Influenza vaccination for healthcare workers: from a simple concept to a resistant issue?

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ABSTRACT. Different strategies for the management of influenza epidemics are particularly important in elderly population. High morbidity and mortality rates are associated with influenza in the elderly, and annual vaccination against flu is considered to be the best cost-effective strategy. However, its efficiency is reduced in older adults and only half of them are protected. Several studies show that vaccinating healthcare workers is an efficient way of decreasing mortality rates in nursing home residents within influenza season. National and international public health authorities recommend therefore healthcare worker vaccinations for up to 5 years. However, influenza healthcare worker vaccination coverages are still low. Here we summarize data regarding the justification of healthcare worker vaccination, the efficiency of this strategy, the reasons of the reluctance of vaccination, the means and results of interventional programs and, then, focus on the debate of a mandatory healthcare worker influenza vaccination. Because several interventional programs are efficient but still need high financial and human support, only a strong political-will can improve this chosen strategy.

(Aging Clin Exp Res 2009; 21: 216-221)

INTRODUCTION

Influenza and pneumonia are particularly severe in populations aged 65 years or older (1). Influenza contributes to high morbidity and mortality, which have been found to be 100 times higher in patients 85 years or older than in younger adults (65 years) (1). Despite recent controversy concerning the extent of the effectiveness of such vaccination in the elderly population (2, 3), there is strong agreement to recommend flu vaccination to all elderly adults in almost all countries (4). Many studies have demonstrated the effectiveness of flu vaccination in various subgroups of elderly patients to decrease cardiovascular and pneumonia-associated mortality and hospitalization (5-8). However, immunosenescence leads to decreased efficacy of the vaccine, meaning that the rise in influenza antibodies after immunization, described for 30-70% of the elderly population, is not sufficient protection (9). The efficiency of the vaccine is not optimal in the elderly population, particularly in those with high disability, bad nutritional status and/or comorbidities (9, 10). In addition, in developed countries, because the latter population is often found in healthcare facilities such as long-term care or nursing homes, the spread of microorganisms is easier. Therefore, the oldest disable population accumulates risk factors such as poor antibody rise after flu vaccination and risk of severe influenza or complications.

How to deal with this problem and improve this unfavourable situation? Part of the answer is vaccination of healthcare workers (HCW). We present here the various problems connected with HCW flu vaccination (rationale, influence of vaccination on the elderly population, coverage rates, reasons for declining and various programs promoting vaccination) with special consideration for elderly population.

RATIONALE FOR HCW INFLUENZA VACCINE TO PROTECT PATIENTS

The essential rationale for promoting vaccination in HCW is the report of nosocomial influenza outbreaks in several healthcare settings, associated with the demonstrated role of HCW in transmission (11, 12). Yet the concept of getting an "herd immunity" was postulated: a decrease in influenza should be observed in patients by decreasing viral circulation by HCW vaccination especially in wards where immunosuppressed patients are at high risk. This is particularly important in the elderly population living in nursing homes because, despite high immunization rates in residents, studies report outbreaks with

Key words: Elderly, healthcare worker, influenza, vaccination.

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Received March 30, 2009; accepted in revised form April 14, 2009.

high attack and death rates (13-15). There are many reasons for the decreasing efficacy of flu vaccine in this population, but they include mainly immunosenescence, nutritional and functional status and comorbidities (9): these outbreaks are recurrent enough to lead international and national public health authorities to recommend strategies not only to prevent but also to limit them (16-18).

The effectiveness of flu HCW vaccination in decreasing serologically confirmed influenza by nearly 90% in vaccinated persons has been demonstrated, as well as decreased absenteeism on the part of HCW during the flu season (19). This suggests that, during large-scale flu outbreaks, HCW vaccination significantly decreases HCW absenteeism resulting in persistently adequate staffing, which may in turn prevent reduced quality of care (20, 21). In addition, two other factors contribute to the high risk of transmission of the flu virus by HCW: i) most affected HCW tend to work through their illness (22); ii) HCW may have fewer or no symptoms throughout their period of infection but still shed the virus (21, 23, 24).

When the data are considered together, they strongly indicate that role of HCW flu vaccine may be significant in providing greater immunity to the elderly.

EFFICACY OF INFLUENZA VACCINE IN HCW TO PROTECT ELDERLY

Until now, only three studies (one pilot study and two randomized trials) have been carried out to demonstrate the veracity of the concept of herd immunity due to HCW flu vaccines (25-27). The main results of the two randomized trials are listed in Table 1 (25, 26). In a cluster-randomised controlled trial, Carman et al. were the first to show that flu HCW vaccines in wards caring for elderly people in Scotland led to decreased mortality among residents (25). However, in adjusted models the influence was not significant, the number of nursing homes may have been too low to consider the randomization as efficient in controlling for other factors associated to mortality, and concerns were voiced regarding the temporality of the reductions in death and the action of the wards. The second study by Hayward et al. was then designed to overcome these points. It demonstrated in one out of two different flu seasons (3 months) that HCW flu vaccine could provide an herd immunity by decreasing morbidity and mortality associated with flu in residents (Table 1) (26). In addition, the above authors reported that statistically speaking, respectively, 8, 5, 6, and 20 HCW vaccinations were needed to prevent, respectively, one death, one case of influenza-like illness, one general practitioner consultation for influenza-like illness, and one admission to hospital with influenza-like illness (26). Finally it demonstrated that these results were related to flu activity but already efficient in a moderate season.

Considering an end-point such as death, it may be argued that these studies lacked adjusted models for other important risk factors for death, such as nutritional and functional status and comorbidities: however, as they were clustered randomized trials, it may be acceptable to consider these factors as equivalent in the two groups of nursing homes.

To add to this knowledge, a stochastic, individual-based, mathematical model has recently demonstrated a robust linear relationship between the number of HCW vaccinated and the expected number of flu virus infections among patients (28). The authors concluded that 60% of flu infections among residents could be prevented when the HCW vaccination rate increased from 0 to 1, but no threshold for herd immunity was found (28).

At collective level, cost effectiveness has not been examined in depth but one study concluded that HCW flu vaccination may save cost or in the "worst case scenario" should cost £ 405 per year of life gained (29).

Currently, in nursing home settings, HCW vaccination provides very probably an "herd immunity", leading to decreased direct and indirect morbidity and mortality associated with flu according to the scale of the epidemic. However, to our knowledge no such equivalent studies have confirmed the reality of herd immunity in other patient groups or other wards. Only two observational studies show a decrease in cases of nosocomial influenza after a campaign to improve infection control measures

Table 1 - *Results of 2 clustered-randomized clinical trials on HCW influenza vaccination (25, 26).*

Study	Carman et al. 2000		Hayward et al. 2006	
Institutions (n)	10	10	22	22
Number of residents (n)	749	688	1249	1323
HCW influenza vaccination rates (%)	49.8	4.8	35.4	5
Death among residents (%)	13.6	22.4*	11.2	15.3*
Influenza-like illness (%)	ND	ND	11.4	22.7*
General practitioner consultations for influenza-like illness	ND	ND	10.0	18.7*

HCW: healthcare worker; ND: not determined. *p-value<0.05.

Table 2 - *Barriers to HCW influenza vaccination. Adapted from (21-23, 36, 39-47).*

	Individual reasons for declining vaccination	**Organizational reasons for declining vaccination**
Influenza vaccination	Lack of time	Lack of time
	Lack of efficacy of flu vaccination	Cost
	Lack of motivation	No flu shots in work place
	Flu-like symptoms	No flu shots in occupational medicine
	Fear of adverse effects	Limited access
	Fear of flu shot	General inconvenience
	Efficient alternative means of prevention (homeopathy)	Young staff / Part-time work
	No personal need or benefit	Type of healthcare setting
	Only for immunosuppressed individuals	
About influenza	Benign disease	
	Disease of frail individuals	
	Not contagious	
	Low risk of nosocomial transmission	

and staff immunization rates; one in a specific unit (bone marrow transplant) (30), and another in a long term interventional study in a tertiary academic hospital in the United States (31). Despite this lack of definite data for varying healthcare settings and populations, the principle of the rule is demonstrated and it is therefore currently well-admitted that vaccination of staff is an important preventive policy in decreasing seasonal in-hospital flu outbreaks. Public health authorities in many countries have also strongly recommended HCW flu vaccination for more than ten years but it is still based on a voluntary approach (17, 18, 21, 32).

The next question is whether and how recommendations are implemented or not. The first question is easily assessed by measuring staff vaccination coverage but the second is more difficult as it depends on several parameters.

VACCINATION COVERAGE IN HCW AND BARRIERS TO VACCINATION

In the absence of specific campaigns, international reports from public health authorities show large variations in HCW flu vaccine rates (5-75%). These variations are also found at national levels, as seen in France: very recent studies report rates varying from less than 5% (33) to more than 50% in a mucoviscidosis center (34), even though HCWs vaccination has been recommended by the public health authority since 1999 (18), in accordance with annual telephone surveys reporting stable rates of 15-25% for several years (35) and with the type of geriatrics healthcare settings (acute, rehabilitation, and long-term) (36, 37). The largest study in geriatric healthcare settings found an overall vaccination rate of 23.4% in rehabilitation and long-term care, and 48.4%, 30.5%, and 27.9%, in physicians, nurses and auxiliary nursing staff, respectively) (38). This figure is in agreement with many reports from other countries with some specificities according to national public health policies and existence of large national programs. For example, in the United States, since 2000 there have been recommendations for vaccinating younger individuals (50-64 years old) which may improve staff coverage (17); in 2005-2006, HCW vaccination coverage reached 41.8% [37.4-46.3] as compared to less than 35% before the recommendations (17).

As it may sound surprising to find such low rates in healthcare professional populations, the next question is to analyse the putative reasons for not accepting vaccination in the part of professionals who take care of patients.

Many studies have examined the reasons for being reluctant to accept flu vaccination on the part of HCW; several reasons are regularly found (21-23, 36, 39-47) and are listed in Table 2. Inconvenience, low risk of exposure to influenza, lack of effectiveness of the vaccine, side-effects, use of alternative medicine, trust in one's own immune defences, and lack of personal benefit are the repeated reasons for reluctance. Because of different methodological approaches (survey questionnaire, focus group, etc.), many authors have found some correlations between the level of knowledge and behaviors (22, 40, 43, 45-47), but others emphasize the discrepancy between knowledge, beliefs and behaviors concerning HCW flu vaccination (38, 42, 48). Focus groups highlight particularly the lack of trust in vaccination (38, 42, 48).

Vaccination is still an active way of preventing infectious diseases, but specific goals merge because of advances on sciences and medicine. Individual and collective benefit/risk ratios, new therapeutic and protective alternatives, changes in the prevalence and influence of dis-

eases are all factors that may affect personal decisions to be vaccinated. Because of the high quantity of available information (plus misinformation and disinformation), the personal choice of vaccination is becoming more complex. In addition, for a long time general vaccine policies emphasized more personal than collective benefits. As staff vaccination leads much more directly to a collective benefit, there is an evident explanation to the limits of voluntary programs that have not yet been assessed.

There are also modifications in the role, place and representation of the flu vaccine (49) which may explain the low rates of various vaccines, especially flu vaccination for staff which sounds like a typically altruistic action.

Because of the benefits and low rates of HCW vaccination, voluntary based programs have been carried out to enhance staff coverage.

PROGRAMS TO ENHANCE COVERAGE

Based on analysis of the various components of reluctance to be vaccinated, several strategies have been proposed to enhance vaccination, some through national guidelines (17). Organizational issues must be overcome and the most convenient strategies in each healthcare setting must be implemented. Options are: free vaccines, vaccination in the work place several times a week in a convenient location and after-hours availability; intensive promotion of the anti-flu campaign, announcements at staff meetings and during ward rounds; poster notices, recruitment memoranda; electronic reminders; and hospital-wide agenda. According to many authors, the most efficient strategy in this field is a vaccine team using a mobile cart and managing the campaign before the flu season (21, 22, 31, 40, 41, 46, 47, 50-52). In several places, mobile carts demonstrated instant efficiency.

Other strategies use educational programs targeting misconceptions, misperceptions and misinformation. Large scale staff interviews and mailed encouragements are different ways to motivate vaccination (38, 53-55). However, even with active campaigns, several educational programs have failed to increase vaccination rates (38, 53-55). More recently, incentive programs have been implemented, with variable results. For example, Doratotaj et al. did not find any differences between groups of HCW vaccine coverage with either educative alone or both educative and incentive programs (56).

Unfortunately, very few studies demonstrate long-term positive results; following a flu outbreak, Salgado et al. implemented a multi-component strategy (convenient vaccine delivery from a mobile cart and educational programs) to address the issue. Over a 13-year period, staff vaccination rates increased from 4% to 67%, and nosocomial influenza was reduced (31); in a long-term care facility, Nace et al. reported improved vaccination rates over a 10-year period from 1996 to 2006 (57). Staff immunization rates improved from 54-55% to 95% over the previous 4 years with implementation of educational interventions and reminders based on barrier assessment (57).

Multicomponent programs combining convenient, educational and incentive aspects thus seem to be the most effective strategies to increase vaccination rates. In addition, an integrated survey of HCW beliefs and attitudes, as a routine part of programs, may lead to refinement of responses for the next season's campaign. A recent SHEA position paper recommended strongly the implementation of multicomponent programs combining not only targeted education and increased vaccine access but also "emphasizing the ethical responsibility HCW have to protect themselves, their patients, and their colleagues as part of institutional patient and employee safety programs" (21). They therefore recommend the signing of a declination each year, if HCW refuse influenza vaccination after participating in an educational program (21).

However, from an economic point of view, there is a lack of data regarding the cost-effectiveness of active, permanent, multicomponent programs.

MANDATORY VACCINATION: A SHORT ECONOMIC ANSWER?

Because of the failure of many voluntary programs, controversy arose regarding mandatory vaccination programs (21, 55, 58-63). Several authors support mandatory programs (55, 58, 59, 61-63) on the basis of unnecessary risk of exposure to influenza, lack of efficiency of multicomponent programs, and their long-term costs to act on; but the main justification stems from the moral responsibility of HCW not to harm their patients when they know that there is a significant risk of harm and that vaccination can reduce this risk and lead to a favourable balance of benefit over burdens and risks.

Some authors think that autonomy and the risk of flu vaccines are not well known, and are not outweighted by the risk of harm to patients from flu in healthcare settings (55, 60). In addition, voluntarily based programs are not well implemented according to recommendations (55, 62, 64), and mandatory vaccination means repression of personnel views, which has to be described in detail before vaccination can be implemented. Then, discussions may be required with HCW to avoid situations of confrontation. Recently, the Canadian Labour Board ruled against a provincial regulation, which sought to make influenza vaccination for first responders mandatory (55). In the other hand, the meaning of mandatory still needs to be discussed (55, 60, 62), and for many authors this does not mean that staff should be vaccinated against their will by force. Mandatory programs should be conditional and several proposals have been announced: statement of declination by staff (62, 65), mandatory use of masks throughout the flu season (66), exclusion from work (completely or temporarily) within the flu season (58, 59, 61, 62), etc.

CONCLUSIONS

It is probable that each added HCW vaccination decreases the risk of influenza circulating in healthcare settings particularly in nursing homes. There is a moral responsibility not only to propose but also to implement flu vaccination to HCW. However, in many places, vaccination rates remain too low, despite active convenient, educative or incentive programs. Because only a few long-term multicomponent voluntary programs show significant improvements, the question of mandatory vaccination is an ongoing debate.

The huge number of studies show that HCW influenza vaccination is still a passionate debate which covers several drastic positions. From a more general point of view, the discussion of mandatory vaccination may be the consequence of the failure of political will to offer general educative debates to HCW, to better understand how their situation, role and representation are modifying very rapidly together with scientific knowledge; this debate should be important in view of the similar future issues for coping with the elderly population. However, although mandatory flu vaccination would be a fast and cost-effective measure, it is probable that political willingness (and resources) to implement voluntary vaccination must be sufficiently strong and sustained to provide the required long-term changes in cultural attitudes.

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