

FIFTH EPIDEMIOLOGICAL PROBLEM SET

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**MULTISTATE OUTBREAK OF INFECTIONS LINKED TO TOASTED OATS
CEREAL — UNITED STATES, APRIL–MAY, 1998**

During April–May 1998, a total of 11 states reported an increase in cases of *Salmonella* serotype Agona infections; as of June 8, a total of 209 cases have been reported and at least 47 persons have been hospitalized, representing an eightfold increase over the median number of cases reported in those states during 1993–1997. The states reporting increases were Illinois (49 cases), Indiana (30), Ohio (29), New York (24), Missouri (22), Pennsylvania (20), Michigan (15), Iowa (eight), Wisconsin (six), Kansas (four), and West Virginia (two). This report summarizes the outbreak investigation by local, state, and federal public health officials, which implicated Millville brand plain Toasted Oats cereal manufactured by Malt-O-Meal, Inc. as the cause of illness.

Among 162 patients in this outbreak for whom information was available, 85 (52%) were female. Most cases occurred in children and the elderly (47% in persons aged <10 years and 21% in persons aged >70 years). Most illnesses began in May.

Officials in the 11 state health departments, in collaboration with CDC, conducted a matched case-control study comparing persons with cases of *S. Agona* infection in April and May with well household members (controls); conditional linear logistic regression was used to examine the relation between consumption of cereal and illness. As of June 8, information from 55 households has been analyzed; 46 (84%) of these 55 households shopped at an Aldi supermarket. During the 3 days before onset of illness, 31 (66%) of 47 patients and 32 (36%) of 89 household controls consumed Millville brand plain Toasted Oats cereal purchased at an Aldi supermarket (matched odds ratio=22; $p=0.003$). This association remained significant when controlled for age ($p<0.05$). When average daily consumption of Millville brand plain Toasted Oats cereal purchased from an Aldi supermarket was categorized into three groups (no consumption, ≤ 1 cup, and >1 cup), a significant dose response relation was found ($p=0.003$).

Culture of an open box of Millville brand plain Toasted Oats cereal obtained from the home of a case-patient yielded *Salmonella* Agona at CDC. The pulsed-field gel electrophoresis (PFGE) pattern of this isolate was indistinguishable from the predominant PFGE pattern among outbreak-associated clinical isolates. The Food and Drug Administration (FDA) isolated *Salmonella* Agona from two separate composite samples from unopened boxes. Clinical isolates were susceptible to all antimicrobial agents tested (i.e., ampicillin, trimethoprim-sulfamethoxazole, and ciprofloxacin).

The Minnesota Department of Health, the Minnesota Department of Agriculture, FDA, and CDC are collaborating in the investigation of the Malt-O-Meal, Inc. plant that manufactured the implicated cereal to determine the source of contamination. At this plant on the same production line, multiple brands of plain Toasted Oats are manufactured at different times. Malt-

O-Meal has issued a voluntary recall of all plain Toasted Oats cereal produced on the same production line. Investigation is ongoing to determine whether other plain Toasted Oats cereal brands produced by the same company were contaminated. Cases of *Salmonella* Agona infection occurring during the same time have now been reported in California (11), Washington (9), New Jersey (5), Tennessee (3), Oklahoma (3), Idaho (2), Maryland (2), Minnesota (2), Nebraska (1), and Connecticut (1). These cases are being investigated to determine possible links to this outbreak. CDC recommends that consumers not eat plain Toasted Oats cereal produced by Malt-O-Meal until further investigation has identified the scope, magnitude, and cause of the contamination.

1. In what range would you estimate the a_w of this product to be?
2. Could *Salmonella* grow at this a_w ?
3. Could *Salmonella* survive at this a_w ?
4. What do you suppose to have been the most likely mode of contamination of this product?
5. Do you think the additional cases mentioned last are part of this outbreak?

**OUTBREAK OF DISEASE AFTER A POTLUCK SUPPER
IN SANTA BARBARA COUNTY, CALIFORNIA**

One day following a potluck supper held in a home in Santa Barbara County in July of 1996, 20 of 26 attendees became ill with fever, diarrhea, and abdominal cramps. Five were hospitalized. A total of 22 different food items brought by guests were served. In addition to the 20 people — including members of the host family — who became ill, one out of five persons who ate the leftover potluck food became ill. This person ate only desert items (vanilla ice cream, orange sherbet, chocolate cake).

In a univariate analysis, four items were associated with illness: vanilla ice cream ($p = 0.0001$), orange sherbet ($p = 0.007$), chocolate cake ($p = 0.05$), and green beans ($p = 0.04$). In a stratified analysis only ice cream had a statistically significant association ($p = 0.002$); results for those eating sherbet could not be calculated because all had also eaten vanilla ice cream.

Food-specific attack rate table:

Food item	# of persons eating food item				# of persons NOT eating food item				Diff.	Rel. risk
	ill	well	total	attack rate (%)	ill	well	total	attack rate (%)		
Vanilla ice cream	19	1			0	5				
Orange sherbet	15	1			3	5				
Chocolate cake	13	1			5	5				
Green beans	15	2			3	7				

The potluck hostess was also the maker of the vanilla ice cream, orange sherbet, chocolate cake, and smoked turkey breast. She denied any symptoms, gastrointestinal or otherwise, in herself or any family member in the week before the potluck.

On July 20, she went shopping mid-day and purchased 3 dozen eggs at Supermarket A, and whipping cream and half-and-half at Supermarket B. The eggs were from a refrigerated case, and none were broken. It was a hot and dry day; the eggs were left in the car for a maximum of 45 minutes. When she got home, she put all the perishable items in the refrigerator.

At about 6 o'clock that evening, she prepared the vanilla ice cream mix. First she beat together eight eggs, sugar, imitation vanilla, salt, and 2 pints of whipping cream ("ultra-pasteurized"). Then she poured the mixture into a Tupperware pitcher with an "airtight" lid and

placed it in the refrigerator. After rinsing the bowl and beaters with warm water, she made the orange sherbet mix with two cans of Eagle brand sweetened condensed milk, one can of diet orange soda, and one quart of half-and-half (“ultra-pasteurized”). She then transferred this mixture to a second Tupperware pitcher with an “airtight” lid and placed it in the refrigerator. Both mixtures remained in the refrigerator until approximately noon the following day (7/21/96).

Before the mixes were frozen, she and her husband “sterilized” the ice cream maker by washing with soap and boiling water. At noon, she poured the vanilla ice cream mixture into the ice cream maker and added one quart of half-and-half and enough milk to fill the entire 5-quart volume. The ice cream was frozen within about half an hour, transferred to a clean Tupperware container, and placed in the freezer. The ice cream maker was rinsed with warm tap water, and the sherbet mixture was poured in and frozen. The sherbet was then transferred to a clean Tupperware container and placed in the freezer.

Dessert was served between 2 and 3 p.m. Separate serving spoons were used for ice cream and sherbet, but might have been used interchangeably at times.

Later, a laboratory analysis revealed the presence of 1.2×10^5 cells (CFU's) of the suspect organism per gram of ice cream and 5×10^3 per gram of sherbet.

1. What is the likely agent?
2. Are the described preparation procedures acceptable?
3. How could the relatively high numbers of organisms in the ice cream and sherbet be explained?

**ILLNESS FOLLOWING INGESTION OF HOMEMADE BEVERAGE
STORED IN A CERAMIC JUG — NEW YORK**

In the summer of 1987, seven persons living in Westchester County, New York, became ill after ingesting a homemade beverage stored in a ceramic bean jug. The six adults and one child were relatives and lived at or frequently visited the home where the jug was kept.

The 140-ounce brown ceramic jug had been obtained in Mexico and is of a type commonly used to cook beans. The first person to experience illness used the jug to store a beverage he prepared frequently from sugar, water, and mara, a grain imported from Colombia. After the beverage fermented, family members consumed it several times daily throughout the summer.

In October 1987, the first patient — a 67-year-old man — consulted a physician because of severe abdominal pain, fatigue, and weight loss. The physician initially suspected gastric carcinoma. However, because severe anemia and red blood cells with basophilic stippling were detected, further analyses of the blood were done. The man was hospitalized and received chelation treatment during a 2-week stay.

1. What is your diagnosis?

After the initial case was diagnosed, a public health sanitarian visited the home to search for the source of the problem. The jug was examined and found to be severely corroded on the inside. Analysis of the jug by the New York State Department of Health (NYSDH) detected a dangerous condition of the interior.

2. Why was the jug suspect, and what was probably found?

Further blood testing identified six other household members, aged 8-90 years, who were ill or significantly at risk of illness. One of the five adults was also hospitalized.

Investigation by NYSDH revealed other hazardous earthenware in shops and bodegas in this town. The Westchester County Department of Health distributed bilingual fliers in ethnic communities in the county warning of the possible hazards from the use of ceramic ware. No additional cases have been identified. All patients have been followed by their personal physician and have recovered uneventfully.

3. Why might the beverage that was prepared and stored in this jug have enhanced the risk of consumer illness?

**DIARRHEA ASSOCIATED WITH IMPORTED FROZEN
COCONUT MILK — MARYLAND, 1991**

During August 1991, three cases of severe diarrhea in Maryland were associated with the consumption of frozen coconut milk imported from Asia. Following an investigation, the product was recalled, and no other cases have been reported.

On August 19, a woman residing in Maryland had onset of severe watery diarrhea and vomiting and, on August 22, was hospitalized with dehydration. An agent that was probably the cause of the illness was isolated from a stool specimen.

The patient had neither traveled outside the United States nor eaten raw shellfish during the preceding month. She and five other persons had attended a private party on August 17. Two of the other persons also had onset of an acute diarrheal illness after the party; incubation periods were 6 hours and 14 hours. Their antibody titers were elevated, indicating recent infection with the same agent. One asymptomatic person also had an elevated antibody titer. Thus, four persons attending the party had laboratory evidence of recent infection, and three of the four had similar symptoms. None of the four reported recent foreign travel.

Food served at the party included steamed crabs and a homemade Thai-style rice pudding served with a topping made from frozen coconut milk. All six persons ate crabs and rice pudding with coconut milk. However, crabs left over from this party were served at a second party held later on August 17 at the same site; the coconut milk topping was not served. One of 20 persons at the second party had onset of mild diarrhea; specimens obtained from this person and 14 others were negative for antibodies against this pathogen when tested 12-26 days after the party.

The Food and Drug Administration's (FDA) Baltimore District Laboratory cultured unopened packages of the same brand of frozen coconut milk (but a different shipment) as that served at the party. The same pathogen was isolated from one of six bags tested, as well as several other potential causes of illness. Coliform counts measured up to 11,000 most probable number per gram.

No secondary cases were identified among contacts of the affected persons. In addition, surveillance through emergency rooms failed to identify additional cases in the area. The MDHMH placed Moore swabs in four central sewage collection points in the Baltimore metropolitan and Montgomery County areas as a surveillance measure, with negative results.

The implicated product in this outbreak was Asian Best brand of frozen coconut milk, produced in Thailand and exported by a Bangkok trading company to a Maryland distributor. Nineteen shipments, totaling 36,160 8-ounce bags, had been imported since January 1, 1991. On September 20, the distributor issued a voluntary product recall, and FDA halted all further importation of this product. The Thai Ministry of Public Health reported that the manufacturer of this brand was not licensed by the Thai FDA and shipped the product only to the United States.

1. In all probability, what pathogen or illness was involved here?
2. How might the product have been contaminated?
3. Should freezing have offered some measure of protection from this agent?
4. What was the rationale for the Moore swab sampling?
5. What could the FDA do, then or now, to prevent such incidents?