Trend of Multiple Cases of Poliomyelitis In Household Units

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INTEREST IN the occurrence of multiple cases of poliomyelitis in the household was stimulated by the urgent need for basic preliminary data in formulating recommendations for the use of gamma globulin in familial contacts and by the long-range objective of studying the household as a basic social unit. Epidemiological study of family units is particularly applicable to poliomyelitis because of the heavy localization of infection in affected households and the close association between host factors and the disposition to paralysis (*1–3*).

Investigations within the home by others have revealed the common prevalence of infection among family members at the time of or soon after the first case develops as well as the rapidity with which the virus is disseminated among household contacts (*4–6*). Consequently, when multiple cases do occur, they usually appear within a very short time of each other (*7*).

The foregoing clinical observations were confirmed in a recent epidemiological study of household infections in New York City, in which detailed data on age, time intervals, and other factors are given (*8*). In addition it was shown that the frequency of multiple clinical infections in the family was related to the number of susceptible persons in the household and to the annual attack rate of poliomyelitis. The association with incidence has been further explored in the present study because of its bearing on the evaluation of passive immunization in a community control program and on the broad problem of host-agent parasitism.

The method for determining the trend in the percentage of multiple cases during the year involved the tabulation by week of onset of (*a*) all reported cases, (*b*) first cases in families that had multiple cases, and (*c*) subsequent cases among the latter families. The difference between items *a* and *c* reveals the total number of newly affected families. This value divided into item *b* gives the weekly percentage of newly affected families with multiple cases.

Because of the newness of the approach, the results obtained by this method of tabulation are given by week of onset in the table for 1949 and for the endemic years combined. The households with multiple cases appeared to be fairly evenly distributed during the year in proportion to the total number of families affected. This was reflected in the weekly fluctuation of percentages above or below the annual average of 4.4 for 1949 and 2.7 for 1950–1952. As expected, the weekly deviations from the annual average are usually greatest when the number of reported cases is smallest, and can be reduced by accumulating the cases over broader periods.

The Data

The conditions of the investigation have been described previously (*8*). The data available

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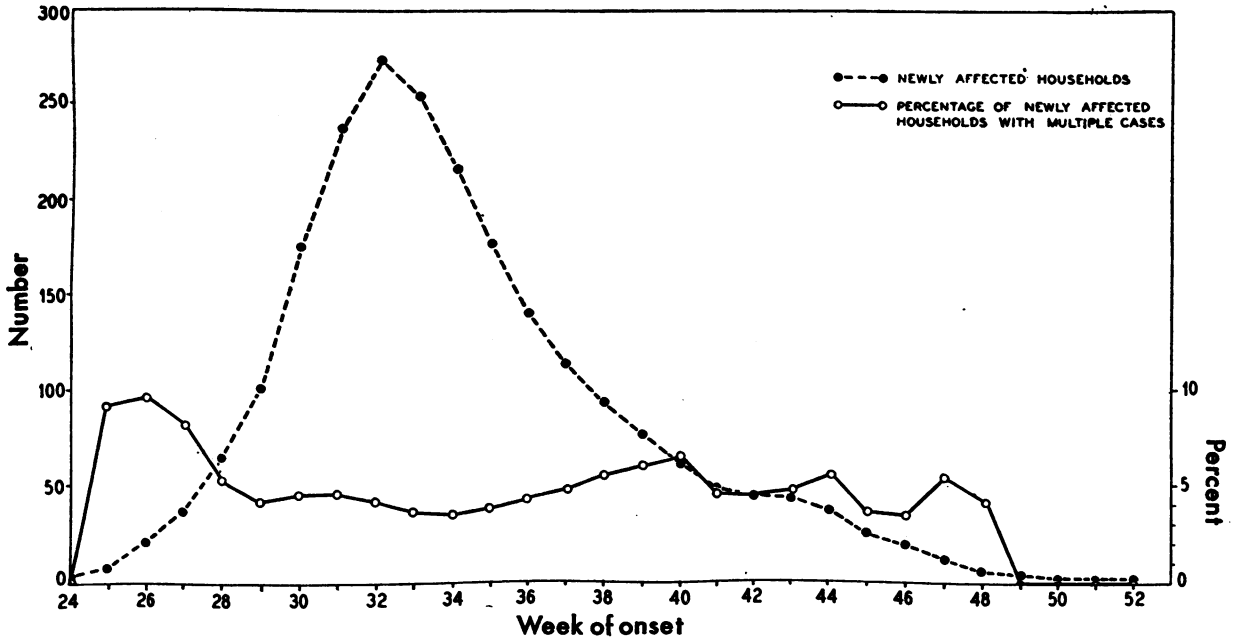
Figure 1. Poliomyelitis cases in newly affected households and percentage of newly affected households with multiple cases by week of onset (3-week moving average), New York City, 1949.



were 4,886 cases of poliomyelitis reported to the New York City Department of Health from 1949 through 1952. About 61 percent were paralyzed, and 39 percent had evidence of central nervous system involvement without recognizable muscular weakness. The cases reported occurred in 4,708 households of which 167 or 3.6 percent had more than one case per household. In the endemic years of 1950, 1951, and 1952, when the incidence in the general population varied from 6.8 to 13.1 per 100,000, the percentage of affected families with multiple cases fluctuated between 2.4 and 3.0. In the 1949 outbreak, when the incidence of poliomyelitis reached 31 per 100,000 population, the frequency of multiple cases was 4.4 percent. Because of these differences in endemic and epidemic years, it was deemed desirable to study the trend of multiple cases throughout the year. The clinical and epidemiological data analyzed were obtained by medical inspectors who visited the home of every reported case as well as the hospital.

The foregoing data by week of onset are presented graphically in figures 1 and 2. The fluctuations in weekly values shown in the table were smoothed by using the conventional method of a 3-week moving average. Thus, each value shown on the graph represents the average number of households newly affected in the weekly period before, during, and after the specific week designated in the chart.

Horizontal Trend

In the epidemic year of 1949 the number of newly affected families each week rose sharply to a peak in the 32d week ending August 12, and then declined slowly (fig. 1). However, the percentage of those developing more than one case followed a horizontal trend which was elevated only at the onset of the outbreak, then dropped to a level maintained for 20 weeks until the end of the epidemic period. Consequently, while a rise and fall in the number of affected families was occurring, the percentage of those developing more than one case remained fairly constant during the epidemic except at onset when the percentage was unduly elevated.

The results observed in the endemic years from 1950 through 1952 are given in figure 2 in terms of an annual average for the 3-year period. That is, the data from the corresponding weeks of each year were combined, as shown in the table, and the average value for each week was used as representative of the period.

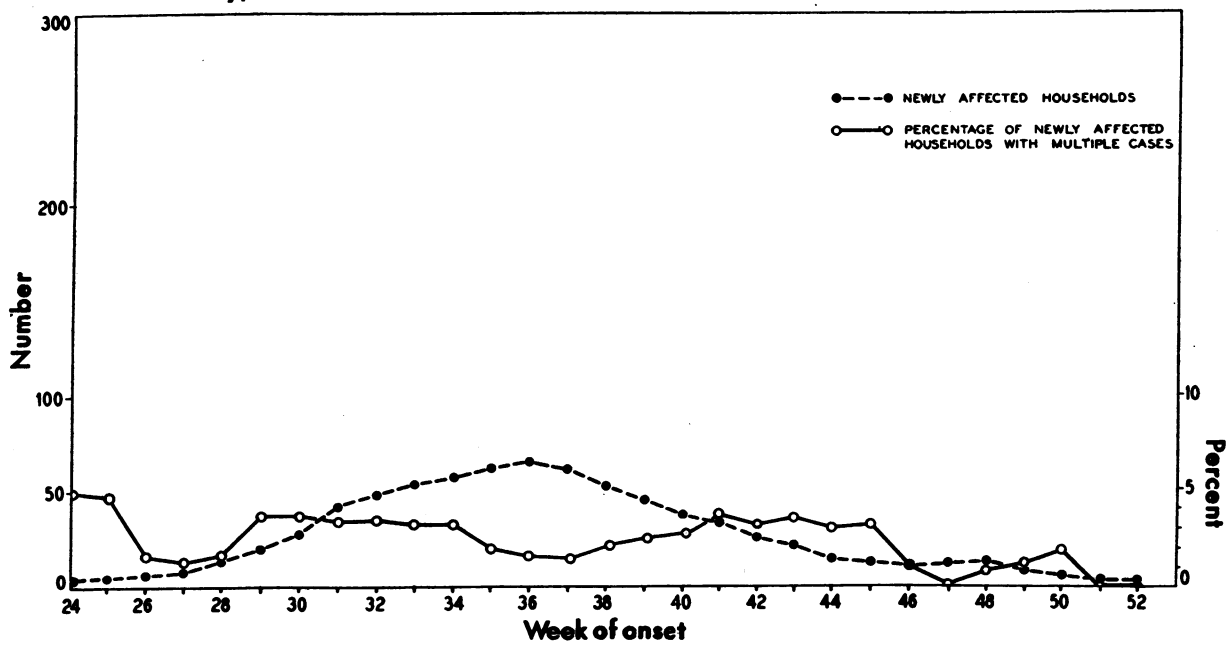
Poliomyelitis cases in newly affected households and percentage of newly affected households with multiple cases by week of onset in 1949 and in 1950–1952

Week of onset	1949			1950–1952		
	Newly affected households	Households with multiple cases		Newly affected households	Households with multiple cases	
		Number	Percent		Number	Percent
1–22	8	0	0.0	64	2	3.1
23	3	0	0.0	9	0	0.0
24	2	0	0.0	11	1	9.1
25	7	0	0.0	20	1	5.0
26	13	2	15.4	10	0	0.0
27	44	4	9.1	25	0	0.0
28	54	3	5.6	38	1	2.6
29	97	3	3.1	54	1	1.9
30	151	7	4.6	91	5	5.5
31	280	14	5.0	114	4	3.5
32	286	11	3.8	165	4	2.4
33	257	9	3.5	158	8	5.1
34	225	9	4.0	159	5	3.1
35	173	5	2.9	186	4	2.2
36	139	7	5.0	201	2	1.0
37	107	5	4.7	191	3	1.6
38	86	4	4.7	154	4	2.6
39	85	6	7.1	128	3	2.3
40	62	4	6.5	122	4	3.3
41	40	2	5.0	99	3	3.0
42	44	0	0.0	90	4	4.4
43	49	4	8.2	54	1	1.9
44	32	2	6.3	47	2	4.3
45	31	0	0.0	28	1	3.6
46	16	1	6.3	20	0	0.0
47	13	1	7.7	39	0	0.0
48	7	0	0.0	40	0	0.0
49	5	0	0.0	27	1	3.7
50	4	0	0.0	17	0	0.0
51	3	0	0.0	3	0	0.0
52	3	0	0.0	6	0	0.0
Unknown	12	0	0.0	0	0	0.0
Total	2,338	103	4.4	2,370	64	2.7

In the endemic years, a slowly progressive rise and decline in the number of newly affected families occurred during the summer and fall, and the percentage of households with multiple cases followed a horizontal trend. The number of new cases did not rise to the high levels observed in the 1949 epidemic, and the percentages of affected families with multiple cases were consistently lower than in 1949. It is further to be noted that the poliomyelitis season was again ushered in by a rise in the frequency of multiple cases above average levels as had been observed in 1949.

Thus, the percentage of households with multiple cases appears to be fairly constant during the so-called poliomyelitis season, being higher in epidemic years than in nonepidemic years. In both periods, the percentages were somewhat elevated above their respective mean values at the onset of the poliomyelitis season.

Figure 2. Average annual cases of poliomyelitis in newly affected households and percentage of newly affected households with multiple cases by week of onset (3-week moving average), New York City, 1950–52.



Discussion

This study of the seasonal trend of multiple household cases of poliomyelitis has revealed some interesting features of theoretical and practical importance. The frequency of multiple clinical infections for a given year, expressed as a percentage of households with more than one case of poliomyelitis, was established early in the poliomyelitis season and was continued at a fairly constant level throughout the year regardless of seasonal fluctuation in incidence. From this standpoint, therefore, there was no evidence of a basic alteration in host-agent parasitism in the course of the seasonal rise and fall in number of reported cases. The data suggest that virulence as measured by the capacity to induce clinical infection among household contacts was not altered by serial passage in the human host under the natural conditions that prevailed during the study.

Several points of practical importance follow as a consequence of the foregoing observations. First, there was no evidence of an alteration in epidemic pattern arising from the control measures generally employed at the time. Otherwise there should have been a reduction in the percentage of households with multiple cases.

Second, the percentage of affected households with multiple cases could serve as a useful index for measuring the efficacy of a prophylactic agent, particularly when used during one part of an epidemic or in the absence of satisfactory controls. A favorable prophylactic effect should result in a measurable reduction in the percentage of household contacts developing clinical infection.

The increase in the percentage of multiple cases in the epidemic year of 1949 as compared with the 3 endemic years that followed was observed at the onset of the poliomyelitis season and continued throughout the summer. Such an increase might be used as an early index of epidemicity. However, our experience is limited to 1 epidemic and 3 nonepidemic years. If confirmed in other studies, its value in forecasting an impending epidemic should be further explored in conjunction with other methods thought to have predictive value (*9*). The practical value of the method might be limited because of the low frequency of multiple cases to large population groups or to areas of inordinately high attack rates (*10*).

The increase in the percentage of multiple household cases observed at the onset of the poliomyelitis season in epidemic and endemic

years may be apparent only. It may represent merely a variation due to small numbers or may be due to underreporting of cases in the general population. Selective reporting of families with multiple cases might be expected, particularly at the onset of the poliomyelitis season when the population has not yet been overly alerted, and would carry more weight in calculating percentages at that time when the total number of reported cases is low than later on when the totals are high. Unusual factors affecting the host and his environment were considered but could not be related to the change. Obviously, additional data are needed before its full significance can be properly evaluated.

Summary

1. The seasonal trend of the percentage of households with multiple cases of poliomyelitis was studied in New York City from 1949 to 1952, inclusive.

2. The percentage of affected families with more than one case of poliomyelitis for a given year was maintained at a fairly constant level throughout the poliomyelitis period despite the seasonal fluctuation in incidence, but was consistently higher in the epidemic year of 1949 than in the ensuing endemic years. This difference between epidemic and endemic years was discernible from the very onset of the poliomyelitis season.

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Medical Practitioner Committee on Gamma Globulin

The Public Health Service has named a committee of seven practitioners of medicine to advise concerning the practical problems faced by the practicing physician in connection with the program of allocating gamma globulin for poliomyelitis. The group has been asked to interpret the allocation program through medical organizational channels so as to prevent misunderstanding, to evaluate the acceptability of the distribution plan, and to suggest desirable changes.

The committee held its first meeting in Washington September 10. Members are: Dr. Woodruff L. Crawford, Rockford Ill.; Dr. Edward E. Haddock, Richmond, Va.; Dr. Aims C. McGuinness of the School of Medicine, University of Pennsylvania; Dr. Herbert P. Ramsey, Washington, D. C.; Dr. A. M. Townsend, St. Louis, Mo.; Dr. Frank Wilson, director of the Washington Office of the American Medical Association; and Dr. Samuel M. Wishick of the Graduate School of Public Health, University of Pittsburgh.