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A STUDY OF SMALLPOX TRANSMISSION RATE IN BANGLADESH

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Summary: A retrospective study of 835 smallpox outbreaks was conducted to determine the rate of transmission of infection in these outbreaks prior to their detection. It was found that on average the number of cases in an outbreak, doubled every 15 days.

Introduction and Method

Various studies have related the size of smallpox outbreaks to the detection interval (the number of days between the date of onset of the first case in an outbreak and the date of the outbreak's discovery). In most of these studies the recorded size of an outbreak was its ultimate number of cases and was, thus, to some extent dependent on the effectiveness of containment measures.

This study relates the number of cases at the time of detection of an outbreak, to the detection interval. In this way it was hoped to determine the usual rate of undetected smallpox transmission within the particular climatic, socio-economic and other less clearly defined conditions of rural Bangladesh.

The initial investigation records of 835 outbreaks, which had occurred between July 1974 and June 1975, in five districts, were examined. The criterion for inclusion of an outbreak in the study was merely that a complete and apparently reliable record was available.

Results and Comment

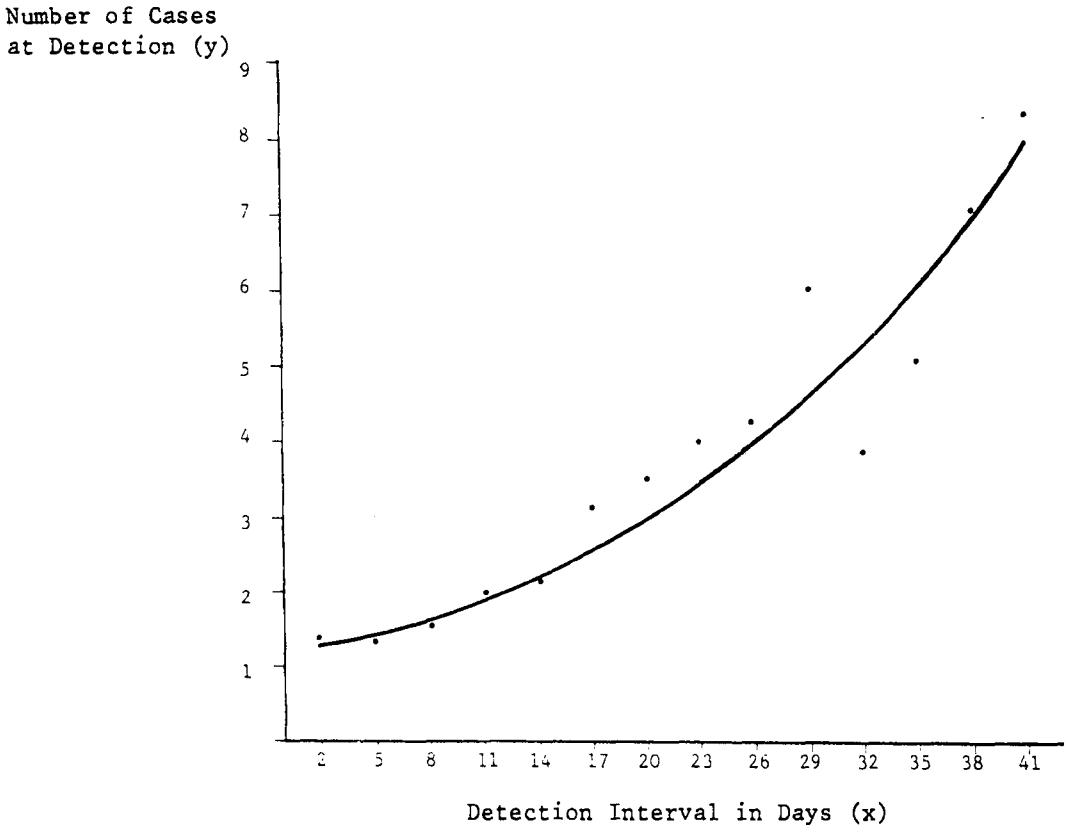
Figure 1 shows the average number of cases per outbreak, at the time of detection, related to the detection interval (by three day periods). This relationship was found to be significant ($p \leqslant 0.001$) and, within the range studied, could be defined by an equation which is plotted in figure 2. It is noted that extension of the curve to day zero indicates an average of 1.2 cases, compared with an expected 1.0. This suggests that some outbreaks may have had more than one index case or, perhaps more likely, that in some outbreaks one generation was missed. This finding does not, however, affect the interpretation of the subsequent rate of transmission. It can be seen that the number of cases almost exactly doubles every 15 days. If this period is considered an approximation of the average interval between subsequent generations of smallpox transmission in Bangladesh, it can be concluded that, at least during the first three generations, on average one case was the source of infection for a further two cases.

[a] WHO, Smallpox Eradication Programme, Bangladesh

Fig. 1: Detection Interval Related to Size of Outbreak at Time of Detection

Detection interval in days (x)	Number of outbreaks examined	Total cases at initial investigation	Average cases per O/B at initial investigation (y)
1-3	177	251	1.42
4-6	186	245	1.32
7-9	124	190	1.53
10-12	73	145	1.99
13-15	62	130	2.10
16-18	49	156	3.18
19-21	48	168	3.50
22-24	26	104	4.00
25-27	27	115	4.26
28-30	18	110	6.11
31-33	10	38	3.80
34-36	11	56	5.09
37-29	21	148	7.05
40-42	3	25	8.33
	835	1 881	

Fig. 2: Graph of Number of Cases per Outbreak against Detection Interval [a] [b]



[a] Average number of cases at the time of detection of the outbreak

[b] Detection interval in days by groups of three days (e.g. day 2 represents the average for days 1-3).

The relationship was found to be significant ($p \leq 0.001$) and in the range shown is defined by the equation $y = 1.2087e^{0.0462x}$, which is represented by the curve shown.

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