

Impact on Vaccination Rates of a Pharmacist-Initiated Influenza and Pneumococcal Vaccination Program

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ABSTRACT

Background: The health and economic benefits of vaccination against influenza and pneumococcus are well established, yet these vaccines remain underused. The National Advisory Committee on Immunization has advocated more aggressive vaccination strategies. The purpose of this study was to evaluate the impact of a pharmacist-initiated intervention on vaccination of high-risk inpatients receiving care in a hospital's family practice program.

Methods: Over the 33-day study period, 102 patients met the inclusion criteria and were randomly assigned to the intervention or the control group. Those in the intervention group received written and verbal information from a pharmacist on both types of vaccine and were offered the opportunity to be vaccinated in hospital. If written consent was given, the pharmacist wrote a conditional vaccination order in the chart. The vaccination status of all patients was determined 3 months later from the hospital chart or a family physician report.

Results: Follow-up showed that of patients who had not already been vaccinated against influenza, 61% (17/28) of those in the intervention group and only 16% (6/37) of those in the control group had received the influenza vaccine. Of patients who had not already been vaccinated against pneumococcus, 67% (33/49) of those in the intervention group and only 21% (10/48) of those in the control group had received the pneumococcal vaccine. Both of these differences were statistically significant ($p = 0.0001$).

Conclusion: A patient education intervention performed by a pharmacist, combined with a conditional vaccination order, can significantly increase influenza and pneumococcal vaccination of hospitalized high-risk family practice patients.

Key words: vaccine, influenza, pneumococcus, pharmacist, patient education, hospital

RÉSUMÉ

Historique : Les avantages de la vaccination antigrippale et antipneumococcique pour la santé et l'économie ont été clairement démontrés. Malgré cela, les vaccins antigrippaux et antipneumococciques restent sous-utilisés. Le Comité consultatif national de l'immunisation a plaidé en faveur de stratégies de vaccination plus énergiques. Le but de cette étude était d'évaluer l'impact d'une intervention entreprise par les pharmaciens pour vacciner les patients à risque élevé hospitalisés et soignés dans le cadre du programme de médecine familiale.

Méthodes : Au cours de la période d'étude de 33 jours, 102 patients qui ont satisfait les critères d'admission à l'étude ont été répartis aléatoirement dans le groupe intervention ou dans le groupe témoin. Les patients du groupe intervention ont reçu des renseignements écrits et verbaux du pharmacien sur les deux types de vaccins et ont été informés de la possibilité d'être vaccinés à l'hôpital. Après avoir obtenu le consentement écrit du patient, le pharmacien a rédigé une ordonnance conditionnelle de vaccination dans le dossier du patient. Le statut d'immunisation de tous les patients a été établi trois mois après la vaccination, à partir du dossier hospitalier ou du rapport du médecin de famille.

Résultats : Le suivi montre que parmi les patients qui n'avaient pas déjà reçu le vaccin antigrippal, 61 % (17/28) de ceux du groupe intervention et seulement 16 % (6/37) de ceux du groupe témoin ont reçu le vaccin antigrippal. Des patients qui n'avaient pas déjà reçu un vaccin antipneumococcique, 67 % (33/49) de ceux du groupe intervention et seulement 21 % (10/48) de ceux du groupe témoin ont reçu le vaccin antipneumococcique. Ces deux différences étaient statistiquement significatives ($p = 0,0001$).

Conclusion : Une intervention de sensibilisation des patients à la vaccination menée par les pharmaciens, combinée à une ordonnance conditionnelle de vaccination peut notablement accroître le nombre de vaccinations, antigrippales et antipneumococciques auprès des patients à risque élevé hospitalisés et soignés dans le cadre du programme de médecine familiale.

Mots clés : vaccins, grippe, pneumococcus, pharmacien, sensibilisation des patients, hôpital

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INTRODUCTION

Only 45% of high-risk Canadians are vaccinated annually against influenza, despite documented effectiveness and economic benefits.¹ The influenza vaccine is effective in preventing pneumonia, admission to hospital, and influenza-related hospital deaths among noninstitutionalized people over 45 years of age.² The pneumococcal vaccine is even more underused than the influenza vaccine,^{3,4} in spite of the fact that the 23-valent pneumococcal vaccine is 81% effective in preventing pneumococcal bacteremia in people over 55 years of age and up to 84% effective in people with various chronic illnesses.⁵⁻⁸ Both vaccines are also cost-effective.^{9,10}

An annual influenza vaccine (preferably given in mid-October) is recommended for people with the following risk factors: chronic cardiac or pulmonary disorder; residence in a nursing home or chronic care facility; age 65 years or older; chronic condition such as diabetes mellitus, cancer, immunodeficiency, immunosuppression, renal disease, anemia, or hemoglobinopathy; infection with human immunodeficiency virus; foreign travel to destinations where influenza is likely circulating; health care occupation; or household contact with people at high risk.¹ Those eligible for influenza vaccination, with the exception of people embarking on foreign travel, should also receive a single dose of pneumococcal vaccine (given at any time throughout the year). Additional criteria for pneumococcal vaccination include asplenia, splenic dysfunction, sickle cell disease, cirrhosis, alcoholism, or chronic leak of cerebrospinal fluid.¹¹ The most recent guidelines from Canada's National Advisory Committee on Immunization state that at least 90% of eligible patients should be vaccinated against influenza.¹ Similarly, an American national health objective for the year 2000 has been to increase influenza and pneumococcal vaccination levels to at least 60% for people at high risk.³ Accordingly, a number of attempts have been made to increase vaccination rates in both hospital and community settings, with hospital-based programs generally resulting in greater improvements in vaccination rates.¹²

As background for this study, the English-language literature was searched by means of MEDLINE to identify studies examining the impact of hospital-based vaccination programs on vaccination rate. The reference lists of studies located by the MEDLINE search were then reviewed to identify additional pertinent studies. The studies identified in these searches¹³⁻²⁰ are

summarized in Table 1. The most successful strategies, patient education and a standing order for vaccination, used alone or in combination, have been associated with rates as high as 78% for influenza vaccination and 75% for pneumococcal vaccination. In one study, in a 316-bed teaching hospital, the pharmacists increased the pneumococcal vaccination rate by 28% by attaching a printed vaccination reminder to the charts of eligible patients.¹⁹ This study was uncontrolled, involved non-primary-care physicians, and lacked a patient education component.

The literature search demonstrated that evaluation of the pharmacist's role in vaccination programs is lacking. As well, few studies carried out in a Canadian setting have been reported. The study reported here represents a prospective, controlled evaluation of a pharmacist-initiated influenza and pneumococcal vaccination program for family practice patients in a Canadian hospital. It was hypothesized that the rates of influenza and pneumococcal vaccination would be higher among vaccination-eligible patients who had received the intervention than among similar patients in the nonintervention control group.

METHODS

Study Design

This study was conducted at The Moncton Hospital in Moncton, New Brunswick, a 393-bed tertiary care hospital. Permission to conduct the study was granted by the hospital's Ethics Review Committee. Physicians who admitted patients to the Family Practice Program during the 33-day period between October 20, 1997, and November 21, 1997, were matched on the basis of admitting frequency over the previous year. Physicians within each matched pair were randomly assigned to either the intervention group or the control group. The patients of these physicians were assigned to the intervention or control group on the basis of their physicians' assignment. Randomizing physicians rather than patients ensured that no physician had patients in both the intervention and control groups, which would be a potential source of cross-contamination.

Subjects

Patients who met at least one of the inclusion criteria for influenza or pneumococcal vaccination, who had none of the exclusion criteria, and who gave written, informed consent were enrolled in the study. The inclusion and exclusion criteria are presented in Table 2.

Table 1. Studies of Hospital-Based Interventions to Increase Vaccination against Influenza or Pneumococcal Infection

Study Design and Reference	No. of Subjects	Intervention	% of Eligible Patients Who Received Influenza Vaccine		% of Eligible Patients Who Received Pneumococcal Vaccine	
			Before Intervention	After Intervention	Before Intervention	After Intervention
Prospective randomized controlled						
Klein and Adachi (1983) ¹³	200	Control			0	2
		Chart reminder			0	19
Herman et al. (1994) ¹⁴	1202	Control	34	76	31	31
		Patient education (nurse)	47	91	25	30
		Patient education (nurse) + standing order	31	86	19	41
Prospective controlled						
Bloom et al. (1988) ¹⁵	189	Control	0	0	0	0
		Patient education (pamphlet)	0	76	0	75
		Patient education (nurse)	0	80	0	75
		Patient education (volunteer)	0	78	0	75
Retrospective controlled						
Klein and Adachi (1986) ¹⁶	258	Control			2	2
		Standing order			9	87
Retrospective						
Nichol (1991) ¹⁷	274	Standing order + chart reminder	NA	79		
Clancy et al. (1992) ¹⁸	1013	Chart reminder			3	45
Vondracek et al. (1998) ¹⁹	160	Chart reminder			0	28
Observational						
Crouse et al. (1994) ²⁰	NA	Physician education	NA	10		
		Chart reminder	NA	17		
		Standing order	NA	40		

Blank cell = vaccine not studied, NA = data not available.

The exclusion criterion pertaining to baseline vaccination status was assessed differently in each group. To avoid sensitizing control patients to a possible need for vaccination, baseline vaccination status was determined either from the hospital chart or by contacting the family physician 3 months after discharge. In the intervention group, however, vaccination status had to be determined before the intervention, so that a vaccine would not be administered unnecessarily. Therefore, if vaccination status could not be determined from the hospital chart, the patient was asked. Patients who were uncertain checked with their physician. Patients who had received both vaccines at baseline were eliminated from the study.

Intervention

The intervention consisted of patient-focused

education and a standing order for vaccination. The pharmacist (S.H.G.) reviewed the benefits and potential side effects of vaccination with each patient, using a pamphlet to highlight relevant information about the vaccines. Material in the pamphlet was based on empirically derived determinants of vaccination behaviour, both cognitive (fear of contracting influenza from the vaccine) and behavioural (transportation and visit time).²¹ Patients were informed that both vaccines were available in the hospital and were asked to give written consent to be vaccinated. Eligibility and consent to be vaccinated were documented in the patient's chart, and a conditional order for the appropriate vaccine or vaccines was written by the pharmacist. The order required a physician's signature before the vaccine could be administered. A record of in-hospital vaccination was forwarded to the patient and his or her family physician.



Table 2. Inclusion and Exclusion Criteria**Inclusion criteria**

Age > 65 years
Chronic cardiac or pulmonary disorder
Chronic condition such as diabetes mellitus, renal disease, anemia, hemoglobinopathy, asplenia,* splenic dysfunction,* sickle cell disease,* or cerebrospinal fluid leak*
Liver cirrhosis or alcoholism*
Immunosuppression due to disease (e.g., cancer, human immunodeficiency virus) or drug therapy

Exclusion criteria

Known anaphylactic hypersensitivity to eggst
Acute febrile illness
Terminal illness or palliative care
Resident of nursing home or chronic care facility
Previous receipt of both current influenza vaccine and a pneumococcal vaccine
Inability to give informed consent

* Pneumococcal vaccine only.

† Influenza vaccine only.

Primary End Point

The primary end point was vaccination status after the intervention phase of the study. The pharmacist reviewed the hospital charts of all patients (intervention and control) to determine whether vaccination had occurred during the hospital stay. The family physicians of patients in both groups were contacted 3 months after the intervention and asked to fill out a form indicating which of the vaccines, if any, had been given since discharge from hospital, along with the date of administration. For control patients, the physician was also asked about vaccination status before admission. This information was obtained from all physicians contacted. If the specific date of vaccination was unavailable, it was assumed that the patient had been vaccinated before the intervention phase of the study.

The baseline vaccination rate for influenza was defined as the proportion of patients vaccinated for the 1997 season before the intervention phase of the study; the baseline rate for pneumococcal vaccine was the proportion vaccinated at any time before the intervention phase.

Statistical Analysis

The comparability of intervention and control groups at baseline was tested with the χ^2 test (for gender and high-risk conditions) and Student's *t*-test (for age). The study hypothesis about the impact of the intervention on vaccination was tested with the χ^2 test. Only patients who had not received the relevant vaccine at baseline were included in the test of the hypothesis, because previously vaccinated patients were not eligible

for vaccination and, therefore, were not eligible for the intervention. To control the experiment-wise error rate, the accepted level of significance for each statistical test was set at $p < 0.01$. Statistical tests were performed using SPSS for Windows, Version 8.0 (SPSS Inc., Chicago, Illinois).

RESULTS

Thirty-six physicians admitted a total of 353 patients to the Family Practice Program during the study period. The average length of stay was 7.2 days. Of these patients, 143 were eligible for the study, and 102 consented to participate. Forty-one patients, 16 admitted by physicians in the intervention group and 25 admitted by physicians in the control group, did not give consent. Reasons included early discharge (4 intervention, 10 control), participation declined (9 intervention, 7 control), and communication barrier related to language or hearing impairment (3 intervention, 8 control). The final sample consisted of 50 intervention and 52 control patients. The intervention and control groups did not differ significantly with respect to age, gender, frequency of high-risk conditions, or baseline vaccination rates (Table 3).

Of the 102 subjects, 65 were eligible for the influenza vaccine (28 in the intervention group and 37 in the control group), and 97 were eligible for the pneumococcal vaccine (49 in the intervention group and 48 in the control group). Thirty-nine of the 50 intervention patients consented to undergo vaccination, permitting the pharmacist to write a conditional vaccination order in the hospital chart. Thirty-four of these 39 orders were cosigned by the physician. Vaccination (with one or both vaccines) during the hospital stay was documented in the hospital record for 68% (34/50) of the intervention patients and 10% (5/52) of the control patients. By physician report, vaccination occurred after discharge in 1 patient in the intervention group and 10 patients in the control group.

After the intervention phase, 17 (61%) of 28 patients in the intervention group who were eligible for influenza vaccination had been vaccinated, whereas only 6 (16%) of 37 patients in the control group who were eligible for this type of vaccination had been vaccinated. In the case of pneumococcal vaccine, 33 (67%) of the 49 eligible intervention-group patients but only 10 (21%) of the 48 eligible control patients had been vaccinated. These differences in vaccination rates were statistically significant ($p = 0.0001$ for both influenza and pneumococcal vaccination).



Table 3. Characteristics of Study Population

Characteristic	No. (and %) of Subjects*		p Value
	Intervention (n = 50)	Control (n = 52)	
Mean age (and SD) (years)	65.6 (17.5)	70.2 (14.0)	0.14
Gender (no. and % female)	33 (66)	35 (67)	0.90
High-risk condition			
Cardiac disease	35 (70)	27 (52)	0.06
Pulmonary condition	18 (36)	12 (23)	0.15
Diabetes mellitus	9 (18)	10 (19)	0.87
Vaccination status at baseline			
Influenza	22 (44)	15 (29)	0.11
Pneumonia	1 (2)	4 (8)	0.19

SD = standard deviation.

* Except where indicated otherwise.

DISCUSSION

These results demonstrate that a pharmacist-initiated, hospital-based vaccination program can significantly increase influenza and pneumococcal vaccination rates. The vaccination rates achieved are comparable to those reported in the literature for programs using both standing orders and patient education.¹³⁻²⁰ Unique to this study was the use of educational material developed by a pharmacist and based on known determinants of vaccination behaviour. Given that this study was conducted in only one hospital, however, it is unclear to what extent these results may be generalized to hospitals in other parts of the country.

This study did not assess the effect of the intervention on vaccination rates over time, nor did it assess outcomes such as incidence of influenza and pneumococcal infection, hospitalization, and health-care costs. These are all areas recommended for future research.

Other limitations of the study were that the pharmacist who collected the data was not blinded as to the patients' group assignments; in addition, the observations in each group were not independent, as required for statistical tests. Because physicians (rather than patients) were randomized to study groups, to safeguard against potential contamination of the control group, several physicians had more than one patient in a given study group. Because each physician could be expected to treat all of his or her patients similarly with regard to vaccination, clusters of patients with similar likelihood of vaccination were created. Thus, the assumption of independence of data was not met for statistical tests in which the patient (rather than the

physician) was the unit of analysis. Violation of this assumption results in inflation of type I error, in proportion to the amount of interdependency in the data.²² Fortunately, the results of the hypothesis tests were strong (*p* values of 0.0001 relative to the critical *p* value of 0.01), so a false statistical conclusion is unlikely.

The results of the study were used to guide a multi-disciplinary committee created to implement a hospital-wide influenza vaccination program. The patient information pamphlet and standing order used in the study were modified for use in the hospital-wide program. On the basis of experience with implementation problems in the study, such as the time required to identify and educate patients and failure to complete a vaccination history for all patients on admission, the pharmacist was able to recommend procedural changes to the program. Overall, this study enhanced the health promotion role of the pharmacist in the hospital.

The baseline pneumococcal and influenza vaccination rates in this study were consistent with the low rates reported in the literature.^{1,3,4} Because previous hospitalization is itself a risk factor for pneumonia,²³⁻²⁵ an improved effort to vaccinate high-risk patients before hospital discharge seems necessary. Moreover, further study of optimal strategies for increasing the rate of vaccination both in hospital and in community settings is warranted. In conclusion, this study has demonstrated that provision by a pharmacist of patient-centred education and a physician prompt in the form of a standing order in the hospital chart can significantly increase vaccination rates.



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