

The Effectiveness of an Influenza Vaccination Program in an HMO Setting

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Abstract

This prospective cohort study was designed to determine the effectiveness, costs, and benefits of an influenza vaccination postcard reminder program in the Medicare population of a health maintenance organization. Study subjects were 21,474 Medicare enrollees in the largest region of U.S. Healthcare, a large independent practice health maintenance organization located in the northeastern United States, who were continuously enrolled through the 1993 to 1994 influenza season (September 1993 through March 1994). The intervention consisted of an educational effort targeted to physicians and a series of three postcard reminders mailed directly to members. After the intervention, the immunization compliance rate improved from 55.8% (in the 1992 to 1993 baseline influenza season) to 76.1% (in the 1993 to 1994 season). Furthermore, relative to a comparable group of enrollees who were not vaccinated, hospital admissions for acute and chronic respiratory conditions decreased for enrollees who received a vaccination (26.3 vs 36.9 admissions per 1,000 enrollees). The investment in the outreach program produced a net return having an investment ratio of 2.3:1. These results demonstrate the effectiveness of influenza vaccination in reducing admissions and associated costs of influenza-related admissions for acute and chronic respiratory conditions. They also show that the postcard reminder program to increase immunization rates was cost-effective and improved outcomes.

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Influenza virus infection leads to substantial morbidity and mortality, especially in the elderly and in patients with chronic medical conditions. The cost of excess hospitalizations from influenza-related

illness for Medicare recipients has been estimated to be more than \$1 billion annually in epidemic seasons, and almost \$750 million during nonepidemic seasons.¹

Since 1964, the Advisory Committee on Immunization Practices has recommended influenza vaccination for the elderly. The committee based this endorsement on the vaccine's efficacy in reducing morbidity and mortality in young adults. The vaccine is approximately 65% to 80% protective in this population against illness caused by influenza viruses having antigenic characteristics that match those in the administered vaccine.^{2,3}

Because the vaccine is not completely protective, the goal of vaccine policy has been prevention of the complications that result from infection in high-risk populations, rather than reduction of infection and transmission.⁴ Although the vaccine may be only 30% to 40% effective in the prevention of clinical illness in the elderly, it has the added benefit of reducing the severity of the disease in infected patients.⁵ In a serial group study at a large health maintenance organization (HMO), Nichol and colleagues⁶ demonstrated that rates of hospitalization and of death from influenza and its complications were lower in a group of elderly community-living patients who were vaccinated against influenza than in a group of elderly unvaccinated patients.

According to the Centers for Disease Control and Prevention (CDC), vaccination of persons at high risk before the onset of the influenza season each year offers the best protection against the illness.⁷ The following high-risk groups should receive immunization as stated by the American College of Physicians⁸:

- Residents of nursing homes and long-term care facilities
- Patients with chronic cardiopulmonary disorders
- Persons with chronic metabolic diseases, including diabetes mellitus, renal disease, hemoglobinopathies, or immunosuppressive disease
- Otherwise healthy persons 65 years of age or older

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Although substantial evidence as described above points to the cost-effectiveness of influenza vaccines in reducing the serious effects of influenza infections and their respiratory complications, the number of people who are vaccinated against influenza remains suboptimal. Reasons include providers' doubts about the effectiveness of the vaccine, patients' lack of information about its effectiveness, patients' fears about possible side effects, and the scarcity of programs to promote its use.⁹

Reminder programs increase the influenza vaccination rates in ambulatory settings. Mullooly¹⁰ and Mullooly and colleagues¹¹ demonstrated that a single mailed postcard cuing recipients to obtain an influenza vaccination increased the vaccination rate among elderly high-risk individuals from 30% to 39%. A poster placed in physicians' offices increased the vaccination rate from 50% to 67% both saw the poster and received a postcard reminder.¹² In another study, telephone- and mail-reminder programs were equally effective in increasing influenza vaccination rates.¹³ Although the vaccination rate in that study was higher for those contacted via telephone, fewer patients were contacted by that method and, therefore, overall results were similar.

In October 1988, the CDC, in collaboration with the Health Care Financing Administration, awarded demonstration grant funds to nine programs as part of the Medicare Influenza Vaccine Demonstration Project. Early results showed that a variety of interventions were useful in improving vaccination coverage from 26% during 1989 to 1990 to 40% during 1990 to 1991. Interventions included offering provider education, supplying the vaccine without cost to providers, reimbursing providers for administering vaccinations, instituting a direct-mail campaign urging Medicare beneficiaries to receive vaccinations, and establishing informational hot lines.

In a coordinated, community-wide program that was part of the demonstration project in Monroe County, New York, a variety of strategies, including vaccine distribution and promotion, extensive provider and public education efforts, an office-based physician incentive project, and centralized claims processing, was determined to have improved the vaccination rate, from 40.5% to 74.3%.¹⁴ In a separate study, a performance-based financial incentive program rewarded physicians who achieved immunization rates of more than 70%.¹⁵ The immunization rate in the group that received a financial incentive was 73.1%, compared with 55.7% in the comparison practices.

The National Vaccine Advisory Committee's 1994 report on Adult Immunization included five goals and

18 recommendations for improving adult immunization.¹⁶ Among the goals and recommendations were:

- Conduct information programs for providers to improve providers' immunization practices
- Conduct information programs for the public to emphasize the importance of vaccine-preventable diseases and the safety and benefits of immunization
- Ensure adequate financial mechanisms to support the expanded provision of vaccines to adults
- Ensure adequate support for research on the efficacy, safety, clinical effectiveness, and cost-benefit/cost-effectiveness of adult immunization

It is with these principles in mind that our program was designed and implemented.

... MATERIALS AND METHODS ...

The study population included 21,474 eligible U.S. Healthcare Medicare members in U.S. Healthcare's southeastern Pennsylvania region. The study subjects were aged 65 years or older and were continuously enrolled in U.S. Healthcare throughout an influenza season (September 1993 through March 1994).

The intervention consisted of two components: (1) a series of mailed reminders sent to participating enrollees; and (2) a letter sent to U.S. Healthcare physicians. As part of the first component, a mailing, consisting of a cover letter and a postcard, was sent to all study participants on September 15, 1993. The letter encouraged the participants to visit their primary care physicians to receive their annual influenza vaccination, which would be administered at no additional cost to the member. The postcard, which had return postage on it, requested the following information: the member's name, U.S. Healthcare member identification number, and answers to yes/no questions on whether the member had been vaccinated that year and had ever had pneumonia. In November 1993, on the basis of responses to the first postcard reminder, a second mailing of postcard reminders was sent to all members for whom a self-report of vaccination could not be identified. Finally, based on the results from the first two mailings, a third and final mailing was sent to the remaining unvaccinated members on December 15, 1993.

For the second part of the program, a letter was sent to all participating family physicians and internists at U.S. Healthcare. This letter reminded physicians both of the importance of the influenza vaccine and that it was a covered benefit included in their capitation. The physicians also were reminded that their

performance in the influenza program would be considered to be part of the quality-based compensation system for their Medicare population, which could result in an increase in their capitation as well as in their semiannual performance-based payment.¹⁷

Separate analyses were conducted to determine the effect of the postcard reminder program on vaccination rates, the cost-effectiveness of the influenza vaccine, and the cost-effectiveness of the influenza vaccination postcard reminder program.

Effect of the Postcard Reminder on Vaccination Rates

U.S. Healthcare routinely conducts chart reviews to evaluate an office's compliance with certain performance guidelines. Professional service coordinators routinely audit charts for compliance with a yearly influenza vaccination for members aged 65 years or older. In order to fairly evaluate the providers' opportunity to offer the vaccine, U.S. Healthcare uses encounter-based selection criteria that include only members who have been in the practice at least 12 months, and who have had three or more visits to the office. In order to comply with the chart audit, a date of immunization must be recorded within the 18 months preceding the audit. A notation on the chart indicating that the physician recommended that the member return for immunization or that the patient refused immunization also is acceptable.

To determine the impact of the reminder program, the vaccination rates in U.S. Healthcare's southeastern Pennsylvania region and southern New Jersey regions were compared. Because no reminder card program was implemented in southern New Jersey, the authors assumed that the Medicare enrollees in southern New Jersey could serve as a valid control group. To conduct the analysis, 2 years of data from each region were used, with the period 1992 to 1993 serving as a baseline rate for compliance in each region, and the differential change between regions in the vaccination rate for the period 1993 to 1994 serving as the basis for estimating the impact of the reminder program.

Cost-Effectiveness of the Influenza Vaccine

The benefits of the influenza vaccination program were determined by comparing the vaccinated group with the unvaccinated group on selected outcomes for all chronic respiratory conditions. The 21,474 U.S. Healthcare Medicare enrollees who were sent reminders were divided according to vaccination status into two groups. Vaccination status was determined from self reports and other positive evidence of influenza vaccination; the additional evidence was ob-

tained from the claims or encounter systems, which was based on the *Current Procedural Terminology, 4th revision* (CPT-4) code for influenza vaccine (90724). The vaccinated and unvaccinated groups contained 13,570 and 7,904 members, respectively. The main outcomes of interest were hospitalizations and costs for acute and chronic respiratory conditions (*International Classification of Disease, Ninth Revision, Clinical Modification* [ICD-9-CM] codes 460, 462, 465, 466, 480-487, 490-496, and 500-518).

Analysis of covariance was used to adjust the selected outcome measures for age and sex, and for the following comorbidities: coronary heart disease (ICD-9-CM codes 393-398, 410-414, 425, 428, and 429); chronic lung disease (ICD-9-CM codes 491-496 and 500-518); chronic renal disease (ICD-9-CM codes 581, 582, and 585, plus ICD-9 procedure code for dialysis 39.95); vasculitis or rheumatologic disease (ICD-9-CM codes 446, 710, 714); dementia or stroke (ICD-9-CM codes 290-294, 331, 340, 341, 348, and 438); nonhematologic cancer (ICD-9-CM codes 140-199); and previous occurrence of pneumonia (ICD-9-CM codes 480-486 found for the 1992-1993 season). These conditions were selected for their ability to explain the burden of illness in treated patients, including the increased risk for influenza-related complications. The comorbidities for each patient were identified from previous medical claims. Table 1 presents the baseline characteristics for these important explanatory variables for the vaccinated and unvaccinated groups.

Cost-Effectiveness of the Influenza Vaccination Postcard Reminder Program

The savings related to influenza vaccination for all respiratory conditions were calculated according to the following formulas:

Table 1. Patient Demographics and Comorbidities

Demographics	Vaccinated	Unvaccinated
Number of patients	13,570	7,904
Mean age (yr)	73.7	73.7
Comorbidities (%)		
Proportion of males	46.0	40.0
Chronic lung disease	1.9	1.2
Nonhematologic cancer	6.4	4.0
Previous pneumonia	0.5	0.4
Chronic renal disease	0.3	0.2
Vasculitis or rheumatologic disease	0.5	0.5
Dementia or stroke	0.3	0.3
Coronary heart disease	6.1	3.8

mean cost savings for vaccine administration =
 (mean costs of hospitalization for unvaccinated subjects) -
 (mean costs of hospitalization for vaccine recipients) -
 (mean costs of influenza vaccine administration)

The total costs savings related to the vaccine administration was as follows:

total cost savings of influenza vaccine =
 (mean cost savings) x (number of people vaccinated)

The total costs savings of the vaccination postcard reminder program was calculated as follows:

postcard reminder vaccination program cost savings =
 ([total cost savings of influenza vaccine] x
 [differential improvement in vaccination rates in southeastern Pennsylvania relative to southern New Jersey]) -
 (total costs of the vaccination postcard reminder program)

... RESULTS ...

As described, the impact of the reminder program was determined by using the chart audits to compare the vaccination rate in southeastern Pennsylvania with the vaccination rate in southern New Jersey. For the 1992 to 1993 baseline comparison period, the compliance rate in southeastern Pennsylvania was 55.8%, which was higher than the 40.9% rate in southern New Jersey. For the period 1993 to 1994, despite starting from a higher baseline rate, the difference in the compliance rate between the two regions increased a full 23.5% (76.1% in Pennsylvania vs 52.6% in New Jersey). Although other factors may have contributed to the increased difference, the reminder program was likely to have been instrumental in

achieving this result. It is possible to estimate the effect related to the postcard reminder program by taking the difference in improvement in observed rates (20.3% for southeastern Pennsylvania vs 11.7% for southern New Jersey, for an 8.6% program effect). A graph of the comparison between southern New Jersey and southeastern Pennsylvania compliance rates is presented in Figure 1.

Nearly 76% (16,582) of the U.S. Healthcare Medicare members responded to our request for verification of their vaccination status. From the self-reported vaccination status and analysis of data from the encounters and claims databases at U.S. Healthcare, 13,570 Medicare members were determined to have received the vaccine, for a compliance rate of 63.2%. Given that 24% of the members failed to respond to the postcard reminder, this estimate of the compliance rate may be low. In determining the compliance rate, we assumed that a member who did not respond and for whom we could not find evidence of vaccination in our encounter data did not receive a vaccination. It is possible, however, that a member could have received a vaccination from a source from which we had no information, such as a senior center or county public health department.

Figure 2 graphically presents the results of an analysis of inpatient admissions for pneumonia, influenza, and chronic respiratory conditions. The unadjusted results show only a small decrease in the number of admissions for the vaccinated group relative to those for the unvaccinated group (29.7 versus 30.9 admissions per 1,000 enrollees, respectively). The analysis of covariance identifies a difference between groups that reflects the impact of the vaccine

Figure 1. Comparative Compliance Rates, Southern New Jersey Versus Southeastern Pennsylvania

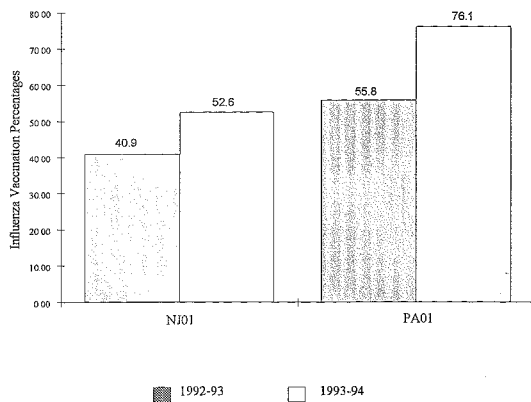
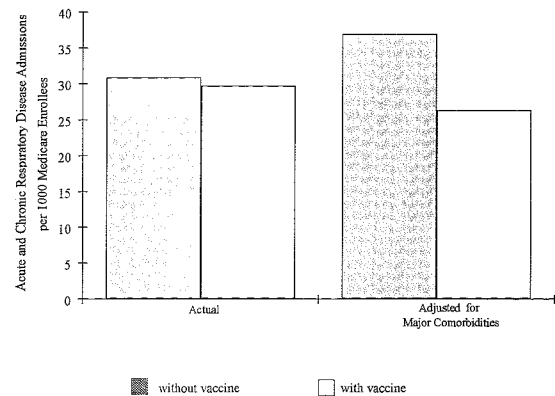


Figure 2. Inpatient Admissions for Acute and Chronic Respiratory Conditions



on admissions for all chronic respiratory conditions, after accounting for the important explanatory variables. Because the burden of illness is greater in the vaccinated group than in the unvaccinated group, the difference in admissions between the two groups is 10.6 admissions per 1,000 enrollees (26.3 per 1,000 for the vaccinated group versus 36.9 per 1,000 for the unvaccinated group). On the basis of this result, for the 13,570 people who reported having received a vaccination, we estimate that 144 admissions for acute and chronic respiratory conditions may have been averted.

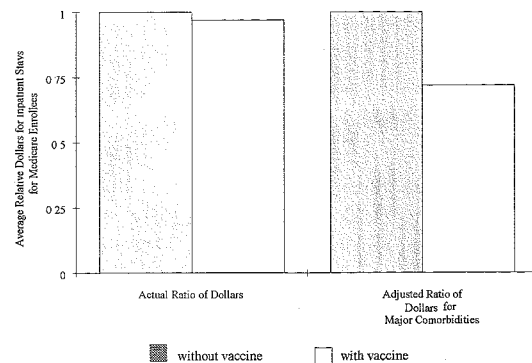
Figure 3 presents the results of a similar analysis for relative inpatient costs for chronic respiratory conditions. The unadjusted results again show that relative charges for the vaccinated group decreased only slightly compared with those for the unvaccinated group. Using the unvaccinated group as a baseline, the average relative costs for the vaccinated group was 0.97 those for the unvaccinated group. Because of the greater burden of illness in the vaccinated group, the adjusted results more accurately reflect the true difference in relative inpatient costs. After accounting for burden of illness, the average relative inpatient costs for the vaccinated group decreased significantly to 0.72 those for the unvaccinated group. For the 13,570 people who had been vaccinated (according to self-report or claims or encounter evidence), the estimate of the total savings associated with avoidance of inpatient costs for acute and chronic respiratory conditions is \$801,851 (\$1,052,896 - \$251,045 [the cost of the vaccine (\$3.50) and dispensing fee (\$15)]). (This unit cost of vaccine delivery excludes the cost of the postcard program).

On the basis of a cost-savings of \$801,851 and an improvement in vaccination rates of 8.6% outside a control region in the U.S. Healthcare system, we estimate that the influenza vaccination postcard reminder program is cost-effective. This estimate is based on the assumption that 8.6% of the total cost savings was related to improved vaccination rates (0.086 x \$801,851, for a costs savings directly attributable to the postcard reminder program of \$68,959). However, we estimate that total program costs were \$30,030 (Table 2). The result is a net return on the \$30,030 invested in the program of \$68,959, or a return-on-investment net ratio of 2.3:1.

... DISCUSSION ...

Managed care organizations are uniquely positioned to develop innovative preventive healthcare programs to help their members to lead healthier

Figure 3. Inpatient Costs for Acute and Chronic Respiratory Conditions



lives. As part of this effort, U.S. Healthcare initiated a postcard reminder program in 1993 to help to protect its Medicare members against influenza and its complications.

Evaluation of the chart audits indicated that the vaccination postcard reminder program resulted in a greater increase in the influenza vaccination rate in U.S. Healthcare's southeastern Pennsylvania region than in the southern New Jersey region. In addition to demonstrating an improved vaccination rate as a result of the postcard reminder program, our study adds to the already substantial evidence that influenza vaccination is effective in decreasing morbidity, as demonstrated by a decreased hospitalization rate for respiratory conditions for vaccinated members versus unvaccinated members. It decreases morbidity at a net cost benefit even when projecting costs for the vaccine and separately costing out the vaccine administration. It is likely that the latter cost is an

Table 2. Costs of Postcard Reminder Program

	Cost (\$)
Initial Patient Mailing	6,200
Follow-Up Patient Mailing	6,200
Response Postage	4,700
PCP Mailing	300
Supplies and Materials	2,655
Human Resources	9,975
Total	30,030

PCP = primary care physician.

overestimate of true expenses, as influenza vaccines often are administered during a physician office visit for another reason, such as for routine follow-up care.

On the basis of the improved vaccination rate and demonstrated cost-benefit and cost-effectiveness of influenza vaccine administration, our study allows us to analyze the net effect of the cost savings from the improvement in vaccination rate and the expenditures of the influenza vaccination postcard reminder program. Although our cost analysis is an estimation, we have made conservative estimates in projecting the cost-benefit of the program.

Cost savings is not the only criterion for judging the success of such a program, as improving the health of the at-risk membership of a managed care organization is a worthwhile investment in and of itself. Nevertheless, objective evidence that an investment in a postcard reminder program yields a net positive outcome supports the use of cost savings as a criterion. Moreover, the evidence presented in this analysis strongly supports the cost-effectiveness of the influenza vaccination reminder program in an HMO setting. Toward this end, the influenza vaccination reminder card program has been extended to all U.S. Healthcare enrollees aged 65 years or older.

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