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Influenza in Britain 1967–68

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INTRODUCTION

During the 35 years since the discovery of the influenza virus, its laboratory properties, clinical effects and epidemiology have been widely studied and much effort has been devoted to the development of vaccines. Yet influenza remains virtually uncontrolled, and, during epidemics, seriously disrupts the activities of affected communities and causes many deaths; it is still impossible to predict with accuracy when and where epidemics will occur and no satisfactory treatment is known. Much of the difficulty lies in the frequent changes in antigenic composition that the virus undergoes, and in the fact that immunity to one variant may confer only partial immunity to another. Efficient schemes of national and international influenza surveillance are therefore important in providing early warning of the appearance and spread of new antigenic variants and to assess the extent of immunity to them; this information, if obtained quickly enough, may permit the production of suitable vaccines and their use in advance of an epidemic to protect the most vulnerable population groups.

Consideration of the past behaviour of influenza may be helpful in interpreting surveillance reports and in judging the likely behaviour of influenza in particular circumstances. This paper sets out, therefore, to provide a brief review of experience of influenza in Britain since the last major antigenic variant of influenza virus A, the Asian (A2) virus, was introduced in 1957, and to examine in more detail the epidemiology of the epidemic of the winter 1967–8, which was the largest for 7 years.

SOURCES OF EPIDEMIOLOGICAL INFORMATION

Several independent sources of information that reflect the prevalence of influenza have been selected for analysis, including mortality statistics, sickness benefit claims, general practitioner records and laboratory reports. The analyses include figures for England, Wales and Scotland combined, unless otherwise stated.

Deaths

The number of deaths attributed to influenza (International Classification of Diseases (ICD) Nos. 480–3) for the years 1957–68 were extracted from the Registrar Generals' weekly returns; these returns record deaths up to and including Friday of each week. Deaths due to pneumonia (ICD Nos. 490–3) and bronchitis (ICD Nos. 500–2) during the winter 1967–8 were also analysed; pneumonia deaths do

not include those secondary to accidents and other infections; bronchitis deaths include both acute and chronic bronchitis.

The age of distribution of influenza deaths in the 1967–8 epidemic was obtained from the (then) Ministry of Health's weekly influenza statement; these figures were based on provisional notifications to the Registrar General (England and Wales only).

Sickness benefit claims

Claims for sickness benefit under the National Insurance Act are submitted by insured persons to the Department of Health and Social Security (formerly the Ministry of Pensions and National Insurance and, later, the Ministry of Social Security), and the numbers of new claims received in each of the standard statistical regions of England, Wales and Scotland up to and including Tuesday of each week, are published in the Registrar Generals' weekly returns. The certified causes of absence are not published in these returns, and analyses could be made only of the total numbers of claims.

Royal College of General Practitioners' morbidity returns

The Records and Statistics Unit of the Royal College of General Practitioners receives returns from general practitioners in various localities, which record the number of new sickness episodes in their practices according to age, sex and clinical diagnosis of patients, during the 7 days up to and including Wednesday of each week. During the winter of 1967–8 these returns were submitted from 40 general practices in England and Scotland (23 urban, 10 rural and 7 mixed) with a total population of approximately 150,000. Weekly rates for cases of influenza and other acute respiratory illnesses were extracted from these returns. Except where otherwise stated, the term 'influenza' when applied to case rates reported by general practitioners includes illnesses diagnosed on clinical grounds as influenza or influenza-like or febrile common cold. The diagnosis is not normally supported by laboratory evidence of influenza virus infection.

Laboratory reports

Influenza virus isolations and cases with serological evidence of recent influenza virus infection (four fold or greater rise in antibody titre) are reported each week by virus diagnostic laboratories in Britain to the Public Health Laboratory Service. These reports state the date on which the specimen was received by the laboratory, the virus serotype identified, the age and sex of the patient, and the main clinical features of the illness. The selection of patients for virological investigation depends entirely on clinical considerations and local epidemiological interest, and the submission of specimens may be stimulated by knowledge that influenza is likely to be present in the community. Thus the nature of the population sampled for laboratory studies cannot be defined, but the viruses identified probably broadly represent the types present in the population.

PREVALENCE OF INFLUENZA IN BRITAIN 1957–68

Figure 1 traces the average weekly number of deaths attributed to influenza for each month and the average weekly number of new claims for sickness benefit in England and Wales for each month from 1957 to 1968. The types of influenza virus shown by current laboratory reports to be prevalent during each year when influenza was epidemic are also shown in this figure.

Each winter there was a seasonal rise in the number of sickness claims, but in the winters when there was a large number of influenza deaths and laboratories were reporting significant numbers of influenza virus infections, the number of claims greatly exceeded that in epidemic-free years. The increase in claims usually slightly preceded or coincided with a correspondingly sharp increase in influenza deaths. It appears, therefore, that the excess number of claims in epidemic years is probably largely due to influenza and may be taken as an approximate index of influenza morbidity, at least in the insured population.

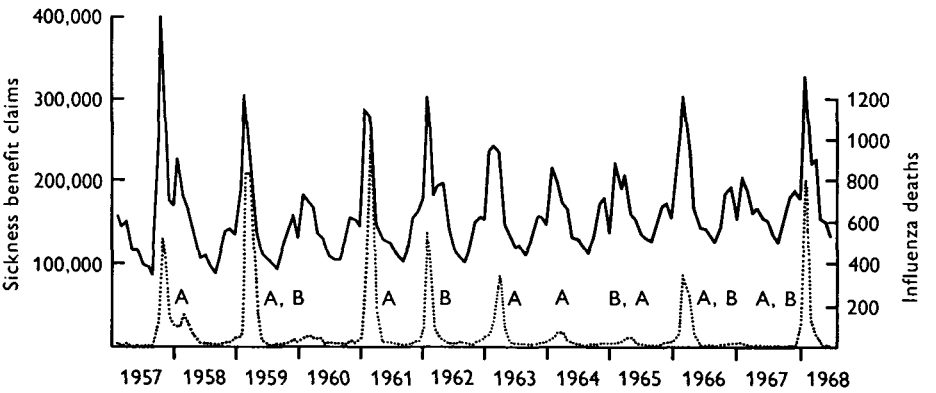

Fig. 1. Influenza in England and Wales, 1957–68. Average weekly no. of new sickness benefit claims and average weekly no. of influenza deaths (in four-weekly periods). ———, New sickness benefit claims; ·····, influenza deaths.

Virus A2 (Asian) influenza was first epidemic in Britain during the autumn of 1957 and again in early 1958. Further major epidemics of influenza A occurred in 1959, 1961, 1963, 1966 and 1968, with smaller epidemics in 1964 and 1965. Influenza virus B was isolated during the epidemics of 1959, 1962, 1965, 1966 and 1968. In gauging the size of recent epidemics from Fig. 1 it should be noted that during the period as a whole the number of sickness benefit claims tended to increase irrespective of seasonal or epidemic changes. Thus the summer trough rose by approximately 40,000 claims between 1957 and 1967. No regular pattern of recurrence of influenza A epidemics is evident, but between 1961 and 1966 the size of outbreaks, as indicated by numbers of sickness claims and by numbers of deaths, appeared to be diminishing. This trend was interrupted by a moderately large outbreak in the winter of 1965–6 and by the even larger epidemic in 1967–8. In the intervening years influenza A, when present, was largely confined to local community or institutional outbreaks and sporadic cases. Influenza B showed a more regular pattern of recurrence, appearing every 3 years, with the exception of

1965 and 1966 when it was present in successive years. In each year when virus B occurred concurrently with A, except in 1965, fewer B than A infections were identified by laboratories. Virus B is sometimes said to be less severe than A, but in 1962, a year when it was the sole cause of the epidemic, it is notable that there were as many deaths as in some influenza A outbreaks of similar size.

THE 1967–8 EPIDEMIC

World-wide influenza

Reports in the World Health Organization's weekly epidemiological record indicated that countries in the northern hemisphere, with the exception of certain Eastern European States, experienced little influenza during the winter of 1966–7. In July and August 1967 outbreaks of influenza A2 were reported from South Africa and New Zealand. Strains isolated proved to be antigenically similar to those that had been circulating in Britain in the past few years. As antibody to this variant and to influenza B appeared to be well distributed throughout the population (Pereira, Chakraverty, Pollock & Pope, 1967) widespread outbreaks were not expected.

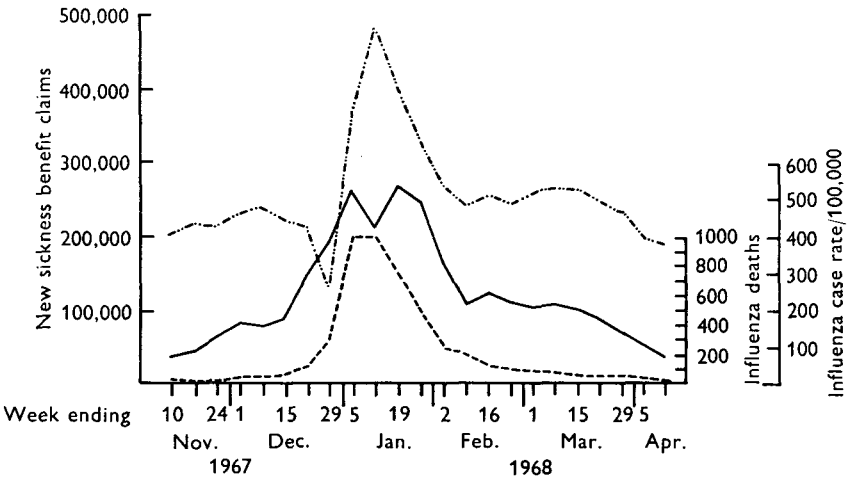

Fig. 2. Weekly nos. of sickness benefit claims and influenza deaths with influenza case rates reported by general practitioners. England, Wales and Scotland, November 1967 to April 1968. –·–·–, new sickness benefit claims; ——, influenza case rates; – – –, influenza deaths.

The first of the winter's outbreaks of influenza in the northern hemisphere were reported from Michigan, U.S.A. in school children and university students during October and November 1967; thereafter influenza spread to affect the whole country. Influenza began in many countries of Europe, including Britain, in December, and extensive epidemics, nearly all due to virus A2, ensued.

The epidemic in Britain

It has been noted that the epidemic during the winter 1967–8 was the largest for 7 years (Fig. 1). A detailed picture of the progress of this epidemic is shown in

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Fig. 2, which charts weekly numbers of influenza deaths and sickness benefit claims, and rates for cases of influenza reported by general practitioners. The recording weeks covered by returns from these three sources unfortunately do not exactly coincide; in this graph the difference has been ignored and each has been plotted against the dates for the weeks ending on Friday, which are those used for the Registrar General's returns of deaths; in fact, the general practitioners' returns cover the week ending 2 days earlier and the sickness benefit returns the week ending 3 days earlier.

The graphs show that the main epidemic began towards the end of December and was over by early February; but all three indices began to rise about 1 month earlier and did not return to the mid-November levels before the end of March. Increased morbidity and mortality rates from respiratory disease are to be expected

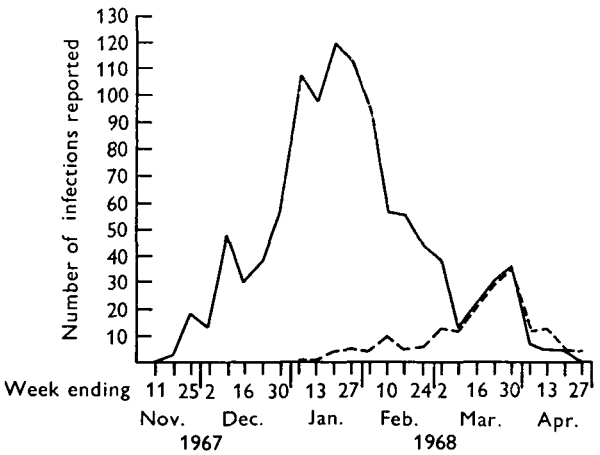

Fig. 3. Weekly no. of influenza virus infections identified by laboratories, November 1967 to April 1968. ——, influenza A; – – – –, influenza B.

at this time of year and some illnesses and deaths diagnosed as due to influenza may be due to other causes. But Fig. 3 shows that laboratory reports of influenza, based on the week in which specimens were received, also began to accumulate in late November and continued until the end of March, with a few as late as April. Although trends based on laboratory reports must be interpreted with caution owing to the uncertain method of selecting cases for examination, the number of influenza infections reported followed a general pattern similar to that in Fig. 2. The main epidemic from December to February was evidently caused by virus A, but in March an increased number of virus B infections was reported with a small recrudescence of virus A infections.

The sharp fall in sickness benefit claims in the last week of December coincided with the Christmas holidays, which fell on 2 week-days, and may be accounted for in this way. Thereafter claims rose steeply to a peak in the second week of January, a week later than the peak in case rates in general practice and in deaths; this may be due to the late submission of claims after the holidays. After the second week of January the number of sickness claims and deaths declined rapidly, but influenza

case rates in general practice and the number of laboratory reports of influenza, after a small fall in the second week, showed a second peak in the third week before declining.

The geographical spread of the epidemic

A few, mainly sporadic, cases of influenza A and B infection were reported by laboratories in various areas in October and early November 1967. The first reports of community outbreaks, supported by influenza A virus isolations, came from the Chester and Liverpool areas, in the north-west of England during the last week of November. Outbreaks due to this virus were also reported in two residential institutions in Yorkshire, but there was no evidence of influenza in the general population of Yorkshire at the time. In the south of England, influenza was first reported in early December, when virus A was isolated among children and staff in a residential and day nursery in North London. Laboratory reports of influenza A simultaneously in many parts of the country quickly followed.

The extent of the epidemic in different parts of the country may be gauged by analysing the weekly numbers of sickness benefit claims in each of the standard statistical regions. This analysis showed that there was an increase in claims in the north-west region at the end of November and beginning of December, confined mainly to the Wirral and south-west Lancashire, coinciding with laboratory reports of outbreaks in these areas, but no substantial increase occurred in any other area before Christmas. After Christmas the number of claims everywhere increased rapidly, reaching a peak in the first week of January, except in Scotland, where both the increase and the peak were recorded a week later (presumably because of the New Year holiday in Scotland). Claims then declined steeply in all regions, though the decline was noticeably slower in the south-west than elsewhere. In all regions claims returned to their early November numbers by the end of March or the beginning of April.

Age groups affected

Figure 4 shows weekly influenza case rates reported by general practitioners by age from the end of November to the end of February. In adults, rates began to increase from early December and reached a peak in the first week of January. Rates in persons over 65 years of age did not rise as high as those in younger adults, but continued at an increased level for longer. In children aged 5–14 years, rates rose in the first 3 weeks of December and then declined, when schools closed for the Christmas holidays. However, in the week ending 17 January, after the reopening of the schools, there was a further sharp rise in the rate to a higher peak than that reached in this age group in December. The rates in preschool children, under the age of five, showed the biggest rise of any age group in late December and reached a peak in early January; this was followed by a second peak, coming after the second rise in older children, in late January. During this period laboratories reported increased numbers of isolations of respiratory syncytial virus (R.S.V.) as well as of influenza mainly from children under the age of 5 years. The increased prevalence of R.S.V. began in November, earlier than influenza, and continued

until the end of January; R.S.V. infections may therefore account for some of the cases of clinical influenza diagnosed at this time in young children. No other respiratory virus infections were reported in large numbers.

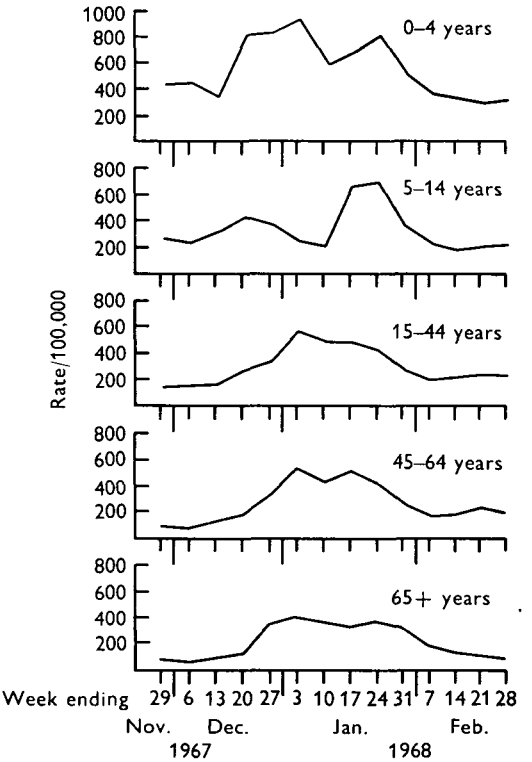

Fig. 4. Weekly influenza case rates by age reported by general practitioners.

Table 1. *Age-specific consultation rates for influenza reported by general practitioners*

(Weeks ending 29 November 1967 to 28 February 1968 inclusive.)

Age (yrs.)	Rates/thousand
0–4	76·0
5–14	46·3
15–44	40·6
45–64	36·6
65 or more	27·9

Table 1 shows the age-specific consultation rates in general practice. The rates in young children were considerably higher than in older children and in adults. However, Fig. 4 shows that the rates in children were higher than in adults before the epidemic, which suggests that the figures for children include a higher proportion of illnesses not due to influenza virus infection. Considering only illnesses diagnosed as influenza there was little difference in the consultation rates between age groups, but this may underestimate the infection rate. The age distribution of cases

in which laboratory evidence of infection was found (see Fig. 3) is shown in Table 2. The proportion of cases sampled may have varied between age groups and the age distribution of virus isolations does not necessarily reflect that of all cases. However, it may be noted that in influenza A infections all age groups were equally represented, except those under the age of four, who contributed approximately one-sixth of the total. The distribution of influenza virus B infections was different: 30 % of the total was in children aged 5–14 years and there was a relative deficiency of cases in older adults.

Table 2. *Age distribution of laboratory-diagnosed cases of influenza A and B infection*

	No. of cases		Distribution (%)	
Age (yrs.)	A	B	A	B
under 2	90	10	8·6	5·6
2–4	74	19	7·1	10·6
5–14	118	54	11·3	30·2
'Child'	1	—	0·1	—
All children	283	83	27·2	46·4
15–44	336	66	32·3	36·9
45–64	179	13	17·2	7·3
65 and over	157	5	15·1	2·8
'Adult'	9	—	0·9	—
All adults	681	84	65·4	46·9
Not stated	77	12	7·4	6·7
All ages	1041	179	100	100

Clinical features of illness

Comparison of the incidence of influenza with that of other respiratory illnesses reported by general practitioners (Fig. 5) showed that the rate of increase in cases of pneumonia in December and early January was approximately parallel to that in cases of influenza, which suggests that much of the increase in pneumonia was primarily due to influenzal infection. The incidence of bronchitis, tracheitis and laryngitis also increased during the epidemic but was not as closely associated with that of influenza.

The main clinical features of illnesses in which influenza virus was identified are shown in Table 3. Cases selected for virus examination may not be representative of all respiratory illness caused by influenza viruses; in particular, they are likely to include a high proportion of patients suspected of having influenza infection on clinical grounds and those who are most seriously ill. But it is interesting to compare the clinical features of influenza A and influenza B infections, which are presumably selected on a similar basis. Influenza A infections were more often diagnosed clinically as influenza and more often associated with lower respiratory illnesses than influenza B, but were rather less often recorded as upper respiratory illness. The proportion of cases in which lower respiratory illness was the main feature was

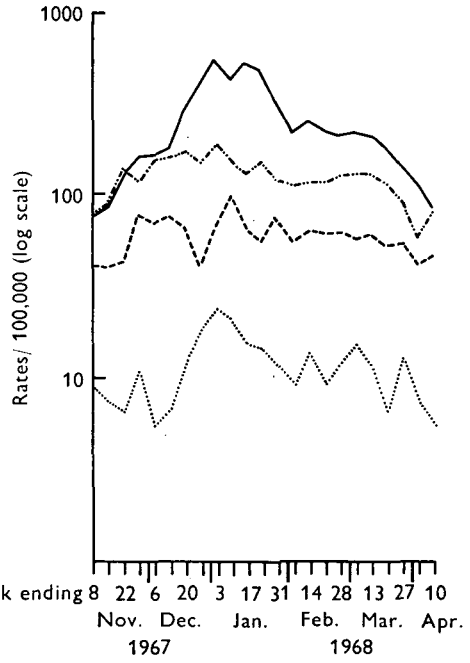

Fig. 5. Weekly case rates by diagnosis reported by general practitioners. ——, influenza; –·–·–, acute bronchitis; – – –, laryngitis and tracheitis; ·····, pneumonia and pneumonitis.

Table 3. *Main clinical features in laboratory-diagnosed cases of influenza A and B infection*

	No. of cases		(%)	
Main clinical features	A	B	A	B
Influenza-like illness	574	70	55·1	39·1
Upper respiratory illness (cold, coryza, pharyngitis, sinusitis, tonsillitis)	121	34	11·6	19·0
Lower respiratory illness (laryngitis, tracheitis, bronchitis, pneumonia)	264	38	25·4	21·2
General non-specific symptoms (pyrexia, headache, myalgia)	27	11	2·6	6·1
Central nervous system				
Convulsions	1	—		
Encephalitis	2	1		
Meningitis	8 } 13	1 } 4	1·2	2·2
Meningism	1	1		
Neuritis	1	1		
Gastro-intestinal symptoms (Vomiting, diarrhoea, abdominal pain)	6	1	0·6	0·6
Others*	36	21	3·5	11·7
Total	1041	179	100	100

* No symptoms, no information, unspecified respiratory or CNS illness.

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highest in young children, particularly those under two, and in adults over 65 years (Table 4); at these ages such cases amounted to more than half the total of both influenza A and influenza B infections.

Table 4. *Frequency of lower respiratory complications by age group in laboratory-diagnosed cases of influenza*

Age (yrs.)	Total diagnosed	No. with lower respiratory illness	(%)
under 2	100	53	53·0
2–4	93	37	39·8
5–14	172	21	12·2
'Child'	1	1	100·0
All children	366	112	30·6
15–44	402	34	8·5
45–64	192	64	33·3
65 and over	162	87	53·7
'Adult'	9	1	11·1
All adults	765	186	24·3
Not stated	89	4	4·5
All ages	1220	302	24·8

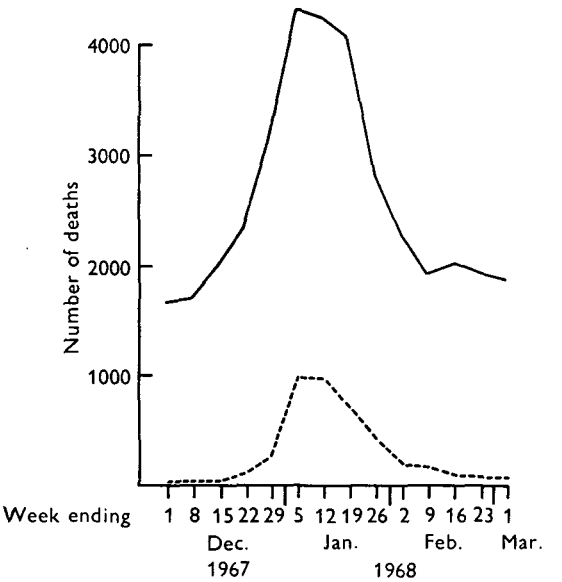

Fig. 6. Weekly no. of deaths from influenza, bronchitis and pneumonia, for the period December 1967 to March 1968. – – – –, influenza; ——, bronchitis and pneumonia.

Mortality

During the 4 months from the beginning of December to the end of March there were 4503 deaths certified as due to influenza in England and Wales and 145 in Scotland. Figure 6 compares the weekly numbers of deaths attributed to influenza with those attributed to bronchitis or pneumonia. The increase both in

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bronchitis and in pneumonia deaths followed a similar pattern to that of influenza deaths. Thus, it seems likely that influenza virus infection was the primary cause of many of the deaths attributed to bronchitis and pneumonia in addition to those diagnosed as influenza. Table 5 records the age distribution of 4134 influenza deaths in England and Wales from the end of December 1967 to the end of February 1968. Most deaths occurred in older persons, mainly in those over the age of 65; there were only 27 deaths attributed to influenza in children.

Total incidence of influenza

It is difficult from the figures quoted to estimate the actual incidence of influenza virus infection in different population groups or the population as a whole. Only a large prospective study, supported by laboratory investigations could do so. However, the excess mortality and morbidity attributable to influenza during the winter 1967–8, when an epidemic took place, may be estimated by comparison with similar figures in an epidemic-free winter, 1966–7.

The number of deaths attributed to influenza from December 1967 to March 1968 (inclusive) exceeded those for same period in 1966–7 by 4444; the excess for pneumonia was 10,595, for bronchitis 6579 and for all causes 46,408. Similarly the difference between the number of sickness benefit claims in the two winters provides an approximate figure of the number of influenza cases in the working population. The excess number of claims in 1967–8 over those in the winter of 1966–7 in England and Wales and Scotland for the 4 months December to March was just over 1·1 million, a figure similar to that noted in previous epidemics (Roden, 1963). This, however, excludes cases in children, and in non-insured and retired adults. From a similar calculation based on the attack rates reported by general practitioners it is estimated that in the total population of England, Wales and Scotland there was an excess of 1·9 million cases diagnosed as influenza in the period December to March 1967–8 compared with the corresponding period 1966–7.

Table 5. *Age distribution of influenza deaths*

(Weeks ending 29 December 1967 to 1 March 1968, inclusive.)

Age (yrs.)	No. of deaths	Distribution (%)
0–4	19	0·5
5–14	8	0·2
15–44	63	1·5
45–54	76	1·8
55–64	295	7·1
65–74	772	18·7
75 and over	2901	70·2
All ages	4134	100

DISCUSSION

Epidemics of influenza cause large and sudden increases in morbidity and mortality in all sections of the population in a way that no other infection does. Because the impact of influenza is so dramatic any of a number of different

indices may be used for surveillance purposes. The way in which several such indices reflect the presence of epidemic influenza is illustrated by the analyses presented in this paper. Each gives a different kind of information and, though none by itself is entirely satisfactory, taken together they do provide a fairly complete picture of the progress, extent and seriousness of an epidemic. Also, provided adequate base-line information is available about the level of reporting in non-epidemic periods and rapid central collection and analysis of information is ensured, each is sufficiently sensitive to detect the early stages of an epidemic. Unfortunately, owing to the rapid evolution of epidemics locally the warning usually comes too late to be useful in the area concerned, but it may give at least some notice to medical services elsewhere that an epidemic could be imminent. Thus, the outbreaks reported in the north-west of England in early December 1967 presaged the nationwide epidemic later in the month. It is not clear what factors determine the spread of an epidemic. According to the sickness benefit figures, after the outbreaks in the north-west there was an interval with little evidence of widespread sickness in the population, followed by explosive epidemics simultaneously in all parts of the country. If this is a true description of the epidemic it suggests that the virus was widely disseminated during the lag period but only began to cause illness when some undefined environmental conditions were favourable.

Mortality attributed to influenza probably includes some cases not infected with influenza virus, and, conversely, some deaths certified as due to bronchitis, pneumonia and probably some other causes such as heart failure, are in fact primarily due to influenza. This suggestion is borne out by the observation during epidemics in the United States of excess deaths, not only in persons with acute respiratory disease, but also in those with cardiovascular or renal disease, some bronchopulmonary diseases and diabetes mellitus (Eickhoff, Sherman & Serfling, 1961). This would account for the fact that mortality from all causes during the epidemics exceeds the seasonal expected rates in non-epidemic periods and that the excess is greater than can be explained by influenza deaths alone (McDonald, 1963, 1967). Moreover, at these times the increase in deaths from all causes tends to run parallel with that of influenza deaths (Roden, 1963) again suggesting that the excess is directly due to influenza. The findings reported in this paper give further evidence that influenza causes many deaths other than those so certified. Fortunately lack of diagnostic precision in recorded causes of death does not seriously detract from the value of mortality rates in influenza surveillance. The same is evidently true of morbidity returns from general practitioners: two groups of diagnoses, those recorded as influenza and those recorded as influenza-like illnesses or febrile common cold each showed a similar pattern and because of this were combined in the analysis. Among other diagnoses changes in pneumonia rates followed those of influenza most closely, but other diagnoses also increased. The increase in other diagnoses was most noticeable in the early stages of the epidemic, possibly because as the epidemic progressed awareness that influenza was prevalent led to this diagnosis being used with increasing frequency. Thus, the consultation rate for *all* acute respiratory disease may be as useful an index of the early stages of an epidemic as that for influenza alone and possibly more so.

As expected, the great majority of influenza deaths were in persons over the age of 65, and lower respiratory complications were commoner in young children and older adults. Age-specific attack rates without laboratory confirmation are difficult to interpret, particularly since there was evidence that the diagnosis was less precise in children, especially those under 5 years of age, than in adults. But there was no clear evidence of greater susceptibility to influenza A in particular age groups. It may be significant, however, that influenza B was detected most often in children of school age, possibly owing to the fact that the last major epidemic of influenza B was in 1962. It is often stated that schools form the main source of spread of infection. The epidemic of 1967–8 spanned the school Christmas vacation and it is clear that the epidemic in children of school age was interrupted for the duration of the break. There is no evidence, however, that this influenced to a noticeable extent the course of the epidemic in adults or in preschool children, except that there was a second wave of cases in the under five-year-olds after the older children returned to school. The smaller, but more prolonged increase in rates in the elderly may simply reflect their greater social isolation and decreased risk of exposure to infection early in an epidemic.

Sickness benefit claims are a well recognized source of epidemiological information and have been used for many years in the surveillance of influenza and the assessment of its impact (McDonald, 1963; Roden, 1963). They have the limitations that only total numbers of claims are currently available and that they apply only to the working population. But, because the scale of sickness absence caused by influenza during epidemics is far greater than that due to any other cause, the total number is a sufficiently sensitive index of influenza prevalence to detect epidemics. As influenza epidemics affect all ages the restriction of information to working persons is no serious handicap, unless, as occurred in 1967–8, a holiday period intervenes when claims for insurance benefit are not submitted: during this period returns from general practice and deaths revealed that the epidemic was continuing to increase at a time when sickness claims showed a sharp temporary drop.

Laboratory reports, though more precise than any other index, are too scanty and based on too selected a population to give a reliable measure of incidence. They do serve, however, to substantiate or refute reports of epidemics and to characterize the virus responsible.

SUMMARY

The occurrence of epidemics of influenza in Britain since 1957, when the A2 (Asian) virus was first introduced, has been traced by an analysis of influenza deaths and sickness insurance benefit claims. In a more detailed study of the epidemic in 1967–8, the largest for 7 years, mortality statistics, sickness benefit claims, consultation rates in general practice and laboratory reports were analysed according to time and geographical location, the age distribution of cases and their clinical features. The value of these various indices in the surveillance of influenza is discussed. It is estimated that the number of cases of influenza during the 1967–8 epidemic was just over one million in the working population and almost two millions in the whole population of Britain.

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