Cause of illness in 229 of 441 conventioneers may have been Salmonella *or streptococcal organisms or both*

Food Poisoning Outbreak in Kentucky Traced to Creamed Turkey

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ON MONDAY, April 22, 1963, at about 1:30 p.m., the Louisville and Jefferson County (Ky.) Department of Public Health was notified by the Kentucky State Department of Health that reports of illness symptomatic of food poisoning had come from several parts of the State. A preliminary investigation indicated that all the victims had eaten a special luncheon served to members of the Kentucky School Food Service Association at a Louisville hotel on Saturday, April 20. Further, although the majority of the illnesses were mild, there was one death which might have resulted from this outbreak.

Data Collection

An investigating team from the Louisville and Jefferson County Department of Public Health and the State health department was organized to conduct an epidemiologic study. A complete list of all foods served to members of the Kentucky School Food Service Association at the hotel on April 20 was compiled. It was determined that the food consisted of a mid-morning snack of coffee and pastry served from the commercial display of a Louisville food manufacturer to about 100 persons and a special creamed turkey luncheon served by the hotel about 12:30 p.m. The hotel reported that 441 persons had been served this luncheon.

Investigation of the procedures for preparing the suspect foods revealed that 12 turkeys, weighing 26–28 pounds each, were used in the creamed turkey. These birds were from a Louisville purveyor and were federally approved for interstate shipment. They had not been treated with an antibiotic during the packing process. At the time of this epidemic the policy of the Poultry Inspection Division of the U.S. Department of Agriculture was to permit, but not require, the treatment of poultry with certain of the tetracycline antibiotics that are neutralized by cooking. The use of all other antibiotics was prohibited. Since this was a matter of policy rather than prescribed regulation, permission to use a tetracycline was granted by individual letter to the slaughterhouses requesting it.

According to the kitchen staff, six turkeys

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Epidemiologic data for this report were gathered primarily by staff of the Louisville and Jefferson County Department of Public Health and the Kentucky State Department of Health. The most active workers from the local department were John C. Barwick, R.S.; Ambrose P. Bell, B.S.C.E.; Cooper Brougher, B.S.; Dr. Dorothy Holtgrave; Lula B. McClain, R.N., B.S.; and Dr. Thomas S. Wallace, Jr. Dr. Buster Brown and J. Clifford Todd, M.P.H., were the most active workers from the State department of health.

were removed from the freezer (about 30° F.) during the afternoon of Friday, April 19, 1963, and placed in the kitchen's refrigerator (about 45° F.) to thaw. They remained there all night. About 5:30 a.m. on April 20, these six partly defrosted birds were placed in the pressure cooker and cooked at 5 pounds pressure (350° F.). About 2½ hours later, at 8 a.m., the turkeys were removed from the cooker and placed in a sink of water for cooling. This sink had just been emptied of the water used for thawing a second six turkeys. Neither the sink's just-previous uses nor the time of its latest cleaning are known.

The second six turkeys, which had been taken from the freezer at about 7 a.m., were put in the pressure cooker at 8 a.m., just after the first six had been removed. They were cooked at 5 pounds pressure for about 2 hours, until 10 a.m.

While the second six birds were cooked, the first six were cooled in the sink for about 2 hours, until 10 a.m., and then removed to a dicing board. About the same time, the second six turkeys were removed from the cooker to the same sink for cooling. New water was drawn, but the sink was not cleaned.

In about one-half hour, by 10:30 a.m., the first six turkeys were diced, and the second six turkeys were removed from the sink to the same dicing board. By 11 a.m., all 12 turkeys had been diced. While the second six turkeys were being diced, the first six had stood at kitchen temperature (about 95° F.). At about 11 a.m. some of the white meat from the second six birds was put in the kitchen's refrigerator in reserve for sandwich orders from one of the hotel's restaurants.

While the turkeys were being prepared, a sauce was made from flour, oleomargarine, canned mushrooms, and milk. The milk was in the refrigerator until just before being used.

Next, this sauce was heated for about 10 minutes to a temperature reported to have been less than boiling. At the same time, the diced turkey was reheated in the pressure cooker at 5 pounds pressure to a temperature also reported to have been less than boiling. (Successful preparation of creamed turkey requires that both the turkey and the sauce be at about 180° F. or hotter when mixed.) Then the diced meat from all 12 turkeys and the sauce were combined. This turkey and sauce combination is called creamed turkey hereafter, though it was listed on the luncheon menu as "chicken a la king."

Just after the mixing, at about 11:15 a.m., the creamed turkey was put in pastry patty shells which were already on the plates. The patty shells had been baked during the morning of Friday, April 19. For approximately three-quarters of an hour the filled plates stood at kitchen temperature, and about noon they were put in portable warmers (175° F.) where they remained until about 12:30 p.m., when they were served.

The supply of creamed turkey was exhausted with about 25 persons yet to be served. After about 10 minutes' delay, these persons were served from a second batch of creamed turkey made from the refrigerated white meat formerly reserved for the restaurant, fresh sauce, and patty shells from the same batch as those served initially. All of the second batch of creamed turkey was consumed. The chronology of preparing and serving of the creamed turkey is shown in the table.

Time	*First six turkeys*	*Second six turkeys*
5:30 a.m.	Began cooking	
7:00		Began thawing
8:00	Ended cooking, began cooling	Ended thawing, began cooking
	(Sauce was prepared sometime during this period)	
10:00	Ended cooling, began dicing	Ended cooking. began cooling
10:30	Ended dicing	Ended cooling, began dicing
11:00		Ended dicing, reserved white meat
11:05	Re-heated sauce and diced meat from 12 turkeys	
11:15	Mixed sauce and diced turkey, put in patty shells	
12 N	Creamed turkey put in warmers	
12:30	Served meal, mixed second batch of creamed turkey	
12:40	Served second batch	

At this time there was also a shortage of 21 portions of cherry pie for which apple pie was substituted. There was no systematic correlation between the persons served the substitute foods. Additionally, some swapping of cherry and apple pie was reported. Although it was impossible to identify persons served the second

batch of creamed turkey, persons who ate apple pie were subsequently identified.

The investigating team developed a procedure for finding and a form for interviewing the 441 persons who ate the meal. Ultimately, 390 conventioneers were found and interviewed, most of them during the week of April 22–26, 1963. Of those interviewed, 229 were classified as "ill—possibly from suspect foods," 146 as "not ill," and 15 as "ill—but not from suspect foods."

Table 1. Frequency distribution of incubation periods as measured by symptom latency

Symptom latency (hours) [1]	Number of patients	Percent [2]
1	1	0.5
2	5	2.2
3	7	3.1
4	4	1.7
5	3	1.3
6	5	2.2
7	8	3.5
8	5	2.2
9	1	.5
10	11	4.8
11	21	9.2
12	18	7.9
13	24	[3] 10.5
14	22	[4] 9.6
15	20	8.7
16	13	5.7
17	15	6.6
18	15	6.6
19	4	1.7
20	7	3.1
21		
22	3	1.3
23	4	1.7
24	1	.5
25	3	1.3
26		
27	2	.9
28		
29	1	.5
30	1	.5
31	2	.9
32		
33	1	.5
34		
35	2	.9
Total	229	100.6

[1] Corrected for eastern and central time zone differences. [2] Rounded to nearest decimal. [3] Mode. [4] Mean.

Respondents were assigned to the last classification only after careful medical and statistical review of their symptoms and symptom latencies. Since for purposes of these analyses, there was no meaningful distinction between the last two classifications, they were combined so that 161 persons were classified "not ill."

Louisville and Jefferson County health agents interviewed 220 persons (56 percent of the total) and Kentucky State health agents interviewed 170 (44 percent of the total). The 220 interviews by local agents included 19 conducted by telephone with persons outside Jefferson County. The persons seen by the local agents were interviewed regardless of whether they had become ill or what they had eaten. However, several of the State agents interviewed only persons who became ill, and some of their interviews were incomplete.

The results of these interviews indicate that the average (mean) incubation period as measured by symptom latency was 14 hours, that it ranged from 1 hour to 35 hours, and that for the largest number of persons (mode) it was 13 hours (table 1). The figures in table 1 are entirely valid because the first appearance of most food poisoning symptoms is unavoidably noticeable.

The interviewees revealed that diarrhea, cramps, and nausea, in that order, were the most common symptoms. Among the several other symptoms reported were some unusual for food poisoning; however, they were deemed to have resulted from suggestive questioning by inexperienced interviewers. Since symptoms unrelated to food poisoning might have occurred, the validity of the figures in the following table is in direct proportion to their magnitude.

Symptom	*Number*	*Percent* [1] *(N=229)*
Diarrhea	217	95
Cramps	145	63
Nausea	111	48
Chills	35	15
Fever	28	12
Headache	25	11
Faint or weak	21	9
Other	14	6

[1] Rounded to the nearest whole number.

Only 34 persons reported that they received medical aid; one of those required hospitalization. The average duration of the illness was 27

hours. This figure is not entirely reliable, however, since in most cases there was difficulty in determining when the symptoms ceased.

Data Analysis

To determine the specific food that was responsible for the outbreak, morbidity and cross-reference tables were prepared. Table 2 shows the composite morbidity of all persons interviewed and indicates the attack rates for persons eating the suspected foods to be high and homogenous for all foods. Except for the snack, however, the suspected foods were served interdependently. Therefore, it was necessary to compute attack rates for persons not eating the suspect foods before conclusions could be drawn. The attack rate for persons who did not eat the creamed turkey was zero. The attack rates for those who did not eat the other foods were relatively high and homogenous, which was to be expected because, except for the pies, the components of the meal were served to all the guests.

When the difference in attack rates between persons who ate a suspect food and those who did not is small or negative, there is no significant difference between the attack rates for persons who ate a food and those who did not (table 2). A high positive value for this difference is indicative of the responsible food item. The value for creamed turkey is positive and far exceeds that of any other food.

Inferences About the Food Preparation

All 12 turkeys probably were undercooked. Directions printed on the pressure cooker state that thawed birds weighing 26–28 pounds should be cooked 208–224 minutes at 5 pounds pressure. Even with the most generous approximation, the first six of these somewhat icy birds could not have been cooked more than 150 minutes, and the second six not more than 120 minutes, with both sets of birds at 5 pounds pressure.

Multiplication of bacterial contaminants unkilled by cooking could have occurred in the first six turkeys during the 4½ hours after cooking but before consumption. Likewise, such multiplication could have occurred to a lesser extent in the second six birds during a similar, but shorter, period of 2½ hours. During these periods the meats were cooling, standing, or being worked at kitchen temperature or standing in a warmer.

Even if the turkeys had been cooked competely, there was ample time for bacterial invasion from an external source. There was also enough time for contaminant multiplication to and beyond the attack threshold—quite certainly for the first six birds, but less so for the second six (*1–3*).

Since the second batch of creamed turkey was composed of freshly made sauce and meat that had been refrigerated since about 1 hour after cooking, this batch may not have been contaminated. This assumption is supported by the facts that the second batch was served independent of the first and that many more persons reported illness than were served the second batch. However, since it was impossible to identify those persons served the second batch, their real attack rate is inextricable from that of all persons served creamed turkey.

Although the patty shells had been baked more than 24 hours before the meal was served, it is improbable that they were contaminated. Neither the literature nor the investigators suggested a bacterial or inorganic contaminant that might have either survived baking or invaded the finished pastry later and then caused an outbreak such as this one—even with the 24 hours between baking and consumption.

Conjectures About the Disease

Symptoms of botulism were not evident in this outbreak. Staphylococcus food poisoning is all but precluded because its incubation period is well established as much shorter than that observed in this outbreak. Further, the symptom latencies in this epidemic were long and varied enough to make improbable the presence of staphylococci or any other toxin-producing bacteria. For this same reason, it is just as improbable that inorganic toxin was present.

Both the distribution of the incubation periods and the symptomology of this outbreak are impressively similar to those reported in the literature for *Salmonella* infection. Further, it is well known that the visceral cavity of the turkey is always a suspected residence of *Sal-*

Table 2. Morbidity of 390 persons interviewed—229 ill and 161 not ill

Foods	Ate listed food				Did not eat listed food				Attack rate difference
	Ill	Well	Total	Attack rate (percent)[1]	Ill	Well	Total	Attack rate (percent)[1]	
Tomato juice	214	147	361	59	15	14	29	52	7
Creamed turkey	229	152	381	60	0	9	9	0	60
Sweet potatoes	217	149	366	59	12	12	24	50	9
Salad	219	151	370	59	10	10	20	50	9
Dressing	206	143	349	59	23	18	41	56	3
Broccoli	217	147	364	60	12	14	26	46	14
Cherry pie	213	144	357	60	16	17	33	48	12
Apple pie	11	6	17	65	218	155	373	58	7
Bread	190	142	332	57	39	19	58	67	−10
Butter	149	121	270	55	80	40	120	67	−12
Pastry	53	12	65	82	176	149	325	54	28
Milk	36	23	59	61	193	138	331	58	3

[1] Attack rates are the quotient of the number of persons ill divided by the total number of persons who ate the specific food.

monella organisms. Still further, both the implied undercooking and the long periods between cooking and consumption of the turkey made the microclimate suitable for *Salmonella* organisms to multiply to and beyond the attack threshold. A weakness in the epidemiologic data indicating *Salmonella* infection is that there were fewer reports of prostration and weakness than the literature suggests there would have been.

Salmonella organisms are relatively easy to find and identify; however, the Kentucky State Department of Health laboratory reported that no such organisms were found in the 14 stool specimens it had obtained, the intestinal contents of the person who died, or the unused turkeys from the same shipment as those in question. Although these negative findings are weak, they are strong enough for questioning somewhat the possibility of *Salmonella* infection, in spite of the rather strong epidemiologic findings.

It is reported in the literature that the incubation periods for *Streptococcus faecalis*, *Bacillus cereus*, and *Clostridium perfringens* food poisoning are similar to the one for this outbreak. However, the literature also reports that the symptomologies for those infections are less severe and varied than in this outbreak. Reports from the State laboratory contain positive findings of some *S. faecalis*, but negative findings for *B. cereus* and *C. perfringens*. From these laboratory results, and from the epidemiologic findings, it may be speculated that *S. faecalis* was the etiological agent.

Conclusions

The epidemiologic data clearly vindicated all suspect foods except the first batch of creamed turkey. There was insufficient evidence to determine whether the contaminants were internal and unkilled by the undercooking or external and contracted through unsanitary conditions after cooking. In either case, however, the initial concentration and subsequent multiplication probably could have been abated, perhaps below the attack threshold, by either reducing the time between cooking and consumption, or, if that were impossible, by adequate refrigeration during that period.

On the basis of the epidemiologic data and the reports from the State laboratory, it may be concluded that this outbreak probably was not botulism or staphylococcus food poisoning. On these same grounds, it probably was not *B. cereus* or *C. perfringens* food poisoning. It is most likely that it was *Salmonella* food poisoning, but it may have been streptococcal, or it may have been both.

Limitations to the Investigation

The effectiveness of this investigation was severely limited by the following conditions.

At the conclusion of the suspect meal, the

convention was adjourned and the members departed the hotel at once, presumably to their separate homes in all parts of the State.

No conventioneers, private physicians, or anyone else contacted the Louisville and Jefferson County Department of Public Health until about 1:30 p.m., April 22, 1963—49 hours after the suspect meal.

The hotel reported that all food was eaten or disposed of; hence, no direct sample was available for bacteriological examination.

Summary

An outbreak of food poisoning among 229 conventioneers was statistically traced to creamed turkey. The investigation was conducted by the Louisville and Jefferson County Department of Public Health and the Kentucky State Department of Health.

Of the 441 persons who were served the suspect meal, 390 were interviewed, and 161 of these did not become ill. The average (mean) incubation period as measured by symptom latency was 12 hours and for the largest number of persons (mode) it was 13 hours.

Diarrhea, cramps, and nausea, in that order, were the most common symptoms. Only 34 persons reported that they received medical aid; one of those required hospitalization. The average duration of the illness was believed to have been 27 hours. The symptoms were mild in the majority of cases, but there was one fatality which may have resulted from this outbreak.

There was insufficient evidence to determine whether the contaminants were internal and unkilled by undercooking or external and contracted through unsanitary conditions after cooking. The epidemiologic data and laboratory reports suggest *Salmonella* or *Streptococcus* food poisoning of unknown etiology or both. The investigation was limited by the statewide distribution of the diners' homes, the lateness of the reports of illness, and lack of direct food samples for laboratory analysis.

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Tearsheet Requests

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Motion Pictures of Coronary Circulation

Scientists have produced a motion picture giving a microscopic view of circulation within a living heart. The new technique will give medical scientists an unprecedented firsthand view of how drugs affect the heart and how the organ functions before, during, and after an attack.

Dr. Richard Bing, an internationally known cardiologist and professor of medicine at the University of Southern California, and Dr. Harold Wayland, professor of engineering science at the California Institute of Technology (Caltech), collaborated to devise the technique for use on laboratory animals.

The technique has broad implications for coronary research. For the first time viewers can actually see and measure directly what certain drugs do to coronary circulation. Previously, one had to rely on indirect calculations. For example, the action of nitroglycerine, which has been used for a long time in heart disease, has never before been studied by direct visualization.

Another important use of the motion pictures will be to study coronary circulation in laboratory animals before, during, and after artificially induced heart attacks. With microcirculation motion pictures of heart attacks in the animals, one can see not only how the diseased area is affected, but also how the rest of the heart is behaving.

Secondary uses of the motion picture technique include measurement of blood flow velocity in small capillaries and studies of the pattern of heart microcirculation compared with that of other tissues in the body.