Impact of a pharmacist-led pneumococcal vaccine compliance program

Streptococcus pneumoniae (pneumococcus) infection remains a major cause of morbidity and mortality among both the pediatric and geriatric populations in the United States.¹ According to the most recent Active Bacterial Core surveillance report from the Centers for Disease Control and Prevention (CDC), approximately 29,100 cases of invasive pneumococcal disease were reported in 2014, and 3,250 deaths were attributed to S. pneumoniae infections. Among individuals less than 5 years of age, the 2010 U.S. incidence was approximately 19 cases per 100,000 population, surveillance data indicate; among individuals 65 years of age or older, the rate was 35 cases per 100,000.² Consequently, CDC has a listed objective to reduce the incidence of invasive pneumococcal infections in those populations to 12 and 31 cases per 100,000, respectively, by the year 2020.² Vaccination against S. pneumoniae is the primary modality to reduce rates of pneumococcal disease. The spectrum of clinical syndromes attributable to pneumococcus is wide, including community-acquired pneumonia, bacteremia without an obvious focus of infection, meningitis, and otitis media.³

Vaccination against Streptococcus pneumoniae has proven to be effective in disease prevention. Vaccination of children began in 2000 with administration of a 7-valent pneumococcal conjugate vaccine (PCV7) and then, beginning in 2010, with a 13-valent conjugate vaccine (PCV13) as part of the standard childhood vaccination schedule. The 23-valent pneumococcal polysaccharide vaccine (PPSV23) has been available since the 1980s but, in contrast to the PCV13 vaccine, is not recommended for use in children younger than 2 years of age, as it does not elicit an adequate immunologic response in that age group.¹ Childhood vaccination against S. pneumoniae infection confers both direct and indirect, or “herd effect,” protection to both infants and adults. By 2003, invasive pneumococcal disease (IPD) of all serotypes had been decreased among vaccinated children by 75%; through indirect protection, IPD had been decreased in older adults by 2 cases for every child immunized.⁴

The effectiveness of vaccination for prevention of pneumococcal pneumonia was recently evaluated in a randomized controlled trial (the CAPITA trial) involving roughly 85,000 older adults (≥65 years of age).²³ PCV13 was effective in preventing vaccine-serotype pneumococcal pneumonia (efficacy rate, 45%; 95% confidence interval [CI], 14.2–65.3%) as well as vaccine-serotype IPD (efficacy rate, 75%; 95% CI, 41.4–90.8%).

In terms of serotype exposure, PCV13 provides exposure to 13 serotypes of pneumococcus, while PPSV23 covers 23 serotypes (12 of which are included in PCV13).⁶⁷ Intuitively, one might expect that the vaccine containing the widest variety of pneumococcal antigens would provide the broadest coverage and hence be the overall preferred agent, but this has not proven to be the case. The 2 vaccine products have been shown to elicit different antibody titers, with PCV13 stimulating titers comparable to or even higher than those elicited by PPSV23.⁸ Vaccination sequence also seems to play a role in antibody response; 1 year after administration of both vaccines, study subjects who received PPSV23 as the initially administered vaccine and then received PCV13 exhibited lower antibody titers than those who received PCV13 first.⁹

Rates of pneumococcal infection vary according to demographics, with a trimodal distribution.¹⁰ Rates are highest in infants, young children, and the elderly. In terms of invasive disease, the risk is highest in the following groups: individuals with congenital or acquired immunodeficiency, individuals with functional or anatomic asplenia, smokers, alcohol abusers, and individuals with asthma.

All of the data and factors discussed above have served to shape current guidelines on vaccination against pneumococcal infection.

**Recommendations.** The CDC Advisory Committee on Immunization Practices (ACIP) in 2010 released recommendations advocating PPSV23 for all adults 65 years of age and older, and PCV13 for pediatric use. In 2014, ACIP recommended that PCV13 be administered to all children younger than 2 years of age, the elderly, and individuals at risk for pneumococcal infection. These recommendations were based on substantial evidence of effectiveness, safety, and prioritization based on age and risk group. The CAPITA trial found that PCV13 was effective in preventing pneumococcal pneumonia and IPD in older adults. Despite some studies showing comparable or even higher antibody titers with PPSV23, the 23-valent vaccine may not be effective in those with asplenia, and is not recommended for use in children younger than 2 years of age.

The effectiveness of pneumococcal vaccination extends beyond disease prevention. Vaccination has been shown to reduce hospitalization and antibiotic use for pneumococcal infections among children and adults. Vaccination also reduces the incidence of invasive pneumococcal infections among both the pediatric and geriatric populations. In 2014, the CDC reported 3,250 deaths due to pneumococcal infection among adults, highlighting the importance of vaccination in preventing mortality.

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age or older and for adults 19–64 years of age with underlying medical conditions or other risk factors. These conditions and factors include chronic heart disease, chronic lung disease (including chronic obstructive pulmonary disease, asthma, and emphysema), diabetes mellitus, cerebrospinal fluid leaks, cochlear implant placement, alcoholism, chronic liver disease, smoking, functional or anatomic asplenia, immunocompromised state, chronic renal failure, and generalized malignancy. If a patient had received PPSV23 before age 65, the recommendation was that he or she receive a second dose after age 65 provided that 5 years had passed since the previous dose.

In 2012, ACIP revised the vaccination recommendations for adults 19 years of age or older with immunocompromising conditions. ACIP recommended that vaccine-naive patients in this age group receive PCV13 first, followed by PPSV23 8 weeks later. If the patient had already received PPSV23, administration of PCV13 at least 1 year after PPSV23 administration was advised.

ACIP revised its recommendations again in late 2014, providing an update regarding vaccine administration to immunocompetent patients age 65 or older. This update mirrored the 2012 recommendation for immunocompromised patients: administration of PCV13 followed by administration of PPSV23 at least 8 weeks later or, if PPSV23 was already given, administration of PCV13 at least 1 year after the last PPSV23 dose.

Current ACIP recommendations on pneumococcal vaccine include the update in 2014. Additionally, persons who received PPSV23 before the age of 65, who are now age 65 or older, should receive a dose of PCV13 as long as a year has passed between the initial dose of PPSV23 and the initial dose of PCV13. These patients should then receive a dose of PCV13 at least 1 year after PCV13 and 5 years after the initial dose of PPSV23.

Pharmacists’ role in pneumococcal vaccination. According to 2011 Joint Commission data, pneumococcal infections account for 2.4 million hospitalizations and 5,000 deaths each year in the United States. In order to help decrease these numbers, the Joint Commission and the Centers for Medicare and Medicaid Services added pneumococcal vaccination as a core measure for all hospital admissions beginning in 2012. Additionally, 1 of the Healthy People 2020 objectives is for 90% of eligible adults to receive vaccination against pneumococcus.

Pharmacist vaccination certification programs have served to increase vaccine administration across a wide variety of settings. Community pharmacies routinely advertise pharmacist administration of vaccines, particularly influenza vaccines. According to the American Pharmacists Association (APhA), as of January 2015, pharmacists were authorized to administer any vaccine (some requiring prescriptions) in 46 states and some vaccines in all 50 states. APhA estimated that more than 280,000 practicing pharmacists were trained to administer vaccines. While community pharmacies typically come to mind as the primary setting for pharmacist participation in vaccination, hospital pharmacists can also serve to increase vaccine administration and compliance with ACIP guidelines.

Inpatient vaccination programs can have a dramatic impact on vaccination rates and disease prevention. According to CDC, more than 65% of patients with pneumococcal infection were hospitalized in the previous 3–5 years, with very few receiving pneumococcal vaccine. Accordingly, the Joint Commission has adjusted the vaccination process measure to include all patients admitted to hospitals regardless of age. The Healthy People 2020 campaign has a listed goal of vaccinating 90% of patients age 65 or older by 2020. The American Society of Health-System Pharmacists (ASHP) has advocated for the development of pharmacy-based programs to increase pneumococcal vaccination. ASHP has identified 6 activities through which pharmacists who are not involved in administering vaccines can promote immunization best practices: history and screening, patient counseling, documentation, formulary management, administrative measures, and public education. At our facility, the pharmacy department has focused on screening and formulary management.

Description of pneumococcal vaccine compliance program. All inpatients are assessed for pneumococcal vaccine administration at the time of admission. Nursing staff are responsible for documenting the patient’s vaccination history and completing a pneumococcal vaccine assessment form. An order for a pneumococcal vaccine is generated via the computerized electronic-order-entry (CPOE) system for patients at risk for developing IPD. Per the indications for receipt of a pneumococcal vaccine, targeted patients include vaccine-naive adults who are 65 years of age or older and patients 19–64 years of age with at least 1 of the following medical conditions: cerebrospinal fluid leakage, cochlear implant placement, sickle cell disease or hemoglobinopathy, functional or anatomic asplenia, congenital or acquired immunodeficiency, human immunodeficiency virus infection, chronic kidney disease, nephrotic syndrome, solid organ transplant, malignancy, and iatrogenic immunosuppression.

Prior to development of the vaccine compliance program, the CPOE system was unable to discern which pneumococcal vaccine formulation should be dispensed based on a patient’s age, comorbidities, or other information in the medical record. A formulary substitution policy was implemented in March 2016 to allow a pharmacist to automatically dispense PCV13 for vaccine-naive adults 65 years of age or older. Additionally, an alert was created in TheraDoc (Premier, Inc., Charlotte, NC), an
electronic clinical surveillance system that continuously mines patient data in order to identify opportunities for pharmacist intervention. The clinical pharmacist is notified in real time when a pneumococcal vaccine order is received via the CPOE system. The pharmacist then assesses the patient’s past medical history to determine if medical conditions that would warrant initial receipt of PCV13 are present.

A medication-use evaluation (MUE) was conducted to measure the rate of adherence to ACIP recommendations before and after implementation of the vaccine compliance program.

MUE results. A historical, prepolicy cohort consisting of adults who received any pneumococcal vaccine at the hospital from January through February 2016 (n = 100) was established. The mean ± S.D. age of the cohort was 62.0 ± 14.1 years, and 48% were 65 years of age or older. Other than advanced age, the 2 most common indications for receipt of PCV13 were chronic kidney disease (17%) and a history of malignancy or immunosuppression (11%). The postpolicy cohort consisted of all adults who received any pneumococcal vaccine from June through July 2016, after implementation of the vaccine compliance program (n = 45); their mean ± S.D. age was 67.1 ± 16.0 years, and 62% were 65 years of age or older. Other than advanced age, the 2 most common indications for receipt of PCV13 were history of malignancy or immunosuppression (22%) and chronic kidney disease (7%). For all age groups combined, the percentage of patients who received the correct vaccine formulation (i.e., Prevnar 13 [Pfizer Inc.] or Pneumovax 23 [Merk & Co., Inc.]) on the basis of age or medical condition increased from 40.0% during the historical period to 95.6% during the postpolicy period. Among vaccine-naïve adults 65 years of age or older, the percentage of patients who received the correct vaccine formulation (i.e., Prevnar 13) increased from 2% to 100%.

Closing notes. Revision of ACIP pneumococcal vaccine guidelines over the past decade has led to the need to change clinical practice to maintain compliance with vaccination recommendations. Accordingly, a pharmacist-led assessment of all orders for pneumococcal vaccine improved guideline compliance and use of the proper vaccine formulation at our institution.


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