Although approximately one-half of the Eskimos observed in this study gave a history of diarrhea, few pathogenic bacteria or parasites were identified as likely causative agents. While diarrhea continues to be a problem, it does not appear to be as serious today as it was in the past.

Seasonal Study of Enteric Infections in Alaskan Eskimos

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SEVERAL QUESTIONS pertaining to the recurrence of diarrhea and of bacterial and parasitic infections remained unanswered after a survey of enteric infections in Alaskan Eskimos (*1*). To augment the survey, we undertook a year's study in an Eskimo community during which time samplings were taken at different seasons. The year-long study was designed to determine occurrence of diarrhea and specific bacterial and parasitic infections by season, age, and sex, and to answer specific questions such as how many times during the year an individual reported diarrhea and how many times bacterial pathogens and parasites were found in that individual.

The occurrence of diarrhea among Alaskan natives has been reviewed by Babbott and associates (*2*). Fournelle and co-workers (*1*) found that *Shigella* was the main causative agent among the Eskimos of southwestern Alaska, where the children under 10 years of age accounted for about two-thirds of the cases of diarrhea and isolates of bacterial pathogens. Approximately one-third of the persons surveyed reported diarrhea, with prevalence greatest during July and August. Few *Salmonella typhosa* and pathogenic *Escherichia coli* were isolated. Dogs were not considered important as a source of human infection because examination of 278 dogs yielded only one bacterial pathogen. Parasitic infections were not considered extensive.

Mainly because of their accessibility throughout most of the year, the neighboring villages of Napaskiak and Oscarville were selected for this seasonal study of enteric infections. The villages are located on the Kuskokwim River in southwestern Alaska about 5 miles from Bethel and approximately 400 air miles from Anchorage. Napaskiak's population was 129 and Oscarville's 46, with a total of 38 household units.

A house rented from an Eskimo in Napaskiak served as a bacteriological field laboratory and as living quarters for the fieldworker (Fournelle). Procedures and techniques have been described previously (*3*). Briefly, fecal specimens were cultured on SS agar, with enrichment in selenite broth in most cases. Colonies resembling salmonellae, shigellae, or coliform organisms (in infantile diarrhea) were picked onto TSI agar slants and were saved for further

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studies in the Anchorage laboratory. For the parasitological examination, a small portion of the fecal specimen was placed in MIF stain-preservative solution (*4*), which was later shipped to Mississippi for examination by a contract parasitologist.

Prior to laboratory work, each occupied dwelling in the two villages was visited to find out something about morbidity from diarrhea among members of the households. Since it was necessary to employ an interpreter during the interview, diarrhea was defined simply as consisting of at least 3 or 4 stools a day and usually lasting at least 3 days. Although we sought additional information on symptoms, we were not always successful. Usually the mother was the informant. Specimen cartons were left for everyone with instructions to bring specimens to the field laboratory soon after they were passed.

Findings

Six field trips were made during July 1956 to June 1957 with samplings and examinations during July, August, October, January, April, and June. The individuals sampled in each of the 6 interviews numbered 146, 163, 135, 167, 167, and 147, and totaled 925. Diarrheal attack rates, by month of occurrence, are shown in table 1. Where history of diarrhea was reported, a single episode was recorded only once, although it may have been reported more than once during successive interviews.

Table 1. Occurrence of diarrhea, by month, March 1956–June 1957

Month	Number of cases (163)	Attack rate [1] (per 1,000)
1956		
March	4	27
April	0	0
May	2	14
June	18	123
July	33	226
August	27	166
September	15	111
October	6	44
November	2	12
December	20	120
1957		
January	13	78
February	4	24
March	5	30
April	2	12
May	5	34
June	5	34
Unknown	2	----------

[1] Rate of persons interviewed reporting diarrhea during specified months.

NOTE: Italics designate months when interview took place.

Table 2. Occurrence of diarrhea, by age groups, July 1956–June 1957

Age group (years)	Person-years observed	Cases of diarrhea	
		Number (163)	Attack rate (per 1,000)
Under 1	6. 9	2	290
1–4	32. 9	73	2, 219
5–9	30. 8	26	844
10–19	32. 8	8	247
20–29	27. 5	11	400
30–39	17. 1	14	819
40–49	23. 1	13	563
50–59	8. 5	6	706
60–69	4. 8	5	1, 042
70–79	5. 4	2	370
Unknown	3. 1	3	968

The total cases of diarrhea reported were 163. The annual diarrheal attack rate for the community was 845 per 1,000 persons observed. Eighty-eight (50.6 percent) of the 174 individuals sampled reported diarrhea during the year. Of the persons who reported diarrhea, 38 (43.2 percent) had 1 diarrheal attack; 30 (34.1 percent) had 2 attacks; 15 (17.0 percent) had 3 attacks; and 5 (5.7 percent) had 4 attacks. Frequency of diarrhea appeared to be greater among females (53/94) than among males (35/80), but the difference is not statistically significant ($P=0.10$). Annual diarrheal attack rates, according to age groups, are shown in table 2.

Bacterial Pathogens

Bacteriological examinations were made of 638 fecal specimens collected during the six sampling periods. In most instances, multiple stool specimens were received from the 174 individuals sampled, with an average of 3.7 specimens per individual. Only 1 bacterial pathogen, *Shigella flexneri* 2a, was isolated from 3 individuals who gave no history of diarrhea.

The organism was isolated during the August field trip from a 16-year-old male and from an elderly woman whose age was not ascertained. The third individual was a 4-month-old girl from whom the organism was isolated during the January trip.

Parasitic Infections

Parasitological examinations were also made of the 638 fecal specimens collected during the year. All specimens were examined by the MIF direct (*4*) and concentration techniques (*5*). There were 292 (45.8 percent) specimens positive for parasites. Parasitic infection rates for the 6 sampling periods ranged between 368 per 1,000 (October) and 587 per 1,000 (April). The largest number of parasitic types found in a single specimen was three. The numbers of individuals infected with one or more parasites and those infected with *Entamoeba histolytica* and *Diphyllobothrium* sp. are shown in table 3 according to age group. In general, total parasitism was high among all age groups, with the lowest frequency of infection in those under 1 year of age. Prevalence of the three classes of parasites listed was high.

The results of the parasitological examinations are shown in table 4. Two hundred fifty-nine parasites were recovered from 174 individuals sampled. Of these, 78 (44.7 percent) had more than 1 parasite. The largest number of parasitic types found in an individual was 5, all being found in 2 girls, aged 3 and 10 years. The parasites were *Entamoeba coli*, *Endolimax nana*, *Iodamoeba buetschlii*, *Diphyllobothrium* sp., *E. histolytica*, or *Giardia lamblia*. The 2 girls submitted 5 and 4 specimens, respectively, in each of which 1 or more parasites were found.

Table 4. Parasites recovered from preserved fecal specimens of 174 persons, July 1956–June 1957

Parasites	Number	Percent
Entamoeba coli	90	51.7
Entamoeba histolytica	15	8.6
Endolimax nana	68	39.1
Iodamoeba buetschlii	5	2.9
Giardia lamblia	11	6.3
Chilomastix mesnili	1	.6
Diphyllobothrium sp	60	34.5
Enterobius vermicularis	8	4.6
Ascaris sp	1	.6

Ten of the 15 individuals positive for *E. histolytica* were found in the July sampling. One of the 15 was positive twice, in July and October.

Forty-four (73.3 percent) of the 60 individuals positive for *Diphyllobothrium* sp. were found in the April sampling. Eight individuals were positive twice (7 of them in consecutive samplings), and 1 each was positive 3, 5, and 6 times. One woman, aged 40, was positive

Table 3. Parasitic infections, by age groups, July 1956–June 1957

Age group (years)	Number of individuals sampled	Individuals infected with—					
		One or more parasites		*Entamoeba histolytica*		*Diphyllobothrium* sp.	
		Number	Percent	Number	Percent	Number	Percent
Under 1	7	1	14.3	0	0	0	0
1–4	31	22	71.0	1	3.2	7	22.6
5–9	28	23	82.1	2	7.4	9	32.1
10–19	29	20	69.0	4	13.8	5	17.2
20–29	22	19	86.4	3	13.6	8	36.4
30–39	16	13	81.3	1	6.3	10	62.5
40–49	21	17	81.0	2	9.5	10	47.6
50–59	7	7	100.0	2	28.6	6	85.7
60–69	6	6	100.0	0	0	2	33.3
70–79	5	5	100.0	0	0	3	60.0
Unknown	2	1	50.0	0	0	0	0
Total	174	134	77.0	15	8.6	60	34.5

3 times; a man, aged 49, 5 times; and a 7-year-old girl, 6 times.

Discussion

This study has revealed a number of points which are similar to the results of the survey previously reported (*1*). The diarrheal morbidity rate was highest in the age group under 10 years, which also accounted for the largest number of cases of diarrhea. Since interviewing was more frequent during the summer months, more cases of diarrhea were reported during July and August. Although only 1 bacterial pathogen was isolated, it was 1 of the 2 found most often during the survey. There were fewer parasitic infections in younger age groups. The same three parasites were found most often, *E. coli*, *E. nana*, and *Diphyllobothrium* sp.

The number of reported cases of diarrhea varied considerably during the seasonal interviews; high and low attack rates were found during both summer and winter. While most cases of diarrhea were reported as occurring during the summer, there also appeared to be an upsurge in December and January. Diarrhea was reported an average of 1.9 times by the 88 individuals who gave a history of diarrhea, and of these, 50 (56.8 percent) gave a positive history either 2, 3, or 4 times. Certain parasites recurred in the stools of some individuals. These recurrences were either reinfections or continued carrier status, or a combination of both. It was mentioned earlier that *Diphyllobothrium* sp. was found 3, 5, and 6 times in stool specimens taken from 3 individuals during the 6 sampling periods. As would be expected, the largest numbers of repeated positive stools per individual, either in consecutive or intermittent samples, were for *E. coli* and *E. nana*. *E. coli* was found in 3 individuals on 4 consecutive samplings and in 7 and 19 on 3 and 2 consecutive samplings, respectively. *E. nana* was found in 1 and 10 individuals on 3 and 2 consecutive samplings, respectively. These parasites were also found 2 or 3 times in a number of other persons but on intermittent samplings. In most parasitized individuals, these parasites were found only once, for example, *E. coli* in 41 individuals and *E. nana* in 49. Most of the other parasites were found only once in a person during the entire year.

No sharp enteric outbreak was reported during the year, although high attack rates were noted during several of the interviews. Although there was a midwinter increase in the number of reported cases of diarrhea, approximately one-half of all cases (51.7 percent) were reported during the period from June to September. Occurrence of the illness was reported as sporadic within and among the families of the two villages.

During interviewing, the symptoms of reported diarrhea appeared to be mild. This was confirmed by Fournelle who experienced a mild diarrheal attack while in the village during the August field trip. (*S. flexneri* 2a was isolated from several fluid stool specimens.)

During the survey prior to this study an impression was obtained that diarrheal diseases were not as serious at that time as had been reported in past years. We wonder now if the problem is even less serious in the community where this study was made in view of the lower attack rates and fewer isolated bacterial pathogens. In general, the community exhibited a higher degree of sanitation, as reflected by personal and household cleanliness, than was shown in most villages visited during the preceding survey.

Although the bacteriological findings of this study are meager and give few clues to the cause of the reported incidence of diarrhea, the survey revealed that the main source was *Shigella*, including, among several organisms, *S. flexneri* 2a, which was isolated in this study. Shigellosis was also implicated in the present study by the sporadic nature of the attacks and by the involvement principally of the group under 10 years of age.

In some instances our findings for parasites varied considerably from the results of Hitchcock (*6*). Our results are based on specimens collected during a 1-year period, while Hitchcock's were based on specimens taken in a few days. The low *Enterobius vermicularis* rate we found is no doubt due to the examination of the passed stool specimen.

There appeared to be no correlation between parasitic infection rates and the occurrence of

diarrhea. In view of this, it is difficult to consider the parasites of any importance as possible causative agents of diarrhea. Of the 15 individuals positive for *E. histolytica*, 9 reported no diarrhea whatsoever throughout the year; 5 reported no diarrhea at the time the specimen was taken; and only 1 person reported diarrhea when the specimen was taken. We have no idea why the highest infection rate for *E. histolytica* occurred during the July sampling nor why the highest *Diphyllobothrium* sp. rate occurred during the April sampling. According to R. L. Rausch in a personal communication, certain of the fish used as food by these people are infected with several species of *Diphyllobothrium*, none of which has been identified as *D. latum*.

The MIF technique of stool preservation has been found to be well suited to delayed examination. Examination by both the direct and concentration procedures gave a greater recovery of parasites than one procedure alone.

Summary

Eighty-eight (50.6 percent) of the 174 Eskimos observed in the villages of Napaskiak and Oscarville during a 1-year period gave a history of diarrhea at some time during the course of the study. Most cases were reported during July and August. Children under 10 years of age accounted for 62.0 percent of the cases of diarrhea, and gave an annual attack rate of 1,431 per 1,000 persons observed. One bacterial pathogen, *Shigella flexneri* 2a, was isolated from three individuals.

Parasitic infections were high among all age groups, with an average of 77.0 percent of the people parasitized. *Entamoeba coli*, *Endolimax nana*, and *Diphyllobothrium* sp. were most numerous. Individual infection rates for *Entamoeba histolytica* and *Diphyllobothrium* sp. were 8.6 and 34.5 percent, respectively. There appeared to be no correlation between parasitic infection rates and the occurrence of diarrhea.

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Research, Construction, and Training Grants

During the fiscal year ending in June 1958, the National Institutes of Health, Public Health Service, awarded 9,534 grants totaling $136,112,014 for research, training, and construction in non-Federal institutions.

Details of the 1958 operations are given in the publication, Public Health Service Grants and Fellowships Awarded by the National Institutes of Health, 1958.

More than two-thirds of the total grant funds were allotted to 7,028 research projects concerned with the major diseases and other aspects of the medical and biological sciences, in 699 institutions in the United States and 28 foreign countries. Grants to help build, equip, or expand 177 research facilities were made on a matching basis to 134 institutions throughout the Nation, and research fellowships were awarded to 2,329 fellows.