Impact on CDC Guideline Compliance After Incorporating Pharmacy in a Pneumococcal Vaccination Screening Process

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ABSTRACT

Background: Centers for Disease Control and Prevention (CDC) guidelines for pneumococcal vaccinations were updated in 2014. Given the complexity of the guidelines and the fact that hospitals are no longer required to keep records for pneumococcal vaccinations, many hospitals are determining whether to continue this service.

Objective: The primary objective of this study was to determine the impact on compliance with the revised pneumococcal vaccination guidelines from the CDC after involving pharmacy in the screening and selection processes. Secondary objectives were to determine the impact of the new process on inappropriate vaccination duplications, the time spent by pharmacy on assessments, and financial outcomes.

Methods: This institutional review board (IRB)–approved, retrospective, cohort study examined all patients who received a pneumococcal vaccination from January to February 2016 after implementing a new process whereby pharmacy performed pneumococcal vaccination screening and selection (intervention group). These patients were compared to patients who received a pneumococcal vaccination from January to February 2015 (control group).

Results: Of 274 patients who received a pneumococcal vaccine, 273 were included in the study. Compliance to CDC guidelines increased from 42% to 97%. Noncompliant duplications decreased from 16% to 2%. In the intervention group, labor cost for assessments and expenditure for vaccines increased. For Medicare patients, the increased reimbursement balanced the increased expenditure in the intervention group.

Conclusions: Involving pharmacy in the pneumococcal vaccine screening and selection process improves compliance to CDC guidelines, but further clinical and financial analysis is needed to determine financial sustainability of the new process.

Key Words—pharmacy, pneumococcal vaccines

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Pneumococcal pneumonia and invasive disease caused by *Streptococcus pneumoniae* have high mortality rates, up to 60% for elderly patients.¹ Two vaccines are currently available, the pneumococcal 23-valent polysaccharide vaccine (PPSV23; *Pneumovax*) and the pneumococcal 13-valent conjugate vaccine (PCV13; *Prevnar*). There are at least 90 serotypes of *S. pneumoniae*

identified.² Only PCV13 covers the highly antibiotic resistant 6A serotype, but PPSV23 covers an additional 11 serotypes.^{3,4} In addition, because PCV13 is a conjugated vaccine,³ it can produce a superior memory response over that of PPSV23 among their shared serotypes. Among the 12 shared serotypes, PCV13 has been shown to be either non-inferior or superior to PPSV23.³

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In October 2012, the CDC recommended PCV13 for ages 19 and older for specific patients including immunocompromised patients, asplenic patients, and patients with cerebrospinal fluid leaks or cochlear implants. In September 2014, the CDC adopted the recommendation made by the Advisory Committee on Immunization Practices (ACIP) to make PCV13 first line for ages 65 and older. This recommendation was based on the CAPITA study which showed that PCV13 had significant efficacy against first and subsequent episodes of vaccine-type community-acquired pneumonia and invasive disease when compared to placebo.⁵ For CDC recommendations on pneumococcal vaccinations, refer to <http://www.cdc.gov/vaccines/vpd-vac/pneumo/>.

A medication use evaluation performed at our hospital in 2015 revealed that 55% of patients who received a pneumococcal vaccination received PPSV23 when they should have received PCV13, and at least 8% of PPSV23 vaccinations were inappropriate duplications. Therefore, in August 2015, our hospital added PCV13 to its formulary, making both PCV13 and PPSV23 available for administration. Furthermore, in December 2015, our pharmacy implemented a new process for evaluating patients for pneumococcal vaccines that heavily involves the pharmacy department.

Prior to implementation of the new process, nurses completed a screening tool that prompted the pharmacy to enter PPSV23 to be given at discharge (Figure 1, white boxes). In the new process, medication reconciliation technicians (MRT) ask patients about their pneumococcal vaccine history, obtain information via the patient's pharmacy or primary care physician when necessary, and document findings in the electronic medical record. Then, the patient's nurse completes a revised patient screening tool that inquires about possible indications, contraindications, and/or patient refusal of the vaccine. If the nurse's screen results in a positive screening for a pneumococcal vaccine, an automatic message is sent to the pharmacy. The pharmacy staff then assesses the patient using the MRT and nursing screenings, the patient's history and physical, and records from the primary care physician when available. They can then determine whether a pneumococcal vaccine is indicated and which specific one should be administered (Figure 1, grey boxes). As the CDC guidelines have major distinctions for patients less than 65 years old and patients 65 years and older, 2 hospital-specific algorithms were created

and approved by the hospital's Pharmacy & Therapeutics Committee to guide vaccine selection. Once selected, the vaccines were ordered by a pharmacist to be given on the day of patient discharge. Prescribers are not involved in vaccine selection; however, prescribers may discontinue a vaccine if they choose.

In August 2013, the Centers for Medicare & Medicaid Services (CMS) removed the requirement to assess patients for pneumococcal vaccines from their Inpatient Quality Reporting Program, making it unnecessary for hospitals to have documentation of pneumococcal vaccine screening and administration. Given the removal of the CMS mandate and the complexity of the new CDC guidelines, many hospitals are debating whether to continue their pneumococcal vaccination programs.

The primary objective of this study was to determine the impact on compliance with the revised pneumococcal vaccination guidelines from CDC after involving pharmacy in the screening and selection processes for pneumococcal vaccinations. Secondary objectives were to determine the impact the new process had on inappropriate vaccination duplications, time spent by pharmacy on assessments, and financial outcomes.

MATERIALS AND METHODS

Study Design and Patient Population

This IRB-approved, retrospective, cohort study was performed at Blount Memorial Hospital, a 304-bed hospital, as a postgraduate year 1 (PGY1) residency project. The control group consisted of all patients who received a pneumococcal vaccination during the months of January and February 2015. The intervention group consisted of all patients who received a pneumococcal vaccination during the months of January and February 2016 (after implementing the pharmacy-driven pneumococcal vaccination screening and selection process). Patients were excluded if they were younger than 19 years old or if they were not assessed for a pneumococcal vaccine during the intervention time period.

Data Collection

Patients in the control group were identified by running a report on pneumococcal vaccine administration. Patients in the intervention group were identified by data collection forms filled in by pharmacy staff when evaluating patients. In the same manner that pharmacy staff performed assessments, the patient's age, medical conditions, and vaccine history

Figure 1. Previous pneumococcal screening process in white with process changes in grey. MRT = medication reconciliation technicians; P&T = Pharmacy & Therapeutics Committee; Pt = patient; RN = nurse.

(obtained from MRT and nursing screenings, the patient's history and physical, and records from the primary care physician) were used to assess compliance to CDC guidelines with the aid of the age-specific vaccine algorithms designed for use at our hospital. Patients were categorized as either compliant or noncompliant to CDC guidelines (Figure 2). Patients could be noncompliant for 1 of 3 reasons: wrong pneumococcal vaccine (eg, PPSV23 was given when PCV13 was indicated), inappropriate vaccine duplication (eg, a patient who has received their fourth PPSV23), or no clinical indication (eg, no medical condition that warrants a pneumococcal vaccine).

Statistical Analysis

All nominal data were evaluated using the chi-square test.

RESULTS

In the intervention group, 341 patients were assessed and 248 patients were prescribed a vaccine. Of 248 patients, 126 received the vaccine at discharge. In the control group, 148 patients received the vaccine. One patient who was younger than 19 years

old was excluded from the control group, leaving 147 patients in the control group (Figure 3). Patients were categorized into 2 age groups: 19 to 64 years and 65 years and older based on age-specific vaccination guidelines. Age groups were similar between both study groups (Table 1).

Table 2 shows the difference in clinical outcomes between study groups. There was a significant difference in CDC guideline compliance between study groups (42% vs 97%; $p < .001$). A vaccination may be noncompliant for more than one reason. The most common reason for a patient to receive a noncompliant vaccine was having the wrong pneumococcal vaccine prescribed (54% vs 2%; $p < .001$). Inappropriate vaccine duplications were the second most common reason for vaccine noncompliance (16% vs 2%; $p < .001$) followed by no clinical indication for a vaccine (1% vs 0%; $p = .19$).

Of the 126 vaccines received in the intervention group, the pharmacy documented time taken to assess for a vaccine for 117 patients (93%) (Table 3). Paid pharmacy interns assessed 116 (99%) of the patients with a mean assessment time of 6 minutes (range, 1-30 minutes). One pharmacist did one assessment

Figure 2. Assessment tool for determining compliance with the Centers for Disease Control and Prevention (CDC) guidelines. PCV13 = pneumococcal 13-valent conjugate vaccine (*Prevnar*); PPSV23 = pneumococcal 23-valent polysaccharide vaccine (*Pneumovax*).

Figure 3. Patient inclusion.

Table 1. Baseline characteristics

Age group	Control (<i>n</i> = 147)	Intervention (<i>n</i> = 126)	<i>p</i>
19-64 years	74 (50)	67 (53)	.745
65+ years	73 (50)	59 (47)	.737

Note: Values given as *n* (%).

that took 15 minutes. Over the 2-month study period, the pharmacy spent a total of 12 hours on assessments.

Labor cost of interns and pharmacists over 2 months totaled \$152. Vaccine expenditure by the hospital in the control group was \$10,151 and increased to \$13,642 in the intervention group (Table 4).

Table 2. Clinical outcomes

Outcome	Control (<i>n</i> = 147)	Intervention (<i>n</i> = 126)	<i>p</i>
Compliant	62 (42)	122 (97)	<.001
Noncompliant			
Wrong vaccine prescribed	79 (54)	3 (2)	<.001
Duplication	24 (16)	3 (2)	<.001
No clinical indication	2 (1)	0 (0)	.190

Note: Values given as *n* (%).

Table 3. Assessment time for vaccines

Assessor	No. assessed (%)	Mean time (range)	Total time
Intern	116 (99)	6 (1-30) minutes	11.7 hours
Pharmacist	1 (1)	15 minutes	0.25 hours
Total	117	—	12 hours

Table 4. Total expenditure for all patients

Expenditure	Control, \$ (n = 147)	Intervention, \$ (n = 126)	Δ
Labor	0	152	+ 152
Vaccines	10,151	13,642	+ 3,490
Total	10,151	13,794	+ 3,693

Total expenditure was \$40.43 more per patient in the intervention group (Table 5). Reimbursement outcomes were only available for patients with Medicare. Of 147 patients, the control group had 38 Medicare patients (26%); of 126 patients, the intervention group had 35 Medicare patients (28%) (Table 6). For Medicare patients, compared to the control group, the intervention group resulted in a net gain of \$3.31 per patient (Table 7).

Table 5. Expenditure per patient for all patients

Expenditure	Control, \$	Intervention, \$	Δ
Labor	0	1.20	+ 1.20
Vaccines	69.05	108.27	+ 39.22
Total	69.05	109.48	+ 40.43

Table 6. Financial outcomes for Medicare patients

Expenditure	Control, \$ (n = 38)	Intervention, \$ (n = 35)	Δ
Labor	0	42 ^a	+ 42
Vaccines	2,624	4,697	+ 2,073
Total expenditure	2,624	4,739	+ 2,115
Reimbursement			
Vaccines	3,080	5,882	+ 2,802
Administration	1,633	897	- 736
Total reimbursement	4,713	6,779	+ 2,066
Net gain	+ 2,089	+ 2,040	- 49

^aEstimation.

DISCUSSION

This study found that modifying the pneumococcal screening and selection process significantly improves compliance to the revised CDC guidelines and decreases noncompliant duplications. Time spent by pharmacy and labor cost for performing patient assessments was minimal for those patients who were included in the intervention group. However, the assessments from the intervention group only account for the assessments that resulted in a patient receiving a vaccine. Of the 341 assessments completed during the 2-month intervention period, only 117 (34%) of those resulted in a patient receiving a vaccine and the assessment time being documented (Figure 3). Therefore, 66% of assessments were not included in the study. Including assessments done on patients who did not receive a vaccine, labor cost would be about \$456 over 2 months.

Vaccine expenditure increased in the intervention group due to PCV13 being about twice as expensive as PPSV23. Medicare paid about twice as much for a PCV13 than for a PPSV23, and reimbursement for PPSV23 increased by 8% in the intervention group. Reimbursement from Medicare for vaccine administration decreased by 42% in the intervention group. We were unable to determine reimbursement in

Table 7. Financial outcomes per patient for Medicare patients

Expenditure	Control, \$	Intervention, \$	Δ
Labor	0	1.20 ^a	+ 1.20
Vaccines	69.05	134.20	+ 65.15
Total expenditure	69.05	135.40	+ 66.35
Reimbursement			
Vaccines	81.05	168.05	+ 87.00
Administration	42.97	25.63	- 17.34
Total reimbursement	124.03	193.69	+ 69.66
Net gain	+ 54.98	+ 58.29	+ 3.31

^aEstimation.

non-Medicare patients; therefore, we do not have a true estimation of the net difference in reimbursement between groups. It is possible that protecting our community with a pneumococcal vaccine may decrease pneumococcal disease and lead to decreased admissions in the future. It is estimated that in the United States pneumococcal pneumonia and invasive disease cause 400,000 and 12,000 hospitalizations per year, respectively, which is a large burden on health care costs.¹ There may also have been savings in terms of decreased inappropriate duplications. However, neither of these variables was studied.

This study had several limitations. In both arms of the study, pharmacy was dependent on nursing staff to do accurate initial screenings, so there may have been patients who met criteria to receive a vaccine but were not identified by nursing. PCV13 was not on the hospital's formulary during the control group time period; however, there were no requests or orders for PCV13 during that time. There were 248 vaccines prescribed in the intervention group, but 126 (51%) received the vaccine at discharge, representing a problem with our hospital's discharge process that existed during the control group time period as well. Also, time spent by pharmacy on assessments did not include nursing time or the time spent by pharmacists who entered vaccine orders. However, these times would be comparable in both groups as these processes changed very little. Finally, labor cost would be different for

other facilities depending on pay rates and whether pharmacy interns are employed. Additional variables include vaccine expenditure and reimbursement.

CONCLUSION

This study shows that a revised pneumococcal screening and selection process significantly improves the rate at which patients receive the correct pneumococcal vaccine when one is indicated. In Medicare patients, both groups were profitable; however, in non-Medicare patients, financial analysis could not be completed. Further study and financial analysis may determine whether the process is financially sustainable.

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