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Epidemiology of poliomyelitis : including a survey of cases in Douglas County, Nebraska, during the 1946 season

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THE EPIDEMIOLOGY OF POLIOMYELITIS, INCLUDING A SURVEY OF CASES IN DOUGLAS COUNTY, NEBRASKA, DURING THE 1946 SEASON

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INTRODUCTION

The epidemiology of poliomyelitis is a controversial subject. There are many theories advanced in the literature by numerous authorities. These theories are supported by data of many types. There is no satisfactory evidence presented to prove conclusively that one theory is better than another. In this paper, the various theories and the reasons for them will be presented with some original findings relating to the outbreak of poliomyelitis in Douglas County, Nebraska, in 1946.

REVIEW OF THE LITERATURE

In order to fully understand the problems confronting a person attempting to work out the solution of the epidemiology of poliomyelitis, an understanding of the known mode of action of poliomyelitis is essential.

ETIOLOGY

The majority of the authorities are agreed that the etiological agent of poliomyelitis is a filtrable virus which has the characteristic properties of viruses in general. Gudakunst 1943, (1). Some authorities believed that the virus is an obligate neural parasite. Rosenow 1943, (2), maintained that there is a pleomorphic streptococcus in association with the virus which may be the cause of the disease.

PATHOLOGY

Goodpasture 1941, (3), and Casey 1942, (4), have shown that

axonal infection is the basic mechanism of pathogenesis. The fact that the virus lives and travels in nervous tissue and is found only temporarily in other tissues is fairly well established. Fraser 1943, (5). The American Orthopedic Assn. 1946, (6), stated that there is no absolute proof of any lesion outside of the central nervous system.

DIAGNOSIS

Poliomyelitis is usually not diagnosed unless complicated by paralysis. Since paralysis is an uncommon complication, many cases escape diagnosis. Kendall 1945, (7), observed that paralytic poliomyelitis is to uncomplicated poliomyelitis like tuberculus meningitis is to tuberculosis.

In the Chicago survey, Casey and co-workers 1945, (8), reported that only one out of six instances of poliomyelitis would have been diagnosed, even under an alert public health reporting system, without an intensive neighborhood study. Smith and co-workers 1945, (9), have shown that the incidence of illness suggestive of being nonparalytic poliomyelitis is at least five times as great as the clinical cases. According to The American Orthopedic Ass'n. 1946, (6), there are many abortive and undiagnosed nonparalytic cases. This is strongly suggestive of a much wider dissemination of poliomyelitis than would be suspected by the number of cases diagnosed.

INCUBATION AND INFECTIOUS PERIODS

There is some disagreement among the authorities as to the length of the incubation period. In the study of a small epidemic on an isolated island off the coast of Sweden, Kling and Levaditi 1911, (10), as reported by Haynes 1917, (11), found the incubation period of poliomyelitis to vary from 1 to 3 days. This is the shortest incubation period reported in the literature. Nicoll, 1917, (12), reported that the incubation period during the 1916 epidemic in New York state varied from 4 to 14 days with an average of 7 days. According to The American Orthopedic Assn. 1946, (6), the incubation period varies from 7 to 21 days and usually most cases occur in the 7 to 14 day range. The majority of the authorities agreed that the incubation period varies from 4 to 35 days with an average of approximately 12 days. Casey and co-workers 1945, (8), Aycock 1940, (13), and Aycock and Kessel 1943, (14), Casey 1942, (4), mentioned that the incubation period for paralytic cases alone varies from 5 to 15 days with an average of 9.5 days.

There is more agreement among the authorities concerning the length and occurrence of the infectious period. Aycock and Eaton 1925, (15), stated that the time of greatest infectiousness of Infantile Paralysis is within the first 3 or 4 days of the acute stage of the disease. In data from milk-borne outbreaks, small isolated groups of cases, and cases following tonsillectomies,

Aycock and Luther 1929, (16), found the infectious period extended from the fifth day preceding the onset of the signs and symptoms to the fifth day of the disease.

A most interesting observation concerning the incubation and infectious periods was made by Gordon 1943, (17). He has shown that it is exceptional when the infectious period can be determined from history of exposure to a previous case or the incubation period measured from the interval between exposure and onset. This is due primarily to the lack of accurate information in the majority of cases. He went on to state that where contact between cases is seen in multiple cases in families, exposure between the individuals has usually been continuous so that the precise time of infection could not be fixed.

IMMUNITY

Most authorities agree that one attack of poliomyelitis develops immunity. Kendall 1945, (7), claimed that adults are usually immune and that recovery leads to life-long immunity. Kerley 1917, (18), believed that only 5 to 10 percent of children are susceptible to poliomyelitis.

Nelson and Green 1943, (19), however, presented a series of cases of second attack. Their explanation was Aycock's 1937, (20), and 1940, (21), theory of autarcesis. In this theory, the power to resist infection is determined by the normal activity

of the normal somatic cells rather than by antigen-antibody relationship.

Fraser 1943, (5), brought up another aspect of immunity. He has shown that the virus of poliomyelitis is more plentiful or virulent or both in dense populations, but the proportion of cases is less than in rural areas. He believed, therefore, that some immunity must develop in densely populated urban areas.

PORTAL OF ENTRY

The problem of the portal of entrance of the virus of poliomyelitis is of great importance because its solution would help answer the mode of transmission of poliomyelitis. It would also help answer the method of host protection and immunity. Toomey 1937, (22). This problem must be solved before poliomyelitis can be prevented and eradicated.

The two principal ideas of portal of entry are: (a) nasal, via the olfactory bulb, and (b) gastro-intestinal, via the nerves in the gastro-intestinal tract.

Toomey has almost been the sole exponent in this country of the gastro-intestinal tract. He 1936, (23), maintained that the virus passes up the gray fibers from the gastro-intestinal tract as the virus has a gray fiber obligation. He 1930, (24), proved this by placing a virus suspension in the gut of a monkey, and the monkey acquired poliomyelitis. This work has been confirmed by Howe and Bordian 1940, (25). Toomey's 1941, (26), strongest

argument for the gastro-intestinal portal of entry is the fact that the logical sequence of pathogenesis arising from this portal of entry best fits and explains the known clinical facts of the disease. Faber and co-workers 1943, (27), and McClure 1943, (28), have shown by the study of the histo-pathology of the peripheral nerves of the gastro-intestinal tract that the portal of entry is the upper portion of the alimentary tract, i.e., mouth, pharynx, and esophagus.

The American Orthopedic Ass'n, 1946, (6), brought up the fact that poliomyelitis is mainly a rural disease and that it is seasonal in character. They compare this with other enteric diseases such as typhoid and draw the conclusion that poliomyelitis must have a gastro-intestinal portal of entry.

The olfactory portal of entry was advanced as early as 1910. The possibility of this entrance has been proved by Brodie and Elvidge 1934, (29). They had 100 percent takes in monkeys which had a virus soaked tampon inserted into the nasal cavities. Schwartz and Gebhart 1934, (30), also confirmed the possibility of a nasal portal by cauterizing the olfactory tract of six monkeys and inserting virus soaked tampons in the nasal cavities. These six were well while controls became ill. The susceptibility of the cauterized monkeys was proved later by intracerebral injection. Gudakunst 1943, (1), and Schultz 1942, (31), stated that the olfactory route of invasion is possible but very rare.

Many authorities believe that both portals are involved.

Aycock and Eaton 1924, (32), suggested that the spring rise in poliomyelitis is due to the respiratory mode of spread and the summer rise is due to the enteric mode of spread. Fraser 1943, (5), believed that the virus can invade the physiological interior of the body by any nerve fiber near a body surface, especially the mucosa of the gastro-intestinal and respiratory tracts. The factors governing which particular tract are unknown. Dauer 1938, (33), introduced a new idea by stating that several distinct strains of poliomyelitis virus exist and may produce the disease by different portals of entry.

The American Orthopedic Ass'n. 1946, (6), summed up the whole controversy by stating that there is no absolute proof of portal of entry.

PORTAL OF EXIT

The problem of the portal of exit of the poliomyelitis virus from the body plays an important part in the epidemiology of poliomyelitis, since an answer to this problem would aid in the control and prevention of the disease.

There are three routes of exit from the human body which have been studied. Of the three, the most agreement is found among the authorities on the presence of the virus in the stool. Many authorities have found this to be true. Fraser 1943, (5), Toomey 1936, (34), Kramer and co-workers 1939, (35), Trask and co-workers 1940, (36), Paul and Trask 1941, (37), and Sabin and Ward 1941, (38).

There is disagreement as to the presence of the virus of poliomyelitis in the saliva and nasal spray. Fraser 1943, (5), concluded that there is no definite, conclusive proof that the virus is in the saliva and nasal spray. Howe 1944, (39), however, has shown that the virus is in swabs from the oropharynx and peritonsillar areas in acute cases. In a series of virus detection tests on nine convalescent cases, Kling and co-workers 1912, (40), showed that the secretion from the mouths of persons who had recovered from poliomyelitis had the power to infect monkeys for periods over seven months.

The urinary portal of exit has not yet been shown to pass the virus. Toomey and co-workers 1943, (41), have been unsuccessful in their attempt to isolate the virus from urine.

OCCURRENCE

Poliomyelitis has a world-wide distribution, but the incidence is higher in the temporate zones. Fraser 1943, (5), Kendall 1945, (7), and the American Orthopedic Assn. 1946, (6). It occurs in sporadic, endemic, and epidemic forms and mainly in the summer and fall months with a small peak in late spring. The American Orthopedic Ass'n. 1946, (6), and Fraser 1943, (5). Bohls and Irons 1944, (42), reported that July was the month of highest incidence in the 1943 epidemic in Texas. Schwartz 1917, (43), and Craster 1917, (44), stated that cases have been reported in every month of the year.

The fact that poliomyelitis is endemic is shown by Smith and co-workers 1945, (9). They made an intensive study of the circumstances surrounding the development of the first three paralytic cases of poliomyelitis in the 1944 epidemic in the Buffalo-New York City area. Their study showed that these three cases were relatively late developments in a cycle which had been in progress, but unsuspected for approximately three months. There was a period of 5.5 months elapsing between the last reported case of the preceding year and the first case of 1944, but the interval was only two months to the earliest minor disease which was caused by the virus of poliomyelitis. In view of the difficulties in recognizing such minor illnesses it seemed probable that the virus was certainly active in the area throughout the entire period between the 1943 and 1944 cycles.

Most authorities agree that poliomyelitis is more prevalent in rural areas than urban. The American Orthopedic Ass'n. 1946, (6), Fraser 1943, (5), and Schwartz 1917, (43). Fronczak 1916, (45), showed in the 1912 Buffalo epidemic that the proportion of the cases was the lowest where the density of the population was the highest. In the 1916 New York state epidemic, Nicoll 1917, (12), showed that a higher proportion of the population in the rural areas was attacked than in the cities. Emerson 1917, (46), noted a similar condition in New York City.

The first cases of poliomyelitis reported in this country

occurred in 1841 and were reported by Colmer 1843, (47). It is interesting to note that all these cases occurred in rural areas.

According to the majority of authorities, poliomyelitis is more prevalent in males than females. In the 1916 New York state epidemic, Nicoll 1917, (12), found that males are attacked more frequently than females. Perkins 1941, (48), found that during the 1930 epidemic in Minnesota three males contracted poliomyelitis to every two females. Bohls and Irons 1944, (42), has shown that the ratio of males to females was 1 to 2.2 in the 1943 Texas epidemic. The American Orthopedic Assn. 1946, (6), has also confirmed this statement.

Craster 1917, (44), suggested that another predisposing cause of poliomyelitis is age. He believed that it is commonest under 5 years of age. Kendall 1945, (7), also believed that poliomyelitis is a disease of childhood. Schwartz 1917, (43), found the disease to be fifty times more prevalent in younger children than in adults. Casey and co-workers 1945, (8), found poliomyelitis to be contagious to the degree of 90 percent in the 1.5 to 3.5 years age group, and less infectious in the older age groups. The American Orthopedic Ass'n. 1946, (6), stated that while poliomyelitis is chiefly a disease of children, it may occur at all ages. Dauer 1943, (49), made the comment that the average age of poliomyelitis patients is gradually increasing. By observing the following figures a slight tendency toward the older age group is noticed. During the 1917 epidemic in

New York City, Nicoll 1917, (12), reported that 80 percent of the cases were under 5 years of age, 95 percent under 10, and 98 percent under 16 years of age. In up-state cities, less than 66 percent of the patients were under 5 years of age, 86 percent under 10, and over 7 percent beyond 15 years of age. In rural New York, 55 percent of the patients were under 5 years of age, 80 percent under 10, and 10 percent over 15 years of age. This information would lead to the conclusion that more older persons are involved in rural areas. Perkins 1941, (48), observed that 24 percent of the cases in the 1930 epidemic in southwestern Minnesota were under 5 years of age. Bohls and Irons 1944, (42), reported that 7.5 percent of the cases were under 2 years of age, 34.6 percent under 5, 57.8 percent under 10, 78 percent under 15, 89.1 percent under 20, and 10.9 percent over 20 years of age. The American Orthopedic Ass'n. 1946, (6), stated that 60 percent of the cases occur under 10 years of age and 80 percent under 15 years of age.

Aycock 1940, (21), reported that poliomyelitis is more predilected to pregnant women. He suggested that this might point to an estrogen imbalance. Harmon and Hayne 1943, (50), indicated, however, that pregnancy has little influence on the course of poliomyelitis and that infection of the fetus in utero rarely occurs. He believed that the placenta acted as a barrier against the virus of poliomyelitis. Peelen 1943, (51), stated that the type of paralysis and the complications arising should determine

the course to be followed in the pregnancy.

MORTALITY

The earliest mortality figures were found in the publication by Nicoll 1917, (12). He stated that during the 1916 epidemic in New York state, 19.8 percent of the rural cases ended with fatality while in New York City, 27.2 percent of the cases ended with fatality. These figures indicate that in rural areas a much lower proportion of the cases proved fatal than in the city. He also noted that in New York City, 80 percent of the deaths were under 5 years of age and 97 percent were under 15 years of age. In rural areas of New York state, 45.5 percent of the deaths were under 5 years of age and 81 percent were under 15 years of age. He also reported that more males than females died from poliomyelitis. Perkins 1941, (48), reported that the mortality percentage in the 1930 epidemic in southwestern Minnesota was 7.7 percent.

RACE, COLOR, AND SOCIAL STATUS

The literature does not throw much light on the role of race, color, and social status in the epidemiology of poliomyelitis. According to Craster 1917, (44), no nationality or social stratum is exempt from poliomyelitis. Bohls and Irons 1944, (42), reported that the majority of the cases in the 1943 epidemic in Texas were white. The American Orthopedic Ass'n. 1946, (6), stated, however, that race and color are not significant.

TRANSMISSION

One of the problems in the epidemiology of poliomyelitis is the mode of transmission of the disease from one person to another. Schwartz 1917, (43), stated that the epidemiology characteristics of poliomyelitis as shown in numerous reports are not in agreement with experimental concepts and ideas regarding other infectious diseases. Various observers blame its transmission upon human contact and others on the "place infection" theory, thereby incriminating the food supply, domestic animals, insects, and other local environmental factors. Sheppard 1916, (52), suggested that there is an indirect or social contact as well as direct contact. The former is any object in intimate association with an infected person which may come in contact with another person.

Many authorities claim that poliomyelitis is spread by personal contact. They also believe that persons recovered from the disease, immune carriers, and unrecognized cases may also transmit the disease. Lucas and Osgood 1913, (54), Flexner 1916, (55), Craster 1917, (44), Kerley 1917, (18), Schwartz 1917, (43), Gordon 1943, (17), Bohls and Irons 1944, (42), and Smith and co-workers 1945, (9).

Craster 1917, (44), has shown that the first large epidemic in the United States was in New York in 1907. The impetus of this epidemic was attributed to direct infection brought from Europe. He stated that epidemic poliomyelitis appeared to be a disease

carried directly from place to place by some human carrier not yet possible of identification. However, he also maintained that while infection by direct contact is possible, it is not the most common mode of transmission.

Kling and Levaditi 1913, (10), in an extensive survey on an isolated island near Sweden in 1911 found that where there is no contact between individuals, there is no disease. In the 1916 epidemic in New York state, Nicoll 1917, (12), observed that the spread of cases paralleled routes of travel and therefore concluded that personal contact was the immediate factor in the spread of the epidemic. Perkins 1941, (48), showed that the 1930 epidemic in southwest Minnesota had a radial spread typical of person-to-person contact. There were more and more cases at the expanding periphery and less and less at the site of the original focus. In all of his cases, he was able to obtain a history of exposure within thirty days prior to the onset of the disease.

Aycock 1937, (20), believed that another indication of person-to-person contact is the fact that the age distribution and incidence of poliomyelitis, measles, and diphtheria are identical. He also stated that the incidence of all were proportional to population density.

Perhaps the most conclusive work reported to date to prove the personal contact theory was done by Casey and co-workers 1945, (8), in the 1945 Chicago survey. They found that among 66 persons in

contact with poliomyelitis cases during the infectious period, 37 developed signs and symptoms similar to poliomyelitis in 6 to 15 days, of which 24 were later diagnosed as poliomyelitis. Among 109 other children of the same age who resided within one block of the patient, but who had not been in contact with the patient during the infectious period, 4 developed signs and symptoms similar to poliomyelitis but no definite cases were diagnosed. Among 115 children in the control neighborhoods, of same ages as the contacts and non-contacts but who lived 10 to 50 blocks distant from the poliomyelitis region and who were apparently without contact with a clinical case, 5 developed signs and symptoms similar to poliomyelitis, but no definite clinical cases were diagnosed. There was no statistically significant difference between the non-contacts and the controls, but there was a highly significant difference between these two groups and the contact group.

Casey 1942, (4), believed that the contacts are not casual but last several hours. Thus, hands contaminated with nasal, oral, or bowel excreta are incriminated.

Several authorities have presented data which are opposed to the contact theory. Kendall 1943, (7), claimed that a majority of the clinical paralytic cases occur sporadically with no history of contact and show little tendency to spread. Paralysis has never occurred in epidemic proportions, the most cases reported at any one time in the United States being 29,000 cases in 1916.

Kendall 1945, (7), also stated that the incidence is no greater among doctors and nurses who are in intimate contact with the disease than in civil population. He also claimed that two paralytic cases in one family is unusual. This was confirmed by Robinson and Sweadner 1945, (53). However, Casey and co-workers 1945, (8), reported that multiple cases in a family were the rule when there were other children from 1.5 to 8.5 years of age in the home.

In a study of several epidemics, Kramer and co-workers 1939, (35), concluded that in only 20 to 30 percent of the cases was evidence given of prior direct or indirect association with suspected or proven cases.

VECTORS

The role of vectors in the transmission of poliomyelitis is a controversial subject.

Fraser 1943, (5), believed that the human reservoir is not the only one for the virus of poliomyelitis and that the virus exists free in nature for long periods. According to The American Orthopedic Ass'n. 1946, (6), insect vectors are strongly suspected of transmitting the virus.

Some of the vectors mentioned by various authorities include rats, flies, mosquitoes, ticks, fleas, lice, mice, and domestic animals.

Richardson 1916, (56), has shown that rats are infected and the disease is transferred to man by fleas. Bohls and Irons 1944,

(42), stated that since rats are ubiquitous, it is difficult to eliminate them as direct or indirect contacts.

Trask and co-workers 1943, (57), collected a series of 19 samples of flies within epidemic areas during and after the onset of poliomyelitis. These were tested for the virus of poliomyelitis and 4 specimens were found to be positive. The dominant species in each specimen were green bottle flies and black blow flies. The common house fly was rarely encountered. Similar observations had been previously made by Rosenow and co-workers 1937, (58), and Sabin and Ward 1942, (59). Flexner and Clark 1913, (60), and Bohls and Irons 1944, (42), suggested that the domestic fly may act as a mechanical carrier.

Bodine 1916, (61), suspected that the tick, mosquito, and stable fly were responsible for the transmission of poliomyelitis.

Casey and co-workers 1945, (8), believed that insects played a minor role in the transmission of poliomyelitis during the Chicago epidemic.

Robinson and Sweadner 1945, (53), stated that there was no consistency in their reports on the presence of the various domestic animals. The various animals listed in their report were horses, cows, dogs, and cats. In only a small percentage of the cases was there a history of no contact with a domestic animal.

Flexner and Clark 1913, (60), observed that neither mosquitoes nor lice were able to take the virus of poliomyelitis from the blood

of infected monkeys. Sabin and Ward 1941, (38), stated that they were unsuccessful in their attempts to isolate the virus from mosquitoes and house flies in epidemic areas. Casey 1945, (62), reported that mosquitoes, flies, mice, lice, and fleas were not proven to carry the virus of poliomyelitis. The American Orthopedic Ass'n. 1946, (6), stated that there is no absolute proof of vectors.

WATER, FOOD, AND MILK

The role that water, food, and milk play in the epidemiology of poliomyelitis is uncertain. Haynes 1917, (11), reported that in a study of a small epidemic on an isolated island off the coast of Sweden, made by Kling and Levaditi 1913, (10), that the use of milk, food supplies, or water in common may not result in the transmission of the disease from a sick person even to an individual of susceptible age. Casey and co-workers 1945, (8), reported that nothing unusual was reported in their survey as to the water supply. Fraser 1943, (5), however, observed that many children having poliomyelitis in August gave a history of drinking untested water at summer camps.

Several authorities reported evidence that milk may be implicated in the transmission of poliomyelitis. Aycock 1924, (32), reported an epidemic of poliomyelitis in Broadstair, England, traced to the milk from one town. Dingman 1916, (63), recorded an epidemic traced to milk.

Toomey 1941, (26), pointed out that the peak of the incidence of poliomyelitis corresponds with the season of fresh fruits and vegetables. He attempted to prove this by isolating the virus from fruit washings but has been unsuccessful this far. Toomey 1943, (64). He suggested that it is a good idea to wash all fruit to be eaten uncooked even though there is an absence of conclusive evidence that fruit is a common carrier of the virus.

SEWAGE AND GARBAGE

Many authorities agree that sewage contains the virus of poliomyelitis but they do not all agree as to its role in the epidemiology of poliomyelitis.

Paul and co-workers 1939, (65), found that sewage in stagnant streams in epidemic areas contained the virus. In another report, Paul and co-workers 1940, (66), investigated sewage in an epidemic and found that from 2 out of 3 cities were positive for the poliomyelitis virus. Both positive cities were near isolation hospitals. They concluded that the virus can be carried in sewage for a short time.

Trask and co-workers 1940, (36), in a series of investigations found that the virus is detectable in stools with an ease related directly to the nonparalytic stage and inversely to the age of the patient. This work was confirmed by Sabin and Ward 1941, (38). Paul and Trask 1941, (37), found positive stools in paralytic and abortive cases in the Connecticut epidemic. The cases were closely

related geographically to one water course and were all down-stream from the original focus.

Smith and co-workers 1945, (9), stated that the evidence indicated that the Buffalo, New York, epidemic was not initiated from sewage, polluted streams, toilets, or unsanitary environmental conditions. Casey and co-workers 1945, (8), found nothing unusual reported in their survey about garbage and sewage disposal or to the sewerage.

TOPOGRAPHY

There is very little in the literature concerning the importance of topography in the epidemiology of poliomyelitis. According to Frost, (67), the epidemics offer unexplainable irregularities in their geographic distribution. As previously stated, Paul and Trask 1941, (37), found that the cases in the Connecticut epidemic follow the water course of one stream.

TYPES OF RESIDENCES AND NEIGHBORHOODS

Schwartz 1917, (43), believed that hygienic conditions do not play an important role in the transmission of poliomyelitis since cases may occur in the best hygienic surroundings. This was also shown by Emerson 1917, (46).

Robinson and Sweadner 1945, (53), have shown that cases occur in persons living in every type of residence from high class residential areas to slums. The premises range from no vegetation to forest conditions.

SWIMMING

Swimming has always been considered a means of acquiring poliomyelitis by many physicians and especially the laity.

Fraser 1943, (5), reported that many children having poliomyelitis in August give a history of swimming in some stream. According to Varga 1944, (68), however, only one case in his series gave a definite history of swimming. Bohls and Irons 1944, (42), observed that swimming did not seem to be a factor in the Texas epidemic. Maxcy 1943, (69), claimed that there is little or nothing about poliomyelitis suggestive of transmission through water.

GENERAL BODY CONDITION

Most authorities agree that tonsillectomies seem to predispose a person to the virus of poliomyelitis especially to the bulbar type. This is shown even better in persons with recent tonsillectomies. Aycock 1942, (70), Howard 1944, (71), Lucchesi and La Bocetta 1944, (72), and The American Orthopedic Ass'n. 1946, (6).

Colmer 1943, (47), suggested that teething and dental work may be a factor in poliomyelitis.

According to The American Orthopedic Ass'n. 1946, (6), excessive fatigue and exertion seems to reduce a person's resistance to the virus of poliomyelitis.

Smith and co-workers observed that minor illnesses simulating ordinary gastro-intestinal upsets and upper respiratory infections were widely prevelant during the poliomyelitis season. Perkins

1941, (48), has shown in his study of poliomyelitis in southwestern Minnesota that as poliomyelitis appears in new areas, local physicians report a concurrent wave of "summer flu".

WEATHER

There have been various observations on weather and its relation to the epidemiology of poliomyelitis.

Fraser 1943, (5), believed that the virus is sensitive to climatic factors, therefore, it survives in greatest amount and/or virulence in an atmosphere neither too hot nor too cold. Weather and season probably govern in large measure the concentration of the virus in nature. Bowerman 1945, (73), believed that the most probable cause of poliomyelitis is a dust-borne virus aided by hot, humid weather. He observed that hot, dry summers seemed to be frequently associated with outbreaks of poliomyelitis and the lack of rain seemed more significant than the change in mean temperature. Craster 1917, (44), mentioned the fact that during the week preceding the highest incidence of poliomyelitis in the Newark epidemic, the highest mean temperature and the least rainfall of the whole summer occurred. Casey 1945, (62), stated that nearly every large epidemic occurs in an area after a severe drought.

Schwartz 1917, (43), claimed that there is no direct evidence supporting the suggestion that deficient rainfall has any effect on an epidemic.

Fraser 1943, (5), reported that the incidence of poliomyelitis

falls precipitously with the first frost. Bowerman 1945, (73), has shown that nearly every year the decline of poliomyelitis in New York City coincides with the onset of fall storms. He has also observed that the mortality rate has frequently been in accord with the cycle of sunspot numbers.

PREVENTIVE MEASURES

In an effort to prevent the high incidence of poliomyelitis, The American Orthopedic Ass'n. 1946, (6), suggested that crowded places, especially indoors, swimming pools, travel, streams and water subject to pollution, over-exertion, and tonsillectomies should be avoided. Paralytic cases should be hospitalized and screened and the bedding and excreta sterilized. General sanitation should be checked, especially sewage disposal and milk and water supply. Food supplies in stores and homes should be protected from contamination by flies and other insects. Toomey 1941, (6), added the following measures to be taken: wash hands before eating anything; wash all raw fruits and vegetables; treat every minor illness during a poliomyelitis epidemic as a case of poliomyelitis.

SURVEY

In an attempt to augment the literature, an extensive survey of local poliomyelitis cases reported to the Board of Health in Omaha, Nebraska, during the 1946 season (to November 17th) was made.

The purpose of this study was to learn the extent personal

contact played in the epidemiology of poliomyelitis and to what extent sanitation was practiced in families and neighborhoods where poliomyelitis occurred, also to ascertain whether or not the patients were involved in any unusual habits regarding personal hygiene, food, recreation, or occupation. Data was also gathered concerning the weather. Clinical and sociological aspects are not treated in this report.

To accomplish this objective it was necessary to visit each home as soon after the case was reported to the Board of Health as possible and to interview the patient or immediate family personally. A questionnaire (to be included in this report) was used so that the information could be compiled into a statistical report which would reflect conditions found to be common in all cases contacted. The cases of poliomyelitis included in this survey were ones diagnosed by local physicians and reported to the Board of Health. It was assumed by the writer that these cases were definitely poliomyelitis.

In all but three cases, the interview was conducted by the writer. In this way, differences in interpretation of the questions were eliminated. In one case the questionnaire was filled out by the family physician and in the other two cases the questionnaire was filled out by a member of the immediate family, and in these two incidents both were physicians.

Records in the office of the Board of Health indicate that

88 patients lived in Omaha (an incidence of 37 per 100,000 of population) and 3 patients lived in Douglas County outside the corporate limits of the city. Personal contact was made with 83 of these cases and a satisfactory interview had with the patient or member of his immediate family. The exhibits in this report are based upon the eighty-three patients who were contacted.

OCCURRENCE

The first case of poliomyelitis reported in Omaha in 1946 occurred June 8th; the last case, November 17th. A typical normal distribution curve is revealed in the following chart, i.e., the incidence starts in June and builds up gradually to the high point in August, then declines gradually to the middle of November.

Period	Number of Cases	Percentage
June 8 to 30	3	3.60
July 1 to 15	3	3.60
July 15 to 31	11	13.25
August 1 to 15	15	18.20
August 15 to 31	17	20.30
September 1 to 15	11	13.35
September 15 to 30	10	12.00
October 1 to 15	7	8.50
October 15 to 31	3	3.60
November 1 to 17	3	3.60

This data is in general agreement with the findings of the

American Orthopedic Ass'n. 1946, (6), Fraser 1943, (5), and Bohls and Irons 1944, (42).

WEATHER

Included in this report is a general summary of each month's weather from May 1946 to November 1946, as published by the Omaha Weather Bureau. From the same source it is learned that the average date of the last killing frost in the spring in this area is April 14th, and the average date of first killing frost in this area is October 17th. The actual dates in 1946 were May 11th and October 12th.

It is noted that the date of the first killing frost roughly corresponds with a drop in the incidence of poliomyelitis. This finding is in agreement with that of Fraser 1943, (5).

The following are monthly summaries of the weather:

May 1946: "The mean temperature for the month was 3.2° below normal and the highest recorded during the month was 84°....The lowest was 21° on the 11th...This was the latest day of spring that a temperature of 32° or lower has been reached...Only 7 days of the month were without precipitation."

June 1946: "Temperatures for the month were generally above normal...Precipitation exceeded the normal by 2.22 inches, but very little occurred during the first 15 days; 1 inch or more fell on four days during the latter half of the month and a 24-hour fall of 3.27 inches was recorded on the 17-18..."

July 1946: "Temperature for the month average 2.0° above normal. The highest temperature was 97° on the 14th; the lowest, 59°, occurred on the 1st.

The average daily range was 21.6°. Precipitation was 1.70 in. below normal, occurring mostly as thundershowers fairly well distributed throughout the month..."

August 1946 — "The month was the coolest August since 1940 with mean temperature 73.0°, or 0.2° below normal. Highest temperature 96° on the 2nd, and 44° on the 29th, was the lowest recorded since 1915. Precipitation amounted to 3.92 inches, 0.87 inch above normal..."

September 1946 — "Temperature for the month was near normal. Temperatures ran well above normal from the 4th to the 8th inclusive, from the 14th to the 18th; and on the 26th and 27th, with the mean reaching 12 degrees above normal on the 26th. Temperatures from the 22nd to the 30th were well below normal except on the 26th and 27th. Precipitation was 0.52 inch above normal with most of the excess occurring on the 3rd and 4th..."

October 1946 — "Although the temperature for the month was 3.4 degrees above normal this was largely the result of the period of warm weather occurring at the end of the month. The mean temperature for the first half of the month was exactly normal with temperature reaching freezing on the 12th, when a low of 29° was recorded. The last half of the month was 6.5° above normal, with the temperature barely reaching freezing on the 18th. Every day from the 19th to the end of the month was above normal, with a mean of 68° reached on the 28th and 29th. Precipitation went above normal with the 1.28 inch of rainfall on the 10th, and remained above normal for the remainder of the month..."

November 1946 — "The first appreciable snow of the season occurred on the 9th when 1.8 inches fell. The total precipitation for the month was 1.87 in., .80 above normal. A total of .74 in. fell in one 24-hour period on the 6th and 7th. Practically all of the precipitation fell during the first half of the month. An unusually late thunderstorm occurred on the 15th...."

It was noted from the preceding weather summary excerpts that the temperature during June, July, September, October, and November was generally above normal. This finding is in agreement with Bowerman 1945, (73). August, however, with the highest incidence of poliomyelitis, was the coolest since 1940. This is not in accord with the findings of Bowerman 1945, (73), and Craster 1917, (44). Precipitation was above normal in June, August, September, October, and November. This is not in agreement with Craster 1917, (44), Casey 1945, (62), or Bowerman 1945, (73), but the finding that the precipitation was below normal in July is.

AGE, SEX, COLOR, AND NATIONALITY

Poliomyelitis occurred in a wide range of ages. The youngest patient was 10 months of age and the oldest patient, 56 years. The survey showed that 83.2 percent of the cases involved patients under twenty years of age.

The information from the following chart indicates that poliomyelitis is mainly a disease of childhood as the greatest incidence occurred between the ages of 3 and 10 inclusive, i.e., five 3-year olds, eight 4-year olds, nine 5-year olds, eight 6-year olds, four 7-year olds, six 8-year olds, and five 10-year olds. This is 61.5 percent of the total cases.

This information agrees with Kendall 1945, (7), Schwartz 1917, (43), and The American Orthopedic Ass'n. 1946, (6).

AGE DISTRIBUTION

5 years and under	18 cases	21.6 percent of total cases
10 " " "	51 "	61.5 " " " "
15 " " "	62 "	74.5 " " " "
20 " " "	69 "	83.2 " " " "
21 years and over	14 "	16.8 " " " "

These figures also correspond with those of Dauer 1943, (49), showing a gradual increase in the age of poliomyelitis victims.

No colored or oriental patients were found among the cases interviewed. This agrees with Craster 1917, (44), and Bohls and Irons 1944, (42), but disagrees with The American Orthopedic Ass'n. 1946, (6). The negro district in Omaha is just about in the center of one of the poliomyelitis districts. In one instance there was a white family with a poliomyelitis case living in the same duplex with a negro family. There were several suspicious cases suggestive of poliomyelitis which developed in the white family, but there was no evidence of the slightest illness in the negro family which was in close contact with the white family.

Slightly more males than females were affected with poliomyelitis, there being 44 male and 39 female cases interviewed. This is simular to the findings of Nicoll 1917, (12), Perkins 1941, (48), Bohls and Irons 1944, (42), and The American Orthopedic Ass'n. 1946, (6).

MORTALITY

The mortality rate of this survey was 9.6 percent, representing

eight deaths. This corresponds with the mortality rate of Perkins 1941, (48). There was no discrimination in sex, as there were four male and four female fatalities. This does not agree with the findings of Nicoll 1917, (12). There was no discrmination in age between male and female fatalities as shown in the following chart. The youngest fatality was a six-year old male, and the oldest was a nineteen-year old female. One patient, a 56-year old male, remains in critical condition at the date of this report (December 31, 1946). Other patients included in this survey who are still hospitalized are in varying stages of convalescence.

FATALITIES

Females:	Males:
1 seven years of age.	1 six years of age.
2 ten years of age.	1 nine and one-half years of age.
1 nineteen years of age.	1 fifteen years of age.
	1 eighteen years of age.

These figures do not correspond to the ones given by Nicoll 1917, (12). This can be explained, perhaps, by the better means of earlier diagnosis and better treatment.

HOMES

Whenever possible, each home was visited without an appointment in order that the general cleanliness and orderliness practiced in the household might be observed. On this basis it was concluded that fifty patients lived in homes classified as satisfactory for the above conditions, and thirty-three patients lived in homes

classified as unsatisfactory. All strata of social life were represented in the survey. However, the majority of the cases could be classified as being in the lower middle class bracket.

Of the eighty-three cases visited, only four patients were housed in unscreened homes.

PREMISES

Using general neatness and freedom from offensive and unsanitary conditions as a yardstick to evaluate home surroundings, it was found that thirty-five patients lived on premises classified as satisfactory and forty-eight patients lived on premises classified as unsatisfactory.

Several premises were found to be outstanding in their lack of ordinary sanitation. For instance, these conditions existed: (a) dead rats and chickens in yards, (b) fruit permitted to decompose under trees, (c) dilapidated outbuildings, (d) privies too close to house, (e) livestock in yard, (f) accumulated filth and rubbish, and (g) weeds and general debris.

NEIGHBORHOODS

Eighty-three patients (100 percent of cases contacted) lived in neighborhoods containing vacant lots, home gardens, rubbish dumps, or other conditions conducive to the breeding and harboring of rats and other pests. The few cases which occurred in preferential neighborhoods were exposed to health hazards emanating from sources beyond their control, such as park ravines which harbor

pests due to rubbish dumps. Elements injurious to public health were prevalent in blighted neighborhoods and in areas where a rural atmosphere predominates. Vacant lots were permitted to grow up in weeds which remained uncut all summer. Home gardens were not kept weeded and clean, and vegetables and fruits were allowed to rot on the plants, trees, or ground. Piles of debris were found in backyards, alleys, in vacant lots, and in back of grocery stores. Some families disposed of garbage by throwing it on the premises, vacant lots, or gardens for fertilizer. Inadequate storm sewers were found which permitted water to stand in the streets after hard rains. Many of the persons interviewed claimed that the street sewers provided shelter for rodents. In one instance, a dilapidated vacant building was permitted to menace a neighborhood as a fire hazard and a breeding place for rats.

GARBAGE DISPOSAL

Garbage containers were classified according to adequacy of size and whether they were kept covered and reasonably clean. A satisfactory garbage arrangement was provided by 52 families and an unsatisfactory condition prevailed in 21 cases.

There was considerable complaint about the city garbage collection service, especially during the summer months. The three things most often complained about were: (a) garbage not picked up often enough, (b) collectors spilled garbage, and (c) collectors did not replace the lid of the garbage container.

The following chart indicates the frequency of collection and other means of disposal:

18 cases reported garbage collections twice a week.
47 " " " " once a week.
3 " " " " every two weeks.

8 cases burned their garbage.
8 " fed their garbage to livestock.
4 " dumped their garbage on the premises or nearby lots.

SEWAGE DISPOSAL

Twenty-three cases complained that street sewers in their immediate neighborhood were inadequate to handle the load and inferred that they contracted poliomyelitis from this source. The sewers were also alleged to be the source of nauseating odors and havens for rodents. The practice of connecting storm sewers to sanitary sewers was not considered to be a satisfactory condition and therefore was condemned.

The majority of the cases contacted had modern plumbing facilities in their homes. The questionnaire revealed that seventy-three cases had modern toilet facilities in their homes. Seven cases used privies; one case had modern toilet facilities in the home which were connected to septic tank; two cases had modern toilet facilities connected to a cess pool. Another two cases admitted having cess pools on their property which were no longer in use. Eleven cases reported trouble with their sewers shortly before the onset of poliomyelitis.

VECTORS

The following chart gives the information obtained from the survey on the presence of vectors:

54	cases	complained	of	rats	on	their premises.
61	"	"	"	flies	"	" "
67	"	"	"	mosquitoes	"	"
33	"	"	"	roaches	"	"
29	"	"	"	mice	"	"
22	"	"	"	ants	"	"
2	"	"	"	fleas	"	"
1	"	"	"	bees and wasps		"

Fifty cases had contact with domestic pets before the onset of poliomyelitis.

WATER SUPPLY

On the home premises, seventy-eight patients obtained water from the city mains. Five patients obtained water from wells.

Only one contact intimated that city water might have been the cause of poliomyelitis in their home. This opinion was unsolicited since the questionnaire aimed only at learning the source of the water consumed. Water used on outings, vacations, et cetera, is charted in another section of this report.

MILK SUPPLY

The survey revealed that seventy-seven patients drank pasteurized milk. Three drank raw milk, and three did not drink any milk. The source of pasteurized milk was not confined to any one dairy but was distributed among reputable, licensed companies.

DIET

The patient was asked to give an average daily diet and the amount of their daily food intake. From this data the vitamin and caloric values and completeness of the diet was estimated according to the values of Bowes and Church 1944, (74). In arriving at a conclusion regarding the adequacy of the diet, consideration was given to the normal tendency to exaggerate and to intimate that all meals were well balanced. The majority of the families appeared well nourished. The following chart indicates the findings of the type and amount of the diet.

77 cases ate a diet classified as adequate for calories, carbohydrates, proteins, fats, and vitamins.

6 cases ate an inadequate diet.

83 cases ate raw fruit and vegetables.

47 cases ate fruit directly from the tree, bush, or vine, and vegetables directly from the garden.

36 cases stated that all food was thoroughly washed.

47 cases stated that all food was not thoroughly washed.

PERSONAL HYGIENE

Since each case report involved a personal contact, opportunity was afforded to note the general appearance of the patient and/or his family as to cleanliness of clothing, hands, and hair. Direct questions were asked concerning bathing and dental care habits. Inasmuch as the interview occurred from several days to five weeks

after the onset of the illness, it was not possible to observe all of the patients as some were hospitalized and some were deceased. It was felt, however, that the appearance of the patient's family and the general cleanliness of the household would reflect the appearance of the patient. In some instances the home was found to be unsatisfactory from a sanitary standpoint, but the patient and/or other members of the family appeared neat and clean. In other cases just the opposite was found. In other words, unsanitary homes and unsatisfactory personal hygiene did not always occur in the same family. The following chart, then, represents personal reactions after allowances were made for contributing factors at the time of the interview.

68 patients were classified as satisfactory in general hygienic measures.

15 patients were classified as unsatisfactory.

WEIGHT

The patient and/or his family, in most instances, was unable to recall any significant changes in weight of the patient prior to the onset of poliomyelitis. Approximately one-half of the patients considered their weight normal at the time, considering age, height, and family characteristics. The following chart indicates the estimated weight of the patients.

2 patients were over-weight before illness.

11 patients were slightly over-weight before illness.

40 patients were average weight before illness.

17 patients were slightly under-weight before illness.

13 patients were definitely under-weight before illness.

INSECT BITES

Some of the patients interviewed recalled specific instances of insect bites. The first case contacted, and incidentally the first case reported in Omaha, revealed that the patient had suffered a severe insect bite on the breast about a week before the attack. The second patient contacted complained of a painful insect bite on the head shortly before the onset of poliomyelitis. Several other patients stressed insect bites which they considered unusual and which became sensitive and swollen. Some of the patients interviewed were positive that mosquitoes were responsible for the lesions and other patients were unable to identify the insect. Twenty-six patients were found to be hypersensitive to insect bites.

PAST MEDICAL AND DENTAL HISTORY

The survey aimed at learning how many of the patients had undergone surgery or had had some diagnosable ailment prior to the onset of poliomyelitis, especially in 1946. The facts obtained indicate there is no connection between tonsillectomies in 1946 and bulbar cases. This does not agree with the findings of Aycock 1942, (70), Howard 1944, (71), Lucchesi and La Bocetta 1944, &72), and The American Orthopedic Ass'n. 1946, (6). Computation of data reveals the following:

3 patients had tonsillectomies in 1946.

1 patient (pregnant) had a gallbladder operation one month before onset of illness.

Previous to 1946:

5 patients gave a past history of tonsillitis.

11 p " " " " " childhood diseases.

4 " " " " " rheumatic fever.

28 " " " " " tonsillectomies.

No " " " " " poliomyelitis.

Dental care in 1946 was confined to:

7 patients who were teething when taken ill.

9 patients who had had regular dental care.

ACTIVITIES

Each case was questioned regarding shows, vacations, recreation, carnivals, and other outings prior to the onset of their illness. They were questioned about toilet facilities, water supply, garbage disposal, insects, and comments on any unusual occurrence while away from home. Many patients were vague about sanitary measures and contacts made while away from home, and further allowance must be made in considering the following chart of activities. The data was limited to four weeks prior to the occurrence of poliomyelitis, with the following results:

Outings:

31 patients had been on picnics within 4 weeks prior to the onset of their illness.

5 patients had been at church socials.

6 patients had been on other outings.

Food:

28 patients stated that their food was adequately protected.

6 " " " " " was not " "

Garbage:

28 patients stated that they had adequate garbage disposal facilities.

3 patients stated that they did not have adequate garbage disposal facilities.

Toilet Facilities:

8 patients stated that they had sanitary toilet facilities.

17 " " " " did not have " " "

Miscellaneous:

2 patients reported that there were sick persons on their outings.

10 patients had been to house parties within 4 weeks prior to the onset of their illness.

43 patients had been to picture shows within 4 weeks prior to the onset of their illness.

6 patients had been to State or County fairs within 4 weeks prior to the onset of their illness.

3 patients had been to carnivals or the air show within 4 weeks prior to the onset of their illness.

33 patients had visitors to their homes within 4 weeks prior to their illness.

7 patients had out-of-town visitors from farms within 4 weeks prior to their illness.

1 visitor was ill with symptoms suggestive of poliomyelitis.

SWIMMING

Thirty-one patients had been swimming within 4 weeks prior to the onset of illness. Sixteen patients had been swimming in pools, as follows:

Technical High School Pool, Omaha. This indoor pool has a filter system and automatic chlorinating system. City water is used and the pool is open during the school year and part of the summer.

Peony Park, Omaha. This is a private commercial pool, open in the summer. It has an automatic chlorinating system and uses water from own wells.

Morton Park Pool, Omaha. This is a city pool, open in the summer. It is manually chlorinated and there is no filtering system. However, the pool is emptied and cleaned twice a week.

Capital Beach, Lincoln, Nebraska. This pool has an automatic filtering and chlorinating system and uses water from nearby salt water wells.

One patient had been swimming in the Atlantic Ocean.

Twelve patients had been swimming in lakes or sandpits as follows: Valley, Carter Lake, Linoma Beach, Cowles Lakes, and Merritt's Beach, all near Omaha.

Two patients had been swimming in rivers. One in the Niobrara river and the other in a creek near Curtis, Nebraska, just below the place where sewage from McCook empties into it.

There were two fatalities among patients who had been swimming.

One occurred at Peony Park, and the other at Merritt's Beach.

The patients who had been swimming prior to the onset of their illness represent 37.4 percent of the total patients.

VACATIONS

Twenty-nine patients had been on a vacation within four weeks preceding their illness. Three patients became ill on their vacation.

Sixteen patients had modern, sanitary toilet facilities while on their vacation and thirteen patients had outdoor facilities.

Sixteen patients drank city water while on their vacation and thirteen patients drank well water.

Thirteen patients had their garbage collected, six patients burned their garbage, and ten patients fed their garbage to livestock while on their vacation.

Thirteen patients complained of mosquitoes while on their vacation. Ten patients complained of flies and one patient complained of spiders.

FARMS

Four of the patients lived on farms or acreages in rural areas. Twenty-six patients visited farms within 4 weeks prior to their illness.

Four patients had modern toilet facilities connected to septic tanks and fifteen of the twenty-six patients who visited farms stated that they used outdoor privies.

Eighteen patients stated that garbage was fed to livestock.

Sixteen of the thirty patients who visited or lived on farms were around livestock.

Seventeen patients stated that they were on farms which obtained their water from wells. The other patients did not remain long enough to drink water.

Fifteen patients drank raw milk while on farms. Two patients drank pasteurized milk.

Two patients were on farms where there was illness resembling poliomyelitis.

CONTACT

It was found that twenty-six persons had contact with patients within a week before or a week after the onset of the signs and symptoms of poliomyelitis, and that these twenty-six persons developed an illness resembling poliomyelitis but were not diagnosed or treated for the disease. Of these twenty-six persons who became ill after contact with poliomyelitis cases, twenty-one were family members and five were outside the family circles.

Of the eighty-three cases contacted, twenty-eight patients had been in contact within four weeks previous to the onset of their illness with twenty-six persons who had been ill with signs and symptoms of poliomyelitis. Regarding these twenty-six persons contacted, twenty were in the families of poliomyelitis patients and six were in families outside the family groups.

There were eight families in which two cases of poliomyelitis

occurred. Of these sixteen cases which occurred in eight families, two were fatalities. The number of days difference between the onset of diagnosable cases of poliomyelitis in the same family varied. The shortest lapse of time between the onset of the illness in the same family was one day, and the longest period was fifteen days. According to these findings, four and one-half days was the average lapse of time between the occurrence of the illness in the same family. The figures also indicated that in at least five families, or ten cases, the exposure was approximately at the same time, and in three families or six cases there is a possibility that the second case to develop might have been contracted from the first case in the family.

SUMMARY AND CONCLUSIONS

Poliomyelitis is a world-wide disease occurring most frequently in the temperate zones. It is endemic, sporadic, and epidemic, but most cases occur in late spring, summer, and early fall. It is caused by a filtrable virus which seems to have an affinity for neural tissue, especially gray matter. It is chiefly a disease of children, but the average age of the patient is gradually increasing. It is more prevalent in males, and appears to be more prevalent in rural areas. The survey showed that 100 percent of the cases occurred in rural areas or neighborhoods where there were vacant lots and and unkept gardens.

Race, color, and social status have little to do with polio-

myelitis; however, the survey showed that no negro or oriental people were involved.

Both the gastro-intestinal and olfactory portal of entry have been presented. At the present time, the gastro-intestinal portal is in favor. Some believe both are involved but as yet no portal has definitely been proved to take precedence over the other.

All authorities agree that the virus is found in the stools and nasal secretions, but it has not been demonstrated in the urine.

The incubation period varies from 1 to 25 days with an average of 7 to 14 days. The infectious period varies from 7 days before to 7 days after the onset of symptoms.

The diagnosis of poliomyelitis is difficult because paralysis is an uncommon complication of the disease and is also one of the main diagnostic criteria. It is concluded that more cases are undiagnosed than diagnosed, therefore poliomyelitis is more widespread than the number of diagnosed cases indicates.

There is disagreement on the subject of immunity; therefore, no conclusions can be made at this time. The survey indicated there were no second attacks of poliomyelitis.

Poliomyelitis seems to have a higher mortality rate in rural areas. The average mortality rate is about 10 percent.

The mode of transmission of poliomyelitis is uncertain. Evidence was presented for both the personal contact and "place infection" theory. No definite conclusion can be made at this time.

Some claim that both are involved.

Of the eighty-three cases contacted, twenty-four had visited another community within 45 days prior to their illness. Reference to such activities as vacations and other outings will show that forty-two persons attended picnics, church socials, and other outings within 4 weeks previous to the onset of their illness; that two of these patients were in contact with persons on these occasions who were ill with symptoms suggestive of poliomyelitis. Also, it will be noted that twenty-nine patients were on vacations within four weeks prior to becoming ill and that three of these cases became ill while on vacation. In one instance, a visitor to the home of patient was ill with symptoms resembling poliomyelitis.

There is no absolute proof that vectors play a part in the transmission of poliomyelitis, although some are prevalent in epidemic areas.

The role of food, water, and milk is uncertain and no conclusion can be drawn at the present time.

The virus of poliomyelitis has been found in sewage, but its role in the spread of poliomyelitis is uncertain at this time.

The role of topography is uncertain. Some have shown that poliomyelitis seems to follow water shed.

The types of residences and neighborhoods do not appear to be significant in the epidemiology of poliomyelitis.

Swimming can not be proven to contribute to the transmission

of poliomyelitis, but the survey noted that a large percentage of the patients have the history of being swimming.

A run-down condition seems to predispose a person to poliomyelitis. Recent tonsillectomies appear to predispose a person to the bulbar type of poliomyelitis but this was not shown in the survey.

The observations on role of weather in the epidemiology are conflicting.

Since the means of acquiring and the mode of spreading poliomyelitis are unknown, general sanitary precautions should be taken. Also, all unnecessary contact should be eliminated and all illnesses during the poliomyelitis season resembling poliomyelitis should be treated expectantly.

The following is a copy of the questionnaire used.

Name:

Age of Pt. Sex: Color: Nationality: Occupation:

Home address: (Est. IB $)

Address where patient became ill:

Did patient visit any other community or live at any other address within 45 days prior to attack? Where, when, how long?

If dead, give cause and date:

	Age	Occupation	Living w/Pt.	Gen'l Cond.
Father				
Mother				
Sisters				
Brothers				

Other persons living at address with patient:

Name	Age	Occupation	General Condition

Comment on any unusual occupation of patient or member of household, i.e., food handler, garbage hauler, etc.

PROPERTY SANITATION

1. Garbage Disposal
   How
   How often
   If pail used, is it kept clean and covered?

2. Sewage Disposal
   How :
   Has sewer backed up recently?
   Basement drain? Clean?
   Toilets? Clean?
   Cesspool: Covered? When last cleaned? How?
   Street sewer?

3. General appearance of yard and house:

4. House screened?

5. Is there any evidence of rats, mice, mosquitos, ants, roaches, flies, (kind), bed bugs, fleas, mites, lice, etc.

6. Kind and number of pets and their general appearance:

7. Did patient handle pet before illness?

8. Are there cisterns, rubbish dumps, cesspools or any other unusual things in neighborhood, i.e., breeding places for mosquitos, etc.

9. Comments:

PERSONAL SANITATION:

1. General appearance of patient, i.e., clothing, hands, hair, nails:

2. How often does patient bathe? Brush teeth?

3. General appearance of other members of household, i.e. clothing, hands, etc:

4. Laundry:
How cleaned: Where: Where dried:

5. Sleep:
Where: How long:
Alone: Ventilation:

6. Exercise:
What kind: How much:

7. Swimming:
When: Where: How much:

Comments:

8. The use of drugs: Alcohol? Tobacco? Tea? Coffee?

9. Vacations: When: Where: How long:
General sanitation of places visited:
Toilet facilities:
Water supply:
Garbage disposal:
Insects:

10. Picnis, Church Socials, and Other Outings:
When: Where:
Food protected: Water supply:
Garbage disposal: Toilet facilities:

11. Was there any one with patient on outing or vacation who was sick and handled food, played or slept with patient?

12. Parties:
Kind: When: Where: How often:
Food: Sanitation:

13. Shows and other forms of amusement:
When: Where:

14. Visitors
When: Ill:

15. Is patient allergic to mosquito bites, chiggers, lice?

16. Has patient visited farm recently: When: Where:
Toilet facilities:
Garbage disposal:
Around any livestock:
Any illness on farm:
Milk and water supply:

17. Any visitors from farm: When: From where: Ill:

18. Comments:

FOOD SANITATION AND NUTRITION

1. Was any particular food eaten in large quantities prior to symptoms:

2. What is the patient's favorite foods:

3. Eating habits: (average)
Breakfast: Lunch: Dinner: Between meals:

4. Did patient eat raw:

Strawberries	Cherries	Grapes
Raspberries	Peaches	Apples
Plums	Apricots	Lettuce

Any other raw fruit or vegetable:

5. Is all food thoroughly washed? Cooked? Refrigerated?

6. Dishes: Dish pan? Running water? Soap? Scalded?

7. How much milk does patient drink? Where obtained:
   Standard: Homogenized? Raw?

8. How much water per day? Source?

9. Is food bought at small neighborhood store or at chain store?

10. Was any home canned foods consumed prior to symptoms?
    Method of canning: Open kettle: Cold pack: Pressure:

11. Comments:

MEDICAL

1. Date of onset of illness and presenting signs and/or symptoms:

2. Check following for occurrence and date of appearance:
   Fever
   Headache
   Muscle pain
   Muscle weakness and paralysis
   Stiff neck
   Vomiting
   Coryza
   Stiff back
   Abdominal pain
   Back pain
   Mental symptoms
   Anorexia
   Dysuria
   Diarrhea
   Convulsions
   Joint symptoms
   Swallowing difficulties
   Voice change
   Palate paresis
   Facial nerve paresis
   Respiratory difficulty
   Pulse irregularity
   Encephalitic symptoms
   Tongue paresis
   Diplopia

3. Had patient been in contact with any one who had any of the signs and symptoms of polio in previous 5 weeks? List contact and contact's signs and symptoms:

4. List of persons known to have come in contact with patient a week before and a week after the onset of signs and symptoms. Give age and any signs or symptoms they developed:

5. History of:

Chicken pox	Smallpox
Chorea	Mumps
Tonsilitis	Influenza
Pneumonia	Pleurisy
Scarlet fever	Typhoid
Diphtheria	Malaria
Whooping cough	Rheumatism
Insect bite:	Tuberculosis

6. Previous hospital entries: Operations, etc., especially tonsillectomy.

7. Previous dental care: Tooth pulled, cutting teeth, etc:

8. Statement about appetite:

9. Statement about weight:

10. Type of polio:
    Paralytic
    Nonparalytic
    Bulbar

11. Type and length of treatment:

12. Prognosis:

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