

# Vaccination of health-care workers against influenza: our obligation to protect patients

Helena C. Maltezos,<sup>a</sup> Athanassios Tsakris<sup>b</sup>

<sup>a</sup>Department for Interventions in Health-Care Facilities, Hellenic Centre for Diseases Control and Prevention, Athens, Greece. <sup>b</sup>Department of Microbiology, Medical School, University of Athens, Athens, Greece.

Correspondence: Helena C. Maltezos, Department for Interventions in Health-Care Facilities, Hellenic Centre for Disease Control and Prevention, 3-5 Agrafon Street, Athens 15123, Greece. E-mail: helen-maltezos@ath.forthnet.gr

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Nosocomial influenza poses a threat for specific groups of patients and is associated not only with the disruption of health-care services but also excess costs. Although vaccination of health-care workers (HCWs) has been recommended for almost three decades and constitutes the most convenient and effective means to prevent nosocomial transmission, vaccine uptake within this group remains unacceptably low worldwide. In regard to the pandemic influenza A H1N1, HCWs constitute a priority group for immunization. Nevertheless, low vaccination rates have been documented regarding the influenza pandemic and associated with the onset of nosocomial cases and outbreaks. HCWs, health-care

institutions, and public health bodies have the moral obligation to protect vulnerable patients and therefore weigh the benefits of mandatory vaccination. Key effective interventions, such as the education of HCWs concerning the benefits and safety of influenza vaccination, the reinforcement of on-site, free of charge vaccinations, and the use of mobile vaccination teams in conjunction with incentives, should be widely implemented.

**Keywords** Health-care workers, influenza, nosocomial, outbreak, pandemic, patients, safety, vaccination.

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Ὁφελείν ἢ μὴ βλάπτειν

First, do not harm

Hippocrates, Greek physician (460–377 BC)

## Introduction

It has been less than four decades that several fearful infectious diseases of the past have virtually disappeared or have come to be largely under control in developed countries, as a result of the broad implementation of vaccination programs.<sup>1</sup> Nowadays seasonal influenza is the most common vaccine-preventable illness in developed countries. In the United States alone, an average of 226 000 hospitalizations and 36 000 deaths occur each year in association with influenza epidemics.<sup>2</sup> Seasonal influenza is also associated with an estimated \$10·4 billion direct medical costs and \$87·1 billion total costs annually in the same country.<sup>3</sup>

Nosocomial seasonal influenza constitutes a serious risk among patients with underlying illnesses, the elderly, and neonates. Outbreaks have occurred in various health-care settings, with documented attack rates up to 54·8%,<sup>4</sup> fatality rates up to 25%,<sup>5</sup> closure rates up to 38·5%,<sup>6</sup> and notable excess costs.<sup>7</sup> Despite long-standing recommendations by public health authorities and the fact that the immuni-

zation of health-care workers (HCWs) has proven to be an effective and very convenient measure of preventing nosocomial influenza, vaccine coverage rarely exceeds 40% worldwide.<sup>2,5,8–16</sup> The sharp increase in amantadine resistance and the emergence of oseltamivir-resistant strains over the past few years<sup>17</sup> indicate that our means for interrupting influenza spread within health-care settings are limited. This is very important for the safety of both patients and employees and for the preservation of health-care infrastructure during the influenza seasons.

Apart from the seasonal influenza, a novel influenza A H1N1 virus emerged in North America in early 2009 and thereafter spread globally rapidly,<sup>18</sup> thus necessitating the declaration of an influenza pandemic by the World Health Organization (WHO) in 11 June 2009.<sup>19</sup> As of 1 August 2010, more than 214 countries have reported laboratory-confirmed cases to World Health Organization, which included at least 18 449 deaths.<sup>20</sup> In accordance with the WHO, the United States Centers for Disease Control and Prevention (CDC), and the European Union Health Security Committee recommendations, HCWs were considered a priority group for vaccination against the pandemic influenza H1N1.<sup>21,22</sup> Preliminary data, however, indicated low acceptance rates among HCWs,<sup>23–25</sup> with safety issues being

raised at the center of the debate against vaccination. As of mid-January 2010, estimated vaccination coverage among HCWs in the United States was 37.1% for the 2009 pandemic influenza A H1N1 and 61.9% for the seasonal influenza, while only 34.7% of HCWs reported having both vaccinations.<sup>26</sup> It is not yet known how this criticism and non-compliance to vaccination recommendations from HCWs globally affected the attitude of the general population toward the pandemic vaccines and thus possibly the course of the pandemic itself. This article reviews vaccination of HCWs against influenza.

## Nosocomial influenza

Nosocomial influenza is associated with considerable morbidity and mortality among specific groups of patients. Vivid examples of such patients for whom influenza infection poses a serious risk include a low-birthweight neonate in a neonatal intensive care unit (NICU),<sup>5</sup> an allogeneic bone marrow transplant recipient,<sup>27,28</sup> and a 68-year-old hospitalized patient with chronic obstructive pulmonary disease.<sup>8</sup> Nosocomial influenza can constitute a serious health threat for unvaccinated HCWs as well, as in the case of grossly obese or pregnant HCWs, who were working during the influenza A H1N1 pandemic.<sup>29,30</sup> Outbreaks with high attack rates among patients and HCWs have been documented in various health-care departments.<sup>5,31,32</sup> The influenza virus can spread in an extremely rapid rate within a closed setting and trigger outbreaks with an abrupt onset. Crowded wards, prolonged hospitalization, and staff shortage facilitate transmission.<sup>5</sup> The pandemic influenza A H1N1 virus has higher transmissibility, and outbreaks in health-care settings have been reported.<sup>33–37</sup> Such outbreaks caused by the novel A H1N1 influenza with severe morbidity and fatalities did occur and involved both HCWs and hospitalized patients with underlying diseases who should have been vaccinated. In such an outbreak in a Haematology Clinic in late December 2009, eight unvaccinated patients developed pandemic influenza H1N1, three of which succumbed to their infection. Unvaccinated HCWs with asymptomatic or mild infection might have introduced and transmitted the virus within the department. This event highlights the importance of vaccination of HCWs caring for such high-risk patients.<sup>38</sup>

Nosocomial influenza is commonly under-diagnosed, because many cases may remain largely unnoticed or may be attributed to the exacerbation of coexisting underlying conditions or to other respiratory viruses with overlapping seasonality.<sup>8</sup> A recent case-control study showed that the CDC's definition of an influenza-like illness was associated with poor (21%) sensitivity and a 50% positive predictive value among asthmatic hospitalized patients with influenza infection.<sup>39</sup> Influenza infection may not be suspected early

upon the admission of new patients, and furthermore, visitors may also have subclinical infections, thus constituting an obscure pool for the transmission of the infection to those hospitalized.<sup>8</sup> Adults with chronic diseases and young children may transmit the influenza virus for more than 1 week and immunocompromised patients for several weeks or even months.<sup>5,40,41</sup> Such patients may act concurrently as a substrate for the emergence of resistant strains and as a source of nosocomial transmission. Nevertheless, unvaccinated HCWs are indeed the main source of nosocomial influenza. In a review of six outbreaks in NICUs, it was the HCWs in all cases who were identified as the source of infection (Table 1).<sup>5</sup> HCWs may be infected either in the community setting or at their workplace and may continue working while contagious.<sup>9,42</sup>

Nosocomial influenza has a substantial impact on health-care costs because of additional diagnostic tests that are necessary, the administration of further treatment for the infection, and the extension of the patient's hospital stay.<sup>5</sup> In an outbreak that occurred in a large pediatric hospital over a 1-year period from 1989 to 1990, hospitalization was prolonged for a mean of 8 days with an excess cost of US\$ 7545 per case.<sup>7</sup> In a recent review, it was found that outbreaks caused by influenza or parainfluenza were associated with a 38.5% closure rate of wards, while influenza accounted for three of 10 closures of entire health-care facilities because of outbreaks.<sup>6</sup> Furthermore, excess absenteeism and disruption of health-care services are common during seasonal influenza epidemics. A survey in 221 health-care institutions in the United States revealed that 35% of hospitals face staff shortages, 28% bed shortages, and 43% ICU bed shortages during the peak of the influenza season.<sup>15</sup> An influenza pandemic simulation model

**Table 1.** Published influenza outbreaks in neonatal intensive care units and infant wards\*

Year/influenza type	Number of patients (% with underlying disease)	Attack rate (%)	Source of infection	Case fatality rate (%)
1997/A	4 (100)	27	ND	25
1976/A	8 (100)	ND	Parents/HCWs	0
1972/A	3 (100)	ND	HCWs	0
1999/A	30 (ND)	31.5	Parents/HCW	0
1998/A	19 (ND)	35	ND	5
1974/A + B	12 (91.5)	41	Patient/HCWs	0

ND, no data; HCW, health-care worker.

\*Adapted from: Maltezou HC, Drancourt M. Nosocomial influenza in children. *J Hosp Infect* 2003;55:83–91.

revealed that the secondary attack rate among unprotected HCWs was approximately 60% higher than that of non-HCW adults (54.3% versus 34.1%, respectively), which would result in substantial absenteeism and additional infection risks concerning their families.<sup>43</sup>

## Vaccination of HCWs against influenza

Annual vaccination of HCWs is an important preventive measure for nosocomial influenza and is consistently recommended by public health bodies worldwide.<sup>2,44,45</sup> The rationale behind this recommendation is to protect vulnerable patients from contracting influenza within a health-care setting. This is important, given the fact that persons at high-risk for influenza-related complications and even death (e.g. persons with underlying diseases, the elderly) tend to use health-care services more frequently than the general population and their vaccinations may often be ineffective. As influenza vaccination is recommended after the age of 6 months, hospitalized neonates and young infants cannot receive the vaccine. The same concept of herd immunity applies in this case as in other diseases. A recent Cochrane review on the effectiveness of neuraminidase inhibitors in preventing influenza complications in healthy adults states that current data do not provide any clear evidence of benefit from their administration.<sup>46</sup> This fact constitutes an additional reason necessitating vaccination of HCWs. Furthermore, given the emergence and predominance of influenza strains resistant to antiviral agents, vaccination emerges as the core preventive measure against influenza within health-care facilities.<sup>17</sup> Vaccination of HCWs is important not only in order to protect HCWs and their families from occupationally acquired influenza infections but also for the preservation of the essential health-care infrastructure during the winter months.

It is recommended that the employees of such health-care facilities who may come in contact with patients get vaccinated. This group includes all permanent, casual, and contract staff, trainees, volunteers, and students, who in fact constitute a group of people likely to transmit influenza to the hospitalized patients.<sup>2,8</sup> In seasons of vaccine shortage, the first to receive the vaccine should be HCWs working in the ICUs, NICUs, oncology, transplantation, pulmonary, cardiology, and geriatric departments, as well as the staff in the ERs because their work places them in the front line and in wards where the potential impact of nosocomial influenza is large. A recently published article showed that physicians and medical personnel had a higher infection rate than other employees, with those working in emergency departments exhibiting the highest infection rate.<sup>47</sup> For the 2010–2011 influenza season, it is also recommended that the personnel of the obstetric departments be vaccinated against pandemic influenza H1N1 virus. The

vaccine has been found to be 70–90% effective in healthy adults under 65 years, a category into which almost all HCWs fall into, and has a long-term safety profile.<sup>2,8</sup> Similar seroconversion rates, tolerance, and rates of adverse effects were found with pandemic (influenza H1N1) vaccines tested on healthy young or middle-aged adults.<sup>48,49</sup> The implementation of vaccination programs for HCWs has been associated with less cases of seasonal influenza, less cumulative days of influenza-like illness and absence from work,<sup>8,50–52</sup> and a reduction in the total number of nosocomial influenza cases.<sup>32,53</sup> On the other hand, outbreaks have occurred in the context of low coverage.<sup>33</sup> Vaccination in long-term care facilities reduces all-cause mortality, influenza-like illness, and hospitalizations among residents.<sup>10,54,55</sup> Carman *et al.*<sup>56</sup> found that with vaccination rates of even only 50.9% of HCWs, a substantial decrease that ranged from 22.4% to 13.6% was noted in the mortality rates of residents in long-term care facilities. In contrast to long-term facilities, the rapid turnover of patients in acute care facilities makes it difficult to estimate the exact impact of vaccination of HCWs in such a health-care setting.

Despite long-standing recommendations and the negligible time required to get vaccinated, thus acquiring protection for the entire influenza season, vaccination rates among HCWs remain low worldwide, ranging from 2% to 44%.<sup>2,5,10–16</sup> After more than a decade of efforts to increase vaccine uptake in the United States, vaccination rates were shown to be consistently low with data for the years 2005–2006 and 2006–2007 exhibiting 42% and 44% compliance rates, respectively.<sup>2</sup> Low vaccination rates (22.8% and 30.2%) were also reported in the only two existing studies that were conducted in primary health-care settings.<sup>57,58</sup> Optimal vaccination rates for HCWs, which aim to provide adequate patient protection against infection within the health-care setting, have been estimated at 90%.<sup>2</sup> Several studies have investigated the reasons behind non-compliance to vaccination recommendations in general. Misconceptions concerning vaccine effectiveness and safety, the belief that HCWs are not at risk of contacting influenza, fear of injections, a lack of leadership support, and unawareness regarding the recommendations for annual influenza vaccination appear as significant reasons (Table 2).<sup>4,35,59–66</sup> Similar barriers exist concerning the H1N1 pandemic vaccine. A strong association between the uptake of the seasonal influenza vaccine and the pandemic vaccine has been reported.<sup>24,67</sup> Overall, preliminary data indicate low acceptance rates of the pandemic vaccines among both HCWs and the general population.<sup>23–25,67,68</sup> Safety concerns, with Guillain-Barré syndrome (GBS) being noted as the most important reason for refusing vaccination, were the major barriers for vaccine acceptance during the 2009 H1N1 pandemic.<sup>25,67,69</sup> The association between

**Table 2.** Barriers to increase influenza vaccine uptake among health-care workers

Insufficient knowledge about nosocomial influenza
Misconceptions that they are not at risk for contacting influenza
Misconceptions about vaccine effectiveness
Misconceptions about vaccine safety
Misconception that the vaccine can cause influenza
Unawareness of the recommendations for annual influenza vaccination
Unavailable vaccine
Fear of injections
Lack of leadership support
Reliance on homeopathic agents

**Table 3.** Strategies associated with increased influenza vaccine uptake in health-care workers

On-site vaccination
Vaccination free of charge
Lectures about influenza and influenza vaccine
Organization of campaigns
Mobile vaccination teams
Use of declination forms
Implementation of a mandatory vaccination policy
Use of reminding systems
Incentive programs
Leadership support

the 1976 swine influenza vaccine and GBS has been well documented, with an attributable risk ranging from 4.9 to 11.7 cases per 1 million vaccinated adults in the United States.<sup>70</sup> Nevertheless, the estimated risk for vaccine-associated GBS is only one additional case per 1 million persons vaccinated against the seasonal influenza, compared with the annual incidence of GBS, which is 10–20 cases per 1 million adults.<sup>2</sup> It should be noted that, according to a recent study, the risk for GBS onset following a serologically confirmed influenza infection is 4–7 times higher.<sup>71</sup> Strategies that have been found to deliver increased influenza vaccination rates include on-site and free of charge administration, lectures concerning benefits and safety, the use of mobile teams, incentives and declination forms, and of course the implementation of mandatory vaccination programs (Table 3).<sup>1–3,53,60,63–66,72,73</sup> Unfortunately, efforts based solely on staff education have failed to achieve high and sustainable coverage rates. Higher vaccination rates have been recorded in small rural hospitals with a limited number of beds and employees,<sup>9,12</sup> thus underlying the difficulty in organizing vaccination campaigns in large tertiary-care hospitals. Their own protection is among the strongest motivations for HCWs influenza vaccination, while a history of influenza vaccination in the past is highly associated with increased rates of vaccination.<sup>8,59,65,66</sup>

### Is it time to rethink our policy about influenza vaccination among HCWs?

The evidence is clear: the majority of HCWs do not comply to the existing recommendations concerning influenza immunization. Voluntary vaccination programs have failed to achieve and sustain high coverage rates. This is almost universal and remains unchanged throughout the years. There is a need to rethink our policies toward vaccination of HCWs against influenza. Starting in 2005, the CDC recommended the use of signed declination forms for HCWs who refuse vaccination and also the use of HCWs' coverage

rates as a quality index for patient safety.<sup>51</sup> The use of declination forms improved vaccination rates, but failed to yield high compliance rates.<sup>9,74–76</sup> A mandatory vaccination policy is yet another option. The implementation of such a mandatory vaccination program in a large multi-hospital, health-care organization with approximately 26 000 employees during 2008–2009 was associated with a 98.4% coverage, which represents a raise by 43.4% and 26.5% in comparison with rates achieved in 2006 and 2007, respectively; the only exemptions made were reviewed by the occupational health services and were because of pre-determined medical contraindications and religious reasons.<sup>77</sup> In this study, high levels of acceptance of this type of approach to the vaccination issue were also recorded.<sup>77</sup> In the United States, the following professional organizations have called for mandatory influenza vaccination of HCWs: Association for Professionals in Infection Control and Epidemiology, Infectious Diseases Society of America, National Foundation for Infectious Diseases, Society for Healthcare Epidemiology of America, American Academy of Pediatrics, American College of Physicians, American Medical Association.

Acceptance of such a mandatory policy by HCWs is another issue. A recent survey among nurses in a health-care institution in the United States revealed that although 83% believed that influenza vaccination was in fact the preferred preventive method during influenza outbreaks compared with wearing a mask (3.7%) or taking antivirals (1%), only 56% were willing to accept a mandatory influenza vaccination policy.<sup>78</sup> It is interesting that mandatory vaccination of HCWs was supported by 24.3% of nursing home administrators in the Netherlands,<sup>79</sup> indicating that different attitudes toward a mandatory vaccination policy may exist across nations and communities, and within profession groups.

There is a need to consistently communicate to HCWs the benefits of influenza vaccination. The message that by taking five minutes to get vaccinated provides HCWs the most convenient and effective measure against nosocomial

influenza for the entire influenza season. The only option remaining for those who refuse vaccination should be the consistent use of masks during clinical practice for the duration of the influenza season. Public health bodies, health-care institutions, and HCWs themselves have the moral obligation to ensure a safe environment for both patients and employees. This obligation has been at the core of health-care since antiquity. HCWs refusing immunization could argue that the implementation of a mandatory vaccination scheme is in conflict with the ethical principle of personal autonomy, because the right to freely choose not to get vaccinated is suspended.<sup>80</sup> Nevertheless, we should take into account two other ethical principles that are equally important: non-maleficence (the moral obligation to not to harm others) and beneficence (the moral obligation to act for the benefit of others). In light of this aspect, one would argue that HCWs have the obligation to take all appropriate measures in order to protect their vulnerable patients and thus should get vaccinated. Such a measure ensures that HCWs are not the cause of significant morbidity and mortality.<sup>80</sup> Health-care institutions motivated by the fundamental principles of beneficence and non-maleficence are expected to implement policies that promote all reasonable measures to avoid transmitting communicable pathogens to their patients, including influenza.<sup>64,81</sup> The ethical justification for the immunization of HCWs against relatively rare diseases such as rubella, measles, mumps, varicella, and hepatitis B has already been recognized.<sup>75</sup> Mandatory influenza vaccination for HCWs is in the interest of public health and although such policies may appear to be in conflict with the principles of liberty, autonomy, and self-determination in the long run, the safety of the patient is and should remain an absolute priority for the health-care-providing community.

## Conclusion

The moral obligation to protect patients and ensure that they are treated in a safe environment has always been strong and constituted the core of clinical practice since the era of Hippocrates. Despite the fact that over the past few years enormous efforts have been made to reinforce infection control capacity and to improve employee and patient safety, nosocomial influenza remains a serious risk for specific groups of patients. Although vaccination of HCWs is the most easily applied and effective means for the prevention of nosocomial influenza, vaccine uptake rates remain suboptimal worldwide. Therefore, it is high time public health bodies and health-care institutions weight the benefits of mandatory vaccination and make it a part of everyday clinical practice. Communication and training of HCWs regarding safety issues, dismissal of com-

mon misconceptions concerning influenza and influenza vaccines, and well-studied strategies are imperative.

## Authors' declaration

The findings and opinions in this article are those of the authors and do not necessarily represent those of the Hellenic Centre for Diseases Control and Prevention.

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