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# Factors Associated with Increased In-Office Influenza Vaccine Coverage and Two-Dose Compliance Among Practicing US Pediatricians

Seth L. Toback, MD;<sup>1</sup> Chyongchiou Lin, PhD;<sup>2</sup> Richard Zimmerman, MD;<sup>2</sup> Mary Patricia Nowalk, PhD;<sup>2</sup> Christopher S. Ambrose, MD<sup>1</sup>

<sup>1</sup>MedImmune, LLC, Gaithersburg, MD, USA; <sup>2</sup>Consultant, Pittsburgh, PA, USA

## Introduction

- Annual influenza vaccination rates for children remain suboptimal despite universal vaccination recommendations for children ≥6 months of age.
- Recent studies have described the challenge of vaccinating all eligible children, suggesting that an additional 42 million office visits would be required to vaccinate all eligible children against influenza.<sup>1</sup>
  - This is, in part, due to the need for 2 doses given one month apart for previously unvaccinated children <9 years of age.
- Efficient and effective methods for vaccinating large numbers of children in primary care offices are essential.

## Objective

- The purpose of this study is to describe influenza vaccination activities in 130 pediatric practices and the relationship of those activities to influenza vaccination coverage and compliance with the two-dose schedule.

## Methods

- A prospective observational study was conducted during the 2008–2009 and 2009–2010 influenza seasons in 130 unique outpatient offices in the US.
- US outpatient pediatric offices collected all seasonal influenza vaccinations as they were administered and reported totals biweekly over a 32-week influenza season (August 1–March 31).
  - Activities to increase vaccine uptake were also captured biweekly (Table 1).
- Coverage was calculated by dividing the number of children vaccinated by the total number of children under the office's care.
- Two-dose compliance was the ratio of second dose and first dose administered to children identified as needing 2 vaccinations.
- Descriptive statistics were used to summarize office characteristics.
- Individual correlations between the outcome variables and each immunization activity were examined.

- Kolmogorov-Smirnov tests were used to examine the distribution of each outcome variable.
- Linear regression analyses used a priori office characteristics and those variables correlated with coverage and compliance at  $P \leq 0.1$ .
  - Significance for the linear regression was declared at  $P \leq 0.05$ .

## Results

- Office characteristics are shown in Table 2.
- The mean coverage was 25.5% (range: 2.1%–79.0%); mean compliance was 54.6% (range: 5.4%–100%).
- $P$  values for univariate regression analyses are shown in Table 3, and results from linear regression using significant variables are shown in Table 4.
- Vaccination coverage increased with increased ratio of staff per 1000 patients ( $P < 0.01$ ), duration of vaccine availability ( $P = 0.041$ ), and offering weekend hours for vaccination ( $P < 0.01$ ).
  - Larger offices ( $P < 0.01$ ) and those located in rural areas ( $P = 0.035$ ) had lower vaccine coverage.
- There were no statistically significant associations between 2-dose compliance and the office practices examined.

## Conclusions

- There is significant heterogeneity in influenza vaccine coverage and 2-dose compliance across US pediatric offices.**
- To maximize vaccine coverage, offices should offer vaccine during weekend hours and extend the duration of vaccine availability.**
- Offices may also be able to achieve higher influenza vaccination coverage with a higher staff to patient ratio.**
- Additional efforts may be required in large offices and those serving rural areas.**
- Greater efforts should be employed to help maximize 2-dose compliance for eligible first time vaccinees.**

Table 1. Data on Demographics and Behaviors

Topic	Type of Data Collected
Office demographics	<ul style="list-style-type: none"> <li>Total number of patients, total number of staff by specialty, patient/staff ratio, provider/staff ratio</li> <li>Geographic region</li> <li>Setting (rural, suburban, urban)</li> <li>Percentage of vaccinations reimbursed by private insurance, VFC/Medicaid</li> <li>Standing orders (Yes/No)</li> <li>Family vaccination offered (Yes/No)</li> </ul>
Timing of vaccine availability	<ul style="list-style-type: none"> <li>Total number of days vaccine was available to patients</li> <li>Total number of work hours during which vaccine was offered</li> <li>First date the influenza vaccine was offered</li> <li>Last date the influenza vaccine was offered</li> <li>Number of influenza vaccine shipments</li> </ul>
Staff support of influenza vaccination	<ul style="list-style-type: none"> <li>Staff influenza vaccination rate</li> <li>Mean staff agreement with ACIP/AAP recommendations</li> </ul>
In-office activities to promote vaccination	<ul style="list-style-type: none"> <li>Number of months the office handed out reading material, posters, or fliers related to influenza vaccination</li> <li>Number of months the office played videotape reminders, played on-hold recordings, mailed/telephoned/emailed reminder, offered patient incentives</li> <li>Number of months of staff computer reminders, educational workshops</li> </ul>
Local influenza vaccine activities	<ul style="list-style-type: none"> <li>Presence of local vaccination events (eg, school programs, mobile clinics; Yes/No)</li> <li>Significant local media coverage (Yes/No)</li> </ul>

AAP=American Academy of Pediatrics; ACIP=Advisory Committee on Immunization Practices; VFC=Vaccines for Children program.

Table 2. Characteristics of Physician Offices

Characteristics (Number of Pediatric Offices=130)	
Total number of staff, mean (range)	12 (2–48)
Physicians, mean (range)	3 (1–9)
Nurses, mean (range)	4 (0–19)
Nurse practitioner/physician assistant, mean (range)	1 (0–4)
Total number of patients, mean (range)	7080 (525–31,866)
Patients per physician, n (range)	2947 (274–13,160)
Geographic region, n (%)	
Northeast	28 (22)
South	54 (42)
West	24 (18)
Midwest	24 (18)
Setting, n (%)	
Rural	20 (15)
Suburban	84 (64)
Urban	26 (22)
Percentage of children in VFC, n (%)	
0	17 (13)
1–25	43 (33)
26–50	42 (32)
51–75	14 (14)
76–100	14 (14)

VFC=Vaccines for Children program.

Table 3. P Values for Univariate Regression Analyses Using Office Immunization Activities and Influenza Vaccine Coverage and Compliance

Activity	Coverage P value	Compliance P value
Verbal recommendation	0.128	0.392
Handout reading materials	0.734	0.484
Video tape recommendation	0.274	0.254
Offered incentives	<b>0.030</b>	0.861
Mail/phone reminders	0.495	<b>0.009</b>
"On hold" influenza reminders	0.138	<b>0.074</b>
Email reminders	0.257	<b>0.001</b>
Staff internal comparison vaccination rates	0.937	0.777
Staff computer reminders	0.133	0.174
Presence of local vaccination activities	0.346	0.394
Standing orders program for influenza vaccine	0.139	0.372
Family members offered vaccines	0.538	0.885
Offered weekend hours for influenza vaccine	<b>0.014</b>	<b>0.055</b>
Offered evening/weekend hours for influenza vaccine	0.262	0.479
Clinical staff education workshops during influenza season	0.199	0.533

Values in bold indicate statistical significance.

Table 4. Variables Related to Coverage and Compliance with Influenza Vaccine in Pediatric Practices by Linear Regression

Explanatory Variables	Coverage			2-Dose Compliance		
	Coefficient	Standard Error	P value	Coefficient	Standard Error	P value
(Constant)	4.962	8.517	0.561	43.563	14.923	0.004
Urban vs others	-2.782	2.894	0.339	-5.138	5.273	0.332
Rural vs others	-7.335	3.437	<b>0.035</b>	-4.451	6.120	0.469
Size of practice (no. of patients)	-0.001	0.000	<b>&lt;0.001</b>	0.000	0.000	0.389
Medicaid patients, %	0.079	0.047	0.094	-0.147	0.080	0.070
Staff/1000 patients	1.552	0.350	<b>&lt;0.001</b>	-0.067	0.614	0.914
Staff vaccinated, %	0.058	0.056	0.307	-0.006	0.101	0.954
Duration vaccines available	0.067	0.032	<b>0.041</b>	0.063	0.057	0.271
Total weekend hours offered	0.036	0.144	0.805	-	-	-
Offered weekend hours	10.833	3.446	<b>0.002</b>	8.229	4.577	0.075
Mail/phone reminders	-	-	-	3.803	4.202	0.368
Offered incentives	-4.668	2.604	0.076	-	-	-
"On hold" influenza reminders	-	-	-	2.242	6.438	0.728
Email reminders	-	-	-	11.600	6.304	0.069

Values in bold indicate statistical significance.

## References

- Rand CM, et al. Arch Pediatr Adolesc Med. 2008;162:1048-1055.

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