Shigellosis in Sitka, Alaska, 1968

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SHIGELLOSIS in epidemic form has been less common than salmonellosis. Sporadic outbreaks have been associated with contaminated food and water, but in recent years community outbreaks from a common source have been reported infrequently in the United States (*1–3*). This decline has been attributed to improved housing and sanitation (*4*).

Six outbreaks of shigellosis were reported to the National Communicable Disease Center during the first 6 months of 1968, and no common source could be incriminated (*4*). One of these outbreaks occurred in Sitka, Alaska, and is discussed in detail in this report. Person-to-person transmission is postulated as the primary mode of spread.

Background

Sitka, the old capital of the territory in North America held by Russia, is a prosperous community surrounded by mountains and nestled in a well-protected harbor on the west coast of Baranof Island, 125 miles south of Juneau. According to information released by the Alaska Department of Commerce, the population of Sitka has remained stable during the past 10 years with 3,237 and 3,327 residents in 1960 and 1970, respectively. In 1960 the population of the community was one-third Tlingit Indian and two-thirds white. The Indian population is well integrated and no longer resides predominantly in a section of Sitka known as "Indian Village."

The principal industries are fishing and lumbering. Salmon and Dungeness crab canneries and a multimillion dollar pulpmill are located in or near the city.

A junior college and a State-maintained home for retired Alaska residents are located in the city. In 1968 there were five public schools with an enrollment of 1,553 (fig. 1).

The village of Mount Edgecumbe is on neighboring Japonski Island and is essentially a part of Sitka. At half-hour intervals a ferryboat crosses the narrow channel and residents of Mount Edgecumbe frequently go to Sitka to shop, attend church, and visit friends and relatives. Primary education is obtained at the Mount Edgecumbe Grade School, but after the fifth grade the children attend the public schools in Sitka. The Bureau of Indian Affairs' Mount Edgecumbe High School is attended by approximately 650 Eskimo, Indian, and Aleut children from all parts of Alaska. A Public Health Service hospital is adjacent to the school and provides medical care for the Indian beneficiary population of southeast Alaska.

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Investigation

Four cases of dysentery caused by *Shigella sonnei* were identified by the State laboratory in Juneau during the week of April 21, 1968. This organism had not been isolated in Alaska for at least 2 years, and when reports of a widespread outbreak of gastroentéritis were received, a detailed epidemiologic investigation was undertaken. All local physicians were notified and radio publicity was used to inform the community of the outbreak and to encourage persons with gastroenteritis to seek medical aid.

Stool specimens from all patients seeking medical attention for diarrhea, fever, and cramps were subsequently submitted to the local hospital laboratory. Rectal swabs and stool specimens were streaked directly onto *Salmonella-Shigella* agar plates and placed in Selenite F enriching fluid. Suspect isolates from the agar and subcultures from the enrichment broth were forwarded to the State laboratory on triple-sugar-iron slants and grouped with *Shigella* antiserums.

Each household from which a positive specimen was obtained was contacted, and each family member was instructed to submit a stool specimen to the State laboratory. The specimens were transported in Hajna's medium. Serologic confirmation of *Shigella* in each culture was obtained from the National Communicable Disease Center in Atlanta, Ga.

A physician and public health nurse visited households where illness occurred and filled out a detailed questionnaire on 23 of the 27 documented cases (table 1). Questions covered dining in restaurants, social activities, and contact with persons with diarrhea. Specific histories were obtained on consumption of milk, meat, eggs, seafood, and produce. The grocery store that supplied each patient's food was also noted.

During the week of May 26 a communitywide illness survey was conducted through the students of the Sitka public schools and the Mount Edgecumbe Grade School. Of the 1,100 questionnaires distributed, 828 (75 percent) were returned. All persons with a history of either diarrhea and cramps or diarrhea, fever, and cramps were considered to have had an illness consistent with shigellosis.

Figure 1. Geographic distribution of shigellosis, Sitka, Alaska, 1968

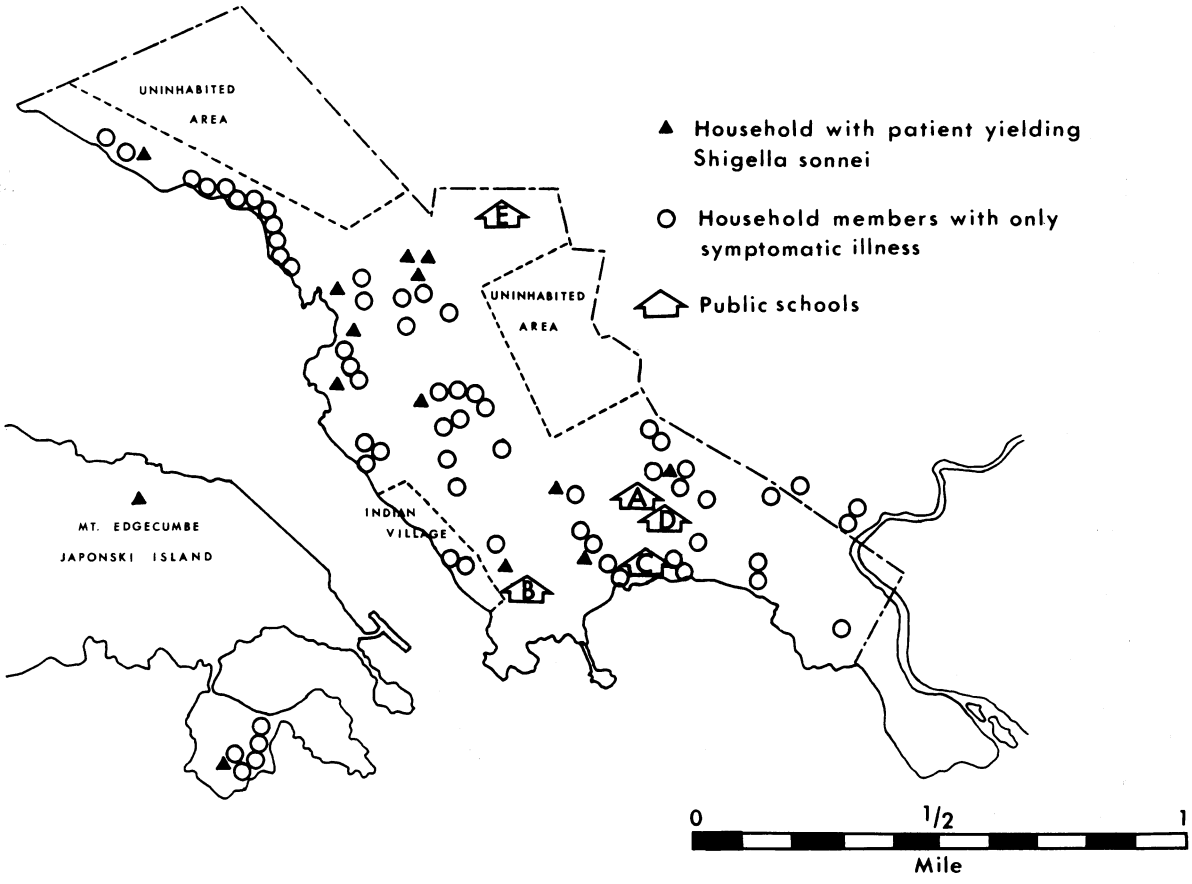


Table 1. Persons yielding specimens positive for *Shigella sonnei*, Sitka, Alaska, 1968, by date of onset of illness

Date	Sex	Age (years)	School and grade or status	Number of cases in family	Number of persons in family
April 21	F	7	A–2	1	3
April 25	F	5	Preschool	4	5
April 27	F	15	E–9	3	10
Do	M	3	Preschool	1	3
Do	M	2	do	4	5
April 29	F	15	D–8	1	9
May 1	F	29		4	5
Do	F	53		1	2
Do	M	8	B–2	1	4
Do	M	3	Preschool	4	6
May 6	M	3½	do	2	3
Do	F	26		3	5
Do	F	15	E–9	1	7
May 8	M	30		4	5
May 13	F	8	A–1	1	5
Do	F	9	A–4	5	6
May 14	F	30		2	4
May 15	M	7	A–1	(1)	(1)
May 16	M	12	D–7	2	4
Do	F	5	Preschool	3	5
Do	M	8	B–2	3	4
May 19	M	4	Preschool	2	4
May 20	M	6	A-kindergarten.	1	4
May 21	F	4½	Preschool	2	4
May 31	M	24		1	1
Do	F	5	Preschool	(1)	(1)
(2)	M	30		3	5

[1] Unknown.

[2] Asymptomatic.

Results

Of 301 cases of illness consistent with shigellosis reported to have occurred among Sitka residents between March 15 and June 2, 1968, 26 were confirmed by culture. One asymptomatic carrier was identified. The date of illness onset was noted by 266 of the patients, and even though abrupt increases in the number of new illnesses occurred during the weeks of March 31 and April 28, no single week had a large cluster of cases (fig. 2). The number of new cases gradually declined during May, and in the week of the survey only two were reported.

Of 116 families reporting illness, a single index case was followed by one or more secondary cases on 78 occasions. In contrast, only 38 of the 116 families reported the occurrence of co-primary cases in which the second illness in a family occurred either simultaneously or within 48 hours after the onset of the index case.

The origin of the outbreak could not be determined. However, *S. sonnei* was isolated from small clusters of patients in Ketchikan, Alaska, and Seattle, Wash., in March and April 1968. Sitka residents frequently visit these communities. Also, a statewide political convention was held in Sitka during the first week of April, and many of the participants were housed in private residences because of the shortage of hotel accommodations.

All persons excreting *S. sonnei*, except one asymptomatic carrier, reported diarrhea, fever, and abdominal cramping. The cramping was especially severe in four patients and resulted in an exploratory laparotomy and appendectomy in one of the early patients. *S. sonnei* was isolated from the appendiceal fluid. Illness in most of the patients lasted 3 to 4 days, but five patients had prolonged cramping for 6 to 8 days. Four persons with documented cases suffered relapses (or reinfection) after being symptom free for 5 to 7 days.

Illness was reported from all areas of the borough and city of Sitka (fig. 1). The families involved were predominantly in the middle-income stratum, but crowded living conditions were not uncommon in this group because many lived in housetrailers. Many of Sitka's residents in the lower socioeconomic stratum reside in "Indian Village." There were no laboratory confirmed cases from this section, and only two cases were reported in the illness survey. There were few cases in Mount Edgecumbe; only seven illnesses occurred there. There were no known cases among students of the Bureau of Indian Af-

fairs High School or the junior college or among residents of the State home.

The age distribution of the patients revealed relatively few cases among the preschool (under 5 years) and older (over 35 years) populations, even though these two groups accounted for more than 50 percent of Sitka's population (table 2). *S. sonnei* was isolated from only one person over 35, and only 29 of the 301 cases were in persons in this age group. The age-specific attack rates among students in the grade and junior high schools were 24 and 28 percent, respectively; more than double the attack rate of 11 percent among preschool children (table 2).

Illnesses occurred in all five of the Sitka public schools, but 90 of the 152 cases among students were in enrollees in school A (table 3). An additional comparison between pupils in grades 1–3 in school A and in the same grades in school B disclosed a significantly greater attack rate in school A ($P<0.01$).

Figure 2. Shigellosis cases, by week of onset, Sitka, Alaska, 1968

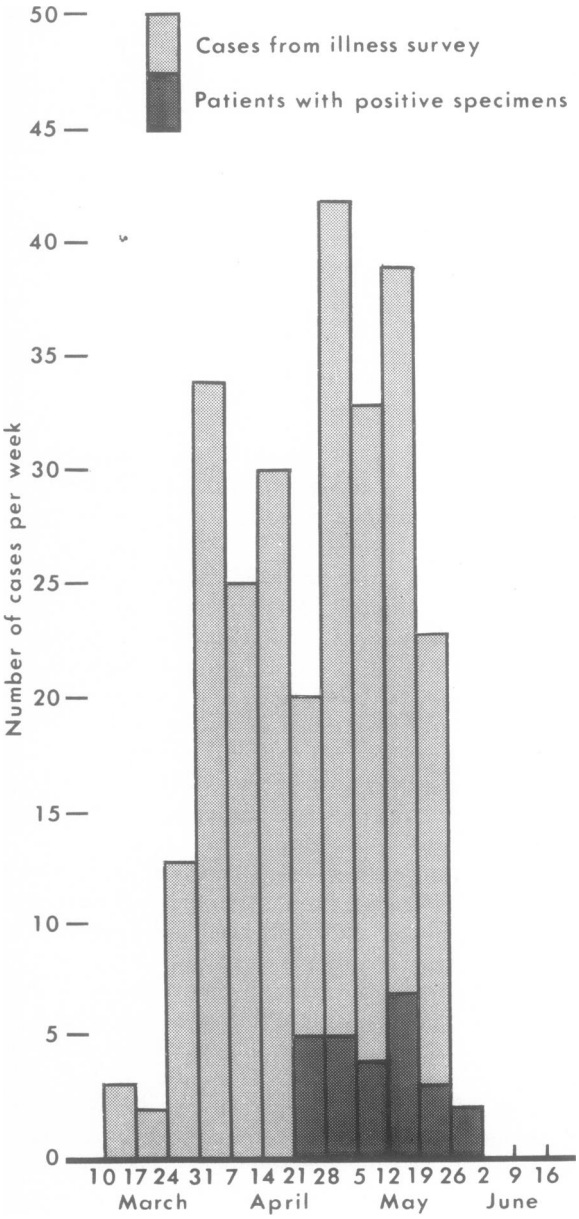


Table 2. Age-specific incidence of shigellosis among surveyed population, Sitka, Alaska, 1968

Age group (years)	Population	Number ill	Attack rate (percent)
0–4	421	47	11
5–9	355	84	24
10–14	255	72	28
15–19	298	18	6
20–24	200	6	3
25–29	231	12	5
30–34	239	28	12
35–39	214	13	6
40–49	350	14	4
50 and over	674	2	<1
Unknown		5	
Total	3,237	301	9

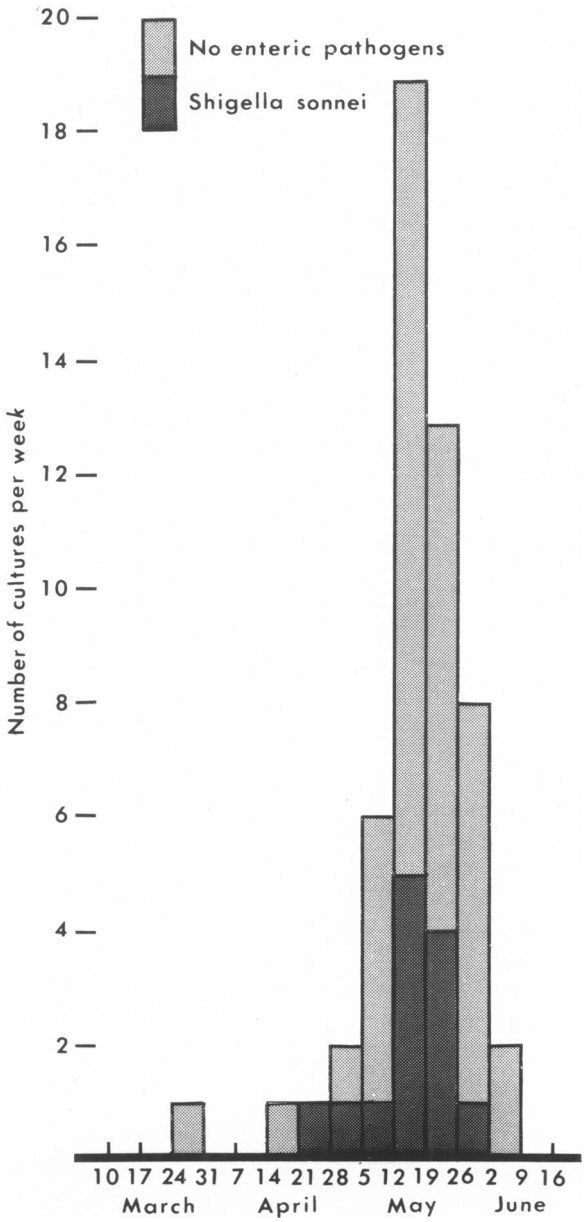
Table 3. Attack rates of shigellosis in Sitka, Alaska, public schools, 1968, by school and grade

School and grade	Number of students	Number of cases	Attack rate (percent)[1]
School A	658	90	14
Kindergarten	98	10	10
1	110	21	19
2	90	13	14
3	103	15	14
4	120	15	12
5	129	16	12
Special education	8	0	0
School B	109	7	6
1	46	4	9
2	38	2	5
3	25	1	4
School C–6	136	16	12
School D	251	19	8
7	131	12	9
8	120	7	6
School E	399	20	5
9	122	7	6
10	101	7	7
11	92	3	3
12	84	3	4
Total	1,553	152	10

[1] Rounded to the nearest whole number.

A common source could not be found. Contamination of the city water supply was not documented, and daily records indicated adequate chlorination. There was no incidence of water shortage, water shutdown, or recent construction in the area. No common denominator could be found concerning restaurant visits or participation in social activities. The patients' food came from a number of grocery stores, and no common food could be identified.

Figure 3. Stool specimens cultured by the Sitka Community Hospital Laboratory during shigellosis outbreak, by week, Sitka, Alaska, 1968



Discussion

Large outbreaks of shigellosis in the United States usually are confined to institutions for the mentally retarded, psychiatric hospitals, ghettos, and Indian reservations, where sanitary facilities or good personal hygiene are minimal or lacking (*2–5*). In Sitka the original source of the outbreak could not be identified, but the following epidemiologic data support the supposition that person-to-person transmission was the subsequent mode of spread.

1. Cases occurred over a 3-month period
2. Illness was dispersed throughout the community
3. Of more than 300 cases, 184 were secondary.

The presence of an adequate water supply together with the lack of common social activities, restaurant visits, and food consumption by persons with laboratory-confirmed cases also ruled strongly against a common source

A convalescent carrier state commonly follows shigellosis (*6*), and this phenomenon probably is responsible for the concentration of cases in the school-age population, especially in school A. Once illness was established in school A, *S. sonnei* was able to move with ease from family to family, especially through the children in grades 1–3. Relatively few kindergarten children became ill, but these youngsters only attend school half days and do not mingle with other students in the lunchroom.

Two observations may account for the significantly different attack rates for the students in grades 1–3 in school A and those in school B. First, the children are separated geographically. Students in school B reside predominantly in "Indian Village" (fig. 1). These children have little, if any, contact with students in school A, who live in the residential areas of the city and borough. Second, a hot lunch is served in school A, and the students mingle in the cafeteria during the lunch hour. There is no lunch program in school B, and since the children return to their homes for lunch there is less chance of fecal-oral transmission.

Squalor and unsanitary living conditions apparently are not prerequisites for transmission of shigellosis in open populations (*2*). In Sitka, persons in the lower socioeconomic stratum were spared. Illness occurred primarily in the households of the middle socioeconomic stratum; patients lived in single-family dwellings in generally good repair with adequate washing and sanitary facilities. Many lived in trailers, however, and the close quarters of housetrailer living probably contributed to person-to-person spread. A similar lack of correlation between cleanliness of the home and school-centered outbreaks was noted in Britain (*6*).

Shigellosis frequently is not diagnosed because of the relative fragility of the organism and the loss of its viability during transportation of specimens. Facilities for bacteriological determinations are frequently lacking or inadequate in rural Alaska. Case investigation and culturing specimens from family contacts dramatically increase the number of confirmed cases (7). Once shigellosis had been documented in Sitka and culturing of specimens was encouraged, 23 additional cases were documented during a 3-week period (fig. 3). Symptoms were generally so mild that most of the illnesses would not have been recognized had this investigation not been done. More frequent culturing of specimens from patients with febrile gastroenteritis would greatly increase the number of *Shigella* isolates both in Alaska and the rest of the United States.

When studies failed to reveal a common source, attention was focused on documented cases. All patients were treated with antibiotics, instructed in personal hygiene, and encouraged to isolate themselves even from their families. A sharp decline in reported cases and positive cultures was documented. The efficacy of this therapeutic program further supports the hypothesis that person-to-person transmission was primarily responsible for inter- and intra-household spread.

REFERENCES

(1) Mosley, W. H., Adams, B., and Lyman, E. D.: Epidemiologic and sociologic features of a large urban outbreak of shigellosis. JAMA 182: 1307–1311, Dec. 29, 1962.

(2) Elsea, W. R., Partridge, R. A., and Neter, E.: Epidemiologic and microbiological study of a *Shigella flexneri* outbreak. Public Health Rep 82: 347–352, April 1967.

(3) Tucker, C. B., Fulkerson, G. C., and Neudecker, R. M.: A milkborne outbreak of shigellosis in Madison County, Tenn. Public Health Rep 69: 432–436, May 1954.

(4) U.S. Public Health Service: Shigella surveillance. Report No. 16. National Communicable Disease Center, Atlanta, Ga., 1968.

(5) Eichner, E. R., Gangarosa, E. J., and Goldsby, J. B.: The current status of shigellosis in the United States. Amer J Public Health 58: 753–763, April 1968.

(6) Davies, J. B. M.: Symptomless carriers in home contacts in sonne dysentery. Brit Med J No. 4777: 191–192, July 26, 1952.

(7) Hardy, A. V., and Watt, J.: Studies of the acute diarrheal diseases. 23. Epidemiology. Public Health Rep 63: 363–378, Mar. 19, 1948.

CLARK, PAUL S. (Center for Disease Control, Anchorage, Alaska), NOBLE, GARY R., MAYNARD, JAMES E., and BARRETTE, PAULINE: *Shigellosis in Sitka, Alaska, 1968. Epidemiologic study. HSMHA Health Reports, Vol. 86, February 1971, pp. 173–178.*

An outbreak of dysentery associated with *Shigella sonnei* occurred in Sitka, Alaska, during the spring of 1968. A communitywide survey revealed 300 cases of illness.

The date illness began was noted by 266 patients, and although an abrupt increase in the number of illnesses occurred during the weeks of March 31 and April 28, no single week had a cluster of cases. Of the 116 families reporting illness, a single index case was followed by one or more secondary cases on 78 occasions. In contrast, only 38 families reported the occurrence of co-primary cases in which the second illness in a family occurred either simultaneously with or within 48 hours after the onset of the first illness. Twenty-six cases were confirmed and one asymptomatic carrier was identified as a result of a culture. The attack rate was 9 percent.

Diarrhea, fever, and abdominal cramping were commonly reported, and the severity of symptoms in one patient lead to an exploratory laparotomy. Epidemiologic studies indicated that person-to-person transmission of illness was the primary mode of spread, especially between grade school children and persons in the middle-income stratum. Preschool children and persons in the lower income stratum were uniquely spared.

Reduction in the number of new cases was associated with intensified case investigation, surveys of cultures of specimens taken from members of each patient's household, and antibiotic therapy for patients with documented cases.