Gastroenteritis at a University in Texas

INSTRUCTOR'S VERSION

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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 and allow completion of the case study in less than 3 hours.

Students should be aware that this case study describes and promotes one particular approach to foodborne disease outbreak investigation. Procedures and policies in outbreak investigations, however, can vary from country to country, state to state, and outbreak to outbreak.

It is anticipated that the epidemiologist investigating a foodborne disease outbreak will work within the framework of an "investigation team" which includes persons with expertise in epidemiology, microbiology, sanitation, food science, and environmental health. It is through the collaborative efforts of this team, with each member playing a critical role, that outbreak investigations are successfully completed.

We invite you to send us your comments about the case study by visiting our website at http://www.phppo.cdc.gov/phtn/casestudies. Please include the name of the case study with your comments.

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Target audience: epidemiologists and other persons with knowledge of basic epidemiologic concepts and experience in data collection and analysis who are interested in learning specific skills for investigating infectious disease outbreaks

Trainee prerequisites: working knowledge of descriptive epidemiology, epidemic curves, measures of association, stratified analysis, study design, outbreak investigation. The student will also benefit from having some familiarity with food microbiology and environmental investigation techniques but will be likely to rely heavily on others with greater expertise in these areas in a real-life outbreak situation.

Teaching materials required: calculator

Time required: approximately 2 hours and 30 minutes

Language: English

Level of case study: Basic ___ Intermediate _X_ Advanced ___

Materials borrowed from:
"Foodborne Illness Investigation and Control Reference Manual", Massachusetts Department of Public Health, Division of Epidemiology and Immunization, Division of Food and Drugs, and Division of Diagnostic Laboratories (1997)

"Guidelines for the Investigation and Control of Foodborne Disease Outbreaks", World Health Organisation, Food Safety Unit Division of Food and Nutrition and Division of Emerging and Other Communicable Diseases Surveillance and Control (DRAFT, 1999)

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INSTRUCTOR'S VERSION
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Learning objectives:

After completing this case study, the student should be able to:

1. list categories and examples of questions that should be asked of key informants who report a suspected outbreak of foodborne disease
2. list four criteria for prioritizing the investigation of suspected foodborne disease outbreaks
3. list three common pitfalls in the collection of clinical specimens for the investigation of suspected foodborne diseases
4. determine the most efficient epidemiologic study design to test a hypothesis (including the case definition and the appropriate comparison group)
5. describe the advantages and disadvantages of different forms of questionnaire administration (e.g., self-administered, telephone, in-person)
6. list key areas of focus in interviewing foodhandlers and observing kitchen practices in a foodborne disease outbreak

PART I - OUTBREAK DETECTION

On the morning of March 11, the Texas Department of Health (TDH) in Austin received a telephone call from a student at a university in south-central Texas. The student reported that he and his roommate, a fraternity brother, were suffering from nausea, vomiting, and diarrhea. Both had become ill during the night. The roommate had taken an over-the-counter medication with some relief of his symptoms. Neither the student nor his roommate had seen a physician or gone to the emergency room.

The students believed their illness was due to food they had eaten at a local pizzeria the previous night. They asked if they should attend classes and take a biology midterm exam that was scheduled that afternoon.

Question 1: What questions (or types of questions) would you ask the student?

In recording a complaint about a possible foodborne illness, it is important to systematically collect the following information:

- ***WHAT** is the person's problem? (e.g., clinical description of the illness, whether a physician was consulted, whether any tests were performed or any treatments were provided)*

- ***WHO*** *else became ill, their characteristics (e.g., age, sex, occupation), and the nature of their illnesses (e.g., symptoms, whether any persons were hospitalized or died)?*

- ***WHEN*** *did the affected person(s) become ill?*

- ***WHERE*** *are the affected persons located? (including names and telephone numbers)*

- ***WHY (and HOW)*** *do they think they became ill? (e.g., risk factors, suspected exposures, suspected modes of transmission, hints from who else did and did not become ill)*

NOTE:

1) *Always collect as much information as possible from the person reporting an illness the first time contact is made; it might be difficult to talk with the person again. If the complainant cannot provide critical pieces of information, try to find out who may be able to and contact that person. Be sure to ask the reporter how s/he can be reached in the future and if anyone else has been notified of this problem.*

2) *Collect information on pertinent negatives as well as pertinent positives. For example, if one only records that the person's symptoms included vomiting and diarrhea, it is difficult to know if that means there was no fever or the information was not collected.*

3) *Collect a complete food history. Regardless of the source, complainants will often associate illness with the last food or meal they consumed (particularly if it was at a commercial establishment).*
    - *If the etiologic agent is not known, obtain at least a 72-hour food history (i.e., all foods/beverages/meals consumed in the 72 hours prior to onset of illness).*
    - *For illnesses in which diarrhea is the predominant symptom (as opposed to vomiting), one should collect a 5-day food history because incubation periods for diarrheal diseases tend to be longer.*
    - *If the etiologic agent is known, ask about foods/beverages/meals eaten within the incubation period for that illness.*
    - *If more than one person is reported ill, foods/beverages/meals COMMON to all persons will be of particular interest BUT complete food histories for the appropriate time periods should still be collected.*

4) *Remember that many illnesses that can be acquired through foods may also be acquired through other means such as water, person-to-person contact, and animal-to-person contact. Keep an open mind about possible sources and do not assume that it must be food.*

5) *Be sure to accurately record symptoms, dates and times of the onset of illness, and dates and times of food consumption. Most people who have experienced a recent illness should be able to provide you with these answers.*

6) *Thank the person for notifying you of their illness.*

Question 2: What would you advise the student about attending classes that day?

You probably should refer the student to his personal physician or the Student Health Center for a complete assessment.

While symptomatic, the students would probably be most comfortable staying in their dorm room. With adequate hygienic practices, however, they can return to normal activities (excluding foodhandling and direct care of high risk persons [e.g., infants, elderly, immunocompromised, or institutionalized persons]). Persons involved in foodhandling and direct care of high risk persons should not return to work until 48-72 hours after symptoms have resolved. For selected illnesses, the local jurisdiction may require 1-3 negative stool specimens collected at least 48 hours after completion of any antibiotic treatment. One should check local isolation and quarantine policies for clarification.

The "Foodborne Illness Complaint Worksheet" (Appendix 1) was completed 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.

Question 3: Do you think this complaint should be investigated further?

Ideally, all reports of possible outbreaks of foodborne illnesses should be investigated to:
1) *prevent other persons from becoming ill (either from the same food or method of food preparation),*
2) *identify potentially problematic foodhandling practices, and*
3) *add to our knowledge of foodborne diseases.*

Given current resource constraints in many health departments, however, it may not be possible to investigate all individual cases or investigate all cases to the same degree. Therefore, public health workers often must choose which instances receive highest priority for investigation.

The most important diseases/complaints to investigate are those that are a severe threat to the public's health or where a timely control response is critical. Top priorities include:

- *an outbreak associated with a commercially distributed food product*
- *severe (life-threatening) illnesses such botulism or E. coli O157:H7 infection*
- *confirmed clusters of a similar illness that appear to be associated with a specific food preparer or food service establishment*
- *instances where a large number of people appear to be affected*
- *indications of adulterated food presenting an imminent danger*
- *foodborne illness in a foodhandler*

Clues that a follow-up investigation may not be warranted or is unlikely to be productive include:

- *signs and symptoms (or confirmed diagnoses) among affected individuals suggesting they might not have the same illness*
- *ill persons who are not able to provide adequate information for investigation including date and time of onset of illness, symptoms, or a complete food history*
- *confirmed diagnosis and/or clinical symptoms that are not consistent with the foods eaten and the onset of illness*
- *repeated complaints made by the same individual(s) for which prior investigations revealed no significant findings*

In this foodborne disease complaint, one might be a little skeptical. First, if the illness was due to food consumed the night before, the incubation period would have been relatively short, suggesting a preformed toxin. The students' symptoms (e.g., diarrhea and fever), however, are more consistent with an enteric infection; infections tend to have longer incubation periods (i.e., ≥6 hours as opposed to <6 hours as seen with intoxications). Secondly, the student refused to give a food history beyond the foods eaten at the pizzeria. Finally, the question about attending classes and taking a midterm exam sounds as if the roommates might just want an excuse to avoid an unpleasant situation (particularly if they did not study sufficiently!)

NOTE: The fact that the student was not willing to give his or his roommate's name should not be over interpreted. Anonymous complaints are not uncommon and do not automatically invalidate a complaint. Complainants often request anonymity for fear of retribution.

TDH staff were skeptical of the student's report but felt that a minimal amount of exploration was necessary. They began by making a few telephone calls to establish the facts and determine if other persons were similarly affected. The pizzeria, where the student and his roommate had eaten, was closed until 11:00 A.M. There was no answer at the University Student Health Center, so a message was left on its answering machine.

A call to the emergency room at a local hospital (Hospital A) revealed that 23 university students had been seen for acute gastroenteritis in the last 24 hours. In contrast, only three patients had been seen at the emergency room for similar symptoms from March 5-9, none of whom were associated with the university.

At 10:30 A.M., the physician from the University Student Health Center returned the call from TDH and reported that 20 students with vomiting and diarrhea had been seen the previous day. He believed only 1-2 students typically would have been seen for these symptoms in a week. The Health Center had not collected stool specimens from any of the ill students.

<u>Question 4:</u> Do you think these cases of gastroenteritis represent an outbreak at the university? Why or why not?

An outbreak is the occurrence of more cases of a disease than expected for a particular place and time. In a 2-day period, over 40 cases of gastroenteritis occurred among students at the university (assuming that individual students did not visit both the Student Health Center and the emergency room). This compares with the handful of students that would normally have been seen for these symptoms at the two facilities in a week. Therefore, it is highly likely that these cases represent an outbreak.

What is not clear is whether the outbreak is limited to the university or if the wider community may also be affected. Case finding methods to this point, a hospital near the university and the University Student Health Center, are more likely to pick up cases among students than in the community.

NOTE: The terms "outbreak" and "epidemic" are used interchangeably by most epidemiologists. The term "outbreak" is sometimes preferred, particularly when talking to the press or public, because it is not as frightening as "epidemic".

PART II - INITIAL MICROBIOLOGIC INVESTIGATION

On the afternoon of March 11, TDH staff visited the emergency room at Hospital A and reviewed medical records of patients seen at the facility for vomiting and/or diarrhea since March 5. Based on these records, symptoms among the 23 students included vomiting (91%), diarrhea (85%), abdominal cramping (68%), headache (66%), muscle aches (49%), and bloody diarrhea (5%). Oral temperatures ranged from 98.8˚F (37.1˚C) to 102.4˚F (39.1˚C) (median: 100˚F [37.8˚C]). Complete blood counts, performed on 10 students, showed an increase in white blood cells (median count: 13.7 per cubic mm with 82% polymorphonuclear cells, 6% lymphocytes, and 7% bands). Stool specimens had been submitted for routine bacterial pathogens, but no results were available.

<u>Question 5:</u> List the broad categories of diseases that must be considered in the differential diagnosis of an outbreak of acute gastrointestinal illness.

There are two broad classifications for enteric diseases:

- *<u>Infections</u> are a consequence of the growth of a microorganism in the body. Illness results from two mechanisms: 1) viruses, bacteria, or parasites invade the intestinal mucosa and/or other tissues, multiply, and directly damage surrounding tissues and 2) bacteria and certain viruses invade and multiply in the intestinal tract and then release toxins that damage surrounding tissues or interfere with normal organ or tissue function. The necessary growth of the microorganism (for production and release of toxins) takes time; thus, the incubation periods for infections are relatively long, often measured in days compared with hours as are seen with intoxications. Symptoms of infection usually include diarrhea, nausea, vomiting, and abdominal cramps. Fever and an elevated white blood count are often associated with infection.*

- *<u>Intoxications</u> are caused by ingestion of food already contaminated by toxins. Sources of toxin include certain bacteria, poisonous chemicals, and toxins found naturally in animals, plants, or fungi. Intoxications most often result from bacteria that release toxins into food during growth in the food. The preformed toxin is ingested, thus live bacteria do not need to be consumed to cause illness. Illness from a toxin manifests more rapidly than that due to an infection because time for growth and invasion of the intestinal lining is not required. The incubation period for an intoxication is often measured in minutes or hours. The most common (and sometimes only) symptom of an intoxication is vomiting. Other symptoms can range from nausea and diarrhea to interference with sensory and motor functions such as double vision, weakness, respiratory failure, numbness, tingling of the face, and disorientation. Fever is rarely present with intoxication.*

See Appendix 2 for a list of common enteric disease agents in each of these categories.

<u>Question 6:</u> How might you narrow the range of agents suspected of causing the gastrointestinal illness?

The following information might help shorten the list of suspected agents:

- *predominant signs and symptoms*
- *incubation period*
- *duration of symptoms*
- *suspect food*
- *laboratory testing of stool, blood, or vomitus*

TDH staff asked health care providers from the University Student Health Center, the Hospital A emergency room, and the emergency departments at six other hospitals located in the general vicinity to report cases of vomiting or diarrhea seen since March 5. A TDH staff person was designated to help the facilities identify and report cases. The health care providers were also asked to collect stool specimens from any new cases. Bacterial cultures from patients seen in the emergency rooms were to be performed at the hospital at which they were collected and confirmed at the TDH Laboratory. Specimens collected by the Student Health Center were to be cultured at the TDH Laboratory.

<u>Question 7:</u> What information should be provided with each stool specimen submitted to the laboratory? How will the information be used?

The following information should be submitted with each stool specimen:

- *patient's name or identification number - used to track and provide results; allows comparison of results from repeat specimens*
- *date of collection of specimen - along with date of onset of symptoms, this date helps the laboratory determine where in the course of the patient's illness the specimen was collected (and, therefore, the likelihood of isolating an etiologic agent); also allows the laboratory to determine the age of the specimen when they receive/process it (i.e., determine if it is old)*
- *date of onset of symptoms - along with the date of collection of the specimen, this date helps the laboratory determine where in the course of the patient's illness the specimen was collected (and, therefore, the likelihood of isolating an etiologic agent)*
- *signs and symptoms - may suggest a particular agent and lead the lab to perform specific testing (e.g., bloody diarrhea may suggest the need to culture for <u>E. coli</u> O157:H7 or other Shiga-like toxin producing <u>E. coli</u>)*

<u>Question 8:</u> How should specimens be transported from the University Health Center to the TDH laboratory?

NOTE: One should check with the laboratory that will be testing the specimens for any collection, storage, or transportation recommendations. In general, collection and storage of stool specimens will depend on the examinations to be performed. Appendix 3 (in both the student and instructor versions) includes the following information:

<u>For bacterial pathogens</u>
Rectal swabs or swabs of fresh stools should be placed in refrigerated Cary-Blair transport medium. If the specimens are likely to be examined within 48 hours after collection, they can be refrigerated at 4°C until shipping. Specimens should be enclosed in a secure container and placed in a waterproof bag. Specimens should be packed with ice or frozen refrigerant packs in an insulated box.

If specimens must be held longer than 48 hours, they should be frozen as soon as possible after collection. Although storage in an ultra-low freezer (-70°C) is preferable, storage in a home-type freezer (if it is properly set at -20°C) is acceptable for short periods. So that the specimens remain frozen, they should be shipped on dry ice. Sufficient dry ice should be used to keep specimens frozen until the laboratory processes them (i.e., enough dry ice to fill one-third to one-half of the shipping container). Glass tubes should not be in direct contact with dry ice; a layer of paper or other material should be placed between the tubes and the dry ice. To prevent excess exposure to carbon dioxide (from the dry ice), screw caps should be tightened and sealed with electrical tape or specimens should be sealed in a plastic bag within the container of dry ice.

<u>For viral pathogens</u>
Collect as large a quantity of diarrheal stool as can be obtained (at least 10 cc). Place in a leak-proof, clean, dry container, and refrigerate immediately at 4°C. DO NOT FREEZE SPECIMENS IF ELECTRON MICROSCOPY EXAMINATION IS ANTICIPATED. The use of rectal swabs to detect viral causes of gastroenteritis is discouraged because the sensitivity of detection compared to bulk stool is suspected to be low.

<u>For parasites</u>
Mix fresh bulk stool specimens thoroughly with each of two preservatives, 10% formalin and polyvinyl alcohol fixative, at a ratio of one part of stool to 3 parts of preservative. If there is any delay in obtaining the preservatives, refrigerate untreated stool specimens at 4°C for up to 48 hours. For routine microscopy DO NOT FREEZE. Once preserved, the specimens can be stored and transported at room temperature or refrigerated. Note, it is now possible to do genotyping on many parasites, but this may require different preservatives. If parasites are considered a likely etiology, contact a lab that has the capacity to conduct genetic testing and ask for specific instructions.

Later that afternoon, preliminary culture results from 17 ill students became available. The specimens, collected primarily from the emergency room at Hospital A on March 10, did not identify *Salmonella*, *Shigella, Campylobacter*, *Vibrio*, *Listeria*, *Yersinia*, *Escherichia coli* O157:H7, *Bacillus cereus*, or *Staphylococcus aureus*. Some specimens were positive for fecal leukocytes and fecal occult blood.

<u>Question 9:</u> How might you interpret the bacterial culture results? What questions do these results raise?

Several explanations may exist for the negative cultures:

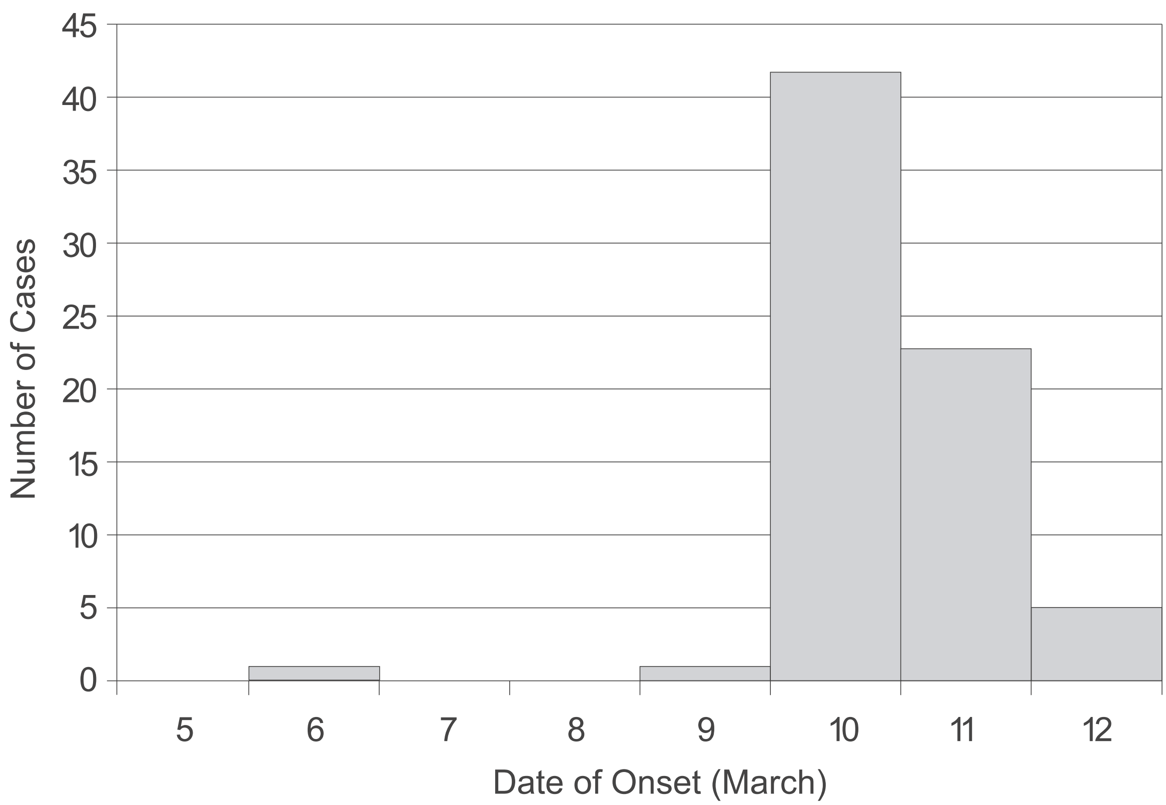
- *Specimens may have been mishandled during storage or transport leading to the death of any biological pathogen present.*
- *Specimens may have been mishandled during processing or culture leading to the death of any biological pathogen present.*
- *Specimens may have been collected too late in the course of the patients' illnesses (i.e., the patients were no longer excreting the pathogen in adequate numbers for detection).*
- *The illness may be due to some agent not tested for by the laboratory (e.g., virus or bacterial pathogen not routinely identified, parasite, preformed toxin, chemical agent).*

Since the cultures were performed in house at Hospital A, it would seem that transportation difficulties (and aging of specimens) would not be a large problem. Most of the specimens were collected on March 10, shortly after the students became symptomatic. For most infectious agents, patients would still be shedding microorganisms at that point in their illness. We do not know about the reputability of the Hospital A laboratory or whether there may have been some temporary problems with processing the specimens. The fact that all 17 specimens were negative suggests either the laboratory had a very big problem or, indeed, the cultures were negative for the pathogens examined. If we assume that laboratory procedures were acceptable, it seems likely that the agent causing the illness was not detected because it was not tested for.

PART III - DESCRIPTIVE EPIDEMIOLOGY AND HYPOTHESIS GENERATION

By March 12, seventy-five persons with vomiting or diarrhea had been reported to TDH. All were students who lived on the university campus. No cases were identified among university faculty or staff 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, University X, Texas, March 1998. (N=72) (Date of onset was not known for three ill students.)



TDH staff met with the Student Health Center physician and nurse, and several university administrators including the Provost. City health department staff participated in the meeting.

<u>Question 10:</u> What topics would you include in discussions with university officials?

In the meeting, investigators would want to: 1) negotiate cooperation with the university officials so that the investigation will go smoothly and 2) collect information that might provide insights into the source of the outbreak.

To negotiate cooperation from university officials, one should cover:
- *why it is important to investigate the outbreak (especially, to the university, itself) and to do so in a timely fashion*
- *what has already been done and found to date*
- *what is planned*
- *what the health department can provide to the university*
- *what kind of cooperation will be needed from the university (food samples, menus, time and place to interview foodhandlers and managers, etc.)*
- *how press inquiries will be handled*
- *how the university will be kept informed of progress in the investigation*

To collect information on possible sources of the outbreak, one might ask questions about:
- *the population at risk (e.g., the size and characteristics of the student body)*
- *possible sources for enteric diseases including water supplies and sewage systems (e.g., source of water, treatment of water and sewage if done locally, recent breaks in water and/or sewage lines), sources of food for students (e.g., number and distribution of dining establishments on campus, meal plans, sources of food for each of the establishments [central vs. site specific]), possible contact with animals (e.g., animal husbandry classes, special events [e.g., rodeos]), and living arrangements for students (e.g., number and distribution of residential halls).*

TDH and City Health Department staff gathered the following information:

> The university is located in a small Texas town with a population of 27,354. For the spring semester, the university had an enrollment of approximately 12,000 students; 2,386 students live on campus at one of the 36 residential halls scattered across the 200+ acres of the main campus. About 75% of the students are Texas residents.
>
> The university uses municipal water and sewage services. There have been no breaks or work on water or sewage lines in the past year. There has been no recent road work or digging around campus.

The campus dining service includes two cafeterias managed by the same company and about half a dozen fast food establishments; about 2,000 students belong to the university meal plan which is limited to persons living on campus. Most on-campus students dine at the main cafeteria which serves hot entrees, as well as items from the grill, deli bar, and a salad bar. A second smaller cafeteria on campus offers menu selections with a per item cost and is also accessible to meal plan members. In contrast to the main cafeteria, the smaller cafeteria tends to be used by students who live off campus and university staff. The smaller cafeteria also offers hot entrees, grilled foods, and a salad bar, but has no deli bar.

Spring break is to begin on March 13 at which time all dining services will cease until March 23. Although many students will leave town during the break, it is anticipated that about a quarter of those living on campus will remain.

Hypothesis generating interviews were undertaken with seven of the earliest cases reported by the emergency rooms and the Student Health Center; all of the cases had onset of illness on March 10. Four were male and three were female; 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 five different residential halls and all reported eating most of their meals at the university'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.

Except for the psychology majors, none of the other students shared any classes; only one student had a roommate with a similar illness. 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.

<u>Question 11:</u> Using information available to you at this point, state your leading hypothesis(es) on the pathogen, mode of transmission, source of the outbreak, and period of interest.

<u>Pathogen:</u> Signs and symptoms among students (i.e., vomiting, diarrhea, fever, bloody stools, fecal leucocytes, and fecal occult blood) are consistent with an acute gastrointestinal infection. The negative bacterial cultures (which covered the usual bacterial agents) suggest the pathogen

might be a virus or a parasite. Signs and symptoms among students (i.e., high prevalence of vomiting and diarrhea) are more common among viral infections than a parasitic infection, but could be seen in both. Although the incubation period is unknown, the quick upswing in the epicurve with a rapid decline in cases suggests a relatively short exposure and incubation period (i.e., a few days), again, more suggestive of a virus than a parasite. (NOTE: The duration of symptoms, which is not known at this point, would also be helpful in distinguishing between a viral infection [hours to days] and a parasitic infection [weeks].)

<u>Mode of transmission:</u> Illness is limited to students living on campus. The campus uses city water supplies. If city water supplies were contaminated, one would also expect to see cases in the community. It is possible that there are isolated problems with water and sewer lines on campus, but students from at least five residential halls were affected, so a break would have to affect water distribution over a wide area. (And if campus water was widely contaminated, one might expect to see illness in faculty, staff, and off-campus students who consumed water while on campus.)

Cases occurred in a number of different residential facilities and, among hypothesis generating interviews, did not cluster by dorm rooms (i.e., roommates were not affected), or classes. This pattern is not consistent with person-to-person spread.

A large proportion of students living on campus are part of the meal plan; most on-campus students eat at the main dining room. University staff and off-campus students rarely eat at the main cafeteria. All students in the hypothesis generating interviews ate at the main cafeteria and most also ate at the deli bar suggesting contaminated food or drink from this site might be the mode of transmission.

<u>Source:</u> No common food items were identified through hypothesis generating interviews. However, viral agents are commonly transmitted through raw or poorly cooked shellfish, sandwiches, and salads.

<u>Period of interest:</u> The incubation periods for viral gastroenteritities range from less than a day to about a week. The majority of cases had an onset of illness from March 10 - 12. Counting back the minimum incubation period (< 1 day) from the earliest cases and the maximum incubation period (7 days) from the latest cases suggests exposure between March 5 and 10.

LEADING HYPOTHESIS: a viral infection spread by a food or beverage served at the university main cafeteria between March 5 and 10

<u>Question 12:</u> What actions would you take?

At this point, findings are only <u>suggestive</u> that food from the main cafeteria is the source of the outbreak. Exposures common among cases may be common among all students living on campus; therefore, it would seem that insufficient information exists to undertake effective control measures at this time.

Next steps in this investigation include a controlled epidemiologic study, an environmental investigation of the main cafeteria and deli bar (e.g., inspection of operations and interviews with staff), viral testing of stool specimens from ill persons, and collection and testing of leftover food, water, and ice from the main cafeteria and deli bar.

PART IV - ENVIRONMENTAL INVESTIGATION

Based on clinical findings, the descriptive epidemiology of early cases, and hypothesis-generating interviews, investigators hypothesized that the source of the outbreak was a viral pathogen spread by a food or beverage served at the main cafeteria at the university between March 5 and 10. As a result, TDH environmental sanitarians inspected the main cafeteria and interviewed staff on March 12.

Thirty-one staff members were employed at the cafeteria of whom 24 (77%) were foodhandlers. Except for one employee who worked at the deli bar and declined to be interviewed, all dining service personnel were interviewed.

Question 13: What key areas should be explored during interviews with the cafeteria foodhandlers?

Items to cover with foodhandlers include: (in order of importance)

1) *Identify food items served at the main cafeteria (particularly the deli bar) during the implicated time period.*
2) *Determine whether any kitchen staff or their family members were ill at the time of the outbreak.*
3) *Describe handwashing facilities at the cafeteria and routine hygienic practices of foodhandlers.*
4) *Collect stool specimens from all foodhandlers.*
5) *Watch or reconstruct the procedures in the kitchen (in handling/preparing the food items) that happened the days it is believed the contaminated food was prepared. Try to identify any unusual occurrences or departures from routine during the implicated time period.*
6) *Outline work schedules for foodhandlers during the implicated period and identify who was responsible for what on which days.*
7) *Get recipes for food items served during the implicated time period and identify the ingredients and their sources.*

Cafeteria staff were questioned about their responsibilities in the cafeteria such as the foods they handled, which meals they served, and where they usually worked (e.g., deli bar, grill). They were also asked about use of gloves, handwashing practices, their work schedule during the week before the outbreak, and if they had been ill at that time.

In the cafeteria, the deli bar had its own preparation area and refrigerator. During mealtimes, sandwiches were made to order by a foodhandler. 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 was open for service, sandwich ingredients were not kept refrigerated or on ice. The deli bar containers were not routinely cleaned. Samples of leftover food, water, and ice were collected.

None of the foodhandlers interviewed reported being ill in the last two weeks. Stool cultures were requested from all cafeteria staff.

Before dinner on March 12, the City Health Department closed the deli bar.

Question 14: Do you agree with the decision to close the deli bar? What actions would you take now?

There is no solid evidence to implicate the deli bar as the source of the outbreak. The action is based on the most likely hypothesis and circumstantial evidence (i.e., other foodhandling problems identified in the deli bar). Because there were multiple serious problems identified at the deli bar, closing it down until safer practices can be assured would seem reasonable. Furthermore, closure will be a minimal burden to the university and its students and could prevent additional cases from occurring.

Although the suspected source of the outbreak has seemingly been addressed, it is important to undertake a more definitive epidemiologic study for the following reasons:

- *the source may not be the deli bar and cases may continue to occur*
- *more specific information is needed on the source to determine when it is safe to reopen the deli bar*
- *more specific information is needed on the source to prevent the problem from recurring in the future*

PART V - DESIGNING AN EPIDEMIOLOGIC STUDY TO TEST THE HYPOTHESIS (STUDY #1)

On the evening of March 12, about 36 hours after the initial call to the health department, TDH staff conducted a matched case-control study among students at the university. Ill students (reported from emergency rooms and the Student Health Center) who could be reached at their dormitory rooms were enrolled as cases. Dormitory roommates who had not become ill were asked to serve as matched control subjects. Investigators inquired about meals the students might have eaten during March 5-10 and where the foods were eaten. All information was collected over the telephone.

Question 15: What are the advantages and disadvantages of undertaking a case-control study instead of a cohort study at this point in the investigation?

At this point, the goal of the epidemiologic study is to find the source of the outbreak. The population at risk is well-defined and consists of students living on campus. The primary exposure of interest is eating at the main cafeteria. The outcome is relatively rare (i.e., only 75 cases or approximately 3% of the 2,400 students living on campus are known to be ill) and the suspected exposure (the main cafeteria) is common (i.e., about 2000 or 84% of the students living on campus have meal tickets). With unlimited resources, one could do either a cohort or a case-control study to investigate the source of this outbreak.

A retrospective cohort study would include all students living on campus, comparing those who ate at the main cafeteria during the period of interest with those who did not. A cohort study would allow one to calculate the risk of disease among students living on campus, an added bonus. With the large number of students in the cohort, however, a cohort study would be costly and take a lot of time, and response rates are likely to be poor. If a random sample of the cohort were selected (a more doable undertaking), the number of cases included in the study is likely to be small, decreasing the power of the study to find a source of the outbreak.

A case-control study would compare students with the illness (cases) with a sample of students without the illness (controls). It would allow one to limit the number of subjects involved in the study, include a sufficient number of cases to assure adequate study power, and focus one's efforts on the smaller number of subjects to get higher participation/response rates. Although a case-control study would not allow one to directly calculate attack rates, it would be much cheaper and quicker to undertake than a cohort study. As a result, it would seem that a case-control study would be the most cost-effective study type at this juncture.

Question 16: How would you define a case for this study?

A case definition is a standard set of criteria for deciding whether an individual should be classified as having the disease of interest. A case definition includes clinical criteria (e.g., signs, symptoms, and laboratory tests) and restrictions on time, place, and person. It is important not to include the hypothesis being tested (e.g., eating at the main cafeteria) in the case definition.

Because initial laboratory tests among ill persons in this outbreak were negative, the clinical component of the case definition will be based largely on signs and symptoms. Predominant symptoms among persons seen at the Hospital A emergency room included "vomiting" and/or "diarrhea". Because humans naturally experience changes in bowel patterns (e.g., consistency and number) on a day-to-day basis, "diarrhea" among cases needs to be defined in such a way as to exclude as many well persons with these natural variations as possible. For this study, a case was defined as vomiting or diarrhea (≥3 loose bowel movements during a 24-hour period) with onset on or after March 5, 1998, in a student from the university seen at an emergency room or the Student Health Center.

Twenty-nine cases and controls were interviewed over the telephone. Investigators tabulated the most notable results in Table 1.

Table 1. Risk factors for illness, matched case-control study, main cafeteria, University X, Texas, March 1998.

Exposure	Ill exposed/ Total ill* (%)	Well exposed/ Total well* (%)	Matched Odds Ratio**	95% Confidence Interval	p-value
Ate at deli bar - lunch on March 9	11/28 (39)	1/29 (3)	11.0	1.6-473	<0.01
Ate at deli bar - dinner on March 9	7/27 (26)	2/29 (7)	6.0	0.73-275	0.06
Ate at deli bar - lunch on March 10	8/29 (28)	1/28 (4)	8.0	1.1-354	0.02
Ate at deli bar - dinner on March 10	2/29 (7)	2/28 (7)	1.0	0.01-79	0.75
Ate at deli bar - lunch or dinner March 9 or lunch March 10	15/27 (56)	3/28 (11)	7.0	1.61-63.5	<0.01

*Denominator does not always total to 29 because several subjects could not remember where they ate the indicated meal.
**The data provided for cases and controls cannot be used to calculate the matched odds ratio which is based on an analysis of discordant pairs.

<u>Question 17A:</u> How do you interpret these data?

Cases were more likely than controls to have eaten at the deli bar for lunch or dinner on March 9 (11 and six times more likely, respectively) or lunch on March 10 (8 times more likely). Cases were not more likely than controls to have eaten at the deli bar for dinner on March 10. The differences were statistically significant for lunch on March 9 and lunch on March 10. Fifty-six percent of cases were exposed to the deli bar during at least one of the implicated meals.

NOTE: (OPTIONAL) More advanced students may be interested in the matched analyses. Matched odds ratios are based on the pairs for which cases and controls are discordant in their exposure status (i.e., where the case was exposed and the control was not or where the control was exposed and the case was not). The matched odds ratio cannot be calculated from the data given in Table 1. If instructors would like to pursue this with their students, they should use the data in Table 1a.

Table 1a. Risk factors for illness in 29 case-control pairs, main cafeteria, University X, Texas, March 1998

Factor	*Case exposed, control exposed*	*Case exposed, control unexposed*	*Case unexposed, control exposed*	*Case unexposed, control unexposed*	*Matched Odds Ratio (95% CI)*
Ate at deli bar - lunch on March 9	*0*	*11*	*1*	*16*	*11 (1.6-473)*
Ate at deli bar - dinner on March 9	*1*	*6*	*1*	*19*	*6.0 (0.73-275)*
Ate at deli bar - lunch on March 10	*0*	*8*	*1*	*19*	*8.0 (1.1-354)*
Ate at deli bar - dinner on March 10	*1*	*1*	*1*	*25*	*1.0 (0.01-79)*

.

Question 17B: What elements of this case-control study might affect the validity of the measured association?

- *selection bias - less than half of the cases reported at the time of the study (and less than a quarter of the 125 cases ultimately reported to TDH) were included in the study. We are not told how the 29 cases were selected, but since the study was limited to students who could be reached at their dormitory rooms on the night before spring break, it seems likely that the selection process may not have been random. Cases who were more severely affected or ill later in the course of the outbreak (and, therefore, not well enough to participate in the study) may also have been excluded from the study. These cases may have had different exposures compared to less severely affected cases or cases that were sick earlier in the outbreak. The impact of this potential selection bias on the resulting odds ratio cannot be determined.*

- *possible overmatching - university roommates often share exposures. Many eat meals together and attend special functions together. As a result, case-control roommates are more likely to be similar (i.e., concordant) with respect to exposures compared with other case-control pairs, and will ultimately not contribute to the analysis in a matched study design (i.e. a matched analysis focuses on discordant pairs). This will weaken the association between an exposure and illness (i.e., decrease the estimated odds ratio).*

- *matching on a possible risk factor - diarrheal diseases can be spread by person-to-person transmission. Although unlikely to be the predominant mode of transmission in this outbreak (based on earlier information), matching of well and ill roommates will inhibit examination of this risk factor.*

Eating at the main cafeteria, in general, was not associated with illness; however eating from the deli bar during lunch on March 9 or March 10 was significantly associated with illness. Because such a small number of controls ate at the deli bar, individual food items from the deli bar could not be examined.

PART VI - DESIGNING AN EPIDEMIOLOGIC STUDY TO REFINE THE HYPOTHESIS (STUDY #2)

By March 13, one hundred and twenty-five persons with vomiting or diarrhea had been reported to TDH. TDH invited staff from the Centers for Disease Control and Prevention (CDC) to participate in the ongoing investigation. CDC staff suggested submission of fresh stool specimens from ill students for viral studies including reverse transcriptase-polymerase chain reaction (RT-PCR). TDH and CDC staff decided to undertake an unmatched case-control study to further explore the source of the outbreak.

Question 18: Who should be enrolled as subjects for this study?

At this point, the study hypothesis shifts to the source of the outbreak being at the main cafeteria/deli bar. To zero in on risk factors in this setting, subjects should be persons who ate at these facilities during the implicated time period.

The case-control study was undertaken among students who ate at the main cafeteria. A case was defined as vomiting or diarrhea ($\geq$3 loose bowel movements during a 24-hour period) with onset on or after March 5, 1998, in a student who was a member of the university meal plan. Cases were selected from those reported to TDH by one of the local emergency rooms or the Student Health Center. Controls were students enrolled in the university meal plan 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 the university meal plan database.

Question 19: Investigators considered collecting information for the case-control study through face-to-face interviews, telephone interviews, or self-administered questionnaires. What are the advantages and disadvantages of each method of data collection? Which method would you recommend given the circumstances around the outbreak?

FACE-TO-FACE
advantages: results in higher response rates than telephone or self-administered questionnaires; can use more complex questionnaire designs (with skip patterns); usually results in more accurate recording of responses

disadvantages: requires tracking down subjects and arranging meetings; seems less anonymous to subjects than self-administered questionnaires; subjects may be less honest in their responses and try to give answers they think the interviewer wishes to hear; has potential for interviewer bias; is most costly of three (particularly if subjects are geographically dispersed)

TELEPHONE INTERVIEW
advantages: *can track down subjects more quickly than face-to-face or self-administered questionnaires; usually results in higher response rates than self-administered questionnaires; can use more complex questionnaire designs (with skip patterns); results in more accurate recording of responses; is less costly than face-to-face interviews*

disadvantages: *seems less anonymous to subjects than self-administered questionnaires; subjects may be less honest in their responses and try to give answers they think the interviewer wishes to hear; has potential for interviewer bias; is more costly than self-administered questionnaires*

SELF-ADMINISTERED QUESTIONNAIRE
advantages: *seems more anonymous to subjects; subjects may be more honest in their responses; takes less investigator time once questionnaires are received by subjects; is less expensive than face-to-face or telephone interviews*

disadvantages: *greater care needs to be taken in developing questionnaire so that it is self-explanatory and easily completed by subject; additional time is necessary to send questionnaires to students and wait for return of responses; usually results in more errors in recording of responses; results in lower response rates*

Due to spring break, a telephone interview seems to be the best method for tracking down subjects and administering the questionnaire.

The investigators administered the study questionnaire by telephone from March 15-23. Students selected for participation were called at their dormitory room or their home telephone number as recorded in university records. If the student was not present at either location but information on his/her whereabouts was available, additional phone calls were made to contact the student. Students not reached during spring break were interviewed on their return to the university.

Thirty-six cases and 144 controls were contacted. Cases included in the study were similar to all cases with respect to gender, age, and year in college. Their dates of onset of illness had a distribution similar to that seen in Figure 1.

Results from the unmatched case-control study were tabulated by TDH and CDC epidemiologists. Only persons who ate at the main cafeteria for the specified period were included in the meal-specific analyses. (Table 2)

Table 2. Risk factors for illness among persons eating at the main cafeteria, unmatched case-control study, University X, Texas, March 9-10, 1998.

Exposure	Ill exposed/ Total ill	Well exposed/ Total well	Measure of association	p-value
Ate at salad bar - lunch March 9	9/30	36/100		
Ate at salad bar - dinner March 9	5/18	15/59		
Ate at salad bar - lunch March 10	6/28	23/96		
Ate at salad bar - dinner March 10	6/15	12/44		
Ate at salad bar*	13/19	49/69		
Ate at deli bar - lunch March 9	18/30	12/101		
Ate at deli bar - dinner March 9	7/18	5/61		
Ate at deli bar - lunch March 10	13/29	12/96		
Ate at deli bar - dinner March 10	4/16	4/44		
Ate at deli bar*	28/36	20/116		

*for lunch or dinner March 9 or lunch March 10

<u>Question 20:</u> Calculate the appropriate measure of association for these exposures. Interpret the results.

For a case-control study, the odds ratio is the appropriate measure of association. The odds ratio compares the odds of exposure among cases to the odds of exposure among controls.

	Case	*Control*	*TOTAL*
Exposed	*a*	*b*	*(a+b)*
Unexposed	*c*	*d*	*(c+d)*
TOTAL	*(a+c)*	*(b+d)*	*t*

$$\text{odds of exposure (cases)} = \frac{\text{number of cases with the exposure}}{\text{number of cases without the exposure}} = a/c$$

$$\text{odds of exposure (controls)} = \frac{\text{number of controls with the exposure}}{\text{number of controls without the exposure}} = b/d$$

$$\text{odds ratio} = \frac{\text{odds of exposure (cases)}}{\text{odds of exposure (controls)}}$$

$$= \frac{a/c}{b/d}$$

$$= ad/bc \quad \text{(known as the cross-product)}$$

NOTE:
An odds ratio of 1.0 means that the odds of exposure among cases is the same as the odds of exposure among controls (i.e., the exposure is not associated with the disease).

An odds ratio of greater than 1.0 means that the odds of exposure among cases is greater than the odds of exposure among controls; the exposure may be associated with the disease if the odds ratio is statistically significantly greater than 1.0. A p-value of less than 0.05 or a 95% confidence interval for the odds ratio that does not include 1.0 suggest that the odds ratio is significantly greater than 1.0.

An odds ratio of less than 1.0 means that the odds of exposure among cases is lower than the odds of exposure among controls; the exposure may be protective if the odds ratio is statistically significantly less than 1.0. A p-value of less than 0.05 or a 95% confidence interval for the odds ratio that does not include 1.0 suggest that the odds ratio is significantly less than 1.0.

To save time, the instructor may wish to divide up the calculations among different students or groups. For example, the instructor could ask half of the class to do the calculations for *exposure to the salad bar and the other half, the calculations for exposure to the deli bar. The odds ratios for the exposures at the main cafeteria were:*

Table 2. Risk factors for illness among persons eating at the main cafeteria, unmatched case-control study, University X, Texas, March 9-10, 1998.

Exposure	Ill exposed/ Total ill (%)	Well exposed/ Total well (%)	Odds ratio	p-value**
Ate at salad bar - lunch March 9	9/30 (30)	36/100 (36)	0.8	0.7
Ate at salad bar - dinner March 9	5/18 (28)	15/59 (25)	1.1	1.0
Ate at salad bar - lunch March 10	6/28 (21)	23/96 (24)	0.9	1.0
Ate at salad bar - dinner March 10	6/15 (40)	12/44 (27)	1.8	0.5
Ate at the salad bar*	13/19 (68)	49/69 (71)	0.9	0.9
Ate at deli bar - lunch March 9	18/30 (60)	12/101 (12)	11.1	<0.00001
Ate at deli bar - dinner March 9	7/18 (39)	5/61 (8)	7.1	0.004
Ate at deli bar - lunch March 10	13/29 (45)	12/96 (13)	5.7	0.004
Ate at deli bar - dinner March 10	4/16 (25)	4/44 (9)	3.3	0.2
Ate at deli bar*	28/36 (78)	20/116 (17)	16.8	<0.00001

*for lunch or dinner March 9 or lunch March 10
** p-value for 2-tailed Fisher exact test or Yates-corrected chi-square

Similar to the matched case-control study, an association was seen between illness and eating at the main cafeteria deli bar for lunch or dinner on March 9 or lunch on March 10. Illness was not associated with eating at the salad bar. Twenty-eight (78%) of the 36 cases reported eating at the deli bar during at least one of the implicated meals.

To identify the specific item(s) at the deli bar causing the outbreak, investigators reanalyzed study data from only cases and controls who ate at the deli bar during March 9-10. (Table 3)

Table 3. Food items eaten by students who ate at deli bar during implicated meals, unmatched case-control study, University X, Texas, March 9-10, 1998.*

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 21: Interpret the results in Table 3.

Among persons who ate at the deli bar during the implicated meals, cases were three times more likely than controls to eat American cheese and mayonnaise. They were also 1.5 times more likely to have eaten ham. These differences, however, could be due to chance (p-values: 0.06 for cheese and mayonnaise and 0.33 for ham).

The inability to epidemiologically implicate a specific food item could reflect the relatively small number of cases included in the study or inaccurate recall of foods consumed by both cases and controls. (Remember, some cases and controls were not questioned until their return to campus after spring break.) These findings could also result if multiple foods were contaminated or if illness was caused by some factor at the deli bar that was not explored.

PART VII - ADDITIONAL INVESTIGATIONS

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

The staff member who initially refused to be interviewed worked primarily at the deli bar. When she finally agreed to be interviewed on March 23, 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. She 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. Because the foodhandler wore gloves during food preparation and serving, she did not feel that handwashing was an important activity.

Of the 18 fresh stool specimens sent on ill students to CDC, 9 (50%) had evidence of Norwalk-like virus (NLV) by RT-PCR. Of the four deli foods available from the implicated meals, only the ham sample, from March 9, was positive by RT-PCR for the presence of NLV RNA. NLV was also detected by RT-PCR in a stool sample from the ill infant of the foodhandler who prepared the deli sandwiches on March 9. The sequence of the amplified product was identical to those products from the ill students and the deli ham.

<u>Question 22:</u> Do you think the evidence implicates the foodhandler as the source of the outbreak? Explain.

Yes. Although foodhandlers are often victims of foodborne disease outbreaks because they consume the contaminated food themselves, the facts in this outbreak suggest this foodhandler might have been the source of infection for the students:

- *The diarrheal illness in her child preceded the outbreak and occurred at the probable time the students were exposed (i.e., began three days before the outbreak and continued through March 23).*
- *The foodhandler prepared ingredients and sandwiches served at the deli bar during the time that her child was ill.*
- *Finally, NLV was isolated from the child's stool and was identical to that obtained from ill students and the deli ham.*

However, the facts do not necessarily imply that the foodhandler was either ill or infected; she may have transferred contamination from her ill infant indirectly.

PART VIII - CONTROL

Spring break at the university ended on March 23. The chief of the campus food service called TDH to find out what must be done to reopen the deli bar.

Question 23: Which of the following actions would you recommend? What are the pros and cons of each?

A) throw away all leftover deli bar foods and ingredients
B) clean and disinfect all equipment and surfaces in the deli bar
C) require all foodhandlers to submit a stool specimen before allowing them to return to work
D) educate foodhandlers on proper foodhandling procedures including handwashing and appropriate hot-holding and cold-holding temperatures
E) develop a sick foodhandlers policy

At this point, one must consider short-term interventions for the control of the current outbreak and longer-term interventions which might prevent the spread of foodborne diseases at the cafeteria in the future. The first two items on the above list will prevent further spread of disease from this particular outbreak. The last two are more focused on prevention of future outbreaks, although they may be effective in controlling the current outbreak if any foodhandlers are infected and still shedding virus. It is likely that a combination of these actions will be most appropriate to improve food safety at the university cafeteria. Examination of stool specimens from foodhandlers (to look for viral pathogens) will be expensive and has little benefit for the current outbreak or in preventing future problems.

NOTE: A fundamental problem in this outbreak appeared to be the management of the deli bar and assurance that food is safely handled on a routine basis. Although one might initially evaluate the adequacy of specific foodhandling policies and behaviors, one must also consider the institution's responsibility to assure that recommended policies and practices are followed. Because foodworker turnover in this setting is likely to be high, the institution needs to take a major role in assuring:

- *a safe, clean environment with adequately functioning equipment*
- *facilities which promote good foodhandling practices (e.g., conveniently placed sinks with adequate soap and clean towels)*
- *safe sources for foods and ingredients*
- *training of employees in proper foodhandling procedures*
- *monitoring (and correction) of employee practices and behaviors*

If this assurance function seems inadequate, the university should be asked to develop a plan to address and exercise this function.

The health department should monitor the situation until satisfied that a safe foodhandling system has been established. A food safety specialist and/or sanitarian should return to the university cafeteria in one month and on a quarterly basis for at least the first year to make sure no further disease is occurring and assess the development and implementation of appropriate policies, the practice of good foodhandling procedures by employees, and ongoing oversight by the institution, itself.

Question 24: Who might you consult in developing actions/policies for the campus food service to prevent a recurrence of this problem in the future? Why?

- *university administrators or their representatives - they will be legally responsible for the policy and dealing with union or employee grievances; they must serve the assurance function*
- *supervisors in the cafeteria - they will have to implement the policy and answer employee questions*
- *foodhandlers - they can provide their perspectives and insights (including hardships resulting from the policy); they can also help review the policy and provide feedback on ability to be understood by other employees*
- *union representatives (if applicable) - they can provide information on legal implications*
- *staff from the local health department - they can provide expertise on foodborne diseases and control measures; they may be able to provide an objective viewpoint and moderate discussions*

APPENDIX 1

Foodborne Illness Complaint Worksheet
STATE DEPARTMENT OF HEALTH

Date: 03/11/97
#: 97-076

PERSON COMPLETING INFORMATION
Name: Xavier Onassis ☎ : (512) 555 - 1234
Affiliation: ☐ Local BOH *(town)*: ______________ ☒ State DPH *(division)*: Epi ☐
Other:_____________

REPORTER / COMPLAINANT
Name: Refused to provide ☎ : ( ) _______ - ___________

Affiliation: ☒ Consumer ☐ Laboratory ☐ Local BOH ☐ Medical Provider ☐ State DPH ☐ Other

specify: division, *facility,* address, *town, etc.* ______________________________

ILLNESS INFORMATION
 # Persons ill: 2
Symptoms: (% reporting)

☒ Diarrhea (both) ☒ Vomiting (both) ☒ Nausea (both) ☐ Abdominal cramps
☒ Fever (only one) ☐ Bloody stool ☒ Headache (only one) ☐ Muscle aches
☐ Chills ☐ Loss of appetite ☒ Fatigue (both) ☐ Dizziness
☐ Burning in mouth ☐ Other symptoms: None

Onset: Earliest Date: 03/10/97 Time: 11:30 ☐ AM ☒ PM
Latest **(if ≥ 2 ill)** Date: 03/11/97 Time: 2:30 ☒ AM ☐ PM

Duration: ☐ Less than 24 Hours ☐ 24-48 Hours ☐ More than 48 Hours ☒ Ongoing ☐ Unknown

Ill Persons:

	Name	Address/Town	☎	**Age (yrs)**	**Occupation**	**Med. Provider/ ☎**
1	☒ same as reporter	University X	refused	18	student	none
2	refused	University X	refused	19	student	none
3						
4						

Medical attention received ***(by anyone)***? ☐ Yes ☒ No ☐ Unknown ⇒ ***If Yes, specify above:***
Stool specimens submitted ***(by anyone)***? ☐ Yes ☒ No ☐ Unknown ⇒ **To SLI** [1]**?** ☐ Yes ☐ No ☐ Unknown
Medical diagnosis reported?

FOOD HISTORY

⇒ Obtain history **back 72 hours** prior to symptoms, or, if organism identified, **use min and max incubation** periods (see p.3)

⇒ If ≥2 ill, follow above time frame for common meals (foods) only

Date & Time[2]	# Exp[3]	Food(s) consumed	Restaurant / store where purchased (name, town)	Place consumed
March 8 ☐ B ☐ L ☐ D		University cafeteria		☐ Same *(as left)* ☐ Home ☐ Other *(specify)*:
March 9 ☐ B ☐ L ☐		University cafeteria		☐ Same *(as left)* ☐ Home ☐ Other *(specify)*:
March 10 ☐ B ☐ L ☒		Anchovy pizza and beer	Local pizzeria	☐ Same *(as left)* ☐ Home ☒ Other *(specify)*:
☐ B ☐ L ☐				☐ Same *(as left)* ☐ Home ☐ Other *(specify)*:
☐ B ☐ L ☐ D				☐ Same *(as left)* ☐ Home ☐ Other *(specify)*:
☐ B ☐ L ☐ D				☐ Same *(as left)* ☐ Home ☐ Other *(specify)*:

NOTES

Student refused to provide food history beyond foods eaten at local pizzeria. He reported that he and his roommate shared no other meals in the last 72 hours; they ate separately at the University cafeteria.

FOOD TESTING

Food(s) available for testing? ☐ Yes ☐ No ☒ Unknown **Sent to SLI [1]?** ☐ Yes ☐ No ☐ Unknown
If Yes, specify *food(s) & sources*:

Product and Manufacturer Information for Commercially-Processed Food(s)

Product name: ____ **Code/lot** #______________________
Expiration date: _____ /_____ /_____ **Package size/type**: ____
Manufacturer: ____ ☎: ( ) ______ - __________
Address:

Incubation Periods for Selected Organisms

	Min	*Max*		*Min*	*Max*		*Min*	*Max*
B. cereus (short)	1 hr	6 hrs	E. coli O157:H7	3 days	8	Staph. aureus	30 min	8 hrs
B. cereus (long)	6 hrs	24 hrs	Hepatitis A	15 days	50 days	Shigella	12 hrs	96 hrs
Campylobacter	1 day	10 days	Salmonella (non-typhi)	6 hrs	5 days	Vibrio cholerae	few hrs	5 days
Cyclospora	1 day	14 days	Salmonella typhi	1 wk	3 wks	Viral GI	12 hrs	48 hrs
C. perfringens	6 hrs	24 hrs	Shellfish poisoning	min	few hrs	Yersinia	3 days	7 days

1 State Laboratory Institute
2 Always record **Time** if possible; otherwise, choose **B**=breakfast, **L**=lunch, **D**=dinner
3 Total # persons (both ill and well) who consumed indicated food(s)

APPENDIX 2. Causative agents for acute enteric illness

INFECTIOUS

<u>Bacteria</u>

Aeromonas (not proven)
Bacillus cereus
Campylobacter
Clostridium perfringens
Escherichia coli
- Shiga Toxin producing *E. coli* (STEC)
- Enterotoxin producing *E. coli* (ETEC)
- Enteroinvasive *E. coli* (EIEC)
- Enteropathogenic *E. coli* (EPEC)

Plesiomonas (not proven)
Salmonella, non-typhoid
Salmonella Typhi
Shigella
Vibrio
Yersinia enterocolitica

<u>Viruses</u>

Norwalk and Norwalk-like agents (caliciviruses)
Rotavirus
Hepatitis A

<u>Parasites</u>

Cryptosporidium parvum
Cyclospora
Entamoeba histolytica
Giardia lamblia

TOXINS

Bacillus cereus
Staphylococcus aureus
Clostridium perfringens
Clostridium botulinum
heavy metals (cadmium, copper, zinc, tin)
mushroom toxins
fish and shellfish toxins (scombroid, ciguatera)
insecticides
drugs
boric acid

OTHER

psychogenic
radiation

APPENDIX 3. Recommendations for Collection of Stool Specimens for Laboratory Examination *(from the Morbidity and Mortality Weekly Report: Recommendations and Reports 1990;30 [No. RR-14])*

Specimen collection is critical in identifying the causative agent in an outbreak of gastroenteritis. Bacteria, viruses, and parasites each require different specimens and methods of storage and transport for optimal diagnosis. When the causative agent is unknown, one should consider plausible pathogens based on predominant signs and symptoms and other outbreak information.

For bacterial pathogens

Rectal swabs or swabs of fresh stools should be placed in refrigerated Cary-Blair transport medium. If the specimens are likely to be examined within 48 hours after collection, they can be refrigerated at 4°C until shipping. Specimens should be enclosed in a secure container and placed in a waterproof bag. Specimens should be packed with ice or frozen refrigerant packs in an insulated box.

If specimens must be held longer than 48 hours, they should be frozen as soon as possible after collection. Although storage in an ultra-low freezer (-70°C) is preferable, storage in a home-type freezer (if it is properly set at -20°C) is acceptable for short periods. So that the specimens remain frozen, they should be shipped on dry ice. Sufficient dry ice should be used to keep specimens frozen until the laboratory processes them (i.e., enough dry ice to fill one-third to one-half of the shipping container). Glass tubes should not be in direct contact with the dry ice; a layer of paper or other material should be placed between the tubes and the dry ice. To prevent excess exposure to carbon dioxide (from the dry ice), screw caps should be tightened and sealed with electrical tape or specimens should be sealed in a plastic bag within the container of dry ice.

For viral pathogens

Collect as large a quantity of diarrheal stool as can be obtained (at least 10 cc). Place in a leak-proof, clean, dry container, and refrigerate immediately at 4°C. DO NOT FREEZE SPECIMENS IF ELECTRON MICROSCOPY EXAMINATION IS ANTICIPATED. The use of rectal swabs to detect viral causes of gastroenteritis is discouraged because the sensitivity of detection compared to bulk stool is suspected to be low.

For parasites

Mix fresh bulk stool specimens thoroughly with each of two preservatives, 10% formalin and polyvinyl alcohol fixative, at a ratio of one part of stool to 3 parts of preservative. If there is any delay in obtaining the preservatives, refrigerate untreated stool specimens at 4°C for up to 48 hours. For routine microscopy, DO NOT FREEZE. Once preserved, the specimens can be stored and transported at room temperature or refrigerated. Note, it is now possible to do genotyping on many parasites, but this may require different preservatives. If parasites are considered a likely etiology, contact a lab that has the capacity to conduct genetic testing and ask for specific instructions. Currently recommended preservatives for genetic analysis include freezing the specimen or preserving it in ethanol or potassium dichromate.