

# **Influenza outbreak in a well-vaccinated nursing home population in Belgium**

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**Running title: Influenza outbreak in a nursing home in Belgium.**

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## **Abstract**

Elderly people in nursing home communities are vulnerable to contagious infections, including the influenza virus. Systematic anti-influenza vaccination is an important preventive measure; however, vaccination does not provide absolute protection. We report an outbreak of influenza A infection in a well-vaccinated nursing home population. Several factors can facilitate the occurrence of this type of outbreak. This report mainly addresses the discrepancy between the circulating viral strain and strains present in the recommended vaccine.

## **Introduction**

In the elderly patient, influenza is a severe respiratory affliction that is responsible for substantial morbidity and mortality related to bacterial superinfection and acute decompensation. The risks of influenza are even more severe for the elderly patient who has an underlying disease and/or is institutionalised<sup>1</sup>.

## **Materials and Methods**

The described outbreak occurred in a residence home for elderly people (Maison de Repos pour Personnes Agées; rusthuis) in a rural area of Belgium. The facility accommodates 62 residents aged 50–100 years (41 women, 21 men; average age, 80.9 ±9.5 years). Residents are under the care of their own, freely selected general practitioner (GP). There is no coordinating doctor because the establishment does not have the status of nursing home (in Belgium: MRS Maison de Repos et de Soins,; verzorgingstehuis). The 33 GPs who share the medical care of the residents carried out influenza vaccination during the autumn of 2004, using vaccines according to WHO recommendations. At the beginning of December, the vaccination rate of residents exceeded 98%, and only one resident had not received a vaccine. None of the 26 members of the institutional staff was vaccinated against influenza.

Between March 9 and 21, 2005, 32 (23 women and 9 men) of the 62 residents showed a common symptomatology: hyperthermia, asthenia, and cough. Moreover, 39% of the patients presented expectorations, 32% had rhinorrhea, 29% had cephalgia, and 9% had digestive symptoms. Six people died from respiratory insufficiency. Table 1 shows the chronology of occurrence of the diseases in this establishment and the age and gender of the affected residents and deceased patients.

The incidence of this outbreak among residents was 51.6%, and the death rate of affected patients was 18.7%. Whereas the average age of the residents was 80.9 years, that of

the affected population was  $81.2 \pm 10.5$  years, and that of the deceased patients was  $88.1 \pm 5.2$  years. Among the 26 members of the staff, 5 presented comparable symptoms, as did a GP a short time after caring for an infected patient. Each patient benefited from the care of their own GP, who was summoned by the personnel. No GP conducted nasopharyngeal smears. There was no concerted action regarding the diagnosis during the outbreak. The influenza diagnosis was mentioned by only one GP, who, on the seventh day of the outbreak (March 15), initiated oseltamivir as treatment (75 mg, 2/day) for two residents and as prophylaxis (75 mg, 1/day) for three other patients. The diagnosis of bronchitis was mentioned by GPs of 13 patients. All of the infected patients who presented with fever and cough were treated with antibiotics.

Three patients were hospitalised and died. The hospitalisation reports mentioned unfavourable evolution of a pulmonary infection, without further precision. The affected people were confined to their rooms, and, by the initiative of the head nurse, the decision was made to stop all community meals on March 17–18. No declaration to the health authorities was made by the concerned GPs, hospital doctors, or residence home management or personnel. No comparable outbreak was reported in the area, at least to the knowledge of the authors and the 19 involved GPs.

Two of the authors, GPs who treated affected patients, initiated an etiologic investigation a posteriori. With the joint assent of the patients (or their representatives) and GPs, two blood samples were obtained from 21 of the 32 affected patients on March 31 and April 16. The samples were analysed at the laboratory of microbiology services at the CHU of Liege (Prof. P. De Mol). At that time after the outbreak, only a serologic diagnosis a posteriori was possible. A serologic response to the following respiratory pathogens, including pathogens that were potentially responsible for outbreaks, was investigated by an immuno-enzymatic method: influenza A and B (IgA and IgG), parainfluenza (IgA and IgG),

adenovirus (IgA and IgG), RSV (IgM), *Chlamydia pneumoniae* (IgA and IgG - MEDAK - ELISA), and *Mycoplasma pneumoniae* (IgM and IgG – ELISA-VIRION). *Legionella* (total Ig – I.F.I.) was investigated by immunofluorescence. For each patient, the first serum sample was taken 10–21 days after the beginning of the outbreak, and the second sample was obtained 2 weeks later. A complementary specific serologic analysis of various strains of the influenza virus was carried out at the laboratory of the National Centre of Influenza in Rotterdam. The available sera from 18 patients were analysed by the method of inhibition of haemagglutination.

## **Resultats**

### *Serologic tests for various respiratory pathogenic agents*

All samples were positive for anti-influenza A IgG (Elisa-IBL), with an average IgG titre of 903 u/ml. For 16 patients, two or several consecutive sera were titrated, and six "influenza A" seroconversions were observed. For nine other patients, the titre of the first serum was already high. These results support an outbreak of recent influenza A infections. However, the presence of anti-influenza IgA was never detected. No specific immune response was detected against the other infectious agents.

### *Complementary serologic "influenza" tests*

Specific serologic tests of influenza A and B virus that were carried out by the reference method (inhibition of haemagglutination) showed high titres against the strain influenza A New York, X-157 (H3N2) for 12 of the 17 evaluated patients and two of the three staff members. Of the 13 patients for whom several consecutive sera were titrated, seven seroconversions were observed. The major serologic answer to this strain of laboratory influenza A indicated a response to the related circulating strain A/California/7/2004 (H3N2).

## **Discussion**

The present observation shows once again that the nursing home population is not safe from an influenza outbreak, even if all residents are well vaccinated<sup>2,3</sup>. The effectiveness of a seasonal vaccine depends on the correspondence of its antigenic composition with circulating strains. The time between vaccination and viral contact is important: after a 6-month time lapse, vaccine immunity against influenza erodes and loses its protective effectiveness<sup>1,2,3</sup>.

For this reason, the Centres for Diseases Control and Prevention (U.S.A.) does not recommend vaccination before October because of the loss of immunity that can be observed in the spring<sup>4</sup>. Moreover, in the elderly person, other elements play substantial roles in immunity, such as the reduced capacity of immunological response with age, lack of physical activity, and nutritional deficits<sup>1</sup>.

The occurrence of the outbreak at the end of the influenza season, several months after vaccination of the residents (6 months for the first residents vaccinated in September), the absence of vaccine coverage of the nursing personnel, and institutional living could have favoured the occurrence of this outbreak<sup>5</sup>. However, the complementary serologic results indicated that the strain responsible for this outbreak, which was influenza A/California/7/2004 (H3N2)-like, was distinct from the vaccine strains recommended by the World Health Organisation and was not included in the vaccine administered in 2004–2005. Consequently, acquired vaccine protection was likely very low.

The influenza vaccination guidelines were unequally respected in this nursing home. The vaccination rate of the residents was optimal (98%), according to the literature<sup>6</sup>; on the other hand, the total absence of vaccination of the nursing personnel (0%) is a matter of concern. Van Ranst showed that in Flanders in 2002, the vaccine coverage of health professionals was rather poor (~20%)<sup>7</sup>. Canadian and American publications have reported

vaccine coverage of 36–37% of health care professionals. Vaccine efficacy in the prevention of deaths in nursing home populations has been proven if the health care professional vaccination rate reaches 50–60%<sup>8,9</sup>. In the situation we described, the virus may have been introduced by a visitor or a staff member. The horizontal transmission of these flu infections between residents could have been enhanced by the activities of the five staff members who developed the disease. Indeed, some of them continued their professional occupation even after they presented symptoms.

The attack and death rates were 51.6% and 18.7%, respectively. Publications describing influenza outbreaks in long-stay institutions for elderly people have reported attack rates of 10–70% and death rates that reach 50%<sup>7,8,10,11,12,13</sup>. However, it is difficult to compare observations relating to different circumstances of care and very different elderly populations. Nevertheless, the extent of the outbreak poses questions regarding the way in which this outbreak in a elderly community was managed, mainly about the absence of coordination between health care workers and GPs. This lack of collaboration can explain the absence of a collective diagnosis and, consequently, the lack of appropriate treatment and adequate hygienic and prophylactic measures.

The diagnosis of influenza solely on the basis of clinical signs remains difficult<sup>14,15,16</sup>. Our observation confirms this fact: only one GP administered an antiviral treatment, mentioning an influenza diagnosis. No doctor used viral culture, PCR analysis, or antigen detection from nasopharyngeal smears, the effectiveness of which is well proven<sup>17,18,19</sup>. These diagnostic interventions are cost-effective in long-term care facilities and are mainly recommended in the case of outbreaks of viral infection in a closed community<sup>20</sup> but not in every individual case of influenza. The effectiveness of oseltamivir treatment in similar circumstances is no longer questioned<sup>20,21,22,23,24</sup>. At that time of the year the GPs probably did not expect to be confronted with an influenza outbreak; however, the weekly bulletin of

the Belgian National Centre of Influenza of the Scientific Institute of Public Health clearly mentioned cases of influenza infection at this time<sup>25</sup>. GPs should remember that influenza virus can cause outbreaks throughout the year, even in the summer. The use of neuraminidase inhibitors for treatment and for pre- and post-exposure prophylaxis could have helped to confine this outbreak<sup>23</sup>.

With regard to the published guidelines, the following preventive measures within the institution are recommended to control the outbreak: isolation of patients, restricted visits, the use of masks, disinfection of the hands, strict adherence to measures of environmental hygiene, rapid ousting of the affected staff members, and discontinuation of all collective activities<sup>26,27,28</sup>. The Belgian legislation related to MRS entrusts a coordinating GP with responsibilities regarding the management of outbreaks. These legal provisions are not applicable to MRPA, but the absence of management and the consequences of the outbreak described herein demonstrate the importance of a coordinating doctor in this type of institution. Influenza outbreak appears on the list of notifiable diseases in Belgium<sup>29</sup>. Thus, the health authorities should have been contacted because they are the only ones who are legally entitled to manage an outbreak situation of this type.

## **Conclusions**

We have described the effects of a community outbreak, which was most likely due to an influenza A virus similar to A/California/7/2004 (H3N2), in a well-vaccinated residence home population. Whereas the international community is preparing for a possible pandemic related to H5N1 influenza virus, residence homes for elderly people in Belgium are likely unprepared to handle this type of crisis. Our observations indicate the need for targeted training of GPs about influenza. This training should emphasize topics such as clinical signs, methods of rapid diagnosis (PCR detection and antigen detection), prophylactic treatments, and preventive



measures. It is also important to remind GPs that vaccination does not provide total protection due to a possible incomplete match between the vaccine strains and the circulating strains. Also, the protective effect of influenza vaccine erodes 6 months after vaccination, and the immunization response of elderly people is often low. The present report demonstrated once again that an influenza outbreak can occur at the end of the “influenza season”. In fact, influenza infections can occur throughout the year, even in the summer. The roles of the GP with regard to community health in Belgium, and in particular in residence homes, certainly need to be specified.

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**Table 1.** Dates when flu symptoms occurred. The numbers correspond to the ages of the affected residents. These figures are underlined for female patients, and deceased patients are indicated in bold.

Date													
March	9	10	11	12	13	14	15	16	17	18	19	20	21
	<u>87</u>	<u>79</u>	<u>90</u>		<u>96</u>	<u>84</u>	<u>75</u>	82	<u>82</u>	<u>85</u>	<u>80</u>		<u>81</u>
	<b>84</b>		<u>88</u>		71	<u>86</u>	<u>72</u>	<u>84</u>	85	<b>87</b>			
			<u>92</u>		<u>82</u>	50	<u>59</u>	<u>81</u>	<u>91</u>				
							67	<u>62</u>	<u>93</u>				
							<u>86</u>		95				
							81						
							<u>83</u>						