Improving Care for Nursing Home–Acquired Pneumonia in a Managed Care Environment

Evelyn Hutt, MD; Nora Reznickova, MD; Nora Morgenstern, MD; Elizabeth Frederickson, BA; and Andrew M. Kramer, MD

Objective: To characterize care of nursing home residents who became ill with nursing home–acquired pneumonia (NHAP) in a group-model, nonprofit HMO, and to pilot-test a strategy to implement evidence-based NHAP care guidelines.

Study Design: Medical record review and intervention pilot test.

Methods: Nursing home medical records of 78 patients who developed NHAP in 6 homes where the HMO contracts for Medicare services were reviewed for demographics, functional status, comorbidity, NHAP severity, care processes, and guideline compliance. The intervention, combining organizational change (facilitating immunization and providing appropriate emergency antibiotics) and education (quarterly in-services for nursing and aide staff), was pilot-tested for 7 months in 1 facility. Measures of baseline and intervention guideline adherence at that facility were compared with Fisher's exact test.

Results: Among the patients with NHAP, 83% had a response from their physician in less than 8 hours, 82% were treated with an antibiotic that met spectrum recommendations, and 74% were able to swallow were treated with oral antibiotics. However, few patients had documentation of influenza and pneumococcal vaccination; less than half the direct care staff had been vaccinated; and nursing assessments were incomplete for 23%. At the pilot-test facility, improvement was seen in influenza vaccination (14% to 52%, P =.01) and use of the most appropriate antibiotics (47% to 85%; P = .03). The guideline adherence score improved from 52% to 63% (P = .04).

Conclusion: Use of a multidisciplinary, multifaceted intervention resulted in improvement in quality of care for nursing home residents who become ill with pneumonia.

(Am J Manag Care. 2004;10:681-686)

Nursing home–acquired pneumonia (NHAP) causes excessive morbidity, mortality,[1] and hospitalization; nearly a third of survivors suffer significant functional decline.[2] At any given time, 1.1% to 2.5% of the country's 2 million nursing home residents are ill with pneumonia.[3] Unfortunately, many nursing home residents are not appropriately immunized,[4] do not have their respiratory symptoms noticed and treated expeditiously,[5] are not hospitalized appropriately,[6,7] and do not receive appropriate antibiotics.[8] Better care has been associated with survival of nursing home residents who acquired pneumonia.[9]

A national, multidisciplinary panel developed evidence-based guidelines and a care pathway for evaluating and treating NHAP that address immunization, timing and thoroughness of nurse and physician evaluation of lower respiratory tract infections, and criteria for hospitalization and antibiotic use.[10] (See **Figure.**) Although treatment guidelines implemented at individual hospitals have been shown to improve pneumonia outcomes,[11] national guidelines often are not translated into practice.[12-14] Key translational studies have shown that a multifaceted approach, including institutional commitment to change, multidisciplinary interactive staff education, and academic detailing,[15-18] are more likely to effect improvements in quality of care and clinical outcomes than passive educational efforts.

Because a group-model, nonprofit HMO represents an integrated system of care with relatively few institutional barriers to altering behavior of physicians and nursing home personnel, we postulated that it would be an ideal location to pilot-test an intervention to implement guideline-based care for NHAP. Approximately 56 000 nursing home residents received their medical care from an HMO in 1997, a number projected to increase markedly over the next 10 years.[19] The present study was designed (1) to characterize the care received by residents who became ill with NHAP in 1 group-model, nonprofit HMO with an active nursing home rounding service, and (2) to pilot-test a multifaceted guideline implementation strategy at 1 of the HMO's contract facilities.

METHODS

Setting

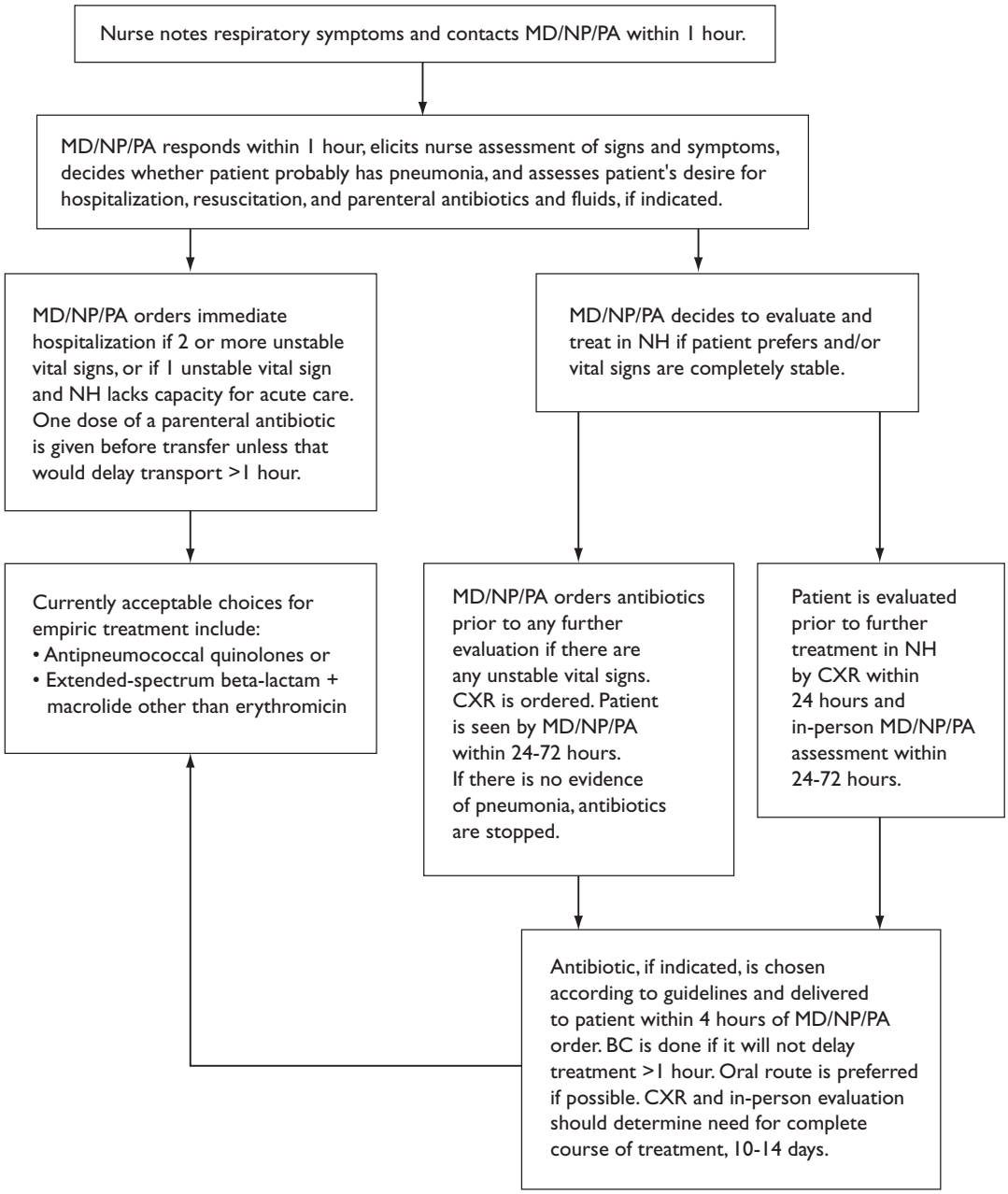
Six Denver-area nursing homes where the HMO contracts for Part A Medicare services participated. A single multifacility corporation owns 3 of the facilities; other multifacility corporations own the others. The HMO's

From the Denver VA Medical Center and the University of Colorado Health Sciences Center, Denver, Colo (EH); the Division of Health Care Policy and Research, University of Colorado Health Sciences Center (EF, AMK); and Kaiser Permanente Rocky Mountain Region, Denver, Colo (NM, NR).

Funded by a faculty development grant to Dr. Hutt from the Hartford/Jahnigen Center of Excellence in Geriatrics, University of Colorado Health Sciences Center.

Address correspondence to: Evelyn Hutt, MD, Director, Program to Improve Quality of Life and Care for Veterans in LTC, Denver VAMC – 151, 1055 Clermont St, Denver, CO 80220. E-mail: evelyn.hutt@uchsc.edu.

Figure. Care Pathway for Nursing Home–Acquired Pneumonia



BC indicates blood culture; CXR, X-ray; MD, medical doctor; NH, nursing home; NP, nurse practitioner; PA, physician's assistant.

nursing home rounding service, a team of 7 physicians, 3 nurse practitioners, 3 telephone nurses, a consulting pharmacist, and 2 care coordinators, admits approximately 2500 Medicare patients per year to these facilities. Sixty-six percent are female; the average admission Functional Independence Measurement score[20] is 63 of a possible 126. The 3 most frequent admitting diagnoses are hip fracture, stroke, and total knee arthroplasty. Average HMO Part A census is 125, representing short-stay, postacute residents served by the Medicare benefit. In addition, about 200 HMO members remain as long-term residents once their Part A stay is complete,

continuing to receive their care from the HMO physician serving that facility. One of these contract facilities served as the pilot-test intervention site. The rounding service admits approximately 330 Medicare patients per year to this facility in Boulder, Colo; about 40 of the HMO's members remain in the facility as long-term residents.

Subjects

HMO members residing in these facilities who developed signs and symptoms of possible pneumonia were identified by their care providers. Only the HMO's members were eligible for the study. A research nurse elicited informed consent from the resident or the resident's proxy if he or she had 2 of more of the following signs and symptoms (at least 1 of which was respiratory): temperature of ≥100.5ºF or ≤96ºF, newly productive cough, wheezing, pleuritic chest pain, dyspnea, respiratory rate of ≥25, pulse rate of >100 beats per minute (bpm), new or worsening hypoxemia, acute decline in cognition or function, and new or worsening adventitial sounds on chest examination. Residents whose symptoms developed fewer than 5 days after admission were excluded because their acute illness was probably acquired outside the nursing home. Symptom onset was defined as the first mention in the chart of a significant change in status. The Colorado Multiple Institutional Review Board approved the study.

Data Collection Protocol

A systematic instrument and data collection protocol were derived from an instrument the investigators had originally developed for the Multi-state Nursing Home Case Mix and Quality Demonstration.[21] Only items that had an inter-rater and test-retest reliability of 0.7 by Cohen's kappa were used in the current instrument. Data on resident characteristics, NHAP severity, comorbidity, laboratory and X-ray data, and processes of care were gathered by chart review within 10 days of the onset of NHAP and 60 days later to ascertain hospitalization and survival. Two nurse researchers pilot-tested the instrument by retrospectively reviewing charts of 20 of the HMO's residents who developed NHAP at the pilot-test facility in the year preceding September 1, 2001. The instrument was refined and then used to gather data prospectively on subjects enrolled from October 1, 2001 through April 30, 2002.

Intervention

First, the nursing home aligned its immunization policies with the guidelines. The beginning of influenza season was used to trigger evaluation of the need for pneumococcal vaccine. Clinic records of 30% of the HMO's members residing in the facility in November 2001 revealed that none had been vaccinated against *Streptococcus pneumoniae*. Accordingly, all of the HMO's residents were offered both pneumococcal and influenza vaccine during the 2001-2002 influenza season. The facility then chose to offer pneumococcal vaccine to all its residents and wrote pneumococcal vaccine orders into their standard admitting procedures.

Second, because getting the appropriate antibiotic to long-term residents quickly was problematic, the HMO's care coordinator worked with its long-term–care pharmacy to set up a tackle box for on-site storage of the first dose of study drugs and a protocol for ordering refills and subsequent doses.

Third, interactive in-services on recognition and timely notification of respiratory symptoms and the need for complete and up-to-date vital signs were delivered every 3 months from September 1 through April 30 (the intervention period) to nursing home nurses and aides at the shift change between days and evenings.

Fourth, during the intervention period the HMO physician and nursing home staff were encouraged to use an evaluation and treatment algorithm that follows the care pathway (Figure) to guide treatment of 25 HMO residents who acquired NHAP and consented to be in the study.

Analysis

Simple descriptive statistics characterize the demographics, functional status, comorbidities, and care processes for the HMO's residents who acquired pneumonia. An NHAP Severity Index,[22] a 5-point scale summing respiratory rate of >25 (2 points), pulse of >125 bpm (1 point), presence of dementia (1 point), and presence of delirium (1 point), was calculated for each episode. Each of the guidelines was applied to the data, and the percentage of episodes in which there was compliance was determined. In addition, percent compliance was calculated for each episode, representing the total number of guidelines complied with divided by the total possible score. For the facility where the pilot test was conducted, we compared that facility's baseline adherence to the guidelines during the preceding year with adherence during the intervention period, using the Fisher exact test for dichotomous variables and the Mann-Whitney U test for continuous independent variables.

RESULTS

The major difference between the HMO's residents and the general population of residents in the study

facilities was in the proportion residing on the subacute unit (Medicare Part A stay). Sixty-three percent of the HMO's residents were on the subacute unit at the time of the study, in contrast to 14% of the nursing homes' general population. Of those HMO residents who developed NHAP, 31.7% resided on the subacute unit, and preceding hospital lengths of stay averaged only 4.2 days. About one third of those who developed pneumonia had comorbid dementia, depression, chronic obstructive pulmonary disease, and/or congestive heart failure.

As illustrated in the **Table**, NHAP episodes were generally less severe than is commonly seen, with 82% of the subjects in the 2 lowest severity categories, which are associated with a 10%, rather than the more usual 25%, mortality from this illness.[22] Average time from admission to development of NHAP was 216 days. Most subjects had chest X-rays, but only half were read as consistent with pneumonia. Other radiographic diagnoses included cardiomegaly (22%), chronic obstructive pulmonary disease (6%), and congestive heart failure and/or pulmonary edema (6%).

Prior to the intervention, the HMO had good guideline adherence at all 6 facilities. For 83% of subjects, their physician responded to a change in their condition in less than an 8-hour nursing shift; 82% of the antibiotics used met recommendations for the bacterial spectrum; 74% of those able to swallow were treated with oral antibiotics. At the same time, a number of opportunities for improvement were evident: few residents had documentation of appropriate vaccination, and fewer than half of the direct care staff had been vaccinated against influenza. Nursing assessments were incomplete for 23% of patients. Eighty percent had not been asked their preferences about hospitalization. Only 20% received their antibiotic within 4 hours of a physician's order, and only 39% received their antibiotic for more than 9 days.

In spite of the small number of subjects and the short intervention period at the pilot-test facility, there were significant changes in compliance with 2 guidelines, and trends toward improvement in others (See Table). Documentation of influenza vaccination improved from 14% to 52% (P = .01). Improvement in pneumococcal vaccination rates, however, did not reach statistical significance. Use of the most appropriate antibiotics improved from 47% to 85% (P = .03). Overall guideline adherence improved modestly from 52% to 63% (P = .04).

DISCUSSION AND CONCLUSION

Quality of care delivered by the nursing home rounding service of this group-model, nonprofit HMO exceeded that described in a retrospective study of care processes for NHAP, particularly in physician behavior.[9] The structure of the rounding service, with 10 care providers whose practice is limited to nursing homes, may have contributed to this enhanced care. Outcomes for these residents also were better, both in terms of survival and hospitalization, than those generally reported for NHAP.[2,23,24] However, the HMO's residents were both less debilitated and less frail than those previously studied, and were less severely ill with their NHAP episode. For example, in the current study, 72% of the residents were independent in eating, compared with 17% in the retrospective study, and the average NHAP severity score was 0.85, in contrast to 1.37.[9]

More importantly, however, this study demonstrated that care improved in specific areas when the HMO's pilot-test site implemented the NHAP guidelines.

Documentation of influenza vaccine improved, but improvement in pneumococcal vaccine was less evident, because the vaccine was actually delivered to the facility a month before the end of the pilot study. Other studies have confirmed that it is possible to improve vaccination rates in nursing homes.[25-27]

Significant changes in antibiotic prescribing also were effected. This outcome parallels academic-detailing studies that demonstrated improvement in nursing home prescribing practices for nonsteroidal anti-inflammatory drugs and neuroleptics.[15-17] Making the most appropriate antibiotics readily available in the facility's emergency kit was likely a key part of the intervention resulting in this change.

Less improvement was seen in processes of care driven solely by the nursing staff, such as prompt physician notification and complete recording of vital signs at symptom onset. Targeting the intervention only to the HMO's residents, about one third of the facility's census, may have diluted the impact of the educational sessions, standardized orders, and posted reminders.

This pilot study is limited in several ways. We described only 1 HMO's nursing home rounding service and only 1 intervention facility. Generalizability to other HMO nursing home services and to fee-for-service residents is therefore limited. In addition, the intervention pilot test was brief and limited to only 25 episodes of infection. In spite of the study's limitations, we were able to demonstrate that use of a multidisciplinary, multifaceted intervention resulted in improvement in quality of care for nursing home residents who become ill with pneumonia.

Table. Comparison of Demographics, NHAP Characteristics, and Percent Guideline Compliance Between Baseline and Intervention

Variable	Baseline		Boulder Intervention (n = 25)	*P**
	All Facilities (n = 53)	Boulder (n = 22)		
Demographics				
Female, %	79	91	68	.08
Average age, y	85.8	89.4	85.0	.05
Preceding length of hospital stay, days	4.2	2.3	4.5	.07
DNR order, %	70	67	80	.33
DNH order, %	8	10	4	.59
On subacute unit, %	31.7	18	28	.33
NHAP characteristics				
SBP <90, %	10	16	17	1.00
CXR consistent with pneumonia, %	56	50	44	.19
Temperature ≥100.5˚F, %	27	30	29	1.00
Average NHAP severity index score	0.85	0.61	0.87	.30
Average number of days from admission to symptom onset	216	204	196	.35
Process of care: percent guideline compliance				
Subjects vaccinated against *Streptococcus pneumoniae*	12	9	20	.42
Subjects vaccinated against influenza	11	14	52	.01
Time between change in condition and call to MD <1 h	68	57	65	.72
Time between call to MD and response <1 h	83	75	86	.64
Complete vital signs recorded at symptom onset	77	73	84	.48
Subject's desire for hospitalization assessed	21	18	28	.51
Subject's venue of care appropriate	94	96	80	.19
X-ray ordered	96	95	96	1.00
MD visited nonhospitalized subjects within 24 h	30	38	67	.10
MD visited nonhospitalized subjects within 72 h	44	56	76	.29
Subjects sent to hospital or receiving antibiotics had blood culture done	20	25	61	.07
Antibiotic ordered within 1 h if any vital sign was unstable	8	0	25	.44
Subjects for whom antibiotics were ordered received them within 4 h of order	20	20	21	1.00
Subjects able to swallow got oral antibiotic	74	71	57	.51
Subjects who received an antibiotic covering *S pneumoniae*, *Haemophilus influenzae*, common gram-negative rods, and *Staphylococcus aureus*	82	73	85	.43
Subjects who received either an antipneumococcal quinolone or an extended-spectrum beta-lactam plus a macrolide	50	47	85	.03
Subjects who were treated for >9 days	39	38	53	.48
Average percent compliance with 16 guidelines	53	52	63	.04

CXR indicates chest X-ray; DNH, do not hospitalize; DNR, do not resuscitate; MD, medical doctor; NHAP, nursing home–acquired pneumonia; SBP, systolic blood pressure.
*For a comparison between the Boulder baseline and the Boulder intervention.

Acknowledgments

The authors would like to thank Linda Morse, RN, and other staff at Boulder Manor Health Care Center for their work implementing the guidelines; Cindy Talacco, RN, FNP, for coordinating the data collection and implementation efforts; the staff and patients of the Continuing Care Department, Kaiser Permanente Rocky Mountain Region, for participating in the study; and Rachel Aaronson for manuscript preparation.

REFERENCES

1. Medina-Walpole AM, Katz PR. Nursing home-acquired pneumonia. *J Am Geriatr Soc.* 1999;47:1005-1015.

2. Fried TR, Gillick MR, Lipsitz LA. Short-term functional outcomes of long-term care residents with pneumonia treated with and without hospital transfer. *J Am Geriatr Soc.* 1997;45:302-306.

3. Degelau J, Guay D, Straub K, Luxenberg MG. Effectiveness of oral antibiotic treatment in nursing home-acquired pneumonia. *J Am Geriatr Soc.* 1995;43:245-251.

4. Zadeh MM, Bridges CB, Thompson WW, Arden NH, Fukuda K. Influenza outbreak detection and control measures in nursing homes in the United States. *J Am Geriatr Soc.* 2000;48:1310-1315.

5. Brooks S, Warshaw G, Hasse L, Kues JR. The physician decision-making process in transferring nursing home patients in the hospital. *Arch Intern Med.* 1994;154:902-908.

6. Saliba D, Kingston R, Buchanan J, et al. Appropriateness of the decision to transfer nursing facility residents to the hospital. *J Am Geriatr Soc.* 2000;48:154-163.

7. Kayser-Jones JS, Wiener CL, Barbaccia JC. Factors contributing to the hospitalization of nursing home residents. *Gerontologist.* 1989;29(4):502-510.

8. Nicolle LE, Bentley DW, Garibaldi R, Neuhaus E, Smith PW. Antimicrobial use in long-term care facilities. *Infect Control Hosp Epidemiol.* 2000;21:537-545.

9. Hutt E, Frederickson EB, Ecord M, Kramer AM. Processes of care predict survival following nursing home acquired pneumonia. *J Clin Outcome Manage.* 2002;9(5):249-256.

10. Hutt E, Kramer AM. Evidence-based guideline for the management of nursing home acquired pneumonia. *J Fam Pract.* 2002;51(8):709-716.

11. Dempsey CL. Nursing home-acquired pneumonia: outcomes from a clinical process improvement program. *Pharmacotherapy.* 1995;15(1):33S-38S.

12. Pearson TA, Laurora I, Chu H, Kafonek S. The lipid treatment assessment project (L-TAP): a multicenter survey to evaluate the percentages of dyslipidemic patients receiving lipid-lowering therapy and achieving low-density lipoprotein cholesterol goals. *Arch Intern Med.* 2000;160:459-467.

13. McLaughlin TJ, Soumeri SB, Willison DJ, et al. Adherence to national guidelines for drug treatment of suspected acute myocardial infarction: evidence for undertreatment in women and the elderly. *Arch Intern Med.* 1996;156:799-805.

14. Cabana MD, Rand CS, Powe NR, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA.* 1999;282(15):1458-1465.

15. Avorn J, Soumeri SB, Everitt DE, et al. A randomized trial of a program to reduce the use of psychoactive drugs in nursing homes. *N Engl J Med.* 1992;327:168-173.

16. Ray WA, Taylor JA, Meador KG, et al. Reducing antipsychotic drug use in nursing homes. A controlled trial of provider education. *Arch Intern Med.* 1993;153:713-721.

17. Stein CM, Griffin MR, Taylor JA, Pichert JW, Brandt KD, Ray WA. Educational program for nursing home physicians and staff to reduce use of nonsteroidal anti-inflammatory drugs among nursing home residents: a randomized controlled trial. *Med Care.* 2001;39:436-445.

18. Naughton BJ, Mylotte JM, Ramadan F, Karuza J, Priore RL. Antibiotic use, hospital admissions and mortality before and after implementing guidelines for nursing home-acquired pneumonia. *J Am Geriatr Soc.* 2001;49:1020-1024.

19. Farley DO, Zellman G, Ouslander JG, Reuben D. Use of primary care teams by HMOs for care of long-stay nursing home residents. *J Am Geriatr Soc.* 1999;47:139-144.

20. Stineman MG, Excarce JJ, Goin JE, Hamilton BB, Granger CV, Williams SV. A case-mix classification system for medical rehabilitation. *Med Care.* 1994;32:366-379.

21. Kramer AM, Frederickson EB, Ecord MK, Hutt E, Kowalsky JC, Eilertsen TB. *Effects on Outcomes and Quality.* Denver, Colo: University of Colorado Health Sciences Center; 2000. *Nursing Home Care Mix and Quality Demonstration Evaluation. Final Report;* vol 2.

22. Naughton BJ, Mylotte JM, Tayara A. Outcome of nursing home-acquired pneumonia: derivation and application of a practical model to predict 30 day mortality. *J Am Geriatr Soc.* 2000;48:1292-1299.

23. Medina-Walpole AM, McCormick WC. Provider practice patterns in nursing home-acquired pneumonia. *J Am Geriatr Soc.* 1998;46:187-192.

24. Muder RR. Pneumonia in residents of long-term care facilities: epidemiology, etiology, management, and prevention. *Am J Med.* 1998;105:319-330.

25. Stevenson CG, McArthur MA, Naus M, Abraham E, McGeer AJ. Prevention of influenza and pneumococcal pneumonia in Canadian long-term care facilities: how are we doing? *CMAJ.* 2001;164:1413-1419.

26. Stevenson KB, McMahon JW, Harris J, Hillman JR, Helgerson SD. 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 Cont Hosp Epidemiol.* 2000;21:705-710.

27. Potter J, Stott DJ, Roberts MA, et al. Influenza vaccination of health care workers in long-term-care hospitals reduces the mortality of elderly patients. *J Infect Dis.* 1997;175(1):1-6.