Effect of Vaccination by Community Pharmacists Among Adult Prescription Recipients

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BACKGROUND. Millions of doses of influenza vaccine are administered each year in the United States at nontraditional sites and by nontraditional vaccine providers. Pharmacists are increasingly becoming vaccine providers.

OBJECTIVES. To measure association between availability of pharmacist-immunizers and immunization delivery to adult prescription recipients, and the relative contributions of various types of vaccine providers.

RESEARCH DESIGN. Mailed survey in spring 1999, contrasting adults in urban Washington State, where pharmacists administer vaccines, to adults in urban Oregon, where pharmacists did not.

SUBJECTS. Cluster sample based on October 1998 prescription records suggesting need for influenza vaccine, derived from 24 community pharmacies belonging to one pharmacy chain.

MEASURES. Vaccination status and choice of vaccine provider.

An average of 20,000 Americans die from influenza each year. 1–3 Among groups for whom influenza vaccine is explicitly recommended, people younger than 65 with chronic heart or lung disease or diabetes have the lowest rates of vaccination. On average, 58% of people over 65 years of age are vaccinated against influenza each year, but only 20% to 38% of younger adults at risk. 4

RESULTS. Influenza vaccination rates among respondents 65 years or older increased 4.7% more in Washington than in Oregon between 1997 and 1998 (P = 0.20). The net increase in influenza vaccination rate among younger respondents taking indicator medications for chronic diseases for which influenza vaccination is recommended was 10.6% (P = 0.05). Among respondents unvaccinated against influenza in 1997, the 1998 influenza vaccination rate was 34.7% in Washington, compared with 23.9% in Oregon (P = 0.01).

CONCLUSIONS. Vaccine delivery by pharmacists is associated with higher rates of vaccination among those younger than 65 taking indicator medications for chronic diseases, as well as prescription recipients unvaccinated against influenza in the previous year.

Key Words. Pharmacists; pharmacies; immunization; vaccination; utilization. (Med Care 2001;39:340–348)

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Among the primary reasons for low influenza immunization rates are missed opportunities. 1–3,5 Of those who die of influenza, 75% to 90% had visited a physician as an outpatient in the year before their death, but were not vaccinated 5–8. Year after year, at least 30 million American adults continue to be inadequately vaccinated and are vulnerable to influenza. 1,4 Pharmacists are regarded as trusted health professionals, 9 readily accessible to the public even in rural zip codes and health professional shortage areas. 10 Since the mid-1990s, progressively more pharmacists have become vaccine advocates and providers. 11–14 Many people at risk of influenza have chronic diseases, 2–4 for which they receive prescription medications dispensed by pharmacists. 15 Pharmacists can identify adults who should be immunized 15–20 and persuade them to be immunized. 15–16,20–21 Research shows a willingness on the part of adults to be immunized in a pharmacy by a pharmacist. 13,21

It has not been previously established whether vaccine administration by pharmacists increases immunization among adult prescription recipients or whether pharmacy-based programs merely displace these adults from being immunized by other providers. This study was designed to answer that question, evaluating how a new type of vaccine provider affects adult vaccine delivery. Given pharmacists’ knowledge of patients’ underlying illnesses, we assessed the hypothesis that more convenient access to vaccination by community pharmacists (based on proximity and hours of availability) will be associated with net increases in immunization rates.

Washington is 1 of 32 States where state regulations explicitly authorize pharmacists to administer medications. In contrast, Oregon regulations did not explicitly authorize drug administration by pharmacists at the time of this study, nor were any pharmacists known to do so. Nonetheless, Oregon and Washington had comparable adult immunization programs and levels in 1995, based on Medicare reimbursement claims (48% vs. 47% vaccinated, respectively) or the Behavioral Risk Factor Surveillance Summary (66% vs. 67%). 22–23

Methods

Study pharmacies were identified from centralized prescription records of Fred Meyer Pharmacies (Seattle, WA). The study included all 11 pharmacies in the Puget Sound area of Washington State and all 13 pharmacies in urban areas of Oregon contributing to a central data repository. The pharmacies differed mainly by availability of pharmacist-administered immunizations. Prescription volume and hours of operation were similar. Pharmacies conducted their usual verbal and visual marketing and advocacy programs.

Fred Meyer Pharmacies, a major pharmacy chain in the western United States, was one of the first to offer vaccinations by pharmacists. In fall 1997, pharmacists at 44 Fred Meyer pharmacies in Washington administered 15,114 doses of influenza vaccine and 1,380 doses of pneumococcal vaccine. Pharmacists at each Fred Meyer pharmacy in Washington State vaccinate, but none of the pharmacists at the chain’s Oregon pharmacies did so during this study. Fred Meyer pharmacies in Oregon hosted nurses 1 day per site in autumn 1998 to offer influenza vaccination.

Based on modal patient zip codes recorded in the prescription database, the Washington and Oregon communities served by these pharmacies did not significantly differ by gender, advanced age, education, household size, or poverty level. 24 People in the Oregon communities were more likely to be white and had a lower median household income, compared with Washington communities studied.

From their prescription databases, 24 pharmacies provided lists of eligible subjects. This study considered two main strata:

(a) People 65 or more years old who received any prescription medication during October 1998; and

(b) People 21 to 64 years old who received certain prescription medications during October 1998.

Medications of interest were those presumably prescribed for diseases that indicate the need for influenza vaccine. 2–3,15 The medications involved the treatment of chronic heart disease (eg, digoxin, nitroglycerin, warfarin), chronic lung disease (eg, beta-adrenergic agonists, ipratropium, leukotriene antagonists, theophylline), or diabetes mellitus (eg, insulin, oral hypoglycemic agents). These drugs (referred to here as indicator medications) have a high positive-predictive value for need of influenza vaccination, 15 and are prescribed in high volume in community pharmacies. 20

People living in nursing facilities were excluded. Only 1 subject was enrolled per household. When 2 eligible subjects had the same residence, only the
person with the greater number of prescriptions was selected.

Among 80,462 prescription records accessible, 13,987 eligible patients were identified. The number of eligible patients from each pharmacy varied. To yield pharmacy subsamples of comparable size, subjects were selected at random, stratified by pharmacy, with a probability proportionate to the number of eligible subjects from each pharmacy. These methods yielded 4,403 subjects, 2,211 in the Washington cohort and 2,192 in the Oregon cohort. The Washington cohort included 1,110 subjects 65 years or older and 1,101 subjects younger than 65 years taking indicator medications. The Oregon cohort included 1,120 subjects 65 years or older and 1,072 subjects younger than 65 years taking indicator medications.

Subjects received a 4-page self-administered survey asking about their beliefs and behaviors related to vaccination. The survey, based on an earlier survey of prescription recipients, was pilot-tested in focus groups before mailing on February 5, 1999. Nonrespondents received a second and third survey mailed at 5-week intervals.

Study subjects reported whether they visited a traditional or nontraditional vaccine provider for influenza vaccination in 1997 and 1998. We define traditional for this study as being vaccinated at a physician’s office, a hospital, or a public-health clinic. Respondents did not name any other traditional, stationary sources of medical care. We define nontraditional for this study as vaccination at a pharmacy, as well as places that do not typically provide medical care, such as work places, senior centers, grocery stores, shopping malls, schools, fire departments, county fairs, subjects’ homes, or similar ad hoc sites recently offering influenza vaccine each autumn.

Immunization rates and other variables were compared for differences across covariates with X² test, Student’s t-test, McNemar’s test, or nonparametric statistics using Epi-Info or SAS software. Alpha was defined a priori as 0.05. Effect modification was evaluated by stratifying by demographic and clinical covariates. Potential confounding variables were assessed using Mantel-Haenszel adjusted measures of association. Pharmacy covariates included prescription volume and median income of the pharmacy’s census tract. Subject covariates included age, gender, race, education, number of prescription fills, previous vaccinations, and health conditions.

The study was reviewed and approved in advance by the University of North Carolina School of Public Health Committee for the Protection of Human Research Subjects, in accordance with applicable state and federal regulations. Only the lead author had access to subject-identifying information at any time during the study. All subjects were informed of their rights regarding data privacy. Subject identifiers were erased as soon as practical.

Results

Characteristics of Study Pharmacies

Although Washington and Oregon pharmacies dispensed comparable prescription volumes and had similar hours and days of operation, the Washington pharmacies delivered progressively more vaccinations in succeeding years: 91 doses per pharmacy when nurses vaccinated at each site for 1 day in 1996, 528 and 807 doses per pharmacy when pharmacists vaccinated throughout the 1997 and 1998 influenza-vaccination seasons, respectively. Based on mean vaccine doses administered in 1998, pharmacists administered 711 more doses per Washington pharmacy than nurses administered in Oregon pharmacies (Table 1).

Characteristics of Study Subjects

The cohorts of eligible Washington and Oregon subjects did not differ on the basis of age, number of prescription fills, or health conditions for which they took prescription medications. The US Postal Service returned 412 surveys as undeliverable; 22 survey responses were uninterpretable. Among the 3,991 potential respondents, 2,090 usable surveys were completed and returned (52%). The response rate was 51% for the Washington cohort and 55% for the Oregon cohort.

The 2,090 people who responded with usable surveys did not differ from the remaining 2,313 nonrespondents on the basis of gender, number of prescription fills, cardiovascular medications, or multiple diagnostic indications (Table 2). Subjects in Washington, people younger than 65 years of age, and people taking indicator medications, respiratory medications, or hypoglycemic medications were less likely than their counterparts to
TABLE 1. Prescription and Vaccination Characteristics Reported by Study Pharmacies, Washington and Oregon

<table>
<thead>
<tr>
<th>Pharmacy Parameters</th>
<th>Washington (11 pharmacies)</th>
<th>Oregon (13 pharmacies)</th>
<th>Statistical Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>(mean per site ± SD)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average weekly prescription volume, 1998</td>
<td>1,195 (± 358)</td>
<td>1,153 (± 288)</td>
<td>P = 0.76</td>
</tr>
<tr>
<td>Vaccinations, Oct–Dec 1996 (a)</td>
<td>91 (± 26)</td>
<td>0</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>by transient nurse teams</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinations, Oct–Dec 1997 (a)</td>
<td>528 (± 233)</td>
<td>233 (± 121)</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>by on-site pharmacists</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaccinations, Oct–Dec 1998 (a)</td>
<td>807 (± 412)</td>
<td>96 (± 64)</td>
<td>P &lt; 0.0001</td>
</tr>
<tr>
<td>by on-site pharmacists</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

(a) Total, without regard to age or underlying disease status.

return surveys. Response rates ranged from 35% in Everett, Washington to 66% in Corvallis, Oregon. Fred Meyer prescription databases do not record personal characteristics of race, ethnicity, and education, which were only known on the basis of survey responses. Respondents who provided this information described themselves as African-American (1.2%), Asian/Pacific Islander (1.8%), Hispanic (1.3%), Native American (1.2%), or white (93%). Respondents reported their formal education level (partial or complete) as grade school (14%), high school (38%), college (44%), or graduate school (14%).

TABLE 2. Self-Reported Characteristics of Survey Respondents and Nonrespondents, Washington and Oregon

<table>
<thead>
<tr>
<th>Characteristic:</th>
<th>Respondents</th>
<th>Nonrespondents</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of subjects (n)</td>
<td>2090</td>
<td>2313</td>
<td></td>
</tr>
<tr>
<td>Mean age (y) (± SD)</td>
<td>64.8 (± 15.2)</td>
<td>58.4 (± 17.7)</td>
<td>P &lt; 0.0001, KW</td>
</tr>
<tr>
<td>Mean prescription fills (±SD) per observation period</td>
<td>2.7 (± 2.2)</td>
<td>2.8 (± 2.3)</td>
<td>P = 0.15, ANOVA</td>
</tr>
<tr>
<td>Gender*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1212 (58)</td>
<td>1269 (55)</td>
<td>Female vs. male, P = 0.34, χ²</td>
</tr>
<tr>
<td>Male</td>
<td>819 (39)</td>
<td>910 (39)</td>
<td></td>
</tr>
<tr>
<td>Indeterminate</td>
<td>59 (3)</td>
<td>134 (6)</td>
<td></td>
</tr>
<tr>
<td>State cohort*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Washington (n = 2211)</td>
<td>1004 (48)</td>
<td>1207 (52)</td>
<td>P = 0.006, χ²</td>
</tr>
<tr>
<td>Oregon (n = 2192)</td>
<td>1086 (52)</td>
<td>1106 (48)</td>
<td></td>
</tr>
<tr>
<td>Risk factor*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age ≥65 y (n = 2230)</td>
<td>1261 (60)</td>
<td>969 (42)</td>
<td>P &lt; 0.0001, χ²</td>
</tr>
<tr>
<td>21 to 64 y, taking indicator medications (n = 2173)</td>
<td>829 (40)</td>
<td>1344 (58)</td>
<td></td>
</tr>
<tr>
<td>Health condition*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Respiratory</td>
<td>443 (21)</td>
<td>729 (32)</td>
<td>P &lt; 0.0001, χ²</td>
</tr>
<tr>
<td>Diabetes</td>
<td>469 (22)</td>
<td>646 (28)</td>
<td>P &lt; 0.0001, χ²</td>
</tr>
<tr>
<td>(Insulin users)</td>
<td>149 (7)</td>
<td>213 (9)</td>
<td>P = 0.01, χ²</td>
</tr>
<tr>
<td>Cardiovascular</td>
<td>276 (13)</td>
<td>334 (14)</td>
<td>P = 0.24, χ²</td>
</tr>
<tr>
<td>Multiple medical indications</td>
<td>41 (2)</td>
<td>64 (3)</td>
<td>P = 0.08, χ²</td>
</tr>
</tbody>
</table>

*Number (% of column n).
Distribution of subjects who reported being vaccinated against influenza in 1997 or 1998 appear in Table 3 and Table 4. The net difference between states in proportions vaccinated among respondents 65 years or older was $+4.7\%$ (95% CI: $-4.5\%$, $+14.1\%$), and $+10.6\%$ among younger respondents taking indicator medications (95% CI: 0.0%, $+21.2\%$).

The association for each risk-based stratum was also assessed by nonparametric methods, using Wilcoxon's rank sum test, to analyze the findings according to the sampling unit (each pharmacy). For respondents 65 years or older, the increased proportion vaccinated in Washington did not reach statistical significance ($P = 0.11$). For respondents younger than 65 years of age taking indicator medications, the difference between state cohorts for vaccination in 1998 was nearly significant ($P = 0.054$).

In addition to overall trends, we considered vaccine-seeking behavior at the individual level. Table 5 depicts the vaccination behavior of 1,161 subjects who reported where they were vaccinated against influenza in both 1997 and 1998: 73% were vaccinated by a traditional provider in both years, 89% were vaccinated by the same category of vaccine provider in both years. McNemar's test statistic indicates that the provider distribution in 1998 did not differ significantly from that in 1997 (ie, 5% $\sim$ 6.5%, $P = 0.15$).

These data can also be assessed as 2 cohorts, distinguished by type of vaccine provider in 1997. This allows a chi-squared test to determine if the conditional probability of going to a nontraditional provider in 1998 given a traditional provider in 1997 differs from the opposite case, the probability of going to a traditional provider in 1998 given a nontraditional provider in 1997. The data in Table 5 show that people who used a traditional provider in 1997 were more likely to return to that provider category in 1998 than were people to visit a nontraditional provider in both 1997 and 1998 (24.8% vs. 8.1%, $P <0.0001$). Applying McNemar's and chi-squared tests to data from Washington only, comparable results obtained.

Between 1997 and 1998, respondents in Washington younger than 65 years taking indicator medications who reported receiving influenza vaccination from pharmacists increased 8 percentage points, from 9% to 17% ($P = 0.002$), with a proportional decrease in nonvaccinated people, from 43% to 34% (Figure 1). In Oregon, vaccination in pharmacies increased 1 percentage point, while the proportion unvaccinated was largely unchanged.

Some, but not all, vaccinations administered in Washington pharmacies were recorded in the prescription database. A total of 120 survey responses corresponded with 127 vaccination entries in the prescription database in Washington pharmacies. Using these automated clinical records as the gold standard, survey responses exhibited 94% sensitivity.

For people 65 years or older, demographic or other factors included in the survey did not influence the state-specific differences in influenza vaccination in 1998, with one exception. Respondents vaccinated in 1997 were 1.61 times (95% CI: 1.02, 2.44) as likely as respondents not vaccinated in 1997 to be vaccinated against influenza in 1998 ($P = 0.047$). For people less than 65 years of age taking indicator medications, no demographic or other factors included in the survey influenced the state-specific differences in influenza vaccination in 1998.

Among the respondents, 595 reported being vaccinated against influenza in 1998, but not in 1997 (Table 4). Overall, 10.8% more respondents from Washington were vaccinated than their Oregon counterparts (95% CI: 3.5%, 18.1%). The increased likelihood holds for both strata. For respondents 65 years or older, the difference in proportion vaccinated was 13.8% (95% CI: 2.6%, 25.0%). Among younger adult respondents taking indicator medications, the difference in proportion vaccinated was 9.6% (95% CI: 0.04%, 19.3%).

The overall association was also assessed by nonparametric methods, using Wilcoxon's rank sum test, to analyze the findings according to the sampling unit (each pharmacy). The difference between state cohorts for people unvaccinated in 1997 was statistically significant by this test, as well ($P = 0.03$).

Figure 2 portrays influenza vaccine provider choices among all respondents who did not report influenza vaccination in 1997. Notable is the 17% fraction vaccinated in Washington pharmacies in 1998 who reported being unvaccinated in the previous year, as well as the 11% difference in the unvaccinated proportions between Washington and Oregon (65% vs. 76%).

In absolute terms, the number of doses of influenza vaccine given in physician offices rose in Washington by 6.4%, from 388 in 1997 to 413 in 1998. In contrast, influenza vaccinations in physician offices in Oregon increased by 3.1%, from 483 in 1997 to 498 in 1998. The net difference (3.3%)
was larger than expected by chance ($P = 0.02$). The rate ratio was 2.1 (95% CI: 1.1, 3.9). People vaccinated in physician offices in 1997 were more likely to return to physician offices for vaccination in 1998 than for people vaccinated elsewhere in 1997 to again be vaccinated outside a physician office in 1998 (29.2% vs. 12.1%, $P < 0.0001$).

**Discussion**

Vaccine delivery by pharmacists was associated with a 10.6% higher influenza vaccination rate among respondents younger than 65 who took medications for prolonged conditions (Table 3). Vaccine delivery by pharmacists was also associated with a 10.8% higher influenza vaccination rate among adult prescription recipients unvaccinated against influenza in the previous year (Table 4).

Influenza vaccination rates for prescription recipients 65 years and older increased only slightly in Washington (Table 3). The consistently high proportion vaccinated in this group offered less room for improvement, compared with younger people needing influenza vaccine.

Building on previous studies, $^{15-21}$ this study supports a finding that pharmacists can identify and motivate pharmacy patrons at risk of influenza to be vaccinated. Of course, pharmacist-

### Table 3. Measures of Association Between State Cohort and Vaccination Against Influenza in 1998

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Cohort</th>
<th>Proportion Vaccinated (%)</th>
<th>Difference (1998–1997)</th>
<th>Net Difference Between States (WA-OR) (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age ≥ 65</td>
<td>Washington</td>
<td>459/600 (76.5)</td>
<td>+4.7%</td>
<td>$P = 0.20$, $\chi^2$ (−4.5% to +13.9%)</td>
</tr>
<tr>
<td></td>
<td>Oregon</td>
<td>554/661 (83.8)</td>
<td>0.0%</td>
<td>$P = 0.11$, Wilcoxon</td>
</tr>
<tr>
<td>Age &lt; 65*</td>
<td>Washington</td>
<td>230/404 (56.9)</td>
<td>+9.2%</td>
<td>$P = 0.05$, $\chi^2$ (0.0% to 21.2%)</td>
</tr>
<tr>
<td></td>
<td>Oregon</td>
<td>252/425 (59.3)</td>
<td>−1.4%</td>
<td>$P = 0.054$, Wilcoxon</td>
</tr>
</tbody>
</table>

*Subjects younger than 65 years taking indicator medications for heart or lung disease or diabetes.

### Table 4. Overall and Stratified Measures of Association Between State Cohort and Vaccination Against Influenza in 1998, Among People Not Vaccinated Against Influenza in 1997

<table>
<thead>
<tr>
<th>Vaccinated Against Influenza in 1998, But Not in 1997 (% vaccinated)</th>
<th>Not Vaccinated Against Influenza in 1998 or 1997</th>
<th>Relative Risk (95% CI)</th>
<th>Statistical Finding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Washington all subjects, n = 315</td>
<td>111 (34.7%)</td>
<td>204</td>
<td>1.47 (1.14, 1.92)</td>
</tr>
<tr>
<td>Oregon, all subjects, n = 280</td>
<td>67 (23.9%)</td>
<td>213</td>
<td></td>
</tr>
<tr>
<td>Washington, age ≥65, n = 141</td>
<td>51 (36.2%)</td>
<td>90</td>
<td>1.61 (1.06, 2.44)</td>
</tr>
<tr>
<td>Oregon, age ≥65, n = 107</td>
<td>24 (22.4%)</td>
<td>83</td>
<td></td>
</tr>
<tr>
<td>Washington, &lt;65*, n = 174</td>
<td>60 (34.5%)</td>
<td>114</td>
<td>1.39 (1.00, 1.93)</td>
</tr>
<tr>
<td>Oregon, &lt;65* n = 173</td>
<td>43 (24.9%)</td>
<td>130</td>
<td></td>
</tr>
</tbody>
</table>

*Subjects younger than 65 years taking indicator medications for heart or lung disease or diabetes.
Table 5. Patterns of Influenza Vaccination Behavior for Persons Vaccinated in Both 1997 and 1998, Washington and Oregon Combined

<table>
<thead>
<tr>
<th>Vaccinated at Traditional Site in 1998</th>
<th>Vaccinated at Nontraditional Site in 1997</th>
</tr>
</thead>
<tbody>
<tr>
<td>852 (73.4%)</td>
<td>75 (6.5%)</td>
</tr>
<tr>
<td>58 (5.0%)</td>
<td>176 (15.2%)</td>
</tr>
</tbody>
</table>

McNemar's test statistic = 2.173, P < 0.15.

X² test, P < 0.0001.

delivery of vaccinations is just one element contributing to a state's overall vaccination rate.

Among the people studied, delivery of influenza vaccination increased in traditional and nontraditional settings, generally, as well as pharmacies and physician offices specifically. Individuals vaccinated in traditional settings were more likely to return to traditional settings in the following year than for people vaccinated in nontraditional settings to continue that pattern (Table 5).

Table 1 illustrates the importance of delivering vaccinations throughout the fall, at the convenience of vaccine recipients, rather than when nurses or pharmacists offer this service on only 1 or 2 days during the season. Contrasting pharmacist-based programs in Washington with pharmacies that hosted nurses in Oregon, 2.3 to 8.4 times as many doses were administered by increasing public access to vaccination.

One important limitation of this study is its reliance on an observational design, which includes the potential for bias. Given the unmeasured differences between adult vaccination environments in Washington and Oregon not controlled by this study, we cannot assert that the availability of vaccinations from pharmacists was the proximal cause of the larger proportions of vaccination.

This analysis relies on respondents' own reports of vaccination, over a 2-year interval. The accuracy of self-reports of annual influenza immunization...
was 91% for the previous year when validated by record review. Among elderly managed-care patients in an outpatient setting, self-report of influenza vaccine in the previous year had a sensitivity of 98% and a specificity of 71%.

Despite asking about managed-care status and other forms of insurance coverage in these surveys, we were not able to assess insurance coverage with sufficient reliability to address any role it may have played. To be eligible for our study, subjects had to receive prescriptions at these pharmacies, without regard to insurance status. We consider it unlikely that managed-care status would increase choice of pharmacists as vaccine providers.

If nonrespondents to the survey were less likely to have been immunized than respondents, then observed immunization rates might overestimate actual rates. Such an error may be nondifferential between the intervention and control groups, biasing toward the null. Response bias of this type was not observed in a Durham County, NC, study of vaccination among prescription recipients.

The samples surveyed are limited in their representativeness to broader populations. Elderly users of prescription medications are only partially representative of elderly people in general. People younger than 65 years old taking indicator medications may have different perceptions of their need for vaccination, compared with either young adults without chronic disease or people 65 years or older.

The major advantage of this study is its assessment of typical vaccination practices, rather than a contrived experiment. This study is one of few to report vaccine-acceptance rates among people younger than age 65 with extensive health conditions. Previous studies found influenza vaccine coverage levels of 14% to 39% among adults in high-risk populations younger than age 65. This study found 58% to 66% coverage.

This study's design and setting poses a difficult test of the effect of pharmacists as immunizers. The communities studied had many sources of vaccine delivery and extensive networks of health insurance. Further, all prescription recipients, by definition, have access to other professionals capable of providing vaccines, their physicians. Nonetheless, this study found that more people were vaccinated in settings where pharmacists vaccinate than in settings where pharmacists did not vaccinate. Whether these findings would apply among people who do not routinely see a physician cannot be determined from this study. Effects of pharmacist-immunizers in other settings with fewer options for vaccine delivery may be different, perhaps greater.

Assuring immunization of the large and growing population of people of advancing age or with chronic disease at high-risk of lethal infection is a continuing challenge for the health-care system. Increasing vaccination in the community could help in reaching the Healthy People 2010 goal of 90% vaccination of people 65 years and older in the United States. Since this study was conducted, the US Advisory Committee on Immunization Practices (ACIP) strongly encouraged standing orders to increase adult vaccination against influenza and pneumococcal disease. The ACIP recommendations encompass long-term care facilities, inpatient and outpatient facilities, pharmacies, adult workplaces, and home health agencies: "Because of the societal burden of influenza and pneumococcal disease, implementation of standing orders program to improve adult vaccination coverage for these diseases should be a national public health priority." Our study indicates that pharmacy-based immunization programs can contribute to a net increase in delivery of influenza vaccine, without disrupting the balance in immunization delivery between traditional and nontraditional sites.

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