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Influenza-like illness in residential care homes: a study of the incidence, aetiological agents, natural history, and health resource utilisation

Key Messages

1. Assuming vaccine reduces influenza A infection, it is likely that only a small proportion of influenza-like illness (ILI) can be avoided. Pneumococcal and other viral vaccines should be considered.
2. Influenza-like illness does not equate with influenza. Nursing home–acquired pneumonia might be a better term, and less misleading.
3. Patients with ILI should not automatically be regarded as infectious and quarantined, as many are secondary to Gram-negative infections.
4. Hospital admissions owing to ILI are unlikely to be prevented by outreach health services, surveillance, or influenza vaccination, because frail elderly people with infection have a deteriorating general condition and need oxygen, intravenous drugs, and support from various health professionals. Policies requiring report of death to the police and infection control requirements also encourage hospital admission.

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Introduction

Outbreak of influenza-like illness (ILI) in residential care homes for the elderly (RCHE) is a public health concern. Such illness is a common cause of admission to hospitals or accident and emergency departments and may result in mortality. It is difficult to identify whether the ILI is caused by infection of SARS, H5N1, influenza or respiratory syncytial viruses (RSV). Influenza vaccination is effective in reducing hospital admissions during an epidemic, particularly in institutional settings,[1] and may reduce the death rate by half in residential institutions.[2] Nonetheless, vaccination is effective only if the ILI is caused by influenza virus. In old age homes, respiratory infections are mostly caused by pathogens other than influenza virus.[3] The disease burden of RSV infection is similar to that of non-pandemic influenza A in a population with high prevalence of vaccination (eg in the elderly or high risk adults).[4] This vaccination policy assumes that influenza causes most of ILI and appears to be empirical rather than evidence-based. It consumes considerable resources from the Hong Kong Centre for Health Protection (CHP) and the Hospital Authority (community geriatric outreach teams and visiting medical officers), which are the two health care organisations supporting RCHEs.

Methods

This study was conducted from March 2006 to April 2007. Four RCHEs supported by the Hospital Authority's New Territories East Cluster Community Geriatric Outreach Teams (CGAT) in the Shatin district were studied. Two were subvented—Sage and Caritas—with 204 and 256 residents respectively; two were private—Shui On and Cambridge—with 221 and 91 residents respectively.

Research staff liaised with the nurse of the CGAT or the visiting medical officer responsible for the RCHEs to identify residents with ILI on a daily basis. An ILI is defined as a temperature of ≥37.8ºC measured by a digital aural thermometer, or an acute deterioration in physical or mental ability, plus new onset of respiratory symptoms or an acute worsening of a chronic respiratory condition.

Patients with ILI underwent the following microbiological investigations: (1) a sputum sample for routine bacterial culture (covering *Streptococus pneumoniae, Pseudomonas sp, Haemophilus influenzae, Moraxella catarrhalis* and other likely pathogens) and for mycobacterial culture of tuberculosis (restricted to those with prolonged respiratory symptoms eg coughing for ≥2 weeks, systemic symptoms associated with weight loss or hospital admission); (2) multiplex-nested polymerase chain reaction for respiratory pathogens; (3) a paired serum sample for atypical pneumonia serology (including influenza A, influenza B, parainfluenza 1, 2, 3; RSV, adenovirus, mycoplasma, *Legionella*, *Coxiella*, and psittacosis); (4) a urine sample for *Legionella* antigen and Pneumococcal antigen (for hospitalised cases).

The aetiology of ILI was determined based on positive culture from sputum, blood or nasopharyngeal aspirate, positive urinary antigen for *S pneumoniae* or *Legionella*, positive polymerase chain reaction identification, serology of 4-fold difference or single titre of 80 or above, and positive IgM antibody titres.

Patients with ILI were cared for in the usual way by the visiting medical officer or a doctor from the CGAT. Management included prescription of drugs eg antipyretics, antibiotics, or antiviral drugs (depending on the clinical presentation), as well as attention to hydration and nutrition. The decision on admission to hospital was made by the attending doctor or RCHE staff, who might have difficulty in providing additional care or in monitoring of the patient. For example, physical signs requiring further investigation (such as chest radiography), failure to eat or drink, or the need for oxygen, usually resulted in further care in the hospital setting. Any RCHE residents admitted to hospital were investigated routinely.

Statistical analysis

Approximately 10% of RCHE residents had an ILI episode over a one-year period. Assuming a standard deviation of 4%, a total of 217 ILI episodes would be needed. Late summer and winter were the two peaks for ILI episodes, in addition to low-level background occurrences. Assuming an incidence of 10%, the number of episodes covering the two peaks over a one-year period would be 2x0.1x1000=200. Additional episodes of 80 during the other periods could be expected. Assuming 10% were missed, the remaining episodes that could be studied were expected to be 0.9x280=252.

Results

A total of 259 episodes of ILI occurred in 194 patients; 77.8% had one episode, 4.4% had two, 4.6% had three, 2.6% had four, and one had five episodes. An infectious agent was identified in 61.4% of these ILI episodes (Table). Bacterial infections were the commonest, accounting for 53.3%, while viruses were identified in 46.7%; 16.2% of the patients had 2 or more organisms identified. The top five causes in order of frequency were *S pneumoniae*, RSV, *P aeruginosa*, Parainfluenza virus type 1 and Metapneumovirus. Seasonal variations in the organisms were observed: Metapneumovirus and Parainfluenza virus type 3 from April to June, RSV and *P aeruginosa* from July to September, *Chlamydia sp*, Parainfluenza virus type l and *S pneumoniae* from October to December, and *S pneumoniae*, Influenza virus type A, RSV, and human coronaviruses from January to March. For the latter period, RSV, coronavirus and influenza A infections were equally prevalent. Viral infections showed more seasonal variations than did bacterial infections. Among the bacterial infections, *S pneumoniae* was the commonest during the autumn and winter months, and *P aeruginosa* in the summer months, and *Staphylococcus aureus* including methicillin-resistant *S aureus* (MRSA) were among the five commonest bacterial agents. Atypical organisms (*Chlamydophila pneumoniae* and *Mycoplasma pneumoniae*) were detected using molecular methods. The prevalences of organisms in the four RCHEs were similar.

The mean age of the patients was 85 years, and there were slightly more women than men. Presentation with 'decrease in general condition' in terms of cognition, activities of daily living and/or mobility was noted in 71%. Approximately 90% had received influenza vaccination (half within 6 months and half between 6 and 12 months), indicating good compliance with the policy of 100% vaccination rate in RCHEs. Decline in physical function occurred in about 66% of patients as a result of the illness, while cognitive decline was also observed. There were 87% of the ILI episodes resulting in hospital admission.

No particular clinical features identified any particular organism. Mortality was 9.7%. Factors associated with mortality were withholding of food (odds ratio, 3.37; 95% CI, 1.22-9.27), decrease in body mass index, decrease in activities of daily living score, and infections attributed to MRSA and *Klebsiella*.

Management included intravenous antibiotics (in 87% of patients), oxygen and intravenous fluids (in over 60% of patients), and extensive involvement of allied health staff. Owing to concerns about possible aspiration or that aspiration might have precipitated the ILI episode, food was withheld in 57% of patients, who were more likely to have fever, shortness of breath, decline in general condition, be admitted to hospital, have longer hospital stays, have crepitations on auscultation and consolidation on chest radiographs. They also had a three-fold higher mortality. The difference between the three age groups (<80, 80-89, and ≥90) was insignificant, except that older age groups had more female, and had lower BMIs and MMSE scores.

No significant differences were observed in any of the clinical characteristics of ILIs due to different aetiologies. Thus, it would be difficult to determine the underlying cause of an ILI episode based on clinical features alone.

Discussion

In Hong Kong, only 4% of the ILI were caused by influenza A virus over the study period, but influenza A infection tends to equate with ILI. This is misleading in terms of clinical consequences. A broader term—such as nursing home–acquired pneumonia rather than community-acquired pneumonia—might be more appropriate.

Previous studies on the community-dwelling elderly (aged ≥65 years) showed that RSV and human metapneumovirus were each responsible for as many hospitalised cases of respiratory infection as influenza,[5] and that metapneumovirus was a common and ubiquitous human pathogen in children and the elderly.[6] The RSV has

Table . Attributed underlying aetiology over the study period

Aetiology	2006				2006				2006				2007				Total
	Apr	May	Jun	No. (%)	Jul	Aug	Sep	No. (%)	Oct	Nov	Dec	No. (%)	Jan	Feb	Mar	No. (%)	No. (%)
Bacteria																	
Streptococcus pneumoniae	1	2	2	5 (9.4)	1	3	1	5 (10.9)	4	2	1	7 (13.0)	2	3	9	14 (18.9)	31 (13.7)
Pseudomonas aeruginosa	1	1	-	2 (3.8)	1	4	3	8 (17.4)	-	1	2	3 (5.6)	1	1	1	3 (4.1)	16 (7.0)
Chlamydophila species	-	1	-	1 (1.9)	1	-	-	1 (2.2)	7	2	2	11 (20.4)	1	-	-	1 (1.4)	14 (6.2)
Haemophilus influenzae	3	-	1	4 (7.5)	-	1	1	2 (4.3)	1	2	-	3 (5.6)	2	-	2	4 (5.4)	13 (5.7)
Methicillin-resistant *Staphylococcus aureus*	-	-	2	2 (3.8)	-	1	1	2 (4.3)	-	1	-	1 (1.9)	2	-	2	4 (5.4)	9 (4.0)
Mycoplasma pneumoniae	-	1	1	2 (3.8)	1	-	-	1 (2.2)	1	1	1	3 (5.6)	1	1	-	2 (2.7)	8 (3.5)
Escherichia coli	-	-	1	1 (1.9)	-	1	-	1 (2.2)	1	-	-	1 (1.9)	1	-	2	3 (4.1)	6 (2.6)
Moraxella catarrhalis	1	-	-	1 (1.9)	-	-	-	-	1	-	-	1 (1.9)	1	1	1	3 (4.1)	5 (2.2)
Klebsiella species	-	-	-	-	1	2	-	3 (6.5)	1	-	-	1 (1.9)	1	-	-	1 (1.4)	5 (2.2)
Mycobacterium avium complex	1	-	1	2 (3.8)	-	-	-	-	-	-	-	-	-	1	-	1 (1.4)	3 (1.3)
Serratia species	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	2 (2.7)	2 (0.9)
Acinetobacter species	-	-	-	-	-	-	-	-	1	-	-	1 (1.9)	-	1	-	1 (1.4)	2 (0.9)
Enterobacter species	-	-	1	1 (1.9)	-	-	-	-	-	-	-	-	-	-	1	1 (1.4)	2 (0.9)
Proteus mirabilis	-	-	-	-	1	-	-	1 (2.2)	-	1	-	1 (1.9)	-	-	-	-	2 (0.9)
Mycobacterium tuberculosis complex	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1 (1.4)	1 (0.4)
Morganella morganii	-	-	-	-	-	-	-	-	-	1	-	1 (1.9)	-	-	-	-	1 (0.4)
Coxiella burnetii	1	-	-	1 (1.9)	-	-	-	-	-	-	-	-	-	-	-	-	1 (0.4)
Virus																	
Respiratory syncytial virus	2	1	2	5 (9.4)	4	5	1	10 (21.7)	-	-	-	-	-	-	6	6 (8.1)	21 (9.3)
Parainfluenza virus type 1	-	-	-	-	1	-	-	1 (2.2)	5	2	3	10 (18.5)	-	-	4	4 (5.4)	15 (6.6)
Metapneumovirus	6	7	-	13 (24.5)	-	-	-	-	1	-	-	1 (1.9)	-	1	-	1 (1.4)	15 (6.6)
Parainfluenza virus type 3	2	1	3	6 (11.3)	1	1	-	2 (4.3)	1	-	-	1 (1.9)	-	-	4	4 (5.4)	13 (5.7)
Influenza virus type A	-	-	-	-	4	-	-	4 (8.7)	1	-	-	1 (1.9)	-	-	6	6 (8.1)	11 (4.8)
Human coronavirus 229E/OC43	-	-	1	1 (1.9)	-	-	-	-	1	-	-	1 (1.9)	4	1	1	6 (8.1)	8 (3.5)
Rhinovirus	1	1	-	2 (3.8)	-	2	2	4 (8.7)	-	-	-	-	-	1	-	1 (1.4)	7 (3.1)
Influenza virus type B	-	-	-	-	-	-	-	-	-	1	-	1 (1.9)	1	-	4	5 (6.8)	6 (2.6)
Enterovirus	2	-	-	2 (3.8)	-	-	-	-	-	-	2	2 (3.7)	-	-	-	-	4 (1.8)
Parainfluenza virus type 2	-	-	-	-	1	-	-	1 (2.2)	-	2	-	2 (3.7)	-	-	-	-	3 (1.3)
Parainfluenza virus type 4	1	-	1	2 (3.8)	-	-	-	-	-	1	-	1 (1.9)	-	-	-	-	3 (1.3)
Total No. of organisms	22	15	16	53 (23.3)	17	20	9	46 (20.3)	26	17	11	54 (23.8)	18	12	44	74 (32.6)	227 (100)
No organism	12	12	11	35 (35)	14	4	11	29 (29)	7	6	4	17 (17)	2	3	14	19 (19)	100 (38.6)
1 organism	9	8	14	31 (26.5)	7	9	5	21 (17.9)	9	7	5	21 (17.9)	9	12	23	44 (37.6)	117 (45.2)
2 organisms	2	0	1	3 (13)	1	1	2	4 (17.4)	5	3	0	8 (34.8)	3	0	5	8 (34.8)	23 (8.9)
≥3 organisms	3	2	0	5 (26.3)	2	3	0	5 (26.3)	2	1	2	5 (26.3)	1	0	3	4 (21.1)	19 (7.3)
Total No. of patients	26	22	26	74 (28.6)	24	17	18	59 (22.8)	23	17	11	51 (19.7)	15	15	45	75 (29.0)	259 (100)

been suggested as giving rise to a disease burden similar to that of influenza A; RSV vaccination should therefore be considered.[4]

The high admission rate to hospital, despite on-site medical and nursing support, suggests that deployment of outreach Hospital Authority staff to RCHEs may not have any impact on reducing hospital admissions for ILI episodes. Because a decrease in general condition may result from many conditions, of which infection is only one, hospital admission is preferred. Furthermore, deaths in RCHEs must be reported to the police, and concerns with meeting government infection control policies may also have predisposed to hospital admissions.

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