

Management of two influenza vaccination campaign in health care workers of a university hospital in the south Italy

R. Squeri¹, R. Riso², A. Facciola², C. Genovese², M.A.R. Palamara²,
C. Ceccio¹, V. La Fauci¹

Key words: Influenza, flu, vaccination, HCWs

Parole chiave: Influenza, vaccinazione, operatori sanitari

Abstract

Background. In Europe, flu remains one of the major public health problems. Healthcare workers (HCWs) are a category at high-risk of contracting the infection and infecting their patients; consequently, for this category, vaccination is highly recommended. Unfortunately, coverage levels remain insufficient with rates ranging between 4 and 40%.

Study design. The purpose of our work was to evaluate the adherence of HCWs to the influenza vaccination and to carry out a combination of educational and motivational interventions in order to increase the rate of adherence to the vaccination in this workers' category.

Methods. We conducted two different influenza vaccination campaigns, 2014-2015 and 2015-2016. The study was divided in two steps. In the first, preliminary step, an anonymous questionnaire was administered to HCWs containing a set of questions in order to gain information about the number of subjects willing to undergo the vaccination and the reasons that led others to its rejection. In the second step, vaccination campaigns were carried out preparing an appropriate vaccination calendar that was communicated to all interested Units and vaccination points located in various wards.

Results. We found a slightly improved compliance trend, from an average of 2.3% in the previous years to 3.3% in 2014 and 7.4% in 2015.

Conclusion. Despite the observed increase, the adherence remains very low. We found that the main causes of this result are the fear of adverse effects, the negligence and indolence of the same workers and a lack of risk perception of contracting the disease and transmitting it to patients. Our work stressed the importance of offering correct information and of meeting the needs of HCWs, often unable to leave their ward for the excess workload. This could be, in future years, one of the possible solutions to increase vaccination adherence.

1) Department of Biomedical Sciences and Morphological and Functional Images, University of Messina, Italy

2) Postgraduate Medical School in Hygiene and Preventive Medicine, University of Messina, Italy

Introduction

In Europe, influenza remains one of the major public health problems. The European Center of Disease Control (ECDC) estimated that from 40,000 to 220,000 people die each year due to this disease. Therefore, in 2009, the European Union Council recommended that all member states should adopt a national action plan to improve vaccination coverage up to 75% in all at risk groups, including HCWs (1). For this reason, influenza vaccination is recommended for HCWs in almost all European countries (2, 3). However, despite the measures designed to encourage vaccination among this worker's category (vaccination campaigns, education, etc.), coverage levels remain insufficient, with rates ranging between 4 and 40% (4, 5). Consequently, unvaccinated HCWs may become the main source of nosocomial influenza (5), with risks for patients' health (6).

In Italy, the Ministry of Health, in the informative note containing recommendations for the prevention and control of influenza (season 2014-2015), considers the HCWs as a category for whom influenza vaccination is recommended (7), in order to protect themselves, their relatives and, above all, the patients with whom they come into daily contact in the exercise of their profession (8).

Several studies have shown that influenza vaccination of HCWs is able to reduce the mortality and morbidity of elderly patients in long-term care facilities (9, 10). Among these, Potter et al have shown that vaccination of HCWs is associated with a reduction of total mortality of patients from 17% to 10% (11).

Currently, influenza vaccination remains one of the mainstays, not only in the prevention of this disease and its complications but also in the reduction of the related costs for the National Health Service. These costs are classified into *direct* costs, related to the care of ill people (healthcare costs), and *indirect* costs, especially for the

lack of productivity due to absence from work, this latter accounting for 89% of the total (12). Influenza, in fact, is one of the major causes of work absenteeism, being the cause of approximately 10% of all absences from work (13). In Italy, the average length of absence from work is 4.8 days and it has been calculated that every case of influenza costs a total of 330 euros (12).

Despite the availability of vaccines, their free administration and proven effectiveness in reducing the incidence of the disease and, consequently, the work absenteeism, their acceptance by HCWs continues to be a critical element. To promote vaccination in this high-risk group, the Italian National Institute of Health has taken part in a European project called "HproImmune - Promotion of immunization of HCWs in Europe" for a period of three years, coordinated by the Institute of Preventive Medicine, Environmental and Occupational Health of Athens, Greece. The main aim of this project was to promote, among HCWs, a correct attitude towards immunization practices, allowing the acquisition of a greater awareness of the problem through the development and administration of a communication tool consisting of an information booklet that emphasizes the importance of vaccination in the prevention of some infectious diseases such as influenza (14).

The purpose of our work was to evaluate the adherence to influenza vaccination by HCWs in the University Hospital "G. Martino" of Messina, Italy, and to perform a combination of educational and motivational interventions in order to increase the rate of adherence to vaccination in this worker's category and thus improve the success of future vaccination campaigns.

Materials and methods

The two vaccination campaigns involved samples of HCWs and administrative

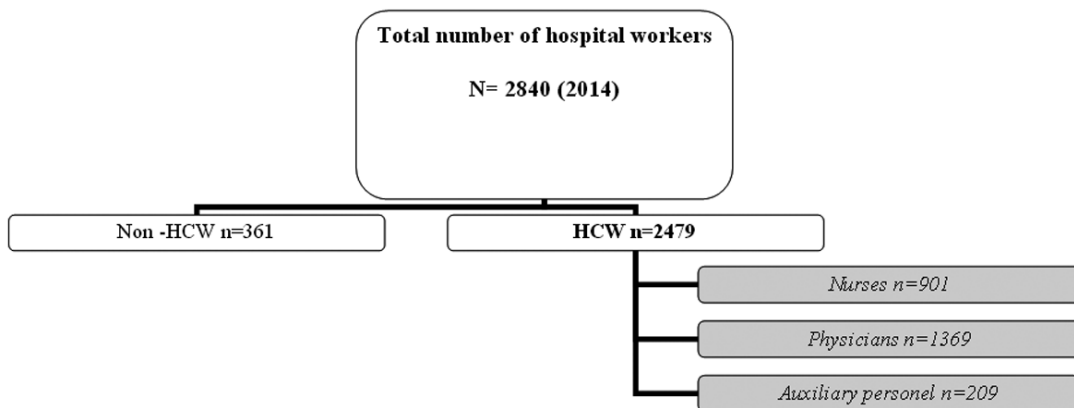


Fig. 1 - Employees by category 2014

employees working in the various units of the Messina University Hospital “G. Martino”. They included 2,840 employees in the season 2014-2015 (361 administrative units and 2,479 HCWs) and 2,809 employees (350 administrative units and 2,459 HCWs) in the season 2015-2016 (Figg. 1 and 2).

The study was divided in two steps. In the first preliminary step, an anonymous face to face questionnaire was administered to HCWs, consisting of four multiple-choice questions, in the months of September and October 2014 and 2015 (periods preceding the influenza outbreak). The questionnaire contained a set of questions in order to gain information about the number of subjects willing to undergo the vaccination, or about the reasons that led others to reject it. For

each category, we included a percentage of the entire categories. For reasons of convenience we choose the units which ensured a high compliance to the study and, at the same time, a sufficiently high number of operators. Then, we interviewed 600 people, corresponding to approximately 21% of the total sample, for each vaccination campaign.

In the second step the vaccination campaigns were carried out, one in the 2014-2015 and another in the 2015-2016 seasons.

In the first campaign, to ensure greater adherence to vaccination, we modified, compared to the previous years, the approach with the HCWs, preparing an appropriate vaccination calendar that was communicated

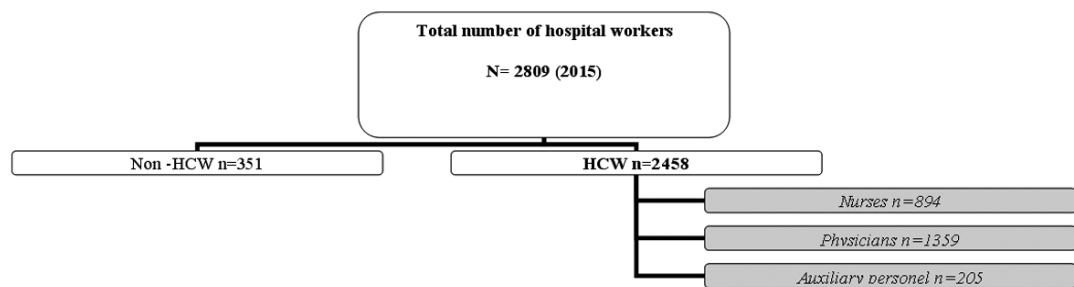


Fig. 2 - Employees by category 2015

to all interested Units and setting up vaccination points located in the various wards. In the second, to further increase compliance, besides the set-up of vaccination points, we prepared, in collaboration with the Sicilian Region and the Hospital Health Direction some informational posters and gadgets. A day was also planned, named "Influ-day", in which the Hospital Health Manager and the University Dean were vaccinated in order to demonstrate the importance of this practice. This sensitization day was organized by one of the Regional Public Health Services and was advertised on various information channels (i.e. on the hospital website) to increase the adherence of HCWs as much as possible. Compared to the previous year, a further change was made, represented by the introduction of a tetravalent vaccine that protects against four strains of viruses (two subtypes of influenza A virus and two types of the B virus).

Statistical analysis. All the variables were analyzed by frequency distributions. For the validation of statistically significant differences between categories of HCWs (Physicians, Nurses, Medical students, Specialty Residents and Nursing Students) and all the other variables detected in the sample, the chi-square test was used for k independent samples with their partition model in case of rejection of H₀ (1). For the purposes of statistical significance, p values <0.05 were considered. All the synthesis and inferential analysis were performed using Microsoft Excel.

Results

In the first step of the study, our sample included 260 males (43%) and 340 females (57%); 136 structured physicians (22.7%), 152 training doctors (25.3%), 84 structured biologists (14%), 126 nurses (21%), 52 health assistants (8.7%), 24 administrators (4%), 6 chemists (1%) and 20 laboratory

technicians (3.3%). The two questionnaires employed during the two vaccination seasons had similar results; it was found that 18.3% of the sample accepted the influenza vaccination every year. Of these, 34.5% were physicians, 22% nurses, 11% health assistants, 7.1% administrators and 25.4% laboratory staff (biologists, chemistry and laboratory technicians). Then, it was found that only 65.5% of the sample knew that the vaccine is free for the employees.

Concerning the reasons of non-adherence to vaccination, it was found that 64% of the respondents did not consider it necessary in relation to their health condition, 12.6% did not accept it for fear of adverse events, 7.9% did not believe in its effectiveness, and only 2.6% because of indolence secondary to concomitance with the working hours and/or the distance from the vaccination center. The remaining percentage (12.9%) did not specify the reasons. In terms of age groups, it was found that 26.4% of people who reported to have been vaccinated every year, were ≥ 51 years old.

In the second step of the study, after realizing the difficulties related to the distance from the vaccination center, we set up vaccination points in various wards; with this measure, we found a slightly positive compliance trend from an average of 2.3% in previous years to 3.3% (93) in 2014 and 7.4% (207) in 2015 (Figure 3).

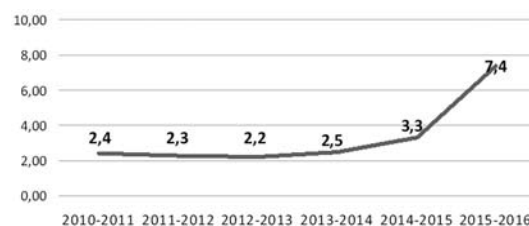


Fig. 3 - Adhesion trend to influenza vaccination by HCWs

Table 1 - Employees divided by area 2014 e 2015

Area	2014	2015
Medical	1276	1262
Surgery	752	744
Services	812	803

In the first campaign, we divided the vaccinated subjects by age, gender, area and qualification. Data are shown in Table 1 and in Table 2. The compliance rate was higher for non-medical staff, with an adherence rate of 6.6% (24/361; IC 95%: 4.1%-9.2%) versus 2.8% of HCWs (69/2479; IC 95%: 2.1%-3.4%) with highly significant statistical differences ($P < 0.001$). The adhesion of the total number of employees was higher for the area of services (5.7%; IC 95%: 4.1%-7.3%) followed by medical (2.6%; IC 95%: 1.7%-3.5%) and surgery areas, respectively (1.9%; IC 95%: 0.9%-2.8%), with highly significant statistical differences ($P < 0.001$). Concerning the HCWs, physicians were the category with the largest adherence, accounting for 3.8% (52/1369; IC 95%: 2.8%-4.8%) versus 2.9% (6/209; IC 95%: 0.6%-5.1%) of health assistants and 1% (9/901; IC 95%: 0.3%-1.6%) of nurses with highly significant statistical differences ($P < 0.001$). The adherence rate by age was higher in the over 60 range with 10.4% (27/259; IC 95%: 6.7%-14.1%), followed by the 36-60 range with 2.9% (50/1730; IC 95%: 2.1%-

3.7%) and, finally, by the subjects <36 with only 1.9% (16/851; IC 95%: 1.0%-2.8%) with highly significant statistical difference ($P < 0.001$). Considering the percentage of adhesion on the total of vaccinated employees (69), it was a higher percentage for males with 4.2% (54/1282; IC 95%: 3.1%-5.3%) than for females with 2.5% (39/1558; IC 95%: 1.7%-3.3%), with statistically significant differences ($P < 0.05$). Despite the slight increase observed in the initial step of the study, there was, in the last period of the first vaccination campaign (December 2014), a significant slowdown in the adherence, probably due to media news about suspected adverse events attributable to some vaccine lots.

In the vaccination campaign 2015-2016 there was a further increase in adhesion compared to the previous one (**Fig. 4**), with 207 vaccinated out of 2809 employees (7.4%). There was a greater adherence during the month of November with 4.3% (121 vaccinated) and the lowest in December with a compliance rate of 3% (83 vaccinated) and only 0.1% (3) in January. Also for the 2015-2016 season, we divided the vaccinated subjects by age, gender, area and qualification. Data are shown in Table 2 and Table 3. Analyzing the vaccinated subjects, it was observed that 76.8% (159/207) had less than 60 years, while 23.2% (48/207) exceeded the age for which the trivalent vaccine is indicated. 89% (185/207) Of HCWs have undergone immunization with a tetravalent vaccine, which can also

Table 2 - Vaccinated subjects of 2014-2015 season (93) divided for gender, age groups, areas and profession.

Age groups			Gender		Area		
<36	36-60	>60	M	F	Medical	Surgical	Services
17,2%	53,8%	29%	57%	43%	33%	16%	51%
Profession							
Physicians		Training doctors		Nurses	Administratives		Others
42%		14%		9,7%	6%		28,3%

Table 3 -Vaccinated subjects of 2015-2016 season (207) divided by gender, age groups, areas and profession.

Age groups			Gender		Area		
<36	36-60	>60	M	F	Medical	Surgical	Services
27,5%	49,3%	23,2%	55%	45%	41,5%	17,9%	40,6%
Profession							
Physicians	Training doctors	Nurses	Administratives	Others			
35%	20%	18%	9%	18%			

protect against the strain B/Brisbane/2008 (Victoria-Linie) influenza virus, while only 11% (22/207) underwent immunization with the trivalent vaccine.

Also in this campaign, the compliance rate was higher for non-medical personnel, with an adherence of 12.3% (43/350;IC 95%:8.8%-15.7%) versus 6.7% of HCWs (164/2459;IC 95%: 5.8%-7.8%), respectively (P <0.001). The adherence was greater for the area of services (10.3%;IC 95%: 8.3%-12.6%), followed by medical (6.7%;IC 95%:5.4%-8.2%), and surgical (4.9%;IC 95%: 3.4%-6.5%) with highly significant statistical differences (P <0.001). Similarly, regarding the adherence of HCWs, physicians were the category with the highest compliance with 8.5% (116/1360;IC 95%:7%-10%), followed respectively by health assistants with a percentage 4.9% (10/205;IC 95%:1.9%-7.8%) and nurses with 4.3% (38/894;IC 95%: 2.9%-5.6%), with highly significant statistical differences (P <0.001). The adherence rate by age was

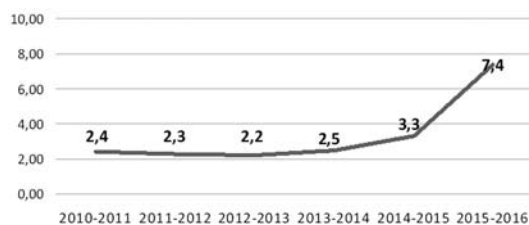


Fig. 3 - Adhesion trend to influenza vaccination by HCWs

higher in the over 60 range, with a percentage of 16.1% (48/298;IC 95%: 11.9%-20.3%), followed by under 36 with a rate of 7.7% (59/771;IC 95%: 5.8%-9.5%) and, finally, by the 36-60 range with a percentage of 5.7% (100/1740;IC 95%: 2.5%-4.2%) with highly significant statistical differences (P <0.001). Considering the adherence in total of health workers, it was a greater adherence of males with 8.8% (111/1267;IC 95%: 7.2%-10.3%) than females with 6.2% (96/1542;IC 95%:5%-7.4%), with significant statistical differences (P <0.05).

Discussion and conclusions

The aim of the present study was to verify the percentages of HCWs adherence to influenza vaccination after taking measures to encourage this practice, including the introduction of vaccination points near the workplace of employees who are often hesitant and lazy as demonstrated by the poor adherence in previous years. The first step of our study, consistent in the administration of the questionnaire, highlighted the lack of knowledge and confidence that HCWs have regarding the influenza vaccination. We found that the main causes of this result are the fear of adverse events, the negligence and indolence of the same workers and a lack of risk perception of contracting the disease and transmitting it to patients with severe clinical conditions (e.g. cancers,

heart diseases, chronic lung disorders, etc.) and to their families; this can promote the spread of infection. In general, we can say that HCWs perceive the hypothetical risks secondary to vaccination rather than the benefits that would result under both economic and health aspects. The fear of adverse effects is, therefore, a major cause of refusal of vaccination, in line with the results of several national and international studies (15, 16). Many studies, in fact, demonstrate the safety and efficacy of the various types of anti-influenza vaccine (17, 18).

During the second step, consistent in the implementation of vaccination “on site” and in the transfer of knowledge on the importance of this practice in the prevention of nosocomial influenza outbreaks, we found, in the 2014-2015 vaccination campaign, a slight adhesion increase compared to the previous years. This increase occurred mainly in November because in December, vaccinations were stopped due to the news, reported by the media, about some deaths following vaccination, for which the administration of some defective batches of the vaccine had been suggested as a possible cause. This association was immediately denied by the Italian Agency of Drugs (AIFA) and the Italian Ministry of Health (19, 20), but HCWs themselves reported this reason as cause of their refusal of vaccination. The results show also that there was not an association between those who in the first step of the study declared their intention to be vaccinated (18.3%) and those who really did receive the vaccine during the second step (3.3%). Among the probable causes of this is the fact that, despite the vaccination has been made free for all employees, many were not informed, or, when informed, preferred to skip the vaccination. Other possible causes are the already mentioned negligence or absence on the day when the nearest vaccination point was set up.

Also in the vaccination campaign 2015-2016 there was an increase in adhesion from

previous years with a percentage increase of 4.1% compared to the previous season. In our opinion, this increase can be attributed to the greater impact of communication through the mass media and the availability of a tetravalent vaccine. The latter was given to employees also with an age greater than 60 years with serious chronic degenerative diseases representing an indication for use, with a percentage of 72.9% (35/48 employees over 60). These employees went directly to the fixed point of our Vaccine Unit, having known the availability of this type of vaccine, which offered broader coverage.

Analyzing the adherence to vaccination by gender, it was found that, in both vaccination campaigns, males underwent vaccination more frequently than females. This result is in line with those reported in the international literature and could be explained by the greater tendency of women to have adverse reactions (21, 22). It was also observed that women have higher antibody responses and a greater inflammatory response (21, 22). We also found a sharp increase in the categories of nurses and training doctors (residents) than the previous year, showing a greater sensitivity of these categories after information campaigns. Despite the fear of side effects, during the second step of our study, not a single HCW reported that he had developed side effects with both the trivalent and the quadrivalent vaccine.

Therefore, our work stressed the importance of correct information and the opportunity to meet the needs of HCWs, often unable to leave their ward for the excessive workload. This can be, in future years, one of the possible ways to increase vaccination adherence by HCWs and, therefore, to prevent the spread of nosocomial influenza. In this way, we can protect the health of patients and of the HCWs themselves, as well as avoid absenteeism due to illness and the resulting economic losses. However, the

only educational interventions do not appear to be sufficient to increase the vaccination coverage rate. A possible solution could be the implementation of policies that introduce the mandatory influenza vaccination, which could be included in the employment contract. In fact, in recent years, such policies have been adopted in the US, ensuring adherence equal to 100% (23, 24). Several studies have shown that the majority of HCWs, according to professional ethics, were in favor of a compulsory vaccination to protect themselves and their patients (25, 26). However, a low proportion of HCWs showed opposition to this type of policy because it violates their individual rights (27, 28). Currently in Europe there are difficulties to adopt such coercive policies (2). In our opinion, a further solution would be to insert the high rates of adherence to influenza vaccination in budget targets to achieve by the members of Care Units.

Riassunto

Gestione di due campagne di vaccinazione antinfluenzale negli operatori sanitari di un policlinico universitario del sud Italia

Introduzione. L'influenza rimane uno dei maggiori problemi di salute pubblica in Europa. Gli operatori sanitari sono un gruppo ad alto rischio di contrarre l'infezione e di trasmetterla ai pazienti; di conseguenza, per questa categoria la vaccinazione è raccomandata. Tuttavia, i livelli di copertura restano insufficienti con tassi di adesione compresi tra il 4 e il 40%.

Disegno dello studio. Lo scopo del nostro lavoro è stato quello di valutare l'aderenza del personale sanitario alla vaccinazione antinfluenzale e di effettuare in concomitanza interventi educativi e motivazionali ed educativi al fine di aumentare il tasso di adesione alla vaccinazione.

Metodi. Abbiamo condotto due diverse campagne di vaccinazione antinfluenzale, una nel 2014-2015 e una nel 2015-2016. Lo studio è stato diviso in due fasi. Nella prima fase, è stato somministrato agli operatori sanitari un questionario anonimo contenente una serie di domande al fine di ottenere informazioni sul numero di soggetti disposti a sottoporsi alla vaccinazione e le ragioni dell'eventuale rifiuto. Nella seconda fase, sono

state effettuate le campagne di vaccinazione dopo aver preparato un calendario vaccinale appropriato che è stato comunicato a tutte le unità interessate e sono stati istituiti punti di vaccinazione nei vari reparti.

Risultati. Abbiamo riscontrato un andamento leggermente positivo, passando da una media del 2,3% degli anni precedenti al 3,3% e 7,4%, rispettivamente del 2014 e del 2015.

Conclusioni. Nonostante l'aumento osservato delle vaccinazioni, l'aderenza rimane molto bassa. Abbiamo scoperto che le principali cause di ciò sono la paura degli effetti collaterali, la negligenza e l'indolenza degli stessi lavoratori, la mancanza della percezione del rischio di contrarre la malattia e trasmetterla ai pazienti. Il nostro lavoro ha sottolineato l'importanza di una corretta informazione e la necessità di soddisfare le esigenze degli operatori sanitari, spesso incapaci di lasciare il loro reparto per l'eccessivo carico di lavoro. Queste potrebbero essere, nei prossimi anni, delle possibili soluzioni per aumentare l'aderenza alla vaccinazione.

References

1. European Union Council recommendation of 22 December 2009 on seasonal influenza vaccination (2009/1019/EU). Official Journal of the European Union L348/71-2 2013 Cox NJ, Subbarao K. Influenza. Lancet 1999; **354**: 1277-82.
2. Maltezou HC, Wicker S, Borg M, et al. Vaccination policies for health-care workers in acute health-care facilities in Europe. Vaccine 2011; **29**: 9557-62.
3. Mereckiene J, Cotter S, D'Ancona F, et al. Differences in national influenza vaccination policies across the European Union, Norway and Iceland 2008-2009. Euro Surveill 2010; **15**(44): pii = 19700.
4. McLennan S, Wicker S. Reflections on the influenza vaccination of healthcare workers. Vaccine 2010; **28**: 8061-4.
5. Maltezou HC. Nosocomial influenza: new concepts and practice. Curr Opin Infect Dis 2008; **21**: 337-43.
6. Salgado CD, Farr BM, Hall KK, Hayden FG. Influenza in the acute hospital setting. Lancet Infect Dis 2002; **2**: 145-55.
7. Ministero della Salute. Nota informativa per la prevenzione e il controllo dell'epidemia stagionale di influenza, stagione 2014-2015. Available from: <http://www.prefettura.it/FILES/docs/1161/ALLEGATO-Controllo%20epidemia%20stagio->

- nale%20influenza%202014_2015.pdf [Last accessed: 2016, October 5].
8. Ji Yun Noh, Woo Joo Kim. Influenza Vaccines: Unmet Needs and Recent Developments. *Infect Chemother* 2013; **45**(4): 375-86.
 9. Carman WF, Elder Ag Wallace LA, McAulay K, Murray GD, Stott DJ. Effects of influenza vaccination of health-care workers on mortality of elderly people in long-term care: a randomized controlled trial. *Lancet* 2000; **355**: 93-7.
 10. Thomas RE, Jefferson T, Lasserson TJ. Influenza vaccination for healthcare workers who work with the elderly: systematic review. *Vaccine* 2010; **29**: 344-56.
 11. Potter J, Stott DJ, Roberts MA, et al. Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis* 1997; **175**: 1-6.
 12. Sessa A, Lucioni C, D'Ambrosio G, Bettoncelli G. Economic evaluation of clinical influenza in Italy. *Int J Med (London)* 2005; **7**: 14-20.
 13. Smith A. The socioeconomic aspects and behavioural effects of influenza. In: Wood C, ed. *Influenza: strategies for prevention*. London: Royal Society of Medicine 1988: 46-52.
 14. Epicentro. La promozione della vaccinazione negli operatori sanitari: il progetto HProImmune e il *toolkit* di comunicazione. Available from: <http://www.epicentro.iss.it/temi/vaccinazioni/HProImmune2014.asp> [Last accessed: 2016, October 5].
 15. Tuckerman JL, Shrestha L, Collins JE, Marshall HS. Understanding motivators and barriers of hospital-based obstetric and pediatric health care worker influenza vaccination programs in Australia. *Hum Vaccin Immunother* 2016; **12**(7): 1749-56. Epub 2016 May 31. doi:10.1080/21645515.2016.1153204.
 16. Hayden F, Poland G, Buchholz U. Influenza vaccination of health care workers in hospitals- A review of studies on attitudes and predictors. *Vaccine* 2009; **27**(30): 3935-44. doi:10.1016/j.vaccine.2009.03.056.
 17. Tisa V, Barberis I, Faccio V, et al. Quadrivalent influenza vaccine: a new opportunity to reduce the influenza burden. *J Prev Med Hyg* 2016; **57**(1): E28-E33.
 18. Beyer WE-, Nauta JJ, Palache AM, Giezeman KM, Osterhaus AD. Immunogenicity and safety of inactivated influenza vaccines in primed populations: a systematic literature review and meta-analysis. *Vaccine* 2011; **29**(34): 5785-92. doi: 10.1016/j.vaccine.2011.05.040. Epub 2011 May 30. doi:10.1016/j.vaccine.2011.05.040.
 19. Agenzia Italiana del Farmaco (AIFA). Vaccino Fluad. L'AIFA fa il punto della situazione.
 20. Ministero della Salute. Vaccino Fluad. Favorevole esito finale analisi ISS, AIFA annuncia sblocco lotti, dicembre 2014. Available from: http://www.salute.gov.it/portale/news/p3_2_1_1_1.jsp?lingua=italiano&menu=notizie&p=dalministero&id=1882 [Last accessed: 2016, October 5].
 21. Klein SL, Pekosz A. Sex-based biology and the rational design of influenza vaccination strategies. *J Infect Dis* 2014; **209**(Suppl 3): S114-19.
 22. Atamna Z, Chazan B, Nitzan O, et al. Seasonal Influenza Vaccination Effectiveness and Compliance among Hospital Health Care Workers. *Isr Med Assoc J* 2006; **18**(1): 5-9.
 23. Talbot TR, Babcock H, Caplan AL, et al. Revised SHEA position paper: influenza vaccination of healthcare personnel. *Infect Control Hosp Epidemiol* 2010; **31**: 987-95.
 24. Rakita RM, Hagar BA, Crome P, Lammert JK. Mandatory influenza vaccination of healthcare workers: a 5-year study. *Infect Control Hosp Epidemiol* 2010; **31**: 881-8.
 25. Wicker S, Marckmann G, Poland GA, Rabenau HF. Health care workers' perceptions of mandatory vaccination. *Infect Control Hosp Epidemiol* 2010; **31**: 1066-9.
 26. Maurer J, Harris KM, Black CL, Euler GL. Support for seasonal influenza vaccination requirements among US healthcare personnel. *Infect Control Hosp Epidemiol* 2012; **33**: 213-2.
 27. Stewart AM. Mandatory vaccination of health care workers. *N Engl J Med* 2009; **361**: 2015-7.
 28. Rosenbaum S. When worlds collide: public health and union rights in Virginia Mason Hospital Washington State Nurse Association. *Public Health Rep* 2008; **123**: 664-6.