**PHR 250, 2007**
**6/6/07, 6p**

# SEVENTH EPIDEMIOLOGICAL PROBLEM SET

# NEUROLOGIC DISEASE FROM EATING SHELLFISH — MASSACHUSETTS AND ALASKA, 1990

## Massachusetts

On June 6, 1990, the Massachusetts Department of Public Health (MDPH) was notified that, on June 5, foodborne illness had occurred in six fishermen aboard a fishing boat in the Georges Bank area off the Nantucket coast. Onset of illness occurred after the men had eaten blue mussels (*Mytilus edulis*) harvested in deep water about 115 miles from the island of Nantucket.

The six men (age range: 24–47 years) developed symptoms 1–2 hours after consuming the shellfish (Table 1). Symptoms included numbness of mouth (five men), vomiting (four), paresthesia of extremities (four), numbness and tingling of tongue (two), numbness of face (two), numbness of throat (one), and periorbital edema (one). In all six men, lower back pain occurred approximately 24 hours after onset. The median duration of neurologic symptoms was 14 hours, and for lower back pain, 3.3 days. Approximately 10 hours after onset, when the fishermen presented to a local hospital emergency room, four were recovering; however, two, including one who had recovered from loss of consciousness, required hospitalization for 2–3 days.

The six fishermen had boiled the mussels for approximately 90 minutes before consuming them with baked fish, boiled rice, boiled potatoes, green salad, and other food items. They did not consume alcoholic beverages with the implicated meal.

Laboratory examination of the uneaten mussels detected toxin concentrations of 24,400 µg/100 g in the raw mussels and 4280 µg/100 g in the cooked mussels (maximum safe level: 80 µg/100 mg).

1. What was the toxin?

2. Why was there less in the cooked mussels?

**Alaska**

On June 26, 1990, a physician reported to the Alaska Department of Health and Social Services (ADHSS) that a Native Alaskan man had died after consuming shellfish collected from a beach on the Alaska Peninsula. On the evening of June 25, while aboard a fishing boat, the decedent had consumed 25–30 steamed butter clams and 2 teaspoons of butter clam broth. Within an hour, he complained of numbness and tingling around his mouth, face, and fingers. Two hours later, he suffered a cardiopulmonary arrest; despite cardiopulmonary resuscitation efforts by emergency personnel, the patient died. The patient's gastric contents contained 370 µg/100 g of toxin, and a sample of the butter clam broth from the meal contained 2650 µg/100 g.

Two other crewmembers had also consumed butter clams. One developed numbness and tingling of the face and hands and dizziness approximately 1 hours later and recovered uneventfully; the other had no symptoms. Four crewmembers from two other fishing boats also had shared the butter clams presumed to be the vehicle for illness; all four had similar symptoms. As a consequence of this episode, ADHSS identified three additional episodes in the region of the Alaska Peninsula and Kodiak Island during June 1990. Each episode involved consumption of shellfish collected from a different area. When aggregated, the four episodes constituted an outbreak with 13 cases among 21 persons (attack rate: 62%) who had consumed the implicated shellfish.

The four episodes occurred during June 17–25. Onset of symptoms ranged from 0 to 2 hours (median: 1 hour) after consumption of shellfish. Duration of illness ranged from 1 to 24 hours (median: 7.5 hours). Seven (54%) persons sought medical care. Only the index patient died
(case-fatality rate: 8%); the others recovered uneventfully.

Seven (54%) cases resulted from consumption of butter clams, and six (46%), from mussels. Shellfish were consumed raw, boiled, or steamed. Affected persons consumed three to 30 shellfish each (median: four shellfish).

Because shellfish from the four episodes were not available for testing for toxin, samples were collected from the four sites where the shellfish had been harvested. Butter clam samples from Volcano Bay and King Cove contained 7750 µg/100 g of toxin, and mussel samples from Sand Point and Kodiak contained 1925–12,960 µg/100 g.

3. What was the most likely source of the toxin?

4. Assuming that the source was “withdrawn” and shellfish sampled again after 4 weeks, what would you expect to find in the butter clams and in the mussels?

# FOODBORNE HEPATITIS A — MISSOURI, WISCONSIN, AND ALASKA, 1990-1992

Person-to-person spread is the predominant mode of transmission of hepatitis A virus (HAV) infection. However, based on findings for national surveillance for viral hepatitis, since 1983, 3%–8% of reported hepatitis A cases have been associated with suspected or confirmed foodborne or waterborne outbreaks (1). This report summarizes three recent foodborne outbreaks of hepatitis A and addresses the prevention of this problem.

## Missouri

On November 26, 1990, hepatitis A was diagnosed in an employee of a restaurant in Cass County, Missouri. The employee's duties involved washing pots and pans in the restaurant. From December 7, 1990, through January 9, 1991, hepatitis A was diagnosed in 110 persons, including four waitresses, who had eaten at the restaurant; two persons died as a result of fulminant hepatitis.

To identify risk factors for hepatitis A in restaurant patrons, CDC, in collaboration with the Missouri Department of Health (MDH), conducted a case-control study. A case was defined as an anti-HAV immunoglobulin M (IgM)-positive diagnosis in a person who had eaten at the restaurant three or more times during the 6-week period before onset of illness. Eating companions of case-patients were selected as controls. Twenty-three case-patients and 31 controls were included. Case-patients were asked about risk factors for hepatitis A (including contact [i.e., sexual, household, or other] with a person with hepatitis A, employment as a food handler, injecting-drug use, recent international travel, association with child care centers, consumption of raw shellfish, and eating at other restaurants in town) during the 2–6 weeks before onset of illness. Foods at the restaurant that were either uncooked or were handled after cooking were included in a food-history questionnaire.

Case-patients were more likely than controls to have consumed a salad (odds ratio [OR] = 8.6; 95% confidence interval [CI] = 2.0- 40.6). In addition, case-patients (100%) were more likely than controls (48%) to have eaten lettuce, either in a salad or as a garnish for a sandwich (OR = undefined; lower 95% confidence limit = 6.2). On follow-up interview, the index case-patient reported that he occasionally helped unpack fresh produce and prepare lettuce for salads. From December 1990 through January 1991, immune globulin (IG) was administered to 22 restaurant employees and approximately 3000 potentially exposed restaurant patrons. No cases of hepatitis A were reported among restaurant patrons after January 9, 1991.

**Wisconsin**

On April 10, 1991, a food handler employed at sandwich shops in downtown Milwaukee and at a university campus sought medical attention following onset of fatigue, loss of appetite, diarrhea, and fever. He was jaundiced and excluded from work. Acute hepatitis A was diagnosed serologically, and the case was reported to the Milwaukee Health Department (MHD).

Inspection by the MHD of the downtown shop found no health-code violations, and medical histories and serologies obtained from other employees were negative for evidence of hepatitis A. The case-patient reported his hygiene to be good, although this report could not be confirmed by his supervisor. His co-workers received prophylaxis with IG. Because of the report of good hygiene and a good report following inspection of the facility, the risk to patrons was considered minimal. Because 2 weeks had elapsed since the employee had last worked in the campus sandwich shop, this shop was not inspected, and IG was not administered to other employees. The sandwiches were predominantly “submarines,” and were prepared during peak periods in assembly-line fashion, whereby each worker in the line touched ingredients of every sandwich.

On April 27, eight students presented to the student health service of a university in Milwaukee with symptoms of hepatitis. On April 28, 60 additional persons with hepatitis A were reported to local public health agencies. Review of food histories from these patients suggested both the downtown and university sandwich shops as probable sources. Because no new cases were identified among food handlers, and because a 2-week period had passed between the food handler's last working at the campus sandwich shop and recognition of the outbreak, IG was not offered to restaurant patrons.

The two sandwich shops were owned by the same person and received some produce from the same commercial suppliers; no other common links were identified. Although the infected food handler reported his personal hygiene to be good, one co-worker and several customers reported his hygiene was poor. To prevent secondary transmission of hepatitis from shop customers who might be food handlers, more than 350 centrally located restaurants were visited by MHD inspectors and advised on proper precautions.

Overall, outbreak-related hepatitis A was diagnosed in 230 persons: 50 reported eating at the university sandwich shop and 180 reported eating at the downtown sandwich shop during April 17-May 29, 1992. The 2-week peak period for onset of jaundice (in 85% of cases) occurred approximately 1 month after the 2-week period in which the infected food handler staffed both shops. Because 228 of the 230 case-patients ate exclusively at one of the two shops and because no prepared food was shared between them, food was considered to have been contaminated independently at each site. Through July 15, one second generation case (in a household contact of a sandwich shop patron) was documented.

**Alaska**

On May 4, 1992, a food handler who routinely prepared uncooked sandwiches at a fast-food restaurant in Juneau, Alaska, had onset of nausea, vomiting, and diarrhea. Although his employer instructed him not to handle food, he was allowed to continue work. On May 8, he sought medical attention and was jaundiced; IgM anti-HAV was negative. On May 18, repeat testing was positive for IgM anti-HAV. The case-patient reported his hygiene to be good, and this was confirmed by his supervisor and co-workers.

From June 1 through June 11, 11 cases of acute hepatitis A were diagnosed in residents of or visitors to Juneau. To identify risk factors for infection, the Alaska Department of Health and Social Services conducted a case-control study. A case was defined as an anti-HAV IgM-positive diagnosis in a Juneau resident or visitor with onset of illness during June 1-11. Twenty-four controls were selected from among co-workers of case-patients. Case-patients were asked about risk factors for hepatitis A, including contact (i.e., sexual, household, or other) with a person with hepatitis A, employment as a food handler, injecting-drug use, recent international travel, association with child care centers, consumption of raw shellfish, and eating at restaurants in town. All case-patients, compared with six (25%) controls, ate at least once during May 4-8 at the fast-food restaurant where the index case-patient worked (OR = undefined; lower 95% confidence limit = 5.1). Because 2 weeks had elapsed between the index case-patient's onset of illness and serologic confirmation of HAV infection, IG was not administered to coworkers or restaurant patrons.

1. Why are salads and sandwiches so much at risk in these situations?

2. If you were manager of one of these restaurants, would you accept the worker’s word about hand-washing habits?

3. What might you do instead?

4. Was the supervisor’s action appropriate in the case of the worker in Alaska? Why or why not?

## OUTBREAK LINKED TO COMMERCIALLY DISTRIBUTED DRY-CURED SALAMI — WASHINGTON AND CALIFORNIA, 1994

From November 16 through December 21, 1994, a total of 20 laboratory-confirmed cases of diarrhea caused by “Agent S” were reported to the Seattle-King County Department of Public Health (SKCDPH). In comparison, three cases were reported during October 1994. Epidemiologic investigation linked “Agent S” infection with consumption of a commercial dry-cured salami product distributed in several western states. Three additional cases subsequently were identified in northern California. This report summarizes preliminary findings from the outbreak investigation.

### Washington

Infection with Agent S has been a reportable disease in Washington since 1987; cases are identified through routine follow-up of infections reported from local laboratories to the SKCDPH. Among the 20 case-patients, the median age was 6 years (range: 23 months to 77 years), 11 (55%) were male, and all resided in King County. Three patients required hospitalization, including a 2-year-old who developed hemolytic uremic syndrome (HUS).

Interviews with initial patients suggested that brand A dry-cured salami purchased at a local grocery chain was associated with illness. Based on these preliminary findings, during November 23–25, the grocery chain voluntarily withdrew brand A salami from its King County stores. To assess potential risk factors for infection, the SKCDPH conducted a case-control study of 16 cases and age-matched controls. A case was defined as culture-confirmed Agent S in a King County resident with onset of illness during November 15–29. Eleven (68%) case-patients and one (6%) control reported eating brand A dry-cured salami within 7 days before onset of illness (Mantel-Haenszel matched odds ratio = undefined; p less than 0.01). No other food item was significantly associated with infection.

All salami was purchased from the delicatessen counters of the local grocery chain. On November 28 and 29, environmental investigations were conducted at three of these delicatessens, and food samples were collected. No errors in food-handling practices were identified. Agent S was isolated from samples of brand A presliced dry-cured salami from two of the delicatessens on December 2 and subsequently from a sample from a third delicatessen in the grocery chain. On December 2, the SKCDPH issued a press release informing the public of this problem and notified the U.S. Department of Agriculture (USDA). On December 6, the manufacturing company voluntarily recalled 10,000 pounds of implicated product labeled "Sell by May 7, 1995," which had been distributed in California, Oregon, and Washington. In addition, the company requested that their distributors suspend the sale of all of its products until the source of contamination was determined. The last case-patient had onset of illness December 6.

Restriction fragment length polymorphism (Shiga-like toxin RFLP and lambda-RFLP) analysis by the University of Washington School of Public Health and Community Medicine determined that patterns were identical in 15 of 19 clinical isolates and in the three salami isolates. Sources for the matching isolates included 12 patients who ate salami, two secondary cases, and one person who ate sliced turkey purchased from a delicatessen where brand A dry-cured salami was sold, suggesting possible cross-contamination. The four non-matching isolates were from specimens from patients who did not eat salami. These findings were confirmed at CDC by pulsed-field gel electrophoresis on a sample of outbreak-related isolates.

**California**

Three patients with laboratory-confirmed Agent S infection who reported consumption of brand A salami during the week before illness onset were hospitalized in northern California during November. Two patients resided in Sonoma County and one in Sacramento County. Patients were aged 4, 25, and 71 years; the 4-year-old developed HUS. Dates of onset ranged from November 17 through November 27. In addition, a 20-month-old resident of Sacramento who had consumed brand A dry-cured salami before onset of illness was hospitalized with postdiarrheal HUS on November 24. Although cultures of stool from this patient were negative for routine bacterial pathogens, screening for Agent S had not been performed before institution of antibiotic therapy. However, serum antibody to Agent S antigen subsequently was detected at the Microbial Diseases Laboratory of the California State Department of Health Services (CSDHS). CSDHS subsequently cultured Agent S from two samples of pre-sliced brand A dry-cured salami obtained from stores in California.

1. The dry salami was made by a company in the Bay Area. You have applied for a job as their Director of Quality Assurance. What would you recommend they do so as not to have this happen again?

2. Obviously, the USDA-FSIS is involved in this situation. What are they likely to require of the company?

3. If you were one of the victims, would you sue the company? If so, on what grounds?

# SIOUX FALLS, SD, RESTAURANT

## Background

On October 14, 1996, the South Dakota Department of Health learned of an outbreak of diarrheal illness at a large business in Sioux Falls; stool cultures from one employee had yielded an infectious agent. Additional cases of diarrheal illness were reported among the staff at two other organizations in the area. All three locations serve catered luncheons to their staffs each weekday from Restaurant A.

The South Dakota Department of Health and the City of Sioux Falls initiated an investigation and implemented control measures on October 16. Food handlers at Restaurant A were tested. The catering operation for the three locations was halted, and strict hand washing guidelines among for handlers were enforced. By October 22, nine culture-confirmed cases were identified.

## Methods

### Case Ascertainment

On October 14, the Employee Health Nurse at the business where illness was first identified (Function 1) began soliciting stool cultures from all employees with a history of recent diarrheal illness. Similar requests were made by the personnel coordinators at the other two catered locations (Functions 2 and 3).

Between October 14 and October 28, all laboratories in the Sioux Falls area were contacted to ensure that any confirmed or suspect cases of _____ had been reported to the State in the preceding 2 months. All hospital emergency departments in the area were questioned regarding clinically suspect cases. The state health departments and laboratories in Minnesota, Iowa, and Nebraska were contacted regarding any recent cases.

On October 25 and October 30, two articles appeared in South Dakota's major newspaper requesting all those who became ill following a potential exposure to either Restaurant A or its catering service to call a toll-free telephone number. Multiple television and radio reports also alerted potentially ill persons to contact the state or local health department. Telephone follow-up was conducted with all such reports. Stool culturing test kits were provided to all potentially ill persons with an exposure to Restaurant A between September 1 and October 18. Finally, approximately 10 patrons of the Sunday brunch at Restaurant A on September 29 were contacted and interviewed by telephone to ascertain cases that may have occurred on that day.

### Cohort Study at Function 1

Between October 29 and November 5, 1996, all persons who could have eaten the food from Function 1, the largest of the three regularly catered functions, were interviewed by standard questionnaire: 91 interviews were conducted in person; 37 were conducted by telephone. Questionnaires requested demographic information; whether meals, or leftover food from meals, were eaten on October 7, October 8, or October 9; symptoms and signs of illness in the attendee or in family members exposed to food brought home from the October 7 luncheon; and data on foods consumed on October 7.

For the cohort study, a patient was defined as a person who ate the food served at Function 1 who had onset of diarrhea (three or more loose stools within a 24-hour period) during the week following the luncheon on October 7. Persons who did not eat lunch on any of the 3 days of interest, or who could not be reached by telephone, were excluded from the analysis. Persons who did not have diarrhea but did experience either abdominal cramping, vomiting, or documented fever during the week of October 7 – October 14 were excluded from the analysis of food exposures.

Cohort Study at Functions 2 and 3

Between November 1 and 5, interviews were conducted in person and by telephone of the attendees at the two other catered functions on October 7. The questionnaire was similar to that used for Function 1, except information was not gathered regarding attendance at meals on days other than October 7.

At all three locations, a deli tray consisting of roast beef, ham, turkey, provolone cheese, shredded cheese, lettuce, and tomato had been served on October 7.

Laboratory Investigation and Surveillance

Stool samples were either sent directly to the South Dakota Health Department State Laboratory, or forwarded from other microbiology laboratories in the Sioux Falls area to the State Laboratory. Information regarding the number of isolates of suspected organisms received between September 1 and October 18 was obtained from microbiology laboratories performing stool cultures in the Sioux Falls area. The State Health Departments and Laboratories in Minnesota, Iowa, and Nebraska were contacted and asked to report any suspected isolates received between September 1 and October 18, 1996.

Investigation of Food Storage and Preparation

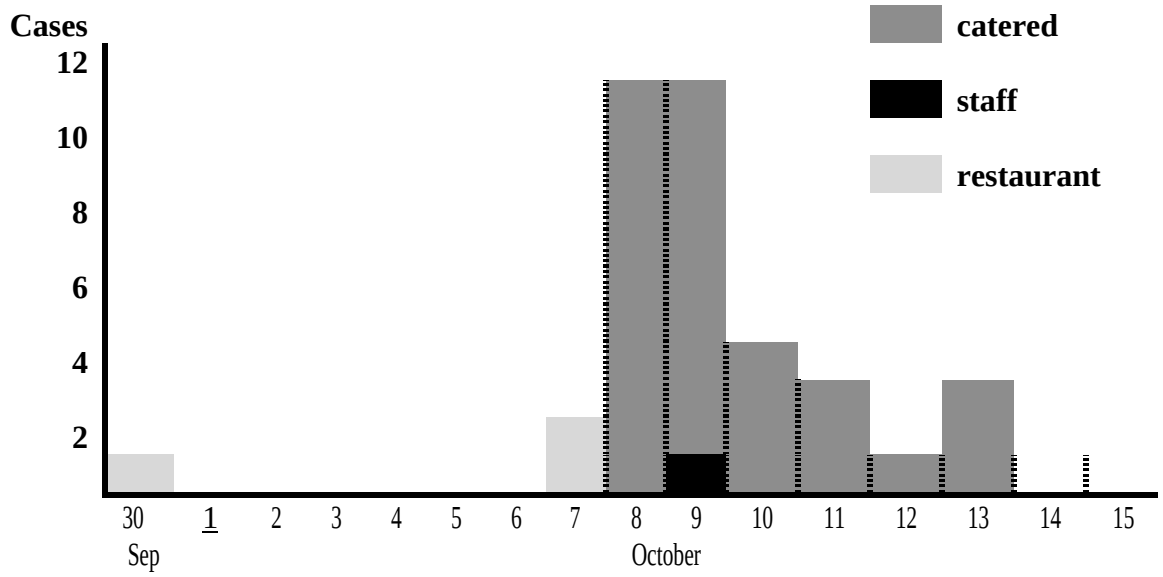
Personnel from CDC, the South Dakota State Health Department, and the Sioux Falls Health Department inspected Restaurant A, collecting information regarding food storage and preparation through formal interviews with Restaurant A's kitchen staff, management, and delivery personnel. Information about food handling was also obtained through interviews at each catering location. There were no samples of suspect food remaining in the restaurant at the time of the investigation, but samples of roast beef and ham left over from the catered luncheon

at Function 3 were obtained from the refrigerator of the catering coordinator on October 19 and sent to the State Environmental Chemistry Laboratory for bacterial analysis.

**Results**

In total, 40 culture-confirmed patients were identified from five separate groups of people – 33 were exposed from the food-served at one of the three catered functions, three were customers exposed to a meal at Restaurant A, and four were food handlers at Restaurant A (Figure 1).

**Figure 1. Persons with culture-confirmed cases by date of onset, Sioux Falls, SD, September –October 1996**




During the cohort studies conducted at Functions 1, 2, and 3, 12 additional patients were identified as meeting a clinical definition of disease following a "likely exposure" (linked to the same meal as at least one culture confirmed patient), for a total of 52 culture-confirmed or suspected patients.

Cohort Study at Function l

One hundred thirty-eight persons were identified as having access to the luncheon at Function 1 on either October 7, October 8, or October 9, 128 were contacted, and all agreed to be interviewed. Of these, 74 actually ate the luncheon on either of these 3 days. Eating the food from the October 7 luncheon was significantly associated with illness (RR 7.0, 95% CI 1.8 -26.9), and the meal on October 9 appeared to be "protective" against illness (RR 0.45, 95% CI (0.3 - 0.8). This apparent protection reflects the absentee rate among those who became ill

following the meal on October 7, and became insignificant when those who ate on October 7 were eliminated from analysis.

Fifty-nine persons ate the food from the Monday luncheon; 54 ate at the event, and 5 ate leftovers from the event. Thirty-three of 59 (56%) fit the case definition of having diarrhea and abdominal cramps between October 7 and 14. Twenty-seven of these had culture-confirmed infection, and six additional persons who ate at Function 1 met the clinical case definition of illness. One additional person had culture confirmed infection but was not ill between October 7 and 14 and did not eat the meal on October 7. The median age for all patients identified at Function 1 was 39 years (range 6 - 55), and for well-attendees it was 41 (range 21 - 58). Twenty-three of 33 patients (70%) were female, and 17 of 21 well attendees (81%) were female. The median time from exposure to onset of symptoms was 2 days, and median duration of diarrhea was 4 days. Food-specific exposures were compiled for those who met the case definition (Table 1).

Table 1. Association between food-consumption and infection among attendees at Function 1 luncheon in Sioux Falls, SD, on October 7, 1996.*

| Food item | Consumed | | Not consumed | | Relative risk | $X^2$† |
|---|---|---|---|---|---|---|
| | Ill/Total | (%) | Ill/Total | (%) | | |
| French fries | 19/32 | ( ) | 13/19 | ( ) | | |
| Ham | 17/25 | ( ) | 16/27 | ( ) | | |
| Lettuce | 19/30 | ( ) | 13/23 | ( ) | | |
| Mayonnaise | 20/34 | ( ) | 12/17 | ( ) | | |
| Mustard | 7/14 | ( ) | 25/38 | ( ) | | |
| Provolone cheese | 18/32 | ( ) | 11/18 | ( ) | | |
| Roast beef | 21/25 | ( ) | 12/28 | ( ) | | |
| Shredded cheese | 6/8 | ( ) | 26/44 | ( ) | | |
| Swiss cheese | 3/8 | ( ) | 26/40 | ( ) | | |
| Tomato | 16/27 | ( ) | 16/26 | ( ) | | |
| Turkey | 21/32 | ( ) | 12/20 | ( ) | | |

*Persons whose illness did not meet the case definition were excluded from the analysis
†Calculate $X^2$ for only the highest three RRs.

Symptoms and signs reported by patients included fatigue (91%), anorexia (81%), muscle aches (70%), nausea (70%), vomiting (12%), and bloody stools (3%). Five (15%) of 33 patients received care from a medical provider during their illness, and two (6%) were placed on antibiotics. No patients were hospitalized. Two (6%) of 33 patients reported a chronic underlying medical condition, while no such conditions were reported among those who did not become ill.

Cohort Study at Functions 2 and 3

Among persons who had access to the food served at either Function 2 or Function 3 on October 7, 51 of 52 persons were interviewed, and 30 actually ate the luncheon. Of these 30, five had culture-confirmed infection and 10 met the case definition. The median age for all patients at

Functions 2 and 3 was 32 years (range 27 – 37), and for well-attendees it was 32 (range 27 – 53). Three (30%) of the 10 patients were female, and 10 (56%) of 18 controls were female. The median time from exposure to onset of symptoms was 1 day, and median duration of diarrhea was three days.

Symptoms and signs reported by patients included fatigue (100%) anorexia (80%), muscle aches (70%), nausea (40%), vomiting (20%), and bloody stools (20%). Three (30%) of the 10 patients received care from a medical provider during their illness, and none were prescribed antibiotics. No patients were hospitalized. No patients or well attendees reported having a chronic underlying medical condition.

Restaurant-Associated Cases

There were four food handlers at Restaurant A who had positive stool cultures. Of these, one was a chef who reported having symptoms of a gastrointestinal illness on October 9, one was a delivery person who reported symptoms on October 14, one was a dishwasher/cook who reported no symptoms, and one was a chef who reported no symptoms. A roast beef carving chef, who recalled having gastrointestinal illness in either late September or early October had negative stool cultures. All other food handlers had negative stool cultures and reported no gastrointestinal symptoms.

Food Storage and Preparation

A routine food service inspection of Restaurant A restaurant on September 9, before the outbreak was reported, led to a score of 67 out of a possible 100 (a failing score), and the repeat score on October 8 was 85% (passing). The restaurant was cited for multiple violations, including a temperature of 50ºF in the walk-in meat storage cooler (45ºF or less required by law).

The handling of roast beef at Restaurant A was investigated. The roast beef is received fresh as "choice inside round" and is delivered about twice a week The meat is aged within its sealed packaging in a downstairs cooler (temperature 40ºF) for 2–3 weeks, and, on Saturday nights at closing, two roasts are placed in the upstairs oven to cook for Sunday brunch. At 7 a.m. on Sunday, the internal temperature of the roast is checked (usually about 110ºF), and it is slowly brought to 125–130ºF by 10 a.m., when it is sliced. According to the U. S. Department of Agriculture (USDA) and the 1995 Food Code published by the Food and Drug Administration (FDA), meat needs to remain at an internal temperature above 130ºF for 2 hours or 145ºF for 3 minutes.

The first roast is sliced at 10 a.m. for the brunch, and the next is sliced later if needed. A carving chef sliced the roasts for the Sunday brunch until mid-October; since then, the meat has been sliced in the kitchen. Following the brunch, any leftover slices are thrown away or given to employees, while the remaining portions of the main roast are set out to cool, then wrapped in cellophane and placed in the upstairs walk-in cooler. This meat is used either for catering events during the week, for soups, which might be made every 2 weeks, or for Greek salads. Other than

Sunday brunch and meals using leftover meat from the brunch, roast beef is not cooked or served at any other time. Occasionally, a precooked ham is served at Sunday brunch, but leftover ham is not used for other meals afterwards.

There is no record of the meat kept in the upstairs walk-in cooler. Four food handlers in the kitchen confirmed that there are times, approximately once per month, when two leftover roasts are in the walk-in at the same time, the cook who puts away the food from Sunday brunch stated that when this occur places the older meat (1 week old) in front of the leftover roast from that Sunday. This upstairs walk-in cooler was found to be at 50ºF on at least two occasions. Current regulations in Sioux Falls specify a maximum temperature of 45ºF. At least one of the food handlers recalled that "there was a lot of meat" in the upstairs walk-in cooler in early October.

Between September 29 (the date of the first possible restaurant exposure for a culture-confirmed case, and October 7 (the date the deli tray was served) there was no documented use of roast beef in a catered function by Restaurant A. However, the meat from the upstairs cooler might have been used in Greek salads.

On October 7, the catering chef used roast beef, ham, and turkey from the walk-in cooler for a cold deli tray prepared for each of the three regularly catered luncheons. All the meat was sliced on an electric slicer. A cellophane-wrapped deli meal was brought to Function 1 at 10:15 am, to Function 2 at 11:30 am, and to Function 3 at 11:40 am.

Assume that the investigations of Functions 2 and 3 and of the restaurant-associated cases are basically compatible with the findings from Function 1.

- Fill in the spaces in Table 1, noting that $X^2$ is to be calculated for only the top three RRs.
- Then, answer the following questions.

1. What foodborne disease agent do you believe caused this outbreak? Why do you think so?

2. What was the likely food vehicle? Why do you think so?

3. What are the possible sources of the foodborne disease agent? Why do you think so?

4. What would you recommend to prevent future outbreaks in the restaurant?

**PHR 250, 2007**
**6/6/07, 7p**

# EIGHTH EPIDEMIOLOGICAL PROBLEM SET

## OUTBREAK OF ILLNESS ASSOCIATED WITH ICED CAKE

Several people developed severe symptoms of gastroenteritis after attending a first holy communion banquet in Benevento, a town of 60 000 inhabitants in southern Italy. About 60 people had attended the banquet, held on 14 June 1998, between 2 and 6 p.m. Public health authorities were notified of the outbreak by a general practitioner on 16 June and immediately began an investigation to identify the causative agent, the contaminated food, and possible mistakes in its preparation.

A list of the guests and the menu were obtained, and some of the ill guests were interviewed in order to formulate a case definition: a case was defined as a person who had attended the banquet and had developed diarrhea (three or more loose stools in 24 hours) or fever (38˚C or higher) within 72 hours of the end of the banquet. A questionnaire was prepared to collect information about the onset of disease, symptoms, and the foods eaten. The questionnaires were self completed; children were helped by their parents. Stool specimens from two patients and from the food handlers were collected and cultured. No leftover food was found. Attack rates and relative risks were calculated for each food item on the menu. The statistical associations were evaluated by the chi square method or Fisher's exact test. Food preparation was evaluated according to the European standards of food hygiene (HACCP, Hazard Analysis and Critical Control Point).

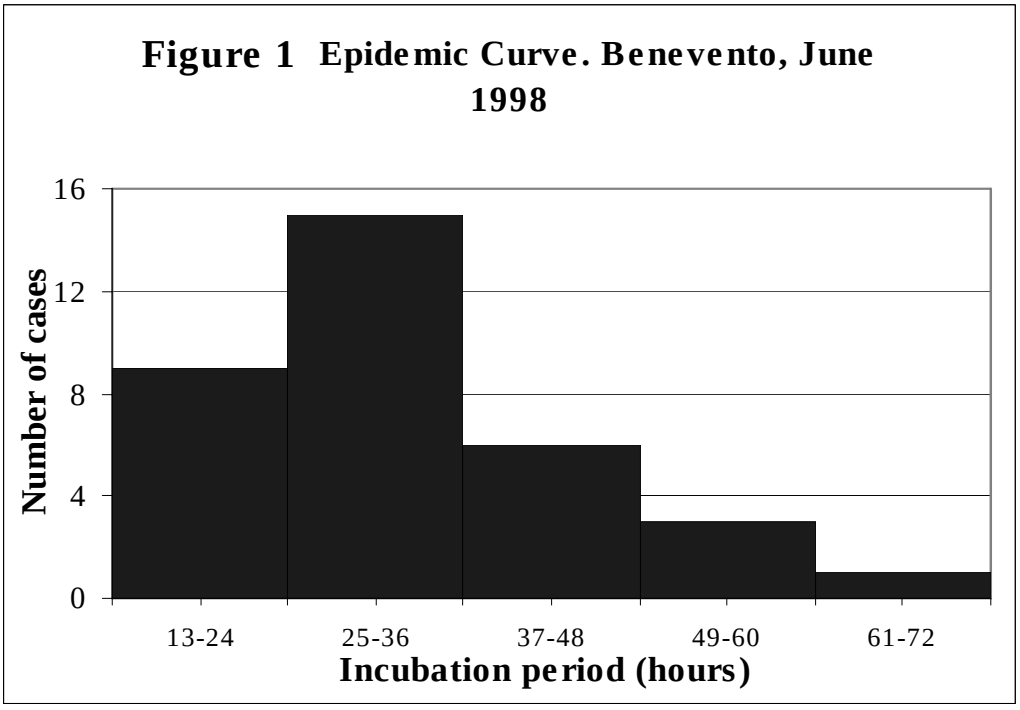
Thirty-six people out of a total of 58 guests who were interviewed felt ill: nine children and 27 adults. The median incubation period was 25 hours (range 12–72) (figure 1). The main symptoms were high fever (34 cases), profuse diarrhea (27 cases), abdominal cramps (26 cases), and less frequently nausea, headache, and vomiting.

Considering the 27 different food items on the menu, a relative risk exceeding 6 (RR 6,4 ; P value 0,001) was associated with having eaten iced cake. For other items, relative risk ranged from 0.5 to 1.8 and no statistical significance was found. Of the 49 people who ate cake, 35 felt ill (attack rate 71%) and 1 case was found among those who did not eat it (attack rate 11%). Bacterial colonies that grew on the stool cultures were later identified as Agent E. The cultures of the food handlers' stool specimens were negative.

The flow chart in figure 2 shows the steps in preparing the cake. The cake was made from four intermediate products: the cake 'pan di spagna' cooked in the oven at 160˚C for 50 minutes, the syrup 'bagna,' the cottage cheese 'ricotta' (produced from whey at 80–100˚C) filling, and the icing. This type of icing, known as 'glassa' is a traditional element of Italian pastry. The standard method of preparation includes only water, sugar and, sometimes, lemon. In home cooking, however, egg whites are sometimes used to help the icing to set. The cake was stored in a refrigerator until the banquet guests arrived and was left at room temperature for 4 hours during the banquet.

Study of the layout and organization of the restaurant revealed that the kitchen was very small and that raw and cooked foods were poorly separated (creating the potential for cross contamination). The refrigerators had no temperature display; no cleaning or disinfecting plans were in use.

**Figure 1 Epidemic Curve. Benevento, June 1998**



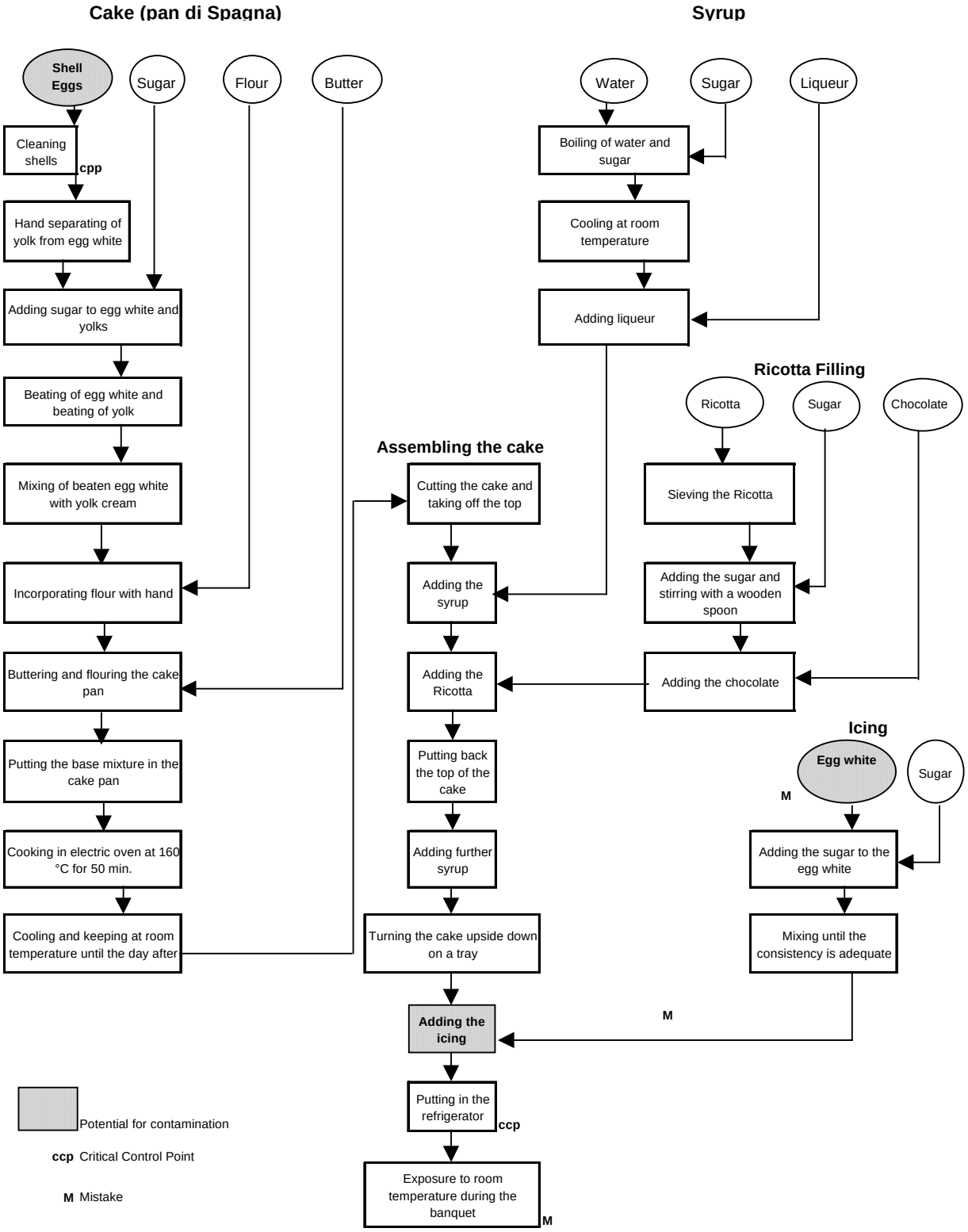

1. What is a likely etiologic agent in this outbreak?

2. What hazards can you find in the cake formulation? What critical control points?

3. Assuming that the cake was somehow contaminated, was the source more likely the ingredients or the kitchen environment?

4. How significant is the holding at room temperature during the reception? How could a hypothesis about this be tested?

**Figure 2 .** Flow chart of the preparation of the cake



## OUTBREAK OF FOODBORNE ILLNESS — SPOKANE, WASHINGTON, 1997

On December 29, 1997, the Spokane Regional Health District received reports of acute gastroenteritis among members of a group attending a dinner banquet catered by a Spokane restaurant on December 18. The illness was characterized by a prolonged (3–9 days) incubation period and diarrhea, which led public health officials to suspect _____ [see question 1, below] cause of the illness. Eight of 10 stool specimens obtained from ill banquet attendees were positive for the agent. This report summarizes the epidemiologic investigation of the outbreak, which suggests that foodborne transmission occurred through a contaminated ingredient in multiple menu items.

In a retrospective cohort study, a case was defined as diarrhea or abdominal cramping in a banquet attendee with onset within 10 days after the banquet. Of the 62 attendees, 54 (87%) had illnesses meeting the case definition; they became ill a median of 6 days (range: 3–9 days) after the banquet. Symptoms included diarrhea (98%), fever/chills (61%), headache (59%), body ache (54%), abdominal cramps (50%), nausea (28%), and vomiting (11%). Based on information from initial interviews, the median length of illness was 5 days (range: 1–13 days), but subsequently several persons reported that they had symptoms intermittently for a month or longer. Two persons were hospitalized, and six others sought health care for their illness.

The banquet buffet included 18 separate food and beverage items; seven items contained uncooked produce. No single food was significantly associated with illness. When menu items that contained green onions were combined, foods containing uncooked green onions (au gratin potatoes, romaine salad, and pasta salad) were reportedly eaten by all 51 case-patients who could recall and by three of four persons who were not ill and could recall (undefined relative risk, $p = 0.07$).

The banquet food items were prepared or served by 15 food workers. Stool specimens were available from 14 food workers within 3–4 weeks of the banquet; specimens from two tested positive for the causative agent. One of the two food workers was symptomatic at the same time as banquet attendees; the other was asymptomatic. A stool specimen from another food worker was not available for testing until 5 weeks after the outbreak and was negative; he reported that he worked for 2 days in December while experiencing diarrhea but he could not remember the dates of his illness. All three of these food workers reportedly ate food items served at the banquet associated with the outbreak.

The green onions were not washed before delivery at the restaurant. Food workers at the restaurant reported they did not consistently wash green onions before using them to prepare food or serving them to patrons.

1. What was the most likely causative agent in this outbreak?

2. Was a food worker a likely source of the contamination?

3. Would washing the green onions probably have prevented this outbreak?

**PHR 250**
**Problem #31**

## SOMETHING FISHY

On December 3, 1998, four adults became ill after eating tuna-spinach salad at a Chester, PA, restaurant. Symptoms of illness included a burning sensation in the mouth, a metallic taste, facial flushing, nausea, diarrhea, sweating, and headache; symptoms occurred approximately 5 minutes to 2 hours after eating the salad. One patient was taken to the local emergency department and treated with diphenhydramine, cimetidine, and epinephrine. The other three patients were not examined by physicians and their symptoms resolved within a few hours.

A sample of the remaining fish obtained from the restaurant was sent to PDOH for testing. The Chester County Health Department (CCHD) and Pennsylvania Department of Agriculture (PDAg) conducted a traceback investigation of the source of the tuna. The wholesale-to-retail chain of events involved transporting the fish across national, state, and municipal borders and involved five transporters and four processors. The tuna was from a 40–60 lb yellow-fin tuna caught by a commercial fishing boat in the Gulf of Mexico during late November 1998. The fish was caught using the long-line method, which uses a mainline up to 60 miles long with a series of suspended hook lines. The water temperature where the fish was caught was 78.5ºF (25.8ºC). The catch of tuna was shipped from the fishing boat in iced vats by truck to a processor on November 24. The average temperature of the fish was 32ºF–33ºF (0ºC–1ºC). Of this catch, 785 lb of tuna were shipped the same day to the wholesaler in Pennsylvania. The wholesaler received the shipment on November 27, and the average temperature of the fish was recorded as 36ºF (2ºC). Three of these fish were delivered to the retail supplier; two large fillets, weighing 11.1 lb each and noted to be in good physical appearance, were delivered to the restaurant on November 27. The fish was divided into 30 portions, kept in the freezer, and removed for thawing as needed for use. During November 28–December 4, 17 portions of the fish were served. The only four persons reporting illness ate the tuna-spinach salad on December 3.

CCHD and PDAg reviewed the records of each distributor involved in the wholesale-to-retail process of the tuna. All of the fish plants involved were inspected regularly by the FDA and/or PDAg and have Hazard Analysis and Critical Control Point (HACCP) procedures. No deviations in HACCP procedures in the wholesale-to-retail distribution of the tuna could be identified.

1. What is your diagnosis? Why?

2. A sample of fish was sent for laboratory testing. What tests would you have ordered?

3. What was the earliest event in this fish's history that might have contributed to the problem?

3. What might the restaurant have done to prevent the consumer illnesses?

4. Why didn't HACCP prevent this problem?

# OUTBREAK OF GASTROENTERITIS AFTER KITCHEN ASSISTANT VOMITED

## Summary

A wedding reception at a North Yorkshire hotel was followed by an explosive outbreak of gastroenteritis. The attack rate among the 111 guests was 50% and vomiting was a predominant feature. The source of the outbreak was traced to a kitchen assistant who suddenly became ill on the eve of the reception and vomited into a sink used for preparing vegetables. The sink was cleaned with a chlorine based disinfectant and used the next morning to prepare a potato salad, subsequently identified as the vehicle of infection in a cohort study of guests (odds ratio 3.21; CI 1.78–5.78, $p = 0.0001$). No other food was associated with illness.

## Background

A wedding reception for 111 guests was held at a North Yorkshire hotel on Saturday 3 August 1996. It was followed by an outbreak of gastroenteritis among guests, reported to the hotel management on Monday 5 August by the bride's father. The incident was first investigated internally by the hotel management. The North Yorkshire Infection Control Service was informed at 1700 on Wednesday 7 August. The hotel was visited the following morning: the kitchen was inspected and food handling practices and procedures were reviewed. No significant weaknesses in kitchen practice that might have contributed to the outbreak were identified.

Staff sickness records showed that a kitchen assistant with learning difficulties had been ill on the day of the reception, with a gastric upset and sickness. He returned to work at 1630 on Sunday 4 August. When interviewed on Wednesday 7 August he said that he had suddenly become ill during his evening shift on Friday 2 August and vomited into a vegetable preparation sink in the main kitchen at about 2300. This was a free-standing unit consisting of a single stainless steel sink with a drainer. The assistant said that he had cleaned the sink with "Mikro-Chlor sanitizing powder" (sodium carbonate >30%, sodium dichloroisocyanurate dihydrate <5%) before going home but had not told the kitchen supervisor about the incident. The next morning the same sink was used to prepare a potato salad dish for the wedding reception. When removed from the boil the potato pan was placed in the vegetable preparation sink, where the potatoes were cooled with running water. The potatoes were then tipped directly into the sink for draining and further cooling before refrigeration. Later that afternoon the potatoes were quartered, mixed with mayonnaise, and returned to the refrigerator. The vegetable preparation sink was not used to prepare other salad dishes but it was used in the preparation of other vegetables before they were cooked.

The potato salad was served only at the wedding reception. It was also sampled by the commis chef who developed gastroenteritis about 48 hours later. After the reception, unused cold meats were refrigerated and used the following day to make sandwiches. Unused salad dishes were discarded.

**Investigation**

On Friday 9 August, environmental health officers conducted a preliminary survey of wedding reception guests by telephone. This confirmed that an outbreak of gastroenteritis had taken place among the guests . Those with symptoms were asked to submit stool specimens. A cohort study of all those who attended the reception was conducted to describe the epidemiology of the outbreak and to determine its cause. A structured postal questionnaire was sent to guests requesting details of food eaten and time of onset of any subsequent illness (defined as one or more of nausea, vomiting, diarrhoea, abdominal pain, headache, dizziness, general aches

**Results**

Ninety-four of the 111 guests returned completed food questionnaires (response rate 85%). Altogether, 47 guests reported illness giving an attack rate of 50% (Table 1).

Table 1. Predominant symptoms in outbreak

| Main symptoms | Number ill (%) |
|---|---|
| Vomiting and diarrhoea | 28 (60) |
| Vomiting only | 7 (15) |
| Diarrhoea only | 7 (15) |
| Nausea only | 2 (4) |
| Nausea with dizziness only | 1 (2) |
| Abdominal pain only | 1 (2) |
| Headache and general aches only | 1 (2) |

The median incubation period (time between eating the food and the onset of symptoms) was 39 hours (range 20–65 hours). The mean incubation period was 39 hours (standard deviation (SD) 8 hours; 95% confidence interval (CI) for mean 23-55 hours). If the apparent outlier is excluded, however, the mean incubation period was 38 hours (SD 7 hours; 95% CI for mean 24–53 hours).

To determine which, if any, of the foods served at the function were independently associated with illness, a multivariate logistic regression analysis was performed. After controlling for the influence of other foods, only the potato salad was associated with illness (odds ratio 3.21; CI 1.78–5.78, p = 0.0001). Forty-three (65%) of the 66 guests who ate this food became ill. Only four (15%) of the 26 guests who did not eat this food reported illness. Exclusion of five guests who reported illness, but not vomiting or diarrhoea, made no difference to the outcome of the logistic regression analysis.

No food samples were available for analysis. Stool specimens from two of the seven guests who were ill, and from the kitchen assistant who vomited into the food preparation sink (onset of illness Friday 2 August submitted Friday 9 August), were positive for _____[see question 1, below].

1. What is the most likely etiological agent for this outbreak? Why do you think so?

2. Based on the information reported above, what would you do if you were in charge of a kitchen in similar circumstances?