

A Common Source Epidemic of Shigellosis

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ON THE EVENING of April 20, 1965, approximately 320 Army personnel, dependents, civilian employees, and guests attended a catered banquet in a private hall in San Antonio, Tex. Within a week nearly three-fourths of the diners were ill with what was later shown to be shigellosis (bacillary dysentery) caused by *Shigella flexneri* 4a.

Shigellosis is an infection which frequently is not diagnosed because of the inadequacy or lack of laboratory facilities. The disease is endemic throughout a large part of the United States (1). In epidemic form shigellosis has been less common than salmonellosis; explosive outbreaks have been reported infrequently. Usually protracted intra-institutional spread of the *Shigella* precedes the epidemic, which lasts weeks or months. Numerous relatively brief epidemics with high incidence also have been reported.

Green and McLeod (2) described an outbreak of 400 cases in a small town of 10,000 population in England in 1942. Two hundred of these cases occurred within a 6-day period; the entire epidemic lasted 1 month. The medium of

transmission was believed to have been the town's drinking water from which *Bacillus dysenteriae* was isolated (2).

An outbreak precipitated by a school lunch in 1954 in Ohio was reported by Keller and Robbins (3). In this epidemic the infection rate was 77.8 percent among 207 students and staff members who ate all or part of the suspected meal and 14.7 percent among 34 who did not eat. Secondary cases occurred within 6 weeks in 28 of 293 household contacts. The causative organism was *Shigella sonnei* 1.

Drachman and his associates (4) reported a waterborne epidemic in a small town of 1,600 population in Utah in 1960. During this epidemic, which extended from July 14 to 26, there were 500 cases, the majority of which occurred July 17-21. Sixteen percent of the cultures of stool from 218 persons, 71 percent of whom had been ill, yielded *Shigella flexneri* 6.

Among the reported outbreaks which lasted longer, three are of particular interest. One was attributed to food, one to flies, and the other to water.

The foodborne epidemic occurred aboard a U.S. Navy cruiser in the Marianas in 1947 (5). During a 23-day period 326 cases of bacillary dysentery occurred. *Shigella flexneri* III was stated to be the organism responsible. The initial cases were limited to personnel from a single mess, and isolation of *S. flexneri* from cultures of stools from 11 of 139 mess personnel suggested transmission through food.

An outbreak of 1,557 clinical cases of shigellosis in a military camp in the southern United States was reported in 1944 and was attributed to flies (6). The epidemic, believed to have been caused by *Shigella paradysenteriae*, Boyd

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88, began 2 weeks after a large unit moved into a bivouac area. Poor sanitation, especially in field latrine facilities, along with a great increase in fly breeding, was thought to be responsible for rapid, wide transmission within the unit. The outbreak reached a peak in 2 weeks and subsided when the latrines were operated properly and the flies were controlled.

The third outbreak occurred in a town of 11,000 population in Kansas in 1942 (7). It lasted from August 1 to September 23 with a total incidence of 2,685 cases, 2,255 of which occurred within the period September 8-14. The organism responsible was reported to be *Shigella paradysenteriae*, Flexner group. Heavy contamination of the town's water supply by sewage was believed to have been the cause of the outbreak.

The Epidemic

The San Antonio epidemic was underway for a week before its existence was recognized, and awareness came about only because of word-of-mouth reports and increased absenteeism in the Army headquarters. The delay in detection of the outbreak was in part attributable to two factors. First, the patients were treated in scattered military and civilian medical facilities. Second, the earliest cases were diagnosed as "flu" or "flu-like" syndrome.

When it became evident that an unusual number of people were involved in the same disease process, an investigation was begun. It was apparent immediately that the only factor common to all the patients and not to other persons was their attendance at the banquet given by the Army headquarters bowling league. Subsequent use of bowling teams' rosters aided immeasurably in the followup investigation.

The earliest cases attributable to infection and not to overeating or drinking were in patients seen on April 22, some 36 to 48 hours after the banquet. At one medical facility three persons who had attended the banquet were seen on April 22, and their condition was diagnosed as "flu" or respiratory infection.

On April 23 eight additional participants were seen at the same facility, and the condition of three of them was diagnosed as "flu" or respiratory infection. A culture of stool from

one of the eight persons contained an organism identified as one of the *Shigella* group. During the next 3 days an additional 22 persons were treated. If anyone involved in treatment of the 33 patients at this particular medical facility during these 5 days thought anything was unusual or detected any link between the patients, he failed to communicate it.

By the end of the first week the existence of the outbreak was at last recognized. During the next 4 days 11 persons were seen at the medical facility, and *Shigella* organisms were found in cultures of specimens from 6 of them. Subsequently questionnaires were completed by 276 of the approximately 320 persons who attended the banquet. Of these persons 196 (71.3 percent) reported that they had been ill and 104 (53.1 percent) had required medical treatment. Nine of those who required treatment were hospitalized.

Data regarding the onset and duration of the attacks are given in the chart. The majority became ill within 96 hours and remained so for several days. The symptoms, which are typical of shigellosis, are given for 196 persons in the following table.

Symptom	Number	Percent
Diarrhea	190	96.9
Abdominal cramps	175	89.3
Headache	115	58.7
Nausea and vomiting.....	87	44.4
Fever	75	38.3
Chills	70	35.7

Investigation

Stools positive for *Shigella flexneri* 4a were obtained from 56 persons, all except one of whom experienced clinical illness. The total number of persons whose stools were cultured while the patients were acutely ill is not known. The majority of the 56 still had symptoms at the time of culture, however. At least 1 negative stool specimen was eventually obtained from 217 of the 276 persons submitting questionnaires, including the 56 whose stools were originally positive. In 186 of the 217, negative stool cultures were obtained on 3 separate occasions. Fifty-nine persons did not submit specimens for culture.

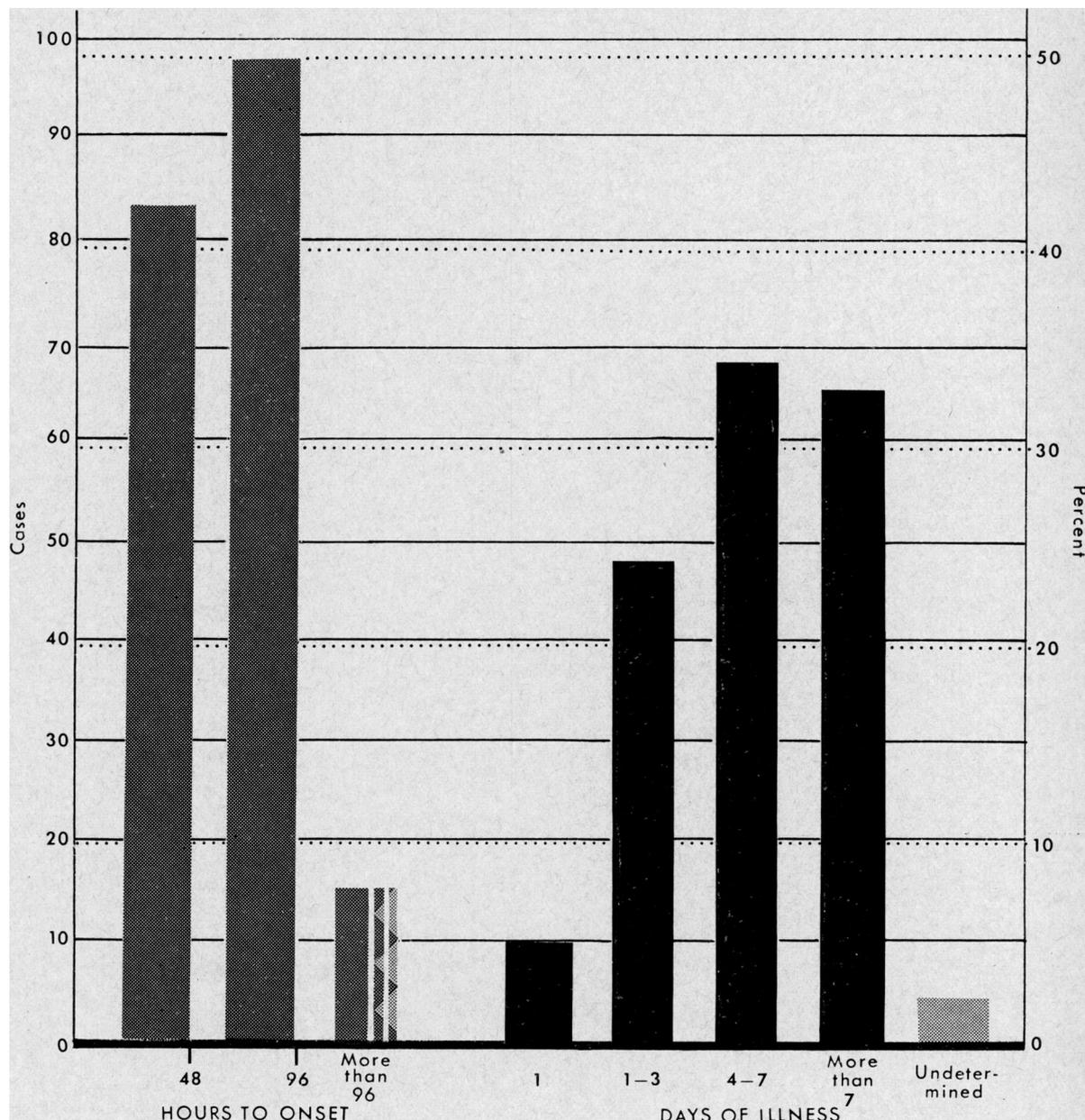
Most of the laboratory procedures were performed at the Fourth U.S. Army Medical Laboratory. Stool specimens were plated on SS

(*Salmonella-Shigella*) and McConkey's agar, and 1 gram placed in selenite F enrichment broth was transferred to SS and McConkey's media after approximately 24 hours' incubation. Colonies suggestive of pathological organisms were then inoculated to Kligler's iron agar media. Confirmation was by slide agglutination and biochemical tests.

The majority of patients seen at Fort Sam Houston were treated with tetracycline in doses of 1 to 2 grams a day for approximately 7 days or until stool cultures were negative. The details of treatment for patients seen elsewhere are not known.

Data on the foods consumed at the banquet are given in the table. It is obvious from the

Duration of incubation period and of illness among 196 of the 276 persons who completed questionnaires after dining at bowling league banquet, San Antonio, Tex., April 20, 1965



NOTE: Five persons known to have been ill left the San Antonio area before termination of illness.

numbers in the table that potato salad stands alone as the one food which determined whether an individual became ill. This determination is apparent only from the negative or "did not eat" numbers. Of the five persons who did not eat potato salad but did become ill, two had their first symptoms the same evening and were well in a day or so; the other three became ill within 8, 10, and 13 days. It is most likely that the first two were ill from overindulgence and the other three were ill from secondary or coincidental nonspecific infections. None of the five had a stool culture positive for *Shigella*.

Food for the banquet was prepared by the staff of a local restaurant and delivered to the hall, where it was kept refrigerated or in steam trays as required. The potatoes used in the salad were obtained from a supplier who delivered them cooked and diced to the restaurant where the salad was prepared and refrigerated.

The dining hall and the restaurant kitchen were inspected 8 days after the banquet. Sanitary defects were minor and food practices were satisfactory. Rectal swabs were obtained from the two workers who were reported to have prepared the food for the banquet. The swabs were placed in tetrathionate enrichment broth from which SS, bismuth sulfite, and brilliant green plates were streaked at a half hour and

24 hours. No colonies suggestive of pathological organisms appeared on these plates. This procedure was carried out at the San Antonio Metropolitan Health District laboratory.

The potato processing establishment was inspected the same day, and major sanitary deficiencies were noted. Flies were numerous, and the lavatory lacked soap and towels. After the potatoes were peeled and cooked, they were cooled, unprotected from flies, in front of a fan for several hours, and then diced.

The potatoes were placed in plastic bags and baskets as they were diced. During this process some of the potatoes spilled onto the floor while others were partly in contact with the floor through the latticework of the baskets. Upon completion of the dicing, some 4 hours after the potatoes were cooked, the bags and baskets of potatoes were placed in a walk-in refrigerator. On the day of inspection the temperature of the refrigerator was 52° F., and the internal temperature of a bag of potatoes which had been in the refrigerator for approximately 3 hours was 64° F. No further processing was carried out until the potatoes were delivered in an unrefrigerated truck to the restaurant where the salad was made.

Additional periods of time during which the potatoes remained unrefrigerated occurred at the restaurant while the salad was being pre-

Food consumption of 276 persons who completed questionnaires after dining at bowling league banquet, San Antonio, Tex., April 20, 1965

Food	Ate				Did not eat			
	Ill		Not ill		Ill		Not ill	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Potato salad.....	192	77.4	56	22.6	5	17.9	23	82.1
Beef.....	145	72.9	54	27.1	52	67.5	25	32.5
Chicken.....	64	78.0	18	22.0	133	68.6	61	31.4
Beans.....	170	73.0	63	27.0	27	62.8	16	37.2
Barbecue sauce.....	140	76.9	42	23.1	57	60.6	37	39.4
Pickles.....	114	74.0	40	26.0	83	68.0	39	32.0
Onions.....	70	69.3	31	30.7	127	72.6	48	27.4
Tomatoes.....	107	74.8	36	25.2	90	67.7	43	32.3
Bread.....	135	72.2	52	27.8	62	69.7	27	30.3
Pretzels.....	102	75.6	33	24.4	95	67.4	46	32.6
Popcorn.....	95	75.4	31	24.6	102	68.0	48	32.0
Beer.....	151	70.2	64	29.8	46	75.4	15	24.6
Coffee.....	36	65.5	19	34.5	161	72.8	60	27.2
Soft drinks.....	43	84.3	8	15.7	154	68.4	71	31.6

pared and later during delivery to the banquet hall. Although the duration of these periods could not be determined accurately, it is estimated that the total time the potatoes were unrefrigerated after they were cooked was approximately 3 to 4 hours.

The two employees who had prepared the potatoes for the banquet were reported to have left their jobs shortly thereafter. No reason was given. These two persons were traced by the health department, and rectal swabs obtained from them 9 days after the banquet. The cultures were negative. Neither person admitted a recent illness.

Discussion

This outbreak of dysentery was unusual because it was a large epidemic attributable to a single meal in a noninstitutional setting. When shigellosis occurs on a vessel, in a military camp, in a school, or in some other institution where meals are taken, a single meal seldom can be isolated as the one at which transmission occurred. Exposure in such settings generally continues through a number of meals over a period of time.

Transmission of foodborne infection in a restaurant seldom is detected unless the symptoms are unusual or the number of persons involved is overwhelming. A point source epidemic of salmonellosis is more likely to be recognized than a point source epidemic of shigellosis because the shorter incubation period of the former results in a closer temporal relation of the illness to the exposure. One-time meals sponsored by churches or other organizations frequently have generated outbreaks, but these have most commonly been caused by staphylococci or salmonellae.

Shigella flexneri 4a has been the reported cause of large outbreaks of dysentery in the Far East (8, 9) and in the Middle East (10). This serotype, however, is unusual in epidemic form in the United States and its incidence is relatively infrequent. *S. flexneri* 4a has been reported recently as occurring with a frequency of 5.2 percent among *Shigella* serotypes isolated during a 21-month survey period; the same report described *S. flexneri* 4a as the sixth most commonly isolated strain of *Shigella* in the

United States (1). It was reported in 1964 as being isolated for the first time in Australia (11).

Failure of the medical personnel to recognize the occurrence of an epidemic was attributable partly to the dispersion of the cases. In at least one facility, however, a sufficient number of cases were seen to indicate that something unusual was happening. While the earliest cases initially were not typical of an enteric infection, the later cases were typical, and the earlier patients reported diarrhea when they revisited the facility. Epidemiologic inquisitiveness and a search for correlation among the cases might have suggested a distinct outbreak before the delayed discovery.

Summary

An outbreak of illness following a bowling league banquet did not come to the attention of public health personnel until it had been underway for a week. Investigation was then undertaken by Fort Sam Houston and the San Antonio Metropolitan Health District.

Questionnaires were completed by 276 of the 320 persons who attended the banquet. One hundred ninety-six persons reported that they had been ill. Of these, 104 required medical attention. Fifty-six patients yielded stool specimens positive for *Shigella flexneri* 4a. All of those whose stool cultures were positive and many others on the basis of illness only received tetracycline compounds. At the completion of the investigation, 217 persons, including the 56 whose stool specimens were initially positive, yielded at least 1 negative stool specimen.

On the basis of food-consumption histories, potato salad served at the banquet was the suspected vehicle of transmission. Subsequent investigation revealed that the potatoes had been handled under very insanitary conditions after cooking and that several periods existed during which the potatoes and later the potato salad were not refrigerated. No history of illness was elicited from the workers who prepared the food for the banquet, and rectal swabs taken from them 9 days later were negative for causative organisms.

The findings show the difficulties inherent in detecting the source of a food infection out-

break which has already been underway for a week. The necessity for maintaining high standards of sanitation during food preparation and the need for adequate refrigeration of prepared foods are clearly demonstrated.

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Education Notes

Toxicologists in Air Pollution. Temple University School of Pharmacy will start training toxicologists to work with air pollution problems. Directed toward students with adequate preparation in biology and who have taken undergraduate work in pharmacy and chemistry or engineering, the 12-month course will lead to a master's degree in environmental health.

A stipend of \$250 a month plus an allowance for dependents and tuition charges will be paid from funds available through a Public Health Service grant. Additional information can be obtained from John D. Robson, Temple University Health Sciences Center, 3400 North Broad Street, Philadelphia, Pa. 19140.

Oral Medicine Research Training Program. The University of Pennsylvania School of Dental Medicine and Philadelphia General Hospital have established a postgraduate curriculum in oral medicine.

The program, supported by the National Institute of Dental Research, Public Health Service, is analogous to those leading to doctoral degrees in the medical specialties. It involves instruction and

supervised research for candidates who eventually will select problems for their own independent investigations.

Enrollment is open to graduates of dental and medical schools who have served a 1-year hospital internship. Stipends of \$5,500 to \$7,000 will be accompanied by allowances for tuition.

Additional information is available from Irwin I. Ship, D.M.D., Director, Oral Medicine Training Program, Philadelphia General Hospital, 34th Street and Curie Avenue, Philadelphia, Pa. 19104.

Air Pollution Control Institute. The University of Southern California conducts an air pollution control institute which it has approved for 12 units toward the degree of master of public administration. Intended for persons who wish to substitute its curriculum for writing a thesis, the 6-month program includes a review of engineering-physical sciences and biological-medical material and field training.

The next institute will be held from January 9 to June 9, 1967. Financial assistance to students is available from a sponsoring agency or a fellowship awarded by the institute.

Additional information may be obtained from the Director, Air Pollution Control Institute, University of Southern California, Civic Center Campus, 206 South Spring Street, Los Angeles, Calif. 90012.