Effect of an Intervention on Medical Resident Knowledge and Adult Immunization Rates

Ashton E. Beggs, PharmD; Karie A. Morrical-Kline, PharmD; Jessica E. Wilhoite, PharmD; Laurel B. Fick, MD

BACKGROUND AND OBJECTIVES: This study evaluated a change in immunization rates and medical resident knowledge following an educational intervention. Differences in immunization rates based on resident or patient characteristics were also assessed.

METHODS: This pre- and post-intervention retrospective chart review targeted family medicine and internal medicine residents at the St. Vincent Joshua Max Simon Primary Care Center. A chart review focusing on vaccination rates for three adult vaccines was conducted at baseline and following an educational intervention. A survey was also administered to residents to evaluate a change in their knowledge of adult vaccine recommendations.

RESULTS: Following the educational intervention, the offer, refusal, and receipt of three targeted vaccines did not demonstrate statistical significance.

CONCLUSIONS: Continued medical resident education is essential to improve resident knowledge of adult immunization recommendations and adult vaccination rates. However, this study demonstrated that additional strategies are necessary to achieve optimal adult vaccination rates.

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Despite the benefits and cost-effectiveness of vaccines, use in adults is suboptimal. This may result from vaccines being overlooked or designated as less important given the possibility of more acute health issues identified at physician visits. Adult patients are also often unaware of routine vaccination recommendations, placing increased responsibility on the physician to ensure patients are up to date on immunizations.

A systematic review by Briss and colleagues evaluated various provider-based interventions previously studied to improve vaccination rates in the adult population. Authors concluded that by increasing physician knowledge and awareness of vaccine recommendations, physician behavior may be affected in a positive manner, leading to increased vaccination rates in adult patients.

This study assessed the change in adult vaccine administration rates and resident knowledge of vaccination recommendations following a presentation of baseline vaccination rate data and an educational intervention. Primary objectives for this study were (1) assessment of baseline adult immunization rates and medical resident knowledge of the Advisory Committee on Immunization Practices (ACIP) recommendations for pneumococcal, tetanus, and herpes zoster vaccines and (2) changes in immunization rates and medical resident knowledge post-educational intervention.

Secondary objectives were to determine the presence of any differences in immunization rates or medical resident knowledge based on medical resident characteristics and immunization rates based on patient characteristics.

Methods

Study Design

This Institutional Review Board (IRB)-approved pre/post-educational intervention, retrospective chart review targeted internal medicine, family medicine, and combined internal medicine/family medicine medical residents at the St. Vincent Joshua Max Simon Primary Care Center (PCC), an outpatient medical residency training facility. A chart review focusing on vaccination rates of herpes zoster, tetanus, and pneumococcal vaccinations was conducted at baseline (July–September 2010) and following an educational intervention (January–March 2011). The educational intervention included presenting baseline vaccination rates to the medical residents and posting weekly educational flyers focusing on the targeted vaccines.
Table 1: Survey Questions and Answers

1. Which of the following patients is an appropriate candidate for revaccination with pneumococcal polysaccharide vaccine (PPSV†)?
   - a. An 80-year-old patient who received first PPSV† dose at age 66
   - b. A 68-year-old patient who received first PPSV† dose at age 64
   - c. A 79-year-old patient who received first PPSV† dose at age 65
   - d. A 65-year-old patient who received first PPSV† dose at age 59*

2. A 30-year-old female works at a daycare. Her past medical history is noncontributory, and she is unsure of her vaccination status. She is indicated to receive which of the following vaccines:
   - a. Tdap*‡
   - b. Td§
   - c. Shingles
   - d. Pneumococcal

3. Which of the following scenarios is appropriate based on current vaccination guidelines?
   - a. Herpes zoster vaccine in a 55-year-old male with diabetes
   - b. Herpes zoster vaccine in a 63-year-old female with asthma*
   - c. Pneumococcal vaccine in a 55-year-old patient with hyperlipidemia
   - d. Pneumococcal vaccine in a 65-year-old patient who last received a PPSV† at age 62

4. The pneumococcal polysaccharide vaccine (PPSV†) is indicated in which of the following patients:
   - a. A 50-year-old male with peripheral artery disease
   - b. A 32-year-old female receiving high-dose corticosteroids for 7 days
   - c. A 66-year-old female who received a dose of PPSV† at age 62
   - d. A 44-year-old male currently taking metformin and glyburide*

5. A 24-year-old male received a primary series with DTaP** and one dose of ‡Tdap at age 13. Which, if any, vaccine should the patient receive at this time?
   - a. Tdap‡
   - b. Td*§
   - c. DTaP**
   - d. None

6. In which of the following patients is a herpes zoster vaccine indicated?
   - a. A 66-year-old male receiving methotrexate for rheumatoid arthritis
   - b. A 59-year-old female receiving high dose steroids for 10 days
   - c. A 34-year-old female in her first trimester
   - d. A 65-year-old male with history of a prior episode of herpes zoster*

7. Which of the following individuals should receive revaccination for pneumococcal disease?
   - a. A 73-year-old female with diabetes who was vaccinated 5 years ago
   - b. A 66-year-old male with diabetes mellitus who was vaccinated at age 62
   - c. A 47-year-old male with HIV who was vaccinated at the time of HIV diagnosis 5 years ago*
   - d. A 64-year-old kidney transplant patient who was vaccinated prior to his transplant 3 years ago

8. A 42-year-old male’s history of tetanus vaccinations is as follows: Age 16: Td§, Age 26: Td§, Age 36: Td§. What action should the medical resident take regarding this patient’s vaccine history?
   - a. None, 10 years has not passed since his last tetanus vaccination
   - b. None, the patient did not present with an acute wound indicated necessity for a tetanus vaccine
   - c. A booster dose of Td§
   - d. A single dose of Tdap*‡

9. Which of the following statements is true regarding the herpes zoster vaccination?
   - a. Revaccination for herpes zoster is warranted if the last dose the patient received was prior to age 65
   - b. Vaccination is indicated for a patient with active herpes zoster
   - c. If a child is diagnosed with chicken pox, the parents should be vaccinated for shingles
   - d. A 62-year-old patient recently diagnosed with dementia is indicated to receive the herpes zoster vaccine*

* correct answer, † pneumococcal polysaccharide vaccine, ‡ full strength tetanus and reduced doses of diphtheria and pertussis, § full strength tetanus and reduced dose of diphtheria, ** full strength diphtheria, tetanus, and pertussis
Additionally, a multiple-choice survey was administered baseline and after the intervention to evaluate a change in resident knowledge of vaccine recommendations (Table 1).

**Study Subjects**
A total of 300 patient visits were evaluated, 150 in each study period. Patient visit inclusion criteria were patients age 19 or older with a regularly scheduled physician visit and who met ACIP recommendations for the targeted vaccines.\(^5\)\(^-\)\(^7\) Pregnant patients, patients with an acute office visit, follow-up hospital office visit, new patient visits, and patients assigned to medical staff other than a medical resident were excluded from the study.

**Statistical Analysis**
Descriptive statistics were utilized for pre- and post-intervention data and comparisons between pre- and post-intervention results were performed. Discrete categorical variables were evaluated by the Fisher’s exact test or Pearson chi-square test as appropriate. Continuous variables were compared using a non-parametric Mann-Whitney U test. A \( P \) value less than .05 was considered statistically significant. Statistical analyses were conducted using Statistical Package for Social Sciences (SPSS) 18.0 for Windows (SPSS Inc., Chicago).

**Results**

**Primary Outcomes**
The educational intervention did not result in any statistically significant differences in the offer, refusal, or receipt of the targeted vaccines from baseline (Table 2). More residents participated in the survey before compared to after the intervention. Only one of the nine vaccine-related questions demonstrated statistical significant knowledge improvement from before to after intervention (question 9 focusing on herpes zoster).

**Secondary Outcomes**
Patient and medical resident demographics were similar for the immunization rates of pneumococcal, herpes zoster, and tetanus vaccines before and after the intervention (Table 3). Additionally, results comparing number of indications, specific indications, revaccination, and previous vaccination status were similar before and after the intervention. Three survey questions demonstrated statistically significant differences in regards to resident characteristics after the intervention, although these were not deemed clinically significant.

**Discussion**
Despite the benefits and cost-effectiveness of vaccines, use in adult patients at the PCC remains poor; however, this correlates with findings collected at the national level. The National Center for Immunization and Respiratory Diseases assessed adult vaccination coverage via a national health interview survey in 2009.\(^6\) This national survey revealed that rates of pneumococcal, herpes zoster, and tetanus vaccines were considered suboptimal. It is evident that efforts are necessary to improve vaccination rates both nationally and at the PCC.

Encouraging improved immunization practices and increased knowledge of vaccine recommendations among medical residents is an important aspect of postgraduate training. The authors selected this specific intervention as the first-line approach given the focus of medical resident education at the study site.

Several limitations were present during this study including sample size, electronic medical record (EMR) documentation, and obtaining the herpes zoster vaccine. Evaluating a larger sample size over a longer period of time may better identify trends in vaccination rates. Also, appropriate documentation of vaccination and the methods for obtaining vaccination histories was inconsistent, and difficulties in obtaining the herpes zoster vaccine due to a manufacturer drug shortage may have limited the study results.

While the outcomes of this study did not demonstrate a statistically significant improvement in adult immunization rates, the findings can be clinically useful. Given the minimal change in vaccination rates following the educational intervention, other interventions may be more effective in this setting. Additional strategies to further improve vaccination rates have been identified, which include the use of additional health care professionals, such as nurses, in vaccine promotion, implementation of a standing order for

<table>
<thead>
<tr>
<th></th>
<th>Pneumococcal Vaccine</th>
<th>Herpes Zoster Vaccine</th>
<th>Tetanus Vaccines</th>
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<tbody>
<tr>
<td></td>
<td>Before (n=100)</td>
<td>After (n=95)</td>
<td>( P ) Value</td>
</tr>
<tr>
<td>Previously vaccinated</td>
<td>15</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td>Offer</td>
<td>4</td>
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<td>(.526)</td>
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<tr>
<td>Refusal</td>
<td>2</td>
<td>1</td>
<td>1.0</td>
</tr>
<tr>
<td>Receipt</td>
<td>1</td>
<td>5</td>
<td>(.107)</td>
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</tbody>
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}\(^5\)\(^-\)\(^7\)
vaccine administration, and promotion of other adult vaccines within the PCC flu shot clinic.9,10 Although the EMR at the PCC does not allow for prompts, other EMRs may be able to incorporate this type of functionality, prompting physicians to vaccinate patients.

**Conclusions**
In conclusion, vaccination rates at the PCC remain suboptimal following the educational intervention. Continued medical resident education is essential to improve resident knowledge and vaccination rates; however, this study demonstrated that additional strategies are necessary to achieve optimal adult vaccination rates.

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**References**

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**Table 3: Chart Review—Medical Resident Characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Pre-intervention Visits % (n=150)</th>
<th>Post-intervention Visits % (n=150)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resident sex</strong></td>
<td></td>
<td></td>
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<tr>
<td>Males</td>
<td>70 (105)</td>
<td>64.7 (97)</td>
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</tr>
<tr>
<td>Females</td>
<td>30 (45)</td>
<td>35.3 (53)</td>
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<tr>
<td><strong>Medical resident year</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First year</td>
<td>8 (12)</td>
<td>14 (21)</td>
<td>.132</td>
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<tr>
<td>Second year</td>
<td>37.3 (56)</td>
<td>38 (57)</td>
<td></td>
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<tr>
<td>Third year</td>
<td>45.3 (68)</td>
<td>34.7 (52)</td>
<td></td>
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<tr>
<td>Fourth year</td>
<td>9.3 (14)</td>
<td>13.3 (20)</td>
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