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# Immunization education for internal medicine residents: A cluster-randomized controlled trial

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## ABSTRACT

**Purpose:** The aims of this study are to evaluate the impact of a novel immunization curriculum based on the Preferred Cognitive Styles and Decision Making Model (PCSDM) on internal medicine (IM) resident continuity clinic patient immunization rates, as well as resident immunization knowledge, attitudes, and practices (KAP).

**Methods:** A cluster-randomized controlled trial was performed among 143 IM residents at Mayo Clinic to evaluate the PCSDM curriculum plus fact-based immunization curriculum (intervention) compared to fact-based immunization curriculum alone (control) on the outcomes of resident continuity clinic patient panel immunization rates for influenza, pneumococcal, tetanus, pertussis, and zoster vaccines. Pre-study and post-study immunization KAP surveys were administered to IM residents.

**Results:** Ninety-nine residents participated in the study. Eighty-two residents completed pre-study and post-study surveys. Influenza and pertussis immunization rates improved for both intervention and control groups. There was no significant difference in immunization rate improvement between the groups. Influenza immunization rates improved significantly by 33.4% and 32.3% in the intervention and control groups, respectively. The odds of receiving influenza immunization at the end of the study relative to pre-study for the entire study cohort was 4.6 ( $p < 0.0001$ ). The odds of having received pertussis immunization at the end of the study relative to pre-study for the entire study cohort was 1.2 ( $p = 0.0002$ ). Both groups had significant improvements in immunization knowledge. The intervention group had significant improvements in multiple domains that assessed confidence in counseling patients on immunizations.

**Conclusions:** Fact-based immunization education was useful in improving IM resident immunization rates for influenza and pertussis. The PCSDM immunization curriculum did not lead to increases in immunization rates compared with the fact-based curriculum, but it did significantly increase resident confidence in communicating with patients about vaccines.

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## 1. Introduction

Vaccines, praised as the greatest public health achievement of the 21st century, have declined in public confidence [1,2]. US immunization rates are well below the *Healthy People 2020* targets [3,4]. In 2014, influenza vaccination coverage for adults aged  $\geq 19$  years was estimated at 43% [4]. Pneumococcal vaccination coverage among those aged  $\geq 65$  years was 61% [4]. Herpes zoster vaccine coverage among adults aged  $\geq 60$  years was 27.9%. Tetanus

vaccination coverage was 62%, and pertussis immunization coverage was 20.1% for adults  $\geq 19$  years [4].

The most significant factors in immunization acceptance are the healthcare provider-patient relationship, provider recommendations [5], and the provider responses to immunization concerns [6–8]. However, many countries have noted gaps in immunization education for medical professionals [9–11]. In a multi-center survey of US Internal Medicine (IM), family medicine, and pediatric residents, 83% reported wanting more education on vaccine communication during their residency [12]. A survey (Whitaker JA, unpublished results) conducted among IM residents at Mayo Clinic in 2013 demonstrated that 86% of residents wanted to learn more about vaccines and how to communicate about them with their patients. Few studies have measured the impact of medical trainee immunization education [13–16].

Vaccine educational efforts have generally used fact-based, analytic approaches that do not account for the perceptions—or preferred cognitive decision-making styles—of patients. This problem has been described as the “vaccine education spectrum disorder” [17]. Understanding the psychology of how patients make decisions about vaccines is critical to addressing barriers to immunization acceptance [17–20]. The Preferred Cognitive Styles and Decision-Making (PCSDM) model is an empirically developed model based on literature in psychology, cognitive linguistics, health psychology, and clinical experience. Unlike traditional educational interventions that assume all individuals process information identically, the PCSDM model acknowledges that individuals utilize preferred cognitive styles when making decisions under conditions of uncertainty. The PCSDM model flips the traditional provider-patient education role and advocates that the provider first understand the PCSDM style of the patient, and then model the educational information around the patient's needs [17–20].

The goal of this study was to perform a cluster-randomized controlled (RCT) trial evaluating the effect of a PCSDM vaccine educational intervention plus fact-based immunization curriculum versus a control of fact-based immunization curriculum alone. The outcomes of this study compare pre and post-study resident continuity clinic patient influenza, pneumococcal, tetanus, pertussis, and zoster immunization rates and resident knowledge, attitudes, and practices (KAP) toward immunizations.

## 2. Methods

This study was conducted among IM residents at the Mayo School of Graduate Medical Education in Rochester, Minnesota between July 2014 and June 2015. This study was approved by the Institutional Review Board of Mayo Clinic.

### 2.1. Study population

There were 143 IM residents eligible to participate. Inclusion criteria were being an IM resident at Mayo Clinic Rochester, ability to participate in the education sessions, and provision of informed consent. The IM outpatient clinics consist of six “firms” of residents who provide continuity care to their own patient panel. Four firms are located within the Division of Primary Care Internal Medicine (PCIM), and two are located within the Division of General Internal Medicine (GIM). PCIM firms care for patients who live in Olmsted County. GIM firms provide care for patients who reside in Olmsted and surrounding counties in Minnesota.

### 2.2. Cluster randomization

Due to differences between divisions, we performed block randomization by firm with stratification by division. A random num-

ber between 0 and 1 was generated for each of the six firms, and the two PCIM firms and one GIM firm with the highest values were assigned to the intervention group. This study was not conducted in a blinded fashion. Cluster-randomization by clinic firm allowed us to avoid “bleed over” effect of the intervention because each clinic firm has a practice at a unique time and location. Residents from the control and intervention groups did not work in the same clinic sessions. The residents in the control arm were not exposed immunization education techniques taught in the intervention arm since they did not attend these sessions and would not have witnessed them being conducted or discussed in clinic.

### 2.3. Interventions

The fact-based immunization curriculum consisted of a PowerPoint™ presentation administered over 60 min. The content was case-oriented and focused on Advisory Committee on Immunization Practices (ACIP) guidelines for the immunizations that were being studied. All presentations in this study were scripted to ensure standardization. The control group received only this educational session and their unique ambulatory clinic patient panel's immunization rates.

The intervention group received the same fact-based immunization curriculum, their patient panel immunization rates, plus an additional PCSDM immunization education session. This session was administered over two hours and consisted of two additional PowerPoint™ presentations. The first presentation covered the cognitive styles and how these relate to vaccine decision making, as well as key communication strategies for each style within the framework of immunization education. The second session consisted of 10 case studies of patients presenting with vaccine hesitancy. The type of cognitive style was identified for each scenario, and strategies for communication and immunization education for each style were discussed.

### 2.4. Data collection

Pre-study immunization rates were measured during August of 2014. Pre-study KAP surveys were performed just prior to the intervention sessions that occurred in October–November 2014. Post-study KAP surveys and immunization rates were measured during June 2015, 7–8 months after the intervention.

Immunization rates (percentage immunized out of those eligible for immunization, as defined below per vaccine type) were determined using electronic data capture from the electronic medical record (EMR). Immunizations are captured in the EMR if they are given within the Mayo Health System. They are entered historically if they are given at another site. If an immunization was declined or deferred, it was counted as not up to date. Influenza immunization status was determined for adults  $\geq 18$  years and was considered up to date if the patient had received any influenza immunization during the prior influenza season. Pneumococcal immunization status was determined for adults aged  $\geq 65$  years, and receipt of any pneumococcal vaccine after age 65 was considered as being up to date. Tetanus (receipt of tetanus-containing vaccine within the last ten years) and pertussis (receipt of a pertussis-containing vaccine in adolescence or adulthood) rates were determined for adults aged  $\geq 20$  years. Zoster immunization status was determined for adults aged  $\geq 60$  years. Persons with contraindications to zoster immunization were not excluded from this analysis. The identical criteria were used for pre- and post-study immunization rates.

The KAP survey was conducted utilizing a unique identifier (only disclosed to the statistician) to link to each survey participant to demographic data. The KAP survey consisted of: 10-item IM board-style multiple choice questions (MCQ) of ACIP recommenda-

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