A measles epidemic in a circumscribed community

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SUMMARY. A measles outbreak of 151 cases in a circumscribed rural community is documented. Attention is drawn to accuracy of vaccination documentation and the factors influencing uptake. The efficacy of the vaccine in the population of school children is estimated (both within the community at large and within the home of an affected person). A failure rate of 5–6 per cent was found.

Introduction

ON two days, 11 and 12 March 1980, one of us (M.J.K.) encountered his first four cases of measles in general practice. Enquiry from colleagues and early contact tracing identified one case originating from 17 February and two, previously diagnosed as scarlet fever, occurring in one family 12 days apart. The first of these two, a girl in the same class as the case of 17 February, developed her rash 13 days later.

Aim

To document the first epidemic in the area since measles vaccination was introduced in 1968. As more information became available, we hoped to answer questions of vaccine efficacy which were raised by parents and colleagues.

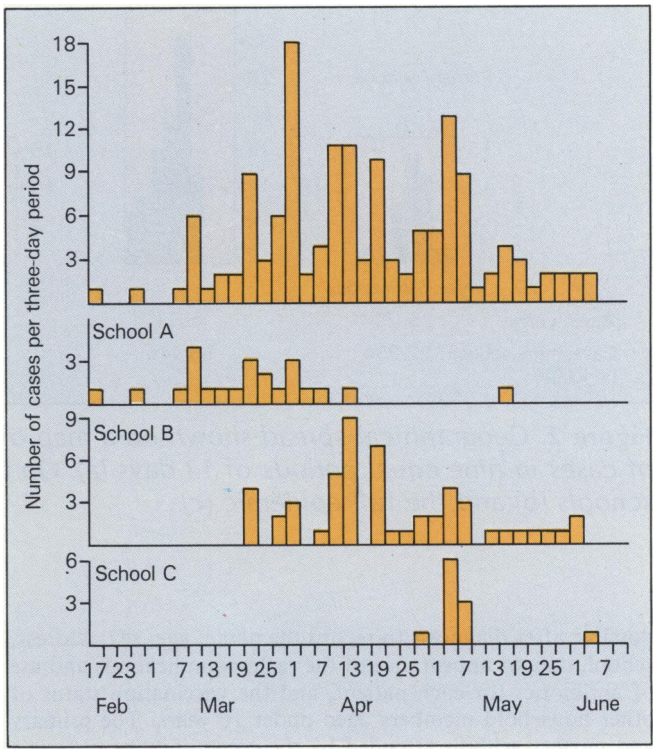

Figure 1. *A histogram showing the cases occurring in three-day periods throughout the outbreak and in the three primary schools. The outbreak affected school A first, and three incubation periods later spread to the second school.*

Materials and methods

The cases were drawn from two practices with a population of 7,238; there were a few additional cases from a third, adjoining practice. The village populations were obtained from the parish council figures. There was a total of 7,128 in the three parishes of Chinnor and Henton, Sydenham, and Aston Rowant and Kingston Blount.

Cases were recorded as they occurred by contact tracing and by notifications from the three practices. Diagnosis was based on a clinical picture of prodromal illness, morbilliform rash, Koplik's spots and a duration of at least five days. One of us (M.J.K.) interviewed all cases or their parents as early as

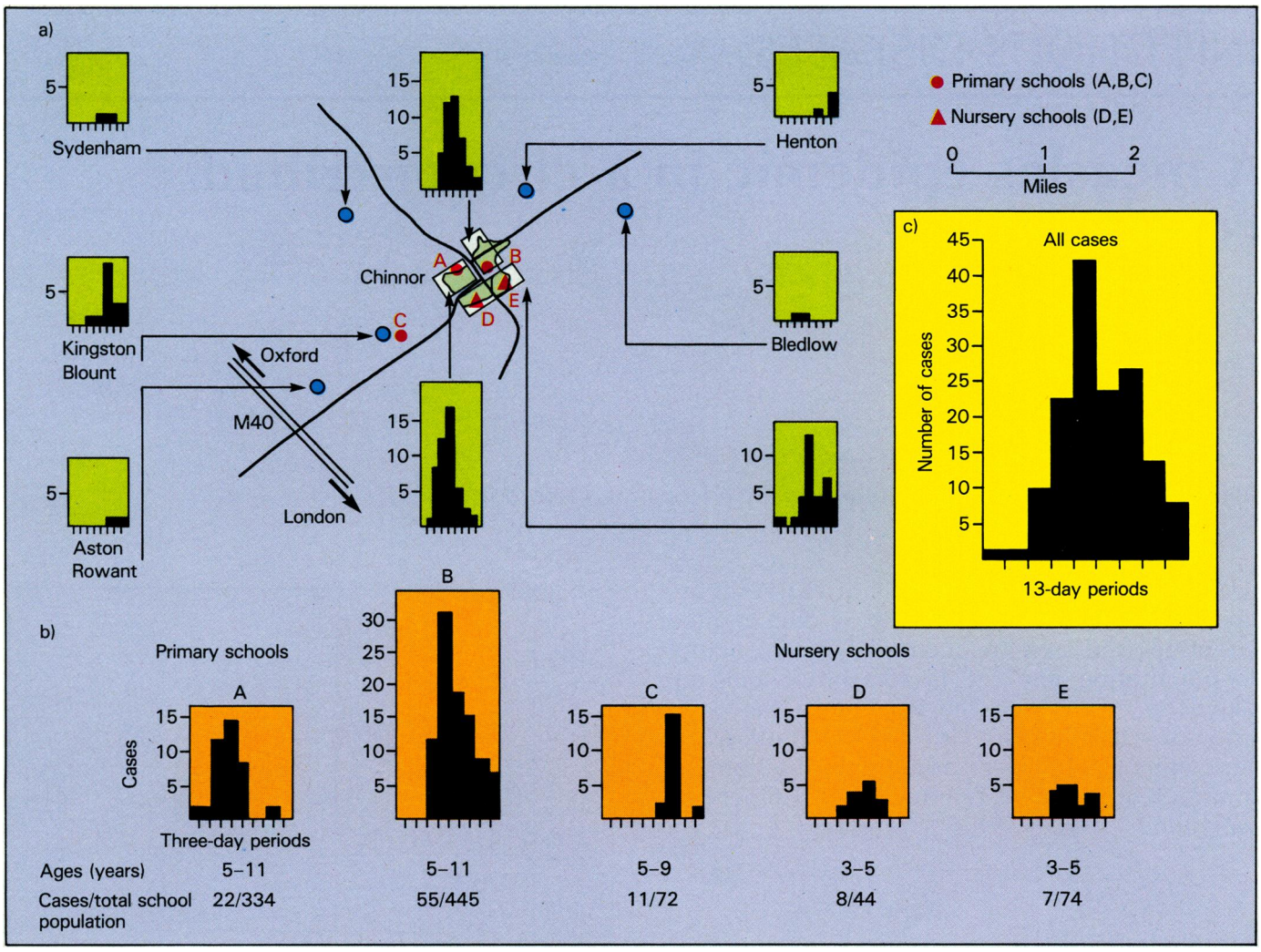

Figure 2. *Geographical spread shown on a map of the area by histograms, demonstrating the number of cases in nine equal periods of 13 days (a). On the same scale, histograms show the spread in the schools (b) and the full epidemic (c).*

possible after diagnosis to record the name, age, sex, address, school, date of appearance of the rash, complications and use of antibiotics for each patient, and the vaccination status of other household members aged under 16 years. The primary and nursery schools attended by the community at risk were asked for details of absentees during the epidemic. The two secondary schools were in nearby small towns outside the area and served a larger population.

The general practice notes of all cases were used to check the details recorded at interview, and the Area Health Authority immunization records were searched for dates and batch numbers of measles vaccination. Edge-punched cards, one per case, were used for analysing the data. The vaccination rate was calculated in M.J.K.'s practice from the 991 children aged 1–12 years; this number constituted about two thirds of the full child population of this age. The spread of infection within the household was calculated by the method described by Hope-Simpson (1952); the cases in the first eight days in one household were counted as co-primaries, and secondary cases were sought amongst the household contacts. An interest in the survey in the community encouraged a few mothers to report cases which might not otherwise have come to light.

The community health implications of the epidemic, including the efficacy of the vaccine and prospects for controlling similar outbreaks, will be reported in a separate publication.

Figure 3. *Ages of measles patients and number vaccinated.*

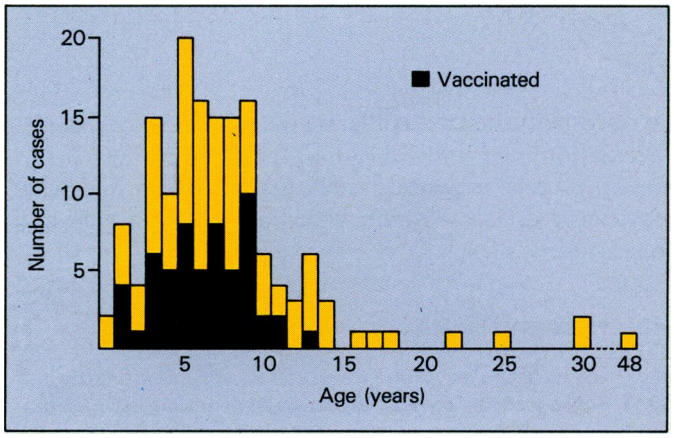

Table 1. Reports of measles vaccination in patients with measles.

Mother's recollection:		Vaccinated		Unvaccinated		
GP's records:		V	NR	V	NR	Total
AHA files	Vaccinated	30	3	3	5	41
	No records in file	6	2	0	33*	41
	Unvaccinated	2	6	0	59*	67
Total		38	11	3	97	149

AHA = Area Health Authority.
V = GP record of measles vaccination.
NR = No record of measles vaccination in GP notes.
*Patients scored as unvaccinated.

Table 2. Reasons why children had not been vaccinated.

	Number of cases
1. Too old (before 1968)	14
2. Too young (under 12–14 months)	8
3. Previous neurological damage	1
4. Febrile convulsions	3
5. Family history of epilepsy	3
6. Family history of epilepsy and childhood eczema	1
7. Family history of eczema	1
8. Eczema and on steroid creams	8
9. History of eczema in the child but not on steroid creams	12
10. Family history of asthma	2
11. Patient history of asthma and eczema	3
12. Previous severe reaction to triple vaccines	3
13. Sibling had post-vaccination illness	1
14. Previously thought to have had measles	3
15. Egg allergy suspected	2
16. Maternal refusal (five of whom were frightened of the consequences because of publicity)	11
17. Until aged five, continually unwell	5
18. Ill before and overlooked because of second child	1
19. Recurrent bronchitis and wheezy chest, so mother refused	1
20. Missed out (two were moving house)	15
21. Advised not to have it by a doctor elsewhere who did not believe in it (three siblings)	3
Total	101

Results

The epidemic

There were 151 patients with measles in the epidemic period from 17 February to 6 June 1980 (Figure 1). The first was a school child who lived on the east side of the village, but went to school A on the west side (Figures 1 and 2). The epidemic spread first through school A, and did not reach the second primary school in the village (school B) until five weeks later, in late March. On the west side of Chinnor the epidemic reached a peak at the end of March, earlier than elsewhere. By mid-April, the nursery schools in Chinnor and the surrounding villages were affected, but the third primary school C in another village was not affected until the end of April.

Seventy-seven of the patients were male and 74 were female. Most of the patients, including all those vaccinated, were less than 14 years old (Figure 3).

Vaccination records of patients with measles

The vaccination histories were examined for 149 of the 151 patients. The other two children lived in Buckinghamshire and their immunization records and population statistics were held by different health authorities. Fifty-seven (38 per cent) of the patients had a history of vaccination, either recorded in health authority files or GP notes or remembered by their parents. All three sources of information were incomplete—each lacked eight of the 57 histories (Table 1).

The reasons for not being vaccinated varied from obvious and clear-cut contra-indications, like being too young, to poorly defined conditions and administrative lapses (Table 2). In the age group 1–12 years, which should have been protected by the vaccination programme, there were 70 unvaccinated and 56 (44 per cent) vaccinated children.

In M.J.K.'s practice 756 (76 per cent) of the 991 children aged 1–12 years had a written record of vaccination. Five of the 991 children had had measles in the past, and 123 children had no vaccination records to be found in the health authority files; if the mother's recollection of vaccination for cases is accepted as valid, a further 6 per cent of the children may have had vaccine. The level of immunization in the whole community may therefore be higher than 76 per cent, and the attack rate in the 969 primary school children has been calculated in two ways: once from a 76 per cent vaccination rate and once from the 82 per cent rate. Both show the benefit of vaccination (Table 3).

Complications

Complications occurred in over a quarter of cases (Table 4). Three children were admitted to hospital, one with encephalitis, one with lobar pneumonia, and one (on holiday in Wales) with otitis media.

Antibiotic prescribing

Antibiotics were prescribed for all but one of the complications, and in a further 10 cases. In 10 of the 39 cases with complications, the antibiotics were prescribed before the rash developed. Of the 10 uncomplicated cases, three were given antibiotics for a cough before the rash developed, two for 'scarlet fever', one for tonsillitis before the rash and four for prophylaxis by one doctor. In all, 10 general practitioners were involved with the patients, although three of them saw 65 per cent of patients.

Table 3. Comparison of attack rates in 969 vaccinated and unvaccinated school children.

School children	Unvaccinated		Vaccinated	
At risk	232	(174)	737	(795)
Cases	61	(61)	43	(43)
Percentages	*26.3%*	*(35%)*	*5.8%*	*(5.4%)*

Rates without brackets based on a 76 per cent vaccination rate, rates in brackets on an 82 per cent rate (see text).

Table 4. Complications of measles.

	Not vaccinated	Vaccinated
Neurological	1	0
Otitis media	12*	10
Chest infections	10*	5
Asthma	2	0
Balanitis	1	0
Total (percentage)	25 *(26%)*	15 *(27%)*

*One child had both.

Table 5. Spread within households.

	Number of children at risk			
Households	1	2	3	4
1 affected	25	41	13	5
2 affected		16	6	1
3 affected			5	2

Spread of infection within households

The spread within households amongst children aged eight months to 16 years was studied in the 89 households where there were cases (Table 5). There were 79 households with one primary contact, eight households with two co-primaries and two households with three co-primaries. There were 70 vaccinated contacts, in whom four secondary cases (6 per cent) developed, 30 non-vaccinated contacts, in whom 22 (73 per cent) secondary cases were noted, and eight who had previously had measles.

Discussion

The numbers in the epidemic were small enough to enable cases to remain named but large enough to provide interesting results and to build up a picture of the community spread, by the naming of contacts and their sources. The inner life of the community was reflected in the contacts in schools, cub scouts, brownies, ballet classes, mother-and-child clubs and a variety of other local activities which were brought to our attention. The sources of information and their accuracy were demonstrated in Table 1 and underline the importance of good records, both for research purposes and for accuracy during clinical practice.

The epidemic showed that measles can still be a virulent illness in a community with a 76 per cent vaccination rate, affecting about one third of the unvaccinated in the schools, three quarters of the unvaccinated in an infected household and between 5 and 6 per cent of the vaccinated. The incidence of complications at 25 per cent was high, and may reflect the modern lack of experience of measles in families, so that medical care is requested for the protracted pyrexial illness. Added to this, general practitioners may overreact by recording as complications the hyperaemia of the tympanic membrane and the chest signs, which are common in measles.

During the course of the epidemic the general practitioner author became more aware of how severely disruptive this illness could be to a household in the absence of immunization, and how the unvaccinated seemed to be more toxic than the previously vaccinated. The mothers of unvaccinated children certainly seemed more anxious about the condition of their children and, as the epidemic unfolded, those involved became more and more grateful that vaccination had conferred some immunity on the population and had kept the size of the epidemic within reasonable bounds. The spread of disease was impressive and endorses the need to quarantine school children, so heavily underlined in the older textbooks and so rarely appreciated by doctors today.

Doctors disagree a lot about how to interpret the recommendations on vaccination given in textbooks, journals and by manufacturers and the DHSS. The reasons given for children not being vaccinated show how poorly patients are advised and what excuses doctors are willing to accept to allow children to avoid immunization. After excluding those too young or too old to have been offered immunization, only 10 of the remaining 79 had reasons that seem to us valid—egg allergy and the use of steroid creams (the latter group could well have been offered immunization at a later date). All other groups show that the immunization clinic service had failed to follow up those missing out, to find out why and, most of all, to vaccinate specific groups under anticonvulsant or gamma-globulin cover.

The high infection rates in the schools show that the DHSS recommendations to school medical officers for the exclusion of cases and unvaccinated children is poorly followed. Further questions are posed: What constitutes an outbreak? Who implements recommendations and when? In the absence of the school vaccination record, how are these to be assessed? Is there a place for the introduction of an emergency immunization programme and at what level should it be triggered? How can immunization records, both in general practice and in community medicine, be made more adequate? How can general practitioners be encouraged to apply vaccination programmes and learn about the management of measles as it becomes an uncommon

illness? We feel that there should be some form of local policy either within the schools or within the communities to isolate the non-vaccinated and to introduce emergency immunization programmes.

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Words our patients use

'Pow-fagged'—to feel tired or weary (Lancashire).
"To be far welted"—to lie on one's back, apparently dead or unconscious (north Lincolnshire).
'Wabbit'—generally unwell (Tayside).
'Twisty'—generally unwell (Nottinghamshire).
'Beat'—unwell (of a part of the body) (Yorkshire).
'Plukes'—furuncles (north England).
'Oxter'—axilla (north-east and Scotland).
"My ears need puggling out"—'puggle' means to clear or clean out, usually of drains or ditches (Essex).
"I was tiffling about"—messing about when having nothing specific to do (Essex).
'Leaders'—tendons (Essex).
"He's allus bin a flimpy sort of a child and now he's hully queer and as yeller as a paigle"—he has always been a delicate child but now he is really ill and yellow as a buttercup (East Anglia).
"That push on my arm hav bin creating so. That dew perish me"—the boil of my arm is very painful, and it makes me feel ill (East Anglia).
"Oi got sich a wunnerful tizzick, it fairly rends me"—I have a terrible cough (East Anglia).
"My owd hid don't fare tew clever"—my head hurts, i.e. isn't feeling too clever (East Anglia).
To be in "morky fettle"—not to feel very well (Cumbria).
"I'm so fit I'm dangerous" (Cumbria).