

## The Epidemiology of Poliomyelitis.

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### INTRODUCTION.

THE purport of this paper is to collect and put together in a concise form the facts which are known in relation to poliomyelitis as an infective and epidemic disease. For this purpose the subject will be dealt with under the following heads:—

- (I) Definition of the term “poliomyelitis” and clinical aspect of the disease.
- (II) Nature of the virus.
- (III) History of past epidemics.
- (IV) Certain details in the investigation of some recent epidemics:—
  - (a) Wickman’s investigation of Swedish epidemic, 1905.
  - (b) Lovell’s investigation of Massachusetts epidemic, 1907.
  - (c) Krause’s investigation of Westphalia epidemic, 1908.
  - (d) Potpeschnigg’s investigation of Steiermark epidemic, 1909.
  - (e) Lindner and Mally’s investigation of Steyr epidemic, 1908.
- (V) Epidemics of poliomyelitis in Great Britain in 1908, 1909, 1910.
- (VI) Distribution of the disease in London in 1904.
- (VII) Conclusion.
- (VIII) Appendix, list of epidemics, literature.

### (I) DEFINITION OF THE TERM “POLIOMYELITIS” AND CLINICAL ASPECTS OF THE DISEASE.

The term “poliomyelitis” has been used to designate the disease under discussion because it is a name that has come into general use, and calls up to most people the clinical picture of a child with a flaccid palsy of one or more limbs. Personally, I prefer the term “polio-encephalomyelitis,” indicating that not only the spinal cord but any part of the nervous system may be affected. The term “infantile paralysis” is objected to because, although children are to the largest extent affected, yet the disease is by no means limited to them.

The terms “Heine-Medinsche-Krankheit” and “epidemic paralysis” have been suggested. With regard to the first, it has the objection common to all diseases described by men’s names—viz., that the name

conveys no indication of the nature of the disease. With regard to the second, I think there is much to be said in its favour; paralysis is a wide term and would include most of the manifestations of the disease, the word epidemic, although true with regard to a large number of the cases which occur, yet is by no means always so.

It is important to have a clear understanding of the clinical aspect of this disease. Poliomyelitis or polio-encephalomyelitis is an acute infective disease, having a special selective action on the nervous system, and giving rise to a variety of symptoms dependent on the portion of the nervous system affected. Such symptoms may be (1) a localized paralysis of one or more limbs; (2) an ascending paralysis, often rapidly fatal owing to the involvement of the respiratory centres; (3) an acute ataxia; (4) a paralysis of one or more cranial nerves; (5) hemiplegia; (6) the symptoms of meningitis; (7) an acute mental defect; and (8) a type of case in which pain, especially on movement, is the most marked feature—so-called neuritis.

Such is the modern conception of the disease. It is fully recognized that there are abortive cases with transient symptoms with or without paralysis; but these cannot be identified except when occurring in direct association with a marked case of the disease. Their true nature will only be fully proved when some serum reaction or animal test is forthcoming.

## (II) NATURE OF THE VIRUS.

It is not the purpose of this paper to deal with the nature of the virus of poliomyelitis, but no paper on the epidemiology of the disease can be complete without a clear understanding as to what is known of the virus. The work of Landsteiner, Popper, Levaditi, Flexner, and Lewis has shown that the disease is transmissible from man to monkeys by inoculation, that it is transmissible from monkey to monkey, that the virus is not killed by glycerination, and that it will pass the finest filter. The organism has not yet certainly been cultivated *in vitro*, has not yet been stained, and has not been seen under the highest powers of the microscope. The virus can be obtained from the mucous membrane of the nose of a monkey which has suffered from the disease, and may be obtained from this situation six months after the date of the infection in a still active condition (Osgood and Lucas).

Animals other than the monkey and ape seem to be immune, although Meinicke states he is able to infect rabbits. The similiarity

of the virus with that of rabies is striking. The pathological lesion in poliomyelitis is also very similar to that of rabies. It has recently been stated by Vipond that cases of poliomyelitis give a positive Widal reaction. In no case which has been tested for me by Dr. Forbes, Pathologist to the Children's Hospital, has a positive Widal reaction been obtained, neither has he succeeded in finding the organism described by Dixon, Fox, and Rucker in the blood of cases of poliomyelitis, but the number of such cases is at present too small to be of any great value.

On experimental grounds the incubation period of the disease would seem to be from five to six days. The clinical evidence would seem to indicate that the period is shorter, the evidence being in favour of a period below four days.

### (III) HISTORY OF PAST EPIDEMICS.

I do not propose to give a detailed account of all the past epidemics of poliomyelitis that have occurred. A good review of 35 epidemics up till 1907 will be found in the paper by Holt and Bartlett, and further details in the papers of Wickman and Job and Froment.

Since 1907 I have collected the record of some 26 epidemics in all parts of the world, and these, together with those previous to 1907, are recorded in a list which is appended to this paper.

The leading features of the past epidemics may, however, be shortly stated. The first record of the disease in an epidemic form comes from Sweden in 1881. (I have purposely omitted an epidemic recorded by Colmer in America in 1841, because I can find no account of it.) In 1883 some groups of cases were recorded in Italy, and in 1886 in Norway, Germany, and France. All of these epidemics were small in numbers. In 1887, however, Medin described an epidemic in Stockholm of 44 cases, and this is the first important work on the subject. In 1894 an epidemic occurred in Rutland, Massachusetts, of 132 cases, which were recorded by Caverly and McPhail. Small epidemics were recorded in the 'nineties in Italy, France, Australia, England and America, and a larger epidemic of 42 cases occurred in Vienna in 1898, and in Norway in 1899, and in Sweden in 1899. The latter epidemic was recorded by Wickman, to whom so much is due with regard to the investigation of the pathology and the spread of the disease. In the middle of the next decade, viz., 1900 to 1910, the record of cases, which before had been limited to two figures, now reached to four figures, and during the years 1903-07

it may be said that the disease was pandemic in Norway and Sweden, and during the years 1907-10 large epidemics occurred in the State of New York and in the State of Massachusetts. At the same time epidemics of the disease were recorded in Australia (Stephens), in Vienna (Zappert), Westphalia (Krause and Reckzeh), in Paris (Netter), in Austria (Fürntratt, Potpeschnigg, Lindner and Mally), Switzerland (Hagenbach), in Russia (Jogichess). (See maps, figs. 1, 2, 3.)

EPIDEMIC POLIOMYELITIS.

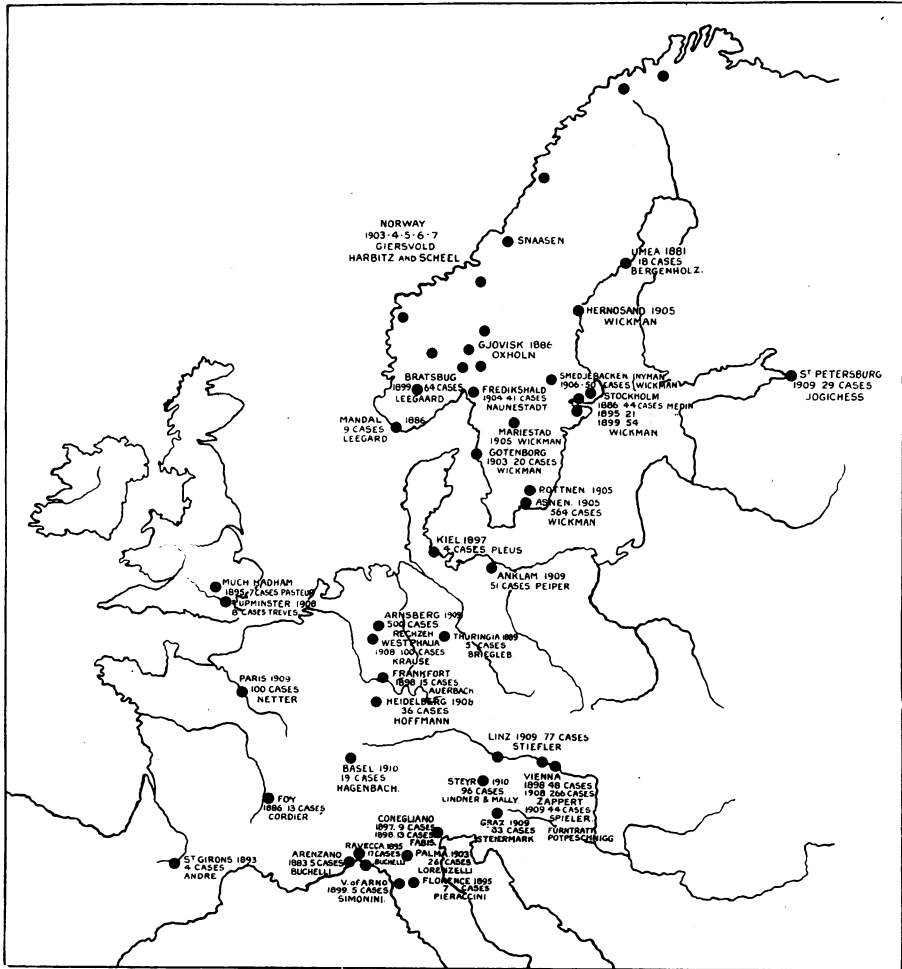


FIG. 1.

Map of Europe, showing the places at which epidemics of poliomyelitis have occurred, the number of cases in the epidemic, the date of the epidemic, and the name of the recorder.

During the year 1910 the number of cases of poliomyelitis, and deaths caused by the disease, recorded in the United States is as follows: Pennsylvania heads the list both in prevalence and in mortality, there were 1,097 cases and 172 deaths in that State. In Iowa there were 638 cases and 161 deaths. In Massachusetts there were 588 cases; the number of deaths is not given. Apparently the epidemic was most continuous in Iowa, for that is the only State from which cases and deaths were reported for every month of the year. The

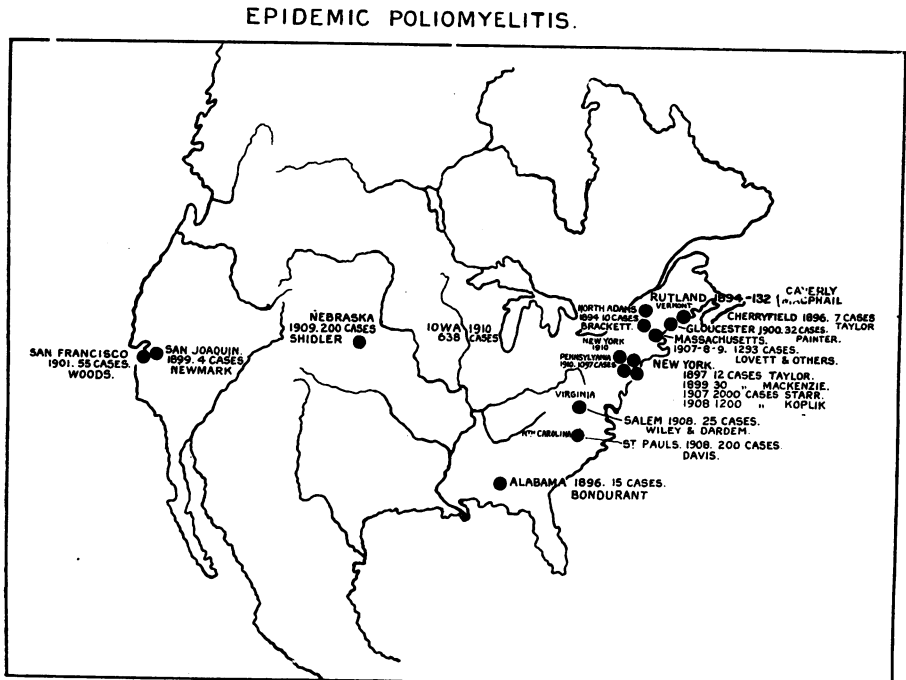


FIG. 2.

Map of America, showing the same facts as in fig. 1.

maximum number of cases in any month was 378 in September in Pennsylvania; the maximum number of deaths, 64, in the same month and the same State. The maximum number of cases in any month in the entire Union was 1,146, in September; the maximum number of deaths, 182, in August. The total number of cases and deaths of poliomyelitis in the United States during the year 1910 was 5,093 and 825 respectively, a mortality of about 13.75 per cent.

I have made no attempt to give all the rest of the epidemics, and for these I must refer you to the list in the appendix, but I have said enough to show you that epidemics were widely distributed over the whole of Europe, and were present in America and Australia. Though I can find no record of South Africa having suffered, yet I know from private information that the disease was epidemic in Pietermaritzburg in 1902, and I have seen other cases which have occurred in South Africa during the past ten years.

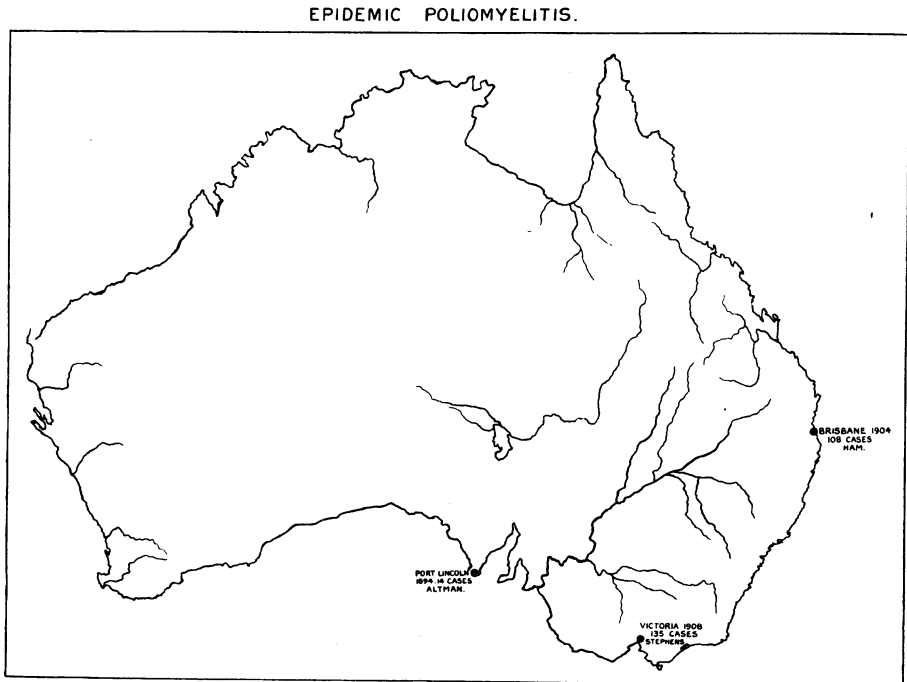


FIG. 3.

Map of Australia, showing the same facts as in fig. 1.

#### (IV) CERTAIN DETAILS IN THE INVESTIGATION OF SOME RECENT EPIDEMICS.

Most epidemics have their particular interest, and it is sometimes from the investigation of small epidemics that most is to be learnt. In the present instance, however, the evidence is so largely on the negative side that I have selected a few of the best investigated recent epidemics as instances of what has been done. I propose to select the

following for consideration: Wickman's investigation of the Swedish epidemic of 1905; Lovell's Massachusetts epidemic, 1907, 1908, 1909; Krause's Westphalian epidemic, 1908; Lindner and Mally's Steyr epidemic, 1909; and Potpeschnigg's Steiermark epidemic, 1909.

*Factors common to all Epidemics.*

There are certain factors common to all epidemics, and these may be shortly stated.\*

*Seasonal Relationship.*—In the Northern Hemisphere the disease always has the greatest prevalence during the months of July, August, September and October, the month of August being nearly always that in which the greatest number of cases occur. In the Southern Hemisphere the disease has occurred during the months of March and April—i.e., months which, I believe, in atmospheric conditions correspond fairly well to September and October in the Northern Hemisphere.

*Age Incidence.*—The incidence of the disease on young children is a constant feature, and it commonly falls upon children during the second and third years of life. Babies in arms are rarely affected; as the age advances the incidence rapidly declines. In the Massachusetts epidemic of 440 cases under 6 years of age, 304 occurred in children between 1 year and 4 years old.

*The Mortality.*—The mortality in the various epidemics varies considerably; over the total number of cases it amounts to from 11 per cent. to 12 per cent. One epidemic had a mortality of 18 per cent. (Rechzeh), and another had a mortality of 5 per cent. to 6 per cent. A great deal depends on how these statistics are made up and whether the abortive cases are included. The mortality is higher for children of older age than it is for young children. In the Massachusetts epidemic the total death-rate was 8 per cent., whereas the mortality in children over 10 years of age was 20 per cent., for under 1 year of age 16 per cent., and between the ages of 1 and 10, 4 per cent.

(a) *The Swedish Epidemic of 1905 (Wickman).*

In this epidemic the incubation period was shown to lie between one and four days, 74 of the 127 cases coming within this period. There are some striking individual cases of isolated contact which show that the incubation may be as short as twelve hours. As a good instance of school infection one may take the outbreak that occurred in the parish of Trästena.

The first cases occurred in Sandbäcken, a neighbouring village, in February and March; three children were affected and one died. An interval of three months now elapsed in which there were no cases. At the end of May and beginning of June, two cases occurred in the same house in Marienstad, a village a mile off. There was then another interval till the end of June and then the outbreak at Trästena began. The first case occurred on June 28 in an isolated house. Early in July a series of cases occurred, mostly in connexion with the school. In this village, out of 102 houses 19 were affected. The numbers of the

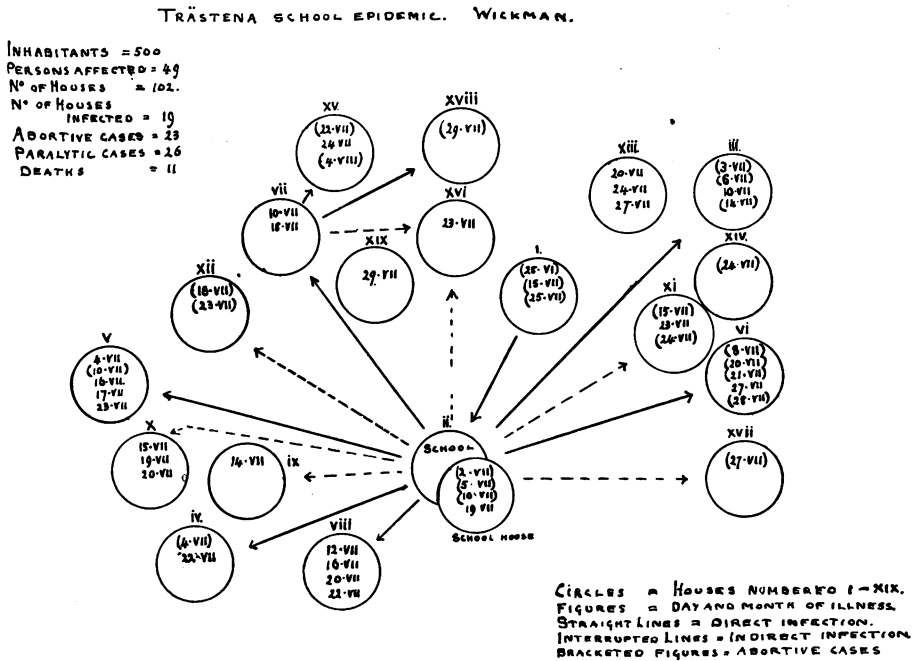


FIG. 4.

individuals affected in each house were as follows: In six houses, one case; in three houses, two cases; in five houses, three cases; in three houses, four cases; in two houses, five cases. (See diagram, fig. 4.)

The school was infected on June 28, and a series of cases occurred on July 3, 4, 8, 10, and 12. The school was shut on July 15. Other cases occurred during the month, and the last on August 4.

In this little parish of Trästena, with 500 inhabitants, 49 persons were affected, 23 with the abortive form of the disease, 26 with the paralytic form. Of the cases with paralysis, 11 died—i.e., 42.3 per cent.



Three other instances of a school being a source of infection are given by Wickman. The disease appears always to be carried by contact, but the contact may be by means of a perfectly sound and healthy individual. The disease was most prevalent in Sweden in 1905 and was less in 1906 and 1907.

(b) *The Massachusetts Epidemic.*

Epidemics of poliomyelitis have been investigated in Massachusetts in the years 1907, 1908, 1909. In the year 1907 some 234 cases were recorded; in the year 1908, 136; and in the year 1909, 923. Most of the cases occurred in and around Boston. The transmissibility of poliomyelitis is shown to be considerably less than either scarlet fever or diphtheria. Of persons known to have been exposed to diphtheria, scarlet fever, and poliomyelitis, the percentages of those infected were as follows: Scarlet fever, 22 per cent.; diphtheria, 17 per cent.; poliomyelitis, 6 per cent. The investigators dealt with 150 of the cases of the 1909 epidemic in detail.

Rainfall, temperature, surroundings, nearness to railroad, nearness to water, age of house, sanitary conditions, location of house, character of house, floor of house inhabited by a family, sewage disposal, character of water supply, relation to dust, prevalence of vermin, insects and rodents, data as to domestic animals kept, occurrence of paralysis in animals, swimming and wading, exposure to heat, cold or damp, diet, and attendance at school, were all investigated. I do not propose to give the results of the investigation of all these various points, most of them are strikingly negative. One or two, however, deserve some mention. Of the 150 cases, 62 were swimming or wading in water more or less contaminated by sewage before the attack. In 87 of 142 families affected, animals of some sort were kept, and in 34 of these there was some illness or paralysis. In no case was a child living on breast milk alone affected by the disease. Thirty-five of 150 cases attended school: the school could *not* be shown to be a source of infection. Another most interesting point is that only one child out of 3,600 who lived in forty-five institutions was affected with the disease. With regard to animal infection the following note from Dr. C. S. Shore is of interest:—

“In my veterinary practice during the past five or six years, I have found a disease appearing among one- and two-year-old colts that shows a line of symptoms corresponding very closely to anterior poliomyelitis of children.

I have had from five to ten cases a year during this time, the cases always occurring during the summer months, and the majority of them during the month of August. The affected colts are usually found in the pasture, unable to stand. The owner sometimes will notice an unsteady gait for twenty-four hours before entire loss of motion occurs. At first these colts have a rise of temperature ranging from 103° F. to 104° F.; pulse and respiration accelerated; animal sweats profusely; appetite remains fairly good, but there is some trouble noticed in swallowing, especially water; slight derangement of the bowels, tending toward constipation; more or less tympanitis present; retention of urine, for a few hours at least; head drawn back so that the end of the nose tends to assume a position somewhat on a line with the neck. The death loss is less than 10 per cent., but in those that do not recover the market value is depreciated to a very great extent because of the faulty gait the animal assumes after an attack of this disease, due to atrophy and contraction of certain muscles, or certain groups of muscles. It seems that the flexor muscles of the limbs especially are more often affected than the extensor, and in almost all the cases some of these deformities are likely to remain permanent. The flexors of the limbs are liable to contract and cause volar flexion of the fetlock. The elevators of the head are also likely to become affected, so as to cause the head to have a poky appearance—that is, it is carried out from the body. After one of these attacks the colt will remain down from one to three weeks, and will then continue to improve for a period of one year, but seldom, if ever, makes a complete recovery.—Dr. C. S. SHORE, Lake City, Minnesota.”

I have referred this question to Sir John McFadyean, and he states that he has never seen such a disease in young colts.

(c) *The Westphalian Epidemic of 1908 (Krause).*

In this epidemic, which occurred in and around Hagen in June, July, August, September, and October, 1908, there were 634 cases with 66 deaths. The epidemic is not worked out carefully from the point of view of its spread from town to town. Individual instances are given of the carriage of the infection from person to person. A grandmother is said to have carried the disease from one grandchild to another who lived in a different town. A mother infected her own child after visiting her infected nephew, and in two instances members of the same family were simultaneously affected. An instance is given in which, at the same time that the daughter of a family was taken ill, two young hens died with paralytic symptoms. The examination of these animals gave a negative result. Krause says the disease not infrequently occurs in children at the breast. He believes that the entrance of the virus is at the intestinal tract, since 90 per cent. of the cases had intestinal symptoms (*see* diagram, fig. 5).

(d) *The Steiermark Epidemic, 1909 (Potpeschnigg).*

This epidemic began in September, 1909, and amounted to 434 cases, 60 of which occurred in Graz, and there was a mortality of 13 per cent. The question of the contagiousness of the disease was discussed. In favour of such a view is the fact that more than one member of the family may be affected, and also that persons coming in contact with the infected develop the disease. As an instance of this the following case is given: At the end of June the two-year-old child of a tailoress was taken ill with meningeal symptoms, and died in a few days of the "Heine-Medinsche" disease. To this child, when ill, the

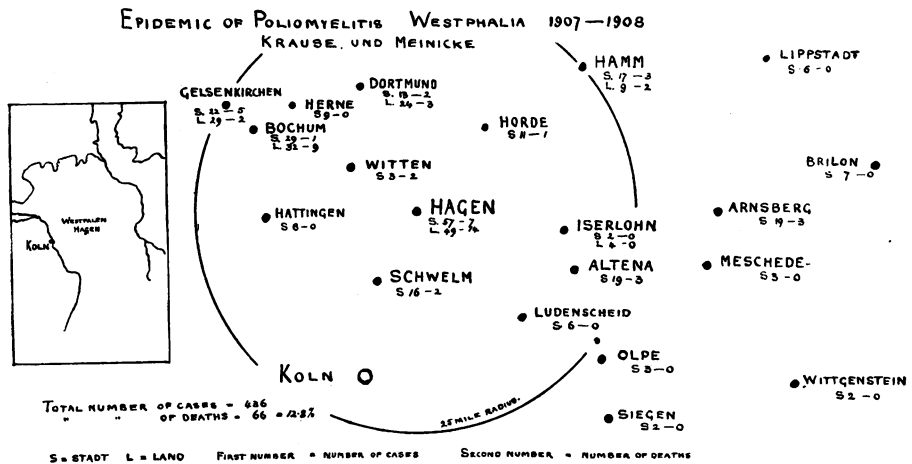


FIG. 5.

two-year-old child M. K. was brought to play, and sat on the bed. Six to eight days later the child developed typical poliomyelitis, there being no other possible contact. In Leibnitz, a place in Mid-Steiermark, the seven-year-old school child M. P. was taken ill on June 20; two days later the six-year-old child A. S., who sat next to her at school and was her playfellow, had follicular tonsillitis. In the course of the week the mother of this child and five brothers and sisters had tonsillitis, and of these the mother and two children had poliomyelitis.

Against the infectivity of the disease may be urged, *first*, the absence of spread of infection in hospital. The cases of poliomyelitis admitted to hospital freely mixed with other cases in the ward without any isolation or disinfection, some 70 children came in contact, but no infection took place. On these grounds it is probable that the paralytic stage of

the disease is not contagious. *Secondly*, the striking absence of infection when contact has been most close. In November, 1909, H. E. was taken ill with poliomyelitis; all five brothers and sisters, although in closest contact, remained unaffected. In October, 1909, M. K., aged  $2\frac{1}{2}$ , was taken ill; two sisters, aged 6 and 11 respectively, slept with and were in close contact with the child and remained unaffected. Twin sisters, aged  $2\frac{1}{2}$ , one was affected, the other unaffected. *Thirdly*, that contact is not the only possible method of dissemination of poliomyelitis is proved by the fact that the disease may arise in persons in whom all contact with affected persons can be excluded.

The instances given of this are as follows: In 1908 the child of a cowkeeper, 30 kilometres removed from the next place in the Alps, was taken ill with poliomyelitis. The child of a railway watchman, whose house could only be reached through a long tunnel, was affected. The contact in school to which Wickman attaches so much importance could not be shown to be a factor in the Steiermark epidemic. It is striking that a large percentage of children are affected before the school age—viz., between 1 and 5 years.

#### *The Steyr Epidemic.*

In the epidemic which occurred in Steyr in the late summer of 1908, described by Lindner and Mally, 92 cases are described; 16 of these died. Of these

1 case occurred in 34 houses	4 cases occurred in 1 house
2 cases       "      16   "	6   "      "      2 houses
3   "      "      1 house	7   "      "      1 house

Two points especially attract attention, the first is the short period between the infection of members of the same family, and the second is the way the disease distributed itself along the railway line and the valley running out of the main valley in which the rail runs. The conclusion arrived at is that the infection of poliomyelitis is carried from individual to individual, and not by means of water or food material, and that the school *is* a method of disseminating the disease.

#### (V) POLIOMYELITIS AS AN EPIDEMIC DISEASE IN GREAT BRITAIN.

So far as I know, no record of any epidemic of poliomyelitis was recorded in England before 1897, when Dr. W. Pasteur described the affection in seven members of one family. That record has become historic, as it is the record number of members affected in the same family.

Dr. Thomas Buzzard, in 1898, published a lecture "On Cases illustrating the Infective Origin of Infantile Paralysis." He gives an instance of two sisters residing in the same house who were attacked with paralysis within six days of each other. Four other children of the same family escaped. Two other children living in a neighbouring street were taken ill in a similar way in the same week. Dr. Buzzard also mentions a case in which a man cut his knee and stopped the bleeding by using moss from the roadside. A week later he was affected with poliomyelitis. He also mentions a case, seen in 1895, of a brother and sister who were taken ill within two days of one another; the sister was feverish and recovered without paralytic symptoms, the brother was paralysed in the left arm. These two cases are alluded to in Dr. Buzzard's presidential address before the Clinical Society, 1895.

It has, of course, long been recognized that poliomyelitis is prevalent during the summer months in London, and especially during August and September. I have a record of undue prevalence in 1902.<sup>1</sup>

*Upminster Epidemic, 1908.*

In 1908 Treves reported an epidemic of eight cases in July, August, and September, 1908, at Upminster, a small village in Essex on the London, Tilbury, and Southend Railway, with a population of 1,477.

	No.	Name	Age	Taken ill
	1	Gertrude H.	3½	July 27; paralysis August 3
	2	John C.	13	August 24; paralysis August 27
Return from Westgate August 18 (sisters)	3	Enid H.	11	August 24; paralysis August 30
	4	Maud H.	12	August 24; not paralysed
Return to Upminster, September 3 (brother and sisters)	5	Stanley M.	8	September 9; paralysis Sep- tember 11
	6	Eva M.	10	September 11; paralysis Sep- tember 13
	7	Gladys M.	6	September 12; paralysis Sep- tember 14
	8	Basil J.	13	September 16; paralysis Sep- tember 16

With regard to incubation period, the child in whom the disease first started had not been out of Upminster, so the disease must have originated in that village. E. and M. H. returned to Upminster on August 18, and were attacked on August 24. The M. family returned to Upminster on September 3, and the first was taken ill on September 9, so the incubation period could not have exceeded six days.

<sup>1</sup> *Lancet*, 1902, ii, p. 1677.

EPIDEMIC POLIOMYELITIS.

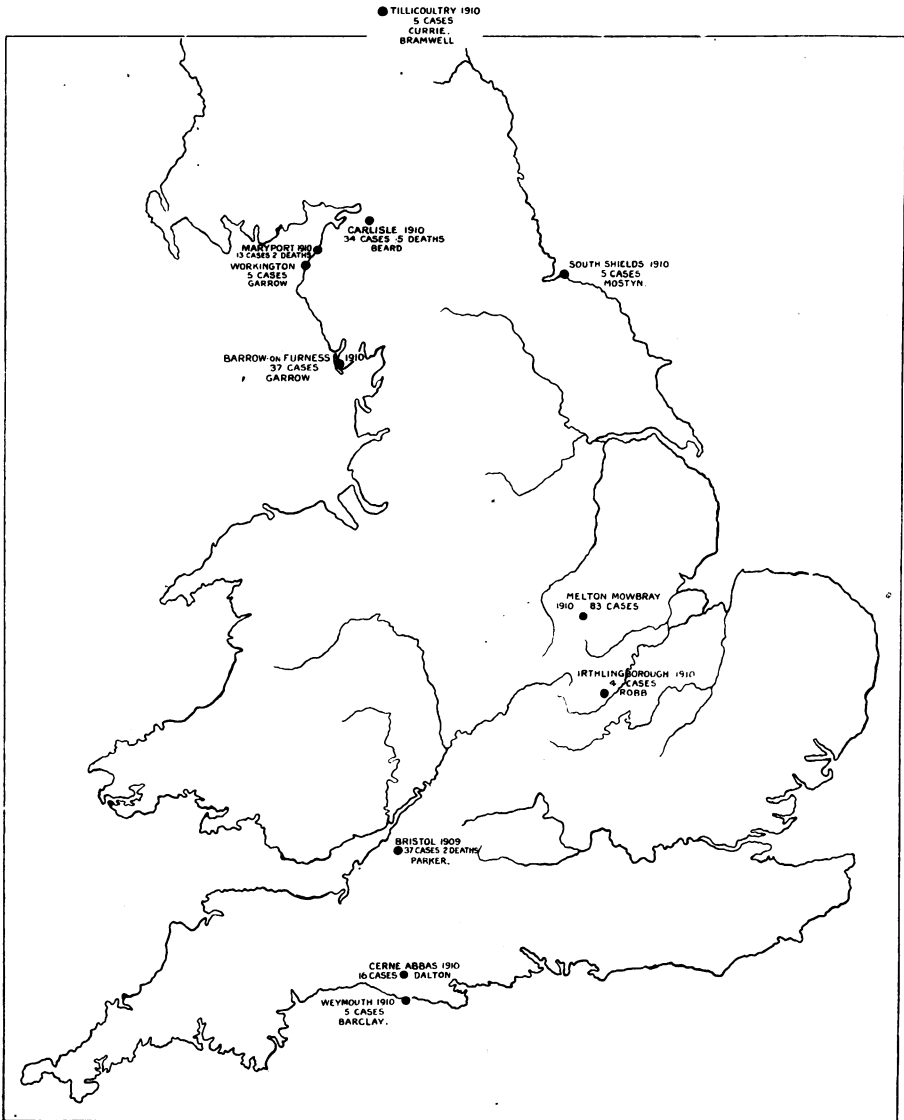


FIG. 6.

Map of England, showing the places at which epidemics of poliomyelitis have occurred during 1909-10, the number of cases in the epidemics, the date of the epidemic, and the name of the recorder.

*Bristol Epidemic, 1909.*

An epidemic of 37 cases is reported by Dr. George Parker in Bristol during the year 1909. Thirty-two of these occurred between June and October—i.e., during the summer (a cold and wet summer). The ages of the patients varied from 4 months to 16½ years. Three were adolescents. The average age of the children was 2 years. There was only one family of eight children in which two members were found to be affected. Two pairs of cases lived within a few doors of one another, but the interval between their attacks was, in one instance, July and November, and in the other, September and December. This epidemic was investigated after its occurrence, and probably only represents the most severely affected individuals of a hospital class. Two patients died, giving a mortality of 5 per cent.

*Epidemics in England, 1910.*

Dr. Garrow reported 13 cases of poliomyelitis in the town of Maryport, Cumberland, in August and September, 1910. One of these cases occurred at the village of Crosby, a little way out of Maryport—this child, aged 1 year and 10 months, died. It is worthy of note that her elder sister suffered from an attack of poliomyelitis on June 16, 1908, when 2 years and 3 months old, and recovered almost completely in four months.

Dr. Garrow has been most kind in furnishing me with further information which he has collected about the epidemics of Workington and Barrow-in-Furness, and Mr. Beard, the Medical Officer of Health, has furnished me with the following details of the epidemic in Carlisle in September, 1910. He, recognizing that the disease was occurring in an epidemic form, obtained the sanction of the Health Committee to make the disease notifiable. In Carlisle 34 cases were notified; five died. Of the remaining 29, one only appears not to have had the disease. Of the 28 cases, 12 will probably be incapacitated for the remainder of life, either from total or partial paraplegia, hemiplegia, or monoplegia of leg and arm. In Carlisle there are three examples of two cases occurring in the same houses, all three examples being in the part of the town where the cases were most common, the pairs are enclosed in a circle on the map (*see fig. 7*).

Dr. Garrow investigated the West of Cumberland and came upon scattered instances of the disease at various villages, as indicated on the

chart (see map, fig. 8). At Barrow-in-Furness he found about 37 cases of permanent cripples. As he says, one can only guess at the actual number of cases. The severe cases which died and the slight cases which recovered are lost for statistical purposes. The incidence of the disease seems to have fallen heavily on North and South Vickers Town: four cases in the former, six in the latter. Dr. Garrow says these are recently built model villages, situated on the slopes of Walney Island, about 50 ft. above sea-level. The houses are well built, streets well

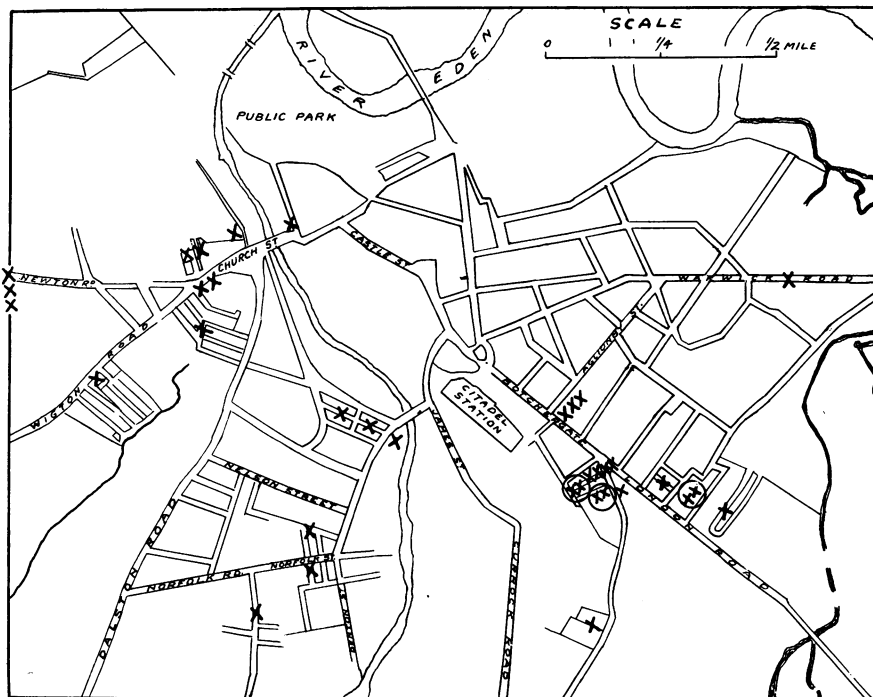


FIG. 7.

Street plan of Carlisle. The X's indicate the cases of poliomyelitis occurring during September, 1910. There were thirty-four cases, of whom five died. There were three instances of two members of one household being affected. These are marked with a circle on the map. Reported by Mr. Beard.

paved and clean, and the sanitation modern. The houses have good water supply, and are lighted by electric light. In short, the hygienic conditions are well-nigh perfect (see map, fig. 9).

With regard to the epidemic in the Midlands, which occurred around Melton Mowbray, I can furnish no detailed information, as the matter is



under investigation by the Medical Officer of the Local Government Board, and his report is not yet published. It is known, however, that 83 cases occurred, with 14 deaths—i.e., 16·8 per cent. The epidemic was at first reported as one of cerebrospinal meningitis, but probably because observers did not recognize the meningeal form of poliomyelitis.

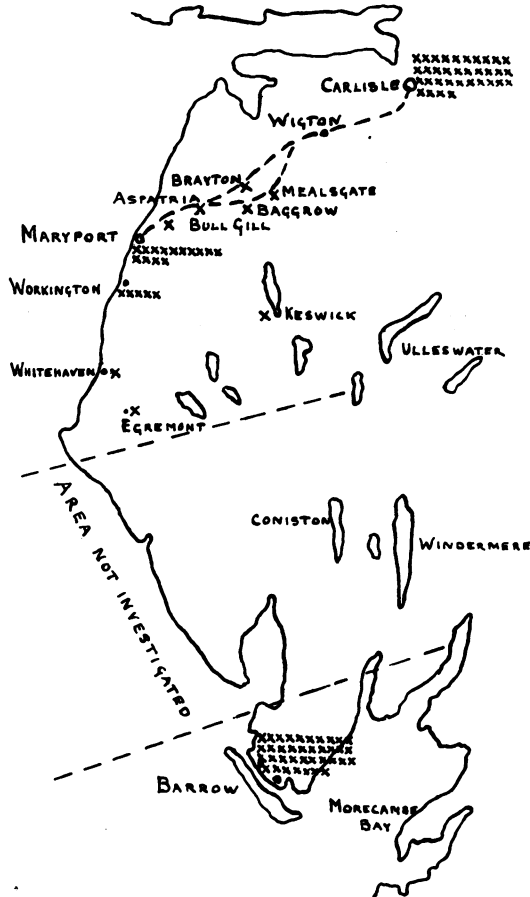


FIG. 8.

Coast of Cumberland, investigated by Dr. Garrow. The X's indicate the cases of poliomyelitis which occurred in 1910. Epidemics occurred in Carlisle, Maryport, Barrow-in-Furness, and other places.

Dr. Robb, of Irthlingborough, Northamptonshire, reported a small epidemic of four cases occurring within a radius of 200 yards, and as

far as he could gather there was no intercommunication between the respective houses. The cases were as follows:—

*Case I.*—E. M., aged  $2\frac{1}{4}$  years, was taken ill at the end of August, 1910, with feverishness and fretfulness, which the mother put down to teething; paralysis of the left leg was noticed next morning.

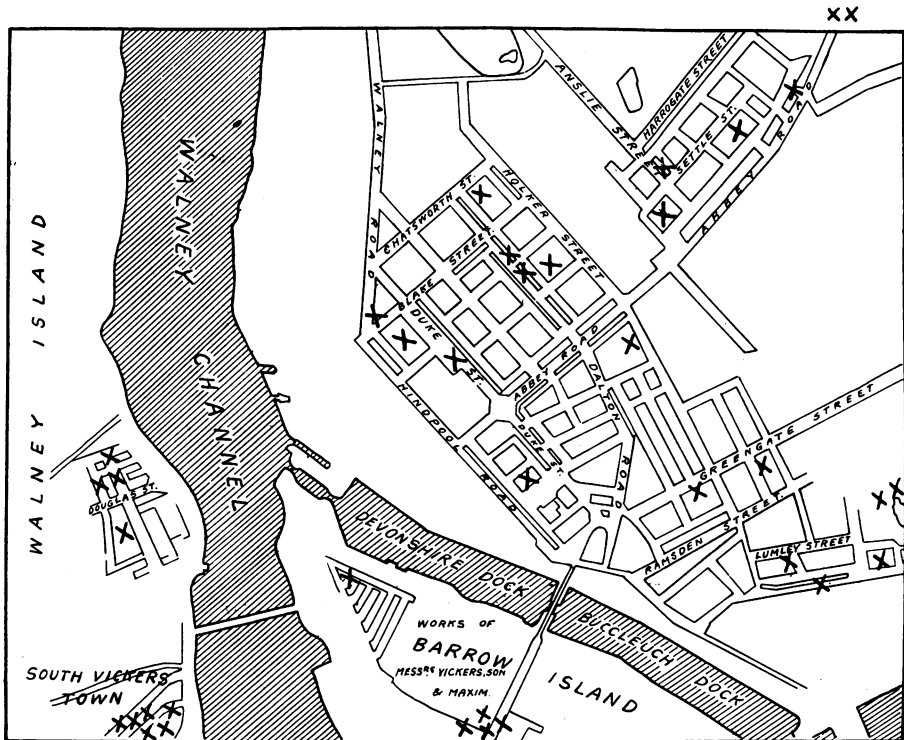


FIG. 9.

Street plan of Barrow-in-Furness. The X's indicate the cases of poliomyelitis occurring during 1910. There were thirty-seven cases. Map prepared by Dr. Garrow.

*Case II.*—J. H., aged 2, taken ill at end of August, 1910; paralysis of left leg and arm.

*Case III.*—W. M., aged 3, taken ill first week in September, 1910; paralysis of the left leg.

*Case IV.*—T. H., taken ill end of September, 1910; paralysis of left arm and leg. He quite recovered by Christmas.

Dr. Robb says: "Although I have been in active practice for over twenty years I have not, to the best of my recollection, had a series of such cases within so short a time."

Dr. Dalton, of Cerne Abbas, reported another small epidemic of 16 cases which occurred in Cerne Abbas, in Dorsetshire. The first of these cases occurred on September 29 and the last on October 24, 1910. Fourteen of these cases were in children under 8 years of age, one case in a boy 14 years old, and one in an adult 36 years old. There were two deaths—in children aged 14 years and 6 years respectively. Four remained badly paralysed, the others made good recoveries. Except for one case in an isolated cottage on the hills the disease was limited entirely to the parishes of Cerne Abbas and Upper Cerne. The former has a population of about 600, the latter, a mile away, is just a small village. In one house Dr. Dalton reports three cases out of four children; in another, two out of three; in another, one out of six; in another, one out of three; in another, one out of four; in another, two out of three. The adult case, a man, the father of four children, lived in quite a small cottage. It seemed almost impossible for the children to escape infection, and yet they did. The possible source of infection in this case was that the man was clipping a horse in a stable with the father of a child suffering with the disease. No local condition could account for the disease, and many cases were in the better houses. The cases were quite scattered as regards houses. Isolation and disinfection of contacts and possible carriers seemed at once to stop further spread of the disease. Dr. Dalton suggests that foreign flour is the carrier of the disease.

In relation to the above epidemic Dr. W. B. Barclay, Medical Officer of Health for Weymouth, says there were five cases of poliomyelitis and one death during the year, and that he knew of none in the previous six years.

There appears to be some evidence that the disease was prevalent in and about Newcastle, but the facts obtainable are scanty and may possibly represent simply the normal incidence of the disease. Five cases were mentioned to Dr. Mostyn, the Medical Officer of Health of South Shields. A series of cases occurred in and about Hexham, and the Medical Officers of Health, Dr. Penford and Dr. Jackson, both consider that the cases have been more frequent than formerly.

In York two deaths were registered from the disease, and in Gloucester Dr. Bond reports three cases in one family.

The evidence obtainable from the Medical Officers of Health must of necessity be most defective in regard to a disease which does not come within their province; but I could wish here to thank all the Medical Officers of Health who have so kindly and courteously answered the questions and returned the post-cards sent to them.

One other small epidemic in September, 1910, is reported by Currie and Bramwell. It is known as the Harvieston epidemic, a private estate near Tillicoultry, in Clackmannanshire. The farmstead consists of four houses, which may be designated A., B., C., D. House A. is occupied by the factor, the three adjacent cottages by farm employees and their families.

The A. family consists of 2 children, A.A., aged 5; B.A., aged 2½.  
 „ B. „ „ 4 „ A.B., aged 7½; B.B., aged 5½; C.B., aged 4; D.B., aged 7½.  
 „ C. „ „ 4 „ All aged over 8.  
 „ D. „ „ 2 „ Aged 2, and a few months respectively.

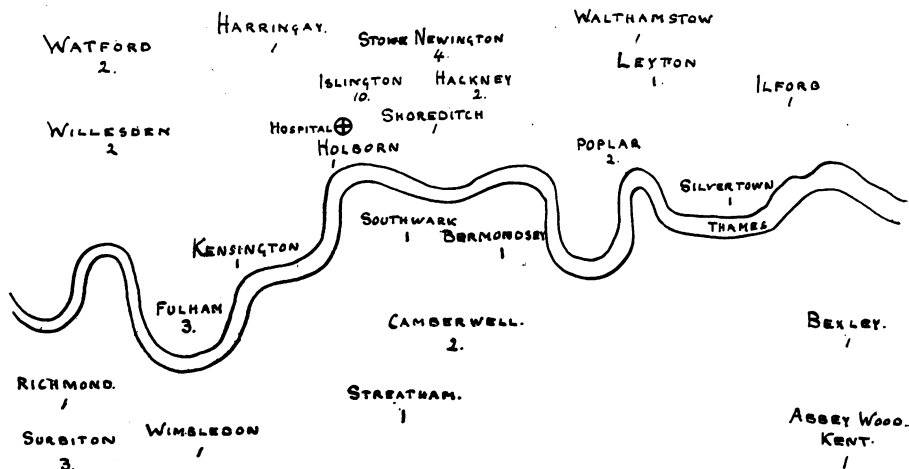


CHART. SHOWING DISTRIBUTION OF 45 CASES OF POLIOMYELITIS COLLECTED AT HOSPITAL MARKED ⊕ THE ONSET OF WHICH OCCURRED DURING THE YEAR 1904.

FIG. 10.

Map of London district, showing the distribution of forty-five cases of poliomyelitis collected at two hospitals. The onset of the disease occurred during the year 1904.

Five children in these four houses were attacked, A.A., B.A., A.B., B.B., and D.B. Children taken ill in following order:—

B.B.	...	September 12	...	Returned to school September 26.
A.B.	...	September 16	...	Paralysed on September 19.
D.B.	...	September 18	...	Squint.
B.A.	...	September 20	...	Paralysed right face.
A.A.	...	September 24	...	Paralysed both lower limbs.

From a consideration of the facts relative to these cases, the authors came to the conclusion that the incubation period in this epidemic was four days, or less, and from the fact that the children of the A. family did not visit the children of the B. family after the first child, B.B.,

was taken ill, but that the mother of the A. family visited and nursed the B. children whilst ill, the infection to the A. family was probably carried by her.

#### (VI) DISTRIBUTION OF CASES IN LONDON, 1904.

During the year 1904 I collected at the Children's Hospital some 45 cases of infantile paralysis. I have charted them in the districts in which they occurred. The chart has no special value except to show that the disease is fairly evenly distributed over all London areas (*see* chart, fig. 10). Ten of the cases occurred in the Islington District, but considering the position of the hospitals at which the cases were collected—i.e., National Hospital, Queen Square, and Children's Hospital, Great Ormond Street—it would be from this district that cases would be likely to come. So far as I know all these were isolated cases. With regard to the month of incidence, these few figures bear out what has been shown in all larger statistics—viz., that by far the larger number of cases occur in the month of August (*see* diagram, fig. 11).

#### (VII) CONCLUSION.

From the evidence which has been brought forward one is justified in regarding poliomyelitis as an infective disease occurring in epidemic form during the months of July, August and September. It tends to affect children rather than adults. It is probably communicated from person to person, or may be carried by a person who presents no sign of the disease.

The resemblance of the disease to rabies suggests the possibility of some animal infection, but none has yet been found. The disease can be communicated to the monkey, and passed from monkey to monkey. The infectivity of the disease is not great, for many persons in the closest contact with the infected escape, and monkeys living in the same cage with infected monkeys fail to contract the disease. But little is known of the incidence of the disease in London. That it occurs every summer, and with greater frequency in some years than others, is known. But it is not known if it affects one district more than another.

It will, I think, be admitted that a disease should be notifiable whenever there is liability of its being transmitted from person to person, provided that the disease itself or its sequelæ are a serious detriment to health, or a danger to life. That poliomyelitis is detrimental to health no one will deny.

That poliomyelitis can be, and is, transmitted from patient to patient has been made evident in all the recent epidemics investigated.

The advantages of notification are great. It will lead to the general recognition that the disease is infective, and will tend to prevent its dissemination by contact. Notification will show the prevalence of the disease, and the investigation which should follow must throw light both on the cause and means by which the disease is disseminated.

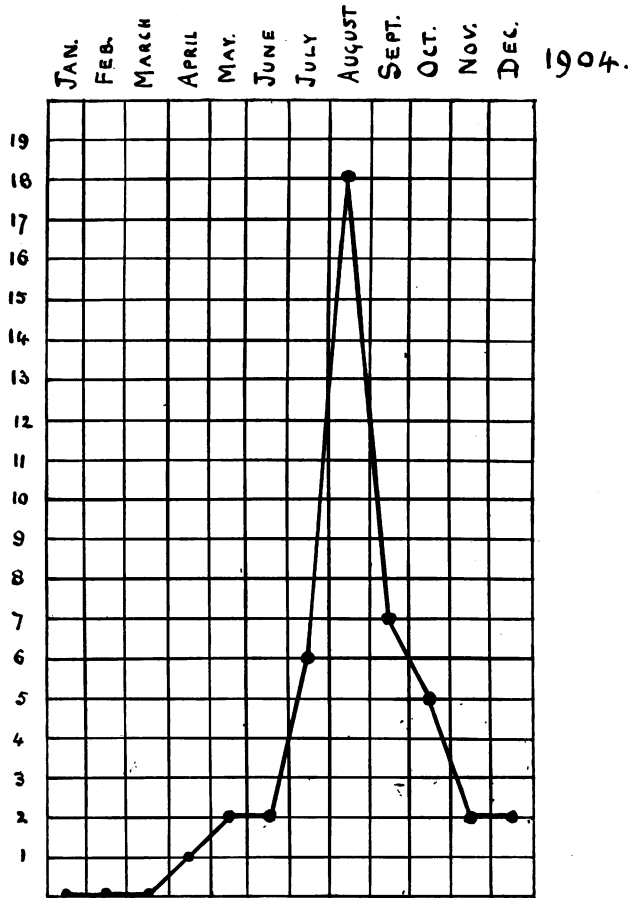


FIG. 11.

Chart showing the month of onset of forty-five cases of poliomyelitis occurring in London during the year 1904. These cases were collected at the National Hospital, Queen Square, and the Children's Hospital, Great Ormond Street.

The infectivity of the disease is not great and the isolation of the infected should diminish the incidence of the disease on the community, and thus prevent the effects which are so disastrous to the usefulness and happiness of many lives.

## LIST OF EPIDEMICS OF POLIOMYELITIS.

Year	Author	Town or village	Country	Number of cases	Number of deaths	Mortality percentage
1881	Bergenholtz ...	Umea ...	Sweden ...	18	—	—
1883	Buchelli ...	Arenzano... ..	Italy... ..	5	2	—
1886	Cordier ...	Foy ...	France ...	13	4	—
1886	Leegard Oxholm ...	Mandal ...	Norway ...	9	2	—
1886	Strümpell ...	... ..	Germany ...	3	—	—
1887	Medin ...	Stockholm ...	Sweden ...	44	3	—
1889	Briegleb ...	Turingen ...	Germany ...	5	—	—
1893	Andre ...	S. Girons... ..	France ...	4	—	—
1894	Brackett ...	North Adams, Massachusetts	U.S.A. ...	10	—	—
1894	Caverly, Macphail ...	Rutland, Massachusetts	„ ...	132	18	—
1895	Buchelli ...	Ravecca ...	Italy... ..	17	—	—
1895	Medin ...	Stockholm ...	Sweden ...	21	—	—
1895	Pierracini ...	Florence ...	Italy... ..	7	—	—
1896	Altman ...	Port Lincoln ...	Australia ...	14	—	—
1896	Bondurat ...	Alabama ...	U.S.A. ...	15	—	—
1896	Pasteur ...	Much Hadham ...	England ...	7	—	—
1896	Taylor ...	Cherry Field ...	Maine,U.S.A.	7	1	—
1897	Buchelli ...	Genoa ...	Italy... ..	17	—	—
1897	Pleuss ...	Kiel ...	Germany ...	4	—	—
1897	Taylor ...	New York ...	U.S.A. ...	12	—	—
1897	Fabis ...	Conegliano ...	Italy... ..	9	—	—
1898	„ ...	„ ...	„ ...	13	—	—
1898	Auerbach ...	Frankfurt ...	Germany ...	15	—	—
1898	Zappert ...	Vienna ...	Austria ...	42	—	—
1899	Leegaard ...	Bratsburg ...	Norway ...	64	2	—
1899	Mackenzie ...	New York ...	U.S.A. ...	30	1	—
1899	Newmark ...	San Joaquin ...	California ...	4	—	—
1899	Wickman ...	Stockholm ...	Sweden ...	54	4	—
1900	Painter ...	Gloucester, Massachusetts	U.S.A. ...	32	1	—
1901	Woods ...	San Francisco ...	California ...	55	—	—
1902	Private information	Pietermaritzburg	S. Africa ...	—	—	—
1903	{ Bergendal } { Wickman }	Goteborg ..	Sweden ...	20	—	—
1903	Harbitz and Scheel	... ..	} Norway ...	1,151	167	—
1906	Giersvold ...	... ..	Italy... ..	26	—	—
1903	Lorenzelli ...	Parma ...	Italy... ..	26	—	—
1904	Ham... ..	Brisbane ...	Australia ...	108	4	—
1904	Naunestadt... ..	Fredrickshad ...	Norway ...	41	6	—
1904	Platou ...	Aafjorden ...	„ ...	20	6	—
1905	Giersvold ...	... ..	„ ...	436	69	—
1905	Wickman ...	... ..	Sweden ...	1,031	145	12.2
1905	Harbitz and Scheel	... ..	Norway ...	283	42	—
1906	„ „	... ..	„ ...	334	34	—
1906	{ Nyman } { Wickman }	Smedjebacken ...	Sweden ...	50	5	—
1907	Lovett ...	Massachusetts ...	U.S.A. ...	234	—	—
1907	Starr... ..	New York ...	„ ...	2,000	—	7
1907	Stephens ...	Victoria ...	Australia ...	135	—	4.5
1908	Davis ...	St. Paul's ...	U.S.A. ...	200	—	—
1908	Hoffmann ...	Heidelberg ...	Germany ...	36	—	—
1908	Löcker ...	Steyr ...	Austria ...	68	—	11.7
1908	Lovett ...	Massachusetts ...	U.S.A. ...	136	—	—
1908	Koplik ...	New York ...	„ ...	1,200	—	—
1908	Krause ...	Westphalia ...	Germany ...	100	9	9
1908	Treves ...	Upminster ...	England ...	8	—	—

## LIST OF EPIDEMICS OF POLIOMYELITIS—(continued).

Year	Author	Town or village	Country	Number of cases	Number of deaths	Mortality percentage
1908	Wiley and Dardem	Salem ... ..	Virginia, U.S.A.	25	3	—
1908	Zappert ... ..	Vienna ... ..	Austria ...	266	14	—
1908	Lindner and Mally	Steyr ... ..	„ ...	96	16	16
1909	Jogichess ... ..	St. Petersburg ...	Russia ...	26	—	—
1909	Lovett ... ..	Massachusetts ...	U.S.A. ...	923	—	—
1909	Netter ... ..	Paris ... ..	France ...	100	5	5
1909	Parker ... ..	Bristol ... ..	England ...	37	2	6
1909	Peiper ... ..	Pommern ... ..	Germany ...	51	6	11·7
1909	Fürntratt ... ..	Steiermark ... ..	Austria ...	433	—	13
1909	Potpeschnigg ... ..	„ ... ..	„ ...	433	—	13
1909	Reckzeh ... ..	Westphalia ... ..	Germany ...	500	—	18
1909	Shidler ... ..	Nebraska ... ..	U.S.A. ...	200	—	7·5
1909	Spieler ... ..	Vienna ... ..	Austria ...	44	2	—
1909	Stiefler ... ..	Liuz and Urfahr ...	„ ...	77	—	—
1910	Beard ... ..	Carlisle ... ..	England ...	34	5	—
1910	Currie and Bramwell	Tillicoultry ... ..	Scotland ...	5	—	—
1910	Garrow ... ..	Barrow-in-Furness	England ...	37	—	—
1910	„ ... ..	Maryport ... ..	„ ...	13	2	—
1910	Hagenbach ... ..	Basle ... ..	Switzerland	19	—	—
1910	Public Health Report	... ..	U.S.A. ...	5,093	825	13·75

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## DISCUSSION.

The PRESIDENT (Dr. Theodore Thomson) said those present would agree with him that, as a Section, they owed a vote of thanks to Dr. Ransome and Dr. Batten for their interesting papers. With regard to the first, many were apt to forget that the notification of disease, of which there was now so much, was not put to its full use. Those who were concerned in the administration of public health naturally thought primarily of its immediate practical utility. Notification of disease was required so that the infected cases could be sought out at once in order to ascertain, if possible, how the disease arose, and stop its spread. That being the first question, many were apt to forget that the information which had been acquired in those epidemics might be put to other uses which, although of less immediate service, might nevertheless result in acquiring valuable information. From that point of view they must be grateful to Dr. Ransome for calling attention to a matter which deserved the consideration of every epidemiologist.

He had listened to Dr. Batten's paper with much interest. The question there dealt with was a very difficult one from the epidemiological point of view, chiefly because it was difficult to ascertain how poliomyelitis was spread. One accepted the idea that the disease could be transmitted, and it had been shown experimentally that it could; yet those who inquired into outbreaks and prevalences of poliomyelitis were constantly face to face with the difficulty that again and again one found children with the closest exposure sleeping in the same bed with affected children, and yet nothing happened. And in another case something did happen, even in circumstances where exposure to infection had been slight or had not been known to have occurred. It was difficult to know how far poliomyelitis was infective. It might be that it was essentially a very infective disease, which was dependent for its transmission upon some intermittent agency, of which nothing was yet known, but which might only occasionally be present. But little was yet known about the propagation of epidemic poliomyelitis.

The papers dealt with subjects which were of great interest to the Section, and the discussion upon them was sure to be very interesting.

Sir SHIRLEY MURPHY agreed that the papers were of very great interest, and he sympathized with Dr. Ransome in his desire to see the returns made more use of for the purposes of study. There were a number of problems which, he thought, they would be able to have solved now that returns were being made from the Local Government Board, showing the number of notified cases in each week throughout the year. He supposed that one of the difficulties which would have to be contended with was that as all the returns were not sent in when they should be there would be gaps. But he did not doubt that efforts would be made to fill up those gaps, and after a time there would be more full records than were obtained in the first few months of the present year.

With regard to Dr. Batten's paper, it was of course possible to think of the groups of cases as being due to infection from case to case; but he thought there might conceivably be other explanations, although no doubt the idea of direct infection was that which suggested itself most prominently. The value of the paper was that it put together the whole story so concisely. The large amount of research which the paper represented might well be borne in mind by anybody who read it, because Dr. Batten had gone far and wide to collect his material. The College of Physicians had asked the London County Council to make an Order requiring the disease to be notified, and that at the instance of Dr. Batten. He did not yet know what action would be taken, but if that information could be got from the returns dealing with the large population of London there would be better opportunities of studying this disease than were afforded at present. In America so many outbreaks had been recorded that he was surprised that more evidence of similar occurrence had not been forthcoming in this country.

Dr. HAMER commented on the observation made on p. 192 of the paper. Dr. Ransome said: "Another point demanding research is the reason for the varying incidence of the poison of these disorders upon different parts of the bodily frame. Why, for instance, influenza should sometimes content itself by attacking only the upper air-passages, at others cause serious mortality from pneumonia, and at others, again, seize upon the brain and nervous system?" These remarks made by Dr. Ransome had perhaps a special interest for them on the present occasion; but, whether that were so or not, he (Dr. Hamer) thought that in some such direction as that indicated by Dr. Ransome there was an opportunity for much careful epidemiological study.

With regard to Dr. Batten's paper, he was much interested in the definition of poliomyelitis. Dr. Batten looked at the question in a very liberal way, and not only included cases which exhibited symptoms of meningitis, neuritis, &c., but even included a number of "abortive cases," which did not seem to exhibit any symptoms of disease of the nervous system at all. The facts relating to epidemics could be mentally focused in at least three different ways. One could focus them bacteriologically, and that was the common method nowadays. Search was made in connexion with each epidemic prevalence for associated micro-organisms, and the epidemic was classified according to the bacteriological findings. But that method failed in the case of poliomyelitis, because there were no commonly associated secondary or terminal invaders. Some other plan must therefore be adopted, and Dr. Batten had apparently started by classifying cases according to the part of the body upon which the stress of attack fell—i.e., the point of least resistance. He began with the anterior horns of the grey matter of the spinal cord; but he soon found that he must go beyond that, and so he included in his groups cases of meningitis, neuritis, and abortive cases. There was a third method, which Dr. Batten had really eventually adopted—namely, the epidemiological. All through the history of outbreaks variously classified as influenza, "new disease," and so forth, there were clearly discernible similar sequences of events, but with regard to

symptoms, as had again and again been remarked, they had to deal with a veritable Proteus. At one time the respiratory system was attacked, at another the gastro-intestinal system, at yet another the nervous system. If one followed out the history of the outbreaks of pandemic influenza, it would be found that in the original invasions, following upon periods of quiescence, the disease behaved in a particular way, but that when it recurred it frequently presented aberrant symptoms affecting the nervous system or the gastro-intestinal system; and therefore he asked Dr. Batten whether he did not think that some of the outbreaks of poliomyelitis and cerebrospinal meningitis which had been recently described were not really part and parcel of outbreaks of influenza. Leichtenstern said that original primary outbreaks of influenza attacked the respiratory system as a rule, but that the "trailing epidemics" frequently attacked the nervous system. He was glad, as a result of reading Dr. Batten's paper, that he had cleared up a point which had been obscure in his own mind—namely, with regard to outbreaks of sweating sickness. There was good reason for looking upon these outbreaks as having really been prevalences of influenza. But the account given by Dr. Caius of the fifth outbreak of sweating sickness was at first sight a source of difficulty. If one imagined oneself, however, back in the sixteenth century and compelled to adopt the terminology of that period, the words of Dr. Caius corresponded quite well with Dr. Batten's conception of an outbreak of poliomyelitis, for the opening sentence of Dr. Caius ran: "Those whom the disease attacked had it in the following way: in some it first seized upon the neck or shoulder, in others the leg or the arm." Dr. Brorström had recently published in Leipzig a most interesting treatise in which he urged that epidemic poliomyelitis was really a manifestation of epidemic influenza. Much of Dr. Brorström's evidence was not convincing, because it merely related to demonstration of the presence of Pfeiffer's bacillus, a line of argument which he (Dr. Hamer) confessed he did not think finally conclusive. Dr. Brorström, however, gave numbers of groups of cases in families; in one instance, for example, three children exhibited what was called influenza with bronchopneumonic symptoms, and the two remaining children developed poliomyelitis. If they were all to devote themselves to collecting instances of a similar sort, some valuable information would be likely to result. The phenomena reported by Dr. Brorström occurred in sparsely populated country districts in Sweden. In London almost the whole population was saturated with the influenza virus, and hence largely immunized against its operation. That was not so markedly the case in country districts. There had been, it was true, outbreaks of cerebrospinal meningitis in towns such as Glasgow and Belfast, coincidentally with notable prevalence of influenza in London, but by far the most noteworthy phenomena had been encountered in rural districts, for example in East Herts. in 1905, and therefore it was in such places that one might most hopefully look for the solution of the riddle.

Mr. MAJOR GREENWOOD, jun., remarked that the statistics of plague showed how difficult it was to determine the way in which a disease spreads from epidemiological data. In bubonic plague it was generally agreed that the

infection was not direct, from person to person, but mediated chiefly by the flea. Looking at the statistics for the Punjab, one found a seasonal curve of plague similar in shape to the curves which Dr. Batten showed of epidemic poliomyelitis; the seasonal prevalence was constant for any given district. In the Punjab it rose somewhat slowly in the early months of the year, reached a maximum in April or May, and fell more sharply than it rose. He had specially investigated the point when studying the differences in mortality in different villages. There were enormous differences in the mortality-rates of villages of the same size. It was important to determine how the spread occurred, because it was probably not from person to person. One would expect the spread of the epizootic disease, which is the substratum of the epidemic, to resemble the spread of a contagious disease, and that the human cases would conform to some regular distribution. But if one studied the maps in the last plague number,<sup>1</sup> one saw that it was impossible to trace a regular spread. There were scattered foci, and there was some evidence of slight spread round each focus, but no general law seemed deducible from the observations. Major Lamb and he had shown<sup>2</sup> that there was no evidence of plague in village communities remaining dormant, but that the facts were consistent with a re-importation of plague from season to season; beyond this it seemed difficult to go. It was very difficult, however complete the statistics might be, to get a satisfactory co-ordination of the facts as a basis upon which to found theoretical ideals. He mentioned these facts as an illustration of the care to be exercised in drawing conclusions, relative to methods of dissemination from spot maps and diagrams.

Fleet-Surgeon HOME thought the Section should be grateful to Dr. Batten for having brought the disease before them. It did considerable harm, and the public should know that it was to be regarded as infectious, as various causes were mistakenly attributed to illnesses due to the disease. He knew a case in Ireland in which a woman was convinced that her daughter got the disease because she was operated upon for adenoids, as, she alleged, the doctor had injured a nerve which went straight from the throat to the leg! The disease had been notifiable for a year in Hamburg. The disease seemed to be a definitely seasonal one, so one was apt to associate the periods of recurrence with meteorological conditions; yet they might be unrelated. Another disease which resembled it in that respect was typhus, though Americans had found that the virus of typhus differed from that of poliomyelitis in that it did not pass through a filter. An American last year showed that typhus could be communicated from monkey to monkey by means of lice. But they found the disease occurred only in Mexico in the upper plateaux, not in the coast zones. The conclusion was that the disease was carried by lice, which lived in the clothes of the person but were not kept at the temperature of the body. They found that lice at the temperature of the coast zone did not convey the disease. So the varying prevalence of typhus would not be due to temperature directly,

<sup>1</sup> *Journ. of Hyg.*, 1910, x, p. 473 *et seq.*

<sup>2</sup> *Ibid.*, pp. 349-443.

but to the influence of the temperature on the carrier lice. When considering the question one should not be too ready to believe that when diseases had a definite relation to seasons of the year, that relation was entirely due to temperature; there might be other conditions which were involved.

Dr. BATTEN, in reply, demonstrated on a map of England the epidemics of the disease which had come under his cognizance, but he did not think it represented the number of cases. No doubt there were other epidemics which occurred throughout England in 1910. He had written to many Medical Officers of Health, but epidemic poliomyelitis did not come within their purview. There were very few cases which died of the disease; and for the epidemics of which he had obtained knowledge he was indebted to Medical Officers of Health who were also practitioners. The Cumberland district epidemic was investigated by Dr. Garrow, who was in practice at Maryport. When the disease was notified he hoped it would be possible to ascertain how widely it was distributed. With care in isolation he thought the disease could be largely controlled. Dr. Dalton's efforts in Cerne Abbas in isolating cases quickly stopped the disease. Dr. Hamer seemed to desire to suggest some relationship between the disease and influenza, but he (Dr. Batten) suggested that there was no such relationship. He admitted that influenza might affect the nervous system. There was influenzal meningitis, but one could do lumbar puncture and obtain fluid from the cerebrospinal canal which was distinctive, and on cultivation one could obtain the influenza bacillus. The cases did not resemble poliomyelitis. The Pfeiffer bacillus would not stand glycerination, and would not pass through the filter. One could take the spinal cord from a case of poliomyelitis, glycerinate it for six months, and then by injecting into the monkey reproduce the disease. That could not be done with the influenzal bacillus. He realized some of the difficulties there would be in regard to notification: but if the straightforward cases alone were notified much could be done to diminish the incidence of the disease among the population. What he was even more interested in was to find out, by notification and investigation, what was the cause, and how it was communicated from individual to individual. The clinician had gone as far as he could; he knew the clinical aspect and the pathology of the disease, but it was impossible for him to work out how the disease was communicated from person to person; that was the work of the epidemiologist, and of this Section of the Royal Society of Medicine.

Dr. RANSOME wrote, in reply, that he was glad that the object of his paper was so fully appreciated. He recognized that only persons devoted to epidemiology were likely to make full use of the "Returns of Disease"; but he had confidence that, in the near future, the energy of the officials of the Local Government Board would be turned in some of the directions now indicated. He thought that Sir S. Murphy's difficulty was a real one, but hoped that, as one small association in Manchester was able, for ten or twelve years, to secure returns without "gaps," so powerful a body as the Local Government Board would be able in time to get full and reliable records.