

CONCISE COMMUNICATION

Predisposing, Reinforcing, and Enabling Factors Influencing Influenza Vaccination Acceptance Among Healthcare Workers

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According to the present case-control study about influenza vaccine acceptance among hospital workers, vaccination campaigns should focus mainly on predisposing and enabling factors, emphasizing the likelihood of acquiring influenza and the positive benefits to patients, addressing concerns about vaccine efficacy or safety, and minimizing the time required for the worker to undergo vaccination.

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The Centers for Disease Control and Prevention recommends annual influenza vaccination for physicians, nurses, and other personnel in both hospital and outpatient settings to prevent infection and subsequent nosocomial transmission to patients. In Spain, employers are encouraged to offer influenza vaccination to healthcare workers (HCWs) yearly. However, influenza vaccination acceptance among HCWs generally remains low,^{1,2} despite a variety of interventions^{1,3,4} and intensive promotional campaigns.⁵ Improved identification of the determinants of vaccination acceptance should facilitate the development and evaluation of vaccine delivery programs created to increase the prevalence of influenza vaccination among HCWs. The PRECEDE (predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation) model may provide a framework for such identification.⁶ This model proposes that health behavior is influenced by predisposing factors (characteristics that lead to or motivate behavior, including knowledge and beliefs), enabling factors (characteristics that facilitate or are needed to perform the particular behavior, such as personal skills and resources in the environment), and reinforcing factors (rewards and punishments). In the present article, we examine the differences, including predisposing, reinforcing, and enabling factors, between hospital workers who received and those who did not receive the influenza vaccine at our institution.

METHODS

We performed a case-control study to examine the factors associated with the acceptance of influenza vaccination among workers at Hospital Universitario "Dr. Peset" (HUDP; Valencia, Spain) during the 2002-2003 influenza season. HUDP is a 529-bed, tertiary care, public, academic medical center with 1906 workers. Influenza vaccination was performed free of charge by the HUDP Employee Health Service,

using inactivated, trivalent influenza vaccines prepared for the 2002-2003 influenza season. The campaign was preceded by several weeks of intense promotion, including recruitment letters, informational meetings, and posters. All hospital workers who received the influenza vaccine at the Employee Health Service from October through December 2002 were considered to be case subjects. An attempt was made to enroll all eligible cases. On the basis of employee identification numbers and a random number table, control subjects were selected from among hospital personnel who did not receive the influenza vaccine and were working at HUDP at the time of the vaccination campaign. A case-to-control ratio of 1 : 1.5 was intended. The study was performed from January through April 2003, using a self-administered, anonymously completed questionnaire, which was the same for all cases and controls.

The independent variables in the study were as follows: age, sex, occupation (physician, nurse or similar professional, and administrative or ancillary worker), employment duration, work on a rotating shift, work in the same building in which the Employee Health Service performed vaccinations, tobacco smoking, previous receipt of influenza vaccine, and all predisposing, reinforcing, and enabling factors that were identified in a previous survey.⁷ The predisposing factors included in the questionnaire were perception of the influenza vaccine's effectiveness, knowledge about influenza vaccination recommendation, agreement with the influenza vaccination recommendation, fear of adverse reactions due to influenza vaccine, fear of needles, presence of chronic disease, perception of high likelihood for acquiring influenza, belief that influenza may be a serious illness, worry about missing work due to illness, worry about transmitting influenza to relatives, worry about transmitting influenza to patients, contact with severely ill patients, and previous influenza in the absence of influenza vaccination. The reinforcing factors were previous influenza after influenza vaccination and presence of adverse reactions due to influenza vaccine. Receipt of personal advice about influenza vaccination and adequate free time for vaccination were included as enabling factors.

Proportions and mean values were calculated for all variables. We performed bivariate analysis using the Pearson χ^2 test for proportions and Student's *t* test for continuous variables, taking into account statistically significant differences (defined as *P* values of <0.05). Odds ratios with 95% confidence intervals were also calculated. We performed a logistic regression analysis using the backward stepwise method to select variables on the basis of the likelihood ratio statistic for assessment of the association of the independent variables with the probability of vaccination. The adjusted odds ratios and 95% confidence intervals were estimated. Variables that

TABLE 1. Analysis of Questionnaire Responses for Determining the Association Between PRECEDE Factors and Acceptance of Influenza Vaccination Among Hospital Workers

Factor by type; questionnaire response	No. (%) of Subjects ^a		OR (95% CI)
	Nonvaccinated (n = 255)	Vaccinated (n = 177)	
Predisposing factor			
Knowledge about FV recommendation			
No	31 (12.16)	12 (6.78)	1
Yes	224 (87.84)	165 (93.22)	1.90 (0.91-4.05)
Agreement with FV recommendation			
No	59 (23.14)	2 (1.13)	1
Yes	196 (76.86)	175 (98.87)	26.34 (6.77-224.76)
Previous influenza in the absence of FV			
No	126 (51.01)	35 (20.83)	1
Yes	121 (48.99)	133 (79.17)	3.96 (2.47-6.36)
Perception of FV effectiveness			
No	93 (38.43)	11 (6.21)	1
Yes	149 (61.57)	166 (93.79)	9.42 (4.68-19.39)
Fear of adverse reactions due to FV			
No	152 (62.04)	153 (87.93)	1
Yes	93 (37.96)	21 (12.07)	0.22 (0.13-0.39)
Fear of needles			
No	192 (77.11)	147 (83.05)	1
Yes	57 (22.89)	30 (16.95)	0.69 (0.41-1.15)
Contact with severely ill patients			
No	92 (36.08)	42 (23.73)	1
Yes	163 (63.92)	135 (76.27)	1.81 (1.15-2.86)
Perception of high likelihood for acquiring influenza			
No	169 (70.71)	38 (21.97)	1
Yes	70 (29.29)	135 (78.03)	8.58 (5.31-13.90)
Belief that influenza is not a serious illness			
No	184 (75.41)	132 (75.86)	1
Yes	60 (24.59)	42 (24.14)	0.98 (0.60-1.57)
Worry about missing work because of illness			
No	91 (36.25)	35 (20.00)	1
Yes	160 (63.75)	140 (80.00)	2.28 (1.42-3.67)
Worry about transmitting influenza to relatives			
No	36 (14.17)	6 (3.39)	1
Yes	218 (85.83)	171 (96.61)	4.71 (1.90-13.94)
Worry about transmitting influenza to patients			
No	29 (11.46)	5 (2.84)	1
Yes	166 (65.61)	144 (81.82)	5.03 (1.85-17.02)
NA ^b	58 (22.92)	27 (15.34)	2.7 (0.89-9.84)
Presence of chronic disease			
No	247 (96.86)	159 (89.83)	1
Yes	8 (3.14)	18 (10.17)	3.5 (1.40-8.99)
Reinforcing factors			
Previous influenza after FV			
Yes	35 (14.71)	48 (27.75)	1
No	33 (13.87)	92 (53.18)	2.03 (1.08-3.83)
NA ^c	170 (71.43)	33 (19.08)	0.14 (0.08-0.26)
Previous adverse reaction to FV			
None	50 (19.61)	96 (54.24)	1
Local	13 (5.10)	41 (23.16)	1.64 (0.77-3.56)
Systemic	10 (3.92)	6 (3.39)	0.31 (0.09-1.02)
NA ^c	182 (71.37)	34 (19.21)	0.1 (0.06-0.17)
Enabling factors			
Received personal advice for FV			
No	192 (75.29)	97 (54.80)	1
Yes	63 (24.71)	80 (45.20)	2.51 (1.63-3.87)
Adequate free time for vaccination			
No	61 (24.21)	14 (7.91)	1
Yes	191 (75.79)	163 (92.09)	3.72 (1.94-7.24)

NOTE. CI = confidence interval; NA = not applicable; OR = odds ratio; PRECEDE = predisposing, reinforcing, and enabling causes in educational diagnosis and evaluation.

^a Denominators for questionnaire items vary according to the number of responses received for that item.

^b Data are for subjects with no contact with patients.

^c Data are for subjects with no history of influenza vaccination.

TABLE 2. Results of a Logistic Regression Model to Determine Predictors of Acceptance of Influenza Vaccination (FV)

Variable	Adjusted OR (95% CI)
Age	1.07 (1.03-1.12)
Occupation	
Administrative or ancillary worker	1.00
Physician	0.73 (0.26-2.06)
Nurse or similar professional	0.22 (0.09-0.55)
Past receipt of FV	6.86 (3.36-14.02)
Receipt of personal advice for FV	2.13 (1.07-4.24)
Adequate free time for vaccination	6.64 (2.36-18.71)
Agreement with FV recommendation	11.03 (1.71-71.17)
Previous influenza in the absence of FV	2.56 (1.25-5.25)
Perception of FV effectiveness	3.51 (1.26-9.76)
Fear of adverse reactions due to FV	0.23 (0.09-0.58)
Contact with severely ill patients	3.54 (1.48-8.50)
Perception of high likelihood for acquiring influenza	4.77 (2.34-9.70)
Worry about transmitting influenza to relatives	7.13 (1.64-30.90)

NOTE. CI = confidence interval; OR = odds ratio.

were statistically significantly different between vaccine recipients and nonrecipients in bivariate comparisons were considered for inclusion into the model.

RESULTS

A total of 194 of 1906 workers received the influenza vaccine, for an overall vaccination rate of 10.2%. The response rate was 91.2% among the vaccinated workers (177 of 194 eligible cases); 17 cases did not complete the questionnaire because they were not working at HUDP during the study period. Of the 291 controls who were initially selected from among the nonvaccinated workers, 5 (1.7%) declined participation, 31 (10.7%) were not working in the HUDP during the study period, and 255 (87.6%) completed the questionnaire. Differences between all characteristics were statistically significantly different between vaccine recipients and nonrecipients. Controls were more likely to be women (81% vs 65%) and nurses or similar professionals (50% vs 28%). Cases tended to be somewhat older (by 4.7 years), employed longer (by 3.2 years), and more likely to have previously received the vaccine (80% vs 26%) and to work in the same building where vaccination was performed (32% vs 19%) than controls. Cases were less likely than controls to smoke (23% vs 40%) or work on a rotating shift (28% vs 47%).

Table 1 summarizes the association between PRECEDE factors and acceptance of influenza vaccination. Results of the logistic regression analysis showed that agreement with the influenza vaccination recommendation, previous influenza vaccination, adequate free time for vaccination, perception of high likelihood for acquiring influenza, and concern about transmitting influenza to relatives were most strongly associated with receipt of vaccine (Table 2). In addition, age, occupation (nurses were less likely to be vaccinated), receipt of personal advice, previous influenza in the absence of influenza vaccination, perception of influenza vaccination ef-

fectiveness, fear of adverse reactions, and contact with severely ill patients all were independently associated with vaccination.

DISCUSSION

The overall rate of influenza vaccination in our hospital was slightly lower than some published rates for other hospitals in Spain^{8,9} and other countries.^{5,10} The present study is, to our knowledge, the first one that was performed using the PRECEDE model, which involves analysis of predisposing, reinforcing, and enabling factors, to evaluate all important predictors of influenza vaccination that might aid in the development of specific intervention strategies to improve vaccination rates among hospital personnel.

According to results of the logistic regression analysis in our study, nurses were statistically significantly less likely than persons from other occupational groups to receive the vaccine. Similar results were reported in other studies^{11,12} and were probably influenced by the presence of a greater number of misconceptions about influenza vaccine among nursing staff.¹³ Likewise, influenza vaccination acceptance was independently associated with advancing age, which is consistent with the results of other studies.^{1,14} In contrast, sex did not influence the decision to accept vaccination in the present study, whereas sex did have such an influence in another study.¹⁵

With regard to predisposing factors, our results are consistent with those of several studies showing that disagreement with the recommendation of influenza vaccination and concern about adverse effects are important barriers to influenza vaccination,^{1,11,16} despite the fact that influenza vaccine is safe and is associated with very few systemic adverse effects.¹⁷ In accordance with findings from another study, perceived risk of contracting influenza in the absence of vaccination was also an important factor.¹⁵ Although influenza vaccination is reasonably effective,^{18,19} our study corroborates findings of

other studies that have shown that uncertainty about vaccine efficacy also influences vaccination acceptance.^{3,4,11}

Adequate free time for vaccination was probably the main enabling factor, because clinical departments do not give time to medical staff and nurses to undergo vaccination or encourage them to take the necessary time. In keeping with this result, a lack of adequate free time for vaccination was common among medical residents who were not vaccinated.²⁰ No reinforcing factor was included in the final logistic regression model. In agreement with the findings of other studies,^{1,11,14} previous influenza vaccination was one of the strongest predictors of receipt of vaccine; this finding shows that it is critical to find ways to get HCWs to accept vaccination for the first time, because they would then be much more likely to accept it again in the future.

With regard to possible sources of bias, the high response rate among cases and controls most likely does not allow selection bias to affect the study findings. Furthermore, controls were randomly selected from among all nonvaccinated hospital employees, thus minimizing the potential for selection bias. On the other hand, the study used self-reported data, which may be subject to error because of misclassification. However, error in reporting was likely minimal, because the HCWs were not asked to provide complex details, but rather to answer "yes" or "no" to simple questions related to influenza vaccination.

The results of this investigation suggest that vaccination efforts that address predisposing and enabling factors through educational programs that include offering the vaccine at the work site may be particularly effective. Additionally, younger staff with more-frequent patient contact (ie, nurses or similar professionals) and HCWs with no history of influenza vaccination should be considered for targeted efforts.

We would like to add that, during the subsequent influenza vaccination campaign in our hospital, more-intense educational activities were performed using personal advice to emphasize the likelihood for acquiring influenza and the positive benefits to patients, and to address concerns about vaccine efficacy and safety. Because of a lack of resources, we could not develop and test other strategies, such as administering vaccine on the hospital wards. Nevertheless, there was an increase from 10.2% to 18.4% in the employee vaccination rate.

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