Factors Predictive of Increased Influenza and Pneumococcal Vaccination Coverage in Long-term Care Facilities: The CMS-CDC Standing Orders Program Project

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Background: Between 1999 and 2002, a multistate demonstration project was conducted in long-term care facilities (LTCFs) to encourage implementation of standing orders programs (SOP) as evidence-based vaccine delivery strategies to increase influenza and pneumococcal vaccination coverage in LTCFs.

Objective: Examine predictors of increase in influenza and pneumococcal vaccination coverage in LTCFs.

Design: Intervention study. Self-administered surveys of LTCFs merged with data from OSCAR (On-line Survey Certification and Reporting System) and immunization coverage was abstracted from residents' medical charts in LTCFs.

Setting and Participants: Twenty LTCFs were sampled from 9 intervention and 5 control states in the 2000 to 2001 influenza season for baseline and during the 2001 to 2002 influenza season for postintervention.

Intervention: Each state's quality improvement organization (QIO) promoted the use of standing orders for immunizations as well as other strategies to increase immunization coverage among LTCF residents.

Main Outcome Measures: Multivariate analysis included Poisson regression to determine independent predictors of at least a 10 percentage-point increase in facility influenza and pneumococcal vaccination coverage.

Results: Forty-two (20%) and 59 (28%) of the facilities had at least a 10 percentage-point increase in influenza and pneumococcal immunizations, respectively. In the multivariate analysis, predictors associated with increase in influenza vaccination coverage included adoption of requirement in written immunization protocol to document refusals, less-demanding consent requirements, lower baseline influenza coverage, and small facility size. Factors associated with increase in pneumococcal vaccination coverage included adoption of recording pneumococcal immunizations in a consistent place, affiliation with a multifacility chain, and provision of resource materials.

Conclusions: To improve the health of LTCF residents, strategies should be considered that increase immunization coverage, including written protocol for immunizations and documentation of refusals, documenting vaccination status in a consistent place in medical records, and minimal consent requirements for vaccinations. **(J Am Med Dir Assoc 2005; 6: 291–299)**

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Research has found that residency in long-term care facilities (LTCFs) is a risk factor for both influenza and pneumococcal diseases.[1–4] Although influenza and pneumococcal vaccinations are cost-effective and efficacious in containing disease in these settings,[5] immunization rates in LTCFs remain well below the national 2010 goal of 90%. During 1999 the national influenza coverage rate was 66% and pneumococcal coverage rate was 39% for institutionalized persons aged 65 years or older, according to the National Nursing Home Survey (NNHS).[6]

Use of multiple strategies to increase immunizations as well as implementation of standing orders for immunizations have been shown to increase vaccination coverage in LTCFs.[7–9] In fact, The Advisory Committee on Immunization Practices (ACIP) recommends that standing orders programs (SOPs) for immunizations be used in LTCFs under the supervision of a medical director to ensure the administration of recommended vaccinations for adults.[10]

This paper examines LTCF structural characteristics, adoption of policies or procedures, and intervention strategies that predict increase in influenza and pneumococcal immunization coverage in LTCFs from a multistate intervention study. We hypothesized that proven interventions, such as promotion of SOPs, would lead to adoption of policies recommended by the ACIP to increase vaccination coverage.[11] We also expected other demonstrated interventions, such as provider and patient reminders and education,[12] to be associated with adoption of policies and procedures to increase vaccination coverage.

METHODS

The Immunization Standing Orders Program Project was a demonstration project conducted collaboratively by the Centers for Disease Control and Prevention (CDC), the Centers for Medicare and Medicaid Services (CMS), and CMS Quality Improvement Organizations (QIO). The goal of the project was to have QIOs, the quality assurance arms of CMS, promote the use of SOPs among LTCFs to increase immunization coverage among residents. Fourteen states participated, including 9 intervention states (Washington, DC, Florida, Hawaii, Idaho, Kentucky, Massachusetts, Minnesota, Montana, and New Mexico) and 5 control states (Ohio, Pennsylvania, Wisconsin, South Carolina, and Nevada). Twenty facilities were selected in each state. The intervention states were selected by CMS, based on the QIO's rating of the SOP Project as a high priority. Control states were selected by the CDC using CMS's criteria, that is, whether the QIOs rated the SOP Project as a lower priority (and were not selected by CMS) and by regional diversity. No states were known to have laws or regulations restricting the use of SOPs before the start of the project. LTCFs were selected using a stratified random sampling design, including facility size and the type of immunization program. Immunization coverage was determined by on-site chart abstractions. Baseline coverage included residents who lived in the LTCFs at any time during the influenza season from November 1, 2000, through January 31, 2001; postintervention coverage included LTCF residents during the following influenza season; in both years 100 residents were randomly chosen from each LTCF. QIOs were responsible for on-site data collection. The project was considered program evaluation and therefore did not require Institutional Review Board review.

LTCF Survey Instrument and Data Collection

The self-administered survey included 35 questions about LTCF structural characteristics as well as policies and procedures, including offering of vaccine for facility personnel, influenza outbreaks, source of vaccines, vaccine storage, immunization documentation, barriers to immunizations, method of obtaining consent from residents or their guardians, procedures in the facility's written protocol for immunizations, and immunization program for residents. Immunization program activities were categorized as "SOP" or "Non-SOP." SOP is an institutional policy that authorizes appropriate nursing or pharmacy staff to immunize residents by institution- or medical director–approved protocol without the need for a written or verbal order or an exam from the personal physician. Non-SOP includes advanced orders, preprinted admission orders (PPAO), and reminders/education.

On-line Survey and Certification Reporting System (OSCAR)

OSCAR is an administrative database containing information on all Medicare- or Medicaid-licensed LTCFs in the United States. Independent variables included ownership (government, nonprofit, or proprietary); facility size (ie, number of beds); type of facility (ie, skilled nursing facility or nursing facility-Medicare and/or Medicaid certified); number of doctor and nurse hours per patient per day; if the facility had any substandard assessments[13]; if the facility was hospital-administered; and if the facility was independent or part of a multifacility chain.

Intervention

We surveyed the QIOs about interventions they used to promote standing orders for immunizations. The actual intervention to promote SOPs for immunizations was implemented by the QIO in each "intervention" state. The QIOs were given flexibility as to what strategies to use. Surveys were conducted of each QIO after the intervention period including questions about what strategies had been implemented to promote immunizations. One survey was conducted by the CDC and the other by an independent contractor. These

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survey responses were combined for analysis. Another survey directed at the LTCFs was also conducted by the independent contractor asking what type of activities had occurred in the facility during the intervention period, including contact by the QIO and resources provided by the QIO.

Statistical Analysis

Analyses were performed using Statistical Analysis Software (SAS), release 8.02 (SAS Institute, Cary, NC, 1999). Separate analyses were performed with 2 outcome measures: change in influenza and pneumococcal immunization rates ($\geq$10 vs $<$10 percentage points). We examined change in coverage as a continuous variable, but the overall change was very close to zero for both vaccines. Hence, the most useful results would be finding predictors of a large increase in coverage (ie, 10 percentage-point increase). Therefore, facilities that had 90% or higher coverage at baseline were not included in the analyses examining predictors of increase (11 were excluded for influenza and 12 for pneumococcal). Categorical variables were analyzed using χ^2 test for associations. Because the proportion of responses with more than a 10 percentage-point increase in coverage (dependent variables) were higher than 10%, we used Poisson regression to obtain risk ratios (RR) and confidence intervals (CI) for the best predictive multivariate models.[14,15]

RESULTS

Response Rate

During the baseline year, of the 279 surveys sent to facilities, 249 were completed (response rate, 89.3%). After the intervention period, of the 266 surveys sent to facilities, 236 were completed (response rate, 88.7%). There were 213 (80.1%) of 266 facilities that responded both years and are included in the following analysis. Sixty-two percent of the facilities (n = 132) were in intervention states. No statistically significant differences were found when we compared nonresponders to responders by facility size, ownership, affiliation with a multifacility chain, type of facility, and whether the home was hospital administered.

Change in Immunization Coverage

At baseline, the mean influenza coverage for all LTCFs in the study was 59.4% (range, 0–96%) and the mean pneumococcal coverage was 38.3% (range, 0–100%). After the intervention, the overall mean influenza coverage was 59.8% (range, 0–100%) and the mean pneumococcal coverage was 40.1% (range, 0–100%). After the intervention, 42 (20%) of the facilities had at least a 10 percentage-point increase in influenza immunizations (59 [28%] for pneumococcal).

Baseline LTCF Characteristics Associated With Increase in Immunization Coverage

A larger proportion of facilities affiliated with multifacility chains had a significant increase in pneumococcal coverage of at least 10 percentage points after the intervention than independent homes (Table 1). No other LTCF characteristic we examined, including participation in an intervention state, use of centralized tracking system for immunizations, or type of immunization program, were statistically significantly associated with an increase in influenza or pneumococcal vaccination coverage.

Adoption of Protocols or Procedures Associated With Increase in Immunization Coverage

Facilities that adopted less demanding consent requirements for the influenza vaccine (ie, in lieu of written consent accepted oral consent) were significantly more likely to have a10 percentage point or higher increase in coverage ($P < .01$) (Table 2). Facilities that adopted a centralized tracking system for pneumococcal immunizations or adopted recording pneumococcal immunizations in a consistent place in medical records were significantly more likely to have at least a 10 percentage-point increase in coverage ($P < .05$). Facilities that amended their written protocol to include documenting refusal of the influenza vaccine by the resident or guardian were significantly more likely to have an increase in both influenza and pneumococcal coverage ($P < .05$). Although 12% and 10% of facilities adopted use of standing orders for immunizations for influenza and pneumococcal vaccines respectively, no statistically significant association with an increase in coverage was found for either vaccine.

QIO Interventions Associated With Increase in Immunization Coverage

No single intervention or combinations of interventions (Table 3) as reported by the QIOs were significantly associated with increase in influenza or pneumococcal coverage (data not shown). In intervention states in which the QIO strongly promoted preprinted orders in addition to or more so than SOPs, facilities were less likely to adopt less stringent consent policies, or to adopt written policies such as informing residents about the risks and benefits of immunizations and documenting vaccine refusals for the pneumococcal vaccine ($P < .01$). On the other hand, facilities that reported being contacted by their QIO during the intervention period to discuss improving immunization programs were significantly more likely to have at least a 10 percentage-point increase in pneumococcal immunization coverage than those that were not contacted (52% vs 24%, $P < .01$). Also, facilities that reported their QIO gave them resource materials to improve immunization programs during the intervention period were more likely to have at least a 10 percentage-point increase in pneumococcal immunization coverage than those that were not given materials (45% vs 25%, $P < .01$).

QIO Interventions Associated With Adoption of Protocols or Procedures

Facilities that were given informational workbooks or samples of protocols and policies by their QIO were significantly more likely to adopt changes in their written immunization protocols that are recommended by the ACIP. For example, facilities that were given informational workbooks began to inform residents about the risks and benefits of both vaccines, and observe for adverse events after receipt of the pneumo-

Table 1. *Baseline LTCF Characteristics by Change in Coverage From Baseline to Year 2, Immunization Standing Orders Program Project, 1999–2002*

	Total	Change in Influenza Coverage			Change in Influenza Coverage			
	N	≥10* %	<10* %	*P* Value	Total N	≥10* %	<10* %	*P* Value
Intervention or control?				.41				.58
Intervention	125	22	78		123	29	71	
Control	77	17	83		78	26	74	
Ownership				.77				.07
Government	25	20	80		26	12	88	
Nonprofit	65	17	83		62	35	65	
Profit	112	21	79		113	27	73	
Chain				.83				.04†
Independent	94	19	81		95	21	79	
Chain	108	20	80		106	34	66	
Facility size				.07				.36
<61 beds	46	30	70		45	20	80	
61–120 beds	87	20	80		88	32	68	
>120 beds	69	13	87		68	28	72	
Any substandard assessments?				.57				.93
Missing	11	9	91		11	27	73	
Adequate	140	21	79		139	28	72	
Substandard	51	18	82		51	27	73	
Hospital administered?				.75				.35
Yes	32	22	78		33	21	79	
No	170	19	81		168	29	71	
Eligible residents offered flu vaccine?				.40				1.00
Not offered	6	33	67		6	17	83	
Was offered	196	19	81		195	28	72	

* Percentage points.
† $P < .05$.

coccal vaccine (Table 3). Facilities that were given samples of protocols and policies began to inform residents about the risks and benefits of the pneumococcal vaccine and document refusals of the pneumococcal vaccine. Also, facilities that participated in QIO-sponsored, multifacility conferences discussing immunization programs were more likely to adopt less demanding consent requirements for the influenza vaccine. Finally, QIOs that provided educational materials to patients influenced facilities' adoption of informing residents about the risks and benefits of both vaccines and documenting refusals of the pneumococcal vaccine. Some interventions had a negative association with adoption of procedures and protocols. For example, facilities that were encouraged to use pre-printed orders only as opposed to use of SOPs were significantly less likely to adopt procedures recommended by the ACIP, such as informing residents about the risks and benefits of the pneumococcal vaccine and documenting refusals of the pneumococcal vaccine.

Multivariate Analyses

Variables that remained in the final model predicting at least a 10 percentage-point increase in influenza immunization coverage included facility size, adoption of less demanding consent requirements, and amendment in written immunization protocol to require documentation of vaccine refusal by resident or guardian (Table 4). Baseline influenza coverage and adoption of using a centralized tracking system for influenza vaccination were included in the model to control for confounding because those facilities with high coverage at baseline had less opportunity to increase in coverage substantially than those with lower baseline coverage, and improved tracking has the potential to artificially increase immunization coverage through better documentation. For the same reason, recording influenza immunizations in a consistent place in the medical record should be controlled for, but 97% of the facilities had adopted this practice before baseline and neither the baseline variable nor the adoption of the practice variable improved the model.

Variables that remained in the final model predicting 10 percentage point or higher increase in pneumococcal immunization coverage included affiliation with a multifacility chain, adoption of recording immunizations in a consistent place in medical records, and facility reported their QIO provided resource materials on immunization programs (Table 5). Baseline pneumococcal coverage and adoption of using a centralized tracking system for pneumococcal vaccinations were included to control for confounding.

DISCUSSION

Adoption of several protocols and procedures, a number of which are recommended by the ACIP, were associated with

Table 2. *Adoption of Protocols or Procedures by Change in Immunization Coverage, Immunization Standing Orders Program Project, 1999–2002*

	Change in Influenza Coverage				Change in Pneumococcal Coverage			
	Total n	≥10* %	<10* %	*P* Value	Total n	≥10* %	<10* %	*P* Value
Adoption of standing orders for flu immunizations								
Yes	23	26	74	.41	24	17	83	.19
No	179	19	81		177	29	71	
Adoption of standing orders for pneumococcal immunizations								
Yes	20	30	70	.24	21	19	81	.34
No	182	19	81		180	29	71	
Adoption of change in consent for flu vaccine from written to oral								
Yes	18	44	56	.01†	18	44	56	.10
No	184	17	83		183	26	74	
Adoption of change in consent for pneumococcal vaccine from written to oral								
Yes	31	26	74	.36	30	30	70	.78
No	171	19	81		171	27	73	
Adoption of centralized system for tracking flu immunizations				.88				.57
Yes	37	19	81		38	32	68	
No	165	20	80		163	27	73	
Adoption of centralized system for tracking pneumococcal immunizations								
Yes	51	25	75	.24	52	40	60	.02†
No	151	18	82		149	23	77	
Adoption of offering flu vaccine to patients with undocumented history				.82				.84
Yes	33	21	79		34	26	74	
No	169	20	80		167	28	72	
Adoption of offering pneumococcal vaccine to patients with undocumented history				.31				.06
Yes	53	25	75		53	38	62	
No	149	18	82		148	24	76	
Adoption of recording flu immunizations in a consistent place in medical records				.60				1.0
Yes	6	0	100		7	29	71	
No	196	20	80		194	28	72	
Adoption of recording pneumococcal immunizations in a consistent place in medical records				.82				.00†
Yes	33	21	79		34	47	53	
No	169	20	80		167	24	76	
Adopted flu written immunization protocol				.35				1.0
Yes	7	0	100		7	29	71	
No	195	21	79		194	28	72	
Adopted pneumo written immunization protocol				.80				.69
Yes	33	18	82		32	25	75	
No	169	20	80		169	28	72	
Adopted requirement of consent for vaccine to written flu protocol				.19				.22
Yes	36	28	72		36	36	64	
No	166	18	82		165	26	74	
Adopted requirement of consent for vaccine to written pnuemococcal protocol				.45				.57
Yes	37	24	76		38	32	68	
No	165	19	81		163	27	73	
Adopted requirement to inform resident of flu vaccine risks and benefits				.83				.20
Yes	43	21	79		42	36	64	
No	159	20	80		159	26	74	

Table 2. *Continued*

	Change in Influenza Coverage				Change in Pneumococcal Coverage			
	Total n	≥10* %	<10* %	*P* Value	Total n	≥10* %	<10* %	*P* Value
Adopted requirement to inform resident of pneumococcal vaccine risks and benefits				.63				.40
Yes	40	22	78		39	33	67	
No	162	19	81		162	27	73	
Adopted requirement to document refusal of flu vaccine by resident/guardian								
Yes	34	32	68	.04†	34	41	59	.05†
No	168	17	83		169	25	75	
Adopted requirement to document refusal of pneumococcal vaccine by resident/guardian				.09				.42
Yes	37	30	70		36	33	67	
No	165	18	82		165	27	73	
Adopted in written protocol to observe for adverse effects after flu IZ				.45				.22
Yes	37	24	76		36	36	64	
No	165	19	81		165	26	74	
Adopted in written protocol to observe for adverse effects after pneumococcal IZ				.82				.82
Yes	43	19	81		41	27	73	
No	159	20	80		160	29	71	

IZ, immunization.
* Percentage points.
† *P* value $< .05$.

an increase in vaccination coverage among the vulnerable elderly population in LTCFs. Also, QIO interventions (such as providing informational workbooks and samples of protocols and policies to the LTCFs, provider reminders, and providing educational materials to patients) were associated with adoption of several protocols and procedures recommended by the ACIP. Further analysis suggested these findings influenced immunization coverage because facilities that reported being contacted by a QIO or reported the QIO provided resources on immunization programs were significantly more likely to have an increase in immunization coverage. However, neither adoption of standing orders nor participation in an interven-

Table 3. *Quality Improvement Organizations' (QIO) Interventions With a Positive Association of Adoption of Procedures/Protocols, Immunization Standing Orders Program Project, 1999–2002*

	Inform Resident About Vaccine per Written Protocol		Document Refusals per Written Protocol		Observe Vaccine Adverse Events per Written Protocol		Less Demanding Consent Requirements	
	Flu	PPV	Flu	PPV	Flu	PPV	Flu	PPV
QIO gave informational workbook	X	X				X		
QIO gave samples of protocols and policies		X		X				
QIO gave educational seminars								
QIO gave conferences to multiple facilities							X	
QIO gave satellite broadcasts								
QIO gave onsite consultation								
QIO gave software								
QIO assisted with implementing tracking system								
QIO gave feedback to staff								
QIO gave reminders to staff		X						X
QIO provided educational materials to patients	X	X		X				
QIO provided educational materials to providers								

X = $P < .05$.

Table 4. *Predictors of ≥10 Percentage Point Increase in Influenza Vaccination Coverage From Baseline to Year 2, Immunization Standing Orders Program Project, 1999–2002*

Multivariate Model	Influenza ≥10* vs <10*
Facility size	
Small (<60 beds)	2.50 (1.16, 5.39)
Medium (60–120 beds)	1.43 (0.68, 2.98)
Large (>120 beds)	Ref
Flu coverage at baseline	0.98 (0.96, 1.00)
Consent for flu vaccine was changed from written to oral vs no change	2.97 (1.43, 6.15)
Adoption of requirement in written immunization protocol to document refusals vs no adoption	2.26 (1.17, 4.37)
Adoption of using a centralized system to track flu immunizations vs no adoption	0.64 (0.30, 1.39)

Risk ratios with 95% confidence intervals.
* Percentage points.

tion state was predictive of an increase in immunization coverage.

Adoption of documenting influenza vaccine refusals in the written protocol was associated with increase in both influenza and pneumococcal coverage in the bivariate analysis, and remained significant in the influenza multivariate analysis. Adoption of this protocol is recommended by the ACIP[10] and might lead to improved immunization coverage because awareness that vaccine refusals must be documented either is a reminder that receipt of vaccines should also be documented or is an incentive for staff to offer influenza vaccine since they need to document the outcome of this offering. Also, less demanding consent requirements for the influenza vaccine (ie, change requirement for written consent to oral consent) were predictive of increased coverage. Only one state requires written consent for giving vaccinations,[16] so facilities should consider changing their requirements to simpler procedures. Further, because facilities that were given educational seminars by their QIOs were more likely to adopt less demanding consent requirements, this intervention should be considered by QIOs to increase immunization coverage.

Adoptions of procedures significantly associated with increase in pneumococcal coverage in the multivariate analysis included documenting pneumococcal vaccinations in a consistent place. Recording vaccinations in a consistent place in the medical record is an efficient use of resources, since it reduces time in assessing immunization status. One study found that 90% of respondents reported difficulty in verifying patients' immunization status as a potential barrier to implementing a new state regulation requiring immunization assessments to increase immunization coverage.[17]

An important factor associated with increase in coverage in the bivariate analysis included use of a centralized tracking system. All residents of LTCFs should be assessed on admission for the pneumococcal vaccine and should be vaccinated if not known to be previously vaccinated. The ACIP recommends that all persons 65 years or older who have unknown vaccination status should receive one dose of vaccine.[18] Since pneumococcal vaccine may have been given many years previously, adoption of offering vaccine to those with unknown status may save time and resources in trying to locate past records. Further, using a centralized tracking system helps to maintain records so that residents' vaccination status can be reviewed periodically and to ensure residents are revaccinated if they received the vaccine when they were younger than 65 years old. This type of system is also useful to determine immunization coverage for the home as a quality of care indicator to ensure optimal coverage.

Contrary to our expectations, adoption of using standing orders for immunizations was not significantly associated with increase in immunization coverage. The reason, in part, may be due to whether LTCF staff actually agreed with the use of standing orders even though they were "adopted" by the facility. In addition, the degree of implementation of SOPs at the facility level was not validated. Hence, those in charge of immunization programs in LTCFs should ensure that the administrators of vaccinations are not only aware that standing orders for immunizations exist, but they should also educate them and be sure they "buy in" to the programmatic change.[19] Further, studies have shown that strategies, such as state immunization regulations, do not necessarily work in a context in which institutions are directed by a regulation yet there is no strong enforcement mechanism.[17] Thus, some kind of positive reinforcement for satisfactory immunization coverage in the LTCF should be considered. Strategies for sustaining long-term change for health promotion practice include setting small, incremental goals, giving feedback about individual performance, and monitoring and reinforcement.[20]

Another approach to quality improvement in nursing facilities includes using key indicators that assess care delivered,

Table 5. *Predictors of ≥10 Percentage Point Increase in Pneumococcal Vaccination Coverage From Baseline to Year 2, Immunization Standing Orders Program Project, 1999–2002*

Multivariate Model	Pneumococcal ≥10* vs <10*
Part of multifacility chain vs independent	1.69 (1.02, 2.79)
Pneumococcal coverage at baseline	1.00 (0.99, 1.02)
Adoption of using a centralized system to track pneumococcal immunizations vs not	1.46 (0.90, 2.36)
Adoption of documenting pneumococcal immunizations in a consistent place in facility records vs not	1.77 (1.05, 2.97)
Facility reported that Quality Improvement Organization provided resource materials about flu and pneumococcal IZ programs the second year but not the first	2.07 (1.20, 3.59)

Risk ratios with 95% confidence intervals.
* Percentage points.

such as CMS Minimum Data Set (MDS), which routinely assesses residents' sentinel health events for all nursing home residents nationwide.[21] Addition of influenza and pneumococcal vaccination status to the list of quality indicators examined by facility administrators, researchers, and other users of MDS data has great potential to increase immunization coverage among LTCF residents.

Although LTCFs report that QIOs provided resource materials had significant improvements in pneumococcal coverage, we were surprised to find that participation in an intervention state overall was not associated with increase in immunization coverage. Some of the QIOs in the intervention states felt their efforts to promote change were hampered by the inability to give nursing home–specific data feedback about the results of the chart abstraction at the end of year 1 of the project. Another reason for this may be that various immunization-promoting activities were later found to have been occurring in some of the control states. First, the QIO's activities varied by state and those activities were important in determining uptake of practices that made a difference in increase in immunization coverage. This is supported by the variation in immunization coverage among intervention states (not presented). Second, the Academy of Students of Pharmacy and the Student National Pharmaceutical Association–conducted "Operation Immunization: The Nation's Pharmacy Students Protecting the Public Health Campaign" to increase immunization coverage in nursing homes[22] might have influenced immunization rates in some of the control states. Indeed, one of the control states was known to have distributed these materials to all facilities in that state. In addition, one of the control states had a project for nursing home quality improvement that could have influenced immunization rates in the LTCFs in that state.[23] Facilities in that state had sizeable increases in both influenza and pneumococcal coverage compared with the rest of the control states.

A limitation of our study is that QIO interventions were not standardized, which made evaluation of the interventions difficult to interpret. Also, our sample was not designed to be representative of all LTCFs in the 14 states. However, we compared the facility characteristics in our sample to the characteristics of approximately 90% of the facilities in each state, and found they were similar. Hence, it is reasonable to suggest that our findings can be used to make inferences to LTCFs with similar characteristics in the same states of those in our study or in similar states.

The findings from this study are a unique contribution to the literature because the study included multiple facilities in 14 states. Very few studies of this magnitude have conducted interventions to increase immunization rates in LTCFs. Our findings confirm ACIP's recommendations for increasing vaccination coverage among LTCF residents. Also, reporting of the negative findings strengthens the case for involving vaccination administrators in decision making when adopting immunization programs in LTCFs. Facilities should also give timely feedback to staff on facility immunization rates as an incentive to maintain optimal coverage. Further research should be done to determine the effects of these actions.

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REFERENCES

1. Arden NH. Control of influenza in the long-term-care facility: a review of established approaches and newer options. Infect Control Hosp Epidemiol 2000;21:59–64.
2. Marrie TJ. Pneumonia in the elderly. Curr Opin Pulm Med 1996;2:192–197.
3. Muder RR. Approach to the problem of pneumonia in long-term care facilities. Compr Ther 2000;26:255–262.
4. Bradley SF. Prevention of influenza in long-term-care facilities. Long-Term-Care Committee of the Society for Healthcare Epidemiology of America. Infect Control Hosp Epidemiol 1999;20:629–637.
5. Carroll NV, Delafuente JC, McClure KL, et al. Economic burden of influenza-like illness in long-term-care facilities. Am J Health Syst Pharm 2001;58:1133–1138.
6. Buikema A, Singleton J, Sneller V, Strikas R. Influenza and pneumococcal vaccination in nursing homes, U.S., 1995–1999. Paper presented at: the 35th National Immunization Conference; May 29–June 1, 2001; Atlanta, GA.
7. Cui XW, Nagao MM, Effler PV. Influenza and pneumococcal vaccination coverage levels among Hawaii statewide long-term-care facilities. Infect Control Hosp Epidemiol 2001;22:519–521.
8. DeHart MP, Salinas S, Barnette LJ. Jr, et al. Project Protect: Pneumococcal vaccination policies and coverage in Washington state nursing homes. Paper presented at the National Immunization Conference; March 19, 2003; Chicago, Ill.
9. Stevenson KB, McMahon JW, Harris J, et al. Increasing pneumococcal vaccination rates among residents of long-term-care facilities: provider-based improvement strategies implemented by peer-review organizations in four western states. Infect Control Hosp Epidemiol 2000;21:705–710.
10. Centers for Disease Control and Prevention. Use of standing orders programs to increase adult vaccination rates. MMWR Morb Mortal Wkly Rep 2000;49:15–26.
11. Klein RS, Adachi N. An effective hospital-based pneumococcal immunization program. Arch Intern Med 1986;146:327–329.
12. Stone EG, Morton SC, Hulscher ME, et al. Interventions that increase use of adult immunization and cancer screening services: a meta-analysis. Ann Intern Med 2002;136:641–651.
13. Centers for Medicare & Medicaid Services. State Operations Manual. Baltimore, MD: Centers for Medicare & Medicaid Services; 1999. (Appendix Q) (42 CFR 483.25 Quality of Care).
14. Zou G. A modified poisson regression approach to prospective studies with binary data. Am J Epidemiol 2004;159:702–706.
15. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol 2003;157:940–943.
16. Kissam S, Gifford DR, Patry G, Bratzler DW. Is signed consent for influenza or pneumococcal polysaccharide vaccination required? Arch Intern Med 2004;164:13–16.
17. Hempstead K, Bresnitz E, Howell-White S, et al. Use of a state regulation for adult vaccination. Am J Prev Med 2004;26:311–314.

18. Prevention of pneumococcal disease: recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR Recomm Rep 1997;46:1–24.
19. Pathman DE, Konrad TR, Freed GL, et al. The awareness-to-adherence model of the steps to clinical guideline compliance. The case of pediatric vaccine recommendations. Med Care 1996;34:873–889.
20. http://cancer.gov/aboutnci/oc/theory-at-a-glance/page2. Accessed September 8, 2004.
21. Rantz MJ, Popejoy L, Petroski GF, et al. Randomized clinical trial of a quality improvement intervention in nursing homes. Gerontologist 2001; 41:525–538.
22. http://www.aphanet.org/news/operimm.html. Accessed September 8, 2004.
23. Stone, RI, Reinhard SC, Bowers B, et al. Evaluation of the Wellspring model for improving nursing home quality. New York: The Commonwealth Fund; 2002.