

# Knowledge of and attitudes to influenza in unvaccinated primary care physicians and nurses

## A cross-sectional study

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**Abbreviations:** aOR, adjusted odds ratio; CI, confidence intervals; HCW, healthcare workers; OR, odds ratio

Primary healthcare workers, especially nurses, are exposed to the vast majority of patients with influenza and play an important role in vaccinating patients. Healthcare workers' misconceptions about influenza and influenza vaccination have been reported as possible factors associated with lack of vaccination. The objective of this study was to compare the characteristics of unvaccinated physicians and unvaccinated nurses in the 2011–2012 influenza season. We performed an anonymous web survey of Spanish primary healthcare workers in 2012. Information was collected on vaccination and knowledge of and attitudes to the influenza vaccine. Multivariate analysis was performed using unconditional logistic regression. We included 461 unvaccinated physicians and 402 unvaccinated nurses. Compared with unvaccinated nurses, unvaccinated physicians had more frequently received seasonal influenza vaccination in the preceding seasons (aOR 1.58; 95% CI 1.11–2.25), and more frequently believed that vaccination of high risk individuals is effective in reducing complications (aOR 2.53; 95% CI 1.30–4.95) and that influenza can be a serious illness (aOR 1.65; 95% CI 1.17–2.32). In contrast, unvaccinated physicians were less concerned about infecting patients (aOR 0.62; 95% CI 0.40–0.96). Unvaccinated nurses had more misconceptions than physicians about influenza and the influenza vaccine and more doubts about the severity of annual influenza epidemics in patients with high risk conditions and the prevention of complications by means of the influenza vaccination. For unvaccinated physicians, strategies to improve vaccination coverage should stress the importance of physicians as a possible source of infection of their patients. The effectiveness of influenza vaccination of high risk persons should be emphasized in nurses.

## Introduction

Influenza is a highly-communicable disease that causes a significant burden of morbidity and mortality in the community every year, mainly in adults aged  $\geq 65$  y, young children and people with medical conditions that increase the risk of complications. Annual administration of the seasonal influenza vaccine, especially to persons known to be at high risk of serious complications as a result of influenza and their close contacts, is the main step in reducing the disease impact.<sup>1</sup> Healthcare workers (HCW) are exposed to patients with influenza in the workplace and, consequently, are at risk of acquiring the disease and may act as vectors of nosocomial transmission. Unvaccinated HCW may develop clinical or

subclinical influenza infection during the winter months and may introduce the infection into a healthcare facility, serving as a source of secondary transmission of influenza to patients and other staff.

Primary HCW play a crucial role in influenza prevention because they are the gateway to the health system, are exposed to the vast majority of patients with influenza, and play a leading role in vaccinating patients.<sup>2,3</sup> Because of this crucial role, investigation of the factors associated with rejection of influenza vaccination by primary healthcare physicians and nurses is of interest.

Studies have demonstrated that influenza vaccination of HCW can reduce morbidity and mortality in their patients.<sup>4–6</sup> Therefore, annual influenza vaccination of HCW is the most

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**Table 1.** Distribution of physicians and nurses not vaccinated against influenza according to demographic and social characteristics

	Unvaccinated physicians (n = 461)	Unvaccinated nurses (n = 402)	P value
Age (y)			
25–34	23 (5.0%)	58 (14.4%)	
35–44	127 (27.5%)	115 (28.6%)	<0.001
45–54	186 (40.3%)	162 (40.3%)	<0.001
≥55	125 (27.1%)	67 (16.7%)	<0.001
Gender			
Male	167 (36.2%)	26 (6.5%)	
Female	294 (63.8%)	376 (93.5%)	<0.001
Years of work			
≤9 y	44 (9.5%)	40 (10.0%)	
10–29 y	314 (68.1%)	256 (63.7%)	0.64
≥30 y	103 (22.3%)	106 (26.4%)	0.63
Type of population			
Rural and intermediate	81 (18.5%)	89 (22.2%)	
Urban	357 (81.5%)	312 (77.8%)	0.18
Persons aged <15 y in the household			
No	265 (57.5%)	244 (60.7%)	
Yes	196 (42.5%)	158 (39.3%)	0.34
High risk conditions in the household			
No	432 (93.7%)	360 (89.6%)	
Yes	29 (6.3%)	42 (10.4%)	0.03
Persons aged >65 y in the household			
No	418 (90.7%)	355 (88.3%)	
Yes	43 (9.3%)	47 (11.7%)	0.26

important measure that can be adopted to prevent transmission in healthcare centers. The United States Centers for Disease Control and Prevention specifically recommend influenza vaccination of physicians, nurses, and other staff of hospital and outpatient settings as a core strategy to prevent influenza transmission in healthcare centers.<sup>7</sup> In Spain, influenza vaccination is also recommended for HCW.<sup>8</sup> However, whereas the seasonal influenza coverage in HCW in the United States is close to 70%<sup>9</sup> or higher,<sup>10</sup> most Spanish studies show coverages under 50%.<sup>11–14</sup> Worryingly, the coverage does not increase over time<sup>12</sup> and may even decrease.<sup>11,15</sup> In most studies, nurses have a lower coverage than physicians.<sup>11,12,14–16</sup>

Some authors have found that misconceptions about the influenza vaccine are associated with non-vaccination, especially in nurses, suggesting that differences between physicians and nurses may influence vaccination coverages.<sup>17–20</sup>

The objective of this study was to compare the characteristics of unvaccinated physicians and unvaccinated nurses in the 2011–2012 influenza season in Spain.

## Results

The questionnaire was sent to 5433 HCW, of whom 2635 began the questionnaire and 1965 (36.2% of HCW contacted) completed it.

Of the HCW who answered the questionnaire, 74 had contraindications to influenza vaccination and 142 had ≥1 health risk condition for influenza vaccination and were excluded. Of the 1749 remaining HCW, 886 (50.7%) had received influenza vaccination in the 2011–2012 season and 863 (461 physicians and 402 nurses) were unvaccinated and were included in the analysis. The sociodemographic characteristics of physicians and nurses initially included and those finally analyzed are shown in **Table S1**.

The most-frequent age groups were 45–54 y in both physicians (40.3%) and nurses (40.3%), and 35–44 y (27.5% and 28.6%, respectively). There was a predominance of females in both physicians (63.8%) and nurses (93.5%;  $P < 0.001$ ). More nurses (26.4%) than physicians (22.3%) had spent ≥

**Table 2.** Comparison of knowledge of and attitudes to the influenza virus and influenza vaccine in unvaccinated physicians and unvaccinated nurses

	Unvaccinated physicians (n = 461)	Unvaccinated nurses (n = 402)	Crude OR	P value	Adjusted OR	P value
<b>What virus type does the vaccine contain?</b>						
A	42 (9.1%)	31 (7.7%)	1		1 <sup>a</sup>	
B	32 (6.9%)	7 (1.7%)	3.37 (1.32–8.64)	0.01	5.48 (1.81–16.61)	0.003
C	3 (0.7%)	0 (0.0%)	-	-	-	-
A and B	334 (72.5%)	303 (75.4%)	0.81 (0.50–1.33)	0.41	1.50 (0.75–3.00)	0.25
No response	50 (10.8%)	61 (15.2%)	0.60 (0.33–1.10)	0.10	2.53 (0.97–6.64)	0.06
<b>What virus type is responsible for epidemics?</b>						
A	74 (16.1%)	32 (8.0%)	1		1 <sup>a</sup>	
B	37 (8.0%)	26 (6.5%)	0.61 (0.32–1.18)	0.14	0.52 (0.22–1.18)	0.12
C	3 (0.7%)	0 (0.0%)	-	-	-	-
A and B	309 (67.0%)	273 (67.9%)	0.49 (0.31–0.76)	0.002	0.44 (0.24–0.81)	0.01
No response	38 (8.2%)	71 (17.7%)	0.23 (0.13 – 0.41)	<0.001	0.17 (0.07–0.42)	<0.001
<b>Influenza has an incubation period of 10–14 d</b>						
No	213 (46.2%)	153 (38.1%)	1		1 <sup>b</sup>	
Yes	219 (47.5%)	221 (55.0%)	0.71 (0.54–0.94)	0.02	0.78 (0.56–1.08)	0.14
No response	29 (6.3%)	28 (7.0%)	0.74 (0.42–1.30)	0.30	0.70 (0.35–1.39)	0.31
<b>Influenza is not transmitted by contact</b>						
No	296 (64.2%)	233 (58.0%)	1		1 <sup>a</sup>	
Yes	149 (32.3%)	149 (37.1%)	0.79 (0.59–1.05)	0.10	0.73 (0.52–1.02)	0.06
No response	16 (3.5%)	20 (5.0%)	0.63 (0.32–1.24)	0.18	0.65 (0.29–1.44)	0.29
<b>I recommend the vaccine to pregnant women in their first trimester</b>						
No	211 (63.0%)	178 (65.7%)	1		1 <sup>c</sup>	
Yes	124 (37.0%)	93 (34.3%)	1.12 (0.80–1.57)	0.46	0.92 (0.62–1.35)	0.66

<sup>a</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact and Any specific training on influenza in the past 5 y; <sup>b</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, Cohabitation with person with chronic disease, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact and Any specific training on influenza in the past 5 y; <sup>c</sup>Adjusted for the following variables: Age, Sex, Professional category, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>d</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤ 15 y, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>e</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, What virus type does the vaccine contain?, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>f</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, Cohabitation with person with chronic disease, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact, and Any specific training on influenza in the past 5 y.

**Table 2.** Comparison of knowledge of and attitudes to the influenza virus and influenza vaccine in unvaccinated physicians and unvaccinated nurses (continued)

	Unvaccinated physicians (n = 461)	Unvaccinated nurses (n = 402)	Crude OR	P value	Adjusted OR	P value
<b>I recommend the vaccine to pregnant women in their second trimester</b>						
No	82 (24.2%)	49 (17.4%)	1		1 <sup>d</sup>	
Yes	257 (75.8%)	232 (82.6%)	0.66 (0.45–0.98)	0.04	0.73 (0.46–1.15)	0.17
<b>I recommend the vaccine to postpartum women</b>						
No	159 (51.6%)	131 (54.4%)	1		1 <sup>d</sup>	
Yes	149 (48.4%)	110 (45.6%)	1.12 (0.80–1.56)	0.52	1.04 (0.71–1.52)	0.85
<b>I recommend the vaccine to persons aged ≥ 65 y</b>						
No	12 (2.9%)	3 (0.8%)	1		1 <sup>e</sup>	
Yes	406 (97.1%)	372 (99.2%)	0.27 (0.08–0.97)	0.04	0.18 (0.05–0.74)	0.02
<b>I recommend the vaccine to people with chronic disorders</b>						
No	8 (1.8%)	1 (0.3%)	1		1 <sup>f</sup>	
Yes	444 (98.2%)	386 (99.7%)	0.14 (0.02–1.15)	0.07	0.11 (0.01–1.00)	0.05
<b>I recommend the vaccine to immunosuppressed people</b>						
No	27 (6.4%)	33 (8.9%)	1		1 <sup>e</sup>	
Yes	398 (93.6%)	339 (91.1%)	1.43 (0.85–2.43)	0.18	1.55 (0.83–22.89)	0.17
<b>Any specific training on influenza in the past 5 y</b>						
No	292 (63.3%)	268 (66.7%)	1		1 <sup>e</sup>	
Yes	169 (36.7%)	134 (33.3%)	1.16 (0.87–1.53)	0.31	0.76 (0.54–1.06)	0.11

<sup>a</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact and Any specific training on influenza in the past 5 y; <sup>b</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, Cohabitation with person with chronic disease, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact and Any specific training on influenza in the past 5 y; <sup>c</sup>Adjusted for the following variables: Age, Sex, Professional category, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>d</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>e</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, What virus type does the vaccine contain?, What strains are responsible for epidemics? and Any specific training on influenza in the past 5 y; <sup>f</sup>Adjusted for the following variables: Age, Sex, Professional category, Cohabitation with person aged ≤15 y, Cohabitation with person with chronic disease, What virus type does the vaccine contain?, What strains are responsible for epidemics?, Influenza is not transmitted by contact, and Any specific training on influenza in the past 5 y.

30 y in the profession, but the difference was not statistically significant (Table 1).

More physicians than nurses (6.9% vs. 1.7%, respectively; aOR 5.48; 95 %CI 1.81–16.61) knew that the type B influenza virus was contained in the vaccine. In contrast, fewer physicians than nurses did not know the types of virus responsible for epidemics (8.2% and 17.7%, respectively; aOR 0.17; 95 %CI 0.07–0.42) and fewer physicians (47.5%) than nurses (55.0%)

did not know the incubation period of influenza, although the difference was not significant. Fewer physicians than nurses recommended vaccination of patients aged ≥65 y (97.1% vs. 99.2%, respectively; aOR 0.18; 95% CI 0.05–0.74) (Table 2).

More physicians than nurses had been vaccinated in any of the 3 preceding seasons (46.4% and 35.8%, respectively; aOR 1.58; 95% CI 1.11–2.25). More physicians than nurses believed that influenza can be a serious illness (63.6% and 55.0%,

respectively; aOR 1.65; 95% CI 1.17–2.32), and that assessment of vaccination of high risk individuals is effective in reducing complications (93.5% and 87.8%, respectively; aOR 2.53; 95% CI 1.30–4.95). In contrast, physicians were less concerned about infecting patients than nurses (39.5% and 49.5%, respectively; aOR 0.62; 95% CI 0.40–0.96) (Table 3).

## Discussion

The results of this study comparing the characteristics of physicians and nurses not vaccinated against influenza in the 2011–2012 season in Spain show between-group differences in the knowledge of and attitudes to influenza. Unvaccinated physicians more-frequently received seasonal influenza vaccination in the preceding seasons, had more knowledge of the virus responsible for epidemics, and more often believed that vaccination of high risk patients can prevent complications and that influenza can be a serious illness. In contrast, unvaccinated physicians were less concerned about infecting patients than unvaccinated nurses.

The overall influenza vaccination coverage observed was 50.7%. Compared with other studies in Spanish primary HCW, the coverage was higher than the 44.2% obtained in 2009–10 by Ortiz et al.<sup>13</sup> and the 31.1% found in 2009–10 and 17.9% in 2011–12 by Jimenez-García et al.<sup>21</sup> Other Spanish authors<sup>22,23</sup> have found higher coverages than ours.

The belief that the influenza vaccine is not effective is a common reason for HCW refusing vaccination.<sup>24–27</sup> In 31% of unvaccinated nurses in a US study,<sup>28</sup> the lack of effectiveness of the vaccine was one reason given, similar to the 27% found in the present study. A United Kingdom study<sup>29</sup> found a negative association between unvaccinated physicians and having doubts about the efficacy of the vaccine in protecting themselves or others (OR 0.8; 95% CI 0.6–0.9), but this association was not observed in nurses.

In an Israeli study,<sup>25</sup> 15% of nurses and only 7% of physicians believed the effectiveness of the vaccine was low. In a survey of members of the Dutch College of Practitioners<sup>30</sup> only 4% of unvaccinated physicians doubted that the vaccine was effective. In the study by Loulergue et al., 31% of physicians and 55% of nurses considered a lack of effectiveness the main reason for not being vaccinated.<sup>31</sup> In a study of primary HCW from the region of Madrid (Spain) doubts about vaccine effectiveness were observed in 8.8% of unvaccinated physicians and 23.5% of unvaccinated nurses.<sup>32</sup>

Other authors have also found that knowledge of the influenza virus or influenza vaccination is low in nurses. The previously-mentioned US study<sup>28</sup> found that 60% of nurses surveyed answered questions about the influenza incubation period incorrectly. In our study, 55% of unvaccinated nurses and 48% of unvaccinated physicians answered the question on the incubation period incorrectly, although the difference was not statistically significant. However, lack of knowledge about the virus that causes epidemics and the virus contained in the vaccine was significantly greater in unvaccinated nurses than in unvaccinated physicians. The belief that vaccination of persons at high risk

of complications is effective in reducing the complications of influenza was more frequent in unvaccinated physicians (93.5%) than in unvaccinated nurses (87.8%). A similar result was reported after comparing the reasons of physicians and nurses for not being vaccinated, with 8% of physicians and 38% of nurses believing the vaccine was ineffective.<sup>33</sup>

In a study of registered nurses in the United States,<sup>34</sup> one main reason for not being vaccinated (19%) was that nurses considered they had a small chance of contracting influenza. In a UK study, 29% of unvaccinated nurses thought that vaccinations were not needed.<sup>35</sup> In our study, this percentage was higher: 76% of unvaccinated nurses were not concerned about infection at work.

In our study, 63.6% of unvaccinated physicians and 55.0% of unvaccinated nurses believed that influenza can be a serious illness, with the difference being statistically significant. Other authors found that 95% of nurses (vaccinated and unvaccinated)<sup>34</sup> and 56.6% of all HCW<sup>36</sup> considered that influenza and its complications can be serious. Concern about infecting patients was less frequent in unvaccinated physicians (39.5%) than in unvaccinated nurses (49.5%). Therefore, convincing messages about the ethical responsibility of physicians to protect their patients from the nosocomial spread of influenza should be introduced.<sup>37</sup>

It is essential that HCW are vaccinated, as they are role models for the public, who are more likely to accept vaccination when it is recommended by a trusted physician or nurse.<sup>38</sup> In addition, when HCW are vaccinated against influenza they protect the patients they care for and increase the ability of healthcare services to respond to influenza epidemics adequately.<sup>39</sup>

In 2 Italian studies, performed in healthcare workers and students<sup>40</sup> and medical residents,<sup>41</sup> respectively, one principal reason for not receiving seasonal influenza vaccine was that subjects did not consider themselves at risk. We found no differences in concerns about becoming ill between unvaccinated physicians (24.3%) and unvaccinated nurses (25.9%), but the low percentages found in the 2 groups suggest that the perception of risk is a problem to be addressed.

It seems unlikely that educational campaigns based on the health belief model will be sufficient to change the behavior of HCW. Strategies that address both the individual and organizational influences on health behavior may be more successful, but require evaluation.<sup>42</sup> Education is perceived as a less-successful intervention, probably because it does not always translate into acceptance of vaccination.<sup>43</sup>

Some authors<sup>44</sup> have suggested that activities performed by occupational services are associated with influenza vaccination. In our study, 72.5% of unvaccinated physicians and 71.4% of unvaccinated nurses had received a recommendation from their personal physician or occupational service and it does not seem that this factor was a relevant reason for not being vaccinated.

The main strengths of this study are the large number of HCW included, the fact that the regions included represent 70% of the Spanish population, and that HCW unvaccinated due to medical reasons were excluded, suggesting that unvaccinated physicians and unvaccinated nurses should be considered as really reluctant to be vaccinated.

**Table 3.** Distribution of attitudes to influenza vaccination in unvaccinated physicians and unvaccinated nurses

	Unvaccinated physicians (n = 461)	Unvaccinated nurses (n = 402)	Crude OR	P value	Adjusted OR <sup>a</sup>	P value
<b>Seasonal vaccination in any of the 3 preceding seasons</b>	214 (46.4%)	144 (35.8%)	1.55 (1.18–2.04)	0.002	1.58 (1.11–2.25)	0.01
<b>Seasonal vaccination in all 3 preceding seasons</b>	63 (13.7%)	39 (9.7%)	1.47 (0.96–2.25)	0.07	1.20 (0.68–2.12)	0.52
<b>Vaccination with pandemic vaccine</b>	103 (22.3%)	54 (13.4%)	1.85 (1.29–2.66)	0.001	1.47 (0.94–2.30)	0.09
<b>Concern about infection at work</b>	110 (23.9%)	95 (23.6%)	1.01 (0.74–1.39)	0.94	1.17 (0.76–1.82)	0.47
<b>Influenza can be a serious illness</b>	293 (63.6%)	221 (55.0%)	1.43 (1.09–1.88)	0.01	1.65 (1.17–2.32)	0.004
<b>Vaccination is effective in preventing influenza and its complications</b>	355 (77.0%)	294 (73.1%)	1.23 (0.90–1.68)	0.19	1.28 (0.85–1.93)	0.24
<b>Concern about becoming ill</b>	112 (24.3%)	104 (25.9%)	0.92 (0.67–1.25)	0.59	1.18 (0.75–1.87)	0.47
<b>Concern about infecting family</b>	176 (38.2%)	183 (45.5%)	0.74 (0.56–0.97)	0.03	0.72 (0.46–1.13)	0.15
<b>Concern about infecting patients</b>	182 (39.5%)	199 (49.5%)	0.66 (0.51–0.87)	0.003	0.62 (0.40–0.96)	0.03
<b>Vaccination of healthcare workers is important</b>	271 (58.8%)	230 (57.2%)	1.07 (0.81–1.40)	0.64	0.83 (0.55–1.26)	0.38
<b>Vaccination of persons at high risk is effective in reducing the complications of disease</b>	431 (93.5%)	353 (87.8%)	1.99 (1.24–3.21)	0.004	2.53 (1.30–4.95)	0.007
<b>Vaccination of healthcare workers reduces outbreaks</b>	234 (50.8%)	174 (43.3%)	1.35 (1.03–1.77)	0.03	1.28 (0.91–1.81)	0.16
<b>Vaccination is the most important measure in preventing influenza infection</b>	354 (76.8%)	273 (67.9%)	1.56 (1.16–2.11)	0.004	1.02 (0.67–1.56)	0.91
<b>My physician/Occupational Unit encouraged vaccination</b>	334 (72.5%)	287 (71.4%)	1.05 (0.78–1.42)	0.73	1.20 (0.84–1.72)	0.32
<b>Pandemic influenza had a more severe presentation than seasonal influenza</b>	103 (22.9%)	81 (22.4%)	1.03 (0.74–1.44)	0.85	1.33 (0.90–1.98)	0.15
<b>Activities performed during 2009–10 were adjusted to the evolution of the pandemic</b>	112 (24.9%)	104 (28.9%)	0.82 (0.60–1.12)	0.21	0.76 (0.52–1.11)	0.16

<sup>a</sup>Adjusted for the following variables: Age, Sex, Professional category, Seasonal vaccination in any of the 3 preceding seasons, Vaccination with pandemic vaccine, I think that influenza can be a severe disease, I worry about giving influenza to my family, I worry about giving influenza to my patients, Vaccination of persons at high risk is effective in reducing complications, Vaccination of healthcare workers reduces outbreaks, Pandemic influenza had a more severe presentation than seasonal influenza, Activities performed during 2009–10 were adjusted to the evolution of the pandemic.

Like all observational studies, our study may have limitations. First, vaccination was self-reported. Self-reported influenza coverage has been reported as a good proxy for recorded vaccination.<sup>45</sup> In addition, it seems unlikely that vaccinated HCW would state they were not vaccinated, and therefore the results should be taken for what they are. Second, there is a risk of selection bias. Although centers were selected randomly, due to the anonymous nature of the questionnaire we could not ascertain whether non-respondents had a higher level of non vaccination than respondents. We compared the

characteristics of all physicians and nurses the questionnaire was sent to and the characteristics of those finally included in the study, and the distribution by sex and type of population was very similar in the 2 groups. The distribution of age groups in physicians was also very similar in most of the age groups but the nurses evaluated were slightly younger than all the nurses the questionnaire was sent to. This difference should not invalidate our conclusions, but we cannot exclude the possibility that there are other, unknown differences between respondents and non-respondents.

## Conclusion

The results of this study suggest that differing approaches to influenza vaccination may be necessary in physicians and nurses. Unvaccinated nurses have more misconceptions than physicians about influenza and the influenza vaccine, and more doubts about the severity of annual influenza epidemics in patients with high risk conditions and the prevention of complications by the influenza vaccination. Therefore, the effectiveness of vaccination of high risk persons should be emphasized in unvaccinated nurses. Unvaccinated physicians, although having direct contact with patients, do not have as many concerns about infecting their patients as nurses. Therefore, strategies to improve vaccination coverages should stress the importance of physicians as a possible source of infection of their patients.

## Methods

### Design

A cross-sectional study was made by administering a questionnaire to HCW in 7 Spanish regions (Andalusia, Castile and Leon, Catalonia, Valencia Community, Madrid, Navarre, and the Basque Country), which represent 70% of the Spanish population. The questionnaire was conducted anonymously between March 1 and May 25, 2012 via the internet.<sup>46</sup>

### Study subjects

The target population was any HCW providing direct patient care (physicians and nurses) in primary care centers. Participating centers were randomly selected from a list of the centers in each region. All workers in each center who had an email address were initially included. The questionnaire was accessible for a month and an email reminder was sent every 10 d to workers who had not accessed the questionnaire or had not completed the survey.

### Variables

The questionnaire was developed after reviewing the scientific literature on the subject, especially the questionnaire used in a Canadian study.<sup>24</sup> The questions were adapted to the specific circumstances of the Spanish National Health System and were tested on 3 occasions in a group of 20 HCW. On the first 2 occasions, the survey was administered by paper in order to identify questions that might have been confusing and determine the response time required (mean 9.75 min; range 4.5 to 18.5 min). Once the potential misunderstandings were resolved, the online survey was designed and a third pilot test performed to ensure that the survey was understood and the time required for the online response remained within the estimated range.

The following sociodemographic and professional variables were collected for each HCW: profession, age, sex, years of work, and type of population (according to the Spanish Institute of Statistics (INE),<sup>47</sup> rural and intermediate  $\leq 10000$  and urban  $> 10000$ ). We also collected data on medical risk conditions for influenza, contraindications to influenza vaccination, cohabitation with children aged  $< 15$  y, people with chronic

disease and people aged  $\geq 65$  y, influenza vaccination in the 2011–2012 season and the 3 preceding seasons, and information on knowledge of and attitudes to influenza and influenza vaccination. Variables related to knowledge of and attitudes to influenza vaccination were covered by a set of questions evaluated on a Likert scale with 5 categories: totally agree, agree quite a lot, neither agree or disagree, disagree quite a lot, and totally disagree.

### Statistical analysis

The data analysis included HCW not vaccinated in the 2011–2012 season who answered the survey. Workers with contraindications to vaccination and those in whom vaccination was indicated due to risk medical conditions were excluded from the analysis.

A bivariate comparison using the Chi-square test was made between unvaccinated physicians and nurses considering the sociodemographic variables and the answers to questions about knowledge and attitudes. To assess associations between the type of HCW (dependent variable: unvaccinated physician or unvaccinated nurse) and independent variables in the bivariate analysis, the odds ratios (OR), and their 95% confidence intervals (CI) were calculated. The answers to questions about knowledge and attitudes were dichotomized in 2 categories: positive (totally agree, agree quite a lot) and negative (neither agree or disagree, disagree quite a lot, and totally disagree). All statistical tests were two-tailed and the  $\alpha$  error accepted was 0.05.

A multivariate analysis was performed using logistic regression with backward selection of variables and a cut-off point of  $< 0.2$  to estimate the association between type of HCW and knowledge of influenza and influenza vaccination.

The analysis was performed using SPSS version 18 (SPSS Inc.).

### Ethics

All information collected was treated as confidential, in strict observance of legislation on observational studies. An email was sent to primary HCW inviting them to participate. By clicking on the link to the questionnaire, workers implied consent to participate. As the survey was answered online, written consent was not sought. The initial email explained that all answers would be anonymous. In the stored data, respondents were identified only by a number. The study protocol was approved by the Ethics and Clinical Research Committee of the Jordi Gol Institute for Research in Primary Care.

### Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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