Outbreaks of influenza A in nursing homes in Sheffield during the 1997–1998 season: implications for diagnosis and control

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Summary

Three recent outbreaks of influenza A in nursing and residential homes in Sheffield were characterized by high attack rates among both residents and staff, and a high mortality rate among residents. The epidemiology of the outbreaks was unusual in that all three occurred towards the end of a quiet influenza season, against a generally low level of community activity, and involved strains of influenza that were not included in the current season’s vaccine. The outbreak investigation was aided by the use of a novel rapid diagnostic technique. In future the combination of vaccination, surveillance, rapid diagnosis and new anti-neuraminidase drugs should improve prospects for control of influenza within closed communities.

Keywords: influenza outbreak, nursing homes, mortality, elderly

Introduction

Deaths from influenza occur predominantly in very elderly people with underlying ill-health, and the need to improve delivery of vaccine to these vulnerable groups has previously been reported.1,2 Nursing homes are considered to be especially high-risk environments in terms of both the susceptibility of individual residents and the close proximity of their living conditions. A review of 41 outbreaks in nursing homes in the United States revealed an average attack rate of 43 per cent although rates up to 60 per cent have been reported.3,4 During the 1989–1990 season in Michigan, USA, < 38 per cent of nursing homes reported an outbreak of influenza.5 We report on three outbreaks of influenza A among residents of nursing and residential homes in Sheffield during the 1997–1998 season, which was otherwise ‘very quiet’ for influenza. The Royal College of General Practitioners’ sentinel scheme identified lower peak and average seasonal rates for ‘influenza and influenza-like illness’ than in any of the 10 previous winters. An estimated 680 000 people in England and Wales consulted general practitioners (GPs) for ‘influenza or influenza-like illness’ between weeks 40/97 and 25/98, compared with an estimated 1 200 000 consultations during the equivalent period in 1996–1997, and 1 420 000 in 1989–1990.6 All the outbreaks were associated with a high attack rate in residents and staff, and in one there was also a high death rate among residents.

Background

The first outbreak occurred in a nursing home (A) of 60 residents and was reported by a GP on 2 April 1998. The GP’s patient, a resident of the home, suffered an acute respiratory illness and died of pneumonia; several other residents, cared for by other GPs, were noted to be unwell with similar respiratory illnesses. Following a visit to the home by a public health consultant and an infectious diseases physician the Directorate of Public Health convened an outbreak management team to investigate the situation. Pending further information, the manager of the home agreed to close to admissions.

The first case occurred on 13 March and the second on 21 March. Over the next 4 days, 25 of 30 residents (83 per cent) on the upper floor of the two-storey home became ill. Over the following 4 days, 20 of 30 residents (67 per cent) on the ground floor also became unwell.

Eleven of 73 staff (15 per cent), and several of their
Figure 1 Epidemic curves for outbreaks of influenza A in three nursing homes in Sheffield.
immediate family members also reported influenza-like symptoms. One member of staff was admitted to an infectious disease ward at the local hospital with a clinical picture suggesting atypical pneumonia. Overall, 46 of 60 residents (77 per cent) were affected, of whom nine died (15 per cent). GP records showed that 32 of 60 residents (50 per cent) had received influenza vaccine.

Residents and staff in a further two homes, one residential home (B) and one nursing home (C) experienced outbreaks of a respiratory illness commencing on 1 April and 3 April, respectively (Fig. 1). A total of 16 of 28 residents (57 per cent) in home B were affected, one of whom was admitted to hospital with pneumonia.

In home C, 12 of 50 (25 per cent) residents and seven staff were affected, and two resident’s deaths were attributed to the outbreak. Over 90 per cent of residents in homes B and C had received the current season’s vaccine.

In all three homes the clinical picture comprised cough, sore throat and myalgia with or without pyrexia >37.5°C, which suggested a common aetiology. However, there was no obvious connection between the homes, and managers of the homes were not aware of any movement of agency staff between the establishments.

Methods

The outbreak management team became alerted to the problem in home A after most residents had become affected. At this time (week 14, ending 5 April 1998), levels of influenza activity in the wider community were extremely low. Weekly consultation rates for influenza and influenza-like illness as reported by the Royal College of General Practitioners’ sentinel network had fallen to 51/10000 by week 13 and had not risen above 100/10000 throughout the season.7 As the clinical picture of illness resembled classical influenza, it was important to secure a definitive diagnosis in case this heralded the onset of wider community activity. A case was defined as a resident or staff member with acute onset of respiratory symptoms including cough, sore throat and myalgia with or without pyrexia (37.5°C). Residents met criteria for sampling if they had an acute onset of illness that met the case definition within the previous 5 days and could consent to the investigations. A clotted blood sample and a naso-pharyngeal aspirate (NPA) were collected from those patients who were well enough to tolerate both procedures.

Direct immunofluorescence, rapid and standard viral culture,8 and serology (complement fixation test) were employed to establish a laboratory diagnosis of influenza.

Polymerase chain reactions (PCRs) for influenza A and respiratory syncitial virus (RSV) were performed retrospectively by the Enteric and Respiratory Virus Laboratory at Central Public Health Laboratory, Colindale, on the NPAs in all three outbreaks from which influenza viruses were not cultured.9

Serology was performed on single (convalescent) or paired (acute and convalescent) sera for adenovirus, Mycoplasma pneumoniae, influenza A and B, respiratory syncitial virus, chlamydia, Coxiella burnetii and legionella.

The outbreak control team recommended a range of measures to limit further spread. All local GPs who were not already aware of the situation were informed about the outbreak. The home managers were requested to close to further admissions until they had had no new cases for 5 days. Homes were asked to run on their own permanent staff for the duration of the outbreaks; agency and bank staff were not permitted to work in the homes and the homes’ staff were asked not to undertake bank work in acute Trust hospitals or other residential homes where they might infect other vulnerable people. Visitors to the homes were warned about the risk of contracting influenza, and frail elderly visitors and parents of young children were advised to stay away.

Results

The five NPAs from residents in home A were all negative for influenza A by all detection methods. However, a serological diagnosis of influenza A, by complement fixation test, was made in three out of six residents.

Influenza A was detected in the NPA of two out of three residents in home B. One was positive by PCR alone, but virus was cultured from the other and typed as H3N2/A/Sydney/5/97.

In home C virus was cultured in two out of five NPAs, the virus being typed as H3N2/A/England/577/98 and H3N2/A/England/1564/98: both are A/H3N2/Sydney/5/97-like viruses (see Table 1).

Discussion

In 1997–1998, influenza activity was generally low.10 However, consultation rates for ‘influenza and influenza-like illness’ recorded by the Royal College of General Practitioners’ sentinel scheme and laboratory reports of influenza A infections to the PHLS Communicable Disease Surveillance Centre show that what activity there was extended late into the season.11 At the beginning of the season the influenza A/H3N2

Table 1 Results of serology and virus detection by nursing home (numbers, with percentages given in parentheses)

<table>
<thead>
<tr>
<th>Home</th>
<th>Serology (no. positive/no. tested)</th>
<th>Virus detection*</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4/71 (57)</td>
<td>0/6 (0)</td>
</tr>
<tr>
<td>B</td>
<td>–</td>
<td>2/6 (30)</td>
</tr>
<tr>
<td>C</td>
<td>–</td>
<td>1/3 (33)</td>
</tr>
</tbody>
</table>

*Positives defined as positive in one or more of the following: direct immunofluorescence, rapid culture, standard culture, polymerase chain reaction.
†Includes one staff member.
isolates were similar to the Wuhan-like strain included in the vaccine; however, by week 4, 1998, several viruses characterized as A/H3N2/Sydney/5/97-like had caused outbreaks of respiratory disease in boarding schools.\textsuperscript{13} We isolated H3N2/A/Sydney/5/97-like viruses from two homes and obtained serological evidence of infection in the third. Neither of these very closely related strains was included in the current vaccine, which comprised an A/Wuhan/(H3N2)-like virus, an A/Bayern/(H1N1)-like virus and a B/Beijing/184/93-like virus.\textsuperscript{14}

The number of samples taken in our population of elderly residents was limited for several reasons. First, virus culture depends upon obtaining clinical material (NPAs) from patients who are acutely unwell. We were alerted to the outbreaks in each home after most residents had become ill, limiting the value of more extensive investigations and explaining why we had no culture positive results from residents in home A. In this population, some residents were too frail to tolerate invasive sampling methods such as naso-pharyngeal aspiration. Several other residents were confused and unable to consent to investigations.

Influenza vaccine offers 60–80 per cent protection to healthy adults when vaccine and epidemic strains are closely related. Studies in elderly care homes in the United States show a mean protection of only 27 per cent against influenza-like illness for influenza A (H3N2), and less for influenza B vaccines.\textsuperscript{15} Given that the circulating strains in the frail elderly care home population in Sheffield were poor matches with the vaccine A/H3N2 strain it is not surprising that the attack rate and (in home A) subsequent death rate were so high despite at least 50–90 per cent of residents having received the vaccine. However, under normal circumstances when vaccine and wild strains are well matched, the likelihood of an influenza outbreak within a nursing home is inversely related to the vaccination rate among residents.\textsuperscript{16}

Assuming that vaccination conferred some degree of cross-protection against A/H3N2/Sydney, differential uptake of vaccine may in part explain the higher attack rate in home A compared with homes B and C (see Table 2).

As vaccine offers less than perfect protection, other control measures for influenza remain necessary in closed institutions. We have described other measures instituted by the outbreak control team. It may be difficult to enforce such measures, particularly the control of staff movement between sectors. In home A, one-third of the permanent staff were off sick for the duration of the outbreak.

The team approach we employed together with rapid laboratory diagnosis provided an opportunity to employ chemoprophylaxis. The outbreak control team considered the use of amantadine as chemoprophylaxis but this was rejected because of its lack of effectiveness if started more than 48 h after the onset of symptoms, the emergence of resistant viruses associated with simultaneous use for treatment and prophylaxis, and potential side effects in a frail elderly population whose renal function could not be easily monitored.\textsuperscript{17–20} In other circumstances use of amantadine is also restricted because of inactivity against influenza B.\textsuperscript{21} The prospects for use of oseltamivir as chemoprophylaxis against influenza in closed communities such as our nursing and residential homes will improve in the future. The neuraminidase inhibitors, of which zanamivir is the prototype, are novel agents with enhanced activity against both subtypes. They have proven clinical efficacy in prophylaxis\textsuperscript{22} and in the treatment of established influenza, in which they can reduce the symptomatic period by 1–2 days provided they are administered within 30 h of onset of symptoms.\textsuperscript{23,24} Novel oral neuraminidase inhibitors are currently undergoing Phase II investigation and may also become valued agents in outbreak management.\textsuperscript{25}

There will be greater opportunity for using novel chemoprophylaxis in the management of outbreaks in future if early warning systems are employed. One of the drawbacks of current surveillance is that reporting in the independent nursing home sector is not well developed. The outbreak in home A was well established by the time our outbreak control team became involved. The subsequent outbreaks in homes B and C were discovered as a result of deliberate enquiry by the local Nursing Homes Inspectorate.

Episodes of influenza-like illness are not unusual in elderly care homes and it is common for the residents in a single home to be served by many different GPs. This makes the early detection of outbreaks less likely. Given that we were able to establish diagnoses within 24 h of sampling and that the introduction of safe novel therapeutic agents seems imminent, it may be time to consider how to implement surveillance so that we identify outbreaks in vulnerable communities in time to make a difference. The development of local protocols

<table>
<thead>
<tr>
<th>Home</th>
<th>Number of residents</th>
<th>% immunized</th>
<th>Residents affected</th>
<th>Death rate 14 days or less after symptom onset</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>60</td>
<td>50</td>
<td>46 (77)</td>
<td>9 (15)</td>
</tr>
<tr>
<td>B</td>
<td>28</td>
<td>&gt;90</td>
<td>16 (57)</td>
<td>0</td>
</tr>
<tr>
<td>C</td>
<td>50</td>
<td>&gt;90</td>
<td>12 (25)</td>
<td>2 (4)</td>
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(endorsed by primary care groups) for the detection and treatment of influenza may ensure a prompt and appropriate response in future.

Acknowledgements

We thank Dr Maria Zambon from PHLS, ERVL, for assistance with PCRs for influenza A and RSV.

References


Accepted on 14 September 1999