Influenza

THE BIRMINGHAM RESEARCH UNIT OF THE ROYAL COLLEGE OF GENERAL PRACTITIONERS

SUMMARY. The 'weekly returns' system for the reporting of infectious and communicable diseases to the Birmingham Research Unit of the Royal College of General Practitioners is described. A detailed analysis of the influenza returns for the winter epidemic of 1975/76 is presented and compared with similar data from the previous ten-year period.

This analysis allows the following generalizations to be made which can, to a limited extent, be used as broad guidelines for predictions.

In any week in which a rate of 20 or more reports per 100,000 population is followed by a week in which there is a trebling of the rate, a major epidemic is imminent in which a peak rate of 500 cases per 100,000 population can be expected within three to four weeks.

In any week other than a week referred to previously in which a rate of 30 cases or more per 100,000 population is followed by a doubling of the rate, a moderate epidemic is imminent and peak rates in the range 150 to 500 per 100,000 population will be reached within three to four weeks.

The earlier in the critical period just before and just after Christmas that either of these changes are noted, the earlier and larger the peak is likely to be. Where neither of these thresholds is crossed, the peak rate for reported influenza is unlikely to exceed 150 cases per 100,000 people.

Introduction

AN INFLUENZA epidemic occurred in Great Britain in the first three months of 1976. The information used in this report is based mainly on the weekly returns service operated by the Birmingham Research Unit of the Royal College of General Practitioners since 1967 and is compared with similar data from the previous ten-year period (College of General Practitioners Records and Statistical Unit, 1963).

Method

The weekly returns system involves the co-operation of 85 general practitioners in 39 practices (Figure 1) caring for a total population of approximately 200,000 (Table 1). The population involved is representative of the population of the UK, though total numbers for some regions are small (Table 2). The population also includes two practices in Northern Ireland.

Figure 1. *Practice population distribution weekly returns.*

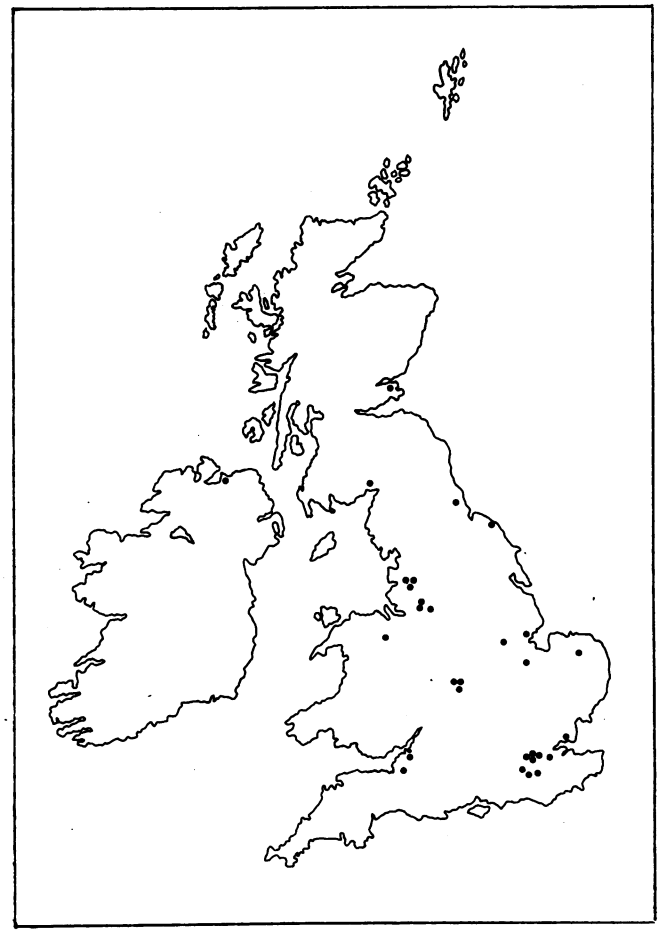


Table 1. Total population by age group and sex.

0-4	5-14	15-44	45-64	65 +	NK	Male	Female	Total
12,909	31,050	83,416	44,785	27,739	16	94,949	104,966	199,915

Table 2. Percentage distribution of study compared with UK, by regional health authority.

Regional health authority	*Study*	*UK*
Northern	*9.2*	*5.6*
Yorkshire	*2.6*	*6.4*
Trent	*4.4*	*8.1*
East Anglia	*5.1*	*3.2*
NW Thames	*Nil*	*2.6*
NE Thames	*1.7*	*2.5*
SE Thames	*4.8*	*3.8*
SW Thames	*13.4*	*2.9*
Wessex	*1.1*	*4.7*
Oxford	*Nil*	*3.9*
South-West	*12.3*	*5.6*
West Midlands	*14.7*	*9.3*
Mersey	*3.5*	*4.5*
North-West	*13.4*	*7.3*
Greater London	*6.4*	*12.7*
Wales	*1.4*	*4.9*
N Ireland	*3.4*	*2.7*
Scotland	*2.7*	*9.3*
Total	*100*	*100*

These general practitioners maintain standard disease indexes (Royal College of General Practitioners Research Unit, 1971), an age-sex register (Pinsent, 1968), or an updated age-sex baseline for the practice population. Each Wednesday a practice secretary abstracts the numbers, by age group and sex, of new cases of a restricted list of infectious, respiratory, and other diseases seen for the first time during the previous week onto a returns sheet. The current version of this sheet is presented in Figure 2. These weekly return sheets are posted to the Birmingham Research Unit. On the Friday morning of each week the returns are tabulated as rates per 100,000 population. Copies of this summary are posted to 19 bodies or institutions throughout the world. These include the Office of Population Censuses and Surveys (where the returns appear weekly in *Monitor*), the Department of Health and Social Security, the Public Health Laboratory Service, Colindale, and *Update,* where a monthly summary is published.

The diagnoses are established on clinical grounds alone and doctors can record episodes as 'influenza' or 'influenza-like illness'. Confirmatory evidence from serology or culture is seldom available in routine clinical practice. For this reason most recorders use the category 'influenza-like illness' to describe episodes occurring sporadically at non-epidemic times and 'influenza' only when an epidemic is established or when they are beginning to see increasing numbers of cases. Only four of the recorders use the rubric 'influenza' for the occasional case where confirmatory laboratory findings are available even when influenza is known to be epidemic. In the analysis, the data are considered for each rubric, separately and combined.

Influenza is perhaps the most important of the diseases warranting the organization of these weekly returns. The weekly returns data contribute to the information used by health care administrators and planners in anticipating the effects of an influenza epidemic. They give enough advance warning to the hospital and ambulance services for reduction in routine work in time to cope with the inevitable increased demand on hospital beds. Perhaps an even more important and more frequent use of this information is the capacity to identify non-epidemic situations when localized outbreaks of influenza-like illness occur. Drastic reduction in routine hospital admissions is disorganizing and appropriate measures can be introduced only when they are really needed.

Other relevant data which are collected weekly by other bodies includes: the numbers of reported deaths from all causes by age and sex by the OPCS; the number of new sickness benefit claims by the DHSS; and the results of influenza virus culture from throat swabs by the Public Health Laboratory Service in their Influenza Surveillance Series, *Communicable Disease Report.*

Results

The mean weekly rates per 100,000 population at risk in England and Wales for new cases of influenza since 3 December 1975 are given in Figure 3. In the UK the rate had been rising gradually from as early as late October but did not exceed 25 cases per 100,000 until 17 December, and remained between 25 and 50 for a further five weeks. In the week beginning 28 January 1976 the rate suddenly more than doubled to 106 cases per 100,000, and in the following week more than doubled again to 289. The peak rate of 540 was reached 14 days later, but did not drop below a hundred for a further six weeks. By 14 April 1976, two weeks later, the rate had dropped below 25.

The timing of the peak rates for each geographical area is given separately in Table 3.

ROYAL COLLEGE OF GENERAL PRACTITIONERS BIRMINGHAM RESEARCH UNIT
WEEKLY RETURN.

DOCTOR'S NAME ..... POPULATION .....
WEEK COMMENCING WEDNESDAY .....

Please complete on Wednesday for week Wednesday to Tuesday inclusive, beginning at the above date, and post on Wednesday to catch the last post.

NUMBER OF NEWLY DIAGNOSED EPISODES BY SEX AND AGE

CC No.	ICD No.	Disease	Total	Male	Female	0 – 4	5 – 14	15 – 44	45 – 64	65+	NK
003 004	090 – 099	Venereal disease *									
005 303	003 – 005 007 – 009 784.1 (pt)	Infectious Intestinal disease									
006	034	Scarlet fever									
008	033	Whooping cough									
009		Meningitis/encephalitis *									
011	055	Measles									
012	056	Rubella									
013	052	Chicken pox									
014	053	Herpes zoster									
015	072	Mumps									
016	070	Infective hepatitis									
017	075	Infective mononucleosis *									
022	133.0	Scabies									
		Other recognized communicable diseases. Please specify classification number									
066	201	Hodgkin's disease									
067	204 – 207	Acute leukaemia									
086	493	Acute asthmatic episode (infective)									
086	493	Acute asthmatic episode (non-infective)									
088	240 – 242	Thyrotoxicosis									
089	243, 244	Myxoedema									
091	250	Acute onset diabetes									
155	430 438	Acute cerebrovascular accidents *									
156	340	Multiple sclerosis *									
174	367	Retrobulbar neuritis									
		Total									

Figure 2. *Current version of weekly returns sheet.*

Geographical spread

There are two ways of plotting the geographical spread of an epidemic. The first is based on plotting the dates of the first recorded increase in the rates for the disease, and the second on the dates of the week of peak incidence. The latter has the advantage of specificity, being based on larger numbers. This sharper definition outweighs the disadvantages arising from the interval in time since the true onset, which in any case is seldom less than three weeks or more than four.

The peak for all ages combined (Table 3) occurred first in the week ending 11 February 1976 in the areas south of the Thames, Wessex, the South-West, Greater London, and Wales. In the following weeks, rates peaked in the north of England, Northern Ireland, the West Midlands, a week later in the Trent, and finally in Scotland. The earlier the peak week, the higher the peak rate reached. Wessex, with a peak rate of 1,683 cases per 100,000, had the highest regional figure recorded for any one week. An apparent peak for East Anglia in

NUMBER OF NEWLY DIAGNOSED EPISODES BY SEX AND AGE											
CC No.	ICD No.	Disease	Total	Male	Female	0 – 4	5 – 14	15 – 44	45 – 64	65 +	NK
183	381·0	Acute otitis media									
211	410	Acute myocardial infarction *									
217	429	Carditis *									
240	460 (pt)	Common cold									
241	460 (rdr)	Influenza-like illness									
242	462 – 463	Sore throat Tonsillitis									
243	461	Sinusitis acute									
244	464	Laryngitis and tracheitis									
245	470 – 474	Epidemic influenza									
246	480 – 486	Pneumonia and pneumonitis									
247	466 (pt)	Acute bronchitis									
251	511	Pleurisy									
		Other recognized respiratory diseases. Please specify classification number.									
277	531	Gastric ulcer									
278	532	Duodenal ulcer									
282	540 – 543	Acute appendicitis									
350	642 – 645	Spontaneous abortion									
405	712	Rheumatoid arthritis									
430 431	741.0 741.9	Birth CNS abnormalities *									
464		Cot death *									
AS		Attempted suicide *									
S		Suicide *									
		Total									

Drug reactions (specify). N.B. These should not be entered if they have already been reported to the Committee on Safety of Drugs.

1. Patient's name or identification .....
2. Name of drug ..... Dose given .....
3. Type of reaction + ...
4. Reason for prescribing .....
5. Age and sex .....

* Additional information may be required for these diagnoses.
\+ Skin rash, nausea, pyrexia, vomiting etc.

the weeks beginning 17 December 1975 and 31 December 1975 may be anomalous and due to a concomitant influenza B epidemic. The peak rate of 207 cases per 100,000 is low. There are no separate rates for influenza alone for Merseyside, Yorkshire, or in the North-East Thames district. If we use the data for influenza and influenza-like illness combined we have the same relationship and timing for the geographical areas.

The peak rates by age for influenza (Table 4) for all areas combined are seen first in the week ending 11 February 1976 in the age groups 0 to 4 and 5 to 14, and next in the week ending 25 February 1976 in the 45 to 64 age group. The equivalent figures for influenza and influenza-like illness combined are the same, except for the 45 to 64 age group which now peaks in the week ending 18 February 1976.

The highest reported weekly rate for influenza (678 cases per 100,000) is in the 15 to 44 age group, with marginally lower rates for the age groups 0 to 4, 5 to 14,

Table 3. Peak week by geographical area (rate per 100,000 population at risk).

	17 December 1975 and 31 December 1975		11 February 1976		18 February 1976	
Influenza	East Anglia	207	Wessex	1,683	West Midlands	874
			SW Thames	1,396	North-West	496
			Wales	1,014	Northern	344
			SE Thames	754		
			Greater London	720		
			South West	573		
					All areas	540
	17 December 1975		11 February 1976		18 February 1976	
Influenza and influenza-like illness	East Anglia	464	Wessex	1,820	NE Thames	1,215
			SW Thames	1,542	Northern	1,011
			Wales	1,154	West Midlands	983
			SE Thames	1,152	North West	731
			Mersey	1,022		
			South West	853		
			Greater London	801		
					All areas	789

No influenza recorded Yorkshire, NE Thames, and Mersey.
All numbers and rates used in this study are based on the actual populations at risk as reported from week to week.

and 45 to 64. Only the age group 65 and over, at 290 cases per 100,000, is markedly lower. The rates for 'influenza' and 'influenza-like illness' combined show a similar pattern, though the rate for the age group 0 to 4 (1,081 cases per 100,000) is now the highest.

The highest peak rates for any individual age groups were reported from Wessex. In the 0 to 4 and 5 to 14 age groups, the rates per 100,000 at risk were 10,526 and 5,515 respectively. A rate of 3,488 was reported for the 0 to 4 age group from the Welsh recorders. These extreme rates reflect the variability in attack rates when smaller communities are considered. The total populations at risk in Wessex and Wales are only 2,198 and 2,860 respectively.

Relation to deaths

The weekly rates for deaths from influenza (Figure 3) follow those for influenza with an interval of approximately one week. This suggests that most deaths recorded as due to influenza occur at the onset of the disease. It is known that all other deaths recorded as due to conditions other than influenza also peak during influenza epidemics (Miller *et al.*, 1971). The equivalent interval for those deaths is also approximately one week. This may simply reflect a tendency for such delayed deaths, even when triggered off by influenza, to be attributed to the other associated conditions.

Relation to sick benefit claims

The weekly rates for new sick benefit claims reach a peak in the same week as influenza deaths, approximately one week after the peak for reported influenza morbidity.

Relation to virus isolations

The PHLS (1976) reported increasing numbers of isolations of influenza A and B from the third week of December 1975 onwards, both reaching a peak in the third and fourth weeks of February 1976. The reports of influenza B isolations built up gradually and at their peak were only one fifth of all reports. The influenza A isolations built up more slowly at first, not passing those for influenza B until the first week in February.

The total number of patients reported from the 14 January until 31 March 1976 as suffering from 'influenza' was 5,075 (2·8 per cent), and from 'influenza-like illness' 3,791 (2·1 per cent). The equivalent proportion of the population at risk as percentages is given in brackets. Not all practices are recording every week and these percentages are based on recordings from an average population of 183,126 during these weeks from the total of 199,915 at risk in all recording practices. All numbers and rates used in

25 February 1976		3 March 1976	10 March 1976	17 March 1976	24 March 1976	
Trent	318	—	—	—	Scotland	784
N Ireland	133					

25 February 1976		3 March 1976	10 March 1976		17 March 1976	31 March 1976	
Yorkshire	505	—	Scotland	893	—	N Ireland	252
Trent	365						

this study are based on the actual populations at risk from week to week. These are all substantially less than the total affected, for only a proportion consult their general practitioner. The PHLS (1976) as part of its influenza surveillance programme reported the proportions of positive virus cultures as two per hundred in its surveillance population. It was considered that the true clinical attack rate is approximately twice this figure, suggesting that about four per cent of the population had clinical influenza compared with the minimum estimate of 4·9 per cent from this study.

Relation to other morbidity

The weekly returns service includes information about new cases of myocardial infarction and attempted suicide. Neither of these showed any increase in incidence rates during and after the recent influenza epidemic.

Comparison with previous epidemics

All graduations in the peak weekly rates from 39 to 918 per 100,000 population at risk are evident (Table 5), and there is no year between 1967 and 1976 in which cases were not recorded. Because the diagnosis of influenza and influenza-like illness is based on clinical criteria, there will be times when illnesses not caused by the influenza virus will be diagnosed as influenza or influenza-like illness by the recording practitioners. However, the lowest reported peak of 39 cases per 100,000 patients at risk is still well above the basal minimal reporting rates of less than 20 per 100,000. This lowest recorded peak rate of 39 also coincided in time with a well-recorded peak influenza B virus isolation (PHLS, 1976). We can say, therefore, that there were no years in this series in which an epidemic did not occur.

The actual time at which the rates for reported influenza begin to appear is the same in each season: approximately the last week in November.

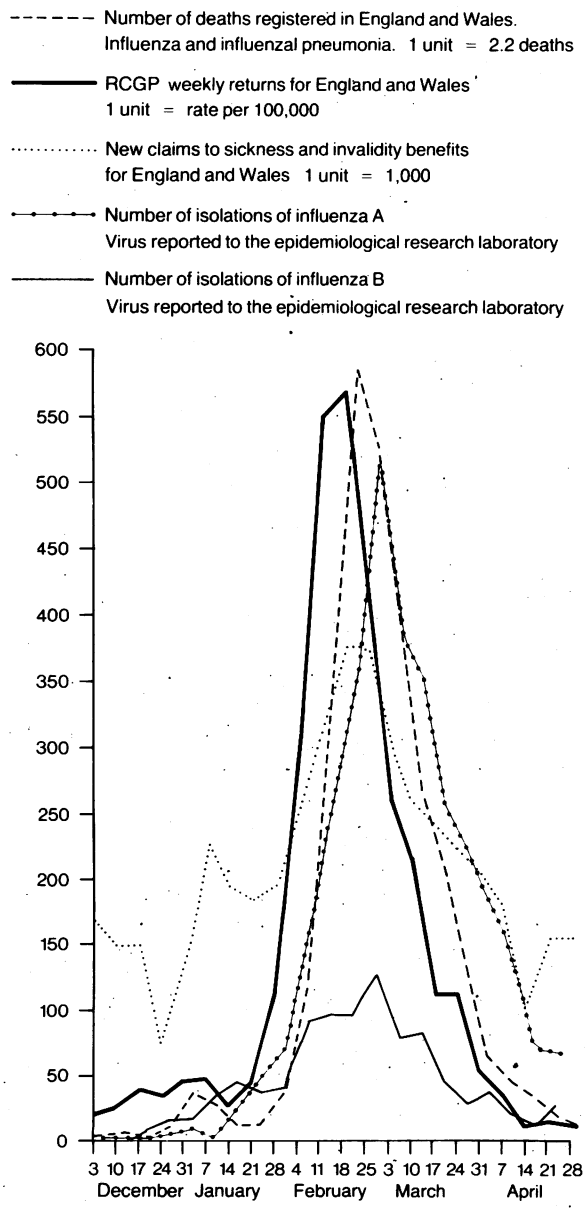
When the weekly rates for reported influenza are plotted separately for each year from 1967 to 1976 (Table 5), one other generalization is evident, namely: the earlier in the season that influenza reaches its peak rate, the higher that peak rate will be. Paradoxically, the recent epidemic is the only major exception to this generalization.

The patterns of virus isolations for influenza A and B separately may provide a clue to the anomalous character of this recent epidemic. The weekly trends for influenza B isolation match slowly rising rates in the weeks just before and after Christmas 1975. From the first week in February 1976 the equivalent reports of influenza A isolations now rapidly increase in harmony with the anomalous, late high peak for reported influenza. It may be no coincidence that this winter was

Table 4. Week of peak rate and rate by age group, all areas combined for influenza, influenza and influenza-like illness, and influenza-like illness.

	0-4		5-14		15-44		45-64		65 +		Total	
	Peak week	Rate	Peak week	Rate	Peak week	Rate	Peak week	Rate	Peak week	Rate	Peak week	Rate
Influenza	11.2.76	507	11.2.76	505	18.2.76	678	25.2.76	537	18.2.76	290	18.2.76	540
Influenza and influenza-like illness	11.2.76	1,081	11.2.76	785	18.2.76	934	18.2.76	743	18.2.76	414	18.2.76	789
Influenza-like illness	25.2.76	652	4.2.76	347	11.2.76	274	18.2.76	218	25.2.76	154	11.2.76	251

Figure 3. *Mean weekly rates per 100,000 population in England and Wales for new cases of influenza from 3 December 1975.*



one of the driest and mildest for many years.

The other minor exception to this first generalization is the early date in 1971 for the lowest peak rate in the series. This also represents a virus B epidemic like the other abortive early peak (PHLS, 1976).

There are other generalizations which can be inferred from the data in Table 5 and used for predictive purposes. For example, the relative volume of influenza to be expected in any season and the peak weekly incidence rate can be estimated from the following guidelines.

In any week in which a rate of 20 cases per 100,000 or more is followed by a week in which there is a trebling of the rate, a major epidemic is imminent in which a peak rate of 500 cases per 100,000 can be expected within three to four weeks. In any week other than a week referred to previously in which a rate of 30 cases per 100,000 or more is followed by a doubling of the rate, a moderate epidemic is imminent with peak rates in the range 150 to 500 reached within three to four weeks.

The earlier in the critical period just before and just after Christmas that either of these changes are noted, the earlier and larger the peak is likely to be.

Discussion

Miller and his colleagues (1971) in a study of the contrasting influenza epidemics in 1968/69 and 1969/70 showed that the peak weekly rates for influenza cases and deaths in the first more prolonged epidemic were much lower than in the second shorter and sharper epidemic. Notwithstanding this, the estimated excess morbidity and mortality due to all causes in 1969/70 was only about 50 per cent greater than in 1968/69. Opportunities for cross-checking the data presented here with data about total morbidity will be possible for 1970/76, when the results of the continuing Second National Morbidity Survey are available.

Miller also made the point that clear and firm predictions of epidemics cannot be made without further study of the interaction between the many

Table 5. Weekly rates of reported influenza per 100,000 population at risk for 1967 to 1976, arranged in order of highest reported weekly rate.

	46	47	48	49	50	51	52	1	2	3	4	5	6	7	8	9	10	11	12	13
1969-1970	10	11	22	76	297	560	854	918	514	309	169	89	56	36	39	27	27	28	29	18
1975-1976	11	16	20	21	24	35	33	42	46	26	42	106	289	521	540	400	253	220	128	131
1972-1973	8	20	75	169	222	225	520	379	288	171	148	89	67	39	26	27	15	16	20	19
1967-1968	18	19	29	39	50	104	218	204	262	229	137	90	86	87	77	83	73	51	42	33
1971-1972	10	5	18	25	41	86	87	155	172	161	187	212	222	197	111	73	47	41	22	14
1968-1969	28	25	30	26	31	28	20	49	64	66	91	63	84	89	117	149	152	141	121	88
1974-1975	18	18	26	21	35	14	52	81	83	86	85	102	120	124	119	137	107	70	69	40
1973-1974	5	6	11	15	24	13	16	20	39	20	35	55	40	53	62	60	91	98	121	104
1970-1971	16	12	16	25	24	28	20	39	28	36	18	16	19	17	12	14	21	25	24	17

variables that determine their occurrence. This is certainly true of relatively long-term forecasting. However, we believe that short-term forecasting about trends once an epidemic has actually started will be possible sooner. The information about influenza from the Royal College of General Practitioners' weekly return service is one piece in an integrated matrix of information. In practical terms the reported rates have an important function as an early, if not earliest, consistent harbinger of an epidemic and its relative scale. The patterns of all the rates discussed in this paper (morbidity, deaths, sickness absence, and virus cultures) followed one another closely in this epidemic. The trends for morbidity rates are evident, at the most, seven days before any of the others. However, it is the rate at which the data becomes available in usable form which determines its practical usefulness. It is here that the reported morbidity rates have advantages over the other rates, since they are actually available within 48 hours of the end of a recording week.

Originally the returns could be completed on Thursday morning for the week ending Wednesday midnight. However, postal delays now require that 48 hours be allowed between posting and tabulating, and the recording week now ends at midnight on Tuesday.

It is probable that the reported deaths could be used in a similar way as an estimate of the relative severity of an epidemic. The rates for reported deaths follow closely the rates for reported influenza. A simple measure of the clinical severity of the impending epidemic could be obtained by estimating the ratio of death rates to morbidity rates in the two first established weeks of an epidemic.

The possibility of automated procedures for the weekly returns has been explored from time to time. Not only would they be more expensive, they would be slower and less flexible than the present manual system. While a big increase in the quantity of data might justify a change to computer processing, experience has shown the population sample used to be both representative and reliable for present purposes. Only the need for detailed information from smaller geographical areas and population sub-groups would justify such a change.

Automated processing will, however, be necessary to abstract the maximum amount of information from the accumulated data, in particular for the linking of the primary morbidity data with environmental and meteorological variables.

References

College of General Practitioners Records and Statistical Unit (1963). *Journal of the College of General Practitioners,* **6,** 217-219.

Miller, D. L., Pereira, M. S. & Clarke, M. (1971). *British Medical Journal,* **1,** 475-479.

Pinsent, R. J. F. H. (1968). *Journal of the Royal College of General Practitioners,* **16,** 127-134.

Public Health Laboratory Service (1976). *Communicable Disease Report No. 1.* London: HMSO.

Public Health Laboratory Service (1976). *Communicable Disease Report No. 10.* London: HMSO.

Royal College of General Practitioners Research Unit (1971). *Journal of the Royal College of General Practitioners,* **21,** 609-613.

Acknowledgement

We are deeply grateful to the general practitioners who contribute to the Royal College of General Practitioners' 'weekly returns' system and to the Department of Health and Social Security who provide a grant to support these activities.

Prevention of eczema

In a prospective study of the development of reaginic allergy, infants of allergic parents were either subjected to an allergen-avoidance regimen from birth, for six months, or managed conventionally. The group on the allergen-avoidance regimen had less eczema at six months and one year than did the control group at six months. They also had a lower mean serum-total-IgE level at six weeks.

Reference

Matthew, D. J., Norman, A. P., Taylor, B., Turner, M. W. & Soothill, J. F. (1977). *Lancet,* **i,** 321-324.