Performance-Based Physician Reimbursement and Influenza Immunization Rates in the Elderly

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Objective: To investigate the effect of performance-based financial incentives on the influenza immunization rate in primary care physicians’ offices.

Design: Randomized controlled trial during the 1991 influenza immunization season.

Setting: Rochester, New York, and surrounding Monroe County during the Medicare Influenza Vaccine Demonstration Project.

Participants: A total of 54 solo or group practices that had participated in the 1990 Medicare Demonstration Project.

Interventions: All physicians in participating practices agreed to enumerate their ambulatory patients aged 65 or older who had been seen during the 1990 or 1991 calendar years, and to track the immunization rate on a weekly basis using a specially designed poster from September 1991 to January 1, 1992. Additionally, physicians agreed to be randomized, by practice group, to the control group or to the incentive group, which could receive an additional $0.80 per shot or $1.60 per shot if an immunization rate of 70% or 85%, respectively, was attained.

Results: For practices in the incentive group, the mean immunization rate was 68.6% (SD 16.6%) compared with 62.7% (SD 18.0%) in the control group practices (P = .22). The median practice-specific improvement in immunization rate was +10.3% in the incentive group compared with +3.5% in the control group (P = .03).

Conclusions: Despite high background immunization rates, this modest financial incentive was responsible for a 7% increase in immunization rate among the ambulatory elderly.


Preventive services in general, and influenza immunization in particular, are underutilized. There have been local successes at improving immunization rates, and national estimates of influenza immunization rates among the elderly are increasing. However, there are 10,000 to 40,000 deaths per year attributed to influenza and pneumonia, and growing evidence shows that vaccination reduces morbidity and mortality. In addition to the human cost, estimates of the financial burden of an influenza epidemic range from more than $600 million to $12 billion. Efforts to improve influenza immunization rates have focused on influencing patients (postcards, telephone calls), on influencing physicians (computer-generated and other reminders), and on changing the organizational structure of medical practices. Combined approaches such as those of Nichol and Margolis have attained 58% and 75% immunization rates in a VA medical center and a large HMO, respectively, using a multifaceted approach including patient and physician reminders as well as...
expanded opportunities for influenza immunization. Although these successes at large institutions are admirable, the majority of the elderly receive care in community-based private practices; the central public health challenge is now to assure that the elderly receive influenza immunization independent of the site of their health care delivery. The Medicare Influenza Vaccination Demonstration Project was a policy-level research project that had as its primary goal determining the cost-effectiveness of making influenza immunization a covered benefit for Medicare beneficiaries, thus reducing cost as a barrier to care. 

In Great Britain, high rates for childhood immunizations were attained following the 1990 introduction of a physician contract, which changed physician reimbursement for immunizations. Under the new model, reimbursement for childhood immunization is now based on the immunization rate achieved among the physician’s patients rather than on a fee-for-service basis. This change was associated with a general increase in immunization rates such that 81% of practices immunized 95% or more of their pediatric target population. Although impressive, this improvement cannot definitely be attributed to the change in reimbursement strategy as there was no comparison group available and there was a secular trend of increasing coverage rates prior to the new 1990 contract.

In Rochester, New York, a 73% influenza immunization rate was achieved among a group of physicians receiving performance-based financial incentives compared to a 56% immunization rate among a nonrandomized comparison group; however, the incentive-group physicians in this study all admitted to one hospital, making alternative explanations for the improved performance of the incentive group plausible. The experiences in Great Britain and in Rochester, New York, are encouraging, but confounding influences cannot be excluded. Therefore, we conducted a randomized controlled trial of performance-based incentives.

Methods

Setting

Monroe County Medicare Influenza Vaccination Demonstration Project. During the 1991-1992 influenza immunization season, Monroe County (New York) was participating in the fourth year of the Medicare Influenza Vaccine Demonstration Project. Over the course of the demonstration, the community was influenced by an extensive media campaign, beneficiary letters to all Medicare recipients from the Health Care Financing Agency (HCFA), and an extended schedule of public influenza immunization clinics. The participating physicians who participated in the demonstration received free influenza vaccine and an $8 administration fee for influenza immunization of Medicare patients. In addition, primary-care physicians were encouraged to use the target-based approach developed by Buffington et al.

Participants

Eligibility requirements for physician inclusion in the randomized controlled trial were (1) provision of primary care to at least 50 elderly patients, (2) participation in the Medicare Demonstration Project (using demonstration vaccine and reimbursement mechanisms), (3) use of the target-based poster method for tracking immunizations during the 1990 influenza immunization season, and (4) lack of participation in a previous study.

Interventions

All physicians participated in the Medicare Demonstration Project and agreed to use the target-based poster model for a second year to track immunization rates among the ambulatory elderly. Briefly, participating physicians made a list of all their active nonnursing home patients 65 years old and above who had an office visit in 1990 or 1991; this constituted their target population. The physician or office staff plotted the weekly cumulative percent of their target population who had been immunized on a specially designed poster (see Figure 1). Practices were allowed to use a group poster or one for each physician.

In the intervention group (incentive group), physicians were eligible for reimbursement above the standard $8 fee established by the Medicare Demonstration Project, if immunization rates above 70% or 85% were achieved. If a final immunization rate of 70% was attained, the physician received an additional 10% reimbursement—that is, $.80 per shot, or 10% additional reimbursement, given in the office. If a final immunization rate of 85% was reached, the physician received an additional 20% reimbursement, or $1.60 per shot given in the office. Immunizations given outside the physician’s office (e.g., public clinics) were included to calculate the physician’s percent immunized, but physicians received the incentive reimbursement only on immunizations given in their office.

Randomization

All physicians agreeing to participate for a second year and who had not previously received incentive reimbursement were randomized. To prevent contamination, the unit of randomization was the office practice
so that all physicians in a given practice were in either the incentive or control group. Practices were stratified by the number of elderly patients to ensure comparable population sizes.

**Main Outcome Measures**

Final immunization rates and change in percent immunization from the 1990 baseline were calculated for each practice. Rates were calculated using a denominator for each physician or group practice, which was the number of noninstitutionalized patients aged 65 or older who had an office visit in the last year. The numerator was total number of immunizations credited to a practice including the reported number of immunizations given in the office, and also those given at the Monroe County public clinics and a local garment workers' association (where vaccinees were asked the name of their primary-care physicians.) For practices that used posters for each physician, the group practice immunization rate was calculated using the weighted average of the individual physician immunization rates, with weights determined by each physician's practice size. To assess the reliability of physician reports of immunizations given in the office, we compared the reported number of immunizations with the number of processed claims through the Medicare Demonstration Project office.

### Office Personnel Questionnaire

Study personnel conducted a brief interview of the office manager or contact person in each physician's office. Information was sought to confirm the number of physicians in the practice, whether physicians used their own poster or shared one with others, specialties of the physicians, number of patients per day per physician, types of insurance accepted, percent of patients on Medicaid, and methods used in the office to encourage the use of preventive services outside of this study.

### Analysis

Stata Version 4.0 (College Station, TX) was used for descriptive statistics, t-tests and Wilcoxon Rank Sum tests for continuous variables (normally distributed and nonparametric variables, respectively), chi-square and Fisher's Exact tests for discrete variables, and simple and multiple linear regression. The Shapiro-Wilk W test was used to test for normality of data. Reported P values are two-sided, and all confidence intervals are 95% CIs.

A linear regression model was developed using change in percent immunized as the dependent variable. Independent variables included assignment to the incentive group as well as potentially confounding variables (variables that were different between the incentive and control group or predictive of change in percent immunized in a simple regression at a P-value level of .20). Candidate independent variables included the number of elderly patients in the practice; number of physicians in the practice; the type of setting (dummy variables for private practice, HMO, or subsidized clinic); percent immunized in the baseline year (1990); whether the practice accepts new Medicaid patients; the routine use of phone calls, postcards, or flowcharts as reminders for preventive services; and the total number of visits by study personnel to the practice. Residuals of the model were checked for normality and were not strictly normally distributed. A robust regression model was developed using median regression and bootstrap resampling; similar coefficients and estimates of significance were obtained so the results of the linear regression are presented.
Table 1. Results of randomization: Practice characteristics of incentive versus control physicians

<table>
<thead>
<tr>
<th></th>
<th>Incentive Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. physicians in practice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>&gt;5</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>No. elderly pts in practice (median)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>in 1990</td>
<td>325</td>
<td>432</td>
</tr>
<tr>
<td>in 1991</td>
<td>331</td>
<td>495</td>
</tr>
<tr>
<td>Percent immunized in 1990 (mean)</td>
<td>57.6%</td>
<td>58.0%</td>
</tr>
</tbody>
</table>

Setting
Private Practice: 24 (Incentive) 23 (Control)
HMO (group model): 0 (Incentive) 1 (Control)
Clinic: 3 (Incentive) 3 (Control)

All differences between incentive and control groups are not significant at P < .10.

Results

Participation
All 28 (100%) solo practitioners and 27/28 (96.4%) of the group practices that participated in the 1990 poster project and had not received incentives previously agreed to participate; (the refuser had lost his partner and therefore declined participation). One group practice had fewer than 50 patients and was therefore ineligible, (leaving 26 group practices). These practices included approximately one-third of the primary-care physicians identified in our community.

Randomization
The 54 practices agreeing to participate were stratified by the number of elderly patients in the practice (<100 patients, 100-300 patients, >300 patients) and practices were randomly assigned to incentive group or control group. Practices determined their target population prior to notification of their assignment. The results of the randomization are shown in Table 1. There were no differences at the P = 0.10 level between the incentive and control groups. The 1990 baseline immunization rates were 57.6% and 58.0% for the incentive and control group, respectively.

Main Outcome Measures
As seen in Table 2, the mean immunization rate was 68.6% in the incentive group compared with 62.7% in the control group (P = .22 by t-test). The overall immunization rates (sum of all immunizations given divided by the sum of eligible patients) for all practices were 66.9% (14,182/21,196) for the incentive group and 60.1% (10,580/17,608) for the control group. As the change in immunization rate (1991 versus 1990) is not normally distributed (P = .009 by Shapiro-Wilk W test), median changes and interquartile ranges (IQR) are reported.

The median change in immunization rate was +10.3% (IQR:0, 19.0) in the incentive group and +3.5% (IQR:-5.5, 8.6) in the control group (P = .03 by Wilcoxon Rank Sum test). In the incentive group, 14/27 (52%) practices attained the 70% immunization target level, with 4/27 (15%) achieving the 85% target level. In the control group, 12/27 (44%) practices reached the 70% goal and 2/27 (7%) reached the 85% goal. Individual physician performance within group practices was quite variable. Of the eight group practices in the incentive group, four groups had no physicians at the 70% target immunization level; of the four groups that had at least one physician above the 70% goal, the percent of physicians at target ranged from 17% to 50%.

Reliability Assessment and Assessment of Confounding
To assess the reliability of the physician reports of immunizations given in the office, we compared the reported number of immunizations given in a physician’s office to the number of immunizations reimbursed through the local Medicare Project office. A direct comparison is possible only when the billing entity is identical to the physician or group of physicians tracking a given population on a poster. Among the 35 physician posters for whom we have data in the incentive group, physicians reported 2.7 more immunizations per poster than were reimbursed compared with 4.5 more immunizations per poster among the 34 posters in the control group (P = .72).

Table 2. Immunization and change in the immunization rates in the incentive and control groups

<table>
<thead>
<tr>
<th></th>
<th>Incentive group</th>
<th>Control group</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immunization rate for 1991 (mean)</td>
<td>68.6% (SD ±16.9)</td>
<td>62.7% (SD ±18.0)</td>
<td>.22a</td>
</tr>
<tr>
<td>Change in immunization rates (1991-1990) (median)</td>
<td>10.3% (IQR:0, 19.0)</td>
<td>3.5% (IQR:-5.5, 8.6)</td>
<td>.09b</td>
</tr>
<tr>
<td>Overall 1991 immunization rate</td>
<td>66.9% (14,182/21,196)</td>
<td>60.1% (10,580/17,608)</td>
<td>N/A</td>
</tr>
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By t-test.
By Wilcoxon Rank Sum test.
SD = Standard deviation; IQR = Interquartile range.
As neither study personnel nor physician office staff could be blinded to group assignment, we sought to measure the potential effect of study personnel. As study personnel also were responsible for delivering vaccine as needed, we could not designate the number of visits to each office. Therefore, study personnel recorded each phone call and visit to each office. Study personnel made 6.0 (±2.4) phone calls to control offices compared to 5.2 (±1.5) to incentive practices ($P = .15$ by t-test), and 5.2 (±2.1) visits to control offices versus 6.0 (±1.4) visits to incentive offices ($P = .12$ by t-test).

The office questionnaire results do not show evidence of confounding based on patient demographic mix or the practice’s routine use of reminder systems. Thirty-five percent of incentive practices reported accepting new Medicaid patients compared with 22% of control practices ($P = .31$ by chi square) and there were similar estimated percents of Medicaid patients in both incentive and control practices ($P = .74$). No differences were seen in the reminder systems already in place in incentive and control practices; for incentive and control practices, respectively, routine phone call reminders were used by 32% and 26% ($P = .63$), routine postcard reminders were used by 32% and 28%, ($P = .48$), and flowcharts in the medical record were used by 33% in both groups ($P = 1.0$).

**Regression Model**

A regression model was developed using the change in percent immunized as the dependent variable. Candidate independent variables included routine use of flowcharts to track preventive services, percent immunized in 1990, size of target population, number of interventions by study personnel, and randomization to the incentive group (as only these variables were different between the incentive and control group at a $P = .20$ level or associated with improved performance).

Only randomization to the intervention group and percent immunized in 1990 remained independent predictors of change in immunization rate. Randomization to the incentive group was responsible for a 7.1% increase in immunization rate ($P = .05$; 95% CI: 0, 14.3%). For each 1% increase in the immunization rate in the baseline year, there was a −0.46% decrease in the change in immunization rate ($P < .001$, 95% CI: −0.64, −0.30). This model explains about 41% of the variability in performance. Figure 2 illustrates the influence of randomization to incentive group and the baseline immunization rate on the mean change in immunization rate.

The financial incentives and the target-based poster were well accepted by the practicing community as evidenced by the high participation rate. The financial incentives were relatively inexpensive (total reimburse-
Performance-based financial incentives for immunization resulted in nonsignificant 6% higher immunization rate ($P = .22$) and a significant 10.3% versus 3.5% improvement in immunization rates from baseline in the incentive group relative to the control group ($P = 0.03$). Although the difference in immunization rate is small, this change occurred despite high baseline immunization rates. The failure to detect higher absolute immunization rates may be due in part to the low power of the study.

A major limitation of this study is the generalizability. It may be that the intensive promotion of vaccine during the demonstration was a prerequisite for the success of the incentive. Alternatively, the effect of the incentive might have been greater had the baseline immunization rates been similar to national levels. Further study in a site independent of community-wide vaccine promotion will be necessary to answer this question.

Another limitation of this study was that it was impossible to blind study personnel or physicians. However, we found no evidence of introduced bias. Study personnel could have introduced bias by the intensity of their interactions with the office staff. As discussed above, we found no difference in the number of interactions that study personnel had with incentive and control physicians. Although we cannot determine whether visits were qualitatively similar between groups, we have no evidence for bias introduced by study personnel. At the physician level, bias could be introduced by overestimating the number of immunizations given or by under-reporting the total number of patients. We compared the number of immunizations reported to us with the total number of immunizations reimbursed through the project office and the results were similar; there was no tendency of the incentive group to over-report more than the control group. To avoid a bias due to underestimating practice size in the incentive group, we did not advise physicians of their assignment until after practice size was determined. We therefore have no evidence for differential bias.

One important result of the overall Medicare Influenza Vaccine Demonstration Project is that influenza vaccination is now a reimbursable benefit for Medicare beneficiaries. However, as pointed out by Fedson, this may be a necessary but not a sufficient condition for increased immunization rates in the elderly. He relates that pneumococcal immunization rates have remained low even though pneumococcal vaccination has been a covered benefit for many years. He suggests the need for an improved vaccine delivery infrastructure.

This study represents one of very few randomized trials of physician financial incentives. It is encouraging that even small levels of additional reimbursement lead to improved compliance with national goals. Future research will be necessary to determine whether this result can be duplicated in the absence of an ongoing community effort.

The optimal structure of the incentive needs to be determined. In this study, incentives were a supplement to the fee-for-service payment. In the British system, there is no reimbursement until a given level of immunization is achieved. The British system also involves substantially larger sums of money. Under our strategy, physicians are rewarded for high immunization rates with no punishment (other than the loss of revenue from a potentially billable service), whereas the British system puts the physician at risk by not paying for immunizations until the physician achieves the immunization rate. Further research will be necessary to determine whether rewards alone or a reward/punishment system is more effective in improving delivery of preventive services. A potential disadvantage to a system where there is no payment until a target level is reached is the potential to introduce another disincentive for physicians to care for traditionally under-served populations who are harder to reach for preventive services. Furthermore, the most cost-effective level of performance-based reimbursement is unknown. For example, we do not know the appropriate target immunization rates or the most effective incentive size to change behavior. In Monroe County in the setting of the Medicare Influenza Vaccination Demonstration Project, target levels of 70% and 85% were attainable with a marginal cost-effectiveness of about $3 for each additional immunization; whether this is generalizable remains unknown.

As our health care system changes in response to a more competitive environment, the delivery of preventive services is an important concern. Many organizational strategies in offices such as computer-generated reminders on encounter sheets and health care flow sheets are valuable only for those individuals who visit the physician. For influenza vaccination in particular, the person needs to visit during an approximately 3 month interval. Although an active outreach strategy, which focuses on all patients and not just those with visits, has been advocated for almost 90 years, we are far from that ideal. Performance-based reimbursement may encourage physicians to focus on their entire population rather than on individual patients; this refocusing could help us attain the Healthy People 2000 goals for preventive services.
We would like to thank the participating Monroe County physicians and their office personnel. The assistance of Nancy LaForce, R.N., Sandra Eich, R.N., and Christine Russo, R.N., in data collection was crucial. We thank Bonnie Lewis and her staff who coordinated the vaccine delivery for the Monroe County Medicare Demonstration Project for their assistance and cooperation. We also appreciate the excellent secretarial support of Laurie Aman, Patricia Kochersberger, Linda Kyle, Maria Milella, and Suzanne Wilson.

References