Effect of Missed Opportunities on Influenza Vaccination Rates Among Children With Asthma

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Objectives: To assess rates of influenza vaccination among children with asthma; document the frequency, timing, and patterns of missed opportunities to vaccinate during successive influenza seasons; and project potential influenza vaccination rates that could be achieved by reducing or eliminating missed opportunities.


Design: Retrospective cohort analysis of administrative claims.

Participants: We evaluated the claims of 4358 children aged 5 to 18 years with persistent asthma who were continuously enrolled in Medicaid.

Main Outcome Measures: Influenza vaccinations and missed opportunities assessed using procedure and diagnosis codes.

Results: During the 2001-2002 season, 16.7% of children with asthma received an influenza vaccination; during 2002-2003, 21.8% received the vaccine (9.5% vaccinated in both seasons). However, 76.5% of children had at least 1 office visit during the 2001-2002 influenza season (75.3% during 2002-2003). Among children without influenza vaccination, 72.9% had at least 1 missed opportunity for vaccination during the 2001-2002 season and 69.3% during 2002-2003. The most common outcome was having at least 1 missed opportunity (39.6%) in each of 2 successive influenza seasons. Eliminating missed opportunities prior to the historical peak of influenza season would have increased the influenza vaccination rate among this population of children to 76%.

Conclusions: Missed opportunities for influenza vaccination among children with asthma are common and are often repeated from one influenza season to the next. Future studies should assess how interventions could be aimed at patients and health care professionals to improve awareness of the need for annual influenza vaccination.

Arch Pediatr Adolesc Med. 2006;160:966-971

Asthma is a common chronic disease that affects 9 million children in the United States. The health services burden of asthma is substantial—especially among minority populations—often requiring physician office visits, emergency department (ED) visits, and hospitalizations. Children with asthma are at increased risk for influenza-related morbidity and mortality and consequently are recommended to receive an annual influenza vaccination.

Despite these long-standing recommendations, many high-risk children remain unvaccinated each influenza season. Prior studies have reported vaccination rates ranging from 7% to 26%. Somewhat higher rates have been observed among children with asthma in practice settings using reminder-recall notices for influenza vaccination, although even the most favorable of rates reported by primary care clinics are well below 50%. One important factor that may influence influenza vaccination rates is missed opportunities to vaccinate. Missed opportunities are visits when a vaccine-eligible child is seen by a health care professional, yet no vaccine is administered. Missed opportunities are a well-documented barrier to primary vaccinations among children. Prior studies of influenza vaccinations among children with asthma suggest that missed opportunities occur frequently and, if eliminated, could improve vaccination rates markedly. However, this work has primarily focused on privately insured children in a single influenza season. We are unaware of any previous studies that have assessed missed opportunities for influenza vaccination among economically disadvantaged children or have considered the degree to which individuals experience missed opportunities during successive influenza seasons.

Our objective in this study was to characterize missed opportunities for influenza vaccination among a population of children with asthma enrolled in Medicaid. We were interested in identifying chil-
children who missed opportunities for influenza vaccination in successive seasons to better understand the potential for improving and sustaining vaccination rates through interventions targeted at high-risk groups. Specifically, we sought to (1) assess influenza vaccination rates among children with asthma, (2) describe patterns of influenza vaccination and missed opportunities to vaccinate during successive influenza seasons, and (3) project potential improvements in influenza vaccination rates among this population by reducing missed opportunities to vaccinate during influenza season.

METHODS

This study is based on a retrospective analysis of administrative claims data for the Michigan Medicaid program and was approved by the University of Michigan institutional review board.

STUDY POPULATION

We identified a total of 4358 children between 5 and 18 years of age who were continuously enrolled in the Michigan Medicaid program, had no other source of health insurance, and had persistent asthma based on Health Plan Employer Data and Information Set (HEDIS) criteria for calendar years 2001 and 2002. The HEDIS persistent asthma criteria require administrative claims evidence of a child having any of the following within 2 consecutive calendar years: at least 4 asthma medication-dispensing events, at least 1 inpatient or 1 ED claim with a primary diagnosis of asthma, or at least 4 outpatient visits with an asthma diagnosis and at least 2 asthma medication-dispensing events. The HEDIS criteria, detailed in a comprehensive list from the National Committee for Quality Assurance, classify an asthma medication-dispensing event as 1 prescription of a supply lasting 30 days or less. Evidence suggests that the identification of asthma cases using claims from 2 consecutive years improves asthma classification specificity.

Children younger than 5 years were excluded because the diagnosis of asthma is difficult among young children and administrative claims records may not reliably reflect persistent asthma cases for these age groups. We excluded children with other health insurance in addition to Medicaid to ensure that claims for all health services during the study period were available in the Medicaid administrative data files. Medicaid program eligibility and demographic characteristics were obtained for each subject from the Medicaid administrative files, including all children enrolled in either a fee-for-service or managed care health plan during the study period.

OUTCOME MEASURES

Four outcomes were measured for the 2001-2002 and 2002-2003 influenza seasons: (1) outpatient office visits, (2) influenza vaccinations, (3) missed opportunities for influenza vaccination, and (4) asthma ED visits. The date at which each outcome occurred was determined for the period from October 1 through January 31, which was considered the influenza vaccination season for this study. The Advisory Committee on Immunization Practices indicates that the optimal time to vac-

STATISTICAL ANALYSIS

We performed χ² tests to assess differences in each outcome measured by demographic characteristics. Simulated influenza vaccination rates were estimated based on observed vaccination rates and the date of missed opportunities during the influenza seasons. The potential achievable influenza vaccination rate was estimated for 3 scenarios of potential reductions in missed opportunities (25%, 50%, and 100%) using the observed dates for first missed opportunities. For each scenario, a corresponding proportion of initial missed opportunities at any point in time (eg, every fourth, every other, or every missed opportunity) were classified as being immunized. Claims data reduction and summarization were conducted using SAS version 9 statistical software (SAS Institute Inc, Cary, NC).

Table 1 summarizes the demographic characteristics of our study population of 4358 children with persistent asthma; most (74.6%) of our study population was enrolled in the same Medicaid health plan throughout the 2-year study period. During the 2001-2002 influenza season, the 4358 children had a total of 19 609 office visits: 3335 children (76.5%) had at least 1 office visit, and 2826 (64.9%) had 2 or more visits. During the 2002-2003 influenza season, there were a total of 13 219 office visits: 3280 children (75.3%) had at least 1 office visit and 2682 (61.5%) had 2 or more visits. Most children (64.5%) had an office visit during both influ-
Enza seasons, whereas 12.7% had no visit during either season. Overall, the vast majority of children had at least 1 short-term or long-term care visit (74.5% for 2001-2002 and 72.8% for 2002-2003), followed by those with preventive medicine or general medical examinations (18.7% and 18.9%). During the 2001-2002 influenza season, 2025 children (46.5%) had at least 1 office visit with an asthma diagnosis reported (2039 [46.8%] in 2002-2003).

During the 2001-2002 season, 16.7% of children with asthma had an influenza vaccination; among the 3630 children not vaccinated, 2647 (72.9%) had at least 1 missed opportunity during that influenza season. During the 2002-2003 season, 21.8% of children with asthma had an influenza vaccination; among the 3408 children not vaccinated, 2363 (69.3%) had at least 1 missed opportunity. Two thirds of children with missed opportunities during the 2001-2002 season had at least 1 office visit with an asthma diagnosis (58.2% during 2002-2003).

**Figure 1** summarizes the proportion of children with influenza vaccination or missed opportunities during both influenza seasons. Less than 10% of children received influenza vaccinations in both seasons; the vast majority (71.0%) were not vaccinated in either season. The most common outcome during the 2 influenza seasons was having at least 1 missed opportunity in each season (39.6%). The timing of the first missed opportunity for unvaccinated children among those with at least 1 office visit is illustrated in **Table 2**. In both seasons, approximately half of the children experienced their initial missed opportunity in October, and nearly three quarters had their first missed opportunity by the end of November.

**Figure 2** contrasts outcomes for 3 groups of children during the 2002-2003 season: those having an influenza vaccination, a missed opportunity, or no office visit during the prior influenza season. For children with no office visits during the second influenza season, the figure also summarizes the frequency of asthma ED use. The figure illustrates that for each outcome observed during the first season, the same outcome was most common during the second season. For example, among the 728 children having an influenza vaccination during the first season, 414 (56.9%) also had an influenza vaccination during the following season. Children with a missed opportunity during the 2001-2002 season were most likely (65.1%) to also have a missed opportunity during the second season; similarly, children with no office visit during the first season were most likely (53.4%) to also have no office visit during the second season. Figure 2 illustrates that asthma ED use varied among children who had no office visits during the 2002-2003 influenza season, with the highest rates for the 525 children with no office visits in either influenza season. Compared with all other outcome groups, this group of children had the highest proportion of asthma ED users during the 2002-2003 season (23%; \( P = .004 \)).

### Table 1. Characteristics of the Study Population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of subjects</td>
<td>4358</td>
</tr>
<tr>
<td>Age, y</td>
<td></td>
</tr>
<tr>
<td>5-9</td>
<td>1614 (37.1)</td>
</tr>
<tr>
<td>10-14</td>
<td>1976 (45.3)</td>
</tr>
<tr>
<td>15-18</td>
<td>768 (17.6)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2571 (59.0)</td>
</tr>
<tr>
<td>Female</td>
<td>1787 (41.0)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1804 (41.4)</td>
</tr>
<tr>
<td>Black</td>
<td>2299 (52.8)</td>
</tr>
<tr>
<td>All others</td>
<td>255 (5.9)</td>
</tr>
<tr>
<td>Residence</td>
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</tr>
<tr>
<td>Urban</td>
<td>3693 (84.7)</td>
</tr>
<tr>
<td>Nonurban</td>
<td>665 (15.3)</td>
</tr>
<tr>
<td>Continuous enrollment in same Medicaid plan</td>
<td></td>
</tr>
<tr>
<td>&lt;22</td>
<td>1108 (25.4)</td>
</tr>
<tr>
<td>≥22</td>
<td>3250 (74.6)</td>
</tr>
</tbody>
</table>

![Figure 1](https://via.placeholder.com/150)
An important and unique component of our study was to document patterns of office visits and influenza vaccination across 2 successive influenza seasons, thereby demonstrating the pathways of care that characterize Medicaid-enrolled children with asthma. We found that children often experienced the same outcome during successive influenza seasons. The majority of children in this study had at least 1 office visit in each influenza season; therefore, these patterns may reflect consistent under-recognition (by either parents or physicians) of the need for annual influenza vaccination for children with asthma. Previous reports have suggested that the most common reasons for children with asthma not receiving an influenza vaccination include the vaccine not being recommended by a physician and parents not perceiving the risk of influenza for their children with asthma.15 Future studies should assess the extent to which certain patient and physician triggers are effective in reducing missed opportunities for influenza vaccination.

We also found that the lack of an office visit was a pattern that repeated itself from one influenza season to the next. For children without office visits during influenza season, these consistent patterns from season to season likely reflect health care–seeking behaviors on the part of these patients and families. Among these children, rates of missed opportunities in the office setting are nil since (by definition) a missed opportunity requires an office visit. On the other hand, we found that many unvaccinated children with no office visits had an asthma ED visit during influenza season. These ED visits may reflect differences in care seeking or severity of illness or may be an indicator of limited access to primary care for this group of children. These visits may represent a different form of missed opportunity, one with unique challenges. Using ED visits to improve childhood vaccination rates has historically proved difficult although it may represent the most commonly used source of care for some children.29,30 Vaccines may not be readily available in EDs,
and therefore these visits may reflect opportunities for referrals to patients’ primary care physicians for appropriate follow-up, including influenza vaccination.9

Strategies to reduce missed opportunities, such as standing orders and reminder-recall systems, have been explored in previous studies.13,31-40; these approaches may be applicable to reducing missed opportunities for influenza vaccination among children with asthma. These strategies may be beneficial for families and health care professionals by establishing expectations and routines for influenza vaccination year after year among children with asthma. The Task Force on Community Preventive Services has supported the use of reminder-recall systems that can be integrated within immunization registries or clinical information systems and can be directed to cue physicians and patients (or their parents) into action.31 Using this information, the health care professional can either recommend a vaccination to the patient at a medical visit or send a reminder to the patient to return for vaccination. The potential for improvement through reminder-recall notices has been demonstrated for primary vaccination rates41-45 as well as for influenza vaccination among children with asthma15 and those with high-risk conditions.13 Given our finding that most unvaccinated children had at least 1 missed opportunity and were therefore in a medical office during influenza season, emphasis should be placed on implementing physician-focused reminder systems. Reminder systems that prompt parents (such as mailed reminder notices) may also be effective in conveying to the physician cues to action regarding administering influenza vaccine to children with asthma. Mailed vaccination reminders provide parents with a tangible mechanism to prompt physicians during office visits to explicitly discuss their child’s eligibility for influenza vaccination. In addition to reminder systems, standing orders may be an effective mechanism for improving influenza vaccination rates.31,38,39

Our results suggest that even a modest reduction in missed opportunities among this population of children could substantially increase influenza vaccination rates prior to the historical peak of influenza activity,7 consistent with findings for a primarily privately insured group of children with asthma.11 We also found that many children do not receive influenza vaccination and have missed opportunities in successive years, suggesting that these occurrences do not reflect isolated events and may be more deeply rooted in physician attitudes and behaviors. Interventions aimed at eliminating the underlying cause of these missed opportunities could result in an influenza vaccination rate higher than 60% and potentially help to establish for families and physicians an expectation for, and a long-term pattern of, annual influenza vaccination.

This study has several limitations. We used a HEDIS-based approach with administrative claims data, since this method is used widely in the United States and is familiar to physicians and health plans. Prior studies have shown that the HEDIS classification for persistent asthma that we used in this study generally has high sensitivity but lower specificity for distinguishing asthma severity.46 Because the HEDIS case definition for persistent asthma is not based on objective clinical criteria, our findings may have limited generalizability to settings that use alternative asthma classification criteria (eg, symptoms or pulmonary function testing) to distinguish intermittent cases from severe asthma cases. These data did not allow us to determine cases in which an influenza vaccination was recommended but refused by the parent, a valid contraindication existed, or children may have obtained influenza vaccinations through health fairs or free clinics. In addition, we were unable to distinguish whether office visits made were with specialists or primary care physicians. Although the completeness of the data reported by Michigan Medicaid managed care plans is generally good, there are variations in the timeliness, accuracy, and thoroughness of plans’ claims data. In an effort to maximize the completeness of vaccination records, we augmented Medicaid administrative claims data with immunization registry information.

CONCLUSIONS

We conclude from our findings that influenza vaccination rates are low among children with persistent asthma enrolled in Medicaid. Missed opportunities to vaccinate for influenza are more common than vaccination among these children and frequently occur in successive influenza seasons. Missed opportunities often occur early in the influenza season and, if addressed, could raise influenza vaccination rates substantially. These findings underscore the need for interventions aimed at improving physician and parent awareness of the need for annual influenza vaccination for children with asthma.

Accepted for Publication: May 8, 2006.

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Author Contributions: Dr Dombkowski had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: Dombkowski and Clark.
The document contains references to various studies and guidelines related to asthma and influenza vaccination, including:

15. Sztaj Erd, Clark, and Davis. 22, 2005, Washington, DC; and the Pediatric Academic Societies’ Annual Meeting, May 14, 2005, Washington, DC. Acknowledgment: We thank Susan Moran, BSN, MPH, of the Michigan Department of Community Health for her insights and comments regarding this study.

REFERENCES