ENTERIC DISEASES IN ALASKA†

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TO UNDERSTAND the problems of the present and enable sound planning for the future, it is wise to have a knowledge of the past history of the area under study. As the enteric diseases have been used as an index of the general environmental sanitary conditions of an area, a history of the past outbreaks in arctic and subarctic Alaska is of value in understanding the present problems in basic sanitation and control of enteric diseases, and formulating plans for the future.

In Alaska, providing safe and adequate water supply and sewage disposal systems is a vital problem which is intricately linked with the outbreaks of enteric diseases. Of the 286 communities in Alaska, there are, according to the 1950 census, 63 with populations of 200 or more. Of this group of 63, only 29 have a limited water distribution system (26). The water supply in the other 223 communities is obtained on an individual basis from single-premise wells, community wells, rivers, lakes, lake ice, or snowfields. Little of this water is treated.

Of the same 63 communities with populations of 200 or more, there are only 5 with community sewage disposal facilities (26). The disposal of sewage in the other communities and villages is taken care of through single-premise systems, scavenger services, or dumping the collected wastes on the surface of the ground in areas not too distant from the dwellings.

The enteric diseases, such as typhoid fever, paratyphoid fever, and bacillary dysentery, as described in this paper, are those caused by the Gram-negative bacteria of the genera *Salmonella* and *Shigella* of the family *Enterobacteriaceae.*

This compilation of the history of the enteric diseases in Alaska is an attempt to bring together the scattered records and reports on gastro-enteric outbreaks. The records are incomplete because of failure to report all cases of enteric diseases and lack of medical or nursing facilities in the isolated areas. For this study, I have recorded only those reports I could verify either through records of the Alaska Department of Health, Alaska Native Service Hospitals, governmental reports, personal correspondence with doctors, or private records[1]. There had to be a sifting, weighing, and interpretation of the many rumours of outbreaks to learn the exact nature of the epidemic and the validity of the reports. It must be stressed that the data is incomplete in

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[1]Detailed tables, listing each outbreak, have been prepared and can be obtained from the author.

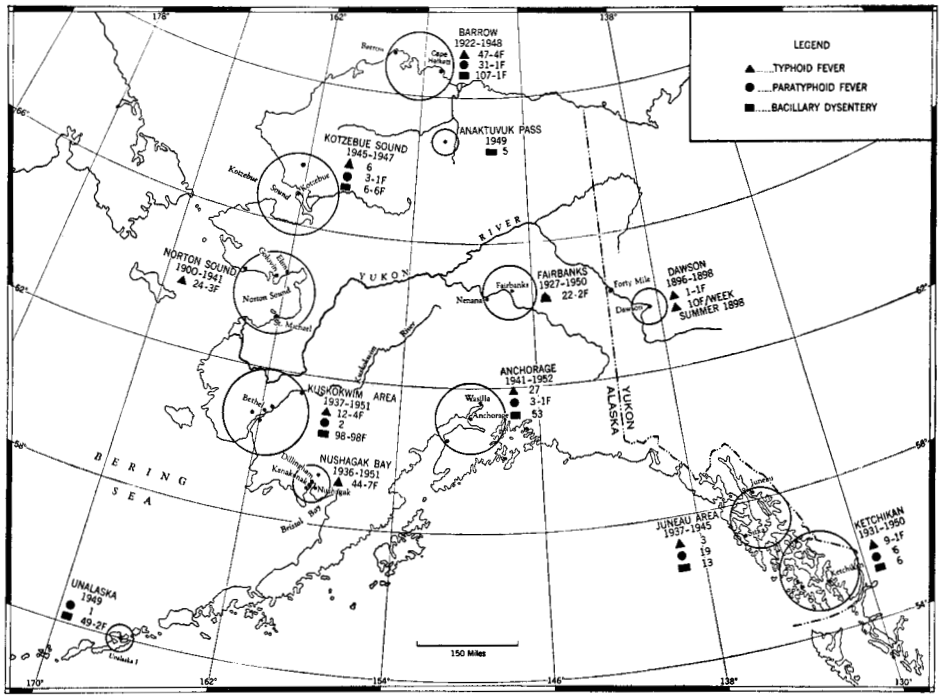

Fig. 1. Distribution of cases of enteric disease in 11 areas in Alaska for the period 1900–52. The first figure represents the total number of cases; the second figure followed by "F" represents the number of fatal cases.

some instances because of loss of records in hospital fires and failure to report all cases. That one case is reported does not mean that only one case existed, as in some instances only the deaths were reported with no record of any cases. For example, no cases of bacillary dysentery were reported from one area where 90 deaths due to bacillary dysentery are on record. In 1936 the first public health laboratory for the territory was established, and diagnostic bacteriological laboratory services were available to hospitals, doctors, public health personnel, and field nurses for enteric disease studies. This laboratory was a part of the reorganized Office of the Commissioner of Health and Territorial Department of Health.

Dr. Aronson (23), in his paper on "The history of disease among the natives of Alaska", stated that the records of Father Veniaminov mentioned that in 1807 at Unalaska an outbreak of bloody diarrhea occurred in the village shortly after an American vessel was wrecked in that area. The epidemic of bloody diarrhea spread rapidly through the young people with a resulting high mortality. The alleged cause of the outbreak was the eating of wet rice. As the main symptom mentioned was the bloody stools and the epidemic pattern was so characteristic, it was presumed that the disease was cholera (23) though it could have been bacillary dysentery.

From 1807 to 1896 I found no medical records or reports suggestive of enteric diseases. Outbreaks of diarrhea were mentioned but these were generally attributed to the native foods.

In 1896 one death from typhoid fever was reported at Forty Mile, Yukon Territory (27). No other cases were noted though the source of infection was stated to be impure drinking water.

In the spring and summer of 1898 during the Klondike gold rush, there were over 30,000 persons in the area of Dawson, Yukon Territory, living in overcrowded quarters and under the most primitive of circumstances. Drinking water was drawn from the Yukon River at a point where "the river became a slough and could not cleanse itself" (35). Typhoid fever broke out in the spring and river water was indicated as the source of infection. According to accounts by Walden (34), the deaths from typhoid fever were 10 to 12 per day and at the peak of the epidemic, Armstrong (22) stated the death rate as 120 per day. The total number of typhoid fever cases and deaths were never noted.

During the present century there appear to be ten main areas in Alaska where enteric disease is endemic.

Norton Sound

In 1900 2 cases of typhoid fever were reported from Golovin on Norton Sound (4). Later questioning of these cases, who were still "healthy" carriers of *S. typhosa* in 1941, revealed that a disease resembling typhoid fever was present in St. Michael in 1898–1900 and from St. Michael it spread to the other villages along Norton Sound. The extent of the cases and deaths is not known. It is entirely possible that the Dawson outbreak was responsible for the introduction of typhoid fever into the Norton Sound area, as travel to Pacific coast ports from Dawson was by river boat down the Yukon River to St. Michael. At this Bering Sea terminus, the passengers transferred to the vessels from Seattle and San Francisco. It is important to note that between 1900–39 (4) in the Norton Sound area there were 11 cases of typhoid fever (one fatal). *S. typhosa* was isolated from the stool specimens on the fatal case (30). In 1940–1, a field team from the Alaska Department of Health investigated a typhoid outbreak in the Golovin–Elim area (4). Thirteen cases with 2 deaths were reported. *S. typhosa* was isolated from stool and blood cultures on the 11 recovered cases and one fatal case. Two persons who gave a history of having typhoid in 1900 were found to be "healthy" carriers of *S. typhosa.* One of the carriers was a trader who visited the villages along Norton Sound and epidemiological investigation linked him with the 1940–1 outbreak. There have been no further known cases reported from this area since the carriers were placed under medical care.

Fairbanks–Nenana

Typhoid fever has been sporadically reported from the Fairbanks–Nenana area since 1927. From 1927 to 1950 there were 22 cases with 2 deaths. From 5 cases, *S. typhosa* was isolated. There have been 3 minor water-borne outbreaks of typhoid due to contaminated drinking water. In one instance, the native village drew its water 250 yards below the outfall of the hospital and town sewer.

Barrow

Stefansson (32) mentions in his 'Arctic manual' that "typhoid is spread in the Arctic as elsewhere by contaminated water" and cites as an example an outbreak of typhoid fever at Barrow. According to recent data obtained from Williams and Alter (37), typhoid fever was reported in 1923 at Barrow and paratyphoid fever in 1922. Since 1922 in the Barrow area there have been 47 cases with 4 fatal cases of typhoid fever and 31 cases with one fatal case of paratyphoid fever. The last case reported was in 1936.

Bacillary dysentery in arctic Alaska was reported at Cape Halkett (37) in the Barrow area in 1933, when 2 cases were seen by the doctor. Since 1933 there have been many rumours and delayed reports on outbreaks of diarrhea that swept through the villages. This type of outbreak is not confined to Barrow, as the Alaska Department of Health receives such reports from communities all over the territory. The notification of the proper authorities of such outbreaks is delayed as much as 3 to 4 months and the outbreak is over before any laboratory specimens can be requested for study. The outbreaks of diarrhea commence during or shortly after the spring break-up and continue to the end of summer. In 1948, during one of these outbreaks, a field team was in the Barrow area for a few days and limited laboratory studies on the few acute cases were possible (36; 2). *Shigella paradysenteriae* (Flexner II) was isolated from stool specimens of 3 cases. In the 1948 outbreak there were 105 cases with one death over a 5-month period. The following year, 1949, bacillary dysentery was reported from Anaktuvuk Pass (31)[1] and *Sh. paradysenteriae* (Flexner II) was found in 5 cases. In both outbreaks drinking water from contaminated sources was indicated as the source. The water for Barrow village came from a lake and during the winter months the slopes draining into the lake were used as the disposal area for human wastes.

Kotzebue Sound

Typhoid fever and bacillary dysentery have been reported from other arctic areas such as Kotzebue and Kotzebue Sound villages (6; 1). Six cases of typhoid fever were reported with 4 cases confirmed by isolation of *S. typhosa* in 1945. In addition, *S. montevideo* was isolated from specimens of 3 cases (one fatal) of gastro-enteritis. Between 1945–7 there were no cases of bacillary dysentery reported from the Kotzebue Sound villages but 6 deaths in children under 1½ years were recorded as due to bacillary dysentery (8).

Nushagak Bay

The Nushagak Bay area during the summer months is the centre of activity for the Bristol Bay salmon fishermen and cannery workers. The annual influx of cannery workers from San Francisco and Seattle swells the population of the cannery villages. The Eskimo and Indians from the surrounding area and the lower Kuskokwim leave their villages to go to the summer fish camps along Nushagak Bay and Bristol Bay taking with them their entire families. After the fishing season, they return to their villages. The fish camps for the

[1]The final report gave 19 cases (2 fatal) of bacillary dysentery.

natives consist of tents crowded together with no sewage facilities except convenient bushes or creek banks, and drinking water is collected at the most convenient pond, creek, or well. In the largest community a local well was the town supply, and drinking water was collected by clearing away the surface debris of paper and dog hair and dipping the water out. Dogs and man had the same easy access to the water as there was no curbing or cover to prevent contamination from other sources or surface water. In addition, the well was at the base of a bluff in a ravine that drained the village graveyard up on the bluff, only 150 feet away. There had been reports of "diarrhea" among the children and according to the people it was expected that some of the children would die every year from this cause. In 1936 a typhoid fever outbreak was reported in the Nushagak Bay area and a nurse was flown in by single-engine float plane from Juneau to Dillingham to investigate the outbreak and carry out an immunization program. The outbreak started among a group of oriental cannery workers and then spread through the fish camps of the Eskimo and Indians (21; 5; 6). During the 1936 outbreak there were 19 hospitalized cases with 4 deaths at the Alaska Native Service Hospital in Kanakanak, and 4 more cases were reported from the outlying villages. There were many more cases that were seen on an out-patient basis by the doctor and, according to local accounts, there were 10 deaths among the children. The cases were dismissed from the hospital on the basis of clinical recovery. It could not be determined if these cases were bacteriologically negative for *S. typhosa* because of lack of local bacteriological laboratory facilities. Mailing specimens was impracticable as mail took anywhere from 25 to 40 days to reach Juneau. In 1939, 1940, 1942, 1948, 1950, and 1951 typhoid fever flared up again and there were 21 known cases with 3 deaths in the Nushagak area. The 1939, 1942, and 1950, as well as the 1936 outbreaks, were water-borne. The first isolation of *S. typhosa* from this area was made in 1950 when *S. typhosa* (Type N) was identified. Since then, 2 additional cases of *S. typhosa* (Type N) have been confirmed in 1951, and the mother of one of the cases was discovered to be a carrier of *S. typhosa* (Type N) (6); according to her history she had typhoid during the 1942 outbreak. No doubt there are other carriers as the population in this area is permanent and the 1936, 1939, and 1940 cases, as well as the more recent cases, are still in the area. Special carrier studies are being carried on by the Alaska Department of Health and several possible carriers have been detected.

Bacillary dysentery has not been reported from the Nushagak Bay area.

Kuskokwim River

The Kuskokwim River area covers many primitive villages and enteric diseases are prevalent. The first reports of typhoid fever from this area were in 1937 when 2 deaths were recorded (7). In 1948 2 cases of salmonellosis due to *S. montevideo* were reported (36). Shortly after the 1950 outbreak of typhoid fever in the Nushagak Bay area, there was a typhoid fever outbreak of 10 cases with 2 deaths. *S. typhosa* (Type N) was isolated from 6 of the

cases (2 fatal) (6; 20). Whether there is any connection between the Nushagak and Kuskokwim outbreaks is not definitely known. It is known, however, that the men from this area and one of the cases worked in the Nushagak Bay area for the summer season of 1950 prior to returning to their villages. Drinking water in most cases is untreated river water.

Bacillary dysentery in the Kuskokwim area is a greater problem. In 1944 there were 97 deaths recorded as due to bacillary dysentery with the majority of deaths among the children (8; 29; 20). Outbreaks of bacillary dysentery were reported again in 1947 and 1948 and the number of cases and deaths is not known.

Unalaska

The Unalaska bacillary dysentery outbreak in 1949 was the first opportunity for a complete epidemiological team in Alaska to investigate an outbreak, determine the etiological agent, and render sanitary and medical aid. The Alaska Department of Health sent out a physician, sanitarian, and bacteriologist with a field laboratory to investigate the report of an epidemic of unknown etiology. Investigation proved the epidemic to be a water-borne bacillary dysentery outbreak caused by *Sh. paradysenteriae* (Flexner II) (3; 9). Recommendations were made about improvements of sewage disposal methods (open pit privies) and relocation of the water supply. There was a total of 49 cases of bacillary dysentery with 2 deaths in this outbreak. Eleven cases were confirmed by field laboratory studies. In addition, *S. newport* was isolated from another case in a stool survey of the village.

Anchorage

Enteric diseases in the Anchorage area were first noted in 1941 when one case due to *Salmonella sp.* was reported (36). In 1947 a food-borne outbreak involved 7 cases of *S. typhosa* (Type B_1) (38). Epidemiological investigation showed that 4 of the cases were passengers who had left Anchorage for Seattle aboard a local airliner and who had eaten box lunches prepared by a local cafe. The typhoid carrier was found to be an itinerant cook who had typhoid in 1930 or 1931. Two cases (one fatal) of salmonellosis due to *S. montevideo* were reported in 1949. In 1950 there was a typhoid fever outbreak involving 17 children (28). *S. typhosa* degraded Vi was isolated from all cases and the carrier, who was the mother of one of the cases. This outbreak occurred in the congested area outside the city limits where the people were dependent on shallow wells (6–12 feet) for water and single-premise sewage disposal (generally cesspools or privies). During the epidemiological investigations, a "healthy" carrier of *S. typhosa* (Type E_1) was discovered. In 1952 there were 3 cases of typhoid fever in a local children's home and the cook was found to be a carrier of *S. typhosa* degraded Vi.

Fifty-three cases of bacillary dysentery occurred between 1950 and 1951 (6). Fifty-two of these cases were in a children's home at Wasilla and *Sh. sonnei* was isolated from 11 cases. *Sh. paradysenteriae* (Flexner II) was isolated from one case in Anchorage.

Ketchikan

In southeastern Alaska, the two main areas of enteric diseases are the Ketchikan and Juneau–Sitka sections. Typhoid fever was noted in 1931 when there were 4 cases in the Ketchikan area (17). Sporadic cases have been reported since then. Between 1937 and 1951 there have been 7 cases of typhoid fever with one death, and 6 cases of salmonellosis. Six cases of bacillary dysentery were confirmed by laboratory examinations in 1946 (36).

Juneau–Sitka

Between 1940 and 1945 there were 3 cases of *S. typhosa* reported from Juneau and outlying villages. Seventeen out of the 19 cases of salmonellosis reported were the result of a food-borne outbreak in a children's home in 1945. *S. typhimurium* was recovered from 2 of the cases (36; 1).

The first cases of bacillary dysentery in the territory to be confirmed by laboratory studies occurred in Juneau in 1937 (24). A sporadic outbreak of bacillary dysentery in 1937 and 1938 was investigated and from 10 cases *Sh. sonnei* was isolated and from 2 cases *Sh. paradysenteriae* (Flexner) was recovered (36).

There are no doubt other endemic areas of enteric diseases but those discussed are the main ones. Sporadic cases of salmonellosis and shigellosis have been reported from many other villages in Alaska. Contaminated water supplies and improper sewage disposal have been the major causes of these outbreaks. In all of the outbreaks, whether water-borne or food-borne, poor sanitation played an important role. Influx of people into crowded areas increases the health hazards already complicated by unsatisfactory basic sanitary facilities, as the newcomers bring with them their own diseases and carriers of typhoid fever and parasitic infestations are undetected in this group.

From 1807, when the first outbreak resembling bacillary dysentery was noted, up to July 1952 there were 206 cases of typhoid fever with 22 deaths reported. *Salmonella typhosa* was isolated from stool or blood cultures on 65 cases (7 fatal). The balance of the cases of salmonellosis and deaths were due to *S. montevideo*, 8 cases (2 fatal); *S. typhimurium*, 3 cases; *S. newport*, 2 cases; *S. schottmuelleri*, one case; *Salmonella sp.*, 4 cases; salmonellosis and paratyphoid fever, 30 cases (one fatal).

In the period 1937–51 230 cases and 110 deaths due to bacillary dysentery and shigellosis were reported. Of the 230 cases, 53 were confirmed by laboratory isolations of the organisms as follows: *Shigella paradysenteriae* (Flexner), 26 cases; *Sh. sonnei*, 24 cases, and other *Shigella sp.*, 3 cases.

References

1. Alaska Dept. Health: "Biennial report of the Office of the Commissioner of Health", 1 July 1944–30 June 1946. Juneau, 1947.
2. Alaska Dept. Health: "Biennial report of the Office of the Commissioner of Health", 1 July 1946–30 June 1948. Juneau, 1949.
3. Alaska Dept. Health: "Field report. Unalaska outbreak". Anchorage, 1949.
4. Alaska Dept. Health: "Field report. Golovin–Elim outbreak". Juneau, 1940.

5. Alaska Dept. Health: "Field report. Clark's Point outbreak". Juneau, 1950.
6. Alaska Dept. Health: Laboratory records and files. Anchorage, 1940 to date.
7. Alaska Dept. Health: Vital statistics, records, unpubl. Juneau, 1937 to date.
8. Alaska Dept. Health: Division of Communicable Disease Control. Files and records. Juneau, 1944 to date.
9. Alaska Dept. Health: "Unalaska intestinal disease field report". *Alaska's Health*, Vol. 8 (1950) pp. 4–5.
10-19. Alaska, Governor of: "Annual report of the Governor of Alaska to the Secretary of the Interior". U.S. Gov. Printing Office, Washington, 1920, 1925–32, and 1937.
20. Alaska Native Service: Hospital records and files, Bethel.
21. Alaska Native Service: Hospital records and files, Kanakanak, 1939–52.
22. Armstrong, Nevill A. D. "Klondike Memories". *Beaver*, Outfit 281 (1951) pp. 28–31, and Outfit 282 (1951) pp. 44–7.
23. Aronson, Joseph D. "The history of disease among the natives of Alaska". *Trans. and Studies of Coll. of Phys. Philadelphia*, Vol. 8 (1940) pp. 27–34.
24. Carswell, J., M.D.—Director, Division of Communicable Disease Control, Territorial Dept. Health, 1937. Personal communication.
25. Davis, G., M.D.—Physician, Anchorage. Personal communication.
26. Day, E. K. "Environmental sanitation problems in Alaska and their solutions". *Harvard Alumni Bull.* Vol. 9 (1952) pp. 3–8.
27. DeWindt, Harry. 'Through the gold fields of Alaska to the Bering Straits'. New York: 1898, 319 pp.
28. Gaub, W. H. "An epidemic of typhoid fever at Spenard, Alaska". *J. Lab. Clin. Med.* Vol. 37 (1951) pp. 931–5.
29. Langsam, Fred M., M.D.—Physician in Charge, A.N.S. Hospital, Bethel, 1943, 1948. Personal communication.
30. Morcom, T., M.D.—Deputy Commissioner of Health, Nome, 1940. Personal communication.
31. Rausch, Robert.—Chief, Animal-borne Disease Section, Arctic Health Research Center, Anchorage. Personal communication.
32. Stefansson, Vilhjalmur. 'Arctic manual'. New York: 1945, 556 pp.
33. U.S. Dept. of Commerce: 1950 Census of Population—Population of Alaska: 1 April 1950; Bureau of Census Series PC-11, No. 4, 25 March 1952.
34. Walden, Arthur T. 'A dog puncher on the Yukon'. Boston: 1928, 289 pp.
35. White, Mrs. A.—Alaska Territorial Museum, 1949, Juneau. Personal communication.
36. Williams, Ralph B. "A summary of the Salmonella and Shigella of Alaska'. *Northwest Med.* Vol. 49 (1950) p. 340.
37. Williams, Ralph B. and Amos J. Alter. "Enteric diseases and their implications in arctic Alaska". Unpublished manuscript.
38. Williams, Ralph B., L. A. Morley, and M. Kohler. "Food-borne typhoid outbreak with rapid dissemination of cases through air transportation". *Northwest Med.* Vol. 49 (1950) p. 686.