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A RESPIRATORY OUTBREAK DUE TO PARAINFLUENZA VIRUS TYPE 3 IN A HOME FOR THE AGED — ONTARIO

Introduction

An outbreak of respiratory tract infection caused by parainfluenza virus type 3 occurred in residents and staff of a home for the aged during May 1993. The home is located in a small town in Perth County, Ontario and, at the time, had 84 residents and 78 staff. Approximately half of the residents were classified as "residential care" and were generally ambulatory, while the remaining "extended care" residents required considerable nursing care for underlying health conditions.

The home's infection control nurse notified the Medical Officer of Health on 24 May that an outbreak of respiratory tract infection was suspected. The Health Unit undertook an epidemiologic investigation and provided consultation about surveillance, laboratory testing and control measures.

Methods

New cases were identified by nursing staff, and resident charts were reviewed back to the start of May by the infection control nurse for signs and symptoms compatible with respiratory tract infection. Staff were asked to report any recent respiratory illness and ill staff were excluded from work. Active surveillance continued in the home until 18 June, when the outbreak was officially declared over.

Acute and convalescent sera (taken two weeks apart) were collected for viral studies from 10 residents with respiratory tract symptoms. All serum samples were tested by the Toronto Central Public Health Laboratory for antibodies to influenza A and B; parainfluenza 1, 2, and 3; adenovirus; respiratory syncytial virus (RSV); cytomegalovirus; and *Mycoplasma pneumoniae*. Respiratory specimens for virus isolation were not obtained.

A nasal aspirate for RSV testing was obtained from one hospitalized resident. Throat swabs were obtained from three

residents and sputum samples were obtained for culture and sensitivity from eight residents.

A case was defined as a resident or staff member who experienced acute respiratory tract illness between 1 May and mid-June. Cases were further categorized as follows:

Definite — one or more respiratory symptom plus a four-fold or greater rise in parainfluenza 3 titre

Probable — one or more respiratory symptom plus a two-fold rise in parainfluenza 3 titre

Suspect — two or more of the following: fever, runny nose, nasal congestion, sore throat, hoarseness, cough, wheezing, chest congestion.

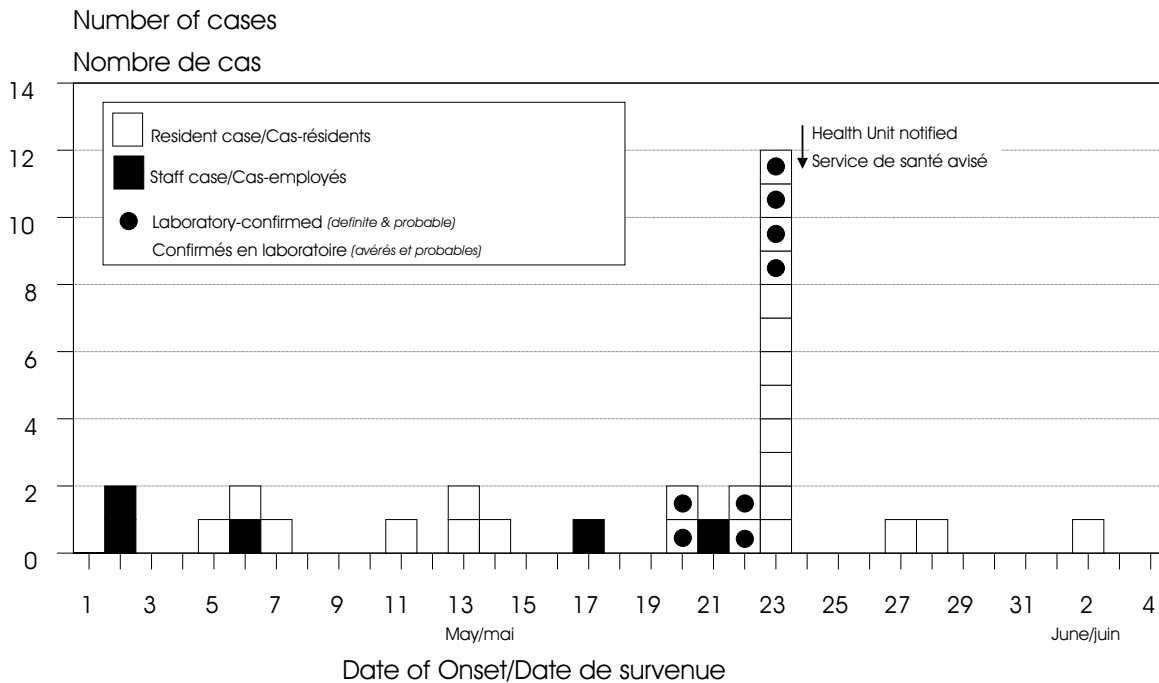
An epidemic curve was developed from the line listings of ill residents and staff. Information was analyzed using the following statistical tests: two-tailed Student's *t*-test, the Chi-square test with Yates' continuity correction, and Fisher's exact test.

Results

The outbreak began on 2 May and lasted 32 days. The epidemic curve shown in Figure 1 is characteristic of a propagated outbreak with person-to-person spread. A total of 31 cases occurred in the home. There were 26 cases among residents (six definite, two probable and 18 suspect), yielding an overall resident attack rate of 31%. Five cases, all suspect, occurred in staff members for an overall staff attack rate of 6.4%. However, among nursing staff the attack rate was 11%.

Paired sera were obtained from 10 ill residents, and six showed a four-fold or greater rise to parainfluenza virus type 3. Two

Figure 1
Parainfluenza 3 outbreak in a home for the aged, Perth County, 1993



showed a two-fold rise and two had stable titres (1:8 and 1:16, respectively). All other testing was negative.

There were no statistically significant differences in attack rates by sex, care category, residential floor or wing, or assigned dining room. However, there was clustering of cases among residents who ate together in the dining rooms. Higher attack rates (not significant) occurred on two of the six wings, one housing the sickest residents (attack rate: 60%) and one with the most mobile residents (attack rate: 53%). There was also no significant difference between the mean age of residents who were ill (87.5 years) and not ill (87.6 years).

Table 1 shows the symptom profile of resident and staff cases. The most common symptoms among residents were runny nose and cough. Half of the residents developed lower respiratory tract illness as did one of the five staff cases. The development of lower respiratory tract illness occurred significantly more frequently in residents who were classified as extended care (82%) compared to those who were residential care (27%) ($p = 0.017$). One resident was diagnosed with pneumonia and one required hospitalization for respiratory illness; there were no deaths. Fourteen ill residents (54%) were placed on antibiotics. The mean duration of symptoms for residents was 7.7 days (range: 3 to 17) and for staff, 4.1 days (range: 2 to 7).

The source for the outbreak could not be determined. However, residents had regular contacts with visiting children and one of the early staff cases reported that she had a young child with a respiratory tract infection.

Table 1
Percentage of ill persons reporting signs and symptoms, parainfluenza 3 outbreak in a home for the aged, Perth County, 1993

Sign or Symptom	Residents (%)		Staff (%) n=5
	All Residents n=26	Lab C onfirmed* n=8	
runny nose	69	88	20
cough	46	63	80
nasal congestion	42	38	100
hoarseness	31	25	80
wheezing	31	25	0
chest congestion	31	25	20
fever	8	13	20
sore throat	8	0	80

* definite or probable cases

Discussion

This outbreak occurred in late spring, several months after the end of local influenza activity. Viral testing revealed an organism, usually associated with infection in early childhood, to be the cause of the outbreak. Parainfluenza 3 infections have been reported only rarely in outbreaks in long-term care facilities^(1,2).

Outbreak control measures were initiated by the home on 23 May and included room isolation for ill residents and restriction of visitors to ill residents. After consultation with the Health Unit on 24 May, full respiratory precautions, reinforcement of handwashing, and additional cleaning of rooms were started.

Primary infection with parainfluenza viruses occurs early in life; parainfluenza 3 is second to RSV as a cause of pneumonia and bronchiolitis in infants < 6 months of age⁽³⁾. Most adult cases are reinfections. Parainfluenza infections can occur year round but show seasonal patterns. Unlike parainfluenza 1 and 2, which usually occur in the fall, parainfluenza 3 usually appears in the spring or summer following influenza outbreaks⁽⁴⁻⁶⁾.

In this outbreak, approximately half of the resident cases experienced upper respiratory tract illness and half experienced lower respiratory tract illness, the latter occurring most frequently in the sickest residents. In the long-term care outbreaks reported by the CDC, lower respiratory illness characterized by pneumonia was also frequent⁽¹⁾. Staff, however, were more likely to report only upper respiratory symptoms.

In the initial analysis of the outbreak we attempted to use the respiratory case definitions proposed for long-term care facilities by McGeer et al⁽⁷⁾. These contain separate case definitions for common cold/pharyngitis, influenza-like illness, pneumonia and other lower respiratory tract infection. They proved difficult to use for an outbreak where the symptom range spanned several of these syndromes. Moreover, none of the laboratory-confirmed and only one of the 13 physician-diagnosed lower respiratory tract infections met the McGeer case definition for lower respiratory tract infection. A less rigorous case definition for a suspect case, consisting of two respiratory signs or symptoms, was subsequently adopted. All but one of the laboratory-confirmed cases had two or more such symptoms.

The incubation period for parainfluenza virus is short, 2 to 6 days, and the virus is felt to be quite infectious⁽⁸⁾. Transmission is by direct person-to-person contact or large droplet spread. A recent study found that parainfluenza 3 virus survived at least a few hours on environmental surfaces and can survive briefly on hands⁽⁹⁾. Therefore, control measures should include disinfection of environmental surfaces as well as handwashing and case isolation. This outbreak was rapidly brought under control within a few days of implementation of these control measures.

We are only beginning to appreciate the full range of respiratory viruses that may affect the long-term care population⁽¹⁰⁻¹²⁾. Some of these, like RSV and parainfluenza viruses, were previously

thought to cause significant illness mainly in infants and young children. As surveillance improves it is likely that additional viral pathogens will be increasingly identified in such outbreaks.

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Source: KW Glasgow, MD, Medical Officer of Health, Brant County Health Unit, Brantford; SE Tamblyn, MD, Medical Officer of Health, G Blair, BScN, Public Health Nurse, Perth District Health Unit, Stratford, Ontario.

AN INFLUENZA A OUTBREAK IN AN ONTARIO NURSING HOME: ESTIMATES OF VACCINE EFFICACY

During the months of December 1993 and January 1994, outbreaks of an influenza-like illness were reported from eight nursing homes in the Ottawa-Carleton area, with influenza A eventually being confirmed in six of them. The nursing home described in this article was the first to report an outbreak of respiratory infections that winter. On 24 December, a newly available rapid diagnostic test, an enzyme immunoassay (EIA), was reported positive for influenza A on two throat swab specimens taken from residents; amantadine was subsequently used. The strain eventually typed from one of these specimens by the Laboratory Centre for Disease Control (LCDC) was present in the trivalent vaccine used in the fall 1993 campaign, A/Beijing/32/92-like(H3N2).

This article estimates vaccine efficacy for various outcome measures based on data from the 326-bed facility. The nursing staff had already been recording upper respiratory infections since September, and this information was used in preparing the epidemic curve. An outbreak case was defined as acute onset of upper respiratory symptoms (cough, runny nose, sore throat, or "congestion") with or without a fever.

The epidemic curve (Figure 1) records episodes of upper respiratory infections; it is bimodal, with one peak during the last week of November and a second one on 20 December. Since many

case-patients in the November peak were also December case-patients, it seems likely that there were two different infectious diseases circulating one after the other. Diagnostic procedures done on the November cases consisted of throat swabs (all negative), with no serologic testing. According to LCDC summary reports, Ontario reported positive tests for parainfluenza, adenovirus and RSV in November and early December 1993⁽¹⁾.

For this analysis the outbreak period is defined as 6 December to 6 January. Using these limits, 12 case-patients from the outbreak were also ill in November. The five laboratory-confirmed cases of influenza A became ill between 20 and 31 December; two were positive on throat swab EIA (one confirmed by viral culture), and the other three were positive by serology.

The total number of deaths (including those unrelated to the outbreak) that occurred in the nursing home in December was 12 and also 12 in January. The mean number of deaths per month for the preceding 6 years was as follows: November 7.5, December 7.2, January 8.2, and February 6.5.

The Ottawa-Carleton Health Department was involved intermittently in this outbreak from late November onward, and appropriate isolation procedures were already in place when the throat swabs were reported positive.

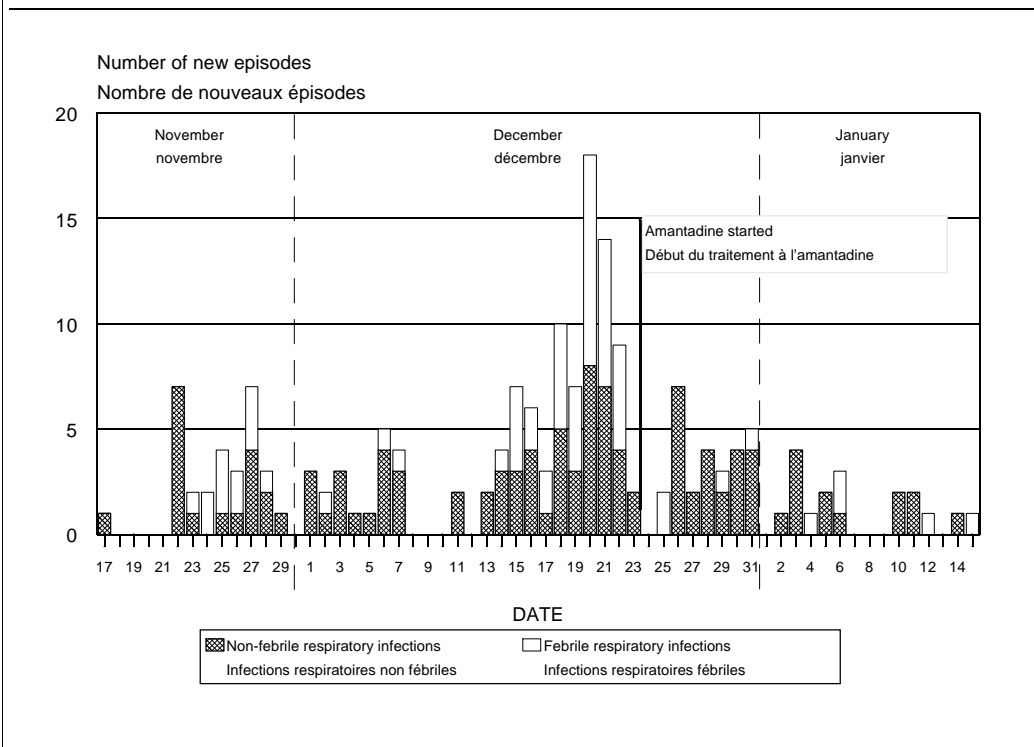
On 24 December, a 10-day course of amantadine was started; only one resident, who was in renal failure, did not take the drug. Although amantadine was recommended for unvaccinated staff as well, none took it.

Methods

The immunization list from the fall 1993 influenza vaccine campaign was used to define a cohort of 284 immunized and 22 non-immunized residents. The 13 residents whose immunization status was unclear were excluded; most of these were residents admitted after the conclusion of the immunization campaign. Residents who died of unrelated causes during the period of the outbreak were retained in the analysis. Although the epidemic curve presents episodes of illness, double counting was eliminated in calculating vaccine efficacy.

The confidence limits on vaccine efficacy measurements were estimated using Taylor series; these are not as accurate where small numbers are involved (as in the death and hospitalization numbers), but do convey a sense of the precision of the measurements.

Figure 1
Respiratory infections in an Ontario nursing home,
November 1993 to January 1994



Results

Immunization coverage was 93% for the 306 individuals for whom vaccination status was known. During the outbreak period, the attack rate was 39% (120 cases) for all respiratory infections and 16% (49) for febrile illness ($\geq 37.5^{\circ}\text{C}$); 1.6% (7) were hospitalized and 2.3% (9) died.

Discussion

Although these estimates are based on small numbers (particularly for hospitalization and deaths), the calculated vaccine efficacy rates (Table 1) are consistent with previously reported rates for nursing home population found in the literature. Recent reviews have cited vaccine effectiveness of 50% to 60% in preventing hospitalizations, up to 80% in preventing death, but only 30% to 40% in preventing influenza illness^(2,3,4,5). The low rates for preventing illness in this type of population contrast with the 70% efficacy for preventing illness in healthy children and young adults⁽²⁾.

Target symptom	Efficacy (95% C.I.)	No. of Cases (Vaccinated)	No. of Cases (Unvaccinated)
All respiratory infections	41% (17-59)	106	14
Non-febrile respiratory infection	29%[(-65)-63]	64	7
Febrile respiratory infection	54% (9-76)	42	7
Hospitalization	81% (6-96)	5	2
Death	73%[(-23)-94]	7	2

Vaccine efficacy estimates based on 284 vaccinated and 22 non-vaccinated residents; the deaths and hospitalizations include only those related to the outbreak.

There are several sources of bias in this study. Outbreak situations, by studying worst-case scenarios, will provide an underestimate of vaccine efficacy⁽⁶⁾. The lack of a more specific case definition, which allowed probable inclusion of some non-influenza respiratory infections, will do the same. The effect of the amantadine course is unknown, and would depend on whether it had a differential effect on vaccinated and unvaccinated individuals.

Although disease in Ottawa area nursing homes seemed to be widespread during this period of time, according to this small study the vaccine provided as much protection as expected. Until such times as more efficacious vaccines are available, effectiveness (efficacy x vaccine coverage) can only be improved by maximizing the latter for residents of long-term care facilities and staff who have extensive contact with them.

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