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The incidence of chickenpox in the community

LESSONS FOR DISEASE SURVEILLANCE IN SENTINEL PRACTICE NETWORKS

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ABSTRACT.

Sentinel practice networks have been established in many European countries to monitor disease incidence in the community. To demonstrate the value of sentinel networks an international study on the incidence of chicken pox has been undertaken. Chickenpox was chosen as an acute condition for which incidence data are important to the determination of health policy on vaccine use. The project examined the incidence of chickenpox reported in sentinel networks in England and Wales, the Netherlands, Portugal and Spain (two regional networks) in January–June 2000 and the potential underestimate from patients who did not consult. An investigation of secondary household contact cases was undertaken. Reported incidence of chickenpox (all ages) in England and Wales was 25 per 10,000, in the Netherlands 13 per 10,000, in Portugal 21 per 10,000, in Spain Castilla y Leon 27 per 10,000 and in Spain Basque 55 per 10,000. Analysis of secondary contact cases suggested underestimation of incidence between 2.4% in Spain Castilla y Leon and 32.2% in The Netherlands. There was a trend towards incidence at an earlier age in England and Wales and in the Netherlands compared with Portugal and Spain. Whilst there was little problem in reliably identifying the number of incident cases in the recording networks and relating the non-consulting contact cases to them, the security of the denominator remains a problem where networks are comprised of differing categories of health care provider. It is essential that numerator and denominator information are made available specifically for each category.

INTRODUCTION

The health monitoring programme of the European commission [1],¹ sponsored by the directorate-general, health and consumer protection (formerly DG V), is particularly concerned with the use of data for providing information at a European level on a set of health indicators some of which require data on conditions managed almost exclusively in primary care. However there are no routine data extraction facilities from primary care in most countries of western Europe, though some computer companies and some health departments have used selected practices to provide databases for use in epidemiological and pharmacological research. Sentinel practice networks focussing on the

¹ Decision no. 1400/97/EC of the European Parliament and of the Council of 30 June 1997 adopting a programme of Community action on health monitoring within the framework for action in the field of public health (1997–2001).

surveillance of disease in the community have been established in many countries [2] and are an obvious potential source of data on selected health indicators.

Sentinel networks in primary care mainly measure disease incidence as it presents to general practitioners or other primary health care workers. In limited circumstances they can also be used to measure prevalence. The comparability of data from such networks depends on the reliability of the recorder; the accuracy of the denominator; the degree to which the condition is managed outside primary care (selfmanagement, direct access to specialist management); and on the selection of cases for inclusion, in particular by the use of diagnostic criteria. This study is particularly concerned with self-management but it raises issues in all these areas.

Chickenpox is generally managed in primary care in most countries. Some studies of incidence based on the presence of antibodies in serum suggest that 90% or more of adults have at some time had chickenpox even if only sub-clinically [3]. Estimates of the burden of illness due to chickenpox are important to assess the need for vaccination and, if substantiated, the population to be targeted. They are also needed to provide a baseline against which to measure the effects of vaccination and to warn persons at known risk of complications. Vulnerable groups include the foetus [4], infants before the immune system has developed [5], the immuno-compromised [6] and the frail elderly in whom immune senescence may occur as has been shown in relation to influenza [7]. A reducing age of first incidence of chickenpox has been reported [8–11]. Universal vaccination at an early age is not necessarily desirable because protection may be time limited and later incidence in adulthood would be undesirable. Furthermore the potential impact of such a policy on the incidence of herpes zoster in later life remains uncertain.

This study examines the incidence of chickenpox unrecognised by health care provision, i.e. the gap between community incidence and incidence reported in primary care, providing insight into the value of information from primary care as delivered by sentinel networks, and into apparent national differences in incidence.

METHODS

Sentinel primary care networks in four European countries co-operated (England and Wales, The Netherlands, Portugal, Spain): two separate regional networks (Castilla y Leon, Basque) contributed data from Spain. Brief information on the networks including the methods for estimating the monitored population are summarised here.

England and Wales – monitored population for this study 611,000

The population is derived weekly in age and gender specific groups on the basis of patient registration inherent in the payment system for general practitioners. The total population of the network is representative of the national population by age and gender and has a wide national coverage in England and Wales. There is no independent access to paediatricians and therefore incident rates reported in general practice truly reflect the incidence presenting to health care. Doctors in the network report the problems encountered at every consultation recording their assessment diagnosis.

The Netherlands – monitored population for this study 142,000

The population is estimated annually from counts of records held in the practices. Adjustments are made to take account of any temporary disturbance in practice reporting arrangements, (such as doctor on holiday). The population is representative of the national population and well distributed geographically. Independent access to medical care for a condition such as chickenpox is extremely unlikely. Recording is limited to selected diseases among which, chickenpox was included during the year 2000.

Portugal – monitored population for this study 66,000

Patients are registered with specific practices with known age and gender composition. Practices participating in the network provide annual summaries of patient registrations. The denominator for calculating weekly incidence is the registered population in those practices participating in that week. The network is reasonably representative of the national population by age and gender.

Spain – monitored population for this study Basque 109,000, Castilla y Leon 110,000

The Spanish sentinel networks include both general practitioners and community based paediatricians. The general practitioner population is derived from the list of individual health record cards held by the general practitioner at the beginning of the year. In some parts of Spain there is independent access to community based paediatricians and children aged less than 15 years may be assigned to them as an alternative to a general practitioner but not as an addition. The denominator in these paediatrician networks is available in age groups 0–1, 2–4, 5–9 and 10–14 years. Because of biased coverage of young children in these networks, incidence data were standardised to the regional population using the age bands 0–4, 5–14 and 15 years and over.

Though diagnostic criteria were not specified for this study, most sentinel physicians are familiar with the definition published in The International Classification of Primary Care ‘a vesicular exanthem which appears in successive crops with the lesions evolving rapidly from superficial papules to vesicles and eventually into scabs’ [12]. Most cases of chickenpox involve only one consultation and sentinel physicians diagnose using all the information available at the time of presentation.

The study was based on incident cases reported to the sentinel networks over a 26-week period between January and July 2000: (limited flexibility of start date in January was available to each network). Cases reported by telephone or diagnosed by the practice nurse were included as incident cases. Practices made contact with each incident case (or parent of children) approximately 3 weeks after presentation to establish whether any other household member had experienced this illness in the 3 weeks before or after the incident case. Age and gender details were collected together with information about medical advice sought. These secondary cases were added to those consulting to estimate total incidence. (Data on adult secondary cases were not obtained in The Netherlands and Spain.)

RESULTS

The participating networks delivered information on 3985 cases of chickenpox over 26 weeks. Numbers peaked in May in all networks except Portugal, where they peaked in March. Even though participation in the enquiry for secondary cases was voluntary, 88% of sentinel physicians in England and Wales and the entire group of physicians in the remaining networks contributed. The enquiry for secondary cases yielded 3243 (81%) usable responses. In England and Wales a further 104 incident cases were reported by the physicians who did not participate in the enquiry for secondary cases and these have been included in the reported incidence (Table 1).

[TABLE 1]

The study identified 296 secondary cases for whom no consultation had been made (Table 2): secondary cases in adults were reported only in England and Wales and Portugal (nine in each network). The relative proportions of secondary cases varied by network (2.4–32.2% of questionnaires) but only slightly within country by age group (0–4, 5–14 years) of the incident case. In The Netherlands, there were 62 secondary cases initially reported but checking showed that 15 of these had consulted but had not been registered within the sentinel system: these were reclassified as primary incident cases. In England and Wales, and in the Spanish networks, a few (not quantified) secondary cases had already been reported as primary incident cases and were excluded from the count of secondary cases.

[TABLE 2]

The incidence of chickenpox reported in the sentinel networks and total incidence including secondary cases is given in Table 3. The total incidence is estimated by applying the proportions of secondary cases identified as a supplement to the initially reported incidence. Total incidence (all ages) ranged from 17 to 28 per 10,000 over the 26-week period excepting in Spain Basque. Relative incidence rates in the age group 0–4 years were six times those in the age group 5–14 years in both England and Wales and the Netherlands, whereas in Portugal and Spain Castilla y Leon the incidence in the 0–4 years age group was only two to three times that in the 5–14 years group. In England and Wales and in Portugal, (networks with a long history of monitoring chickenpox), 15% of cases

occurred in adults: though the proportions reported in other networks were less. Incidence reported in Spain Basque in both childhood age groups was considerably higher and in Spain Castilla y Leon higher than in the other European networks.

[TABLE 3]

DISCUSSION

The incidence of chickenpox measured in the sentinel networks during the 26 weeks varied from 13 per 10,000 in The Netherlands to 55 per 10,000 (age standardised rate) in Spain Basque and including secondary cases from 17 to 57 per 10,000. Total incidences in the three networks with nationally representative populations and accurate population based denominators (England and Wales, The Netherlands and Portugal) varied from 17 to 28 per 10,000. After age standardisation, the rate in Spain Castilla y Leon was similar (28 per 10,000) but the rate in Spain Basque twice as high (57 per 10,000). In this network, 55% of the doctors reporting were paediatricians who reported 95% of all cases; in Spain Castilla the equivalent proportions were 37 and 85%. Chickenpox is a notifiable disease in Spain and incidence reported from notifications from January to June 2000 was 35 per 10,000 in Spain Basque and 33 per 10,000 in Spain Castilla y Leon. The difference between the sentinel network and official notification rate in Spain Basque emphasises the difficulties arising from paediatric networks in which the denominator population is uncertain.

With the exception of Spain Basque, the incidence reported by the networks is consistent with that from other data sources. In England and Wales the sentinel network has monitored the incidence of chickenpox for more than 30 years. In that time the annual rate has varied between 25 and 75 per 10,000 population (all ages) [8], however, over the last 10 years it has stabilised around 50 per 10,000. Statutory notification of chickenpox was introduced in Scotland in 1988 and annual incidence has varied between 48 and 79 per 10,000 [9]. In Slovenia annual incidence based on statutory notifications varied between 58 and 101 per 10,000 over the last 20 years [10], (there is a higher proportion of children in Slovenia than in England and Wales or Scotland). The spring peak of incidence is consistent with other sources of data, though the limitations of a study of 26 weeks duration are recognised. All continuous sources of data show considerable variation in incidence between years and there is no reason to expect annual peaks and troughs of incidence to be synchronous throughout Europe.

In The Netherlands, 32% of incident cases did not consult compared with Portugal (20%) and England and Wales (14%). In The Netherlands and Spain a few adult secondary cases may have occurred but, these are unlikely to lead to substantial underestimation of incidence as recorded routinely in the sentinel networks. There are additional non-consulting cases with no direct household contact with another case. Since these cannot be related to a secure denominator we did not try to estimate their impact on the incidence rate reported. Though adults may contract chickenpox from children, we suspect the converse is unusual, most children contracting it from classmates or siblings.

The study also contains useful lessons for monitoring in sentinel networks outlined below.

Population denominator

A reliable denominator is essential for estimating incidence. Networks embracing differing speciality groups need to report group specific data on incident cases and denominator populations. The representativeness of the monitored population is always important, but particularly so in paediatric networks which may include disparate groups of paediatricians, some of whom care for infants and others, school children. It is difficult to combine data from general practice and paediatric based networks. In the Spain Basque network 36% of the population under surveillance were aged 0–14 years and in Spain Castilla y Leon 30% (national Spanish equivalent 16%), England and Wales 19% (19%), The Netherlands 17% (19%) and in Portugal 16% (17%). In networks monitoring limited age ranges (especially if not representative by age), numerator and denominator data are needed within narrower age bands than is usual in general practice based networks.

Statutory notification

Incidence estimates of chickenpox from statutory notifications in Scotland have been shown to be similar to those derived from sentinel practices [9], in contrast with findings for other notifiable

diseases such as food poisoning and whooping cough, probably reflecting greater certainty of diagnosis. Notification is necessary for diseases in which contact tracing is important. However where information is needed solely to monitor incidence, monitoring in a representative sampled network may be a more economical way to obtain reliable data.

Differences between age groups

Incidence in England and Wales and The Netherlands in age group 0–4 years was much higher than that in age group 5–14 years. The age difference was less pronounced in Spain and Portugal. Decreasing age of incidence of chickenpox has been reported from England and Wales, Scotland and Slovenia [8–11]. In this study, increased incidence in the age group 0–4 years relative to 5–14 years was also seen in The Netherlands. This trend may reflect increasing socialisation among young children in nursery schools. Whatever the explanation, it has important implications for the risk of chickenpox to pregnant women [4]. Increased incidence in young children increases the risk of exposure to chickenpox in women pregnant for the second or subsequent time because the spacing intervals between children are mostly less than 5 years. A similar trend might be anticipated in Portugal.

Reporting procedures

In The Netherlands some ‘secondary cases’, should have been recorded as primary incident cases. This failure has probably resulted from oversight rather than the patient failing to meet a diagnostic definition. No prior disease coding was required and thus confusion with herpes zoster because of the combined name varicella/zoster is unlikely. In England and Wales some primary incident cases were also recorded as secondary contact cases, though these could be identified easily from the records held as part of the routine monitoring system. Recording methods need to be simple to avoid missing cases and primary storage of practice specific data is needed to avoid error from duplicate entry.

The reliability of sentinel networks depends on the goodwill of the sentinel physicians. There is a tension between on the one hand, the workload where reporting demands are high and on the other hand, sustaining the discipline of reliable selective reporting linked to strict diagnostic criteria. In a comprehensive recording network, the practices must include all reported cases including those where the diagnosis is made following a telephone consultation or by a locum or emergency medical service doctor. Selective entry using diagnostic criteria poses a dilemma when persons do not meet all the criteria, sometimes consulting early or late in the illness when critical features are not present. General practitioners are often more dependent on the history and observations of the patient (or parent) than on clinical findings. Routine recording from all consultations (as in England and Wales) reduces the risk of losing information and encourages consistency. Networks monitoring trends must ensure consistency of data capture.

Community or consulting population

The distinction between community based estimates and consulting patient based estimates matters for a few conditions, but the costs of obtaining community based data are substantially greater. Resource implications relate to the consulting rather than the total population. Where information from non-consulting persons is needed, the limitations of self reported information with the bias of retrospective recall and the insecurity of diagnosis need to be recognised.

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TABLES

Table 1. Incident cases, questionnaire responses received, number and % of incident cases

	Incident cases reported				Responses N	Responses % of incident cases			
	Total	0–4	5–14	15+		Total	0–4	5–14	15+
England and Wales	1316	795	316	205	928	71	72	71	67
The Netherlands	178	132	37	9	146	82	86	70	67
Portugal	289	115	128	46	223	77	82	70	85
Spain Basque	1573	1092	409	72	1399	89	89	90	88
Spain Castilla	629	341	260	28	547	87	84	92	75
Total	3985	2475	1150	360	3243	81	84	83	73

Table 2. Age group of secondary cases identified

	Secondary cases				Total	As % of responses within age group			
	Total	0–4	5–14	15+		Total	0–4	5–14	15+
England and Wales*	125	85	31	9	13.5	15.0	13.8	6.5	
The Netherlands	47	37	10		32.2	32.4	38.5		
Portugal*	46	20	17	9	19.7	21.3	18.9	23.1	
Spain Basque	54	39	15		3.8	3.9	3.6		
Spain Castilla	24	12	12		2.4	4.1	5.1		
Total	296	193	85		9.1	9.4	8.9		

* Data on adult secondary cases available.

Table 3. Reported incidence (per 10,000 persons) of chickenpox in sentinel networks by age (26-week period) and total incidence including reported secondary cases

	Reported incidence				Total	Total incidence			
	Total	0–4	5–14	15+		Total	0–4	5–14	15+
England and Wales	25	270	44	5	28	311	50	5	
The Netherlands	13	166	22	1	17	220	30	1	
Portugal	21	183	77	4	25	222	92	5	
Spain Basque	55*	898	151	10	57*	930	156	10	
Spain Castilla	27*	344	115	4	28*	356	120	4	

* Estimate derived after age standardisation to regional population.