

A Coordinated Investigation of a Food Poisoning Outbreak

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The investigation of an outbreak of food poisoning near Baltimore in July 1951 demonstrates a statistical epidemiological procedure which, it is believed, will be of value in determining offending foods in the absence of laboratory analyses. The purpose of this type of investigation is to locate the focus of poisoning so that measures which will decrease the possibility of recurrence of the unfavorable incident may be applied.

Initial Report

On July 19, 1951, the bureau of food control, Baltimore City Health Department, learned from a friend of one of the victims that a number of office workers had become ill after attending a picnic the previous day. The picnic was sponsored by the employees of a local insurance company. The office manager of the company was therefore requested to complete the questionnaire used by the Baltimore City Health Department in investigating outbreaks of food poisoning. The following information was obtained.

On July 18, 1951, the office personnel of the insurance company held an "outing" at a semi-

private resort approximately 30 miles from the city in an adjoining county of the State. Traveling by private automobile and public bus, 320 employees plus friends reached the resort at about 1 p. m. The day was cloudy, humid, and warm. Upon arrival, a number participated in bathing, horseshoe pitching, golfing, and playing soft ball. Exercise was normal, not too strenuous for such an occasion. Beer and pretzels were served constantly, "as much as desired." At about 6 p. m. a buffet style meal was served in an open casino. The food, displayed on tables and served by temporarily employed food handlers, was sliced cooked ham, recently fried crab cakes, potato salad, sliced tomatoes, heated baked beans, sliced bread, ice cream, cake, and hot coffee. Single-service containers only were used. Illness, principally nausea and vomiting, began about 2 hours after the food was eaten.

Field Investigation

On July 20, 1951, the county health officer investigated the resort food-handling procedure and interviewed the manager of the resort. It became readily apparent that the remainder of the food had been disposed of and that the manager was on guard so that the outbreak would not affect his future income from the resort. However, it was ascertained that the precooked ham, potatoes, and beans were purchased from a jobber nearby and delivered to the resort on the morning of the picnic. The crab meat in cans was stored in a standard

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family-sized electric refrigerator until the time of preparation. The tomatoes were procured the afternoon of the picnic from a wholesale vegetable supplier.

The management supplemented the regular staff of four cooks and waiters with nine extra helpers for the day. Food preparation began at 2 p. m. and was continued until serving at 6 p. m. The precooked ham, tomatoes, cake, and ice cream did not demand any special preparation.

The potato salad preparation began at 2 p. m. and continued until 4 p. m. This salad consisted of cut potatoes, saladise, onions, peppers, pimento, celery seed, pickled relish, vinegar, salt, and pepper. The saladise was procured in 1-gallon jars, which were kept in a basement storeroom until used. In the preparation of the salad a single gallon jar of saladise had been used. The pickled relish was also purchased in 1-gallon jars which were kept in a basement storeroom until used. All other ingredients were either fresh or kept on hand as standard season products in the usual commercial containers. The cook used his hands to mix the salad ingredients. There is every reason to believe that he did not wash his hands before

Table 1. Distribution of persons in attendance according to age, sex, and presence of illness

Age and sex	Total	Ill	Not ill	Percent ill
All ages.....	304	146	158	48
Male.....	101	42	59	42
Female.....	203	104	99	51
15-24 years.....	115	58	57	50
Male.....	18	7	11	39
Female.....	97	51	46	53
25-44 years.....	56	19	37	34
Male.....	32	12	20	38
Female.....	24	7	17	29
45 years and over....	28	17	11	61
Male.....	17	10	7	59
Female.....	11	7	4	64
Age not stated.....	105	52	53	49
Male.....	34	13	21	38
Female.....	71	39	32	54

Table 2. Distribution of ill persons according to time of onset of symptoms

Interval between consumption of food and onset of symptoms (hours)	Number reporting ill
Total.....	146
Less than 1.....	1
1-2.....	3
3-4.....	48
5-6.....	59
7-8.....	17
9-10.....	1
11-12.....	11
13-14.....	4
15 and over.....	2

preparing the salad, although neither the manager nor the cook would confirm this statement. After preparation, the salad was covered with waxed paper and left on the work table until serving time.

The crab meat in cans was delivered to the kitchen at noon of July 18, and the cook immediately began to prepare the crab cake patties, which consisted of bread crumbs, Worcestershire and Tabasco sauce, parsley, and pimentos, in addition to the crab meat. The patties were placed on large fryers and fried in deep fat at approximately 350° F. Before heating, the patties and ingredients were handled by the cook. The crab cakes were ready for serving about 5 p. m.

At approximately 5:30 p. m. the crab cakes, potato salad, baked beans, coffee, sliced ham, sliced tomatoes, sliced bread, squares of cake, ice cream in dry ice containers, paper napkins, individual cups, spoons, forks, and plates were transported in an open truck from the kitchen to the picnic area. The food was placed on long tables and served by the waiters to the line of guests, beginning at 6 p. m. Some of the party continued to have "seconds" until about 10 p. m., at which time the service was discontinued. After the remaining food was removed from the picnic area to the kitchen, it was given to the extra helpers to eat and to take home. The manager stated that not a single case of illness developed among the persons who consumed the food "leftovers." This statement had to be accepted as true.

The inspection of the kitchen revealed that general sanitation was "fair." The most sig-

nificant findings were: (a) improper cleaning of the meat grinder, resulting in residual putrefied meat on the parts; (b) 70° F. temperature in one of the two family-size iceboxes; (c) cracked work-table top; (d) no three-compartment sink for cleaning and disinfecting equipment; (e) glasses standing on shelves; (f) no facilities for handling kitchen working utensils; (g) no easily available hand-washing facilities. The general condition of work tables and butcher tables indicated the need for better equipment.

The water used was procured by electric pumps from a 90-foot driven well. For the last few years it has been of acceptable quality. A bacteriological analysis of the water taken on June 11, 1951, was negative for coliform organisms.

From the questionnaire information, 146 persons stated that they had become ill. The total number of persons fed, according to the manager of the resort, was 332.

Statistical Analysis of Food Histories

Questionnaires initiated by the bureau of food control and completed by persons attending the picnic provided information on 304 individuals. To facilitate analysis, punch cards were prepared for each person providing a food history.

The statistical analysis of the data obtained through the questionnaire was designed to indicate which segments of the group attending the picnic were selected for attack by gastrointestinal disease.

A description of the individuals attending the picnic, according to age and sex, is shown in table 1. The attack rate among females was significantly higher than that for males,

Table 3. Attack rates according to food consumed

Food consumed	Total eating	Number ill	Number not ill	Percent ill
Ham.....	230	108	122	47
Crab cake.....	235	124	111	53
Potato salad.....	246	142	104	58
Tomatoes.....	253	127	126	50
Ice cream.....	201	98	103	49
Beans.....	258	129	129	50

Table 4. Attack rates for specified food combinations

Food combination	Total eating	Number ill	Number not ill	Percent ill
Ham.....	230	108	122	47
With potato salad.....	189	106	83	56
Without potato salad.....	41	2	39	5
Crab cake.....	235	124	111	53
With potato salad.....	200	120	80	60
Without potato salad.....	35	4	31	11
Potato salad.....	246	142	104	58
Without ham.....	57	36	21	63
Without crab cake.....	46	22	24	48
Without ham or crab cake.....	103	58	45	56

although the difference, approximately 10 percent, was not striking. Differences are noted among the age groups, but here also it is apparent that the attack of all groups at a high rate is of more significance than the differentials.

A distribution of the individuals who were attacked, according to time between eating the food and onset of symptoms, is shown in table 2. The median time of onset was 5.2 hours, with 85 percent of all cases occurring from 3 to 8 hours following consumption of food. The outbreak of gastrointestinal disease appeared therefore to be associated with a single focus of exposure.

The manner in which individuals in attendance were attacked, according to their food histories, is given in table 3. The highest attack rate occurred among persons eating potato salad. However, relatively high rates also occurred for each of the other foods. The baked beans, tomatoes, and ice cream, however, could be considered as not being the cause of the illnesses. The beans were recently cooked and served hot; the ice cream was pasteurized under supervision and consumed by many persons who did not attend the picnic; and the tomatoes, unless contaminated by a chemical, could not be the cause of the illnesses. The severity as well as the timing of the illness did not indicate that it was caused by a contaminating chemical. The search for the offending

food was therefore narrowed down to the ham, crab cakes, or potato salad.

In view of the fact that the individuals attending the picnic had eaten several foods, it was thought that high rates of all suspect foods were the result of their close association with one another so far as their consumption was concerned. In order to determine the specific effect of a single food, a series of attack rates for combinations was undertaken (table 4). In the absence of potato salad, the attack rates associated with crab cake and ham became relatively insignificant. The attack rate for potato salad, however, remained high whether or not the salad was associated with other foods. Thus, high attack rates were associated specifically with the consumption of potato salad.

This method of determining attack rates for various food combinations is not too often possible because the number of individuals from whom detailed data can be secured in conjunction with a food poisoning incident is usually small. An alternative procedure commonly employed is the comparison of attack rates for persons consuming particular foods with attack rates for persons not consuming the specified foods. This type of analysis is shown in table 5.

Statistically significant differences in attack rates are obtained only for potato salad and crab cake. In the remaining cases, the attack rates seem to be independent of the consumption of the given foodstuffs. This type of analysis, although usually capable of providing a clear-cut inference concerning a source of food infection, only narrows down the possibilities in this incident. The information in table 4 furnishes the final solution to the specific vehicle of infection.

Table 6. Distribution of ill persons according to time of onset and symptoms of disease

Time interval (hours)	Emesis with or without diarrhea	Diarrhea only	Total
Total	120	26	146
1			
2	3		3
3	11	2	13
4	31	4	35
5	30	2	32
6	23	4	27
7	13		13
8	2	2	4
10	1		1
11	6	12	18

An explanation of the manner in which potato salad could have caused the illnesses may be developed from a study of the distribution of time of onset of symptoms, shown in table 6, and from the information obtained by the health officer during his investigation.

The only food of the three suspected ones that was handled with the bare hands and eaten without subsequent heat treatment was the potato salad. The deep-fat frying procedure used in the preparation of the crab cakes requires the fat to be above 300° F., which is sufficient to destroy any thermo-stable staphylococcic enterotoxin that may have been present. Ham usually becomes infected only in spots. The salad, with less solid consistency, maintained at a temperature of about 70° F. and prepared about 4 hours prior to serving, provided ample opportunity for infection, growth of the organism, and formation of the enterotoxin. The time of onset of the illness, 3 to 8 hours after consumption of the food, and the symptoms, chiefly emesis, indicate poisoning by an entero-

Table 5. Attack rates for specified foods according to history of consumption

Type of foodstuff	Total eating	Incidence of illness		Total not eating	Incidence of illness	
		Number	Percent		Number	Percent
Ham	230	108	47	74	38	51
Crab cake	235	124	53	69	22	32
Potato salad	246	142	58	58	4	7
Tomatoes	253	127	50	51	19	37
Ice cream	201	98	49	103	48	47
Beans	258	129	50	46	17	37

toxin produced by a staphylococcus. This time of onset and emesis are not indicative of botulism, salmonellosis, or parasitic infection, and poisoning by an inorganic chemical usually causes emesis within a shorter period.

Summary

Although statistical classification is used in this study as the primary instrument for uncovering causal sequences, a certain amount of past experience is also used. It is known that certain foods are unlikely to be responsible for outbreaks in which the symptoms and times of onset of the illness appear to have been caused

by a staphylococcal enterotoxin. Ice cream made by a plant known to pasteurize its product adequately, tomatoes, bread, cake, and coffee are very unlikely to support the growth of the staphylococcus in quantities sufficient to cause the symptoms experienced by those who became ill. The symptoms of the illnesses also probably eliminate a chemical as the cause. Concentration of search, therefore, was pointed to the ham, crab cakes, and potato salad. By determination of attack rates, which are specific for given foods and combinations of foods, a single focus, potato salad, was isolated as the probable cause of illness.

Radioactive Cortisone To Be Manufactured

Radioactive cortisone, which should prove valuable in the study of arthritis and the various metabolic diseases involving adrenal gland hormones, will soon be manufactured in sufficient quantities for research purposes. Funds for this project will be supplied by the National Institute of Arthritis and Metabolic Diseases, Public Health Service.

This cortisone contains radioactive carbon which makes it possible to trace it through the bodies of experimental animals. Such tracer studies may help solve the mystery of how cortisone acts to produce its dramatic effects in health and disease.

A small committee of scientists from non-Federal research institutions will administer the \$66,000 fund allotted for the project. Headed by Dr. Charles Huggins of the University of Chicago, this group will plan the project, bring together the starting materials, and contract with a suitable manufacturer. The product will be distributed to qualified scientists who submit formal research proposals to the National Institute of Arthritis and Metabolic Diseases.