

Fabrizio Cedrone¹, Omar Enzo Santangelo², Sandro Provenzano², Enrico Alagna², Giulia Dallagiacomà³, Angelo D'ambrosio⁴, Gianluca Voglino⁴, Vincenza Gianfredi⁵

Attitude of students of health professions towards a health care workers' mandatory vaccination: a multi-center cross-sectional survey

¹ Post-Graduate School of Hygiene and Preventive Medicine, Department of Medicine and Aging, "G. d'Annunzio" University of Chieti-Pescara, Chieti, Italy

² Department of Sciences for Health Promotion and Mother and Child Care 'Giuseppe D'Alessandro', University of Palermo, Palermo, Italy

³ School of Hygiene and Preventive Medicine, Department of Public Health, Experimental and Forensic Medicine, University of Pavia, Pavia, Italy

⁴ Department of Public Health University of Torino, Torino, Italy

⁵ Post-Graduate School of Hygiene and Preventive Medicine, Department of Experimental Medicine, University of Perugia, Perugia, Italy

ABSTRACT. *Introduction.* Seasonal influenza epidemics represent a cost that affects companies in terms of sick leave and lost productivity, therefore vaccination can improve occupational health. The vaccination of Healthcare Workers (HCW) has a dual function because in addition to protecting the workers, it also protects the most fragile patients. The students of medical and nursing degree courses, as well as other health professions, attend the workplace daily and are similar to workers in Legislative Decree 81/08. The purpose of this research is to assess the prevalence of students who are in favor of the introduction of a mandatory vaccination for healthcare workers, and to investigate what factors predispose them to be favorable. *Methods.* We performed a multi-center cross-sectional study using a validated questionnaire in a sample of students from different university courses from October 10th, 2017 to September 30th, 2018. For qualitative variables, absolute and relative frequencies, and for categorical variables Pearson's Chi-square test (χ^2) were calculated. A multivariable logistic regression model was used.

Results. A total of 3131 questionnaires were completed by 2132 women and 999 men. The prevalence of students who are favorable to the introduction of a mandatory flu vaccination is 87.3% and that this data is linked to the female gender (aOR 1.52 CI 95% 1.12-2.06), being a medical student compared to nursing (aOR 2.14 CI 95% 1.45-3.17), coming from central Italy (aOR 3.08 CI 95% 2.11-4.51) and northern Italy (aOR 3.09 CI 95% 2.12-4.49) compared to Southern Italy and the Islands, wanting to get vaccinated for the next season (aOR 6.37 CI 95% 3.73-10.88), declaring to have a good/excellent level of knowledge on vaccine-preventable diseases (aOR 1.44 CI 95% 1.04-1.99), planning a recommendation based on ministerial indications (aOR 2.12 CI 95% 1.28-2.30) and having received requests for clarification on vaccinations (aOR 2.02 CI 95% 1.44-2.85).

Discussion. The sample of university students showed to be largely in agreement with the introduction of mandatory vaccination for HCW, which is important for the prevention of influenza virus in the workplace. To increase adherence of healthcare workers to vaccination campaigns against seasonal influenza in the workplace, it is necessary that operative strategies are implemented with educational messages.

Key words: mandatory vaccination, survey, university students, prevention, workplaces.

RIASSUNTO. ATTEGGIAMENTO DEGLI STUDENTI DELLE PROFESSIONI SANITARIE NEI CONFRONTI DELLA VACCINAZIONE OBBLIGATORIA NEI PROFESSIONISTI SANITARI: UN'INDAGINE TRASVERSALE MULTICENTRICA.

Introduzione. le epidemie influenzali stagionali rappresentano un costo per le aziende in termini di congedi per malattia e

Introduction

Seasonal influenza epidemics not only represent a direct cost to national health services in terms of hospitalization and outpatient visits, but they also affect companies, accounting for 10-12% of total sick leave and causing annual losses in productivity (1,2). Influenza is a preventable disease through vaccination (3) and worker compliance to this practice can improve the health of the workplace, so it must be encouraged (4,5).

The 2017-2019 Italian National Immunization Plan considers of primary importance for healthcare workers (HCW) the administration of 7 vaccines: against hepatitis B, varicella, rubella, measles, mumps, pertussis and influenza (6). The same vaccinations indicated for HCW are strongly recommended for university students enrolled in health professions degree courses. The World Health Organization and the US Centers for Disease Control and Prevention also recommend influenza vaccination for health workers and health professions' trainees in order to protect both themselves and their patients (7,8).

As a matter of fact, undergraduate students during their clinical clerkships share the same work environments and tasks as HCW, and are exposed to the same chemical, physical, biological and psychosocial risks (9,10).

Immunization of health professionals has been associated with improvements in patient safety and decreased hospital-related morbidity and mortality (11-16). In addition, vaccination of health workers can reduce sick leaves in the workplace, provide economic benefits to health systems and increase cost savings for healthcare organizations (17).

A much-discussed strategy to increase vaccination coverage is to make flu vaccinations mandatory for healthcare workers. A consent to this strategy, where other ones had previously failed, has been given by the "Pisa card" signed by several scientific societies, including the Italian Society of Occupational Medicine and the Italian Society of Hygiene (18). In this context, the assessment of beliefs, attitudes and knowledge of HCW and students of health professions on influenza and influenza vaccine can be useful for planning tailored influenza vaccination campaigns and therefore improve vaccination rates (19,20).

perdita di produttività e la vaccinazione può migliorare nei luoghi di lavoro. La vaccinazione dei lavoratori nel settore sanitario ha una doppia funzione perché oltre a proteggere il lavoratore protegge anche i pazienti più fragili. Gli studenti dei corsi di laurea in medicina e infermieristica e altre professioni sanitarie frequentano i luoghi di lavoro e assimilati a lavoratori nel Decreto legislativo 81/08. Lo scopo di questa ricerca è valutare la prevalenza di studenti che sono favorevoli all'introduzione di un obbligo vaccinale per i professionisti sanitari e quali fattori li predispongono a essere favorevoli.

Metodi. Abbiamo eseguito uno studio cross-sectional multicentrico utilizzando un questionario validato in un campione di studenti di corsi diversi nel periodo dal 10 ottobre 2017 e al 30 settembre 2018. Per le variabili qualitative, le frequenze assolute e relative e per le variabili categoriali è stato calcolato il test chi quadrato di Pearson (χ^2). È stato utilizzato un modello di regressione logistica multivariabile.

Risultati. 3131 questionari sono stati completati da 2132 donne e 999 uomini, la prevalenza degli studenti favorevoli all'introduzione di una vaccinazione antinfluenzale obbligatoria per i lavoratori è dell'87,3%. Questa predisposizione è legata al genere femminile (aOR 1,52 IC 95% 1,12-2,06), all'essere studente di medicina rispetto allo studente di scienze infermieristiche (aOR 2,14 IC 95% 1,45-3,17), all'essere dell'Italia Centrale (AOR 3,08 CI 95% 2,11-4,51) e Nord Italia (aOR 3,09 CI 95% 2,12-4,49) rispetto al Sud e alle Isole, al dichiarare di vaccinarsi per la prossima stagione (aOR 6,37 CI 95% 3,73-10,88), di avere un buon/eccellente livello di conoscenza delle malattie prevenibili con vaccino (aOR 1,44 CI 95% 1,04-1,99), di dare raccomandazione basate su indicazioni ministeriali (aOR 2,12 CI 95% 1,28-2,30), di aver ricevuto richieste di chiarimento sulle vaccinazioni (aOR 2,02 CI 95% 1,44-2,85).

Discussione. Il campione di studenti universitari ha mostrato di essere in gran parte d'accordo con l'introduzione dell'obbligo di vaccinazione per i lavoratori nel settore sanitario, questo fatto è di buon auspicio per la prevenzione del virus dell'influenza sul posto di lavoro. Per aumentare l'aderenza alle campagne di vaccinazione contro l'influenza sul posto di lavoro degli operatori sanitari è necessario che le strategie operative siano implementate con messaggi educativi.

Parole chiave: obbligo vaccinale, questionario, studenti universitari, prevenzione, luoghi di lavoro.

All students enrolled in health professions programs were eligible for inclusion in the study, regardless of age and year of study. The recruitment was on a voluntary basis and written informed consent was obtained from all participants. An on-line, self-reported and anonymous questionnaire was developed using Google forms ®. All data collected was stored anonymously in a computerized database; the file was protected by password, only known to the researchers. The study was approved by the local Ethical Committee of the University of Perugia (Comitato Universitario di Bioetica), Reference Number 2017-20R. The study was introduced to the students by a member of the research group during a lecture on hygiene and preventive medicine. The researcher explained the rationale for the study, and the modalities of participation. The students were then provided with a Quick Response (QR) code redirecting to the online questionnaire.

Study size

The sample size has been defined considering the number of students enrolled in the different university courses selected for the project. The population of reference was calculated considering the number of students admitted in each degree course in the last academic year and multiplied by the duration of the course; for practical reasons and to be more conservative we assumed the number of enrolled students in every year to be fixed. The total number of students resulted to be 49643. Our sample size was calculated using the EpiInfo software. The sample size calculation was computed considering a 95% confidence level and a 5% margin of error; since the expected proportion of vaccine-hesitant individuals is the object of study and is therefore unknown, we set a conservative expected rate of 50% (in order to maximize the required sample size). These parameters resulted in 382 interviews to be performed. To be more conservative, we doubled the number to 764 questionnaires, as the minimum standard for the study results to be accepted.

Questionnaire

The survey was opened on October 10th, 2017 and closed on September 30th, 2018, corresponding to the beginning and the end of the academic year. The survey included 21 questions covering the following areas of interest: i) demographic characteristics of the respondents, ii) personal experiences of seasonal influenza, iii) whether or not they would consider themselves as a high risk group for flu, iv) main source of information on vaccines, v) attitude towards recommended vaccinations, vi) participation in vaccination campaigns during their clinical clerkships, and vii) opinion on mandatory vaccination. The questionnaire, validated in previously published studies (21), included 20 multiple-choice items and 1 open-ended question. The multiple-choice items permitted only one answer. The questionnaire was developed and validated by the Committee of Medical Residents of the Italian Society of Hygiene and Preventive; the target population consisted of all Italian Public Health Residents. Because the aim of our study was to assess the knowledge, attitude and beliefs of Health Professions students on this topic, we adapted

Aim of the study

The purpose of this multicenter cross-sectional study is to assess, through a survey, the prevalence of university students of health professions who are in favor of mandatory vaccination and, through a statistical analysis, to evaluate the factors that predispose them to be favorable to this strategy.

Materials and Methods

Study design

We performed a multi-center cross-sectional study using a validated questionnaire available in literature (21). The study was developed within the Committee of Medical Residents of the Italian Society of Hygiene and Preventive Medicine. Each Public Health Resident, willing to conduct the study, was responsible for survey administration at his/her university.

the questionnaire to our purpose applying some minor modifications to the original model. Moreover, because in 2017 the Italian Ministry of Health reinforced the law on mandatory vaccinations, we added two questions assessing their opinion on this issue. Lastly, at the beginning of the questionnaire we placed an introductory message containing information about the aims of the study and the research team. The survey lasted no more than 15 minutes.

Statistical Analysis

For all qualitative variables, absolute and relative frequencies were calculated; categorical variables were analyzed by Pearson's Chi-square test (χ^2).

A multivariable logistic regression was performed, considering it as a dependent variable "How would you evaluate the possible introduction of mandatory vaccination for healthcare workers? Favorable", in order to evaluate the role of the variables of the questionnaire, the covariates to be included into the final model were selected using a stepwise backward selection process, with a univariate p-value <0.25 as the main criterion (22). The statistical significance level chosen for all analyzes was 0.05. The results were analyzed using the STATA statistical software version 14 (23). Results are expressed as adjusted Odds Ratio (aOR) with 95% Confidence Intervals (95% CI).

Results

A total of 3131 questionnaires were completed by 2132 women and 999 men, representing respectively 68.09% and 31.91% of the sample. The sample has an average age of 23.41 years (standard deviation 3.69), 40.11% coming from Northern Italy, 28.39% from Central Italy and 31.49% from Southern Italy and the Islands. 38.93% of the student sample was enrolled in medical school, 33.06% in nursing and the remaining 28.01% in other health professions. The characteristics of the sample are summarized in Table I.

Table I. Demographic characteristics of the sample

Variables	N (%)	
Gender	Female	2132 (68.09)
	Male	999 (31.91)
Mean age (SD)	23.41 (3.69)	
Age group	≤23 years old	1251 (39.96)
	>23 years old	1880 (60.04)
Degree Course	Medicine and surgery	1219 (38.93)
	Nursing	1035 (33.06)
	Other	877 (28.01)
Geographic area	North	1256 (40.11)
	Center	889 (28.39)
	South and Islands	989 (31.49)
Total	3131 (100)	

Out of the total sample, 2734 individuals were favorable to the introduction of a mandatory flu vaccination and only 397 were either against or indifferent, with a prevalence of favorable students of 87.3%. Females have greater prevalence (88.98) than those in favor compared to males (83.78) and this difference is statistically significant ($p < 0.001$). The results of the answers for each question in the questionnaire are shown in Table II.

The multivariate analysis showed that the predisposition to be favorable to a mandatory flu vaccination is linked to the female gender (aOR 1.53 CI 95% 1.13-2.08). Medical students are more likely to be in favor of mandatory flu vaccination, compared to nursing students (aOR 2.13 CI 95% 1.44-3.15). The students from central Italy (aOR 3.07 CI 95% 2.11-4.48) and northern Italy (aOR 3.14 CI 95% 2.16-4.55) are more favorable than students from Southern Italy and the Islands. Those who declared they want to get vaccinated for the next flu season (aOR 6.83 CI 95% 4.20-11.10), who have a good/excellent level of knowledge of vaccine-preventable diseases (aOR 1.42 CI 95% 1.03-1.96), who agree with planning a recommendation based on ministerial indications (aOR 2.32 CI 95% 1.60-3.36), and those who had received requests for clarification on vaccinations (aOR 2.00 CI 95% 1.43-2.79) are more predisposed to be favorable to mandatory flu vaccination. All the results of the statistical analysis are summarized in Table III.

Discussion

The sample of university students showed a high prevalence of people who are in favor of a mandatory vaccination for HCW. This is important because it can lead to high seasonal vaccination coverage if accompanied by easy accessibility to the vaccination itself in the workplace. Indeed, the lack of vaccination of the HCW can be the cause of absence from work due to illness in times of increased need for personnel, such as during the seasonal flu epidemics, it can be a source of infection for already fragile patients and it fails to give an example to patients, who have an indication to vaccinate (24).

The statistically significant gender difference that exists in the propensity to a mandatory flu vaccination is in agreement with other scientific evidence that has shown in women a greater propensity to undergo vaccinations (25, 26). However, it remains a topic that deserves further studies to be explained. Given the preponderant female presence in the workforce and its growing trend (27), this propensity could be helpful to achieve adequate seasonal vaccination coverage. Indeed, gender differences are a topic to be strongly considered in the area of health prevention and promotion (28).

The differences recorded among students from different areas of Italy are, in the opinion of the Authors, difficult to explain. The Italian National Health Service (NHS) has a decentralized structure, and this might generate some degree of diversity: a survey on vaccination coverage has recorded low immunization rates in most regions, and 61% of southern regions reported rates even

Table II. Bivariate associations. Used Pearson's Chi-square test

How would you evaluate the possible introduction of mandatory vaccination for healthcare workers?			
	Unfavorable/Indifferent N (%)	Favorable N (%)	p-value*
Gender			
Male	162 (16.22)	837 (83.78)	<0.001
Female	235 (11.02)	1897 (88.98)	
During the next season, do you think you will get the flu vaccine?			
No	368 (18.06)	1670 (81.94)	<0.001
Yes	29 (2.65)	1064 (97.35)	
Degree Course			
Nursing	134 (12.95)	901 (87.05)	<0.001
Medicine and Surgery	108 (8.86)	1111 (91.14)	
Other ^o	155 (17.67)	722 (82.33)	
Geographic area			
South and Sicily	207 (20.99)	779 (79.01)	<0.001
Center	79 (8.89)	810 (91.11)	
North	111 (8.84)	1145 (91.16)	
You think your knowledge about vaccine-preventable diseases and related vaccinations is:			
Insufficient/sufficient/fair	291 (16.33)	1491 (83.67)	<0.001
Good / excellent	106 (7.86)	1243 (92.14)	
Have you had any vaccine-preventable disease in the last 5 years?			
Never	185 (11.14)	1475 (88.86)	0.016
At least once	188 (14.07)	1148 (85.93)	
Given your future profession and your state of health, do you consider yourself a subject with a higher risk of contracting infectious diseases?			
No	98 (11.68)	741 (88.32)	0.017
I don't know	60 (17.44)	284 (82.56)	
Yes	239 (12.27)	1709 (87.73)	
Did you get vaccinated against seasonal flu last year?			
No	387 (13.91)	2395 (86.09)	<0.001
Yes	10 (2.87)	339 (97.13)	
During the last flu season did you recommend vaccination to any patients or family members/general population?			
No	252 (18.10)	1140 (81.90)	<0.001
Yes, based on my clinical evaluation	68 (14.08)	415 (85.92)	
Yes, according to the ministerial indications	77 (6.13)	1179 (93.87)	
During the next flu season, do you plan on recommending the flu vaccination to patients or family members/general population?			
No	228 (23.92)	725 (76.08)	<0.001
Yes, based on my clinical evaluation	79 (13.76)	495 (86.24)	
Yes, according to the ministerial indications	90 (5.61)	1514 (94.39)	
During the last vaccination campaign did you recommend the flu vaccine to any health worker?			
No	364 (13.26)	2382 (86.74)	0.010
Yes	33 (8.57)	352 (91.43)	
Have you ever participated directly or collaborated in the organization of the vaccination campaign for health professionals during your clinical clerkships?			
No	392 (12.84)	2661 (87.16)	0.092
Yes	5 (6.41)	73 (93.59)	
Have you ever received requests for clarification on vaccinations (composition, contraindications, precautions, ...)?			
Yes	210 (12.46)	1476 (87.54)	0.684
No	187 (12.94)	1258 (87.06)	
What is your opinion about the introduction of mandatory vaccination for school access?			
Unfavorable	100 (80.00)	25 (20.00)	<0.001
Indifferent	123 (66.49)	62 (33.51)	
Favorable	174 (6.17)	2647 (93.83)	

^o Other students of health professions

Table III. Crude Odds Ratio and Multivariable logistic regression, stepwise backward selection process, with a univariate p-value <0.25 as the main criterion, adjusted Odds Ratio are presented, each independent variable is adjusted for all the other independent variables

		How would you evaluate the possible introduction of mandatory vaccination for healthcare workers? Favorable					
		Crude Odds Ratio*			adjusted Odds Ratio**		
		OR	C.I. 95%	p-value	aOR	C.I. 95%	p-value
Gender	Male	1			1		
	Female	1.56	1.26-1.94	<0.001	1.53	1.13-2.08	0.006
Age	As the unit increases	0.96	0.94-0.99	0.003	0.92	0.88-0.95	<0.001
During the next season, do you think you will get the flu vaccine?	No	1			1		
	Yes	8.08	5.50-11.89	<0.001	6.83	4.20-11.10	<0.001
Degree Course	Nursing	1			1		
	Medicine and Surgery	1.53	1.17-2.00	0.002	2.13	1.44-3.15	<0.001
	Other	0.69	0.54-0.89	0.004	0.82	0.57-1.19	0.240
Geographic area	South and Sicily	1			1		
	Center	2.72	2.06-3.59	<0.001	3.07	2.11-4.48	<0.001
	North	2.74	2.14-3.51	<0.001	3.14	2.16-4.55	<0.001
You think your knowledge about vaccine-preventable diseases and related vaccinations is:	Insufficient/sufficient/fair	1			1		
	Good / excellent	2.29	1.81-2.89	<0.001	1.42	1.03-1.96	0.031
Have you had any vaccine-preventable disease in the last 5 years?	Never	1			1		
	At least once	0.77	0.62-0.95	0.016	0.76	0.57-1.02	0.069
Given your future profession and your state of health, do you consider yourself a subject with a higher risk of contracting infectious diseases?	No	1			1		
	I don't know	0.63	0.44-0.89	0.009	0.66	0.40-1.10	0.113
	Yes	0.95	0.74-1.21	0.662	0.57	0.40-0.82	0.002
Did you get vaccinated against seasonal flu last year?	No	1			-	-	-
	Yes	5.48	2.89-10.37	<0.001	-	-	-
During the last flu season did you recommend vaccination to any patients or family members/general population?	No	1			-	-	-
	Yes, based on my clinical evaluation	1.35	1.01-1.80	0.043	-	-	-
	Yes, according to the ministerial indications	3.38	2.59-4.42	<0.001	-	-	-
During the next flu season, do you plan on recommending the flu vaccination to patients or family members/general population?	No	1			1		
	Yes, based on my clinical evaluation	1.97	1.49-2.61	<0.001	1.16	0.77-1.74	0.248
	Yes, according to the ministerial indications	5.29	4.08-6.86	<0.001	2.32	1.60-3.36	<0.001
During the last vaccination campaign did you recommend the flu vaccine to any health worker?	No	1			-	-	-
	Yes	1.63	1.12-2.37	0.010	-	-	-
Have you ever participated directly or collaborated in the organization of the vaccination campaign for health professionals during your clinical clerkships?	No	1			1		
	Yes	2.15	0.86-5.36	0.100	2.36	0.68-8.21	0.176
Have you ever received requests for clarification on vaccinations (composition, contraindications, precautions, ...)?	No	1			1		
	Yes	0.96	0.78-1.18	0.684	2.00	1.43-2.79	<0.001
What is your opinion about the introduction of mandatory vaccination for school access?	Unfavorable	1			1		
	Indifferent	2.02	1.18-3.44	0.010	2.40	1.26-4.57	0.008
	Favorable	60.85	38.25-96.81	<0.001	62.18	35.34-109.39	<0.001

* Based on 3131 observations

** After stepwise backward selection process, based on 2996 observations. Pseudo R²= 0.4186

*** Other students of health professions

lower than the national average and a general performance of low quality (29).

Medical students, compared to nursing students, are more likely to be in favor of a mandatory vaccination. This evidence is consistent with the literature, that shows how vaccination coverage in nurses is extremely low (30), and that doctors have fewer fears about the possible consequences of vaccination (31). The coverage of influenza vaccination in medical and nursing students is generally low due to several factors, including the lack of knowledge about the benefits of immunization and the perception of risk associated with both the disease and immunization practice (32).

As the propensity to vaccination depends on the knowledge not only on influenza virus but also on the safety and efficacy of the vaccine (33-38), these aspects can be improved through the appropriate training of future health professionals.

From the data collected, it emerges that those who have decided to get vaccinated for the next flu season, who believe they have a good/excellent level of knowledge of vaccine-preventable diseases, who use the ministerial recommendations and who have received requests for clarification on vaccinations are more prepared for mandatory vaccination. The fact that the most knowledgeable and involved students about the promotion of influenza vaccination are in favor of a mandatory flu vaccination, is consistent with the evidence that poor attitudes towards vaccinations seem to be related to a low degree of awareness about the importance of their role in health promotion (39).

The mandatory flu vaccination for HCW is a complex issue because the workers' rights and decision-making autonomy seem to conflict with the health of both professionals and patients. In this regard, it is appropriate to mention alternative strategies to the mandatory vaccination that the scientific literature has shown to be effective in increasing vaccination coverage such as the combination of effective communication (40), educational and promotional strategies (41,42) also focused on the efficacy and safety of vaccines (43).

Before generalizing the results, some limitations need to be taken into account. Information about vaccine status was self-reported, and because the questionnaire was anonymous it was not possible to double-check the information in official vaccination registries, and recall bias cannot be excluded. However, we tried to reduce social-desirability bias using an anonymous survey, and information bias was diminished using an on-line questionnaire (44). Furthermore, the use of an on-line questionnaire has unquestionable advantages, such as economy and simplicity. The easiness of the tool allowed us to collect a very large number of questionnaires, even larger than the estimated sample size. Moreover, even if the questionnaire was mostly based on closed items, thus reducing the possibility to better clarify certain aspects, the simple structure of the questionnaire facilitated its analysis.

Since the study is based on a convenience sampling of health profession classes and on the spontaneous participation of the respondents, the raw results could lack in generalization; but the great number of participants allowed us

to estimate the influence of their characteristics (eg. gender, health profession, etc...) on the answers to the questionnaire. This permits to translate the results to a larger population with a certain degree of approximation. On the other hand, our results are not immune from possible responding bias, that is the risk that the willingness of the students to participate in the survey could be directly or indirectly related to their attitude to vaccinations. We have no way to measure this bias, but we have also no reason to believe it could have had a relevant effect on the results.

In conclusion, we can state that health professions students, representing the future HCW, mostly agree with the introduction of the mandatory flu vaccination, which could be an effective strategy, though not exclusive, for the prevention of influenza in the workplace.

Conflict of interest

None to declare.

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Correspondence: *Vincenza Gianfredi, Post-Graduate School of Hygiene and Preventive Medicine, Department of Experimental Medicine, University of Perugia, Piazzale L. Severi 1, 06123 Perugia, Italy, vincenza.gianfredi@studenti.unipg.it*