

ing the regulations that were issued was to emphasize first principles of handling any communicable disease: "early diagnosis, hospitalization, and isolation of all fever cases until an accurate diagnosis could be established." The practical handling of the problem could not wait for laboratory confirmation. Many questions arose that might involve months or even years to solve. The soundest principles that we felt were justified were in the belief that this was a virus disease and spread by human carriers and mild cases. Because of the rarity with which more than one member of a family was involved, it was not even deemed advisable to quarantine members of the family. The Health Division did not want to impress anyone with the idea that it was doing more than it was possible to do.

The public was thoroughly informed daily as to the actual facts in the epidemic, and the reasons why certain precautions were taken and why many

other procedures were not advocated.

That the measures of early diagnosis, hospitalization and isolation were efficient can be measured only by the fact that 95 per cent of the reported cases were hospitalized. How successful in checking the disease this was, is a matter of speculation. There is no actual method that we can apply in determining the efficiency of such measures. They are, however, those that have been recognized in the handling of all communicable diseases. Our greatest consolation was in the fact that we did not issue regulations which were not based on sound public health practice. Until more fundamental knowledge is forthcoming concerning the true etiology, mode of spread, or specific remedies for this disease nothing could be advocated further.

The epidemic has now disappeared to the point where there are only a few sporadic cases. We have witnessed to date an epidemic of 1,065 cases with 197 deaths.

Epidemiology of Encephalitis*

With Special Reference to the 1933 Epidemic

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THE identity or non-identity of the encephalitis prevalent during August and September of this year in St. Louis and elsewhere, with ordinary lethargic or epidemic encephalitis, is an open question.

Assuming for the present that they are two different diseases, it may be

useful to compare them epidemiologically with poliomyelitis. In spite of the similarity of the St. Louis disease to poliomyelitis as to seasonal epidemic occurrence and minute histological changes (apart from the preponderant selective localization of poliomyelitic lesions in the anterior gray matter of the spinal medulla), they cannot be considered as due to the same virus. Though showing a limited amount of variation from epidemic to epidemic,

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poliomyelitis as a disease is not subject to such a wide variation as would be necessary to cause an entire epidemic like the recent one. Poliomyelitis has not been so difficult to transfer to animals as has the recent disease. In a limited personal survey—the result of the present investigation will of course not be available for months—two children were found to have had poliomyelitis a few years before the attack of encephalitis, and similar cases have been mentioned this year in Kansas City and Cincinnati. Two attacks of poliomyelitis in the same person are much more uncommon than this.

Except for the higher mortality in Japan, which is always an uncertain difference, the St. Louis outbreak appears to be a counterpart of the Japanese disease which was epidemic recently in 1924 and 1929. The Japanese have differentiated this as Type B encephalitis, and it may be convenient to preserve this distinction, calling the ordinary form, described by Economo, Type A encephalitis, until immunity tests or other study justify a combination or further separation.

The course of the epidemic is shown in Table I, in cases reported by weeks for St. Louis County and St. Louis City, two mutually exclusive administrative units.

The city is 3½ times more populous

TABLE I

REPORTED CASES OF ENCEPHALITIS BY WEEKS
IN ST. LOUIS COUNTY AND ST. LOUIS CITY

<i>Week ending</i>	<i>St. Louis County</i>	<i>St. Louis City</i>
August 12	41	4
August 19	58	15
August 26	82	39
September 2	106	103
September 9	86	106
September 16	76	108
September 23	32	65
September 30	20	49
October 7	14	31
October 14	7	13
	522	533

than the county, having 840,000 people to the county's 230,000. It is evident that the epidemic began in the county, and was more intense there, the rate of cases per 100,000 being 230 for the county and 63 for the city, or 99 cases per 100,000 population for the city and county combined.

This sharply defined seasonal distribution is the same as that occurring in Japan, and is similar to that of the large epidemics of poliomyelitis, but is totally different from that of Type A encephalitis, which occurs at all seasons, but always has had its periods of highest incidence in winter and early spring. Compared with the St. Louis rate of 99 per 100,000, the rate in Kagawa province, the most severely affected in Japan, was 270 in 1924 and 51 in 1929. The area of Kagawa province is 1-1/3 that of St. Louis City and County and the population is 2/3 as great. This is the 6th densest of the 47 provinces of Japan.

Multiple cases in the same family, and connected cases, have occurred in the St. Louis area in about the same proportion as with Type A encephalitis, and somewhat less frequently than in a poliomyelitis epidemic of similar intensity and population density. It might be expected that in an epidemic preponderantly of older people there would be fewer multiple cases in the same family than in epidemics chiefly affecting the young.

The relative frequency of mild or abortive cases is uncertain. Histories of possible cases of this sort have been obtained, but their identity with this disease remains inconclusive in many instances. It is believed that more mild cases have been reported and counted in the total in the St. Louis epidemic than is usual in epidemics of encephalitis.

Data regarding the incubation period are important. Considering only cases where absence from or entrance into the epidemic area occurred just prior

to onset, 7 cases indicated that the infection took place at least 4, 7, 8, 9, 11, 13, and 14 days, respectively, before the first symptoms, while 6 cases indicated that the infection took place not more than 9, 12, 14, 14, 14, and 21 days, respectively, before the first symptoms of the disease in the case becoming infected. The extreme possibilities for the incubation period in these cases would therefore be 4 and 21 days, and the necessary variation in this small group is great enough to take in incubation periods of 9 and 14 days.

No racial or sexual predilection has been shown, except a preponderance of males in the younger age groups, which is common to most diseases. There is no greater frequency in males than in females in the early adult years, such as is usual in smallpox.

As to age, the age group under 15 years comprises 23 per cent of the population in the St. Louis area, and had 13 per cent of the cases; the group 15 to 34 years old had 36 per cent of the population and 23 per cent of the cases; the group 35 to 54 had 28 per cent of the population and 29 per cent of the cases; the group 55 and over had 13 per cent of the population and 35 per cent of the cases.

An even greater preponderance in the aged characterized the two Japanese epidemics which covered the same area most intensively in 1924 and 1929, 5 years apart. A somewhat similar area was covered by the Japanese epidemics of 1912 and 1919, with a similar tendency as to age.

About 20 per cent of the cases reported in the St. Louis area have been fatal, slightly less in the county. This is in contrast to 50 per cent to 60 per cent fatality in the Japanese epidemics. It may be noted, however, that in Japan the ratio of the cases reported in the aged, to the population concerned, in percentages of the totals, is about twice that in the St. Louis area. In other

words, it seems possible that in Japan only the more serious cases tend to be reported, for both here and there the disease is much more severe and more fatal in the older age groups. A similar tendency with regard to smallpox has at times been noted in Japan, where a fatality rate of 80 per cent has been reported—much higher than is recorded elsewhere for large epidemics.

The age distribution of cases is of course very different from that observed in poliomyelitis, where the preponderance is much more marked in the opposite direction, the incidence being highest at about 5 years in metropolitan centers. The age distribution in Type A encephalitis varies with the reporter. There is no such uniform preponderance as in poliomyelitis, but usually during epidemics cases have been more frequent during the later childhood and early adult years, to about the same or to a greater extent than is true for the older age groups in Type B encephalitis.

Among the St. Louis cases, the milk supply was so various as to exclude that as a major factor in spreading the disease. The water supplies of St. Louis County and St. Louis City are entirely different. The early appearance of the epidemic in the county practically to the exclusion of the city, at once directed attention to the water, but within the county the municipality of Kirkwood has a supply drawn from the Meramec River, while St. Louis County and St. Louis City draw from the Missouri and the Mississippi Rivers above the Meramec. The Kirkwood cases were investigated and found to have used Meramec River water, and the incidence of the disease in Kirkwood was even slightly higher than in the remainder of the county.

No distinction as to economic status or occupation apparently separated the persons attacked by the disease from the remainder of the population.

The location of the cases is interest-

ing. There were 522 cases in the county, and 533 cases in the city, giving a rate per 100,000 of 230 for the county and 63 for the city. If the 28 city wards be divided into 6 groups, the eastern group, wards 2-11, bordering the Mississippi River but not the county, have an incidence rate per 100,000 of 31. The south mid-city wards, 13-16, have a rate of 46; the north mid-city wards, 18-22, 51; the two extreme northern and southern wards, 1 and 12, bordering both river and county, have a rate of 67, and the central mid-city wards, 17, 23, 25, and 26, a rate of 72. The three western wards 24, 27, and 28, bordering the county and not the river, with a population about the same as that of the other groups, have a rate of 142. Of the incorporated places in the county, the rate in University City was 200, in Clayton 177, in Richmond Heights 186, in Maplewood 236, in Webster Groves 158, in Kirkwood 284, in Glendale 480, and in Brentwood 530 per 100,000 population. Compared with these rates, Kagawa, the most thickly settled and the most heavily attacked province in Japan in both 1924 and 1929, had a rate of 270 in the former year and 51 in the latter. There are 1,000 people per square mile in Kagawa Province and 2,000 in St. Louis City and County.

This heavy incidence around, rather than in the middle of, the most densely populated area, is characteristic of the

disease this summer in Kansas City, and in other cities. It is striking, but is no different in order of magnitude, from that found in poliomyelitis. The rate in the New York City epidemic of 1916 was nearly tripled in the less thickly settled boroughs of Richmond and Queens as compared with the more metropolitan boroughs of Manhattan and the Bronx.

It is probable that even if Type B encephalitis is a different disease from Type A, it is not entirely new to this part of the country. Dr. H. D. McIntyre reported similar cases in Cincinnati in 1932 and the Illinois State Department of Health reported an outbreak of about 27 cases in Paris, a city of 9,000, in the same summer.

Cases in epidemic intensity have occurred this year in the Kansas City area, in St. Joseph, Mo., and in Louisville, Ky., but with less intensity than in the St. Louis area. In general, the prevalence has been below the 40th parallel of latitude. This geographical distribution, together with the seasonal incidence, suggests an insect carrier, and experiments are under way to test this hypothesis, but there is a similar tendency in poliomyelitis for certain latitudes to be more severely affected, and the early spread of the cases throughout the wide extended suburban area, instead of by radiation from a focus, is more characteristic of human than of insect transmission.