IMPROVING THE RATES OF INPATIENT PNEUMOCOCCAL VACCINATION: IMPACT OF STANDING ORDERS VERSUS COMPUTERIZED REMINDERS TO PHYSICIANS

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Approximately 40,000 deaths are attributed to Streptococcus pneumoniae infections annually, accounting for more deaths than any other vaccine-preventable bacterial disease.1,2 Case-fatality rates are highest for meningitis and bacteremia, with the highest mortality occurring among the elderly and patients with underlying medical conditions.3,5 Close to half of these deaths could potentially be prevented through the use of pneumococcal vaccine, given that vaccine effectiveness in case–control studies has ranged from 56% to 81%.6-10

Despite the availability of a clinically efficacious and cost-effective pneumococcal vaccine, national vaccination rates among targeted populations have remained low, even after the institution of reimbursement incentives.11 Only 45.9% of individuals 65 years or older received the pneumococcal vaccine in 1997.12

Recent strategies to improve pneumococcal vaccination rates have included programs that target hospitalized patients. The potential effectiveness of these programs in reaching patients most likely to develop pneumococcal disease is underscored by reports that two-thirds of individuals with serious pneumococcal disease had been hospitalized during the 4 years prior to their pneumococcal illness, yet few had received the vaccine.11-14 A variety of approaches to promote inpatient pneumococcal vaccination have been implemented, including computerized reminders to physicians at the time of patient discharge, stamped notes on hospital charts, vaccination prompts embedded in pneumonia clinical pathways, and standing orders protocols.11,14

Study methodologies and interventions and reported results vary.11 None of the most successful immunization programs described to date has depended on active physician participation.11 These programs have relied on nurses or pharmacists to identify patients eligible for vaccination and a standing orders protocol to allow physician independent initiation of vaccination. Vaccination rates have been reported to range from 22% to 94%.11,13,14,16 In contrast, studies that have investigated physician reminders to vaccinate eligible inpatients with pneumococcal vaccine have reported vaccination rates ranging from 14% to 44%.18,20,22 This investigation was a prospective

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ABSTRACT
OBJECTIVE: To determine the impact of interventions using standing orders and computerized reminders to physicians on inpatient pneumococcal vaccination rates relative to a control group.

DESIGN: Open trial of the following approaches, each on a different ward: (1) standing orders for vaccination of eligible consenting patients, (2) computerized reminders to physicians, and (3) usual practice.

SETTING AND PATIENTS: Four hundred twenty-four patients were admitted to three 30-bed inpatient medical wards during a 4-month period in 1999 at one hospital. Unvaccinated patients 65 years or older and competent to give oral consent were included.

INTERVENTION: A pharmacist activated a standing orders protocol for vaccination of all eligible consenting patients on one ward and computerized reminders to physicians on a second ward. A third ward served as a control group.

RESULTS: Forty-two patients met inclusion criteria and accepted vaccination in the standing orders arm versus 35 patients in the computerized reminder arm. Vaccination rates on the standing orders ward included 98% of those eligible and accepting vaccination, 73% of eligible patients, and 28% of all patients admitted. Rates on the computerized reminder ward were 23%, 15%, and 7%, respectively. All of the rates from the standing orders ward were significantly greater than those from the computerized reminder ward (P < .0001). Only 0.6% of all patients on the control arm were vaccinated.

CONCLUSION: Although both interventions were effective in increasing inpatient pneumococcal vaccination rates relative to baseline practice, physician independent initiation of standing orders was clearly more effective (Infect Control Hosp Epidemiol 2004;25:904-907).
study that compared the impact of two types of interventions (standing orders vs computerized reminders to physicians) on rates of inpatient pneumococcal vaccination relative to a control group at a single hospital.

METHODS

Setting

Jacobi Medical Center is a 500-bed municipal teaching hospital of the Albert Einstein College of Medicine. The hospital and associated on-site ambulatory care clinics are supported by a computerized clinical information system. The electronic medical record uses computerized order entries by physicians and archives all patient care activities, including vaccination orders, from 1995 to the present. This prospective interventional study was conducted on three separate 30-bed inpatient general medicine teaching wards during a 4-month period in the spring of 1999. A single ward served as the dedicated site for each of the two interventional arms, standing orders versus computerized reminders to physicians, and the third served as a control group. There was no crossover of nursing, attending physician, or resident staff between wards during the study period. This study was approved by the institutional review board of the Albert Einstein College of Medicine.

Patients

All hospitalized patients 65 years or older who were competent to give oral consent and had not received pneumococcal vaccination within the previous 5 years were eligible for inclusion. Prior vaccination history was ascertained by querying the clinical information system and by patient interview. All patients with no computer record of vaccination and either a negative or unknown pneumococcal vaccination history were included. Any patient with a computer record of prior vaccination greater than 5 years before admission or who gave a history on interview of pneumococcal vaccination more than 5 years before admission was included. Patients were excluded if they were unable to give oral consent (due to dementia, altered mental status, or intubation), if they had a computer record of pneumococcal vaccination within 5 years of admission, or if they gave a history on interview of pneumococcal vaccination within 5 years of admission.

Methods

Pharmacy staff screened all patients on both intervention wards within 72 hours of admission to assess eligibility for study inclusion. Eligible patients were provided written bilingual educational materials (English and Spanish), and the contents were reviewed with the patient prior to offering pneumococcal vaccination. Educational materials consisted of information sheets prepared by the Centers for Disease Control and Prevention discussing the risks and benefits and potential side effects of pneumococcal vaccination.

Acceptance or refusal was documented. All patients were then administered a brief oral questionnaire that explored previous vaccination experiences regarding perceived side effects, prior history of pneumonia, perceived individual risk of pneumonia, and the reasons for refusal of vaccination for those patients who had elected not to be vaccinated.

Patients who accepted vaccination on the computer reminder arm had a physician reminder entered into the clinical information system that stated, “Your patient is eligible for and accepted the pneumococcal vaccine. Please order the vaccine as one 0.5-mL dose IM.” The reminder appeared in a pharmacy recommendation screen that users had been trained to review on a daily basis. Patients who accepted vaccination on the standing orders ward had a standing order activated in the clinical information system by the screening pharmacist that authorized pneumococcal vaccination under the physician signature of the Director of Infectious Diseases.

Patients on the control ward were not approached or interviewed by pharmacy staff, and pneumococcal vaccination occurred as per historical practice patterns. Healthcare personnel on the control ward did not know they were serving as the control.

Analysis

Patients in each arm of the study were analyzed regarding gender, ethnicity, mean age, and admitting diagnosis (cardiac, neurologic, and pulmonary disease categories).

Prior rates of pneumococcal vaccination and current rates of vaccine acceptance were compared for each of the two intervention arms, and actual rates of vaccination were compared for all three study groups. Analysis of questionnaire results was accomplished by pooling responses from both intervention wards and then comparing responses from patients accepting vaccination with those refusing it.

Comparisons specifically investigated whether patients accepting vaccination on the intervention wards were more likely to have had a prior history of pneumonia or a self-perception of increased risk for acquiring pneumonia relative to patients who refused vaccination.

Statistical comparisons were made with a two-tailed test of means or a two-tailed chi-square statistic as appropriate.

RESULTS

Four hundred twenty-four patients were admitted to the wards during the 4-month study period (147 in the standing orders arm, 122 in the computerized reminder arm, and 155 in the control group). There was no statistically significant difference between groups regarding mean age, gender, ethnicity, or admitting diagnosis (data not shown). Thirty-six percent (97 of 269) of the patients on the intervention wards had prior pneumococcal vaccination histories, and rates of prior vaccination did not differ significantly between intervention wards ($P = .713$).

After exclusion criteria were applied, 56 patients in
the standing orders arm and 55 patients in the computerized reminder arm were screened by the pharmacists. Excluded patients in the intervention arms had similar demographics. The overall rate of pneumococcal vaccine acceptance was 69%; 75% in the standing orders arm and 64% in the computerized reminder arm ($P = .194$).

Forty-two patients in the standing orders arm accepted vaccination and 41 were documented to have received it. Thirty-five patients in the computerized reminder arm accepted vaccination, but only 8 were documented to have received it. Only one patient in the control arm was documented to have received vaccination. Vaccination rates on the standing orders ward included 98% of those eligible and accepting vaccination, 73% of eligible patients, and 28% of all patients admitted. The rates on the computerized reminder ward were 23%, 15%, and 7%, respectively. All rates in the standing orders arm were significantly greater than those in the computerized reminder arm ($P < .0001$). In comparison, only 0.6% of all patients in the control arm were vaccinated, significantly fewer than those in either intervention arm ($P < .0001$).

Questionnaire data indicated that patients accepting pneumococcal vaccination were more likely to perceive themselves at risk for pneumococcal disease relative to those who refused vaccination (84.3% vs 16.7% of patients; $P < .0001$).

Rates of prior pneumonia infection trended higher among patients accepting vaccination versus those refusing it, but these differences were not statistically significant (27.1% vs 14.8%; $P = .31$).

**DISCUSSION**

The results of this study provide evidence that both standing orders protocols and computerized reminders to physicians are effective strategies to increase rates of inpatient pneumococcal vaccination. The evidence is also compelling regarding the superiority of a standing orders protocol relative to computerized reminders to physicians. The standing orders approach resulted in successful vaccination of 98% of eligible consenting patients admitted to the ward as opposed to only 23% of similar patients admitted to the computerized reminder ward. These results were deemed sufficient to terminate this study and to institute a pneumococcal vaccination standing orders protocol on all general medicine wards at the hospital.

The results of this study are consistent with those of previously published studies investigating the use of computerized reminders to physicians to increase rates of inpatient pneumococcal vaccination, with achieved vaccination rates of 14% to 44%.\(^2\) Although the design of computerized reminders to physicians may be related to the degree of their success in initiating pneumococcal vaccination, even the most aggressive, sophisticated, and user-friendly designs have achieved vaccination rates of only 35.8%.\(^2\) The relative noncompliance of physicians with computerized reminders regarding pneumococcal vaccination remains unexplained, but it has been suggest-
ed to be due to long-established habits of preferentially vaccinating patients in the outpatient setting, exaggerated physician fear of hypersensitivity reactions, lack of knowledge concerning vaccine efficacy, difficulty confirming previous vaccination history, and the competing concerns of other pressing complex issues of inpatient hospitalization.\(^3,4\) Whereas the promise of the easy sustainability of computerized physician reminder systems will undoubtedly continue to drive investigations related to the design and implementation of effective computerized inpatient vaccination strategies, it is clear that further investigation of associated physician noncompliance is warranted.

Although this investigation was not a randomized clinical trial, we believe that the comparability of age, gender, ethnicity, and admitting diagnosis among the patients strongly suggests that there was little bias relative to the admission of any group of patients to each of the three study wards. This conclusion is further supported by the similarity of prior pneumococcal vaccination rates and current vaccine acceptance rates among patients on the two interventional wards. Provider bias was also considered unlikely given that multiple attending physicians and residents provided care during the 4-month period on each of the three study wards, although there was no crossover of staff among the three wards. Furthermore, patient assessments for inclusion, patient education and consent procedures, and intervention activation were the responsibility of a few pharmacists and were applied universally and consistently to all patients on the intervention wards. Yet, it is prudent to note that the possibility remains that some unmeasured difference in patients or providers may have occurred and served to bias the results.

The standing orders protocol used in this study used a pharmacist for patient screening and activation of a standing order, which was found to be a highly effective means of initiating the vaccination process. This strategy is consistent with a recent position paper published by the American College of Physicians and American Society of Internal Medicine that advocated an increased role for pharmacists in the immunization process.\(^5\) Pharmacists are skilled at medication counseling and have previously been demonstrated to be especially effective at screening and identifying candidates for vaccination and as immunization educators.\(^4,6\) In fact, 30 states currently allow pharmacists to administer immunizations, although this is not currently permitted by New York state law.\(^7\) Our program was sustainable by assigning the screening, consent, and standing orders activation responsibilities to the already existing pharmacy staff and was thus cost-neutral. Screening within 72 hours of admission was acceptable to patients and extended the window of opportunity to initiate vaccination prior to discharge, as opposed to waiting until the time of patient discharge. Although the use of a computerized clinical information system facilitated patient screening and undoubtedly helped to minimize unnecessary patient revaccination, the standing orders protocol could successfully stand alone without it. This
standing orders protocol has demonstrated continued and sustained efficacy, with approximately 99.5% of all eligible consenting medical inpatients receiving pneumococcal vaccination during the past 2 years.

It is also apparent that there is an opportunity to increase rates of inpatient pneumococcal vaccination by reducing refusal rates among patients who are eligible to receive the vaccine. The data from this study suggest that approximately 30% of eligible patients refuse vaccination, primarily because they do not perceive themselves at risk for pneumococcal disease. This occurred despite individual patient education sessions using the vaccine information sheets that are currently available. Further research is warranted to identify educational materials and methods that can be used to effectively communicate the risk of pneumococcal disease to patients.

REFERENCES