

Impact of Education Program on Influenza Vaccination Rates in Spain

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Objectives: To assess the impact of a simple education program on adherence to influenza vaccination.

Study Design: Randomized open controlled study.

Methods: The education program group (EPG) received an education program via surface mail, consisting of information regarding the effectiveness and safety of the influenza vaccine. The no-program group (NPG) received no intervention. All patients in 13 primary care practices in the city of Castellón, Spain, were included if they were 60 years or older on the first day of the 2009 seasonal influenza vaccination campaign.

Results: There were a total of 2402 participants (mean age 70.4 [\pm 7.1] years); 1338 (55.7%) were women. In 2009, 950 participants (39.5%) received the vaccine, including 900 of the same participants (37.5%) who had received it in 2008 ($P = .14$). Of those vaccinated in 2009, 501 (52.7%) belonged to the EPG and 449 (47.3%) to the NPG ($P = .01$). In a logistic regression analysis we found an association between adherence to vaccination in 2009 and both vaccination in the previous year and receiving the educational intervention. Influenza-related morbidity was similar in both groups during the 7 months after vaccination.

Conclusions: A mailed reminder program was effective to improve influenza vaccination rate, but only to a limited extent. Vaccination the previous year was the main predictor of adherence to vaccination. More programs are needed to improve vaccination rates in the study community.

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Influenza is a highly contagious infection that causes outbreaks and epidemics throughout the world, generally during the winter season. Every year the disease is responsible for thousands of deaths and substantial costs for health systems worldwide. Although rates of influenza are highest among children, serious illness and death are particularly common in patients with chronic medical conditions and in older individuals, as both groups are especially vulnerable to complications of the disease.^{1,2}

Influenza vaccination of seniors has been found to be effective in reducing hospitalization for heart disease, cerebrovascular disease, pneumonia, and also in reducing overall risk of death.^{3,4} Despite those benefits, significant proportions of patients for whom the vaccine is recommended fail to receive it. In recent years, vaccination rates have progressively increased in most developed countries, but efforts to improve the rates are still pressingly needed.⁵

Strategies to improve vaccination rates can be classified into 4 different categories: (1) personalized education programs, communicated via letters, phone calls, or other means, designed to increase perceptions of susceptibility to influenza, vaccine effectiveness, and vaccine safety; (2) enhancement of access to vaccination, for example by providing more clinics and better hours, vaccinating during home visits, offering free vaccine, and decreasing administrative barriers to vaccination; (3) interventions to ensure that healthcare workers have adequate information about influenza and the vaccine, as well as strategies to increase these workers' motivation and willingness to vaccinate patients; and (4) social intervention, including administrative frameworks and campaigns to inform the population about influenza and vaccination, implementation of policies that suggest changing from risk-based to age-based vaccination targeting, remuneration of healthcare workers for increasing vaccination rates or achieving targets, and so forth.⁶

Studies assessing those strategies are scant, and most of them have been carried out in the United States.^{6,7} So many uncertainties remain regarding the efficacy of those strategies, especially in countries with healthcare systems different from the US system. We undertook this study to assess (1) the impact of a simple education program on the rate of adherence to seasonal influenza vaccination, (2) the morbidity experienced by patients during the 7 months after vaccination, and (3) the factors associated

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In this article
Take-Away Points / e447
Published as a Web exclusive
www.ajmc.com

with adherence with seasonal influenza vaccination.

METHODS

This was a randomized open controlled study to assess the efficacy of an education program designed to improve the rate of seasonal influenza vaccination in patients 60 years and older.

The study was done in Centro de Salud Rafalafena, a health center situated in the city of Castellón, Comunidad Valenciana, Spain, associated with the Agencia Valenciana de Salud of the National Health Service. Participants belonged to the practices of 13 family physicians. All patients in those practices were included if they were 60 years or older on the first day of the 2009 seasonal influenza vaccination campaign (ie, September 28, 2009). Patients were excluded if they had an egg allergy or had been diagnosed with Guillain-Barré syndrome within 6 weeks of influenza vaccination in previous years. Participants were included and excluded with the help of Abucasis II, the intranet application used by the Agencia Valenciana de Salud for clinical follow-up of all of its patients.⁸ We used a computer random-number generator and a 1:1 ratio to randomly assign participants to 1 of 2 groups: the education program group (EPG) or the no-program group (NPG). The study was open for participants but blinded for the healthcare workers responsible for caring for the patients.

The program was delivered to participants by means of a personalized letter sent via surface mail in the first days of September 2009, a few weeks before initiation of the official seasonal influenza vaccine campaign. Postal addresses were obtained from Abucasis II, where patient data are permanently updated in order to provide medical assistance. The letter was written in Spanish on a DIN A4 sheet of paper and included basic information about the clinical manifestations and possible complications of influenza, and about the efficacy of the vaccine to prevent the disease, according to recommendations of the Centers for Disease Control and Prevention⁹ and the local authorities of the Comunidad Valenciana.¹⁰ The content and style of the mailing were intended for patients. The letter addressed common concerns about the flu shot and was written in easy-to-understand language. The mailing was sent once to eligible participants.

For every participant, the following variables were obtained: sex, age on the day of initiation of the 2009 seasonal influenza vaccination campaign, nationality, race, labor status (worker or retired), code of the primary care physician responsible for medical attention, district or town of residence, seasonal influenza vaccine received in 2009 or not, week of the

Take-Away Points

An education program delivered via surface mail was effective in improving the influenza vaccination rate in Castellón, Spain.

- The education program consisted simply of information regarding the effectiveness and safety of the influenza vaccine.
- Among individuals vaccinated in 2009, 501 (52.7%) received the educational intervention and 449 (47.3%) did not ($P = .01$).
- However, vaccination in the previous year was the main predictor of adherence to vaccination.

campaign when the vaccine was received, seasonal influenza vaccine received in 2008 or not, visit to the Department of Health hospital emergency department after initiation of the 2009 seasonal influenza vaccination campaign or not, admission to the Department of Health hospital after initiation of the 2009 seasonal influenza vaccination campaign or not, reason for the visit to the emergency department (respiratory disease, heart disease, cardiovascular disease other than heart disease, other nonsurgical disease, surgical disease, or other reason), and reason for admission (respiratory disease, heart disease, cardiovascular disease other than heart disease, other nonsurgical disease, surgical disease, other reason).

Variables related to personal data or vaccination were recovered from Abucasis II, and variables related to visits to the emergency department or admissions to the Department of Health hospital were recovered from the center general database, where visits and admissions are coded according to the *International Classification of Diseases, Ninth Edition, Clinical Modification*.

No variables related to pandemic influenza, which also occurred in 2009, are included in our study.¹¹

The study was carried out according to the good clinical practice principles set out in the Declaration of Helsinki in 1964 and subsequent updates.¹² The study was approved by the Clinical Research Committee of the Department of Health of Castellón, Spain. Participants' identifying details were replaced by codes, which were used throughout all phases of the study.

On the basis of the percentage of participants vaccinated in 2008 and results of previous studies,⁶ we calculated that a sample size of 1187 participants in each group was needed to find a vaccination rate difference of at least 5% between the EPG and the NPG (42.5% and 37.5%, respectively), with a level of significance of $P = .05$ and a power of 80%. Discrete variables are reported as absolute values and frequencies, and continuous variables are reported as mean and standard deviation if normally distributed or as median and interquartile range if not normally distributed. The following bivariate analyses were used: the χ^2 test for discrete variables, independent samples, or repeated measures; t tests for normally distributed continuous variables; and the Mann-Whitney U test,

■ **Table 1.** Comparison of Participant Characteristics and Influenza Vaccination Rates in the EPG and NPG Groups^a

Characteristic	EPG (n = 1201)	NPG (n = 1201)	P
Female	667 (49.9)	671 (50.1)	.87
Age, y			
Mean ± SD	70.6 ± 7.1	70.3 ± 7.1	.25
Median (IQR)	69 (64-76)	69 (64-76)	
Retired	945 (50.0)	946 (50.0)	.96
Lived in the city of Castellón	1180 (50.0)	1180 (50.0)	>.99
Vaccinated in 2008	458 (50.9)	442 (49.1)	.50
Vaccinated in 2009	501 (52.7)	449 (47.3)	.01

EPG indicates education program group; IQR, interquartile range; NPG, no-program group; SD, standard deviation.

^aData refer to the number (percentage) of participants unless otherwise specified. Percentages are based on the total number of participants with the characteristic.

Wilcoxon signed rank test, or Kruskal-Wallis H test for non-normally distributed continuous variables. A multivariate logistic regression analysis was carried out to assess the possible association of the most representative variables in the study (independent variables) with getting or not getting an influenza vaccination in 2009 (dependent variable). In all analyses an alpha level of <.05 was used, 1 tailed if a unidirectional hypothesis on the results existed or 2 tailed if such hypothesis did not exist.

RESULTS

A total of 2402 patients were included. All data on all variables, except for labor status, were available for 2241 participants (93.0%), and the code of the primary care physician was available for 2125 participants (88.5%). None of the sent letters was returned to sender. No patients were excluded because of egg allergy or previous diagnosis of the Guillain-Barré syndrome.

A total of 1338 participants (55.7%) were women. The mean (± standard deviation) age of participants was 70.4 (±7.1) years, while their median (interquartile range) age was 69 (64-76) years. A total of 1891 participants (78.7%) were retired. Almost all participants belonged to the same sociodemographic group: 2396 (99.8%) lived in the province of Castellón, 2386 (99.3%) were Spaniards, and 2380 (99.1%) were white; most (ie, 2360 [98.2%]) lived in the city of Castellón. The main characteristics of the EPG and NPG groups are shown in **Table 1**; no significant differences existed between the groups with respect to those characteristics.

The proportion of participants cared for by each primary care physician (PCP) varied substantially. The physician with the largest number of participants was in charge of 268 patients (11.2%), and the physician with the smallest number

was in charge of 105 patients (4.4%). A total of 277 patients (11.5%) were not assigned to any physician.

Of all the study patients, a total of 950 (39.5%) were vaccinated in 2009; 900 (37.5%) of those same patients were vaccinated in 2008 ($P = .14$). A total of 752 patients (31.3%) were vaccinated in both 2008 and 2009.

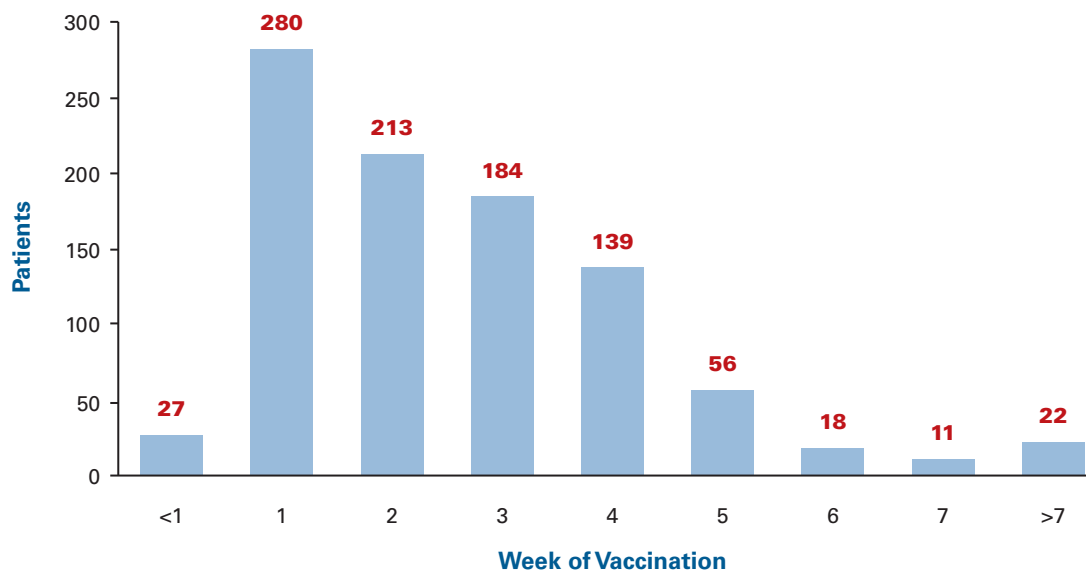
The **Figure** displays the number of patients vaccinated every week during the seasonal influenza vaccine campaign of 2009. A total of 49 patients (5.1%) received the vaccine outside the campaign period.

Table 1 shows the vaccination rates for EPG and NPG participants. The rates did not differ in 2008, but did differ in 2009, with a higher vaccination rate in EPG patients. In 2009, 41.7% of EPG participants were vaccinated compared with 37.4% of NPG participants. Vaccinations were given to 52 more EPG participants than NPG participants, for an 11.6% increase in the vaccination rate. That means that 23 education program letters must be sent to gain 1 vaccinated person. Comparison of vaccination rates in both years showed that 43 more EPG patients were vaccinated in 2009 than in 2008 (a 9.4% increase), whereas only 7 more NPG patients were vaccinated in 2009 compared with 2008 (a 1.6% increase) ($P < .01$).

We did a logistic regression analysis to assess the possible association between the dependent variable (vaccination status in 2009) and 5 independent variables (vaccination status in 2008, sex, age, EPG or NPG membership, and living in the city of Castellón or not). A test of the whole model was significant ($P < .01$), meaning that the independent variables were useful to predict the dependent variable. The variation in the dependent variable explained by independent variables was fair, with a Cox and Snell R^2 of 0.41 and a Nagelkerke R^2 of 0.55. The model correctly predicted vaccination status in 89.8% of participants who did not receive the vaccine, and in 79.2% of those who did receive the

Influenza Vaccination Education Program

■ **Figure.** Number of Participants Belonging to Both Study Groups Who Received the Influenza Vaccine^a



^aParticipants received the vaccine either during the 2009 vaccination campaign period, before the campaign began (<1 week), or after it ended (>7 weeks).

vaccine. **Table 2** shows the regression coefficients, the Wald test, significance of the Wald test, the odds ratios, and the confidence intervals for every independent variable. As can be seen, vaccination in 2009 was predicted by vaccination in 2008 and by belonging to EPG.

The vaccination rate was 46.0% in retired participants and 15.7% in worker participants ($P < .01$). Among the sets of patients assigned to the different PCPs, the highest rate of vaccination for a set was 62.6% and the lowest rate was 34.1% ($P < .01$). The rate of vaccination was only 4.0% in the set of patients not assigned to any particular PCP.

From September 28, 2009 (when the seasonal influenza vaccination campaign began), until April 30, 2010, 291 participants in the study (12.1%) came into the emergency department of the Department of Health hospital a total of 487 times; 86 patients (3.6% of the total) came 2 or more times, and 15 patients (0.6%) came 6 or more times. The reasons for emergency department visits were as follows: re-

spiratory disease (51 visits; 10.5%), heart disease (38 visits; 7.8%), cardiovascular disease other than heart disease (40 visits; 8.2%), other nonsurgical disease (201 visits; 41.3%), surgical disease (135 visits; 27.7%), and other reasons (22 visits; 4.5%). Of the 291 patients who came into the emergency department, 151 (6.3% of the total participants) belonged to the EPG, and 140 (5.8%) to the NPG ($P = .49$). Of the 487 visits to the emergency department, 236 (48.5%) were made by EPG patients, and 251 (51.5%) were made by NPG patients; the number of visits per patient in both groups was 0.20 and 0.21, respectively ($P = .45$). Visits to the emergency department that were probably related to influenza are shown in **Table 3**.

From September 28, 2009, until April 30, 2010, 104 participants in the study (4.3% of the total) were admitted to the Department of Health hospital a total of 125 times; 15 patients (0.6% of the total) were admitted 2 or more times, and 1 patient (0.0%) was admitted 4 times. The reasons for

■ **Table 2.** Logistic Regression Analysis to Assess the Possible Association of Independent Variables With Getting the Influenza Vaccination in 2009

Independent Variable	β	Wald Test	Wald Test, P	Odds Ratio	95% CI
Vaccinated in 2008	3.47	816.97	<.0001	32.23	25.41-40.89
Male	0.06	0.29	.59	0.94	0.74-1.18
Age	0.01	2.37	.12	1.01	1.00-1.03
Belonged to EPG	0.27	5.45	.02	1.31	1.04-1.65
Lived in the city of Castellón	0.03	0.01	.94	1.03	0.43-2.51

CI indicates confidence interval; EPG, education program group.

■ **Table 3.** Comparison of Reasons for Visiting the Emergency Department in the EPG and NPG Groups^a

Reason for Emergency Department Visit	EPG (n = 151; 51.9%)	NPG (n = 140; 48.1%)	P
Respiratory disease ^a	23 (45.1)	28 (54.9)	.36
Respiratory or heart disease ^a	36 (40.4)	53 (59.6)	.06

EPG indicates the education program group; NPG, no-program group.

^aData refer to the number (percentage) of visits. Percentages are based on the total number of participants with the reason for the visit.

admission were as follows: respiratory disease (13 admissions; 10.4%), heart disease (19 admissions; 15.2%), cardiovascular disease other than heart disease (16 admissions; 12.8%), other nonsurgical disease (40 admissions; 32.0%), surgical disease (35 admissions; 28.0%), and other reasons (2 admissions; 1.6%). Of the 104 patients who were admitted to the hospital, 51 (2.1% of the total) belonged to the EPG, and 53 (2.2%) to the NPG ($P = .84$). Of the 125 admissions, 59 (47.2%) were for EPG patients, and 66 (52.8%) were for NPG patients; the number of admissions per patient in both groups was 0.04 and 0.05, respectively ($P = .52$). Hospital admissions that were probably related to influenza are shown in **Table 4**.

The median (interquartile range) duration of admissions was 5 (2-10) days for EPG patients and 6.5 (3-12) days for NPG patients ($P = .09$). While hospitalized, 4 patients died, 1 in the EPG group and 3 in the NPG group; 1 was vaccinated against influenza in 2009 and the other 3 were not. Of these 4 patients, 3 died of cancer and 1 of stroke.

Regarding possible morbidity related to influenza vaccine, 7 patients who were vaccinated in 2009 (0.1%) came into the emergency department of the Department of Health hospital within 10 days of receiving the vaccine: 4 EPG patients and 3 NPG patients. Of those 7 patients, 5 had a surgical disease and 2 had mild gastrointestinal complaints. During the same period of time, only 1 vaccinated patient (0.0%) was admitted to the Department of Health hospital, because of pancreatic cancer.

DISCUSSION

This was one of the largest controlled randomized studies carried out worldwide to assess the efficacy of an intervention to improve adherence to influenza vaccination.⁶ Use of a large sample and the availability of all data on most variables were important strengths of the study that allowed us to reach reliable conclusions. We found that a low-cost educational campaign increased vaccination rates among elderly patients by 4.3 percentage points.

There is the possibility that the difference in vaccination rates found between the EPG and NPG groups after the education intervention was underestimated, because some of the letters sent to participants could have failed to reach them

due to errors in address, patients' change of residence, and so forth, although no letters were returned to sender.

The study data are remarkable because 56% of the participants were women, exactly the percentage who are female and 60 years or older in Spain, according to the National Institute of Statistics (INE, <http://www.ine.es/>). Also remarkable is the fact that most participants were retired and lived in Castellón, a city in East Spain with 180,000 inhabitants.

Our results show that the overall vaccination rate in 2009, the year of the study, was slightly lower than 40% and only 2 percentage points higher than in 2008. These vaccination rates are substantially lower than those reported in other studies carried out in Spain,^{5,13-15} including 1 study performed in the province of Castellón 12 years ago.¹⁶ Nevertheless it is important to note that all these other studies were based on surveys. Therefore, their conclusions are not as reliable as ours, because our study was based on an official electronic database where all vaccinations must be registered by law.

Throughout Europe the rate of influenza vaccination varies substantially from country to country, but in general the reported rates are higher than ours.^{5,15} But again, most studies were based on different kinds of surveys.

Our results clearly demonstrate that a substantial proportion of persons who should receive the influenza vaccine fail to receive it, which exposes them to the avoidable risks of influenza and its complications.¹⁷ Our study also shows that most patients who received the vaccine did so in the first weeks of the vaccination campaign, and that a small percentage of the population received the vaccine outside the campaign period, which suggests that those individuals were especially interested in being vaccinated.

The main finding of our study is that an easy-to-implement education program can improve the rate of influenza vaccination, although to a limited extent. A systematic review⁷ and a Cochrane review,⁶ both published by the same authors in 2010, extensively evaluated all published randomized studies designed to assess different types of interventions to improve adherence to influenza vaccination. Therefore, all recent studies with an objective identical to that of our study are reviewed in those articles. A total of 11 studies used an intervention identical or very similar to ours (ie, postal letters with patient education programs intended to improve vaccination rates). All those studies show

■ **Table 4.** Comparison of Reasons for Hospital Admission in the EPG and NPG Groups^a

Reason for Hospital Admission	EPG (n = 51)	NPG (n = 53)	P
Respiratory disease ^a	5 (38.5)	8 (61.5)	.36
Respiratory or heart disease ^a	13 (40.6)	19 (59.4)	.26

EPG indicates education program group; NPG, no-program group.

^aData refer to the number (percentage) of admissions. Percentages are based on the total number of participants with the reason for hospitalization.

that such an intervention was effective, but only to a limited extent, with improvements in vaccination rates that varied from 0% to 5% in most cases. Findings in those studies are similar to ours.

Of those 11 studies, 5 included more participants than our study did.¹⁸⁻²² But all 5 of those studies (and most of the other 6) were done in the United States. Our study is the largest one done outside the United States and the only one done in Europe. Because the United States and Spain have such different healthcare systems, we believe that our study provides valuable information that complements the conclusions of the larger studies made in the United States. In Spain, as in other European countries, the health system is mainly public. This means that all recipients can get the flu vaccine at no cost to them, that primary care clinics are located near their homes, and so forth.

In a review of the literature we found one more controlled randomized study similar to ours,²³ published in 2010 and not included in the systematic and the Cochrane reviews mentioned before.^{6,7} This new study also was made in the United States and reached conclusions similar to ours.

In a multivariate analysis we found that the main predictor of adherence to vaccination is being vaccinated the previous year. Other studies have reached the same conclusion.^{6,7} In the same analysis we also found that receiving the education intervention was associated with adherence to vaccination.

The variables labor status and code of PCPs responsible for medical attention were not included in the multivariate analysis because data were not available for every participant. Univariate analysis showed that adherence to vaccination was associated with retired status, as other authors have found.^{6,7} Another univariate analysis showed a large variation in the rates of vaccination among the different sets of participants belonging to each PCP; other studies have reached an identical conclusion.²⁴ This finding probably indicates that different physicians have different perceptions about the importance of influenza vaccination. Therefore, it highlights the need for programs to improve adherence to vaccination recommendations designed for healthcare workers, as this kind of program has proved useful.²⁵ Also notable in our results was a low vaccination rate among patients who had no assigned PCP, probably due to underuse of health services by this group of participants.

Our results show that the difference in vaccination rate between the study groups does not imply a difference in influenza-related morbidity during the 7 months after vaccination, which reflects the limited efficacy of the vaccine in preventing clinically significant influenza,¹⁰ particularly its complications, as studies have repeatedly demonstrated.²⁶⁻³⁰ It must be taken into account that the analyzed morbidity in our study may be related not only to seasonal influenza but also to pandemic influenza, which occurred in 2009, the year of our study. Nonetheless, the randomized design of our study prevented such a mix of morbidity from causing any relevant bias.

Finally, we also failed to find a difference in vaccine-related morbidity, which supports the conclusions of multiple other studies regarding the safety of influenza vaccine.³⁰

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