak of acute gastrointestinal illness.
- Use the descriptive epidemiology of an outbreak to develop hypotheses about the source of the outbreak.
- Discuss some of the issues associated with the collection of clinical specimens for the investigation of a suspected foodborne disease outbreak.
- List key areas of focus in investigating a facility implicated in a foodborne disease outbreak including interviews, observations, measurements, and collection of samples.
- Interpret the measure of association for a case-control study.
- Discuss short- and long-term control measures appropriate for a foodborne disease outbreak.

Part I Outbreak Detection

On the morning of March 11, the county health department (CHD) received a telephone call from a student at the local community college. The student reported he and his roommate, a fraternity brother, were suffering from "stomach flu". Both had become ill during the night. The roommate had taken an over-the-counter medication with some relief of his symptoms. Neither had seen a physician or gone to the emergency room

CHD field surveillance staff (FSS) talked to the student at some length and completed a "Preliminary Outbreak Investigation Report" based on the call. (The student refused to give his name or provide a telephone number or address at which he or his roommate could be reached.) The student believed their illness was due to food they had eaten at a local pizzeria the previous night. The student asked if he and his roommate should attend classes and take a biology midterm exam that was scheduled that afternoon.

Question 1: Review the "Preliminary Outbreak Investigation Report", Appendix 1. Do you think the report represents a possible foodborne illness?

Question 2A: Do you think the student's complaint should be investigated further? (VOTE)

- A. Definitely
- B. Probably
- C. Probably not
- D. Definitely not

Question 2B: What criteria would you use to decide which foodborne illness complaints or suspected outbreaks receive priority for immediate investigation?

CHD FSS was skeptical of the student's report but felt that a minimal amount of exploration was necessary. They requested a review the foodborne illness complaint log to see if others had reported similar illnesses or exposures. Although a few reports of vomiting and diarrhea had been received, no other recent complaints mentioned the pizzeria or involved students from the college.

CHD FSS then made a few telephone calls. The pizzeria, where the student and his roommate had eaten, was closed until 11:00 A.M. There was no answer at the Student Health Center, so a message was left on its answering machine.

A call to the emergency room of a hospital close to the college (Hospital A) revealed that 23 college students had been seen for acute gastroenteritis in the last 24 hours. Based on the emergency room (ER) triage log, only three patients had been seen for similar symptoms from March 5-9, none of who were associated with the college. Stool specimens from 17 students had been submitted for routine bacterial pathogens to the hospital lab on March 10, but no results were available.

Around 10:30 A.M., the physician from the Student Health Center returned the call from CHD and reported that 20 students with vomiting and diarrhea had been seen at the clinic the previous day and more were waiting to be seen that morning. He believed only 1-2 students typically would have been seen for these symptoms in a week.

Question 3: Do you think these cases of gastrointestinal illness represent an outbreak at the college?

Why or why not?

Part II – Hypothesis Generation

CHD FSS asked health care providers from the Student Health Center, the Hospital A ER, and the ER at six other hospitals located in the general vicinity of the college to report all patients with vomiting or diarrhea seen since March 5.

CHD FSS then visited Hospital A and reviewed medical records of the 26 patients seen at the facility for vomiting and/or diarrhea since March 5. All but three were students at the college. Based on these records, symptoms among the patients included vomiting (91%), diarrhea (85%),

abdominal cramping (68%), headache (66%), muscle aches (49%), and bloody diarrhea (5%). Oral temperatures ranged from 98.6°F (37.1°C) to 102.4°F (39.1°C) (median: 100°F [37.5°C]). Complete blood counts, performed on 10 patients, showed an increase in white blood cells (median count: 13.7 per cubic mm [normal: 4.8-10.8 per cubic mm]).

Preliminary stool culture results from the 17 patients from whom specimens had been collected did not identify Salmonella, Shigella, Campylobacter, Vibrio, Listeria, Yersinia, E. coli O157:H7, Bacillus cereus, or Staphylococcus aureus. Examinations for ova and parasites were negative. Some specimens were positive for fecal leukocytes and fecal occult blood.

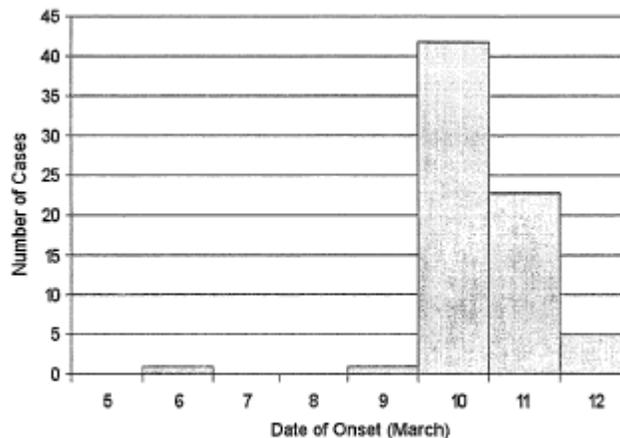
Question 4: How might you interpret the bacterial culture results?

Question 5: Based on the findings so far, what type of agent do you think might be causing this outbreak? (VOTE)

- A. Bacteria
- B. Virus
- C. Parasite
- D. Preformed toxin or chemical

By the next morning, March 12, seventy-five persons with vomiting or diarrhea had been reported to CHD. All were students who lived on the college campus. No cases were identified among college faculty or staff, students living off-campus, or from the local community. Except for one case, the dates of illness onset were March 9-12. (Figure 1) The median age of patients was 19 years (range: 18-22 years), 69% were freshman, and 62% were female.

Figure 1. Onset of gastroenteritis among students (N=72) (Date of onset was not known for three ill students.)



Question 6: Interpret the epidemic curve. Based on the epidemic curve and likely causative agent, what is the period of interest for possible exposures related to this outbreak?

CHD DETECT team met with the Student Health Center physician and nurse and several administrators to learn more about the college and student body. The following information was gathered:

- The college had an enrollment was 12,000 students; 2,386 students lived on campus at one of the 36 residential halls scattered across the 200+ acres of the main campus.
- The college used municipal water and sewage services. Due to the large size of the campus, residential halls received water from several dozen water mains. There had been no work on water or sewage lines in the past year nor recent roadwork or digging around campus.
- The campus dining service included two cafeterias; about 2,000 students belonged to the college meal plan which was limited to persons living on campus. Most on-campus students dined at the main cafeteria which served hot entrees, as well as items from a grill, deli bar, and salad bar. A second smaller cafeteria on campus offered menu selections with a per item cost and was also accessible to meal plan members. In contrast to the main cafeteria, the smaller cafeteria tended to be used by students who lived off campus and college staff.

To better understand the likely source of the outbreak, the CHD team undertook hypothesis-generating interviews with seven of the earliest cases reported by the emergency room and the Student Health Center; all of the cases had onset of illness on March 10. Four were male and three were female.

Among the seven students interviewed, all but one was a freshman. Two students were psychology majors; one each was majoring in English and animal husbandry. Three students were undecided about their major. The students were from seven different residential halls and all reported eating most of their meals at the college's main cafeteria. During the past week, all but one student had eaten food from the deli bar; two had eaten food from the salad bar, and three from the grill. Seven-day food histories revealed no particular food item that was common to all or most of the students.

None of the students shared any classes; only one student knew someone with a similar illness (i.e., his roommate). In the last week, none of the students had had contact with children in diapers and only the student majoring in animal husbandry had had contact with animals. Five students belonged to a sorority or a fraternity. Three students had attended an all school mixer on March 6, the Friday before the outbreak began; two students went to an all night science fiction film festival at one of the dorms on March 7. Students reported attendance at no other special events; most had been studying for midterm exams for most of the weekend.

Question 7: At this point, what is your leading hypothesis on the primary mode of transmission in this outbreak? (VOTE)

- A. Foodborne
- B. Waterborne
- C. Student -to-student transmission
- D. Animal-to-student transmission

Based on clinical findings, the descriptive epidemiology of early cases, and hypothesis-generating interviews, team hypothesized that the source of the outbreak was a viral pathogen spread by a food or beverage served at the main cafeteria at the college between March 5 and 10.

Question 8: What studies or other investigations would you undertake to explore this hypothesis? What other steps would you take at this point?

Part III –Test The Hypothesis: The Three-Legged Stool

To explore the source of the outbreak at the college, the CHD team initiated three lines of investigation: laboratory studies to determine the causative agent, an environmental health assessment of the college main cafeteria, and an epidemiologic study of students living on campus.

Lab

To help identify the causative agent, health care providers were asked to collect stool specimens from new cases of vomiting and diarrhea. Bacterial cultures from patients seen in the ER were performed at the hospital at which they were collected and confirmed at the Bureau of Clinical Laboratories (BCL). Specimens collected at the Student Health Center were to be cultured at the BCL. Stool specimens from a sample of ill patients were sent to the BCL for viral studies including reverse transcription-polymerase chain reaction (RT-PCR).

Question 9: What instructions would you give to health care providers for the collection of stool specimens from patients?

Environmental

On the afternoon of March 12, CHD environmentalist conducted an environmental health assessment of the main cafeteria at the college and interviewed staff. Thirty-one staff members were employed at the cafeteria of whom 24 (77%) were food workers. Except for one employee, all dining service personnel were interviewed.

Question 10: What activities would you undertake during the environmental health assessment? What key areas should be explored during interviews with the cafeteria food workers?

The environmentalists toured the facility and obtained a list of the foods served at the main cafeteria during the implicated period. Cafeteria staff was questioned about their responsibilities such as the foods they handled, which meals they served, and where they usually worked (e.g., deli bar, grill). They also were asked about use of gloves, handwashing practices, work schedule during the week before the outbreak, and if they had been ill. None of the food workers reported being ill in the last two weeks. The cafeteria did not have a sick food workers policy.

An inspection of the main cafeteria food preparation area, equipment, and serving line was unremarkable. Walk-in refrigerators and freezers were organized to prevent cross contamination and maintained at appropriate temperatures. Food preparation surfaces were clean and appropriately situated with respect to flow of kitchen traffic. Steam tables on the serving line

heated to proper temperatures. Other equipment (e.g., meat slicer) was clean and in good working order.

The deli bar had its own refrigerator and preparation area. During mealtimes, sandwiches were made to order by a food worker. Each day, newly prepared deli meats, cheeses, and condiments were added to partially depleted deli bar items from the day before (i.e., without discarding leftover food items). While the deli bar was open for service, sandwich ingredients were not kept refrigerated or on ice. The deli bar containers were not routinely cleaned. The refrigerator cooled only to 47°F.

Water and ice from the cafeteria were collected to test for fecal coliforms. Samples of leftover food were collected from the deli bar for bacterial cultures and special viral studies at CDC. Stool specimens were requested from all cafeteria staff.

Before dinner on March 12, CHD closed the deli bar.

Question 11: Do you agree with the decision to close the deli bar? (VOTE)

- A. Definitely
- B. Probably
- C. Probably not
- D. Definitely not

Epidemiology

By the morning of March 13, one hundred and twenty-five persons with vomiting or diarrhea had been reported to CHD. All cases were among students who lived on campus.

Epi A&R Branch staff designed an epidemiologic study to test the hypothesis that the source of the outbreak was a food or beverage served at the main cafeteria at the college between March 5 and 10.

Question 12A: Given the findings of the environmental health assessment, do you think it is necessary to proceed with an epidemiologic study?

Question 12B: If you undertook an epidemiologic study, what kind of study would you undertake?

Because the illness was relatively rare in the study population (i.e., affecting only 125 of the 2,400 students living on campus) and time was of essence, a case-control study was undertaken. A case was defined as vomiting or diarrhea (3 or more loose bowel movements during a 24-hour period) with onset on or after March 5 in a student who lived on campus. Cases were selected from those reported to CHD by one of the local emergency rooms or the Student Health Center. Controls were students who lived on campus who did not have nausea, vomiting, or diarrhea since March 5.

Forty cases were randomly selected from the 125 reported through March 13. One hundred and sixty controls were randomly selected from a roster of students living on campus. Team administered the study questionnaire by telephone from March 15-23. Team asked cases and controls about a variety of exposures including foods eaten during March 5-10 and where the foods were prepared.

Thirty-six cases and 144 controls were contacted. Cases included in the study were similar to all cases with respect to gender, age, year in college, and onset of illness. Epi staff tabulated the results from the case-control study.

Table 1. Selected exposures among ill and well students living on campus, case-control study

Exposure	Ill exposed	Ill not exposed	Well exposed	Well not exposed	Measure of association
Main cafeteria					
Lunch 3/9	13	23	80	64	
Dinner 3/9	20	16	91	53	
Lunch 3/10	10	26	92	52	
Dinner 3/10	16	20	94	50	
Deli bar					
Lunch 3/9	18	18	12	132	
Dinner 3/9	7	29	5	139	
Lunch 3/10	13	23	12	132	
Dinner 3/10	4	32	4	140	

*No exposures from March 5-8 were significantly associated with illness.

Question 13: Calculate the appropriate measure of association for these exposures. Interpret the results.

Eating lunch or dinner at the deli bar on March 9 or 10 was statistically significantly associated with illness. To identify the specific item(s) at the deli bar causing the outbreak, team reanalyzed study data only from cases (N=28) and controls (N=20) who ate at the deli bar during March 9-10.

Table 2. Food items eaten by students who ate at deli bar during the implicated meals," case-control study

Exposure	Ill exposed/ Total ill (%)	Well exposed/ Total well (%)	Odds Ratio	95% Confidence Interval	p-value
American cheese	13/28 (46)	4/20 (20)	3.4	0.80-17.5	0.06
Swiss cheese	8/28 (29)	8/20 (40)	0.61	0.15-2.4	0.30
Ham	11/28 (39)	6/20 (30)	1.5	0.38-6.3	0.36
Turkey	15/28 (54)	11/20 (55)	0.95	0.26-3.5	0.57
Shredded lettuce	13/28 (46)	10/20 (50)	0.87	0.24-3.2	0.52
Tomato	7/28 (25)	6/20 (30)	0.78	0.18-3.5	0.50
Pickles	7/28 (25)	7/20 (35)	0.63	0.15-2.6	0.63
Mayonnaise	20/28 (71)	9/20 (45)	3.1	0.78-12.4	0.06
Mustard	10/28 (36)	9/20 (45)	0.68	0.18-2.6	0.52

*includes lunch and dinner on March 9 and lunch on March 10

Question 14: Interpret the results in Table 2.

Part IV- Control and Prevention Measures

Water and ice samples obtained from the cafeteria on March 12 were negative for fecal coliforms. Stool cultures from the 23 food workers were negative for bacteria.

Of the 18 fresh stool specimens sent on ill students to BCL, 9 (50%) had evidence of norovirus by RT-PCR.

On March 25, the college cafeteria staff member who initially refused to be interviewed agreed to talk to the team. The staff member worked primarily at the deli bar. She reported slicing ham on March 9 for use at the deli bar during lunch and dinner that day, and lunch the following day. She also prepared and served sandwiches for these same meals. She reported that she had worn gloves while slicing the ham and while serving sandwiches at the deli bar. Because she wore gloves during food preparation and serving, however, she did not feel that handwashing was an important activity.

The staff member denied any gastrointestinal illness during the outbreak period but reported that her infant had been sick with watery diarrhea since March 7, two days before she prepared items for the implicated meals. A stool sample collected from the ill infant on March 25 was positive for norovirus by RT-PCR.

The chief of the campus food service called CHD to find out what must be done to reopen the deli bar.

Question 15: What actions would you recommend/require?

The deli bar was thoroughly cleaned. All equipment and surfaces were disinfected. All leftover foods and ingredients were thrown away. The deli bar refrigerator was fixed so that it cooled to 40°F (or less).

CHD environmentalists worked with college officials to develop and implement policies to assure safe food preparation. Special training sessions were held with cafeteria employees to make sure they understood the policies and safe food preparation practices. The CHD intensified its monitoring of food service activities at the college, placing a special emphasis on the oversight provided by food services management.

After implementing control measures recommended by CHD, the deli bar was reopened on April 1.

Preliminary Outbreak Investigation Report

Who notified FSS?: refused to provide	Date: 03/11	Time: 9:00am
Lead FSS: Anita Potty	County: Ralph	PHA:12
Facility* Name:	Facility Type:	
Total exposed/enrolled	Total ill/absent	
Total facility staff	Total facility staff ill	

*Example facility includes school, restaurant, church, nursing home

Signs and Symptoms	Circle Yes or No	Other signs and symptoms
Fever	X	headache
Diarrhea	X	
Nausea	X	
Vomiting	X	

Describe details of the situation, including common exposure and setting of the suspected outbreak.

Community college student called, but refused to identify himself, to report he and his roommate usually ate separately at the college main cafeteria. Could not provide list of foods eaten. The only shared meal was at pizzeria on 3/10. Pizza with anchovy, cheese, onions, and beer

Exposure	Date (MM/DD/YY)	Time (HH:MM)	AM/PM
Earliest exposure			
Latest exposure			

Illness Onset	Date (MM/DD/YY)	Time (HH:MM)	AM/PM
Earliest onset	03/10	11:30	am
Latest onset	3/11	2:30	am

How many sought medical care? N	How many hospitalized?
Stool specimens collected and tested? N	Results?
How many stool specimens will be submitted for BCL?	When?
Information gathered from (mark all that apply): Environmentalist Ill person X Facility Staff	

Surveillance Branch investigation recommendations to FSS:

Fax report to Epidemiology Division at 334-206-3734.