



Influenza vaccination among healthcare workers and absenteeism from work due to influenza-like illness in a teaching hospital in Palermo

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Abstract

Background: Annual flu vaccination of healthcare workers (HCWs) is recommended worldwide as the best way to prevent influenza and to avoid its transmission. However, in several European Countries, vaccination rate among HCWs is still less than 25%. The aim of this study was to determine the HCW vaccination coverage during a three year period in a large University Hospital, identifying socio-demographic and occupational variables involved in the decision to accept influenza vaccination. Moreover, for the 2007-2008 season, we also assessed the effectiveness of influenza vaccination in reducing influenza-related absenteeism.

Methods: During three consecutive influenza seasons (from 2005-2006 to 2007-2008), a cross-sectional study was carried out on all HCWs employed in the "Azienda Ospedaliera Universitaria Policlinico" (AOUP) of Palermo (Italy). Socio-demographic and occupational data of HCWs were collected from administrative hospital personnel records and included gender, age, birthplace, residence, profession and the workplace unit. In addition, during the 2007-2008 season, a retrospective study was conducted to evaluate absence from work due to influenza-like illness (ILI) in vaccinated versus unvaccinated personnel.

Results: A total of 7,848 HCW-years were observed and 881 vaccines were administered during the study period. Vaccination rate declined from 14.7% in 2005-2006 to 8.2% in 2007-2008 (Chi-square for trend=53.6, $p<0.001$). Coverage was generally higher among older and male HCWs whereas nurses and workers in surgical areas had lower vaccination rates. In the 2007-2008 season, absenteeism due to ILI in the vaccinated group was significantly less common than unvaccinated HCWs (3.3% vs 7.1%; $p=0.04$).

Conclusions: Our experience encourages flu vaccination of HCWs and accentuates the importance of annual influenza vaccination programs for healthcare personnel.

Key words: influenza, vaccination, healthcare workers

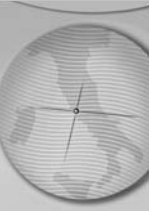
Introduction

Influenza is a highly contagious acute respiratory illness that, every year, is associated with increased morbidity and mortality in high risk groups [1,2]. The Centers for Disease Control and Prevention of Atlanta (CDC) widely recommends annual flu vaccination of healthcare workers (HCWs) as the best way to prevent the disease and to avoid the transmission of influenza from staff to patients [3].

This preventive measure has been found to reduce morbidity and mortality in elderly people living in long term care facilities and it may also reduce disruption of healthcare assistance caused by absenteeism of HCWs due to sick leave [4,5].

Although many international health authorities emphasize the importance of high vaccination

coverage of healthcare personnel, every year flu vaccination is called into question [6,7], and the vaccination rate among HCWs in several European Countries is still less than 25% [8]. Published data suggest that this finding could be due to the doubts about the necessity and the effectiveness of influenza immunization [9] but several other determinants may also contribute to its explanation. In this way, the recent international outbreak caused by the new influenza virus 2009 A/H1N1 encourages us to enrich our knowledge of the common critical factors, such as sex, marital status and occupation, that in Italian HCWs have been recently associated with refusing flu vaccination [10]. Considering that influenza vaccination of healthcare personnel could play a



very important role in the public health response to pandemic influenza [11], the primary aim of the present study was to determine the vaccination coverage during a three year period, identifying socio-demographic and occupational variables involved in the decision of HCWs to accept influenza vaccination.

We also assessed the effectiveness of influenza vaccination in reducing sickness-related absenteeism due to influenza-like illness (ILI) during the 2007-2008 influenza season. Moreover, epidemic curves for ILI in HCWs of AOUP "Paolo Giaccone" and in the general Sicilian population were compared in order to determine if there were differences in peak and time trend.

Methods

Study population

For the aim of the present study, HCWs included all the personnel who were employed full-time or part-time in Azienda Ospedaliera Universitaria Policlinico "P. Giaccone" of Palermo (AOUP) for at least one entire influenza season and who had direct contact with patients, who provided health services and who also shared common areas within the hospital setting [12].

Socio-demographic and occupational data of all HCWs were collected from administrative hospital personnel records and included gender, age, birthplace, residence, profession and workplace unit. The workplace units consisted of in five categories: Internal Medicine (Internal Medicine, Cardiology, Endocrinology, Gastroenterology, Hematology, Hepatology, Infectious diseases, Nephrology, Rheumatology, Geriatrics, Psychiatry, Dermatology, Occupational Medicine), Surgical units (General surgery, Otorhinolaryngoiatry, Orthopedic surgery, Plastic surgery, Urology, Vascular surgery, Cardiovascular surgery, Obstetrics and gynecology, Ophthalmology), Diagnostic units (Radiology, Clinical laboratory, Pathology), Emergency/Intensive care and non medical units. Professions were also dichotomized into subjects with and without clinical duties (doctors, nursing, technicians and biologists versus administrative, auxiliary workers and other non clinical professions).

Study design and outcomes

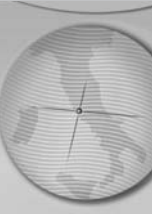
A cross-sectional study was conducted, during three consecutive influenza seasons, from 2006 to 2008, in the largest University Hospital of Sicily (Italy). The primary outcome of the present survey was to assess the occupational and socio-demographic determinants associated with the willingness to receive influenza vaccination

during these years. During the vaccination period (October-December of 2005, 2006 and 2007) vaccination was freely offered by Management of the AOUP. There were no differences in the organization of the three influenza vaccination campaigns. For each season, vaccination was promoted through an educational information campaign using posters displayed in clinical and non-clinical areas of the hospital. Furthermore, a single notice was sent to head physicians and persons in charge of each hospital unit. After obtaining written consent from all voluntary participants, vaccination was administered by resident personnel in the Department of Hygiene and Preventive Medicine of the University of Palermo. The vaccination status of each HCW was noted yearly from Administration and Management data of AOUP and collected data were then included in this study.

Exclusion criteria for vaccination included pregnancy and history of allergic reaction to influenza vaccine or egg derivatives.

Secondarily, a retrospective cohort study was designed during 2008 to assess the incidence of ILI in vaccinated and unvaccinated HCWs and to quantify the days of absence from work due to ILI, certified by general practitioners of each HCW. Days of absence due to sickness were obtained by using medical certificates that, in accordance with Italian law, workers are obliged to provide to Management of the hospital before they return to work. Moreover, general practitioners of absent HCWs were asked to complete certificates without diagnosis, with clearly readable diagnosis or suggesting ILI but lacking information requested for being included in the ILI case definition.

For the aims of this study, ILI was defined as the occurrence of respiratory illness with at least one systemic symptom (fever, chills, myalgia) and at least one respiratory tract symptom (rhinorrhoea, sore throat, cough, hoarseness) [13]. For the 2007-2008 influenza season, the cumulative incidence of influenza-like illness in AOUP workers was defined as the proportion of subjects who took sick leave days due to ILI from 1st January to 31st March 2008. This period was chosen after reviewing that in southern Italy, the last influenza seasons (from 1999-2000 to 2007-2008) depicted their peak during the first three months of each year (data obtained from Italian Influenza Surveillance Network (InfluNet) [14]). Therefore, these three months have to be considered as having an ILI activity just over the baseline. Moreover, our data were compared to the incidence of ILI in the general Sicilian population aged 15-64 years.



Such data was obtained from the Italian Influenza Surveillance Network (InfluNet), and coordinated by the Istituto Superiore di Sanità (ISS) and the Interuniversity Center for Influenza Research (CIRD) [14] which collects, during the influenza period, cases of ILI reported weekly by volunteer physicians, monitoring a sample of at least 1% of general population.

Statistical analysis

Student's t-test was used to assess possible differences for age between vaccinated vs non-vaccinated subjects and absent vs non-absent HCWs. Categorical variables (gender, residence, profession, workplace unit and vaccination status) were analyzed using χ^2 test (Mantel-Haenszel). Finally, all variables that differed between groups ($p < 0.20$) were entered in a logistic regression model in order to check for confounding effects. The significance level chosen for all analysis was $p < 0.05$. All the data were analyzed using R statistical software package [15].

Results

Subject characteristics and influenza vaccination coverages

A total of 7,848 HCWs were observed during the 3 year study period: 2,570 subjects in 2005-2006; 2,670 in 2006-2007 and 2,608 in 2007-2008.

Table 1 shows the distribution of HCWs stratified by year, age, gender, residence, profession and working place. Overall, a mean age of 47 ± 9.3 years, a male sex predominance (52.7%) and a more frequent urban residence (83.5%) were observed. Nurses and doctors accounted for 58.9% of all workers and 41.3% of HCWs were employed in internal medicine units.

During three consecutive vaccination campaigns, a mean coverage of 11.2% was found with a decreasing temporal trend from 14.7% in 2005-2006 to 8.2% in 2007-2008 (Chi-square for trend=53.6; $p < 0.001$). Overall, during three influenza seasons, 521 HCWs received 881 vaccines: 107 workers were vaccinated in all three seasons whereas 146 were vaccinated in two

Table 1. Distribution of HCWs stratified by year, gender, age, residence, profession and workplace unit.

	2005-2006	2006-2007	2007-2008	TOTAL
	(n=2,570)	(n=2,670)	(n=2,608)	(n=7,848)
Age, mean in years (\pmSD)	46.9 (9)	46.6 (9.6)	47.4 (9.3)	47 (9.3)
Gender				
Male (%)	1,388 (54)	1,386 (51.9)	1,359 (52.1)	4,133 (52.7)
Female (%)	1,182 (46)	1,284 (48.1)	1,249 (47.9)	3,715 (47.3)
Residence				
Palermo (%)	2,152 (83.7)	2,234 (83.7)	2,170 (83.2)	6,556 (83.5)
Others (%)	418 (16.3)	436 (16.3)	438 (16.8)	1,292 (16.5)
Profession				
Doctors (%)	620 (24.1)	648 (24.3)	656 (25.2)	1,924 (24.5)
Biologists (%)	82 (3.2)	82 (3.1)	84 (3.2)	248 (3.2)
Nurses (%)	867 (33.7)	940 (35.2)	890 (34.1)	2,697 (34.4)
Technicians (%)	575 (22.4)	573 (21.5)	565 (21.7)	1,713 (21.8)
Administrative workers (%)	335 (13.0)	339 (12.7)	322 (12.3)	996 (12.7)
Other healthcare workers (%)	47 (1.8)	45 (1.7)	45 (1.7)	137 (1.7)
Others (%)	44 (1.7)	43 (1.6)	46 (1.8)	133 (1.7)
Workplace unit				
Surgical unit	650 (25.3)	682 (25.5)	670 (25.7)	2,002 (25.5)
Internal medicine	1,077 (41.9)	1,104 (41.3)	1,057 (40.5)	3,238 (41.3)
Emergency/ intensive care	233 (9.1)	247 (9.3)	256 (9.8)	736 (9.4)
Diagnostic unit	280 (10.9)	305 (11.4)	305 (11.7)	890 (11.3)
Non medical unit	330 (12.8)	332 (12.4)	320 (12.3)	982 (12.5)

seasons and 268 in one season. HCWs vaccinated three times were older than those vaccinated only once (49.9 years vs 47.9 years; $p=0.051$). No significant associations were found between HCWs vaccinated three times and male sex (30.8% vs 25.3%; $p=0.13$) or urban residence (29.5% vs 24.3%; $p=0.19$). On the other hand, HCWs working in non-medical units and both biologists and administrative workers were significantly more likely to be vaccinated three times ($p=0.03$ and $p=0.003$, respectively).

For each influenza season, a comparison of the socio-demographic characteristics of vaccine recipients and vaccine non-recipients is presented in Table 2.

The vaccinated group was significantly older than the non vaccinated group in all three seasons. Moreover, a generally higher coverage was seen in males than females, and this finding was statistically significant in 2005-2006 ($p<0.01$) and 2006-2007 ($p=0.02$). No differences were observed between the two groups in relation to place of residence. Biologists had higher vaccination acceptance (30.5% in 2005-2006; 34.1% in 2006-2007 and 27.4% in 2007-2008) whereas nurses were less compliant to vaccination (9.9% in 2005-2006; 6.4% in 2006-2007 and 4.4% in 2007-2008).

Vaccination coverage was higher among HCWs

employed in diagnostic units (18.6% in 2005-2006; 20.3% in 2006-2007 and 14.8% in 2007-2008) and non medical units (19.7% in 2005-2006; 14.8% in 2006-2007 and 9.4% in 2007-2008). HCWs working in surgical units had lower vaccination rates in all three years (8.8% in 2005-2006; 6.0% in 2006-2007 and 5.4% in 2007-2008). In addition, personnel working in intensive medicine/emergency care units had very low vaccination coverage in two seasons (6.5% in 2006-2007 and 6.3% in 2007-2008). A multivariate analysis including all investigated variables (with the exception of residence; $p>0.20$) is presented in Table 3. Older age (adjusted OR=1.02; 95% CI=1.01-1.03; $p<0.001$) and male sex (adjusted OR=1.35; 95% CI=1.15-1.58; $p<0.001$) were statistically significant in determining vaccination receipt. Moreover, during three years, nurses and HCWs working in diagnostic units were more associated with refusing vaccination (adjusted OR=0.26; $p<0.001$ and adjusted OR=0.42; $p<0.001$, respectively).

Influenza vaccination and sick leave due to ILI

From 1st January to 31st March 2008, during the peak of influenza incidence, there were 178 HCWs who took 827 days of sick leave due to ILI, accounting for 11.9% of all sick leaves from work.

Table 2. Socio-demographic and occupational characteristics in vaccinated and non vaccinated group of HCW during the three influenza seasons.

	2005-2006 (n=2,570)		2006-2007 (n=2,670)		2007-2008 (n=2,608)	
	Vaccinated (n=377)	Unvaccinated (n=2,193)	Vaccinated (n=289)	Unvaccinated (n=2,381)	Vaccinated (n=215)	Unvaccinated (n=2,393)
Age, mean (\pmSD)	$p<0.01$		$p<0.01$		$p<0.01$	
	49.1 (8.1)	46.5 (9.1)	49.3 (8.9)	46.2 (9.6)	49.9 (8.6)	47.2 (9.3)
Gender	$p<0.01$		$p=0.02$		$p=0.14$	
Male (%)	237 (17.1)	1,151 (82.9)	168 (12.1)	1,218 (87.9)	123 (9.1)	1,236 (90.9)
Female (%)	140 (11.8)	1,042 (88.2)	121 (9.4)	1,163 (90.6)	92 (7.4)	1,157 (92.6)
Residence	$p=0.24$		$p=0.48$		$p=0.76$	
Palermo (%)	308 (14.3)	1,844 (85.7)	246 (11)	1,988 (89)	181 (8.3)	1,989 (91.7)
Others (%)	69 (16.5)	349 (83.5)	43 (9.9)	393 (90.1)	34 (7.8)	404 (92.2)
Profession	$p<0.01$		$p<0.01$		$p<0.01$	
Doctors (%)	110 (12.9)	501 (87.1)	86 (13.3)	562 (86.7)	71 (10.8)	585 (89.2)
Biologists (%)	25 (30.5)	57 (69.5)	28 (34.1)	54 (65.9)	23 (27.4)	61 (72.6)
Nurses (%)	86 (9.9)	781 (90.1)	60 (6.4)	880 (93.6)	39 (4.4)	851 (95.6)
Technicians (%)	74 (12.9)	501 (87.1)	53 (9.2)	520 (90.8)	43 (7.6)	522 (92.4)
Administrative workers (%)	68 (20.3)	267 (79.7)	54 (15.9)	285 (84.1)	34 (10.6)	288 (89.4)
Others (%)	14 (15.4)	77 (84.6)	8 (9.1)	80 (90.9)	5 (5.5)	86 (94.5)
Workplace unit	$p<0.01$		$p<0.01$		$p<0.01$	
Internal medicine (%)	164 (15.2)	913 (84.8)	121 (11.0)	983 (89.0)	88 (8.3)	969 (91.7)
Surgical unit (%)	57 (8.8)	593 (91.2)	41 (6.0)	641 (94.0)	36 (5.4)	634 (94.6)
Emergency/ intensive care (%)	39 (16.7)	194 (83.3)	16 (6.5)	231 (93.5)	16 (6.3)	240 (93.8)
Diagnostic unit (%)	52 (18.6)	228 (81.4)	62 (20.3)	243 (79.7)	45 (14.8)	260 (85.2)
Non medical unit (%)	65 (19.7)	265 (80.3)	49 (14.8)	283 (85.2)	30 (9.4)	290 (90.6)

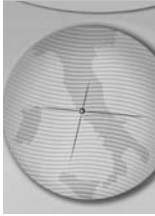


Table 4 shows the comparison between HCWs who were absent and not absent because of ILI during the first three months of 2008, stratified by socio-demographic characteristics, occupational duties and vaccination status.

HCWs absent with ILI were on average younger than those not absent (46 vs 47.5 years).

Females were non-significantly more likely than males to be absent with ILI (7.7 vs 6%). Moreover, absenteeism due to ILI was not associated with residence, profession or working place.

Finally, refusing influenza vaccination was associated with a 3.8% increase (3.3% vs 7.1%) of cases of absenteeism due to ILI (adjusted OR=2.18; 95% CI 1.01-4.71). During the three month study period, 171 unvaccinated subjects also had a higher mean number of days absent due to ILI compared to the 7 vaccinated subjects with ILI (4.7 vs 3.6 days; $p < 0.001$) (data not shown).

Moreover, weekly distribution of both cases of ILI among workers employed in AOUP and cases of ILI in Sicilian general population aged 15-64 years (data from InFluNet [15]) is illustrated in Figure 1. In both curves, the peak was reached between the first and the third week of February with an evident and progressive decrease during the following time periods. During the thirteen weeks observed, the cumulative frequency of workers with ILI among personnel of AOUP was about twice the cumulative incidence of cases of influenza-like illness in the general Sicilian population aged 15-64 years (6.8% vs 3.5% respectively).

Discussion

Although the CDC has strongly recommended influenza vaccination of at least 75% of all HCWs, the vaccination coverage of healthcare personnel working in European settings has been less than

Table 3. Multivariate analysis of factors influencing decision to accept influenza vaccination.

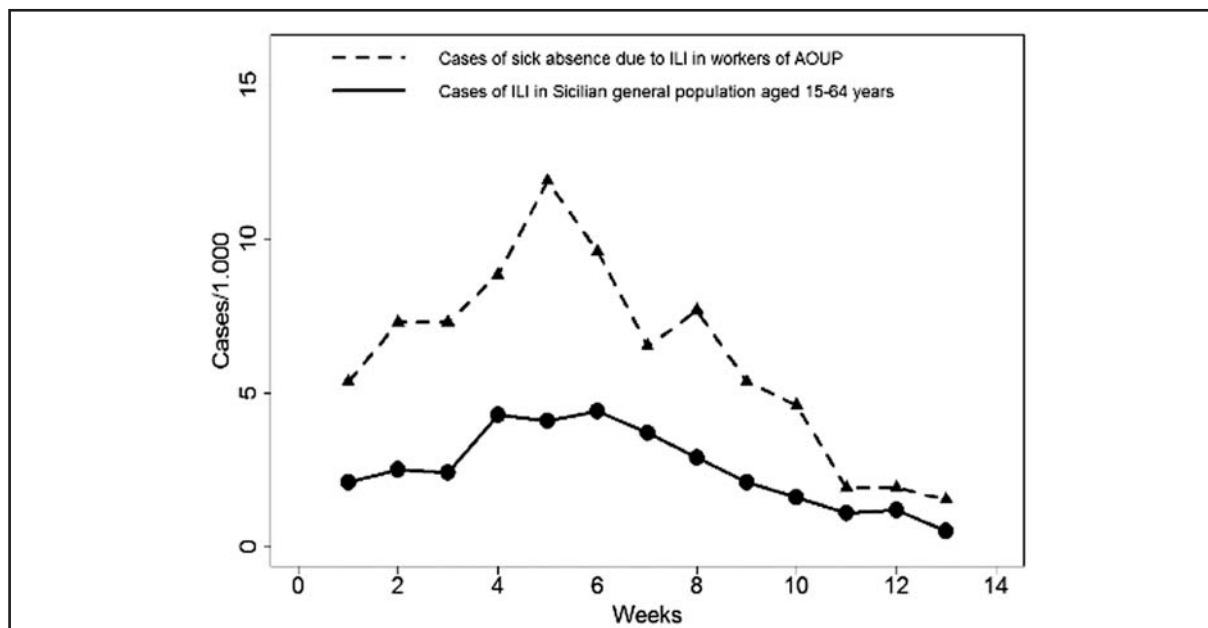
	All seasons (n=7,848)		Crude OR (95% CI)	Adjusted OR (95% CI)
	Vaccinated HCWs (n=881)	Unvaccinated HCWs (n=6,967)		
Age, mean (\pmSD)	49.4 (8.5)	46.6 (9.4)	1.03 (1.02-1.04)	1.02 (1.01-1.03)
Gender				
Male (%)	528 (12.8)	3,605 (87.2)	1	1
Female (%)	353 (9.5)	3,362 (90.5)	0.71 (0.62-0.82)	0.74 (0.63-0.87)
Profession				
Biologists (%)	76 (30.6)	172 (69.4)	1	1
Doctors (%)	267 (13.9)	1,657 (86.1)	0.37 (0.27-0.49)	0.41 (0.30-0.57)
Nurses (%)	185 (6.9)	2,512 (93.1)	0.17 (0.12-0.23)	0.26 (0.19-0.37)
Technicians (%)	170 (9.9)	1,543 (90.1)	0.25 (0.18-0.34)	0.27 (0.19-0.38)
Administrative workers (%)	156 (15.7)	840 (84.3)	0.42 (0.31-0.58)	0.56 (0.33-0.93)
Others (%)	15 (11.3)	118 (88.7)	0.21 (0.11-0.42)	0.36 (0.18-0.74)
Residence				
Palermo (%)	735 (11.2)	5,821 (88.8)	1	NI
Others (%)	146 (11.3)	1,146 (88.7)	1.01 (0.85-1.19)	
Workplace unit				
Diagnostic unit (%)	159 (17.9)	731 (82.1)	1	1
Internal medicine (%)	373 (11.5)	2,865 (88.5)	0.60 (0.49-0.73)	0.69 (0.55-0.87)
Surgical unit (%)	134 (6.7)	1,868 (93.3)	0.32 (0.26-0.42)	0.42 (0.32-0.55)
Emergency/ intensive care (%)	71 (9.6)	665 (90.4)	0.49 (0.36-0.66)	0.66 (0.48-0.91)
Non medical unit (%)	144 (14.7)	838 (85.3)	0.79 (0.61-1.01)	0.58 (0.36-0.92)

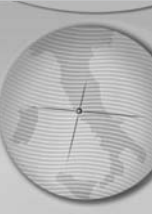
NI: Variables not included in regression model ($p > 0.20$ in the univariate analysis)

Table 4. HCW absenteeism due to ILI, stratified by socio-demographic, occupational characteristics and vaccination status.

	2007-2008 (n=2,608)		Crude OR (95% CI)	Adjusted OR (95% CI)
	Absent HCWs (n=178)	Not absent HCWs (n=2,430)		
Age, mean (\pmSD)	46 (8.9)	47.5 (9.4)	0.98 (0.96-0.99)	0.98 (0.97-1.01)
Gender				
Male (%)	82 (6)	1,277 (94)	1	1
Female (%)	96 (7.7)	1,153 (92.3)	1.30 (0.95-1.78)	1.21 (0.88-1.65)
Residence				
Palermo (%)	151 (7)	2,019 (93)	1	NI
Others (%)	27 (6.2)	411 (93.8)	0.88 (0.56-1.36)	
Profession				
With duty of care (%)	132 (6.9)	1,784 (93.1)	1	NI
Without duty of care (%)	46 (6.6)	646 (93.4)	0.96 (0.68-1.38)	
Workplace unit				
Internal medicine (%)	69 (6.5)	991 (93.5)	1	
Surgical unit (%)	46 (6.9)	624 (93.1)	1.06 (0.71-1.56)	
Emergency/ intensive care (%)	21 (8.3)	233 (91.7)	1.29 (0.75-2.21)	
Diagnostic unit (%)	20 (6.5)	286 (93.5)	1 (0.58-1.61)	NI
Non medical unit (%)	22 (6.9)	296 (93.1)	1.07 (0.63-1.8)	
Vaccination status				
Vaccine recipients (%)	7 (3.3)	208 (96.7)	1	1
Vaccine non recipients (%)	171 (7.1)	2,222 (92.8)	2.29 (1.02-5.38)	2.18 (1.01-4.71)

NI: Variables not included in regression model ($p > 0.20$ in the univariate analysis)

Figure 1. Weekly incidence of ILI in workers of AOUP and in Sicilian general population aged 15-64 years (from 1st January to 31st March 2008).



25% [8]. According to previous data, the mean coverage reported in healthcare staff of AOUP during three influenza seasons was very low and similar to the 12.2% estimated in other Italian geographic areas in 2006-2007 [16].

Considering vaccination as the best prevention against influenza [17], this poor compliance in healthcare settings may neither be able to reduce the risk of spread of nosocomial viral infections nor the disruption of healthcare assistance, particularly in those critical weeks when the need for hospital personnel is maximum.

Several factors have been reported to influence the receipt of vaccination and different influenza seasons can also determine significant differences in vaccination rates.

In our study, a decreasing temporal trend of vaccination uptake was observed with a peak in 2005-2006 and a progressive decline in successive influenza seasons.

As other authors underlined, this finding could be consistent with the remarkable attentions that influenza vaccination had in the winter of 2005 as consequence of media coverage of avian flu [18]. Consequently, during 2005-2006, higher vaccination coverage levels among HCWs were also observed in Germany (27.5% vs 22.6% in 2006-2007) and in Spain (28.9% vs 20.5% in 2006-2007) [16]. Otherwise, the reasons for the decrease in vaccination seen in the 2006-2007 season, in our case as in others, might be the consequence of both the low activity levels of the influenza virus and the related late start of the influenza season that may have lowered the attention of HCWs [16,19].

Our results show that occupational and socio-demographic determinants can also significantly influence voluntary acceptance of the influenza vaccine. According to Abramson *et al* [18], in our experience males and older age groups were strictly associated with acceptance of vaccination. The higher compliance with immunization with age could be due to an increased feeling of personal susceptibility, whereas the correlation between male sex and vaccination uptake remains unclear although this finding is consistent with results from other Italian healthcare settings [20, 21].

Moreover, the present paper shows that personnel working in areas devoted to high risk patients, such as surgery units or emergency/intensive care units, had lower vaccination rates than non-clinical HCWs. Among HCWs with clinical duties, professions commonly associated with higher education levels or requiring degree/specialization were more likely to accept vaccination whereas nurses and paramedics had

generally lower influenza coverage in both our investigation and in other Italian studies [19, 21]. Similar scenarios may suggest to healthcare managers the importance of monitoring influenza vaccination campaigns in order to avoid clusters of non-compliant HCWs in areas that need to respond to high risk patients.

Otherwise, considering that knowledge of professional literature and publications were the main external influence effecting a positive decision to immunize [18], educational events promoted by healthcare managers should be considered as a valid tool for increasing the coverage of those HCW groups.

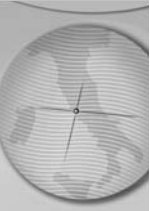
This last statement may appear in contradiction with the scarcity of evidence present about the benefits of influenza vaccination in healthcare personnel. In 2007, Chan underlined that few published studies were available about the efficacy of flu vaccine in HCWs and that only 7 publications were indexed in Medline using the terms "influenza vaccination" and "health care workers" [22].

To enrich this scientific context, our results show that well matched influenza vaccination, such as reported in Italy during 2007-2008 season [23], was significantly associated with reduced workplace sick leaves due to ILI.

This relationship encourages vaccination since influenza-like illness affects up to 25% of non-immunized HCW [24] and causes, in our own and in other studies, about 12% of all sickness absence from work [25]. It is also remarkable that cases of absence from work occur in a short period of the year, such as confirmed by the evident peak of cases of sickness absenteeism due to ILI in AOUP during the first week of February. This last finding is coherent with the incidence trends of influenza-like illness registered in the general Sicilian population, aged 15-64 years, during the 2008 influenza season.

Epidemic curves also suggest that cases of ILI were nearly twice as high in HCWs than ILI in general population and the result appears to be supported by the consideration that the comparison was made by using data obtained by general practitioners in both our study and the Influnet database. As reported by others [26], this higher incidence of ILI among HCWs may also reflect a possible increased circulation of influenza viruses in healthcare settings.

Finally, the results presented in this study could have several important limitations common to all observational studies and, according to other authors [22], vaccinated workers could have a reduction of days lost due to sickness because of better infection prevention practices (washing



of hands, use of standard precautions, etc) or having a healthier life-style than those reported in unvaccinated healthcare workers.

In conclusion, the present paper enriches the general knowledge of flu vaccination of HCWs and accentuates the importance of programs for annual influenza vaccination of healthcare personnel.

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