



INCUBATION PERIOD OF SMALLPOX

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Incubation period

In the following report this period is taken to be the time elapsing between the infecting contact and the commencement of symptoms of illness - not to the commencement of rash, which generally follows two to three days later.

In determining exact incubation periods, only those patients who have been in contact with the infecting source for a short and limited period of time (one day or less) on one occasion can be considered. In endemic areas therefore, and in the course of widespread epidemics such persons will be exceptional. As the disease tends to spread directly from patient to susceptibles within the same household - or in some recent outbreaks within the same hospital - the period of contact will usually be prolonged over several days. In these instances the incubation period can only be stated within limits which correspond to the duration of contact. It may be possible in such situations to state that the incubation period could not have been more than the period which corresponds to the time of the first contact with the infecting source and onset of illness. This may be of value in determining the longest possible incubation periods in those patients in whom the period is unusually short. A few such instances are quoted below. Similarly in some instances it may be deduced that a particular incubation period could not have been less than the time from the last possible contact of a susceptible person and the onset of his illness. There are, however, possible sources of error in such reckoning and these have been discussed by various authors. The possibility of infection from unrecognized mild and missed cases or indirectly from dust or fomites must always be borne in mind. Known indirect contact may, however, on occasion serve to fix the incubation period quite exactly, as in laundry workers, and instances of this kind are included in the table attached.

In attempting to obtain data on incubation periods, most of the accounts of outbreaks of smallpox published during the last 20 years and accessible to the writer have been consulted. In these published reports surprisingly little information is available from which exact incubation periods can be assessed. In some reports it is stated that for the majority of cases the incubation period seemed to fall within the usually accepted limits of 11 to 14 days. Exceptional cases, where the period seems to have been outside these limits, tend to receive special mention. For this reason, the cases listed in the attached table cannot represent the normal distribution of incubation periods. The total number of cases in each outbreak, to which the listed cases belong, is given with the reference to the published report.

It has been stated that acute fulminating cases, especially cases of purpura variolosa, tend to have a shorter incubation period than the average and indeed such cases have been noted in the literature and a few are known to the writer. On the other hand, the suggestion

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that smallpox in vaccinated persons is prone to follow unusually long incubation periods is not supported by Friedemann's experience. The previously vaccinated patients listed by him (see table) and by Sas had incubation periods mostly within the 11 to 14-day period. It may, however, be noted that of the six patients listed in the table as having 17-day incubation periods, only two, those recorded by Anderson et al., and by de Jong, had not been previously vaccinated.

Variola minor (Alastrim)

The statement is to be found in the literature that the incubation period is several days longer in alastrim than in variola major. Such figures as are available from the recent epidemics in Rochdale (1951-1952) and Gravenhage (1953-1954) do not support this statement. In the report of the latter epidemic of 42 cases (de Jong, 1956) determination of incubation period was possible only in a few persons listed as follows:

<u>Incubation period</u>	<u>No. of patients</u>
12 days	3
13 days	2
14 days	1
12-14 days	1
11-13 days	1
17-18 days	1

In the report of the Rochdale outbreak of 145 cases (Innes, 1953) "the general impression gained was that the incubation period was 10 to 12 days, more usually 10, and the rough rule of 14 days from rash to rash was confirmed". A series of cases with known contacts gave incubation periods varying between 10 and 13 days. Details of this latter series were supplied to the writer by Dr Innes, Medical Officer of Health of Rochdale. In each instance, contact on one day only was known. The incubation periods of these patients are shown in the table. Of the 21 patients from these two recent outbreaks of alastrim, all but one patient had an incubation period within 10 to 14 days, which is commonly accepted as the usual for variola vera.

The report of the Clinical Society's Transactions (London 1892, Supplement to Volume 25, pp. 178-212), shows that, of the cases in which there seem to have been only a short and known period of contact (34 cases), the incubation period seems to have varied between 10 and 14 days, with one shorter than that range and three longer than that range (two at 15 days and one at 16 or 17 days).

Variola major and minor

From the table it will be seen that, of the 87 cases listed, in six instances the incubation period was as short as eight to nine days, in six it appeared to have been 16 to 17 days, and in seven it was 15 days. In 66 of the 87 cases, the incubation period fell within 10 to 14 days. (The case marked 'e' of Cramb and that of Leroux with an incubation period of nine to 10 days have not been included in these calculations.)

Comment

Although for the reasons given above the cases listed in the table cannot be regarded as representing the true distribution of incubation periods in smallpox, certain tentative conclusions may be drawn. The cases listed in the table were recorded in outbreaks which comprised in totals something like 900 cases of smallpox. Even if we relate the exceptional incubation periods noted in the table to the total number of cases, it would appear that nearly 1% of patients have an incubation period of 17 days and a similar percentage have incubation periods of eight to nine days. These are likely to be underestimates of the occurrence of these incubation periods.

TABLE. INCUBATION PERIODS OF SMALLPOX - INDIVIDUAL CASES

Days after contact										Author	Public date	No. cases in outbreak	
8	9	10	11	12	13	14	15	16	17				
<u>Variola Major</u>													
		1 <sup>a</sup>	1 <sup>b</sup>			1 <sup>a</sup>					Boul et al. <sup>j</sup>	1946	16
	1	3	1	1		2	2			1 <sup>g</sup>	Purpura	1958	4
				3	1		1				Bradley et al.	1946	11
				1 <sup>b</sup>							Herrlich	1960	20
											Lyons & Dixon	1953	39
											Leroux et al. <sup>j</sup>	1955	73
										1 <sup>h</sup>	Pierce et al.	1958	6
											Hogben et al.	1957	6
											Cramb <sup>j</sup>	1951	29
											Black	1945	66
											Hanna	1930	8
											Anderson et al.	1951	18
											Sas	1954	51
											Friedemann	1927	300
											Stallybras	1947	31
											Bourel	1948	33
<u>Variola Minor</u>													
		3	5	3	1						Innes	1953	145
				3	2	1				1	de Jong	1956	42
<u>Totals</u>													
3	3	6	10	18	21	10	7			6			898

<sup>a</sup> This patient had contact on two occasions with first case.

<sup>b</sup> Time from first known contact with infecting case to onset of illness.

<sup>c</sup> Laundry workers.

<sup>d</sup> These two cases were hospital staff who made contact eight days before their illness with the first smallpox patient admitted (from a distance) to their hospital.

<sup>e</sup> This patient handled infected washing nine days and 16 days before onset of smallpox.

<sup>f</sup> Two nurses who first made contact with infecting case when he was moved, on fifth day of his illness, to cubicle in isolation ward from another open ward where he had been in bed for the previous four days.

<sup>g</sup> Patient in Heidelberg outbreak who had contact with first case of the outbreak on only one occasion and then went home to Kaiserslautern where he became ill 17 days later.

<sup>h</sup> Woman whose only known contact with infecting case was when visiting at his home on the day he was moved to hospital. She was successfully revaccinated, with primary-type take the next day, was under daily surveillance for the next 15 days and became febrile the day after visiting ceased.

<sup>i</sup> This was a child suffering from congenital toxoplasmosis who developed rash 17 days after contact with primary case. If two or three days allowed for pre-emptive fever - which was not in fact recorded - this incubation period might be regarded as 14 or 15 days.

<sup>j</sup> The case of Boul et al., the first case of Leroux et al. and the case marked 'e' of Cramb, have not been included in the totals.

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