Missed Opportunities for Influenza Vaccination in Children With Chronic Medical Conditions

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Objectives: To assess the frequency and characteristics of missed opportunities for influenza immunization in children with chronic medical conditions and, among unimmunized children in that group, to explore parent-reported reasons for not vaccinating their child.

Design: Prospective cohort study. Data were obtained from billing and immunization registry databases and telephone interviews of parents.

Setting: Four pediatric practices in metropolitan Denver, Colo, during the 2002-2003 influenza season.

Participants: Children aged 6 to 72 months with 1 or more chronic medical conditions.

Main Outcome Measure: A missed opportunity for influenza immunization, defined as having a billed encounter, being eligible for immunization, and not receiving vaccine. Subjects with asthma were analyzed separately from those with other conditions.

Results: We identified 926 children with chronic conditions: 820 (89%) with asthma only and 106 (11%) with other conditions. Missed opportunities occurred at 78% of all vaccine-eligible visits for children with asthma and 74% of all visits for children with other conditions. For children with asthma, 92% of vaccine-eligible visits in December and January resulted in a missed opportunity vs 69% in October and November; for children with other conditions, corresponding frequencies were 86% vs 68%, respectively. For children with asthma, 86% of non-well-child visits resulted in a missed opportunity, compared with 62% of well-child visits; similar frequencies were seen among children with other chronic conditions. Parents of unimmunized children reported lack of a physician recommendation and low perceived susceptibility to influenza as the primary reasons for not immunizing their child.

Conclusion: Missed opportunities contribute significantly to low influenza immunization rates among children with chronic medical conditions.

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The influenza viruses cause substantial morbidity and mortality in the United States every year. \(^1\)\(^2\) Children and adults with chronic medical conditions are particularly at risk for complications, hospitalizations, and death during annual influenza epidemics. \(^3\)\(^5\) Vaccination remains the primary means of reducing influenza-associated morbidity. \(^6\) However, although influenza vaccination for children with chronic medical conditions has been recommended for decades, \(^7\)\(^8\) influenza immunization rates in this vulnerable population are strikingly poor. In primary care settings, influenza immunization rates for children with asthma are typically 30% to 42% when patient reminder/recall is used \(^9\)\(^11\) and only 7% to 10% in the absence of patient reminder/recall. \(^9\)\(^10\)\(^12\) Although the factors responsible for persistently low influenza immunization rates are not fully understood, missed vaccination opportunities may have an important role. Missed opportunities, in which vaccine-eligible individuals are seen for care but not vaccinated, contribute significantly to underimmunization for routinely recommended pediatric vaccines. \(^13\)\(^14\) Less is known regarding the impact of missed opportunities on influenza immunization rates in children with chronic medical conditions. One investigation, \(^15\) conducted in a primary care clinic and an emergency department of a teaching hospital, found that 30% of all children with asthma did not receive influenza vaccine despite having been seen at least once during October through January. Similarly, in 2 large health maintenance organizations, 61% of unimmu-
nized children with asthma had 1 or more outpatient visits during September through December. However, little is known about missed opportunities for influenza vaccination in other settings or in children with conditions other than asthma.

In this study of children with chronic medical conditions seen in private pediatric practices, our objectives were to: (1) determine the frequency and characteristics of missed opportunities for influenza immunization, and (2) among unimmunized children, explore parent-reported reasons for not vaccinating their child.

METHODS

STUDY SETTING

This investigation was conducted in 4 private pediatric practices in metropolitan Denver, Colo, during the 2002-2003 influenza season. These practices shared a computerized billing system and also participated in an immunization registry. Study sites had a range of 3 to 8 pediatricians and 2 to 6 nonphysician providers per practice.

The study was conducted concurrently with a randomized controlled trial of patient reminder/recall for influenza vaccination. Study subjects for the present investigation received no intervention as part of the reminder/recall trial, and there were no interventions targeted at missed opportunities conducted in these practices. The study period for assessment of missed opportunities was October 1, 2002, through January 31, 2003. There were no influenza vaccine delays or shortages during this period. This investigation was reviewed by the Colorado Multiple Institutional Review Board, approved as exempt research, and designated as not requiring informed consent.

STUDY POPULATION

In August 2002, we identified a cohort of children aged 6 to 72 months who, because of having 1 or more high-risk conditions (HRCs), were targeted for influenza immunization. Children with HRCs were identified from billing data by using a previously developed set of diagnostic codes. This method of HRC identification was documented to have a sensitivity of 72%, a specificity of 93%, and an overall accuracy of 90% compared with medical records. Children were eligible for the study if they had had 1 or more visits for an HRC in the preceding 2 years and 1 or more visits for any reason in the preceding 18 months. Excluded were children who had moved to another clinic and siblings of children with HRCs living in the same household. Because this investigation was not designed to test the effect of patient reminder/recall on missed opportunities, we excluded subjects who were randomized to receive letters as part of the reminder/recall trial.

DATA SOURCES

Billing Database

The practices' billing system contained demographic information for every patient; International Classification of Diseases, 9th Revision, diagnostic codes for each clinical encounter; and procedural codes for immunizations given. By means of standard evaluation and management procedural codes, the billing database was also used to define all visits as either well-child care (WCC) or non-WCC.

Immunization Registry

All study practices participated in an Internet-based regional immunization registry. When these practices joined the registry in 2001-2002, only children 72 months or younger were entered into the registry; children older than 72 months were therefore not included in this study. Registry data quality was assessed in November and December 2002: in a review of 103 medical records containing 1471 vaccinations, 86% of all vaccines listed in the medical records were accurately entered into the registry.

Telephone Survey

In April and May 2003, we telephoned parents of a randomly selected subset of children not given influenza vaccine at a study practice. Parents were asked whether their child had received influenza vaccine during the preceding fall or winter and, if so, at what clinic. Parents of unimmunized children were also probed in an open-ended manner about reasons for not immunizing their child.

STUDY OUTCOMES

The primary study outcome was a missed opportunity for influenza immunization, defined as a billed encounter that occurred between October 1, 2002, and January 31, 2003, at which a subject was eligible for immunization but not vaccinated. Because the only absolute contraindication to influenza vaccination is a history of anaphylaxis to eggs or other vaccine components, and relative contraindications to vaccination are uncommon, we considered all visits of unimmunized children as vaccine-eligible visits. A subject was considered vaccinated if 1 or more influenza doses was documented in either the registry or billing database. Individual subjects may have had multiple missed opportunities, each of which was analyzed as a separate event.

DATA ANALYSES

For analysis of the characteristics of missed opportunities, subjects with asthma and no other coexisting condition were analyzed separately from subjects with single nonasthma HRCs or multiple HRCs. To account for the clustering of multiple missed opportunities within individual subjects, tests of significance for visit-level comparisons were performed using generalized linear models. Estimates of effect size were calculated with 95% confidence intervals (CIs). All analyses were performed with SAS software (SAS Institute Inc, Cary, NC).

RESULTS

DEMOGRAPHICS

We identified 17 273 patients aged 6 to 72 months with 1 or more office visits in the preceding 18 months, of whom 2007 (12%) had 1 or more HRCs. Of children with HRCs, 1081 were excluded: 915 who received interventions as part of the patient reminder/recall trial, 156 who lived in the same household as another subject, and 10 who had received influenza vaccine before the study period. The remaining 926 children constituted the study population. Of these, 594 (64%) were male and 734 (79%) were between 24 and 72 months of age. Insurance status was as follows: 780 (84%) of the subjects were pri-
HRCs IDENTIFIED

Most (n=820 [89%]) of the subjects with HRCs were diagnosed as having asthma only, with no other coexisting conditions. Other HRCs identified included chronic cardiac conditions (n=26 [3%]); immunosuppressive disorders or therapies (n=15 [2%]); chronic nonasthma pulmonary conditions (n=15 [2%]); and other HRCs (n=22 [2%]). Twenty-eight subjects (3%) had multiple HRCs.

CHARACTERISTICS OF MISSED OPPORTUNITIES

Children With Asthma

Immunization outcomes for the 820 subjects with asthma and no other coexisting conditions were as follows: 133 (16%) received influenza vaccine at their first office visit, 61 (7%) had 1 or more missed opportunities but were subsequently immunized, 309 (38%) had 1 or more missed opportunities and were never immunized, and 317 (39%) had no office visit and were never immunized. Of all 820 subjects with asthma, 177 (22%) had multiple missed opportunities. In addition, the cumulative proportion of children with missed opportunities exceeded the cumulative proportion immunized each month in 3 of the 4 study practices (Figure 1). If all subjects had been immunized at their first opportunity, each site would have achieved influenza immunization rates of 50% or greater (average, 61%).

From October 1, 2002, through January 31, 2003, children with asthma had 881 visits at which they were eligible for influenza vaccination. Children with 1 or more visits were younger (mean age, 40.7 months vs 43.9 months; difference, 3.2 months; 95% CI, 0.8-5.5 months) and were more likely than those without a visit to be privately insured (86% vs 80%; difference, 6%; 95% CI, 1%-12%). Of all vaccine-eligible visits, 78% resulted in a missed opportunity. Missed opportunities occurred at 69% of vaccine-eligible visits during October and November compared with 92% of vaccine-eligible visits in December and January (difference, 23%; 95% CI, 19%-28%). As shown in Figure 2, although the total number of vaccine-eligible visits was highest in October, when few children with asthma were already vaccinated, the proportion of visits resulting in a missed opportunity was highest in December and January.

Of all 881 vaccine-eligible visits, 184 were WCC visits, 668 were non-WCC visits, and the visit type was not recorded for 29 visits. Missed opportunities occurred at 62% of WCC visits and 86% of non-WCC visits (difference, 24%; 95% CI, 16%-31%). The influenza immunization rate was 43% among subjects with a vaccine-eligible WCC visit compared with 18% for those without a vaccine-eligible WCC visit (difference, 25%; 95% CI, 16%-32%).

Children With Other HRCs

Immunization outcomes for the 106 children with single nonasthma HRCs or multiple HRCs were as follows: 23 (22%) received influenza vaccine at their first office visit,
10 (9%) had 1 or more missed opportunities but were subsequently immunized, 34 (32%) had 1 or more missed opportunities and were never immunized, and 39 (37%) had no office visit and were never immunized. Of all subjects with other conditions, 19 (18%) had multiple missed opportunities. If all subjects had been immunized at their first opportunity, study sites would have achieved an average influenza immunization rate of 62% in these children.

During the study period, children with other HRCs had 129 vaccine-eligible visits. Children with 1 or more visits were younger than those without a visit (mean age, 26.9 months vs 35.4 months; difference, 8.5 months; 95% CI, 1.1-15.7 months). Of all vaccine-eligible visits, 74% resulted in a missed opportunity. Missed opportunities occurred at 68% of vaccine-eligible visits during October and November compared with 86% of vaccine-eligible visits in December and January (difference, 18%; 95% CI, −2% to 34%). The influenza immunization rate of 61% in these children.

Comparison Between Children With Asthma and Those With Other HRCs

The characteristics of missed opportunities were similar between children with asthma only and those with other HRCs. The percentage of vaccine-eligible visits that resulted in a missed opportunity was similar for the 2 groups (78% for children with asthma, 74% for children with other HRCs; difference, 4%; 95% CI, −4% to 12%). If all subjects had been immunized at their first opportunity, study sites would have achieved similar influenza immunization rates in these 2 groups (61% for asthma vs 62% for other HRCs; difference, 1%; 95% CI, −9% to 11%). Missed opportunities were significantly more likely in October and November than in December and January for both groups.

PATIENT FACTORS ASSOCIATED WITH MISSED OPPORTUNITIES

For this analysis, 343 subjects with missed opportunities who were never subsequently immunized were compared with 156 subjects who were immunized at their first visit. Subjects with missed opportunities were less likely than those without to be privately insured (83% vs 95%; difference, 12%; 95% CI, 7%–17%). However, subjects with missed opportunities were not significantly different from those with no missed opportunities with respect to sex (66% vs 61% male; difference, 5%; 95% CI, −4% to 14%), mean age (40.0 months vs 38.6 months; difference, 1.4 months; 95% CI, −1.9 to 4.7 months), or type of HRC. (90% of subjects with missed opportunities had asthma only vs 85% of those with no missed opportunities; difference, 5%; 95% CI, −2% to 11%).

REASONS FOR NOT IMMUNIZING

Of the 699 subjects not immunized against influenza, 139 (20%) were randomly selected for survey administration; 88 (63%) of these completed a survey. For 10 subjects, parents reported that their child was actually immunized against influenza (4 at a study site, 6 elsewhere).

Parents of the remaining 78 unimmunized children were asked, “Why didn’t [your child] get a flu shot this year?” (Table). Parents’ reported reasons primarily related to lack of a physician recommendation or low perceived susceptibility to influenza. Parents of unimmunized children were also asked, “Has [your child] had a health condition or health problem that lasted longer than 3 months?” Although all subjects had HRCs identified by billing data, only 32 (41%) responded affirmatively: 30 of 73 (41%) for children with asthma only, and 2 of 5 (40%) for children with other HRCs (difference, 1%; 95% CI, −43% to 45%).

Influenza immunization rates among children with chronic medical conditions remain substantially lower2,12,24 than rates for all other recommended pediatric vaccines.25 In this investigation we found that missed opportunities for influenza immunization were strikingly common among children with asthma and other HRCs, particularly at non-WCC visits and later in the influenza season. If all patients with missed opportunities had been vaccinated at their first office visit, immunization rates would have more than doubled. The high inci-
ence of missed opportunities has important implications; either concerted effort is needed to develop successful strategies to reduce missed opportunities, or consideration should be given to whether expanding the age ranges for universal influenza immunization is feasible and desirable.

To effectively target high-risk individuals for influenza immunization, providers need to be aware that an HRC exists and recognize that particular condition as an indication for influenza immunization. When parents of unimmunized children were surveyed, many reported that influenza vaccine was never recommended for their child. It is plausible that physicians failed to recommend vaccine because they were not aware that it was indicated, and the lack of a recommendation then led to missed opportunities. This premise is consistent with other research documenting that a physician recommendation is an important predictor of influenza vaccination.20-27

Similarly, parents of children with targeted conditions must also recognize the need for influenza immunization. All children in this study had HRCs as determined by billing data, yet 59% of surveyed parents did not identify their child as such. There are several possible explanations for this finding. Children with certain conditions, such as mild asthma, may not have been perceived by their parents as having an HRC. It is also possible that some patients that we considered high-risk on the basis of billing data were actually healthy. However, in a previous investigation in the same setting,11 we found that billing data were an accurate means of identifying HRCs. Also, the prevalence of HRCs that we identified (12%) was similar to the prevalence documented in several other studies (7%-14%).3,28,29 Therefore, our data suggest that some patients who we considered unimmunized could have actually been vaccinated at a study practice or elsewhere, which would lead to an overestimation of missed opportunities.

Several factors may have contributed to the dramatic rise in missed opportunities that we observed in December and January. Study practices did not schedule “flu clinics” after November, and may not have ordered additional vaccine if their supplies ran out in December or January. Patients seen at non-WCC visits in December or January may have had an acute illness and therefore deferred immunization. Our survey results support these possibilities, as parents reported child illness and problems with vaccine and appointment availability as reasons for not vaccinating their child. Finally, the long-standing emphasis of the Advisory Committee on Immunization Practices on early influenza immunization7,8 may have inadvertently fostered a misperception among providers and/or parents that immunization in December or January was “too late” to prevent against influenza. In fact, in a national survey10 of family physicians and interns, 43% of respondents were reluctant to administer influenza vaccine after influenza activity had begun in their area.

Given the unique complexities of providing influenza vaccine to a targeted patient population in a narrow time interval, substantial reductions in missed opportunities may be difficult to achieve. In fact, a high incidence of missed opportunities could be interpreted as an indication of the difficulty in implementing risk-based compared with age-based immunization recommendations.6 For adults with asthma and diabetes mellitus, influenza immunization rates are higher among 50- to 64-year-olds, for whom universal influenza immunization is recommended, than among 18- to 49-year-olds, for whom immunization is based on risk categories.23 Similarly, higher influenza immunization rates were achieved with implementation of universal immunization of young children22 than had been previously achieved in the same setting using risk-based strategies.11

A patient's age is readily available at all patient visits, whereas an HRC may not be obvious to a provider, and providers may not easily recall specific risk categories. However, even if an expansion of age-based influenza recommendations could achieve higher immunization rates among children with HRCs, the feasibility, safety, and cost-effectiveness of this approach would need to be explored prior to a change in immunization policy.

This investigation has several limitations. The study was conducted in 4 private pediatric practices with relatively small Medicaid populations, and therefore may not be generalizable to other clinical settings. Because our definition of missed opportunities was based on billing data, it is possible that some encounters classified as missed opportunities were actually visits at which a contraindication to vaccination existed or parents refused vaccination. Similarly, healthy patients without an indication for influenza vaccination could have been misclassified in billing data as having an HRC, although it is reassuring that the prevalence of HRCs we identified was similar to that found in other investigations.3,28,29 In addition, because this study relied on billing data to identify HRCs, there may have been differences in how individual providers diagnosed and coded certain conditions such as asthma. Finally, some subjects whom we considered unimmunized could have actually been vaccinated at a study practice or elsewhere, which would lead to an overestimation of missed opportunities.

In conclusion, missed opportunities for influenza immunization are common among children with asthma and other HRCs, particularly at non-WCC visits and later in the influenza season, and are likely to contribute significantly to the persistently low influenza immunization rate in this population.

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Additional Information: Dr Daley had full access to all study data and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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REFERENCES