THE EPIDEMIC CURVE FOR MUMPS

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(With 1 Figure in the Text)

The extensive epidemic of mumps which prevailed in Copenhagen in the winter of 1941–2 will presumably serve to establish whether Helge Petersen's (1941) general formula for epidemic curves for direct infectious diseases applies to mumps.

In several ways any disease has its own particular characteristics of appearance, and these imply some particular shortcomings with regard to the collection of statistical data concerning it.

This epidemic of mumps covered 43 weekly observations and comprised altogether 13,106 notified cases in all age classes. Of this total, no less than nearly 75 % fell in the age class of 1–15 years, and the remainder into classes below or above this age class. In other words, a great majority of the patients were school children or children in kindergartens. Owing to the preference of the school board for doctors' certificates instead of parents' communications, relatively many of the school children attacked were included among the cases notified by the physicians. Also many of the cases among the kindergarten children had been observed by physicians.

By limiting this enquiry to the age class of 1–15 years, we are able to exclude the military cases. For several reasons it is doubtful whether the latter cases really all belonged to the epidemic curve for the municipality of Copenhagen.

In the summer vacation proper, the number of children going to the country probably exceeds 50,000, and this great migration of children from the capital in the summer months may have had some influence on the form of the epidemic curve.

The shorter vacations may also have had some influence, though in another way, on the number of notified cases. In these periods the number of notifying physicians often decreases not inconsiderably—during the Christmas vacation, for instance, their number may be lowered by one-sixth; thus in 1941 from 332 to 265.

These, in a way regular, deviations in the accuracy of the notifications have a highly variable influence on the calculation of the form of the curve, depending on the part of the curve involved. If, for instance, the apex of the curve falls in the Christmas week, the notifications give too low a figure, and it becomes necessary in some other way —for instance, graphically—to find the figure that is to be used in the calculation of the theoretical curve. In Copenhagen such an extensive epidemic of mumps as the one under analysis is a rare thing. The last two preceding epidemics of considerable extent occurred in 1928–9 and in 1936–7, comprising respectively 3000 and 4000 cases, with $\gamma = 0{\cdot}2$ and $s \times 10^5 = 5$ and 6, respectively.*

In the recent epidemic the ascending limb of the epidemic curve, commencing in August 1941, is quite typical, according to the requirements of the

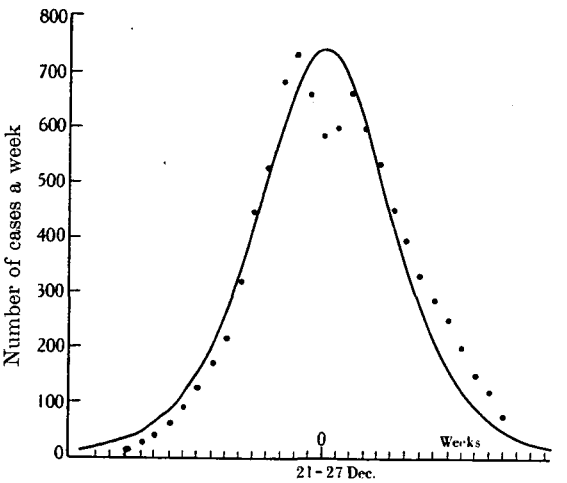

Fig. 1. Curve for epidemic of mumps in Copenhagen, 1941–2, age class of 1–15 years. The points signify the smoothed weekly numbers. The full-line curve is the calculated theoretical curve. The week indicated by 0 is the week of 21–27 December.

theoretical curve, till the middle of December, but in the following three weeks, from the middle of December to the first days of January 1942, the curve shows three atypical weekly observations. After this, the course of the observations corresponds to the theoretical requirements, and late in the spring the epidemic subsides.

* γ is used as a symbol for the value indicating the steepness of the curve. s signifies the relative constant of infection.

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Presumably the Christmas vacation is the reason why the apex of the epidemic curve is notched. As this curve begins to fall off shortly before the new year, it is difficult to establish its apex quite accurately. Here 740 is selected as the apex, while the total number of patients in the age class employed lies between 9600 and 10,000. Because of the aforementioned three weekly observations, in which the figures are artificially too low, the figure for the apex can hardly be established with a higher degree of certainty.

If the regular course of the epidemic had not been interrupted by the Christmas vacation, the greatest weekly number of cases would undoubtedly have been higher, about 1000, corresponding to the fact that the ascending limb of the curve is more steep during the epidemic proper than that of the theoretical curve. The individuals who avoided infection through the vacation have instead been infected later on; and this fact has resulted in the epidemic proper falling off somewhat more slowly than the theoretical curve.

This inquiry shows that epidemics of mumps send their waves over a town in the same manner as do epidemics of measles, whooping-cough and influenza (Petersen, 1941), and that in mumps also theory and experience go hand in hand.

The special epidemic laws demonstrated by Helge Petersen may therefore be assumed to apply to mumps.

Table 1 gives the decisive figures of the epidemic curves for the three above-mentioned epidemics of mumps in Copenhagen, the epidemics being arranged according to their size.

Table 1. *Survey of three epidemics of mumps in Copenhagen*

Age class: 1–15 years*

Period	No. of notified cases	Highest no. of cases observed in one week	γ	$s \times 10^5$	No. of weekly observations
1936–7	3025	140	0·19	6·1	52
1928–9	3890	195	0·2	5·2	48
1941–2	9637	740	0·31	3·3	43

* As only a fraction of the total number of cases is employed here, s does not give the actual relative constant of infection for mumps in Copenhagen (cf. Petersen, 1941). This paper gives the formula employed for the curve, namely:

$$f = \frac{\gamma \text{ (no. of cases)}}{2 + e^{\gamma t} + e^{-\gamma t}}.$$

REFERENCE

PETERSEN, H. (1941). *Acta med. scand.* **107**, 282, 358.

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