RESEARCH PAPER

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Influenza vaccination coverage among medical residents

An Italian multicenter survey

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Abbreviations: MRs, medical residents; HCWs, health care workers; CDC, American Centers for Disease and Control; ECDC, European Centers for Disease and Control

Although influenza vaccination is recognized to be safe and effective, recent studies have confirmed that immunization coverage among health care workers remain generally low, especially among medical residents (MRs). Aim of the present multicenter study was to investigate attitudes and determinants associated with acceptance of influenza vaccination among Italian MRs. A survey was performed in 2012 on MRs attending post-graduate schools of 18 Italian Universities. Each participant was interviewed via an anonymous, self-administered, web-based questionnaire including questions on attitudes regarding influenza vaccination. A total of 2506 MRs were recruited in the survey and 299 (11.9%) of these stated they had accepted influenza vaccination in 2011–2012 season. Vaccinated MRs were older ($P = 0.006$), working in clinical settings ($P = 0.048$), and vaccinated in the 2 previous seasons ($P < 0.001$ in both seasons). Moreover, MRs who had recommended influenza vaccination to their patients were significantly more compliant with influenza vaccination uptake in 2011–2012 season ($P < 0.001$). "To avoid spreading influenza among patients" was recognized as the main reason for accepting vaccination by less than 15% of vaccinated MRs.

Italian MRs seem to have a very low compliance with influenza vaccination and they seem to accept influenza vaccination as a habit that is unrelated to professional and ethical responsibility. Otherwise, residents who refuse vaccination in the previous seasons usually maintain their behaviors. Promoting correct attitudes and good practice in order to improve the influenza immunization rates of MRs could represent a decisive goal for increasing immunization coverage among health care workers of the future.

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Introduction

A multiplicity of international public health authorities recognize influenza vaccination as the best preventive measure to limit influenza virus transmission among population, emphasizing the high priority of selected population groups of public utility.[1]

In this context, vaccinating health care workers (HCWs) against influenza is strongly recommended by international health authorities (e.g., CDC and WHO).[1,2]

During influenza season HCWs are charged of a great responsibility in order to limit the risk of spreading influenza to their patients and to protect themselves assuring the continuity of health care. In fact, occupational influenza infections among HCWs have been associated worldwide with 2 main important consequences: (1) spreading infections to vulnerable patients,[3,4] and (2) an increase of sickness absenteeism from work with possible limitation of healthcare assistance.[5]

Although influenza vaccination is recognized to be safe and effective, providing for 70–90% protection against infection,[6] recent studies have confirmed that influenza vaccination coverage rates especially among HCWs remain generally low.[7] Previous studies have documented that also medical residents (MRs) and general practitioner trainee physicians have shown very low coverage rates (<30%),[8-18] being significantly below the 75% recommended by the American and European Centers for Disease and Control (CDC and ECDC).[19,20]

MRs should be considered a "priority group" since they are frequently the first-line providers for hospitalized and debilitated patients and they represent the medical specialists of the future. Moreover, MRs were graduated in a time of great attention paid to limit care costs and, thus, they should have a major concern in promoting consolidated and cost-saving preventive practices.

In this context, monitoring influenza vaccination coverage among MRs and investigating factors involved in their decision to get vaccinated could represent a milestone to model and increase future trend in vaccination coverage among HCWs.

The present multicenter study represents the first that has been performed on a national basis and has aimed to investigate influenza vaccination coverage among MRs and attitudes/determinants associated with acceptance of vaccination, surmounting some possible limitations of the previous published literature (e.g., small sample sizes and lack of generalizability).

Moreover, the study aims to investigate and suggest what strategies could be more appropriate to increase influenza vaccination rates.

Results

A total of 2506 (24.1%; response rate range in postgraduate school involved in the study: 20.3–28.7%) out of 10396 MRs were recruited in the survey and 299 (11.9%) MRs reported to be vaccinated in 2011–2012 influenza season.

The principal socio-demographic and academic characteristics of the 2506 MRs (median age = 29 y, interquartile range = 3 y) are shown in **Table 1**. The majority of respondents were females (64.7%) and with clinical duties (43.9%). Vaccinated MRs were significantly older (P = 0.006), working in clinical settings (P = 0.048) and vaccinated in the previous 2 influenza seasons (P < 0.001 in both cases). Moreover, MRs vaccinated against influenza were significantly more compliant with recommending influenza vaccination to patients according to own clinical evaluation or to the Italian Health Ministry recommendations (P < 0.001).

Overall, the vaccination rate among Italian MRs has decreased consistently with time, ranging from 21.7% in 2008–2009 season to 11.9% in 2011–2012 season (chi-square for trend = 20.95; P < 0.001).

The factors involved in the decision to be vaccinated during the 2011–2012 influenza season were reported in **Figure 1A**. "To avoid spreading influenza among general population" (30.5%) and "to avoid illness" (29.9%) were the most important reasons associated with influenza vaccination. Otherwise, as shown in **Figure 1B**, "Not consider themselves as a part of a high risk group for developing influenza" (31.3% of not vaccinated) was the main factor involved in the decision to not get vaccinated, followed by "influenza illness and complications does not justify risk of influenza vaccination" (26.6%).

The multivariable analysis, reported in **Table 2**, showed that an older age (>29 y) was likely to be associated with seasonal 2011–2012 influenza vaccination uptake (adjOR = 1.53; 95% CI = 1.11–2.11).

Influenza vaccination uptake in 2010–2011 was the best predictor for getting vaccinated against influenza in 2011–2012 season (adjOR = 17.66; 95% CI = 11.92–26.17). Similarly, MRs declaring to be vaccinated in 2009–2010 season against seasonal (adjOR = 4.42; 95% CI = 2.78–7.05), pandemic (adjOR = 1.98; 95% CI = 1.08–3.62), and both pandemic and seasonal (adjOR = 2.97; 95% CI = 1.84–4.79) influenza virus, have significantly higher vaccination rate in 2011–2012 vaccination season.

MRs who had recommended influenza vaccination to their patients according to the Italian Health Ministry recommendations (adjOR = 1.99; 95% CI = 1.19–3.34) or according to own clinical evaluation (adjOR = 1.98; 95% CI = 1.15–3.41) were significantly more compliant with influenza vaccination uptake in 2011–2012 season.

Finally, a consistent part of the Italian MRs involved in the study considered that multidisciplinary courses on influenza/influenza vaccination (49.3%) can be the best strategy to improve influenza immunization rates among HCWs (**Fig. 2**).

Discussion

Medical residents should be considered an important target group of HCWs for investigating influenza vaccination attitudes, since they are at the beginning of their working life and they are acquiring knowledge, skills, and compliance with patient counselling. A large part of their professional habits and experiences will be retained for the entire life and shared with other colleagues and patients.

Certainly, MRs are medical specialists of the future and, usually being the first-line providers for hospitalized and debilitated

Table 1. Factors associated with seasonal influenza 2011–2012 vaccination among medical Italian residents

n = 2506*		Vaccine uptake during 2011–2012 season		*P* value
	TOTAL	Vaccinated	Not vaccinated	
Total	2506	299 (11.9)	2207 (88.1)	
Age, median in years (interquartile range)	29 (3)	30 (4)	29 (3)	0.006
Gender, n (%)				
Male	885 (35.3)	108 (36.1)	777 (35.2)	0.76
Female	1624 (64.8)	191 (63.9)	1430 (64.8)	
Year after degree, n (%)				
≤2	574 (22.9)	55 (18.4)	519 (23.5)	0.22
3	648 (25.9)	81 (27.1)	567 (25.7)	
4	605 (24.1)	73 (24.3)	532 (24.1)	
≥5	679 (27.1)	90 (30.2)	589 (26.7)	
Year of residency, n (%)				
R1	785 (31.3)	85 (28.4)	700 (31.7)	0.74
R2	489 (19.5)	59 (19.7)	430 (19.5)	
R3	858 (34.2)	111 (37.1)	747 (33.9)	
R4	113 (4.5)	11 (3.7)	102 (4.6)	
R5	250 (10)	31 (10.4)	219 (9.9)	
R6	11 (0.4)	2 (0.7)	9 (0.4)	
Main specialty duties, n (%)				
Clinical	1,099 (43.9)	142 (47.5)	957 (43.4)	0.048
Surgical	567 (22.6)	51 (17.1)	516 (23.4)	
Diagnostic	840 (33.5)	106 (35.4)	734 (33.2)	
Attitude to recommend influenza vaccination to patients, n (%)				
Yes, according to the Italian Health Ministry recommendations	1,011 (40.3)	158 (52.8)	853 (38.6)	<0.001
Yes, according to own clinical evaluation	688 (27.5)	96 (32.1)	592 (26.8)	
No, not recommended	47 (1.9)	0 (0)	47 (2.1)	
No, leaving patients to their free will	306 (12.2)	17 (5.7)	289 (13.1)	
No, there were no occasions for recommending influenza vaccination	454 (18.1)	28 (9.4)	426 (19.4)	
Vaccination against influenza during 2010–2011, n (%)				
Yes	388 (15.5)	229 (76.6)	159 (7.2)	<0.001
No	2118 (84.5)	70 (23.4)	2048 (92.7)	
Vaccination against 2009–2010 seasonal influenza, n (%)				
Yes, seasonal and pandemic	206 (8.2)	113 (37.8)	93 (4.2)	<0.001
Yes, seasonal	205 (8.2)	87 (29.1)	118 (5.3)	
Yes, pandemic	132 (5.3)	22 (7.4)	110 (5.0)	
No	1963 (78.3)	77 (25.7)	1886 (85.5)	

patients, they should be considered one of the physicians group at greater risk of getting or transmitting flu to patients.

Consequently, understanding factors involved in their decision to accept influenza vaccination and operating on these factors could help public health authorities to develop proper strategies in order to increase influenza vaccination rates among MRs and healthcare workers.

Despite of these considerations, a general lack of knowledge and information about this topic raises by consulting the international literature: just a few studies have investigated influenza vaccination among medical residents and have reported data of small-size samples and restricted geographic areas.[8-15]

Looking at the overall vaccination rate observed in the current study, Italian MRs seem to have a very low compliance

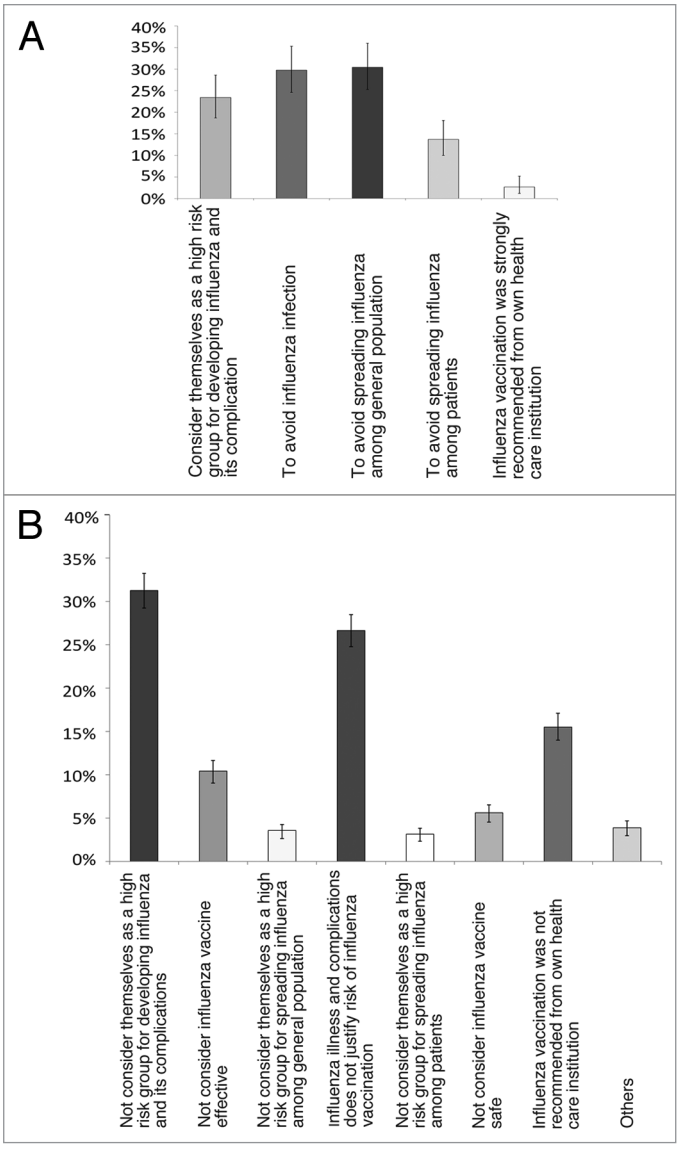

Figure 1. Reasons for influenza vaccination uptake in 2011–2012 season among vaccinated Italian medical residents (n=299) (**A**). Reasons for refusing influenza vaccination in 2011–2012 season among not vaccinated Italian medical residents (n=2207) (**B**).

with influenza vaccination. Acceptance of seasonal and pandemic A (H1N1) influenza vaccination ranged from 12% to 20%, being significantly lower than influenza vaccinations rates reported in MRs attending 3 different university hospitals in the United States (49.5%,[9] 58%,[10] and 75%[11]) and in France (45.6%[12]), but higher than those documented among Brazilian resident physicians (3.1%[13]). Otherwise, influenza coverage rates documented by our study are very similar to those reported in 2 different Italian studies both conducted in a confined regional area (21.8%[8] and 33.7%[15,17]). These last data confirm that compliance with influenza vaccination among Italian MRs has not improved, with a decreasing feeling during the last years.

A such steadily downward trend could be partially explained by considering that the significance of uptaking influenza vaccination in order "to avoid spreading influenza among patients" is misknown also among vaccinated Italian MRs. Moreover, a large part of Italian MRs refuse influenza vaccination since they believe that immunization will not provide any or little own personal health gain whereas a scarce attention is paid to the possibility to reduce the health risks of patients.

According to these considerations, studies conducted among MRs in the United States and other European countries confirm that the main reasons associated with influenza vaccination adherence were "to consider themselves at high risk group for developing influenza,"[10] "to avoid influenza infection,"[14,21] and "to avoid spreading influenza among general populations/relatives[21] or patients."[10,14]

Conversely, the most important factors, reported in previous studies, associated to influenza vaccination refusal ("forgot it,"[10] "I do not have time,"[14] "doubts about vaccine efficacy,"[21] and "not likely to get influenza"[9]), differ from those documented in our study, demonstrating that different attitudes can play a role in influenza vaccine refusal in different countries.

In our study vaccine uptake was also associated with an older age, attitude to recommend influenza vaccination to patients and influenza vaccination acceptance in the previous seasons. An higher vaccination coverage among older HCWs was documented in another Italian regional setting,[5] being probably due to an amplified feeling sense of weakness with age. Considering that in our study the target population is medical residents, whose median age is 30 y, it is difficult to think that at that age, there is already a feeling of weakness. However, since some other variables not investigated in this study (e.g., marital status, living with children at home, comorbidities) could play a role in explaining this finding, further investigations may be required for a better understanding of this relationship.

Furthermore, an important consequence of getting influenza vaccination is that vaccinated MRs were significantly more inclined to recommend influenza vaccination to their patients. Although this result should be considered with caution since in the analysis we have included MRs attending specialties without clinical duties, our results seem to suggest that influenza vaccination of MRs could represent a decisive goal of future public health strategies, also for increasing immunization coverage among general population.

Among the different determinants associated with vaccination uptake, previous influenza vaccinations in 2009–2010 season and in 2010–2011 season were the factors with the higher attributability in the decision to get influenza vaccination, with an an-adjusted risk up to 42-fold higher. Although this risk is considerably decreased after adjustment, probably as consequence of the partial collinearity of the 2 variables, an influenza vaccination in the previous season in our study represented the main predictor of following influenza vaccinations.

Lastly, aim of the present study was to investigate which strategies, according to MRs, can be considered useful to increase vaccination rates.

Reaching a such objective could be of paramount importance also considering that the best predictor for seasonal influenza vaccination is an influenza vaccination in the previous season. This result has been confirmed by studies performed in other European and non-European countries,[21-23] as well as in the Italian setting.[8,15,17,24] As a consequence, increasing influenza vaccination coverage in a season could have an important domino effect for the future influenza season.

Following the MRs suggestions, multidisciplinary courses and, in part, more appropriate university training on influenza and its relative vaccination could be successful strategies. This observation is consistent with the National Vaccine Advisory Committee Guidelines that recommends to organize tailored training program specific for post-graduate medical school.[25]

Furthermore, mandatory vaccination, judged to be a good strategy for the 20% of the interviewed MRs, might be considered to increase the immunization rate among residents and other medical trainees,[26] although similar measures were reported to have damaged staff morale and to infringe bodily integrity, civil liberty, professional autonomy and, potentially, freedom to work.[27]

This study has 2 main limitations that could reduce the validity and generalizability of our results. First, all the data in our survey were self-reported and may be subject to social desirability bias. Second, the low response rate (24.1%) and the lack of information about non-responders (e.g., specialties attended by MRs) may make it difficult to generalize across the target population and could have led to biased data resulting in a misinterpretation (overestimation or underestimation) of both determinants associated with influenza vaccination and vaccination coverage. However, this last hypothesis appears to be partially overcome by considering that influenza vaccination coverage observed in our study is consistent with data obtained in the same period among other Italian healthcare workers.[8,16] Moreover, the low response rate could also be considered an important result suggesting a general lack of interest on this topic among Italian MRs.

Despite of these possible limitations, this is the first national study examining compliance with influenza vaccination in MRs working in one of the most populated European countries.

Moreover, our findings confirm that every year MRs seem to accept influenza vaccination as a habit that is unrelated to professional and ethical responsibility, whereas residents who refuse vaccination in the previous seasons usually maintain their behaviors.

The major challenge for the future will consist in promoting correct attitudes and good practice in order to improve the vaccine compliance of MRs and HCWs.

Material and Methods

The study was performed between 1st April 2012 and 8th June 2012, involving all MRs attending post-graduate schools of 18 Italian Universities (Bari, Bologna, Brescia, Catania, Catanzaro, Chieti, L'Aquila, Messina, Modena, Napoli Federico II, Palermo, Pavia, Parma, Roma Cattolica, Roma Tor Vergata, Siena, Torino, Verona). A total of 10 854 MRs who had regularly paid University fees and were thus enrolled at the post-graduate medical schools of the previously cited Italian Universities were considered eligible for and asked for enrollment in the study. For the aims of the present study, in the statistical analysis we have included also MRs attending specialties that are not involved in direct contact with patients (forensic medicine, pathology, and others) since these MRs have usually clinical duties in outpatient settings (e.g., doctor on call and covering doctor).

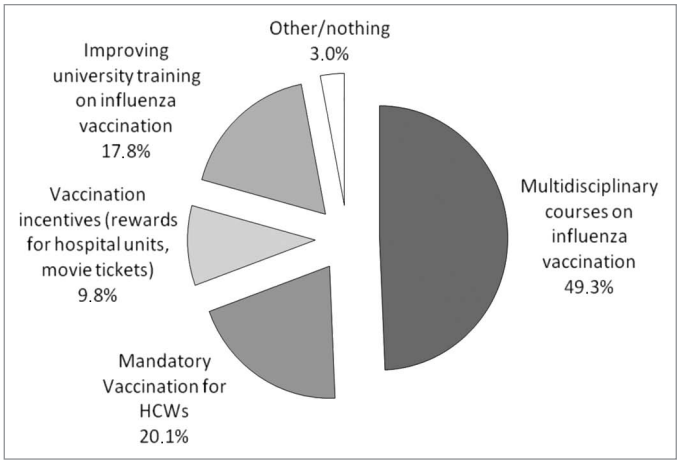

Figure 2. Strategies for increasing influenza immunization rate suggested by Italian medical residents.

MRs were contacted throughout email addresses obtained from the university information centers, and those without at least one valid email address were excluded from the study (n = 458).

Each contacted MR received a recruitment e-mail containing an explanation of the study objectives, an informed consent form, and a link to an anonymous, self-administered, web-based questionnaire.

After the first month, a reminder e-mail was sent to all non-responders. The participation in the study was on a voluntary basis.

Questionnaire

The questionnaire was validated during a previous pilot study and used in a previous local survey.[8] The final version of the questionnaire, designed by a national working group, comprised 10 sections, including 23 items. However, for a more suitable and less scattered analysis, only 6 sections were considered in the present manuscript:

(1) Demographic and academic characteristics: sex, age, year of graduation, year of residency, specialty duties (categorized as "Clinical duties" including allergy and immunology, cardiology, dermatology, endocrinology, gastroenterology, geriatrics, infectious disease, nephrology, neurology, oncology, pediatrics, psychiatry, pulmonology, rehabilitation medicine, rheumatology; "Surgical duties" including cardiovascular surgery, general surgery, gynecology, maxillofacial surgery, neurosurgery, ophthalmology, otolaryngology, orthopedic surgery, pediatric surgery, plastic surgery, surgical oncology, thoracic surgery, urology, vascular surgery; "Diagnostic duties" including hygiene and

Table 2. Best fitting logistic regression model, by Akaike's Information Criterion, for vaccination uptake during 2011–2012 season (Hosmer–Lemeshow goodness-of-fit test *P* value = 0.71)

	Vaccine uptake during the 2011–2012 season	
	Crude OR (95% CIs)	**Adj OR (95% CIs)***
Age, in years		
≤29	referent	referent
>29	1.37 (1.08–1.76)[b]	1.53 (1.11–2.11)[b]
Influenza vaccination in 2009–2010 season		
no	referent	referent
yes, seasonal	29.76 (20.83–42.52)[a]	4.42 (2.78–7.05)[a]
yes, pandemic	4.9 (2.94–8.17)[a]	1.98 (1.08–3.62)[c]
yes, both pandemic and seasonal	18.06 (12.62–25.85)[a]	2.97 (1.84–4.79)[a]
Influenza vaccination in 2010–2011 season		
No	referent	referent
Yes	42.14 (30.83 – 57.6)[a]	17.66 (11.92–26.17)[a]
Attitude to recommend influenza vaccination to patients		
No, there were no occasions for recommending influenza vaccination	referent	referent
No, not recommended	NC	NC
No, leaving patients to their free will	0.89 (0.48–1.67)[d]	0.94 (0.44–1.99)[d]
Yes, according to the Italian Health Ministry recommendations	2.82 (1.85–4.28)[a]	1.99 (1.19–3.34)[b]
Yes, according to own clinical evaluation	2.48 (1.6–3.84)[a]	1.98 (1.15–3.41)[c]

[a]$P < 0.001$. [b]$P < 0.01$. [c]$P < 0.05$. [d]$P \geq 0.05$. NC, not calculable due to absences of vaccinated subjects *Adjusted for gender, year after degree, year of residency, and main specialty duties.

preventive medicine, anesthesiology, clinical laboratory sciences, microbiology, emergency medicine, forensic medicine, intensive care medicine, pathology, radiology, occupational medicine), geographic setting (categorized as "North," "Centre," and "South" of Italy).

(2) Influenza vaccination coverage: during 2009–2010 (categorized as "pandemic AH1N1," "seasonal," "both pandemic AH1N1 and seasonal"); 2010–2011, and 2011–2012 influenza seasons.

(3) Reasons for influenza vaccination uptake in 2011–2012 season: 5 mutually exclusive answers were considered ("Consider themselves as a high risk group for developing influenza"; "To avoid illness"; "To avoid spreading influenza among general population"; "To avoid spreading influenza among patients"; "Influenza vaccination was strongly recommended from own health care institution").

(4) Reasons for refusing influenza vaccination in 2011–2012 season: 7 mutually exclusive answers were measured ("Not consider themselves as a high risk group for developing influenza," "Not consider themselves as a high risk group for spreading influenza among general population or among patients"; "Influenza illness and complications does not justify the risk of vaccination"; "Not consider influenza vaccine effective or not consider influenza vaccine safe"; "Influenza vaccination was not recommended from own health care institution").

(5) Attitudes to recommend influenza vaccination to patients: categorized as "Yes, according to the recommendations of the health Minister"; "Yes, according to my clinical experience"; "No, leaving patients to their free will"; "No, discouraging the patients"; "No, there were no occasions for recommending influenza vaccination."

(6) Suggested strategies for increasing influenza immunization rates among HCWs: categorized as "Multidisciplinary courses," "Mandatory vaccination," "Vaccination incentives," "Specific university training on influenza vaccination," "Other."

Statistical analysis

Absolute and relative frequencies were calculated for qualitative variables, while quantitative variables were summarized as median (interquartile range). Categorical variables were analyzed using the chi-square test (Mantel–Haenszel) and medians were compared by using the Mann–Whitney–Wilcoxon test. Trend in annual influenza vaccination coverage was evaluated by Chi-square for trend. All variables found to have a statistically significant association (two-tailed *P* value < 0.05) with vaccine uptake in the last influenza season (2011–2012) in the univariate analysis were included in a backward stepwise logistic-regression model. Goodness of fit was calculated for each model, and the model with the lowest Akaike Information Criterion was considered to have the best fit. Adjusted OR (adj-OR) with 95% confidence intervals (95% CIs) were also calculated for the variables

retained in the final model. Hosmer–Lemeshow goodness-of-fit test was used to determine how well the final model fit the data.

The significance level chosen for all analysis was 0.05, two-tailed. All the data were analyzed using the R statistical software package.

Ethical approval

The study was approved by the Institutional Review Board of the AOUP "P. Giaccone" of Palermo, Italy.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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