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Epidemiology and Management of Seasonal Influenza Outbreaks in Long-Term Care Facilities in the Health Service Executive East area of Ireland during the 2013-2014 Influenza Season.

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Abstract:

We describe seasonal influenza-like illness (ILI) outbreaks in long-term care facilities in the Health Service Executive (HSE) East area of Ireland in the 2013/2014 influenza season, risk factors associated with outbreak duration and attack rates, and management challenges. Separate questionnaires were distributed to 28 facilities who reported an outbreak and to public health specialists leading outbreak management, with a 79% response rate. Mean outbreak duration (21 vs 17 days; p=0.046) was longer in facilities with staff vaccination rates of <40%. Facilities with a high attack rate (≥50%) were less likely to have an outbreak plan (p=0.03). Smaller facilities (under 50 residents) had a higher attack rate (50% vs 23%, p=0.003) even when controlled for staff vaccination rate (p=0.01). Prior to the outbreak, resident vaccination rates were high (82%, above the World Health Organization target of 75%) but staff vaccination rates were low (39%). Reported challenges to ILI outbreak management in long term care facilities included visitor restrictions, staff education issues, outbreak notification delays and lack of outbreak lead in facilities. Targeted public health-assisted planning, training and response, comprising of staff vaccination, education, written policies, with early notification and prompt response would facilitate a more co-ordinated approach to the management of outbreaks, and reduction in infection rates and consequent morbidity.

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Introduction

Influenza-like illness (ILI) outbreaks are a major cause of morbidity and mortality among residents of long-term care facilities (LTCFs) globally. Residents are at high risk of influenza due to the closed environment of LTCFs and the limited mobility of residents, both of which facilitate transmission of infection [1]. A previous review of influenza outbreaks in LTCFs highlighted attack rates of up to 60% (2).In addition, residents of LTCFs are at higher risk of complications of influenza and can be poorly protected by influenza vaccination [3].

Influenza can persist unrecognised in LTCFs for several months, due to atypical presentation in residents, and outbreaks may not be reported [4]. It is therefore essential that LTCFs maintain a high index of suspicion during the influenza season and have an appropriate surveillance system in place to monitor for symptoms of ILI in residents and staff. Evidence suggests that early detection, high resident and staff vaccination rates and prompt initiation of antiviral medication results in better outbreak control, reduced hospitalisation, morbidity and mortality [5, 6, 7].

In Ireland, under infectious diseases legislation, the local Medical Officer of Health, located in regional Departments of Public Health must be informed by the attending clinician of any suspected outbreak of ILI (S1 707: 2003). Departments of Public Health provide guidance, expertise and support on the management and control of outbreaks [8]. National and international guidelines are also available for the management of influenza outbreaks [8-10].

Information on what makes a LTCF vulnerable to an ILI outbreak is lacking. The reasons are likely to be complex and multi-factorial. We undertook an in-depth survey of a series of notified ILI outbreaks in LTCFs. The aim was to identify risk factors and management challenges for facilities and public health authorities in order to target recommendations for improvement. We describe the epidemiological features of outbreaks including numbers affected, attack rate, hospitalisation rate and deaths for outbreaks of ILI notified by 22 of 108 LTCFs in the HSE East region (population 1.6 million) of Ireland, to the Department of Public Health during the 2013/2014 season.

Methods

In the 2013-2014 influenza season 28 outbreaks of ILI were reported in LTCFs in the HSE East region.

A questionnaire for LTCFs was designed based on national guidelines on the management of influenza outbreaks in residential care facilities [11] and in consultation with public health staff experienced in influenza outbreak management.

We sought LTCF demographic information including; number of residents in the facility, age range of residents and number of staff employed. In addition, information on self-reported outbreak preparedness, vaccination status of staff and residents pre-onset of outbreak, description of illness, control measures used, numbers of residents and staff ill, duration of outbreak and the use of antiviral medication was collected.

While the majority of questions were closed, free text space was provided for LTCF staff to identify challenges experienced during an outbreak. The questionnaire to LTCFs was not pilot tested within LTCFs but was tested and refined with experienced nursing staff within the Department of Public Health. The questionnaire was emailed to the director of nursing at each of the 28 facilities for completion when they notified the Department of Public Health of their outbreak. Follow-up telephone contact to validate the questionnaire replies and to fill in missing information was undertaken by infection prevention and control nurses (IPCNs) from the Department of Public Health. Cross checking with Department of Public Health files, for example on length of outbreak and swab results was

undertaken. Consent forms were not completed as consent was implied by participation which was voluntary. No incentives were provided towards completion.

Supplementary information was sought from Public Health Specialists and IPCNs dealing with each outbreak using a separate questionnaire on issues and challenges in managing each outbreak. This second questionnaire comprised of closed questions on timeliness of notification to Public Health, LTCF lead person to liaise with, antiviral availability when required , management awareness of staff vaccination levels, availability of a lead General Practitioner for liaison, issues with transfer of clients in/ out of LTCF. Free text space was provided for comments on each of these points.

During each outbreak viral swabs were taken by LTCF staff as per outbreak procedure and tested at the National Virus Reference Laboratory, Dublin.

Both quantitative and qualitative data were collected. Quantitative data were analysed using IBM SPSS version 22. Descriptive analysis was carried out to describe the distribution of variables amongst outbreaks, summarising the data using frequencies.

Several outcome variables were continuous scale e.g. % attack rate, duration of outbreak and were regrouped into binary variables for some analysis, having regard to the distribution of our data; such as attack rate≥50%, duration of outbreak over 21 days. Associations between variables were explored using chi square, Fisher's Exact, student T-test, Mann-Whitney-U test and linear regression tests. Odds ratios were also calculated. Significance level was set at $p<0.05$ and some non-significant results of public health importance were also reported on.

Qualitative data collected in questionnaires from LTCF staff and public health staff included challenges experienced during the outbreak and suggestions on how public health could assist LTCFs with outbreak management. Key themes were identified, agreed upon by two of the study team and were grouped into related categories.

The ILI outbreak definition and clinical case definition used are taken from Irish national guidance; ILI outbreak definition; "Three or more cases of ILI or influenza or respiratory illness arising within the same 72 hour period in a long-term care facility which meet the same clinical case definition and where an epidemiological link can be established."[8] Clinical case definition of influenza/ ILI; "Any person with the following clinical syndrome: Sudden onset of symptoms AND at least one of the following four systemic symptoms: fever, malaise, headache, myalgia AND at least one of the following three respiratory symptoms: cough, sore throat, shortness of breath."[12] The duration of an outbreak was calculated from the date the outbreak was first identified by LTCF staff to eight days after the onset of symptoms in the last case.

Results

Twenty-eight influenza/ ILI outbreaks involving 509 persons were notified to the Department of Public Health, HSE East region in the 2013/2014 influenza season, six in January, nine in February, ten in March and three in April 2014. Twenty two LTCFs returned the questionnaire resulting in a response rate of 79%.

Surveillance and Detection

Viral swabs were taken in all 22 outbreaks, however not all ill residents had a viral swab taken, as exhibiting clinical signs and symptoms was deemed sufficient in an established outbreak. Sixty four per cent of outbreaks studied (14/22) were due to influenza AH3 virus. The mean duration of outbreak was 20 days, range 12-29 days.

Responders reported a total of 414 cases of influenza or ILI; 74% (n=305) were residents and 26.3% (n=109) were staff. Mean number of cases per

outbreak was 19 (range 4-39) with mean attack rates of 35% (range 9.2% - 90%) and 10% (range 0 – 31.6%) in residents and staff respectively. Thirty-eight percent (116/305) of residential client cases identified fulfilled the Irish clinical case definition for influenza (8) and the remainder (189/305) were suspected ILI., Thirty four per cent of all cases (104/305) were laboratory confirmed influenza. Among cases in residents (n=305), eight per cent (25/305) of cases were diagnosed with pneumonia, ten per cent (30/305) required hospitalisation and the death rate was almost seven per cent (20/305).

Control Measures

Anti-viral medication (oseltamivir) was given to residents in 82% (18/22) of outbreaks and to staff in 27% (6/22) of outbreaks. There was no association between antiviral use and duration of outbreak. Non-pharmaceutical interventions were used widely to control outbreaks. (Table 1)

Preparedness of LTCFs for ILI outbreak

Sixty-eight per cent (15/22) of the LTCFs that responded self-reported that they were fully or mostly prepared for an influenza outbreak. However, when questioned on specific preparedness elements such as monitoring illness, guideline knowledge, education for staff, having a flu lead and a flu plan, responses varied. Eighty two percent (18/22) of LTCFs had a process in place to monitor for resident illness whereas only 50% (11/22) monitored for staff illness. The majority of LTCFs; were aware of the checklist for the prevention, detection and control of ILI and influenza outbreaks, had a 'flu lead', had a written policy on influenza preparedness and prevention and had a specific influenza outbreak plan for their LTCF (Table 2). Less than half (36%, 8/22) of LTCFs provided influenza education on commencement of employment and/or annually at the start of the influenza season.

Immunization Status of Staff and Residents

Eighty two per cent (n=18) of the LTCFs attained the World Health Organization (WHO) target of 75% resident vaccination uptake in LTCFs. Thirty two percent (n=7) of LTCFs had staff vaccination uptake rates of ≥40%. The Number of residents and staff vaccinated increased across all 22 outbreaks following public health advice and management. (Figure 1)

Outbreak Characteristics

Duration of outbreak in LTCFs where the staff vaccination rate at onset was low (<40%) and was significantly longer compared to units with rates ≥40% (comparison of means 21days vs 17 days; p=0.046). There was a delay of five days or more in notifying the Department of Public Health in 59% (13/22) of outbreaks. Late notification was more likely, though not significantly associated with LTCFs that did not have a process for monitoring resident (OR 2.0, p=0.23) and staff (RR 1.6, p=0.38) illness.

Most LTCFs were confident that they had timely access to the following supplies: surgical masks (95%, 21/22), viral swabs (95%, 21/22), antiviral medication (91%, 20/22) and seasonal influenza vaccine (100%, 22/22).

Higher attack rates (AR) were associated with smaller LTCFs (with < 50 residents) (AR 50% vs 23%, p=0.003) even when controlled for staff vaccination rate (p=0.01). LTCFs with a high attack rate (≥50%) were significantly less likely to have an outbreak plan (OR 0.6, p=0.03) and were less likely to have a written policy on influenza management (O.R. 0.7 p=0.09) than LTCFs with an attack rate of <50%. In addition, in LTCFs with staff vaccination target rates of under 40%, the median resident attack rate was considerably higher than in other LTCFs (9.3% vs 3.6%, p=0.15).

Median duration of outbreaks in facilities where formal influenza training took place was shorter than in those where formal influenza training was not provided

Table 1. Non-pharmacological measures used to control influenza outbreaks in 22 long term care facilities during the 2013/2014 influenza season in the HSE East region of Ireland. *

Non-pharmacological control measures	Percentage of LTCF % (n)
Patient movement restricted	100% (22)
Visitor restrictions	100% (22)
Availability of alcohol gel	100% (22)
Outbreak signs	95% (21)
Cohort nursing	95% (21)
Case isolation	91% (20)
Application of surgical masks on patient movement	86.5% (19)

*In addition standard precautions (including hand hygiene, respiratory hygiene/cough etiquette) and droplet precautions were implemented in all outbreaks.

Table 2. Planning and preparedness for influenza outbreak in 22 long term care facilities that experienced an influenza outbreak in the 2013/2014 influenza season in the HSE East region of Ireland

	Number of LTCFs	% (n)
Self-reported preparedness of LTCF for influenza outbreak		
	Fully or mostly prepared	68% (15)
	Somewhat prepared	23% (5)
	A little or not prepared at all	9% (2)
Awareness of " Checklist for Residential Care Facilities on the prevention, detection and control of influenza-like illness and influenza outbreaks 2012/2013" document		
	Yes	95% (21)
	No	5% (1)
Within LTCF staff there is an appointed "flu lead"		
	Yes	86% (19)
	No	9% (2)
	Unknown	5% (1)
LTCF has a written policy on influenza preparedness and prevention		
	Yes	50% (11)
	No	45% (10)
	Unknown	5% (1)
There is an identified lead GP for LTCF		
	Yes	82% (18)
	No	18% (4)
There is an outbreak plan specific to LTCF		
	Yes	55% (12)
	No	45% (10)

(16

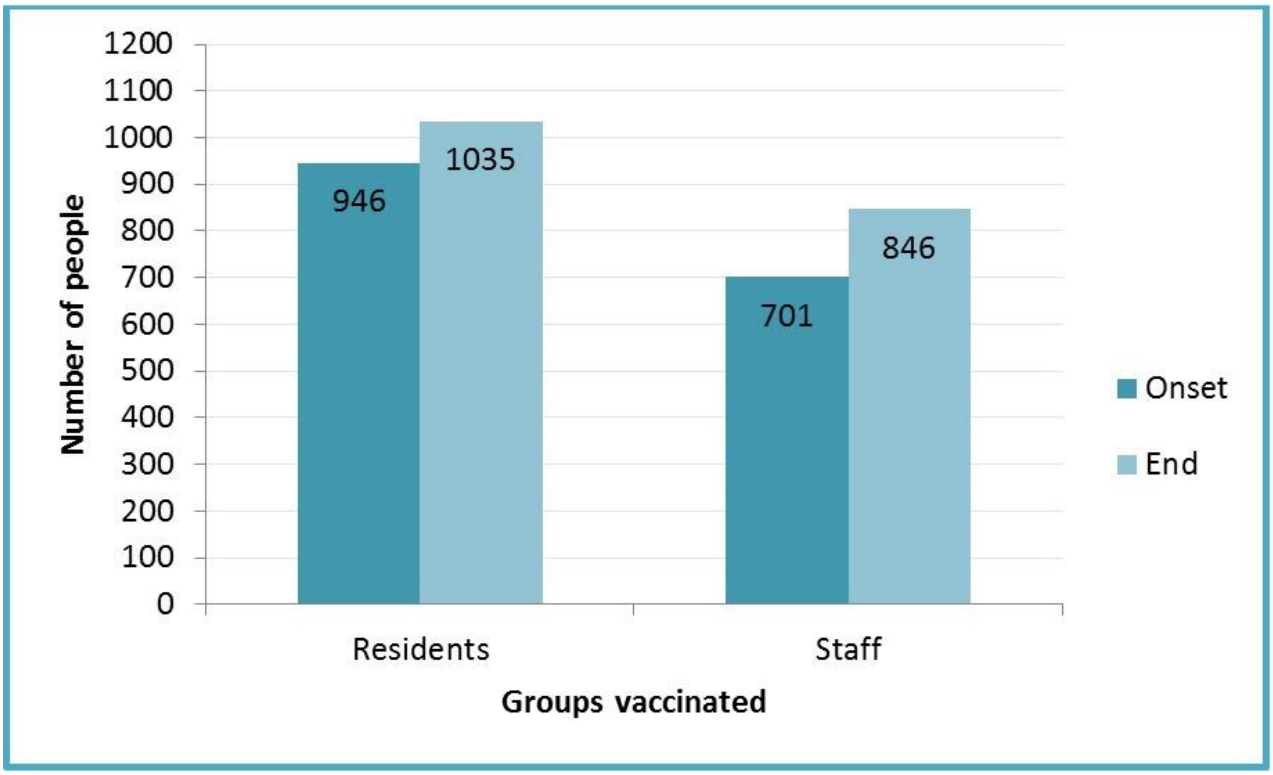

Figure 1. Number of residents and staff who received influenza vaccine at the onset and end of the outbreaks of influenza at 22 long term care facilities during the 2013/2014 influenza season in the HSE East region of Ireland.

days v 21days). Outbreak duration ≥ 21 days was not associated with absence of staff influenza training (p=0.16).

Outbreak Management Challenges

Qualitative data revealed that major challenges experienced by the LTCFs included difficulty cohorting and isolating patients, restricting visitors and educating staff on infection control measures including influenza vaccination. Difficulties reported by Public Health included late notification of outbreaks, low staff vaccination rates, antiviral availability issues and antiviral prescribing issues. (Table 3) Suggestions by LTCFs on how Public Health could support them in future outbreaks included the provision of staff education sessions on influenza outbreak control, especially on the benefit of staff influenza vaccination and assistance in the provision of supplies such as viral swabs and antiviral medication.

Discussion

Influenza and ILI outbreaks in LTCFs place a considerable burden on health services, residents and staff internationally. In the HSE East region of Ireland there were 509 notified influenza/ ILI cases associated with 28 outbreaks in 2013/2014. We report on 22 of these outbreaks comprising 414 reported cases of influenza or ILI, 74% (305/414) in residents and 26% (109/414) in staff. The mean attack rate in residents of 35% is similar to previous reported outbreaks, where attack rates of up to 40% have been seen [13, 14]. Morbidity and mortality rates (almost 10% hospitalisation, 8% pneumonia, almost 7% mortality) and mean outbreak duration of 20 days demonstrate the burden of illness and the workload for facilities and Public Health Departments in management. All reported hospitalisations, pneumonias and deaths occurred in residents. The case fatality rate among residents in our series is relatively low compared to other previously

Table 3. Challenges experienced by LTCFs and public health during influenza/ILI outbreaks

Challenges experienced by longterm care facilities (LTCFs) during influenza/ILI outbreaks
• Isolation of cases
• Cohorting residents
• Education of staff on infection control measures including the benefits of influenza vaccine
• Restricting visitors
• Educating staff on recognising and recording influenza symptoms and signs
• Difficulties accessing supplies such as viral swabs, antiviral medications
• Staff absentee rates during outbreak
Challenges experienced by public health during influenza/ILI outbreaks
• Delay in notification of outbreak to Public Health
• Lack of lead GP to co-ordinate and communicate with
• Lack of knowledge and understanding about infection prevention and control precautions in particular –standard and transmission based precautions
• Lack of lead nurse to manage outbreak
• Access to antiviral medication
• Difficulties related to prescribing antiviral medication

reported outbreaks [15]. Influenza infection exacerbates many underlying illnesses, and the recording of influenza as a contributory factor in resulting deaths does not always occur, resulting in under-reporting of deaths caused by influenza.

Sixty four percent of all (14/22) influenza/ILI outbreaks in LTCFs in the HSE East region in the 2013/2014 season were caused by influenza AH3 virus, the dominant circulating strain during the 2013/2014 influenza season in Ireland [16]. The peak months for influenza outbreak notification in LTCFs (February and March) reflected the sentinel general practice ILI consultation rates peak.

Surveillance and early detection of illness and recognition of an outbreak is the important first step in control. In older people the illness may be more subtle with non-specific symptoms such as confusion, increased cognitive impairment and fatigue. Atypical influenza presentations may delay the identification and declaration of outbreaks in LTCFs. While 414 persons were ill associated with the influenza/ILI outbreaks, only 38% met the Irish case definition for ILI. Case definitions can be poorly sensitive and are undergoing review [17]. We found that there was a delay in outbreak notification from LTCFs that did not have illness monitoring procedures for clients and staff, again highlighting the importance of an illness monitoring process.

The level of preparedness for an influenza outbreak was reported as high by most of the affected LTCFs. However, only half the LTCFs had an outbreak plan or a written policy on influenza preparedness and prevention, and it seems that LTCFs may have an element of complacency in their perceived preparedness. Preparedness is key, requiring an active

and updated flu plan and regular education sessions for staff at the start and through the influenza season.

Some studies specifically in nursing homes have failed to demonstrate a protective effect of post exposure prophylaxis following exposure to influenza [18], and in others the use of oseltamivir has been shown to result in better outbreak control and reduced complications [5, 19]. An updated Cochrane review challenges the benefit of neuroaminidase inhibitors and recommends that guidance for their use in both treatment and prophylaxis be revised [20,]. In our series of outbreaks, the use of oseltamivir was not associated with shorter duration of outbreak. We found prophylactic oseltamivir was used mostly for residents only (18 outbreaks reported use of oseltamivir in residents but only 6 reported use in staff).

During the outbreaks almost all LTCFs used a range of non-pharmacological control measures including: restriction of resident movement, visitor restrictions, increased alcohol gel use, surgical mask use, cohort nursing and case isolation. Thus comparisons between LTCF were not possible due to almost universal use of these control measures. Non-pharmacological interventions are recommended in guidelines for the control of influenza outbreaks in LTCFs [4] and have been shown to be of benefit especially in epidemic situations [21].

A quarter of the identified influenza/ILI cases occurred in staff, demonstrating their vulnerability to symptomatic influenza infection. The lower mean attack rate in staff (10%) may reflect their more effective immune systems and also possible under-reporting of staff illness for a number of reasons, including immunocompetent staff having milder illness which is not recognised as influenza, and staff shortages resulting in a reluctance of staff to report influenza and ILI. In addition, potential loss of earnings may be a disincentive to staff reporting influenza and ILI as some staff report a policy that unvaccinated staff developing influenza will be required to take unpaid sick leave.

We noted a higher attack rate in smaller units, when controlled for vaccination uptake. We suggest this may be due to sharing of communal areas by residents and wider movement of sub-clinically infected staff throughout a smaller unit. Recent outbreak studies record seroconversion of persons with no illness who would not have been captured by any case definition, but who shed considerable viral loads [22].

We found that attack rates were lower in LTCFs that had written policies on preparedness and outbreak plans. The majority of LTCFs reported an awareness of relevant guidelines, had appointed staff flu leads and lead general practitioners (GPs). Conversely, the most commonly reported challenges identified by Public Health specialists in the management of influenza/ILI outbreaks were the identification and communication with lead nursing staff and lead GPs. Further investigation of the communication between LTCF and Public Health Departments with regard to this issue is required, with recommendations to inform Public Health annually of lead personnel and contact details.

National health policy in Ireland recommends that all healthcare workers receive influenza vaccine each year. In the 2013/2014 influenza season, HSE management, in response to an average vaccine uptake among healthcare workers of 15% in the 2012/2013 season, suggested that all healthcare facilities should aim for a vaccine uptake rate of at least 40% among healthcare workers.

While high resident influenza vaccination rates (82% at outbreak onset) were reported, staff vaccination levels were low at 39% at outbreak onset. International evidence advises us that staff influenza vaccination is an integral part of preparedness for outbreaks of influenza [4, 23, 21]. Despite this staff vaccination rates remain universally low. Irish national

guidelines recommend that influenza vaccine be offered to all unvaccinated residents and staff during and after ILI outbreaks. This practice increased staff vaccination rates to 47%. Low staff vaccine uptake is highlighted by both LTCFs and Public Health as a major challenge in managing influenza outbreaks.

The provision of staff education sessions on the prevention and control of influenza outbreaks, including the importance of staff influenza vaccination, is recognised as a vital part of the Public Health Department's role in influenza outbreak prevention. Interventions such as improved vaccine access through the provision of the vaccine on-site at LTCFs, flexible delivery of the vaccine and mobile vaccination carts have been shown to improve uptake [24, 25]. In addition, the use of incentives and declination forms also increase uptake and should be considered [26, 27].

Our study is limited by self-reporting of institutions, highlighted in the differing opinion of LTCF staff and public health staff in relation to the presence of a staff flu lead and lead GP. While our response rate was good, it is possible that non-responders had characteristics that differentiate them from responders. Finally, reporting at unit level meant that although many staff and residents were affected, comparisons between units had power considerations, and amalgamation of several years' data would give more power to our study.

Conclusion

Our study identifies multiple factors associated with influenza outbreaks in LTCFs. In addition to a continued focus on staff and resident vaccination our study findings re-emphasise recommendations of formalised staff training on infection prevention and control, written flu policies at the onset of each season, surveillance of staff and residents for illness, review of staff sick pay policy for viral illnesses, early notification to public health and identification and availability of lead GPs and LTCF staff leads.

Targeted planning, preparedness and training within long term care facilities with public health support, with early notification and response would facilitate a more co-ordinated approach to the management of outbreaks. This public health-supported approach is being strengthened nationally in Ireland and, it is hoped will lead to a reduction in infection rates and consequent morbidity in this vulnerable group [28].

Institution that Work Should be Attributed to:

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