Incidence of Adult Immunization for Influenza and Pneumonia in a Preadmission Testing Unit

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Health care-associated (nosocomial) infection is now more common in surgical patients than surgical-site or wound infection. Elderly patients and those having abdominal, neck, cardiac, or other thoracic procedures are at the highest risk. Pneumococcal pneumonia and influenza are the fifth leading cause of mortality in the elderly population. In the United States, only 54% of persons older than 65 years have received a pneumococcal vaccine, whereas approximately 67% have been immunized for influenza. In this study, interviews were conducted with 160 elderly patients seen in the preadmission testing unit of a large community hospital. Results showed immunization rates of 57% for pneumonia and 76% for influenza. Similar to findings of previous studies, minorities were less likely to be immunized than whites. Of those who were not immunized for pneumonia or could not recall their immunization status, 71% stated they had not been offered immunization. Sixty-four percent stated they would take the vaccine to prevent pneumonia if it were offered. Of those patients who were not immunized for influenza, 54% had not been offered this protection and 41% stated they would take the influenza vaccine if offered. Although vaccination rates of participants in the present study surpassed the 1998 national baseline for noninstitutionalized adults, there is much opportunity for improvement. PeriAnesthesia nurses have an important role in reducing surgical patients’ risks of developing health care–associated pneumonia and invasive bacteremia by assessing the patient’s immunization status and being proactive in helping surgical patients obtain appropriate vaccinations. Routine documentation of a vaccination history for pneumococcal pneumonia and influenza during preadmission testing and use of a standard protocol for educating and immunizing those who lack this protection are strategies that can be easily implemented by nurses practicing in periAnesthesia settings such as ambulatory surgical sites and preadmission testing units. This practice would foster achievement of the Healthy People 2010 goal of 90% vaccination rates for persons at high risk for these deadly diseases.

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older persons in the United States, more than all other vaccine-preventable diseases combined. It is estimated that in 1998, 3,400 older persons died from bacteremic pneumococcal pneumonia, a common complication of influenza, or from other forms of invasive pneumococcal disease. Although effective vaccines are available to protect populations at risk for pneumococcal disease and influenza, the overall vaccination rates remain far from optimal.

Health care–associated (nosocomial) pneumonia is the second most common health care–associated infection and is now more common in surgical patients than surgical-site or wound infection. The perianesthesia nurse can play an important role in reducing surgical patients’ risks of developing serious health care–associated pneumonia and invasive bacteremia by assessing patients’ immunization status and being proactive in seeing that patients scheduled for surgery obtain appropriate vaccinations for influenza and pneumococcal pneumonia. During the preoperative phase of care, including preadmission testing appointments, nurses may administer vaccinations or refer patients to their primary physicians for such vaccines before their scheduled surgery.

Such nursing interventions are particularly important for patients anticipating abdominal, neck, cardiac, or other thoracic procedures that put patients at higher risk for postoperative pulmonary complications, including pneumonia. According to studies using the Centers for Disease Control and Prevention’s definition of health care–associated pneumonia, the overall incidence of postoperative pneumonia after all types of surgery was 15%, with thoracic surgery having the highest incidence at 34%, abdominal surgery at 6% to 22%, and cardiac procedures at 21%. Elderly surgical patients with inherently compromised host defenses, comorbid conditions such as diabetes or chronic obstructive lung disease, and more prolonged hospitalizations than other individuals are especially vulnerable to pneumonia, a leading cause of postoperative mortality.

Background

Pneumococcal disease is caused by the bacterium *Streptococcus pneumoniae*. It is responsible for many infections of the upper respiratory tract, such as otitis media and sinusitis, and it may result in more invasive infections, including bacteremia and meningitis. Streptococcal pneumonia is the most common cause of community-acquired pneumonia, accounting for 25% to 35% of hospitalizations for this illness each year and approximately 40,000 deaths. About 10% to 25% of adult patients with pneumococcal pneumonia develop bacteremia, with an overall mortality rate of about 20%. In the elderly, this rate may be tripled.

Pneumococcal pneumonia contributes to prolonged hospitalizations, which are estimated to increase by 7 to 9 days for all causes of health care–associated pneumonia. Further, the emergence and growth of antibiotic drug resistance make treating *S. pneumoniae* particularly challenging. Results of the SENTRY Antimicrobial Surveillance Program indicated that approximately 44% of the respiratory pneumococcal isolates were resistant to penicillin. Costs associated with treatment of microbial-resistant streptococcal pneumonia are estimated at over $4 billion each year.

Influenza viral infections prevail as the most common cause of medically attended acute respiratory illness. Influenza is caused by a number of serologically distinct strains of single-stranded RNA viruses. In adults, influenza is often complicated by the development of pneumonia, most often caused by *S. pneumoniae*, *Haemophilus influenzae*, and *Staphylococcus aureus*. Although uncommon, primary influenza viral pneumonia has a particularly high mortality rate. During the past 25 years in the United States, excess rates of hospitalization during influenza season have reached 270 per 100,000, with 20,000 deaths per year. The economic impact of influenza is estimated to be in the range of $3 to $5 billion annually, a major contributor to the $10 billion annual cost to
society of vaccine-preventable diseases in adults.6

Immunizations are an effective means of preventing excessive morbidity and mortality in adults, especially those in high-risk categories, including those over the age 65. Despite the proven benefits of immunization for adults, however, immunization rates among the adult population remain low.13 Only 54% of persons older than 65 have received the pneumococcal vaccine.13 Among those 65 and older, influenza vaccination rates approached 67% in 1999.9 However, there is still room for improvement since the elderly account for more than 90% of the deaths associated with influenza in the United States.15

Effective vaccines are available for immunization against both pneumococcal pneumonia and influenza. Currently, licensed pneumococcal vaccines represent 85% to 90% of the serotypes that cause invasive bacterial disease in the United States. A dose of 0.5 mL is administered intramuscularly or subcutaneously in the deltoid region.13 The Centers for Disease Control recommends that a person’s 50th birthday is a good time to review all immunizations and to evaluate risk factors for the pneumococcal vaccine.16 Revaccination is not recommended for persons who have received the pneumococcal vaccine unless they were younger than 65 years when they were first vaccinated and have not received the vaccine in the past 5 years. The need for more than 2 doses of pneumococcal vaccine is not clear and, therefore, not recommended.6,13

Inactivated split- or whole-virus influenza vaccines are available in the United States. All are trivalent, containing 2 type-A strains and one type-B strain of those viruses most likely to circulate. The vaccine should be administered between October and November, given as one 0.5-mL dose into the deltoid muscle. Although vaccination will protect 70% to 90% of healthy recipients younger than 65 years of age, efficacy rates are lower in the elderly because of a decreased immune response. The vaccine has been shown to have a 30% to 40% efficacy rate in preventing disease in studies of elderly persons living in nursing homes. Additionally, it has a 50% to 60% efficacy rate in protecting against hospitalization and up to an 80% efficacy rate in preventing death.13 An overall 50% reduction in influenza in the elderly and a 43% to 50% reduction in hospital deaths caused by all respiratory conditions for vaccine recipients has been demonstrated through meta-analysis.13

Many barriers to vaccination of adults for pneumococcal pneumonia and/or influenza have been identified by the Centers for Disease Control Advisory Committee on Immunization Practices and in independent investigations. These barriers are listed in Table 1.13,16-18 Another barrier that has been specific to influenza immunization at times is insufficient supply and irregular distribution of the vaccine. Despite universal coverage under Medicare, one half to three quarters of elderly adults fail to get vaccinated against pneumonia and influenza.1 Low-income individuals and ethnic minorities are particularly negligent in obtaining vaccinations.

Community hospitals are frequently visited by the elderly for physician appointments, preadmi-

Table 1. Barriers to Adult Vaccinations for Influenza and Pneumococcal Pneumonia

- Missed opportunities to vaccinate adults during contacts with health care providers in offices and outpatient settings (including ambulatory surgery and preadmission testing units, and hospitals)
- Lack of awareness of both providers and patients of the seriousness of certain vaccine-preventable diseases and benefits of vaccination
- Patient and provider fears concerning adverse events after vaccination
- Lack of consistent and efficient documentation by patients and health care providers (eg, computerized database) regarding patients’ immunization status
- Lack of vaccine delivery systems in the public and private sectors that can reach adults in different settings
- Historical misconceptions and cultural beliefs about vaccinations
- Family and personal factors (eg, education, frequent moves, language barriers, undocumented immigrant status)
- Lack of health insurance or lack of knowledge that Medicare pays for vaccination
- Low motivation of primary care providers to recommend immunization to minorities

Data from Reid et al,13 Centers for Disease Control,16 Szilagyi et al,17 and Grabenstein.18
mission testing, individual treatment regimens, wellness programs, and visitation to relatives and friends. Elderly people who present themselves to outpatient clinics, emergency departments, or preadmission testing (PAT) units have a unique opportunity to be immunized for pneumococcal pneumonia and influenza if health care providers make the effort to educate them and provide such primary preventive care. In the setting for this study, the PAT unit is staffed by nurse practitioners who are well prepared to screen elderly patients regarding their immunization status and educate them to the benefits of adult immunization. However, the incidence of patients who used the hospital’s PAT services and were not current in their immunizations for pneumococcal pneumonia and influenza was not known. These data were needed to support the possible introduction of a protocol for screening, educating, and providing pneumonia and influenza vaccines to improve health and reduce morbidity and mortality for patients in the community.

**Purpose**

The purpose of this study was to determine the incidence of adults, 65 years of age and older, seen in the hospital’s Pre-Admission Testing Unit, who were immunized for pneumococcal pneumonia and influenza.

**Setting and Design**

The hospital in which the PAT unit is located is a 468-bed comprehensive community teaching hospital that serves as a regional trauma, burn, and cancer center. Located in a suburb of a major metropolitan area with a relatively large elderly population, it serves a wide variety of clients in regard to age, race, socioeconomic, and educational level. The hospital is part of a regional health system that includes wellness programs, outpatient services, and several long-term care, transitional care, and acute care facilities.

The PAT unit serves an average of 37 patients per day, Monday through Friday, and logged over 9,400 patient visits during 2000. All patients expected to be admitted to the hospital for elective surgery, cesarean sections, and interventional cardiology procedures are scheduled to report for preadmission testing one to 2 weeks before the planned surgery. A nurse practitioner provides a complete assessment including interview, physical examination, electrocardiogram, and relevant laboratory testing. While waiting for their appointments, patients and their companions are made comfortable in an attractive waiting room with upholstered furniture and proximity to a café, telephones, and the hospital lobby. The patients seen in the PAT unit may be considered as representative of the hospital’s overall clientele with respect to major demographic variables.

The study was reviewed for the protection of human subjects and approved by the hospital’s Institutional Review Board. A descriptive comparative design was used. Data were collected via interview of individual patients by the principal investigator.

**Sample**

One hundred seventy-five patients scheduled for preadmission testing were invited to participate in the study. No exclusion criteria were applied. Fifteen patients declined. Those who declined were primarily women (80%), white (60%), and had a mean age of 74.1 years. They were less likely to be accompanied by a family member than those who agreed to participate in the study.

Of the 160 patients enrolled, 95 (59.4%) were women and 65 (40.6%) were men. The participants varied in age from 65 to 93 years of age with a mean age of 73.9 years (SD ± 6.09 years) and a median age of 72 years. Most were white (78.8%) or black (20.6%). Over half of the participants were married (55%), whereas the rest were widowed (31.3%), single (10.6%), or divorced (3.1%) (Fig 1).

**Procedure**

Before each patient’s appointment with the nurse practitioner for the scheduled preadmis-
During a brief interview, the investigator ascertained relevant demographic information and queried the patient regarding his or her history of pneumococcal and influenza immunization. This information was recorded on an investigator-designed data collection form. Patients who had not been immunized for either pneumococcus or influenza were given verbal information about the importance of these vaccinations and their availability. Patients were thanked for their participation and given a colorful brochure on adult immunization produced by the National Coalition for Adult Immunization.19

Results
Study participants replied to 3 specific questions regarding their immunization status for pneumonia and 3 additional questions regarding influenza vaccination. Responses according to demographic categories are displayed graphically in Figs 2 through 7. In response to the query, “Have you ever been immunized for pneumonia?”, 91 participants (56.6%) replied affirmatively, whereas 58 (36.3%) indicated they had not, and 11 (6.9%) did not know. When asked if they had “ever been offered a pneumococcal vaccine?” 49 (71%) of the 69 who either had not been immunized for pneumonia or did not know if they had been stated “No.” Only 9 participants (13%) said “Yes,” and 11 (15.9%) did not know. Of the 69 participants who either had not been immunized or did not know if they had ever been immunized for pneumonia who were asked, “If you were offered a pneumonia vaccine, would you take it?”, 44 (63.8%) of these said “Yes,” whereas 15 (21.7%) said “No,” 9 (13%) did not know whether they would or would not, and one did not respond.

One hundred twenty-one (75.6%) of the study respondents stated they had received “a flu shot” during the previous fall. Thirty-nine (24.4%) had not. These persons were asked, “Were you offered a flu shot last fall?” Sixteen (41%) had been offered this immunization, 21 (53.8%) had not been offered influenza immunization, one person did not know if he had or had not, and one did not answer the question.
These same persons were asked, “If you were offered a flu shot this fall, would you take it?” Sixteen (41%) stated they would agree to this, another 16 (41%) responded negatively, 6 (15.4%) were undecided, and one did not respond.

To determine if demographic characteristics of these elderly persons were associated with their immunization status, $\chi^2$ analysis was performed to test for significant differences in responses among subgroups for the variables of gender, age group, marital status, and race. Alpha was set at 0.5. There were no significant differences between men and women in the proportions of each group that received pneumococcal...
or influenza vaccine. Although there was no significant association by gender in whether participants were offered immunizations or would take them if offered, there was a tendency for the influenza vaccine to be offered more often to women than to men.

Regarding the association between age and immunization status, a significantly higher proportion of persons in the age group from 70 to 79 years had been immunized for both pneumonia ($\chi^2 = 16.27, P = .000$) and for influenza ($\chi^2 = 6.69, P = .012$) than those in the age group...

![Graph](image-url)
from 65 to 69 years. There was also a significantly higher proportion of persons in the age group of 80 to 93 years who had been immunized against influenza compared with those in the age group of 65 to 69 years ($\chi^2 = 4.89, P = .03$). Although those 80 years of age and older were also more likely to have received the pneumococcal vaccine than those 65 to 69 years of age, this difference did not reach significance.

A higher proportion of white persons had been immunized for both pneumonia and influenza than non-whites (61.1% vs 41.2% and 76.2% vs 73.5%, respectively). However, associations between race and immunization did not reach
significance. Among those who had not been immunized, non-whites were more likely than whites to state they would take pneumonia and influenza vaccinations if offered.

Married people were more likely than those who were single, widowed, or divorced to have been immunized for both pneumonia (63.6% v 48.6%) and influenza (84.1% v 65.3%). The association between immunization status and marital status was significant for the influenza vaccine ($\chi^2 = 7.38, P = .009$), but did not reach significance for the pneumococcal vaccine.

**Discussion**

Nearly half of the elderly patients reporting for preadmission testing in an urban/suburban community medical center had never received a vaccination to prevent pneumococcal pneumonia. Almost a quarter were not immunized for influenza. Many of these individuals could not recall ever having been offered these protective vaccinations. Most would have taken the vaccinations had they been offered.

Vaccination is an effective method for reducing illnesses and deaths caused by pneumococcal pneumonia and influenza. Objective 14-29 of Healthy People 2010 is to increase the proportion of adults who are vaccinated against pneumococcal disease and who are vaccinated annually against influenza to 90% of noninstitutionalized adults 65 years of age and older. This target can be compared with the 1998 national baseline for this population of 64% vaccinated against influenza and 46% vaccinated against pneumococcal. Although participants in the present study surpassed these baselines, there is much opportunity for improvement.

A 1999 national phone survey conducted by the Centers for Disease Control indicated that 69% of whites, 48% of blacks, and 59% of Hispanics 65 years of age and older reported having influenza vaccinations in the past year. Comparatively, participants in the present study surpassed these percentages as 76.2% of whites and 73.5% of non-whites had been immunized against influenza. The Centers for Disease Control survey found that 57% of whites, 36% of blacks, and 35% of Hispanics reported they had received a pneumococcal vaccine. In the PAT unit sample, 61% of whites and 41% of non-whites had been immunized against pneumococcus. These percentages are slightly above the national findings and reflect similar racial disparity. However, for both types of vaccination there is still a big gap between the present vaccination rates and the U.S. Public Health Service’s goal for 2010. Therefore, the Centers for Disease Control’s plea for “health care providers [to] use every opportunity to assess the vaccination status of patients and offer indicated vaccines” becomes all the more compelling.

Surveys have shown that physicians, other health care providers, and patients all use adult immunizations as an important means of disease prevention. Achieving the goal of higher rates of adult immunization is critically dependent on improving the attitudes and practices of health care providers. Equally important is a focused effort toward increasing consumer knowledge and removing barriers to preventive health behaviors. Effective immunization strategies have combined education for health care workers with publicity and education targeted toward recipients. In addition, a plan for identifying a likely point of encounter and minimizing administrative and financial barriers for the patient appears to be the most successful strategy.

Vaccinating the elderly to prevent pneumococcal pneumonia and influenza can be achieved not only in primary care offices, but also in other settings where patients access the health care system for episodic care such as community-based nursing clinics, home care agencies, emergency departments, and ambulatory care service settings to include ambulatory surgical services and PAT units. Physicians and nurses in these settings should be proactive in routinely reviewing a patient’s vaccination status on a regular basis. In describing the role of the am-
bulatory surgical nurse, Brockway notes that "the perioperative or perianesthesia nurse, using a holistic approach to patient care, views the ambulatory patient and family as individuals with a wellness-oriented health system." Also, describing nurses' roles in ambulatory surgery, Lancaster states that "preadmission nurses are responsible for identifying potential problem areas and beginning the plan for intervention to ensure successful resolution of identified issues." In fact, hospitalization for surgery or other interventions is a marker for patients at increased risk for pneumococcal and influenza disease and its complications. Investigators have found that two thirds of persons with serious pneumococcal disease had been hospitalized within the previous 4 years before their pneumococcal illness, yet few had received a pneumococcal vaccine.

These missed opportunities could be eliminated with an organizational strategy for increasing vaccination rates among persons at high risk, including elderly surgical patients. Federal regulations permit the use of standing orders to administer pneumococcal vaccine to Medicare patients. Several studies have shown that standing orders are the single-most important element needed for a successful adult immunization program. Further, such orders have been identified by the Advisory Committee on Immunization Practices as a national public health priority.

A vaccination protocol implemented by perianesthesia nurses could begin with documentation of the patient's immunization status at preadmission testing. Eligible patients who are not immunized could be given the appropriate vaccine during their preadmission visit, or an automatic referral to their primary physician for vaccination before surgery is implemented. Alternatively, a protocol could trigger physicians to order vaccination during the patient's hospitalization. Organizational strategies such as standing orders for patients who are eligible for vaccine are the most effective methods for increasing pneumococcal vaccination rates among persons at high risk, and for addressing the national goals of protection for vulnerable populations.

A review of the use of various types of patient reminder/recall systems to improve immunization coverage levels also attests to their value. Use of computers allows practitioners to tailor their billing systems to function as a reminder/recall system to generate reminders about immunizations for elderly patients because the systems can be easily configured using selection by birth dates. With networked patient record systems in many health care settings, perianesthesia nurses can also call up past medical records and quickly determine a patient's immunization status. In fact, nurse-initiated vaccine protocols have been shown to raise vaccination rates substantially more than a physician or patient reminder system.

Similar to the findings of previous studies, this unit study showed that black adults are less likely to be immunized than white American adults. This is of particular concern because members of minority groups are more likely to be infected with vaccine-preventable diseases and are more likely to die than whites. The reasons for this are multiple, complicated, and not fully understood. However, several studies indicate that more frequent offerings of immunizations by trusted health care professionals will lead to increased rates of acceptance and reduce preventable disease in this population. This includes recommendations for immunizations by pharmacists and nurses with whom those with chronic disease frequently interact. Such proactive approaches could help move the elderly of all ethnic and gender groups toward higher levels of protection from pneumococcal pneumonia and influenza.

Medicare covers the cost of both pneumococcal and influenza vaccinations regardless of the health care setting. Therefore, cost is not a viable barrier to vaccination in the elderly. However, consumers need to be educated to this health care benefit and encouraged to request it.
Patient teaching is an integral component of preoperative preparation, and the opportunity for this nursing intervention is presented each time the nurse speaks to patients or their families. PAT sites offer an ideal place for the dissemination of leaflets, posters, and other materials that promote vaccination. Nurses who staff PAT units are well positioned to help their clients achieve the goal of being protected against the morbidity and mortality associated with preventable influenza and pneumonia.

Further, these actions will help bring health care institutions into compliance with the Joint Commission on Healthcare Organizations’ new initiative to integrate performance measures into the accreditation process. Reduction of community-acquired pneumonia is one of the 4 initial core measurement areas for hospitals. Similarly, the new Centers for Medicare and Medicaid Services has set a performance goal for peer review organizations to increase the percentage of Medicare beneficiaries 65 years of age and older who receive an annual vaccination for influenza and a lifetime vaccination for pneumococcal pneumonia.

While promoting partnerships for quality care in a recent editorial in the AORN Journal, then-President Patricia Seifert challenged perioperative nurses “to extend our care and concern beyond the OR walls.” Therefore, perioperative and perianesthesia nurses have an opportunity to contribute to national, institutional, and professional organization health improvement initiatives through assessment and interventions related to the vaccination of surgical patients at high risk for influenza and pneumonia. Most importantly, they have the responsibility to take the initiative in protecting the health of vulnerable patients throughout the surgical continuum.

Conclusions

The U.S. population is aging. Increasing numbers of elderly adults will undergo surgery and will be at risk for pneumococcal pneumonia and influenza. Elderly patients surveyed during preadmission testing before their hospitalization for surgery often lacked immunizations for these major causes of illness and death. Peri anesthesia nurses have an opportunity to educate and vaccinate their clients to reduce their susceptibility to these preventable diseases and can be leaders in the development of institutional protocols that accomplish this goal as part of the surgical continuum of care.

References

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