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## The impact of missed opportunities on seasonal influenza vaccination coverage for healthy young children

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### Abstract

**Objective**—To estimate the impact of missed opportunities on influenza vaccination coverage among 6 through 23 month old children who sought medical care during the 2004–2005 influenza season.

**Design**—Retrospective cohort study

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**Disclaimer:** The findings and conclusions in this article are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention.

**Setting**—Fifty two primary care practice sites located in Rochester New York, Nashville Tennessee and Cincinnati Ohio

**Participants**—Children 6 through 23 months of age

**Methods/Outcome Measure**—Charts were reviewed and data collected on influenza vaccinations, type of health care visit (well-child or other), and presence of illness symptoms. Missed opportunity was defined as a practice visit by an eligible child during influenza season, when vaccine was available, but during which the child did not receive an influenza vaccination. Vaccine was assumed to be available between the first and last dates influenza vaccination was recorded at that practice. Each child was classified as fully vaccinated, partially vaccinated or unvaccinated.

**Results**—Data were analyzed for 1724 children 6 through 23 months. Most children (62.0%) had at least one missed opportunity during this period. Among children with any missed opportunities, 12.8% were fully and 29.8% were partially vaccinated. Overall, 33.6% of missed opportunities occurred during well child visits and 66.4% during other types of visits; 75% occurred when no other vaccines were given. Eliminating all missed opportunities would have increased full vaccination coverage from 30.3% to 49.9%.

**Conclusions**—Missed opportunities for influenza vaccination are frequent. Reducing missed opportunities could significantly increase influenza vaccination rates and should be a goal in each practice.

### Keywords

vaccination; child health services; influenza; human

## Introduction

In April 2004, the Advisory Committee on Immunization Practices (ACIP) expanded influenza vaccine recommendation to include all children aged 6 through 23 months of age<sup>1</sup>. During the 2004–2005 and 2005–2006 influenza seasons, the National Immunization Survey (NIS) estimated that of children 6 through 23 months of age, only 33.4% and 31.9% received at least one dose of influenza vaccine, respectively<sup>2–3</sup>. Earlier studies have shown that missed opportunities to vaccinate have been associated with decreased coverage among young children for all vaccines<sup>4–6</sup> and specifically for influenza vaccine among children with chronic illness<sup>7–9</sup> and those living in the inner city<sup>10</sup>. Our study expands on this earlier work by measuring the frequency of missed opportunities for influenza vaccination in a large cohort of healthy young children from three geographically distinct areas during the 2004–2005 influenza season, the first season after the universal influenza recommendation for healthy 6 through 23 month old children.

## Methods

### Study Setting and Population

Data for this study were obtained from a community-based cohort study of influenza vaccine effectiveness which was conducted in Monroe County, NY (Rochester), Davidson County, TN (Nashville), and Hamilton County, OH (Cincinnati) by the New Vaccine Surveillance Network (NVSN)<sup>11</sup>. Institutional review board approval was obtained from each participating institution and from the Centers for Disease Control and Prevention (CDC). Children were selected from a subset of all primary care practices in the three counties using a cluster sampling design. A list of all pediatric and family medicine practices in each county that provided care for > 30 newborns a year was created and used to estimate the number of county-resident patients seen in each practice's birth cohort. One cluster was

assigned for each multiple of 30 county-resident children and based on the practice's birth cohort size, from 1 to 8 clusters were assigned to each practice in the three counties. Thirty clusters of children aged 6 through 23 months, each cluster comprising a random selection of 30 practice children, were selected from a random selection of practices in each county with a target of 900 children in each of the three sites for a total of 2700. Children were eligible for inclusion if they made a health care visit to the practice during the time period when the practice was administering vaccine, and were 6 through 23 months of age on the date of the medical visit.

### Data source

Medical chart reviews were conducted by study staff for medical visits to 52 physician practices in the three study counties during both the 2003–2004 and the 2004–2005 influenza vaccination seasons. Standardized data collection using a previously implemented form<sup>12</sup> was obtained by trained medical record abstractors for all selected children and included: dates of administered influenza vaccinations during both the 2003–2004 and 2004–2005 influenza seasons, type of health visit (well child care or other care), and the presence of symptoms and diagnoses commonly associated with acute respiratory infection. Well child visits were distinguished from other visits by noting the use of a standardized well child form commonly used for well child visits or notes in the medical record with data usually collected at well child visits such as head circumference and length.

### Study Outcomes

Each child's vaccination status was evaluated for the 2004–2005 influenza season. A child was "fully vaccinated" who received two doses of influenza vaccine at least one month apart in 2004–2005, or at least one dose in 2003–2004 and one in 2004–2005. A child was "partially vaccinated" who had no previous influenza vaccinations and received one dose in 2004–2005. "Unvaccinated" children received no influenza vaccine in 2004–2005. Vaccination status was determined for each child as of the date of their last recorded visit to the practice.

Vaccine supply for each practice was not directly assessed but assumed to be consistently available in the period between the first and the last recorded dates of vaccine administration for each practice site. However, to confirm the appropriateness of this approach, we analyzed data from a November 2005 provider survey to assess influenza vaccination practices during the 2004–2005 influenza season<sup>13</sup>. Providers were asked if they experienced a vaccine shortage and if so, did it impact their ability to vaccinate healthy 6 through 23 month old children. We compared the proportion of missed opportunities between providers who stated that the shortage had an impact on their vaccination capability to those who stated the shortage had no impact.

A missed opportunity was defined as a visit to the primary care practice during which an age- and vaccine-eligible child did not receive an influenza vaccination, and which occurred between September 2004 and April 2005 when the practice was administering vaccine. A child could have one or more missed opportunities, yet be classified as partially or fully vaccinated, if they received one or more vaccines before the final date when vaccination status was assessed. Children who presented with a predefined, acute medical illness or symptom which, by consensus of opinion of study authors, would generally preclude vaccination were not considered vaccine-eligible. These included: inconsolability; apnea; febrile seizure; hypothermia; meningitis, respiratory distress; rule out sepsis, pneumonia/pneumonitis with bronchiolitis, shortness of breath with bronchiolitis; respiratory syncytial virus or pneumonia/pneumonitis. The proportion of missed opportunities was calculated by

child and by medical visit and for first and second vaccine doses. At least 30 days had to elapse after the first dose before a missed opportunity was counted for the second dose.

## Results

A total of 1724 children met study inclusion criteria and received 1525 doses of influenza vaccine from September 2004 through January 2005. Ten children presented with a medical illness considered to preclude vaccination and were excluded from the analysis. Most doses (70.8%) were administered from October through November. Fifty (96%) of 52 practices had started vaccinating in October and 32 (63%) vaccinated one or more children in January, with few vaccinations occurring into April. Altogether 30.3% of children were fully vaccinated and 34.1% were partially vaccinated. Full vaccination coverage was 28.6% for Monroe County, 32.4% for Davidson County and 30.3% for Hamilton County. Full vaccination coverage was 31.9% for children 6–11 months of age, 38.4% for children 12–17 months of age and 29.6% for children 18–23 months of age.

Among 46 (88.5%) of 52 practices responding to the mailed survey, eighteen (39%) stated they experienced an influenza vaccine shortage that limited their ability to vaccinate 6 through 23 month old children. We found the proportion of missed opportunities for children among these 18 providers to be only 4.9% higher than that among the 28 providers who did not indicate such vaccination limitations (65.2% versus 60.3%,  $p=0.06$ ). Because this difference was not significant, we used data from all providers in the analysis.

Of 1724 children evaluated, 1069 children (62.0%) had one or more missed opportunities. Rochester had a significantly higher proportion of children with missed opportunities (69.2%) when compared with Nashville (58.8%,  $p<0.05$ ) and Cincinnati (56.6%,  $p<0.01$ ). A total of 2614 medical visits were made by the 1069 children with missed opportunities occurring at 68.9% ( $n=1802$ ) of the visits (Table 1). Unvaccinated children had approximately 9% fewer medical visits compared to partially or fully vaccinated children. The proportion of visit-specific missed opportunities was similar across the three sites. Among children with one or more missed opportunities, influenza vaccination coverage was 12.8% for fully vaccinated and 29.8% for partially vaccinated. Missed opportunities did not vary by the child's age group but occurred twice as frequently during non-well child visits (66.4%) than well-child visits (33.6%). In addition, 75% of missed opportunities occurred at visits when no other vaccines were given. Eliminating all missed opportunities would have increased the influenza vaccination coverage for children from 30.3% to 49.9% for fully vaccinated children and from 34.1% to 50.1% for partially vaccinated children assuming that the number and types of health care visits to the practice would have remained unchanged.

## Discussion

Our study noted that missed opportunities for influenza vaccination during the first season of implementation of the new universal recommendation for children 6 through 23 months of age were common, and that eliminating missed opportunities could potentially have increased the proportion of fully vaccinated children in that age group from 34% to 50%. To our knowledge, this is the first study to evaluate missed opportunities from a representative cohort of children 6 through 23 months of age from multiple practices in multiple geographic areas while attempting to account for vaccine supply, previous vaccination status and specific medical reasons to defer vaccination.

Our results are comparable to those of prior studies conducted before the universal vaccination recommendations for 6 through 23 month olds. Dombkowski et al<sup>8</sup> reported

69.3% of children with asthma had at least one missed opportunity for influenza vaccination during the 2002–2003 season. During the same season, Daley et al<sup>7</sup> reported missed opportunities for 78% of vaccine-eligible visits in children with asthma and 74% of visits in children with other conditions. In a study conducted in New York City, missed opportunities occurred at 82.2% of all vaccine-eligible visits in children over five consecutive influenza seasons from 2000–2005 and specifically 55% during the 2004–2005 season<sup>10</sup>. The New York study controlled for age, adequate vaccine supply and previous vaccination status, as done in our study. While our study did not control for serious health conditions constituting reasons for deferral, we found that excluding these visits had minimal impact on the proportion of missed opportunities. As shown in earlier studies, missed opportunities for influenza vaccination occurred more frequently at non-well child visits<sup>5–7,9</sup> and early in the vaccination season<sup>8</sup>. We supplemented these observations by showing that missed opportunities also occurred more frequently at visits when no other vaccinations were given.

Our finding that 30.3% of children 6 through 23 months of age were fully vaccinated is substantially higher than the 17.5% for full coverage reported by the NIS for the 2004–2005 influenza vaccination season<sup>2</sup>. Geographic variation has been noted for childhood influenza vaccinations, and our results fall within the wide variability reported by the NIS for full vaccination coverage among states and urban areas, ranging from 3.3% in Detroit, Michigan to 35.5% in Massachusetts. Our study should have higher vaccination coverage than the national sample because all of our study children had at least one medical visit during the influenza vaccination seasons, whereas NIS does not have this requirement.

Our study has several limitations. Although we performed this study in three geographically distinct U.S. counties, the ability to generalize to other populations may be limited. Doses of influenza vaccine may have been given outside of the study practices and not captured by the chart reviews, which would result in underestimation of vaccination coverage and overestimation of missed opportunities. We also assumed a continuous supply of vaccine between the first and last date of vaccination although practitioners could have experienced interruptions in supply during the 2004–2005 season<sup>14</sup>. However, when we accounted for this possibility in the data analysis, we were unable to show an impact of the interruptions on our results. Conversely, we may have underestimated missed opportunities if providers stopped vaccinating before exhausting their supply. We found that excluding visits by children with a serious health condition had a minimal effect on the number of missed opportunities for influenza vaccination. Information about potential reasons that a vaccination was not given, e.g. parental refusal or the vaccine not being offered, was not available for analysis. Finally, since data for this study were collected during the first vaccination season after the new recommendations were announced, providers likely have responded to influenza vaccination recommendations, which have expanded over the years to the current 2010–2011 ACIP recommendation to routinely vaccinate all persons aged 6 months and older.<sup>15</sup>

The greatest proportion of missed opportunities occurred at non-well child visits and at visits when other vaccines were not given. Since most primary care physicians are supportive of influenza vaccination recommendations for young children<sup>16–17</sup>, missed opportunities might be reduced through implementing strategies which have been demonstrated to increase vaccination coverage. One of the strongest factors influencing acceptance of influenza vaccination is a strong provider recommendation.<sup>7,18–19</sup> Daley et al reported that parents of children with chronic conditions indicated lack of provider recommendation was the primary reason for not getting their child vaccinated<sup>7</sup>. Norwalk's study of parental perspectives on influenza immunization found that one of the most important factors related to influenza vaccination coverage of children 6 through 23 months of age was the parental belief that the doctor recommended the vaccine<sup>19</sup>. Other strategies may include provider-based

interventions such as use of standing orders protocols, which allow nurses to vaccinate without a direct physician order<sup>20–22</sup>, and flagging charts either manually or by computer alerts<sup>23</sup> to identify children eligible to receive an influenza vaccine at every clinic visit. Other types of interventions expand access, such as holding weekend or evening vaccination clinics<sup>24–25</sup> and allowing walk-in vaccination.<sup>26</sup> Several interventions increase demand for vaccines for example, discussing influenza vaccination with parents at medical visits throughout the year, scheduling vaccine-only visits year-round,<sup>27</sup> and using reminder-recall methods that notify parents of upcoming visits or the need for vaccinations<sup>28</sup>. The literature has shown that utilizing more than one strategy has been most successful in increasing influenza vaccination rates<sup>25,29</sup>.

## Conclusions

This study found high rates of missed opportunities for influenza vaccination among healthy young children, which has had a negative impact on coverage rates. Missed opportunities occurred most often when children came in for non-routine medical visits and at visits when other vaccines were not administered. Implementing a combination of practice strategies aimed at decreasing missed opportunities can have a positive impact on vaccination coverage.

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**Table 1**

Characteristics of missed opportunity visits compared to influenza vaccination visits

Characteristic	Missed opportunity Visits <sup>a</sup> (n=1802) (%)	Influenza vaccination visits (n=1525) (%)
Child's age group		
6–11 months	35.2	39.5
12–17 months	34.3	39.5
18–23 months	30.5	21.0
Type of visit <sup>b</sup>		
Well child	33.6	68.3
Non-well child	66.4	31.7
Other vaccines given at visit		
Yes	25.1	43.2
No	74.9	56.8
Visit months		
Sept	3.9	1.9
Oct	23.7	38.2
Nov	24.8	32.6
Dec	23.9	18.6
Jan	23.7	8.8

<sup>a</sup>Visit data are not mutually exclusive since a child may have both types of visits.

<sup>b</sup>Type of visit was unknown for 34 missed opportunity and 487 influenza vaccination visits. The missing visit type for influenza vaccination may represent influenza clinic or influenza vaccination-only visits.