

SECOND EPIDEMIOLOGICAL PROBLEM SET

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OUTBREAK OF DIARRHEAL ILLNESS ASSOCIATED WITH DRINKING UNPASTEURIZED APPLE CIDER — NEW YORK, OCTOBER 1996

In October 1996, unpasteurized apple cider or juice was associated with three outbreaks of gastrointestinal illness. In the Western United States, an outbreak of *Escherichia coli* O157:H7 infections associated with unpasteurized commercial apple juice caused illness in 66 persons and one death. In addition, one outbreak of apple cider-related *E. coli* O157:H7 infections and another of cider-related agent Z infections occurred in the Northeast. Apple cider is a traditional beverage produced and consumed in the fall. Cider often is manufactured locally at small cider mills where apples are crushed in presses, and the cider frequently is not pasteurized before sale. This report summarizes the clinical and epidemiologic features of the apple cider-related outbreak in New York, which suggests that current practices for producing apple cider may not be adequate to prevent microbial contamination.

New York

During October 10-15, a local hospital laboratory notified the Cortland County Health Department (CCHD) about 10 cases of laboratory-confirmed agent Z illness with recent onset among county residents (1990 population: 48,963). During the same period in 1995, one case of agent Z illness was reported to CCHD. All case-patients had onset of symptoms during September 28-October 10 and reported drinking apple cider produced at a local cider mill (mill A). CCHD, the New York State Department of Health (NYSDOH), and the New York State Department of Agriculture and Markets (NYS A&M) initiated an investigation of this cluster.

A confirmed case was defined as onset of diarrhea during September 28-October 19 in a Cortland County resident and laboratory evidence of agent Z in a stool specimen. A suspected case was defined as onset of diarrhea during the outbreak period in a household member of a person with confirmed agent Z illness. CCHD conducted active surveillance for additional cases by contacting area clinicians, hospitals, and laboratories.

A total of 20 confirmed and 11 suspected cases were identified from 19 households. The median age was 27 years (range: 1-62 years), and 17 were female. Symptoms included diarrhea (100%), abdominal cramping (55%), vomiting (39%), fever (36%), and bloody diarrhea (10%). The median duration of symptoms was 6 days (range: 1-21 days). CCHD and NYSDOH conducted a matched case-control study to assess probable sources of the outbreak. One neighborhood-matched control-household was contacted for each household with a laboratory-confirmed case. In each control-household, an adult (age ≥ 18 years) member was asked about history of illness, whether anyone in the household had drank apple cider since September 28, which brand of cider was consumed, and the date the cider was purchased. Eighteen case-households were included in the matched case-control study. A history of drinking cider from mill A was reported for at least one member of the 18 households, compared with only one of the

18 control-households (matched OR = undefined, $p < 0.01$). Specifically, cider pressed during September 28-29 (i.e., opening weekend) was associated with illness: 15 of 17 case-households in which the purchase date was known compared with none of the control-households reported drinking cider pressed on opening weekend (matched OR = undefined, $p < 0.01$). Mill A purchased all apples for cider pressing from one New York orchard. Local and state health departments and NYS A&M inspected the cider mill and apple orchard. The owner of the orchard reported that only picked apples were sold to the cider mill, and drop apples were sold for use in processed or pasteurized foods. Before pressing, the mill washed and brushed the apples using water from a 45-foot drilled well; preservatives were not added to the cider. Although dairy livestock were not maintained by the orchard, the cider mill was located across the road from a dairy farm. Testing of remaining cider samples from opening weekend, swabs of equipment surfaces, and water obtained on October 21 from the drilled well did not yield agent Z. However, coliform bacteria were detected in four water samples obtained from the well, and *E. coli* was detected in one sample.

1. What is “agent Z”?
2. How did it contaminate the apples or cider?
3. Was the water supply appropriate, and was it involved in the contamination?
4. What might be done to prevent recurrences of this outbreak?

**FOODBORNE OUTBREAKS OF DIARRHEA — RHODE ISLAND
AND NEW HAMPSHIRE, 1993**

Rhode Island

On March 25, the Rhode Island Department of Health was notified of gastrointestinal illness among passengers on an airline flight from Charlotte, North Carolina, to Providence, Rhode Island, on March 21. The flight carried 98 passengers; 47 (64%) of 74 passengers who were interviewed met the case definition of three or more loose stools in 24 hours beginning within 4 days after the flight. Additional symptoms included abdominal cramps (94%), nausea (70%), headache (57%), fever (13%), and vomiting (13%). The only common meal for all ill passengers was dinner served on board the flight. The median incubation period was 41 hours (range: 12-77 hours); two (5%) of 44 persons recovered within 48 hours of onset of illness.

Illness was most strongly associated with eating garden salad made from shredded carrots and iceberg, romaine, and endive lettuce (46 [98%] of 47 ill passengers compared with 6 [22%] of 27 well passengers; relative risk [RR] = 4.4; 95% confidence interval [CI] = 2.2-8.9). Investigators from the Food and Drug Administration (FDA) contacted 18 passengers who had traveled on March 21 on a different flight operated by the airline and who had been served the same meal; 9 passengers reported gastrointestinal illness. On March 21, approximately 4000 portions of salad had been prepared by one catering service for 40 flights operated by the same airline that day. The FDA traceback determined that all of the salad ingredients were of U.S. origin.

Stool specimens obtained from 20 passengers from the index flight were negative on culture for *Salmonella*, *Shigella*, *Campylobacter*, *Yersinia*, and *Vibrio*, and viral particles were not observed in 12 stool specimens examined by electron microscopy at CDC. Samples from 10 ill passengers yielded a common pathogen.

FDA inspection of the caterer's facilities did not identify deficiencies in sanitary conditions. In addition, all food handlers denied gastrointestinal illness or recent travel outside the United States. Samples of food collected for culture on March 27 did not yield the pathogen.

New Hampshire

On April 5, the New Hampshire Division of Public Health Services was notified of gastrointestinal illness in eight persons who ate a buffet dinner served at a mountain lodge on March 31. A total of 202 persons ate the dinner, including 132 guests and 70 lodge employees. A case was defined as diarrhea (three or more loose or watery stools in a 24-hour period) and one other symptom (cramps, fever, headache, nausea, or vomiting) with onset from April 1 through April 7 in a guest or employee who had eaten the dinner. Of the 123 guests and 56 employees

who were interviewed, 96 (78%) and 25 (45%), respectively, had illness that met the case definition. Additional symptoms included cramps (92%), nausea (59%), myalgias (50%), headache (49%), fever (22%), and vomiting (11%). Illness began a median of 38 hours after foods from the buffet were eaten (range: 3-159 hours); 60 (65%) of 93 persons for whom information was available reported continuing illness 4-6 days after symptom onset.

Illness among guests was most strongly associated with consumption of tabouleh salad (cases occurred in 78 {94%} of 83 guests who ate the tabouleh and 18 {53%} of 34 guests who did not [RR = 1.8; 95% CI = 1.3-2.5]). Tabouleh was the only food associated with illness among lodge employees (RR = 6.4; 95% CI = 2.2-18.8). The tabouleh was prepared from onions, carrots, zucchini, peppers, broccoli, mushrooms, green onions, tomatoes, parsley, bulgur wheat, olive oil, lemon juice, and bottled garlic. All of the produce was of U.S. origin. The salad was prepared the evening before the banquet. All food preparers denied gastrointestinal illness or travel outside the United States the week before the banquet.

Cultures of stool specimens obtained from 14 persons were negative for *Salmonella*, *Shigella*, *Campylobacter*, and *Yersinia*; neither ova nor parasites were detected in stool specimens from seven ill persons. However, the same pathogen as that found in the Rhode Island outbreak was isolated from stool specimens from seven of nine ill guests and from one of five well employees. Additional serotypes also were isolated from six specimens.

Follow-up Investigation

Plasmid profiles of the pathogen strains from the outbreaks in New Hampshire and Rhode Island were identical but differed from those of 10 other serotype strains from other sources.

1. What is the most likely pathogen in these outbreaks?
2. What was the common food in the two outbreaks?
3. What is the probable source of contamination?
4. Why did the FDA do the investigation in Rhode Island, but not in New Hampshire?

FOOD POISONING AT A BANQUET

An outbreak of food poisoning occurred in Spokane, Washington, following a convention banquet at a large hotel on May 4. Of the 1,000 persons who ate the banquet meal, all 1,000 were questioned and 144 reported being ill. The signs and symptoms were:

Diarrhea	(91%)	Headache	(39%)	Vomiting	(10%)
Cramps	(73%)	Nausea	(37%)	Fever	(7%)

One person was hospitalized; he had bloody diarrhea, along with other signs and symptoms.

Table 1. Food poisoning outbreak, Spokane, Washington.
Hours from banquet to onset of symptoms for 85 cases.

<u>Hours</u>	<u>Number of cases</u>	<u>Hours</u>	<u>Number of cases</u>
1	0	16	5
2	0	17	3
3	2	18	3
4	1	19	4
5	1	20	3
6	0	21	3
7	0	22	2
8	1	23	2
9	0	24	2
10	0	25	0
11	7	26	0
12	13	27	0
13	11	28	1
14	12	29	0
15	8	30	1

Table 2. Food histories, Spokane, Washington, outbreak

Food	Ate			Did not eat		
	Ill	Well	Total	Ill	Well	Total
Crab cocktail	102	478	580	11	193	204
Green salad	92	446	538	21	225	246
Baked potato	103	478	581	10	193	203
Prime rib	116	640	756	0	28	28
Green beans	102	479	581	11	192	203
Bread rolls	86	424	510	27	247	274
Chocolate eclair	90	429	519	23	242	265
Milk	34	123	157	79	548	627
Coffee	87	423	510	26	248	274

All foods were prepared in the same place, but served in three shifts: 7-8 p.m., 8-9 p.m., and 9-10 p.m., in three dining areas. People from Spokane City, who ate in dining room A, had higher attack rates than people from other places.

Crabs were boiled and cracked, and the meat was placed in the refrigerator immediately. Cocktails were prepared within 30 minutes after removal of the meat from the refrigerator and placed back in the refrigerator until served.

The green salad was lettuce with vinegar and oil dressing.

The baked potatoes were served hot from the oven.

Thirty roasts were cooked and sliced. Slices served in room A were not placed in a warmer until served, as were the slices for the other dining rooms.

The green beans were commercially frozen; these were boiled and served hot.

The bread rolls were obtained from the largest city bakery.

The chocolate eclairs were purchased from the same bakery as the bread.

The milk was fresh pasteurized.

The coffee was served hot.

One month after the outbreak, roasts obtained from three slaughterhouses supplying meat regularly to the hotel were found positive for a foodborne pathogen at low levels (<100 cells/g).

1. Calculate the median incubation period.
2. Find the most suspect food from Table 2.
3. What was the most likely cause (disease agent) of the outbreak?
4. How did the food become harmful?
5. Why did the people from Spokane have a higher attack rate?
6. How significant is the finding of the same agent in roasts 1 month later?
7. How could the outbreak have been prevented?
8. What laboratory and epidemiological criteria would confirm your explanation of this outbreak?

ILLNESS FROM A PICNIC

On Sunday, June 10, three families left together in the morning on a picnic in a forested area near a lake. Lunch was served at noon and consisted of: barbecued chicken, vegetable salad, bread, ice cream, coffee, and milk. Supper was served at 6 p.m. and consisted of: shrimp casserole, fresh fruit, milk, and coffee.

That evening, 6 of the 10 people who spent the day together and shared the meals became ill (see Table 1). All recovered within 2 days.

Interviews revealed that the barbecued chicken had been bought ready made at a supermarket Sunday at 9 a.m.; it was kept unrefrigerated in the trunk of a car and served at noon without further preparation. The shrimp casserole was prepared Saturday, June 9, from frozen, already peeled shrimp and fresh vegetables. After cooking, the shrimp casserole was placed in the refrigerator overnight and transported to the picnic ground in an ice chest the following day: it was heated almost to boiling immediately before being served at the Sunday supper. The salad was prepared Sunday morning and kept refrigerated. The ice cream, fresh fruit, and milk were bought at the supermarket Sunday morning. The coffee was freshly made and served hot.

1. What were the most common symptoms?
2. Fill in the attack rate for each food in Table 2.
3. Which food is most suspect?
4. What was the probable causative agent?
5. How did the outbreak most likely occur?
6. Are males more susceptible to the agent than females?
7. What was the median incubation time?
8. What laboratory and epidemiological criteria would confirm your explanation of this outbreak?

Table 1. Data on persons at the picnic

Person	Sex	Age	Lunch	Dinner	Symptoms	Onset
1	M	35	chicken salad bread coffee	shrimp coffee	nausea cramps vomiting diarrhea	8:30 p.m.
2	F	32	chicken salad coffee	fruit milk coffee		
3	M	10	chicken salad bread ice cream	fruit milk coffee		
4	M	8	chicken milk ice cream	shrimp milk	nausea cramps diarrhea	9:30 p.m.
5	M	30	chicken salad ice cream coffee	shrimp fruit coffee	nausea cramps vomiting diarrhea	9 p.m.
6	F	30	salad milk coffee	milk fruit		
7	F	5	ice cream milk	milk	nausea vomiting	midnight
8	M	40	chicken salad bread milk	shrimp fruit milk	nausea cramps vomiting diarrhea	10 p.m.
9	F	35	salad milk coffee	shrimp milk fruit		
10	F	15	salad milk	shrimp milk fruit	nausea cramps vomiting diarrhea	9:30 p.m.

Table 2. Attack rate worksheet

Food	-----Persons eating food-----				-----Persons not eating food-----			
	Ill	Well	Total	Attack rate	Ill	Well	Total	Attack rate
Chicken								
Salad								
Bread								
Coffee								
Ice cream								
Milk								
Shrimp								
Fruit								