

A Survey of Enteric Infections Among Alaskan Indians

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LESS IS KNOWN about the occurrence of diarrheal diseases among the Indians of Alaska than among the Eskimos of Alaska. Reports by Williams (1), Pauls (2), Babbott and associates (3), Gordon and Babbott (4), and Williams and Dodson (5) have focused more on the coastal regions than the interior, where the Indians live. In 1957 Dr. J. D. Douglas, Arctic Aeromedical Laboratory, Ladd Air Force Base, Alaska, investigated diarrheal outbreaks at Fort Yukon and Arctic Village. Fifty-one cases occurred at Fort Yukon, mainly in children less than 2 years old; eight cases occurred in Arctic Village, all in persons under 17 years old. No bacterial pathogens from either village were isolated. To explore the possibility that dogs might be a source of human infection, Dr. J. C. Schlotthauer, also from the Arctic Aeromedical Laboratory, had examined fecal specimens from dogs at Fort Yukon and two military bases near Fairbanks in 1955. *Salmonella typhimurium* was found in 7 of 100 dogs at Fort Yukon; however, no bacterial pathogens were found in 166 dogs examined at the military bases.

Dr. Fournelle, bacteriologist, was formerly with the Arctic Health Research Center, Public Health Service, Anchorage, Alaska. He is now with the Service's National Institutes of Health, Bethesda, Md. Mrs. Rader, Gulpport, Miss., made the parasitological examinations. Mrs. Allen was a bacteriologist-technician at the Arctic Health Research Center during the study.

We contemplated an enteric survey of the Indian population in the upper and lower Yukon River areas in the fall of 1958, so we asked Dr. W. Burns Jones, physician-in-charge, Hudson-Stuck Memorial Hospital, Fort Yukon, for information on the prevalence of enteric infection in that area. In personal communication, he stated that 36 persons with diarrhea, some with other symptoms, mainly upper respiratory, had been treated at the clinic during April 1958. Eleven patients were children between 1 and 9 years old. All fecal specimens sent out for bacteriological examinations were reported negative for pathogens. Jones stated that diarrhea seemed to be a yearly problem with the coming of warmer weather and that the children were most often affected, especially the younger ones.

Study Plan and Methods

Our survey of Alaskan Indians was similar in approach and methodology to the earlier survey among the Alaskan Eskimos (6). The purpose was to supplement prior studies of the Eskimos and to give a more comprehensive understanding of enteric disease among the Alaskan natives. Information was obtained through 1,626 household interviews and laboratory identification of bacterial, parasitic, and viral pathogenic agents.

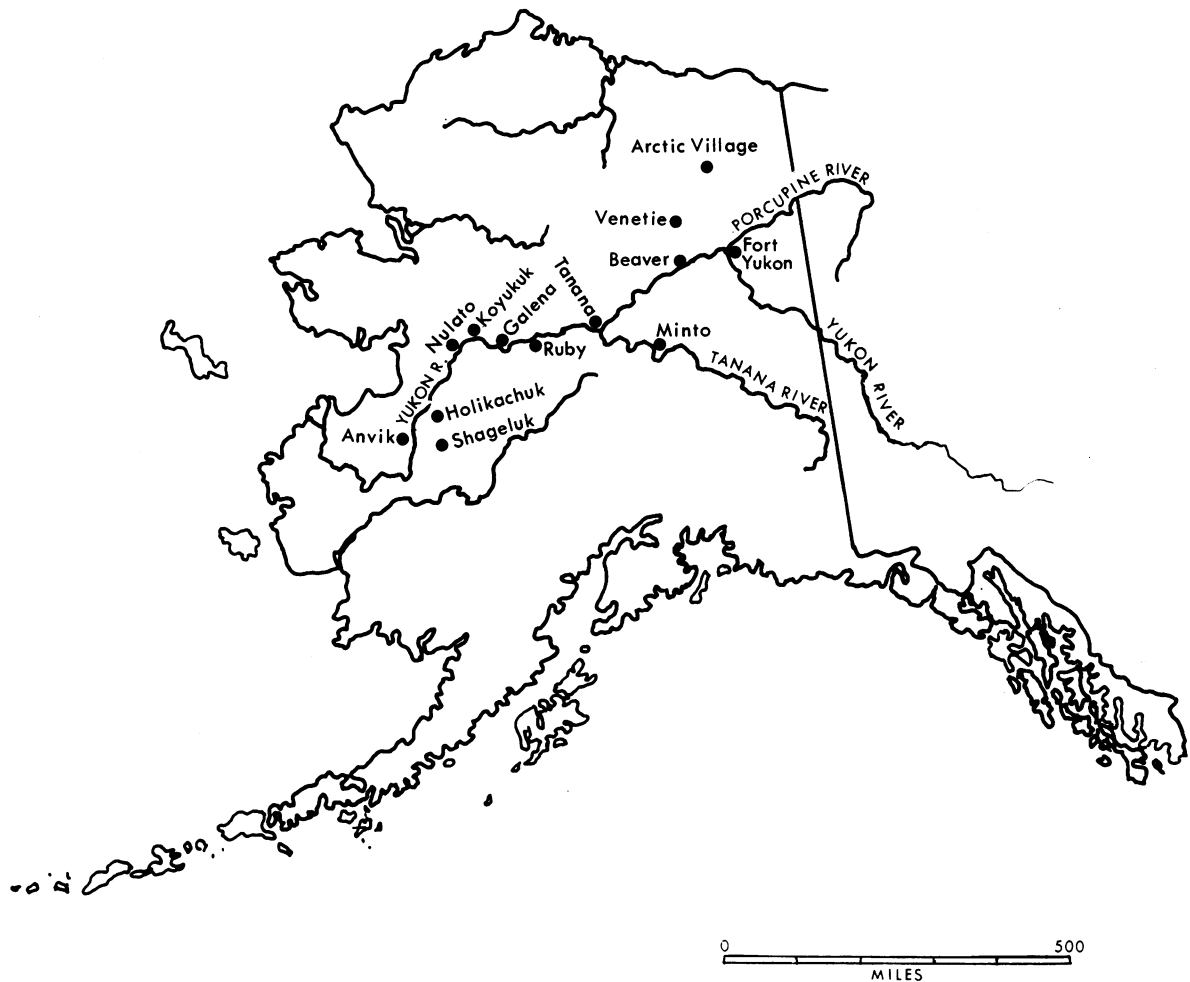
A total of 389 human fecal specimens, or about 80 percent of the number collected in eight villages, were examined for viruses. Although we had planned to examine a limited

number of fecal specimens from dogs in each village for bacteria and parasites, this was not accomplished because of poor response to requests for specimens in the first five villages. Bacteriological screening procedures were simplified for field use. Initial culturing was done on *Salmonella-Shigella* (SS) agar and in selenite broth. Specimens to be examined for the enteropathogenic *Escherichia coli* types were done on MacConkey agar. Suspected pathogenic bacteria were picked onto triple sugar-iron (TSI) agar slants, and those presumed to be pathogens were transferred to nutrient agar slants.

Further biochemical and serologic characterizations were done in the Anchorage laboratory of the Arctic Health Research Center. A detailed account of procedures was published in

1956 (7). Specimens for parasitological examination were placed in merthiolate-iodine-formaldehyde (MIF) solution (8) and later shipped to a contract parasitologist, Mrs. Rader, in Mississippi. Specimens for virological examination were placed in Earle's balanced salt solution containing antibiotics, kept cold but not frozen, and shipped on completion of the village study to the central laboratory in Anchorage for culturing and identification of viral agents.

During August and September 1958, the senior author visited 10 villages in the upper Yukon River area: Venetie, Arctic Village, Beaver, Fort Yukon, Minto, Tanana, Ruby, Galena, Koyukuk, and Nulato. In November, villages in the lower Yukon River area were visited: Holikachuk, Shageluk, and Anvik.



Location of Alaskan villages visited

Village locations are shown on the map. Populations of these villages ranged between 93 and 475 persons, with an approximate total of 2,215 persons in the 13 villages. Of this total about 170 were white persons, not included in the survey unless they were part of an Indian household. Except for the larger villages, each household in a community was visited, and the members were interviewed. A total of 290 households were included in the survey. Most often the mother supplied information about the family.

As in previous studies, we used a simple definition of the term "diarrhea." In the lower Yukon the Indians call it "getei-estrin" which means excessive abnormal fecal discharge. Although a new record sheet was used that called for further details on the illness, it did not help much in obtaining additional information. In each village the senior author was accompanied by one of the Indians, usually an older woman, and if possible, a leader in the community. This no doubt was a factor in obtaining a high degree of cooperation in some villages, promoting both a successful interview and a good supply of specimens. Specimen containers were left for each member of the family, with instructions to bring the specimens to the field laboratory soon after they were passed. Most of the people contacted understood and spoke English, except some of the very elderly.

The nurses who saw and treated most ailments within the villages corroborated data from the household interviews and also provided additional information on diarrheal upsets. Three villages were served by missionary nurses. In two others, the wife of the local minister was a nurse. One of the seven Public Health Service hospitals ministering to Alaskan natives is in Tanana. At the time of the survey, the hospital staff consisted of one physician and several nurses.

When interviewing, we attempted to get as much information as possible without prompting the people being interviewed. Many times they may tell you what they think you want to hear, and leading questions are likely to evoke affirmative replies. We recognize that precise recall is difficult to obtain and becomes progressively less reliable as time elapses between the occurrence of illness and interrogation.

Past episodes of diarrhea in the family were related to other events or happenings; for example, summer fish camp. Although these people willingly supplied information during interviews, they did not cooperate as well as the Eskimos in returning fecal specimens.

Results

Interview data were collected from 1,626 persons, or 73.4 percent, of the approximate total Indian population of the 13 villages. Of those in the study, 445, or 27.4 percent, gave a history of diarrhea within a 19-month period (table 1). Village rates ranged between 10.5 and 47 percent. The highest attack rate, 54.6 percent, was in the 1- to 4-year age group. Children under 10 years comprised 43.9 percent of the persons in the study and 61.1 percent of the patients with diarrhea. Their attack rate was 38.1 percent. These findings check well with statements by the two physicians and the nurses resident in the area, who were unanimous in saying that the children, and especially the young children, are most frequently involved in the diarrheal upsets. The attack rate between males and females was not significantly different.

Alaskan Indians recalled the following number of cases of diarrhea from May 1957 through November 1958, by month of onset:

<i>Month</i>	<i>Number of cases</i>
January -----	1
February -----	3
March -----	11
April -----	12
May -----	14
June -----	39
July -----	113
August -----	106
September -----	112
October -----	22
November -----	2
December -----	0
Unknown -----	10
Total -----	445

The interviews were conducted during August, September, and November. Onset of cases in July, August, and September accounted for 74.4 percent of the total. The recent nature of the episodes probably helped to pinpoint the time of occurrence in many homes visited in August and

September. However, this trend was also substantiated by data of the villages visited in November. By recall, 18 percent of the cases occurred while the families were in fish camp during June, July, and August. The heavy, late summer incidence was also cited by the missionary nurses.

Like the Eskimos, the Indian population interviewed was relatively young. The median age fell within the 10- to 19-year age group, with 43.9 percent under 10 years of age and 63.7 percent under 20 years old. Those 50 years old and over accounted for 6.6 percent.

From economic necessity, the houses are small and considerably overcrowded. Of the 290 dwellings visited, 57.2 percent were one-room structures and 26.6 percent were two-room structures. The other structures consisted of three rooms (8.3 percent) and four rooms (3.8 percent), one 5-room house, and four 6-room houses. Seven families were living in tents at the time of the visit. Most houses are of frame construction, but in the more northern villages they are practically all of logs. An average 5.6 persons occupy the average 1.6-room house.

Environmental conditions are much alike throughout the 13 villages except in several of the larger ones, where some inhabitants have access to a better water supply. Generally, water comes from a nearby river and is used untreated. The majority of people use privies,

Table 1. Attack rates of diarrhea in Alaskan Indians, by age groups, May 1957–November 1958

Age groups (years)	Number of persons interviewed	Persons with history of diarrhea	
		Number	Percent
Under 1.....	90	29	32.2
1-4.....	302	165	54.6
5-9.....	322	78	24.2
10-19.....	322	51	15.8
20-29.....	175	29	16.6
30-39.....	157	28	17.8
40-49.....	117	24	20.5
50-59.....	50	12	24.0
60-69.....	36	13	36.1
70-79.....	20	6	30.0
80-89.....	2	0	0
Unknown.....	33	10	33.3
Total....	1,626	445	27.4

Table 2. Intestinal parasitic infection rates of Alaskan Indians, by age groups, August–November 1958

Age groups (years)	Number of fecal specimens examined	Fecal specimens positive for parasites	
		Number	Percent
Under 1.....	56	4	7.1
1-4.....	178	68	38.2
5-9.....	215	106	49.3
10-19.....	158	81	51.3
20-29.....	54	27	50.0
30-39.....	69	28	40.6
40-49.....	49	22	44.9
50-59.....	29	10	34.5
60-69.....	20	8	40.0
70-79.....	7	3	42.9
80-89.....	1	1	100.0
Unknown.....	19	2	10.5
Total....	855	360	42.1

few of which are satisfactorily constructed, and it is common for several families to share one unit. Some unenlightened inhabitants continue to dump all their household wastes on the surface of the ground, usually not far from their dwellings.

Lack of adequate refrigeration can be significant, especially during the summer months when it may be responsible for food spoilage. In some villages and among some families, the nurses and school teachers have had some influence in persuading the people to improve their living conditions. In recent years, sanitation aides, selected from the native population and trained by sanitary engineers, have succeeded in improving sanitation habits in some villages.

Bacterial infections. Two bacterial pathogens were isolated from 4 of the 855 fecal specimens examined. There were three isolates of *Shigella sonnei* and one of *E. coli* 055:B5. One isolate of *S. sonnei* came from a 10-year-old girl in Ruby, Alaska, with diarrhea at the time of the household visit. She submitted a liquid stool showing blood and mucus. Two older children in the family were also having diarrhea while two younger children were recovering from it. Specimens from the four siblings were negative.

The second *S. sonnei* isolate came from a 25-year-old woman in Nulato, who gave no history of diarrhea but whose six children (4



Schoolhouse in Arctic Village

months to 8 years old) had diarrhea about a week earlier. The stools of the five children examined were bacteriologically negative.

The third *S. sonnei* isolate came from an 11-year-old girl in Anvik, who was one of eight children living with their parents. The mother stated that the girl had diarrhea in October, 3 to 4 weeks before the interview. She also stated that the entire family had diarrhea when they were in fish camp in June and July.

The enteropathogenic *E. coli* type was isolated from an 8-month-old boy, a patient in the Tanana hospital, where a number of the very young patients were reported to have had diarrhea during the previous summer months.

Thirty fecal specimens obtained from dogs during the study were negative for bacterial pathogens.

Parasitic infections. The 855 human fecal specimens were also parasitologically examined by the MIF direct (8) and concentration (9) techniques. Intestinal infection rates, by age

groups, are shown in table 2. A total infection rate of 42.1 percent was found, with relatively little variation among most age groups. The greatest variations were in the very young, the very old, and the age-unknown categories. Variations in the very old and age-unknown categories may be due to the small numbers investigated.

The results of the parasitological examinations, by age groups, are shown in table 3; the numbers include single and multiple infections. *Entamoeba coli* accounted for 55.3 percent, *Endolimax nana* 16.6 percent, and *Giardia lamblia* 19.3 percent of the parasitic infections. No *Entamoeba histolytica* was found. A total of 10 helminthic infections were found; 2 were *Diphyllobothrium* species.

Parasitic infection rates were higher for females (200 of 451) than for males (160 of 404); 44.3 percent for females and 39.6 percent for males. Of the 360 infected persons, 259 or 71.9 percent had 1 parasite, 84 or 23.3 percent

Table 3. Prevalence of single and multiple intestinal parasites in Alaskan Indians, by age groups, August–November 1958

Age groups (years)	<i>Entamoeba coli</i>	<i>Endolimax nana</i>	<i>Iodamoeba bütschlii</i>	<i>Dientamoeba fragilis</i>	<i>Giardia lamblia</i>	Total protozoa	<i>Diphyllobothrium species</i>	<i>Enterobius vermicularis</i>	Ascarid	Hookworm	Total helminths	Total parasites
Under 1.....	3				1	4						4
1-4.....	39	14	1	7	25	86		1		1	2	88
5-9.....	85	24		11	36	156	1	5			6	162
10-19.....	59	20	1	5	21	106						106
20-29.....	21	5		2	3	31						31
30-39.....	23	9		3	4	39						39
40-49.....	16	4	1	1	2	24	1				1	25
50-59.....	10					10						10
60-69.....	6	3		1	1	11						11
70-79.....	2	1				3						3
80-89.....	1					1						1
Unknown.....	2					2			1		1	3
Total.....	267	80	3	30	93	473	2	6	1	1	10	483

had 2 parasitic types, and 15 or 4.2 percent had 3 parasitic types. Two 5- and 6-year-old siblings had four identical parasites; namely, *E. coli*, *E. nana*, *G. lamblia*, and *Dientamoeba fragilis*.

In detecting trophozoites and ova, the differences between the techniques used were slight. However, the concentration method showed 346 cysts compared with 287 by the direct method. On the whole, the preservation of trophozoites, cysts, and ova was found to be very good.

Viral infections. A total of 389 human fecal specimens were examined for enteric viruses. About 80 percent of the specimens were from eight villages. Positive specimens came from Fort Yukon, where there were 12 isolations of poliovirus type III; and from Minto, where there were 2 isolations of Coxsackie virus A9 and 1 of ECHO (enteric cytopathogenic human orphan) virus 19 (10). ECHO 19 as well as 11 other ECHO types have been shown to be associated with enteritis (11). All isolations were from healthy persons.

Discussion

Although diarrhea was reported among the Alaskan Indians throughout the year, it was found to be most prevalent during the late summer months. Household interviews and discussions with the missionary nurses in the

Indian villages indicated that diarrhea is a sporadic problem in the families and villages. Although the nurses have been caring for these people for several years, they did not know of an outbreak involving a number of families at one time in a village. Furthermore, diarrheal disease is usually not severe except in the very young. Diarrhea has been involved in the death of infants along with other symptoms; however, it is often difficult to identify precisely the principal cause of death. Upper respiratory infections are a common concurrent complaint among these people.

The recent diarrheal illness among the Alaskan Indians surveyed resembled shigellosis in a number of respects; namely, in the mild and sporadic nature of the symptoms, the occurrence mainly in young children, and the isolation of *S. sonnei*.

There was no indication that intestinal parasites were responsible for the illness. In many instances, positive results were obtained solely by the concentration technique. This survey represented our third use of the MIF method of stool preservation, and we found it well suited to conditions where examinations must be delayed.

ECHO virus 19, known to be associated with enteritis, was isolated once. Reinhard (10) reported on 31 isolations of 8 types of ECHO viruses from the Eskimo communities of Napas-

kiak and Oscarville, sampled in 1956 and 1957 (12). ECHO types 18 and 19 have been implicated elsewhere as possible diarrheal agents. A similar association of ECHO types 5, 6, 7, 10, 13, and 14 has not been established.

This survey indicated that the occurrence of enteric diseases among the Alaskan Indians is similar in a number of respects to that found earlier among the Alaskan Eskimos.

Summary

Personnel of the Arctic Health Research Center, Anchorage, Alaska, interviewed 1,626 persons, or 73.4 percent of the approximate population (2,215) of 13 Alaskan Indian villages, to determine the prevalence of enteric infection among these people.

A total of 445 persons in the study group, or 27.4 percent of those interviewed, gave a history of diarrhea within a 19-month period. The highest attack rate, 54.6 percent, was in the 1- to 4-year age group. Children through 9 years of age had an attack rate of 38.1 percent. The onset of illness in 74.4 percent of the total number of patients occurred during July, August, and September.

Fecal specimens were cultured in the field for bacterial pathogens, and final identification of cultures was made in the research center laboratory in Anchorage. Specimens for parasitological and virological examinations were placed in preservative fluids in the field and shipped to the laboratory.

Two bacterial pathogens were isolated from 4 of the 855 fecal specimens examined. Three isolates of *Shigella sonnei* and one of *Escherichia coli* 055:B5 were obtained. *Entamoeba histolytica* was not detected. The parasitic infection rate was 42.1 percent. The degree of parasitism per person and the types found were

not considered to be of etiological significance. Enterovirus ECHO 19, considered a possible diarrheal agent, was isolated once in 389 human fecal specimens examined for enteric viruses.

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Program Notes

Training Ambulance Attendants

The Pennsylvania Department of Health sponsored training in the past year to help 1,000 people in the State become better ambulance attendants. During the past 5 years, 4,644 ambulance attendants have received formal instruction on what to do when helping people in need of emergency treatment.

The 50-hour course provides instruction on treatment of injuries and on what attendants should do when transporting people stricken by heart attacks, strokes, and other serious illnesses. Special instruction is also given in safe operation of ambulances and the use of resuscitation equipment.

End of Medical Scholarships

The Florida State Board of Health has recommended discontinuance of the State's medical scholarship program which was designed to help provide general practitioners for rural areas.

Of 125 students accepted under the program since 1955, only 14 have fulfilled their agreement to serve, for each year of scholarship, 15 months in a rural community needing a physician. Fifty-two students found they were unable or did not want to abide by their agreements and have either repaid the State or are in the process of doing so. Two have refused to abide by their contracts or repay the State. Some of the students have not yet finished their medical training.

Board members blame the trend to specialization and the increasing availability of scholarships with less restrictions for the small returns of the program.

Tuberculosis Decline in Alaska

Alaska's tuberculosis rate is now five times that of the nation, but it represents a new low for the State. In 1950 the rate was 10 times that of the nation.

Dr. Robert I. Fraser, chief of the Alaska Division of Public Health's tuberculosis control unit, reported that 1965 showed a 17 percent reduction in the new case rate—a reversal of an upward trend during the first years of the 1960's. In the early 1950's, he pointed out, more than half of the first-graders entering school in Alaska had positive tuberculin tests, compared with less than 2 percent in 1965.

Automobile Inspections

In 1960, 9 of the 50 States had two automobile inspections a year, and 8 others required one inspection. Statistics for that year showed that States which inspect vehicles had a lower death rate for the male population between the ages of 45 and 54 than noninspection States. Moreover, two inspections appeared to be more effective than one.

Robert C. Buxbaum, M.D., and Theodore Colton, Sc.D., two Harvard Medical School investigators, reported these observations at the last annual session of the American College of Physicians.

The doctors noted a lowering of death rates with a rise in income, especially in States requiring inspections, and a correlation between changes in death rates and the adoption of State automobile inspection between 1950 and 1960.—Massachusetts Department of Public Health's *This Week in Public Health*, May 9, 1966.

Decision on Town Dump

The Supreme Judicial Court of Massachusetts recently affirmed the decree of the Superior Court in conjunction with operation of the town dump in Tewksbury. The town is now required to operate its dump as a sanitary landfill or cease operating it. If it is not so operated, the town officials will be liable for contempt.

Many of the State's cities and towns operating open-face dumps may now find it desirable to convert their operations to sanitary landfills. — Massachusetts Department of Public Health's *This Week in Public Health*, May 2, 1966.

Declining Childhood Mortality

Childhood mortality in the United States has shown a downward trend for 25 years. Both boys and girls have experienced this trend. The death rate at ages 1-14 years dropped from 155 per 100,000 in 1940 to 59 in 1964—a 60 percent reduction.

Gains in the past decade, however, have been appreciably less rapid than in the preceding 15 years. Accidents are the greatest single threat to the life of children. They are responsible for about one-third of all deaths among boys at ages 1-4 years and nearly half the total at school ages. Among girls, also, 1 of 3 deaths in the same age range results from injuries.—Metropolitan Life Insurance Company *Statistical Bulletin*.

Women's Responsibilities

U.S. women under 35 years who are heads of families have relatively more young children in their care than do U.S. men under 35 who head husband-wife families. The number of "own children" under age 18 per 100 families headed by persons who were under 35 years as of March 1965 averaged 180 for husband-wife families and 236 for families with female heads.

Many of the female family heads were also the family breadwinners. In 1964, for example, half of the female family heads in the United States were in the labor force.—Metropolitan Life Insurance Company *Statistical Bulletin*.

Items for this page: Health departments, health agencies, and others are invited to share their program successes with others by contributing items for brief mention on this page. Flag them for "Program Notes" and address as indicated in masthead.
