Influenza prevention in nursing homes: Great significance of seasonal variability and spatio-temporal pattern

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Summary

Objective > This work evaluated seasonal variations and spatio-temporal pattern of respiratory tract infections (RTI) in geriatric nursing homes in order to improve effective surveillance, prevention, control and management of RTI.

Methods > Prospective surveillance of RTI (Low Respiratory Tract infections and Influenza Like Illnesses) was conducted in 11 sites in Alsace over a 10-year period with clinical case definitions and rapid tests (Immunoassay) to identify influenza virus.

Results > Influenza national epidemic was a period at high risk of RTI in nursing homes with variable impacts depending on the seasonal period. 2004–2005, 2008–2009, 2011–2012 and 2012–2013 were the periods with the highest impacts. The higher risk was not well understood during these four influenza epidemics and outbreaks occurred in numerous nursing homes despite the alerts and surveillance.

Conclusion > Information about seasonal variability and spatio-temporal patterns of the RTI during the national epidemic periods is essential for the nursing homes in order to help the health care workers and the visitors to understand the risk for the residents and then to improve the implementation of the control and prevention measures.
RÉSUMÉ

Prévention de la grippe en établissements hébergeant des personnes âgées dépendantes : impacts majeurs de la variation saisonnière et de la dynamique spatio-temporelle

Objectif > Nous avons évalué les variations annuelles et spatio-temporelles des infections respiratoires dans les établissements hébergeant des personnes âgées dépendantes (EHPAD) afin d’en améliorer la surveillance, la prévention et la gestion de ces épisodes.

Méthodes > Une surveillance prospective des infections respiratoires basses et des infections avec un syndrome de type grippal a été développée dans 11 sites en Alsace pendant 10 années avec un suivi clinique et l’utilisation de tests rapides d’orientation diagnostique pour identifier le virus de la grippe.


Conclusion > L’information des EHPAD concernant un risque majeur d’infections respiratoires et notamment de type grippal pendant certaines épidémies de grippe dans la communauté est indispensable afin d’améliorer l’application et le respect des mesures de prévention.

What was already known

• The more severe influenza illnesses are more common in the elderly and particularly those with chronic diseases.
• Influenza outbreaks are frequent in nursing homes.
• Surveillance and alerts are necessary in nursing homes to limit the outbreak impacts.

What this study adds

• Influenza outbreaks mostly occur in nursing homes during the national epidemic periods.
• Various influenza impacts in nursing homes are observed according to the years of surveillance.
• The surveillance of simple indicators (cluster of low respiratory tract infections and influenza like illnesses (superior or equal to 5 cases) and influenza rapid immunoassay diagnosis tests) permits epidemiologists to identify the seasonal variability.
• During influenza seasons with high influenza impacts in nursing homes, outbreak control is difficult despite the surveillance and the alert system.
• Nursing homes preparedness needs to be improved to face the seasons with influenza higher risk.

Respiratory tract infections (RTI) are common in geriatric nursing homes. Vulnerable residents and close contacts between residents, staff and visitors provide an environment where cross infection can occur rapidly [1–3]. To fully develop infection control measures for preventing and controlling RTI in geriatric units, the seasonal variations should be perfectly understood. Mortality fluctuations in winter are now well identified and seasonal epidemics including influenza are mentioned as one of the factors that may partly explain these observations [4,5]. Moreover, no specific data exist over a long time and in a cohort of nursing homes about the incidence and the spatio-temporal clustering of RTI during all the seasonal epidemic periods from November to April.

The aim of this work was to study the results of RTI surveillance in geriatric nursing homes in order to evaluate the seasonal variability and the spatio-temporal clustering pattern of the RTI and then to improve the efficiency of the alert and prevention systems.

Methods

Settings
We have conducted surveillance for respiratory tract infections in 11 sites (number one to eleven) spread in a large area of 25 by 65 kilometres in the Alsace region in Eastern France. The study was carried out for 10 years (2004 to 2014) and between weeks 46 and 15. Mean age in the included units and vaccination rates for the residents and for the health workers in the nursing homes were recorded.
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Clinical surveillance
The same hygiene team coordinated the surveillance and the hygiene control measures in the 11 sites. In each site, only units with a doctor coordinating the clinical infection surveillance were included. Every week in the included units, the corresponding doctor collected the number of new cases of Low Respiratory Tract infections and Influenza Like Illnesses (LRTI/ILI). If the weekly surveillance was not performed in one unit, the concerned unit was mentioned as “non-participating” for the concerned week. Upper Respiratory Tract infections were not included in this study because medical diagnosis was not systematic and particularly in case of non severe infections with a possible difference between the nursing homes according to the more or less presence of the doctors.

Case definitions
The case definitions used to be reached by consensus [6]. LRTIs were defined as (at least two signs and symptoms with positive chest-X-ray or at least three signs and symptoms without positive chest-X-ray): new or increased cough, new or increased sputum production, fever (> 38 °C), pleuritic chest pain, new or changed abnormal lung examination (rales, rhonchi, wheezing), changed respiratory rate (dyspnea or tachypnea). ILIs were defined (only during the flu season) as fever (> 38 °C) and at least three of the following criteria: chills, headache or eye pain, myalgias, asthenia or loss of appetite, sore throat, new or increased dry cough. In this study, ILI case inclusions occurred mainly in specific outbreak contexts in one unit with influenza virus identification. In most cases, for lower tract infections, chest radiographs were difficult to obtain and pneumonia was not specifically identified. Bacterial pneumonia secondary to influenza is also frequent and rapid diagnostic tests were not performed for each infected patient. Due to this context, ILI and ILI (LRTI/ILI) were grouped together in the results to limit the risks of errors.

Influenza virus identification
Rapid tests were available in each site in order to identify the influenza virus in the units with and without the clinical infection surveillance. The rapid immunoaassay diagnosis tests for detection of influenza were: QuickVue® from 2004 to 2007 (without the virus type A or B) and Clearview® Exact Influenza A and B from 2007 to 2014 (with the differentiation of influenza A and B virus). The tests were essentially prescribed to identify the epidemiological context and given the low sensitivity of rapid tests, they were not used any longer once the control measures had been implemented and had enabled to control the influenza outbreak. Positive virus identification was counted once the first week of the outbreak when the clusters lasted several weeks.

Control measures and alerts
Preventive measures (hand hygiene, gown and gloves, eye protection, environmental cleaning) around the cases included “contact” precautions (highly symptomatic patients: gown and gloves for all interactions) and “droplet” precautions (mask (Type II, European Norm 14683:2005) donned upon room entry) for at least 5 to 7 days according to clinical symptomatology and particularly cough and fever [7]. Patients on Droplet Precautions who went outside of the room should wear a mask if tolerated. The measures were supported by information about the flu to the health workers (transmission, treatment, risks) with an alert of the hospital manager. Airing the rooms and the unit (10 min three times a day) was recommended and infected staffs were sent home for a minimum of 5 days. Hand hygiene was reinforced and the events were suspended except the assembly of noninfected patients during meals.

Following the detection of the first case in one unit, the daily monitoring of the temperature of all the patients and residents was also implemented in order to identify the cases quickly in the concerned unit. Moreover, cluster of 5 respiratory tract infections in 4 days had to be declared to the French health authorities [8]. Every week, a news bulletin was sent to nursing homes with information about the flu epidemic and when influenza clusters were observed in one nursing home, alerts were transmitted to the other institutions.

Prophylaxis treatments for the patients
In nursing homes, patients were at high risk of developing complications from influenza and post-exposure chemoprophylaxis (PEP) could be recommended [9]. Three types of practices have been developed for this chemoprophylaxis: no prescription, targeted prescriptions (T) and prescription for a large number (L) of residents. For T, prescriptions were considered only for close contacts of a confirmed influenza case (roommates, residents sharing the same table for the meals) and non-vaccinate people in the unit. For the second indication (L), decision of the prescriptions concerned all the residents in one infected unit or site. In addition to influenza confirmed cases, other criteria (difficulties to define case close contacts and to control the episode with increasing number of cases) should be taken into account to make the final decision about large prescriptions [10]. In this work, clinical severity, death related to the influenza infections and national information about a significant decrease of the trivalent influenza vaccine effectiveness were also three factors used to decide or not the large prescription. The protocol to prescribe the PEP was oseltamivir 75 mg during 10 days with reduction of the treatment dosage for patients with creatinine clearance of: > 30 to 60 mL per min, 30 mg once daily; > 10 to 30 per min, 30 mg once every other day; ≤ 10 mL per min, no treatment or chemoprophylaxis dosing recommendations. The dose adjustments for patients with end-stage renal disease (ESRD) were: hemodialysis (30 mg after every second hemodialysis session) or peritoneal dialysis (30 mg once weekly).

The French Haut Conseil de la Santé Publique proposed in 2012 a second protocol in PEP with curative dosage (not indicated in the summary of product characteristics but with high benefit-risk
assessment for people with close contacts and at high risk of complications from influenza: lack of antiviral effectiveness and emergence of resistant influenza strains with PEP dosage: oseltamivir 75 mg twice a day during 5 days with reduction of the treatment dosage for patients with creatinine clearance of: > 30 to 60 mL per min, 30 mg twice a day; > 10 to 30 per min, 30 mg once daily; < 10 mL per min, no treatment or chemoprophylaxis dosing recommendations. For ESRD, the dose adjustments were: hemodialysis (30 mg after each hemodialysis session) or peritoneal dialysis (30 mg single dose). In our study, this protocol could be used in targeted prescriptions for close and long contacts (roommates of an infected residents) and was not applied in the large prophylaxis. The 10 day duration was the most important parameter in the case of an institution in order to have a long preventive effect. Nevertheless, a curative dosage was prescribed if a resident with PEP developed ILI in order to limit the emergence of resistant influenza strains and due to possible lack of antiviral effectiveness with this PEP dosage.

**Monitoring and data analysis**

Resident-day (days that a resident lived in the home) was the unit used to calculate the respiratory tract infection incidence. For each week, incidences of infection were calculated as the number of infections per 1000 resident-days (rd). Seasonal influenza impact in the general population (2004-2013) was based on national GROG network (Regional Flu Observation Groups) surveillance data [11,12].

Two indicators for the clinical infection surveillance in the nursing homes were used to evaluate the RTI impacts during the national epidemic period (NEP) and during the period outside the community influenza activity (POIA). First, total numbers of LRTI/ILI and clusters (superior or equal to 5 LRTI/ILI per week) were recorded. Secondly, LRTI/ILI per 1000 resident-days and clusters per 10,000 resident-days were calculated.

For virus identifications, numbers of NH with at least one influenza identification were recorded and the percentages of NH with influenza identifications were calculated. The infection control measures were specified: only hygiene measures, hygiene measures with targeted oseltamivir prophylaxis or hygiene measures with large oseltamivir prophylaxis.

The dynamics of the RTI were monitored with 3 indicators: weeks during the NEP and the POIA, weeks in one site with LRTI/ILI cluster (≥ 5 infections) and virus identifications with the prevention measures.

Fisher’s Exact Test was performed to compare the percentages. Differences were considered as significant with \( P \leq 0.05 \). Statistical analyses were performed using software R for Mas OS X version 1.4.0.

**Results**

The study of the different indicators for the 10 surveillance periods is in **table I**. For the first period (2004-2005), the number of beds included in the infection surveillance (IS) was less than 500. For the following periods and because of the results of the first year observations, all the sites included beds in the IS except one for the 2008-2009 surveillance. The participation rates increased during the 10 years study to reach 100\% in 2010-2011. Seasonal resident influenza vaccination rates (%) did not vary over the surveillance periods. For the health workers, vaccination rate decrease was observed after the 2008-2009 period. For the results of the infection surveillance during the NEP, the highest LRTI/ILI rates were observed during the surveillance periods 2004-2005, 2008-2009, 2011-2012 and 2012-2013 with similar values (respectively 3.8, 3.3, 3.8 and 3.5 infections/1000 resident-days). For the other periods (2005-2006, 2006-2007, 2007-2008, 2009-2010, 2010-2011 and 2013-2014), LRTI/ILI rates ranged between 1.1 and 2.6 LRTI/ILI per 1000 resident-days. Thirty influenza virus identifications have been reported in the sites during the NEP. Influenza viruses were identified more frequently during the periods with the highest incidence rates (2004-2005, 2008-2009, 2011-2012 and 2012-2013). For the results of the infection surveillance outside the influenza national epidemic periods, LRTI/ILI rates were close to each other with low values comprised between 1.0 and 1.6. The rates of RTI clusters were inferior or equal to 0.9. Seven influenza identifications occurred outside the national epidemics: five between the weeks 46 and 15 and two outside this surveillance period (weeks 16 and 17).

For the entire study, thirty-seven influenza virus identifications have been reported in the sites corresponding to a mean value of 0.34 identifications per year and per nursing home. The frequencies for the different nursing homes were (number of identifications (number of the site)): 3 (1), 4 (2), 6 (3), 4 (4), 5 (5), 3 (6), 4 (7), 1 (8), 2 (9), 4 (10), 1 (11). All the sites identified influenza virus at least one time in the 10 surveillance periods. The percentages of sites with influenza identifications were statistically different according to the surveillance periods: 0 to 63.7\%(\ P < 0.001). For the chemoprophylaxis, 18 episodes were controlled without preventive treatments, 8 with a targeted prescription and 11 with treatment for a large number of residents.

The descriptive dynamics of the indicators were summarized in **figure 1**. Seasonal variability was well described with higher impacts (clusters and virus identifications) for the 2004-2005, 2008-2009, 2011-2012 and 2012-2013 surveillance during the NEP.

During these epidemic periods, the study showed time grouped impacts for 3 seasonal outbreaks (2008-2009, 2011-12, 2012-2013) and a more spread effect for the 2004-2005 surveillance. Two periods were with limited clusters (2005-2006 and 2009-2010) and no virus identification. On the other hand, no large variability was showed during the other influenza periods for the 2006-2007, 2007-2008, 2010-2011 and 2013-2014 surveillances.
### Table I

Respiratory tract infections surveillance in eleven nursing homes from 2004 to 2014

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<tbody>
<tr>
<td><strong>Information about the nursing homes and the included units</strong></td>
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<tr>
<td>Number of sites included in the study (total number of beds)</td>
<td>11 (956)</td>
<td>11 (956)</td>
<td>11 (956)</td>
<td>11 (954)</td>
<td>11 (936)</td>
<td>11 (900)</td>
<td>11 (884)</td>
<td>11 (885)</td>
<td>11 (882)</td>
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<tr>
<td>Mean number of beds/site</td>
<td>86.9</td>
<td>86.9</td>
<td>86.9</td>
<td>86.7</td>
<td>85.1</td>
<td>81.8</td>
<td>80.4</td>
<td>80.5</td>
<td>80.2</td>
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<tr>
<td>Number of sites and beds included in the infection surveillance (IS)</td>
<td>8 (448)</td>
<td>11 (690)</td>
<td>11 (690)</td>
<td>11 (552)</td>
<td>10 (523)</td>
<td>11 (644)</td>
<td>11 (664)</td>
<td>11 (719)</td>
<td>11 (720)</td>
<td>11 (707)</td>
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<tr>
<td>Mean number of beds included in the IS</td>
<td>56</td>
<td>62.7</td>
<td>62.7</td>
<td>50.2</td>
<td>52.3</td>
<td>58.6</td>
<td>60.4</td>
<td>65.4</td>
<td>65.5</td>
<td>64.3</td>
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<tr>
<td>Number of resident-days included (NRD)</td>
<td>72,128</td>
<td>106,260</td>
<td>106,260</td>
<td>85,008</td>
<td>84,203</td>
<td>99,176</td>
<td>102,256</td>
<td>110,726</td>
<td>110,880</td>
<td>108,878</td>
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<tr>
<td>Participation rates (%) (number of resident-days with surveillance/NRD)</td>
<td>61.2</td>
<td>80.0</td>
<td>89.8</td>
<td>94.6</td>
<td>98.9</td>
<td>99.0</td>
<td>100.0</td>
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<tr>
<td>Resident mean age (years) in the units included in the IS</td>
<td>84.4</td>
<td>84.0</td>
<td>83.9</td>
<td>83.6</td>
<td>83.4</td>
<td>83.8</td>
<td>84.1</td>
<td>85.6</td>
<td>85.4</td>
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<tr>
<td>Seasonal resident influenza vaccination mean rates in the sites (%)</td>
<td>91.7</td>
<td>89.5</td>
<td>90.9</td>
<td>85.2</td>
<td>90.2</td>
<td>89.7</td>
<td>91.1</td>
<td>92.8</td>
<td>89.9</td>
<td>89.7</td>
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<tr>
<td>Pandemic resident influenza vaccination mean rates in the sites (%)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>66.9</td>
<td>–</td>
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<tr>
<td>Seasonal worker influenza vaccination mean rates in the sites (%)</td>
<td>21.6</td>
<td>37.6</td>
<td>22.5</td>
<td>27.7</td>
<td>33.8</td>
<td>17.3</td>
<td>9.5</td>
<td>10.2</td>
<td>9.8</td>
<td>9.6</td>
</tr>
<tr>
<td>Pandemic worker influenza vaccination mean rates in the sites (%)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>7.1</td>
<td>–</td>
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<td><strong>Clinical infection surveillance during the National Epidemic Periods (NEP)</strong></td>
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<tr>
<td>National epidemic periods (Weeks)</td>
<td>3 to 12</td>
<td>3 to 11</td>
<td>4 to 8</td>
<td>2 to 8</td>
<td>50 to 7</td>
<td>47 to 1</td>
<td>51 to 8</td>
<td>5 to 9</td>
<td>51 to 9</td>
<td>4 to 9</td>
</tr>
<tr>
<td>Number of resident-days included</td>
<td>20,692</td>
<td>37,996</td>
<td>21,574</td>
<td>25,725</td>
<td>36,743</td>
<td>36,064</td>
<td>46,480</td>
<td>25,165</td>
<td>55,440</td>
<td>29,694</td>
</tr>
<tr>
<td>LRTI/ILI/1000 resident-days (number of LRTI/ILI)</td>
<td>3.8 (78)</td>
<td>1.2 (45)</td>
<td>1.8 (38)</td>
<td>1.9 (49)</td>
<td>3.3 (122)</td>
<td>1.1 (41)</td>
<td>1.6 (75)</td>
<td>3.8 (95)</td>
<td>3.5 (192)</td>
<td>2.6 (76)</td>
</tr>
</tbody>
</table>

Influenza virus was never observed before the NEP, but seven times the virus has been identified after this NEP (18.9% of the identifications). The infection control measures with or without prophylaxis (T or L) were different from one season to another with occasional use of the L prophylaxis.

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<tbody>
<tr>
<td>LRTI/ILI clusters/10,000 resident-days (number of clusters)¹</td>
<td>2.4 (5)</td>
<td>0.0 (0)</td>
<td>0.5 (1)</td>
<td>0.8 (2)</td>
<td>1.9 (7)</td>
<td>0.0 (0)</td>
<td>0.6 (3)</td>
<td>2.8 (7)</td>
<td>1.4 (8)</td>
<td>1.3 (4)</td>
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<td>Clinical infection surveillance during the Period Outside the community Influenza Activity (POIA)</td>
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<tr>
<td>Number of resident-days included</td>
<td>23,436</td>
<td>47,054</td>
<td>73,829</td>
<td>54,663</td>
<td>42,931</td>
<td>66,542</td>
<td>55,776</td>
<td>85,561</td>
<td>55,440</td>
<td>79,184</td>
</tr>
<tr>
<td>LRTI/ILI/1000 resident-days (Number of LRTI/ILI)</td>
<td>1.6 (38)</td>
<td>1.6 (73)</td>
<td>1.2 (87)</td>
<td>1.1 (58)</td>
<td>1.1 (48)</td>
<td>1.5 (98)</td>
<td>1.0 (58)</td>
<td>1.6 (138)</td>
<td>1.3 (74)</td>
<td>1.6 (129)</td>
</tr>
<tr>
<td>LRTI/ILI clusters/10,000 resident-days (number of clusters)¹</td>
<td>0.9 (2)</td>
<td>0.2 (1)</td>
<td>0.4 (3)</td>
<td>0.2 (1)</td>
<td>0.2 (1)</td>
<td>0.2 (1)</td>
<td>0.8 (7)</td>
<td>0.2 (1)</td>
<td>0.8 (6)</td>
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<td>Virus identifications</td>
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<tr>
<td>Number of sites with virus identifications during the NEP²</td>
<td>7</td>
<td>0</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>7</td>
<td>0</td>
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<tr>
<td>Number of sites with virus identifications during the POIA²</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Virus type A, B or Not Determined: respective numbers of identifications</td>
<td>4, 1, 3</td>
<td>0, 0, 0</td>
<td>0, 0, 3</td>
<td>0, 4, 0</td>
<td>6, 0, 0</td>
<td>0, 0, 3</td>
<td>0, 0, 0</td>
<td>1, 0, 0</td>
<td>6, 0, 0</td>
<td>5, 2, 0</td>
</tr>
<tr>
<td>% of sites with influenza identifications² (number of sites)</td>
<td>63.6 (7)</td>
<td>0.0 (0)</td>
<td>27.3 (3)</td>
<td>36.4 (4)</td>
<td>54.5 (6)</td>
<td>0.0 (0)</td>
<td>9.1 (1)</td>
<td>54.5 (6)</td>
<td>63.6 (7)</td>
<td>18.2 (2)</td>
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<td>Infection control measures</td>
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<td>Hygiene measures (H)</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
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<tr>
<td>H and specific prophylaxis with oseltamivir⁴</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
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<td>1</td>
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<tr>
<td>H and large prophylaxis with oseltamivir⁴</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>5</td>
<td>2</td>
<td>1</td>
</tr>
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</table>

¹ > 5 LRTI/ILI per week.
²At least one influenza identification during the surveillance.
³One site was with two different identifications.
⁴Close contacts of a confirmed influenza case (roommates, residents sharing the same table for the meals) and non vaccinated people in the unit.
⁵Indications for all the residents in one affected unit or site.

Discussion
The local surveillance network in collaboration with the regional influenza monitoring groups (Groupes Régionaux d’Observation de la Grippe (GROG)) emphasized the role of RTI surveillance in order to develop information, quick alerts, influenza testing and
rapid prevention control measures \[13,14\]. After a ten-year surveillance, the experience showed important seasonal variability and the necessity of developing descriptive model of RTI in nursing homes to improve information, alerts and prevention control measure implementation.

Prevention strategies for seasonal influenza are necessary in nursing homes. Vaccination for residents and health care workers (HCWs) is the most important measure in preventing influenza in nursing homes \[15,16\]. Despite a campaign for HCWs, we observed limited vaccination coverage. After the controversies about the 2009 pandemic vaccine, the vaccination rates became lower with few vaccinations among the health care workers. Nevertheless, the impact was different among the residents with the same percentage of vaccination before and after the 2009 pandemic.

For the infection surveillance, this work showed that the NEP is a high-risk period for the nursing homes. Significant variations between the 10 surveillance periods and particularly during four national influenza epidemics (2004–2005, 2008–2009, 2011–2012 and 2012–2013) have been observed with higher infection, cluster and influenza identification rates. Moreover, influenza identifications after the NEP were common. The predominance of A(H3N2) influenza virus during 2004–2005, 2008–2009 and 2011–2012 national epidemics could be one of the factors that may partly explain these observations. Indeed, A(H3N2) virus is known to have a greater impact among the old people \[17,18\]. In 2012–2013, three predominant viruses co-circulated, however 5 viral identifications on 7 were the type A. Another point was a significant decrease of the trivalent influenza vaccine effectiveness in 2011/12, as compared to the previous season \[19\]. On the contrary, the impact was less important with some periods with no virus identifications and low infection and cluster rates. Thus, few people aged over 64 were affected by the pandemic outbreak and the indicators were the lowest of the surveillance during this NEP \[20\].

For the prevention, hygiene control measures and targeted prescriptions of preventive treatments with oseltamivir were used to control most of the episodes (26 out of 37). Prophylaxis for a large number of residents was considered for episodes (11 outbreaks) with severe infections or difficulties to control the episodes. In 2011-2012 outbreak surveillance, the information about the significant decrease of the trivalent influenza vaccine effectiveness was also a parameter used by the doctors of the residents to make about the prescriptions of the prophylaxis.

The study of the outbreak dynamics highlighted the seasonal variations and the need to adapt infection control. For the prevention outside the influenza national epidemic periods and for the influenza epidemics with a low impact, practices in the nursing homes allowed a good control of the episodes with low infections and clusters rates. However, when the influenza impact was high as in 2004-2005, 2008-2009, 2011-2012 and 2012-2013, control of the outbreaks was more difficult. The dynamics of the indicators showed at the local level that for the last 3 influenza epidemics, the nursing homes were affected in a large proportion at the same time. When influenza clusters were observed in one nursing home, alerts were transmitted to the other institutions. Nevertheless, the outbreaks occurred in numerous nursing homes despite the alerts and the surveillance. Nursing homes are as much a place to live for the residents as an environment for providing medical care and outbreak management is very complex with possible interactions of virus epidemiology, architecture/organization parameters, infection control measures and individual risk factors, especially the non compliance with the protocol and the individual hygiene measures. Indeed, individual risk factors are difficult to evaluate with a possible high impact in the spread of the outbreaks.

In such context, improving the compliance to infection control measures is essential: early detection and isolation of sporadic cases; personal hygiene measures (HCWs, residents or patients, visitors); and compliance with the protocols.
Moreover, variation of the impacts according to the seasonal influenza epidemiology with higher risk for some periods is knowledge to develop for health care workers, families and visitors with educational program in order to also improve adherence to infection control practices.

At the local level in each institution, organization and architectural parameters and previous experiences into RTI outbreak management have to be taken into account. For the first one, if the events were always suspended during the outbreaks, it is not possible in some institutions to stop assembly of noninfected patients during meals and in the rest areas with television with potential transmission and spreading. In institutions with more than 100 beds, implementation of meal service in rooms is very difficult and particularly in outbreak period with less employees due to possible influenza transmission to HCWs. Very often, residents need care and help during the meals and collective dining room was the only possibility to have a proper surveillance. The architecture is the second parameter with double rooms and a large collective dining room for several units. In these contexts (infection control measures around the roommates and transmision risk to the all institution in the collective dining room), the outbreak control is difficult.

The last point to take into account in the outbreak management is the experience developed through the successive episodes of RTI. Each institution has to keep precise details of the episodes (number of infected patients, mortality . . . ) and the difficulties to prevent and control them (prevention measures and identified limitations to develop them: lack of HCWs, organization, architecture).

When an outbreak occurs in one nursing home, all these information are essential for the outbreak management and particularly to develop appropriate infection control measures. If one or more parameters are not in favour of the outbreak control, the use of large prophylaxis could be evaluated to determine the potential impact in the prevention.

Indeed, in such context with frail residents, infection control is imperative and prophylaxis could be an alternative to complete hygiene measures. Nevertheless, a more systematic use of this large prophylaxis has to be more studied to precise its interest and to determine its indications and particularly in real life situations [21,22].

In complement, national epidemiological information is essential to complete the local surveillance: significant decrease of the vaccine efficiency, increase in the nursing homes of the numbers of RTI clusters or of the influenza identifications, excess mortality in the age group > 65 years. The local indicators have to be interpreted by taking into account these national data and the hygiene team could adapt alerts and better define the risk level in order to improve the HCWs vigilance leading to stricter respect of the recommendations (testing, infection control, information of the health care workers, families and visitors, prophylaxis).

Information about seasonal variability and spatio-temporal pattern of RTI during the NEP is essential for the hygiene team and the nursing homes in order to help the health care workers and the visitors to understand the risk for the residents and then to improve the implementation of the control and prevention measures.

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References

Influenza prevention in nursing homes: Great significance of seasonal variability and spatio-temporal pattern


