

Influenza Vaccination Among Children With Asthma in Medicaid Managed Care

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Objective.—To describe influenza vaccination rates and identify risk factors for missing vaccination among children with asthma in managed Medicaid.

Methods.—As part of a longitudinal study of asthma care quality, parents of children aged 2–16 years with asthma enrolled in Medicaid managed care organizations in Massachusetts, Washington, and California were surveyed by telephone at baseline and 1 year. We evaluated influenza vaccination rates during the follow-up year.

Results.—The study population included 1058 children with asthma. The influenza vaccination rate was 16% among all children with asthma and 21% among those with persistent asthma. Children with persistent asthma (odds ratio [OR] 0.53, 95% confidence interval [CI] 0.36–0.79) and those who had been hospitalized during the follow-up year (OR 0.29, 95% CI 0.11–0.76) were less likely to miss vaccination. Children older

than 9 years (OR 1.66, 95% CI 1.13–2.46) and children of parents with less than a high school education (OR 2.29, 95% CI 1.05–5.03), compared with a college degree, were at risk for missing vaccination. Among children with persistent asthma, older children (OR 1.65, 95% CI 1.01–2.69) and children of parents with less than a high school education (OR 4.13, 95% CI 1.43–11.90) were more likely to miss influenza vaccination.

Conclusions.—Our findings suggest that interventions directed toward older children and families with lower educational levels may help improve influenza vaccination rates among this high-risk group. The low overall vaccination rate highlights the need for improvement in this important component of asthma care quality for all children with asthma.

KEY WORDS: asthma; influenza vaccination; managed care; Medicaid

Ambulatory Pediatrics 2006;6:1–7

Poor and minority children are at heightened risk of asthma hospitalization, and they tend to receive fewer preventive visits and controller medications than their peers.^{1–9} National guidelines recommend influenza vaccination for children with asthma, but past studies suggest that only 10% to 30% of children with asthma actually receive this vaccine.^{10–18}

In the past decade, states have increasingly used managed care programs to deliver services to Medicaid-insured children. Studies of the quality of care delivered in Medicaid managed care programs have yielded conflicting results. Although some studies have suggested that managed Medicaid programs deliver preventive services at least as effectively as fee-for-service settings,^{19–21} others

have found deficiencies in quality of care.²² One study found an improvement in racial disparities in routine childhood immunization coverage after the implementation of Medicaid managed care.²¹ More evidence is needed about how children with chronic conditions fare in Medicaid managed care.

Influenza vaccination is a marker for quality of care among Medicaid-insured children with asthma, but little information is available on how effectively it is delivered in managed care programs. This study sought to address this gap in information by addressing these questions: 1) What is the rate of influenza vaccination among children with asthma in managed Medicaid? 2) Are those children with the most severe asthma more likely to receive influenza vaccination? and 3) How can policy makers and clinicians identify the children at highest risk of missing the vaccine? Because past studies have observed racial/ethnic and socioeconomic disparities in health care for children with asthma in Medicaid fee-for-service⁹ and general populations,²³ we tested the specific hypotheses that minority children and poorer children would be at higher risk of missing influenza vaccination in managed Medicaid programs.

METHODS

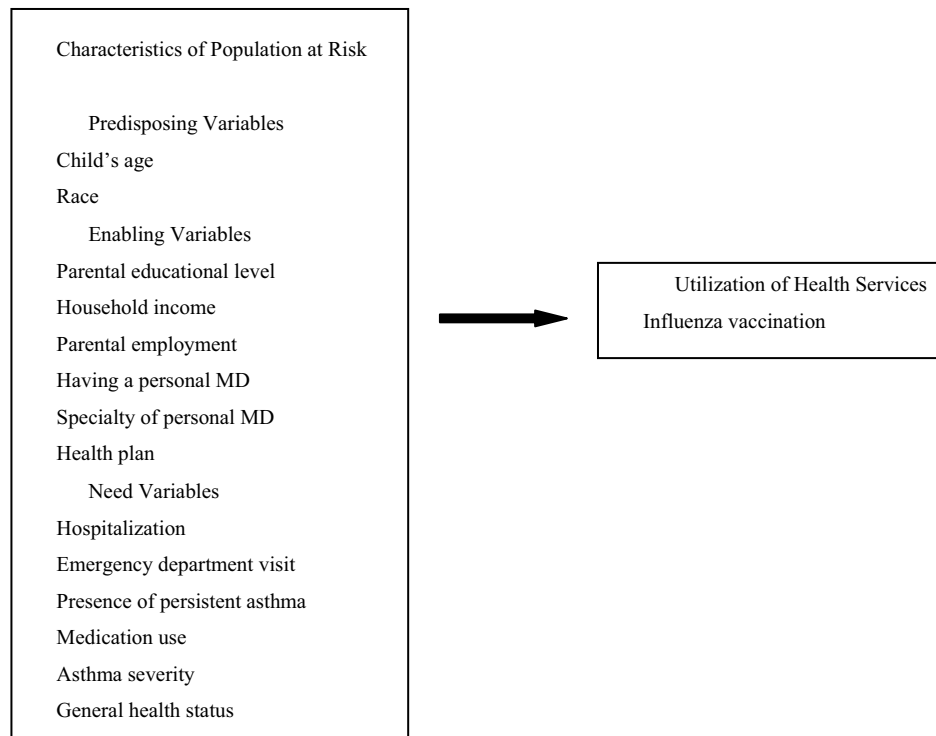
Design and Settings

The Asthma Care Quality Assessment (ACQA) Project was a prospective cohort study of Medicaid-insured children with asthma in 5 large, nonprofit managed care plans

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Received for publication March 23, 2005; accepted August 23, 2005.



Conceptual model of risk factors for missing influenza vaccination.

in 3 states. We studied children in 3 of these health plans, which had computerized data on influenza vaccination status: Harvard Vanguard Medical Associates in Massachusetts, Kaiser Permanente in Northern California, and Group Health Cooperative in the state of Washington. These were all mature nonprofit health plans with relatively cohesive provider groups that received capitated payment for care for all services, from ambulatory care to hospitalization.

Study Population

The target population was Medicaid-insured children aged 2 to 16 years identified with asthma based on the following criteria from computerized data: 1) an outpatient clinic visit, emergency department (ED) visit or hospitalization with ICD-9 code for asthma (493.0 to 493.9), 2) one or more pharmacy dispensings of cromolyn, nedocromil, or inhaled corticosteroids, or 3) two or more pharmacy dispensings of β -agonist medication during the 12 months before October 1998. For a child to be eligible, his or her parent also had to confirm at the start of the attempted telephone interview that a physician had diagnosed the child's asthma. This criteria was also used in other studies from the ACQA Project.⁶⁻⁷

Parent Interviews

Baseline telephone interviews were conducted between February and October 1999, with follow-up interviews 1 year later. The response rate for the baseline interviews was 66%. A contact letter with items of informed consent and a \$10 incentive for participation were mailed before the interviews. The study protocols were approved by the Institutional Review Boards at each study site.

Computerized Data

Computerized data were collected at baseline, between May 1998 and April 1999, with follow-up data collected 1 year later. Computerized data included hospitalizations, ED visits, and influenza vaccination status.

Variables and Definitions

The primary outcome measure was receipt of the influenza vaccine, as established by computerized data during the follow-up year, May 1999 to April 2000. The candidate variables were chosen on the basis of the theoretical model of access to care outlined by Aday and Andersen.²⁴ This model focuses on the effect of predisposing, enabling, and need variables among the population at risk on utilization of care. The Figure illustrates our conceptual model and candidate variables.

Predisposing and enabling variables included demographic and socioeconomic information, such as child's age, race, and parental education, employment, and income; they were based on responses from the baseline telephone interview. Enabling variables also included access to care. Parents were asked if there was one person they identified as their child's personal doctor or nurse and that provider's health care specialty. We also included a variable identifying which health plan the parent belonged to.

Measures of need included mainly characteristics of asthma severity and were drawn from the baseline telephone interview and computerized data. Parents were asked if their child had ever been hospitalized for asthma. Parents reported information on their child's asthma severity at the time of the interview and compared with the

previous year, as well as the frequency of symptoms and medication use, including β -agonist and anti-inflammatory medications, during the past 14 days. Parents were also asked to rate their child's general health. The asthma physical health scale of the American Academy of Pediatrics Child Health Status Assessment instrument for asthma was used to further assess asthma severity, and was also evaluated from the interview during the baseline and follow-up year.²⁵ Asthma status variables from the computerized data included hospitalizations and ED visits during the baseline and follow-up year.

We assessed persistent asthma status on the basis of the National Asthma Education and Prevention Program Expert Panel Report.²⁶ We identified children with persistent asthma as 1) having at least 5 asthma symptom-days in the past 2 weeks; 2) receiving β -agonist medication at least 3 times per week in the past 2 weeks, or 3) receiving daily anti-inflammatory medications in the past 2 weeks. We evaluated persistent asthma status during the baseline and follow-up year.

Statistical Methods

Bivariate analyses were conducted by the χ^2 analyses for categorical independent variables and logistic regression for ordinal or continuous independent variables. Bivariate analyses were used to assess socioeconomic disparities in influenza vaccination rates and to determine variables to include in the multivariate model. An iterative, forced-entry model, based on the framework outlined by Aday and Andersen²⁴ was built with the candidate variables identified in the bivariate analyses to determine risk factors for missing influenza vaccination. Variables significant at $P \leq .20$ in the bivariate analyses were entered in the multivariate logistic regression. Variables significant at $P \leq .10$ in the multivariate logistic model were retained in the final model. For the variables that were evaluated from the baseline and follow-up years (ED visit, hospitalization, persistent asthma status, and American Academy of Pediatrics [AAP] physical health scale), the variable with the higher level of statistical significance in the bivariate analyses that met the entry criteria was included in the multivariate model.

Children with persistent asthma have increased risk of hospitalization and other adverse events compared with children with intermittent asthma²⁶ and therefore may benefit more from influenza vaccination. For this reason, we repeated the bivariate and multivariate analyses among only children identified with persistent asthma. In this model, we also included the frequency of β -agonist and anti-inflammatory medication use during the past 2 weeks as covariates.

RESULTS

Population Characteristics

The study population included 1058 children with asthma from the 3 health plans: Group Health Cooperative, the Harvard Vanguard Medical Associates population of Harvard Pilgrim Health Care, and Kaiser Permanente. Approximately 57% of the population was male with a

Table 1. Characteristics of Study Population and Children With Persistent Asthma

Demographic Characteristic	Study Population (N = 1058)	Persistent Asthma (N = 490)
Sex, n (%)		
Male	608 (57)	295 (60)
Female	450 (43)	195 (40)
Age, n (%)		
2–8 years	597 (56)	279 (57)
9–16 years	461 (44)	211 (43)
Race, n (%)		
White	372 (35)	166 (34)
Black	449 (43)	218 (44)
Hispanic	95 (9)	45 (9)
Other (including multiracial)	139 (13)	61 (12)
Income, n (%)		
\leq \$20,000	577 (59)	279 (61)
\$20,000–\$40,000	303 (31)	139 (30)
$>$ \$40,000	92 (9)	42 (9)
Parental educational level, n (%)		
Less than high school	128 (12)	59 (12)
High school graduate	378 (36)	169 (35)
Some college	404 (39)	199 (41)
College graduate or more	139 (13)	61 (13)
Child asthma characteristics		
Any hospitalization for asthma, n (%)*	286 (27)	155 (32)
Hospitalization for asthma during the follow-up year,† n (%)	21 (2)	14 (3)
Emergency department visit during the follow-up year,† n (%)	27 (3)	14 (3)
AAP physical health scale (range 0–100), mean (SD)	82 (18)	72 (18)

*Based on parental report.

†Based on computerized medical records.

mean age (SD) in years of 8.4 (3.9). The study population was 43% African American, 35% white, and 9% Hispanic, and 60% of children were in families with household incomes below \$20,000. Among the children, 53% had persistent asthma. The distribution of demographic characteristics among the subgroup with persistent asthma was similar to the study population, which included all children with asthma (Table 1).

Risk Factors for Missing Influenza Vaccination

Only 16% of all children had received influenza vaccination. This rate was similar among all 3 health plans. Children with persistent asthma were less likely to miss influenza vaccination (21% vaccinated vs 12%, $P \leq .001$) (Table 2).

Children aged 9 to 16 years were at higher risk for missing influenza vaccination than younger children. Parents with less than a high school education were the least likely to obtain the influenza vaccine for their child, with only 10% vaccinated, compared with 14% among parents with a high school diploma, 16% among parents with some college, and 24% among parents with at least a college degree. Parents who reported that their child's general health was "fair" or "poor" were the most likely to have their child vaccinated (25%), compared with children whose health was rated as "good" (14%), "very good" (15%), or "excellent" (13%). Children who had an ED

Table 2. Factors Associated With Influenza Vaccination in Bivariate Analyses Among All Children With Asthma

Risk Factor	Number Vaccinated (%)	<i>P</i> Value
Age		.01
2–8 years	109/597 (18%)	
9–16 years	58/461 (13%)	
Parental educational level		.02
Less than high school	13/128 (10%)	
High school graduate	54/378 (14%)	
Some college	65/404 (16%)	
College graduate or more	33/139 (24%)	
Recent emergency department visit		.05
Yes	8/27 (30%)	
No	159/1031 (15%)	
Recent hospitalization		.001
Yes	9/21 (43%)	
No	158/1030 (15%)	
Persistent asthma		≤.001
Yes	103/490 (21%)	
No	52/427 (12%)	
General child health		.01
Excellent	35/260 (13%)	
Very good	52/348 (15%)	
Good	44/309 (14%)	
Fair or poor	35/139 (25%)	

visit (30% with an ED visit vs 15% without were vaccinated) or hospitalization (43% vs 15%) during the follow-up year were less likely to miss vaccination. However, only 3% of the study population were hospitalized and 2% had an ED visit for asthma, so the relative effects of these variables on the overall influenza vaccination rate was small. Race, income, and parental employment status did not have an effect on influenza vaccination (Table 2).

Table 3 depicts the odds ratios from the multivariate analysis among the study population. In the multivariate model, children with persistent asthma or who had a recent hospitalization during the follow-up year were less likely to miss influenza vaccination. However, the majority (75%) of children recently hospitalized also had persistent asthma. Children older than 9 years were more likely to miss influenza vaccination. When compared with parents with a college degree, parents with less education were more likely to miss vaccinating their child. Compared with children whose general health was rated as “fair” or “poor,” children whose parents reported better states of general health were more likely to miss vaccination. The following variables met the inclusion criteria for entry into the multivariate model, but were not retained because they were not statistically significant at $P \leq .10$: ED visit, parental report of asthma severity, AAP physical health scale, and asthma-symptom-free days.

Children With Persistent Asthma

Among children with persistent asthma, older children were at higher risk for missing vaccination. Children with a recent ED visit (43% vs 20%; $P = .04$) or hospitalization (43% vs 20%; $P = .04$) were less likely to miss vaccination. When vaccination rates were correlated with parental

Table 3. Risk Factors for Missing Influenza Vaccination in Multivariate Analyses Among All Children With Asthma*

Risk Factor	OR (95% CI)†	<i>P</i> Value
Age		
2–8 years	1.00 (Reference)	...
9–16 years	1.66 (1.13, 2.46)	≤.01
Parental educational level		.15‡
Less than high school	2.29 (1.05, 5.03)	.04
High school graduate	1.75 (0.98, 3.12)	.06
Some college	1.62 (0.93, 2.81)	.09
College graduate	1.00 (Reference)	...
Presence of persistent asthma	0.53 (0.36, 0.79)	≤.01
Recent hospitalization	0.29 (0.11, 0.76)	≤.01
General health scale		.20‡
Excellent	1.65 (0.91, 2.99)	.10
Very good	1.74 (0.99, 3.05)	.05
Good	1.76 (1.00, 3.13)	.05
Fair or poor	1.00 (Reference)	...

*The model adjusted for race, income, health plan, and having a primary care provider, none of which were statistically significant.

†The smaller sample size relative to the 1058 children identified with asthma in the study population reflects missing data.

‡The *P* value for the overall set of these variables was not significant, although the *P* values for some of the pairwise comparisons were significant. The *P* value for the overall set of variables reflects how much the set of variables adds to the multivariate model’s overall fit, whereas the *P* value for the pairwise comparisons measures differences between subgroups.

education, we found that rates ranged from 12% among parents with less than a high school diploma to 34% among parents with a college degree or more. Parents who reported their child’s general health as “fair” or “poor” were more likely to vaccinate their child (29%), compared with children whose parents reported their child’s health as “good” (15%).

In the multivariate model, older child age and lower levels of parental education remained risk factors for missing influenza vaccination (Table 4). Parental rating of their child’s general health did influence their child’s vaccination status, but not as strongly as parental educational level and child age. Variables for ED visit, hospitalization, and frequency of anti-inflammatory medication use were entered into the multivariate model but did not retain statistical significance at $P \leq .10$.

DISCUSSION

Major Findings

Among the Medicaid-insured children with asthma we studied, only 16% received influenza vaccination overall, and only 21% of those with persistent asthma were vaccinated. We found that parental education level led to differences in influenza vaccination rates, but other socioeconomic factors, such as race or income, did not display this correlation. However, even among children with parents with at least a college degree, the influenza vaccination rate was only 24%. Older children were at higher risk for missing vaccination. Children with persistent asthma or a recent hospitalization during the follow-up year were less likely to miss influenza vaccination.

Table 4. Risk Factors for Missing Influenza Vaccination in Multivariate Analyses Among Children With Persistent Asthma*

Risk Factor	OR (95% CI)† (N = 454)	P Value
Age		
2–8 years	1.00 (Reference)	...
9–16 years	1.65 (1.01, 2.69)	.04
Parental educational level		.04‡
Less than high school	4.13 (1.43, 11.9)	≤.01
High school graduate	2.31 (1.11, 4.81)	.03
Some college	1.99 (0.99, 4.00)	.05
College graduate	1.00 (Reference)	...
General health scale		.07‡
Excellent	1.82 (0.85, 3.88)	.12
Very good	1.31 (0.66, 2.60)	.45
Good	2.38 (1.16, 4.85)	.02
Fair or poor	1.00 (Reference)	...

*The model adjusted for race, income, health plan, and having a primary care provider, none of which were statistically significant.

†The smaller sample size relative to the 490 children identified with persistent asthma in the study reflects missing data.

‡The *P* value for the overall set of these variables was not significant, although the *P* values for some of the pairwise comparisons were significant. The *P* value for the overall set of variables reflects how much the set of variables adds to the multivariate model's overall fit, whereas the *P* value for the pairwise comparisons measures differences between subgroups.

Comparisons With Previous Studies

We had the unique opportunity to study a relatively large population of low-income children in managed Medicaid arrangements and identified specific demographic risk factors for missing influenza vaccination on the basis of both parent interviews and computerized data. Previous studies have not been able to evaluate race/ethnicity, parental education, or the other demographic risk factors we included in this analysis among a Medicaid-insured population.^{14–16}

Our finding that children with persistent asthma in families with lower parental education were at higher risk for their children missing influenza vaccination is in accord with previous research that has documented health care disparities based on socioeconomic factors.²³ Past studies have found that parents with lower education were less likely to report providing preventive medications for children with asthma.^{7,27} Studies of influenza vaccination in adults have also identified variations based on educational level as well as race/ethnicity.^{28,29}

Studies of underimmunization for routine childhood vaccines have also consistently shown poor and publicly insured children to be at risk for underimmunization.^{30–33} Other risk factors for underimmunization for routine childhood vaccination include lack of prenatal care and single-parent households.^{30,32,33}

In this study, we did not observe racial/ethnic disparities in influenza vaccination rates. This is consistent with the suggestion of Isaacs and Schroeder³⁴ that although race and class both have an effect on health, class may have a more powerful effect. The lack of variation we observed among different racial/ethnic groups, as well as the lack of association with income, may be due in part to the study

population being composed of Medicaid-insured children who were all from relatively low-income families.

The overall vaccination rate of 16% was comparable to other studies. One study found an overall influenza vaccination rate of 17% among 315 children with asthma enrolled in Medicaid managed care, with 25% of high utilizers of medical services being vaccinated.¹⁷ In a study among 187 children with asthma enrolled in New York State's Child Health Plus program, less than 10% were vaccinated against influenza.¹⁸ In a large study among children with asthma in 4 health maintenance organizations, only 9%–10% received the influenza vaccine.¹⁴ A recent study among privately insured children aged 6 to 72 months with chronic conditions found an influenza vaccination rate of 25% among control subjects and 42% among subjects who received a reminder/recall.³⁵ Our finding that children with persistent asthma were more likely to be vaccinated is consistent with previous studies that have found that children with higher asthma severity based on hospitalizations, ED visits, or medications were more likely to be vaccinated.^{14,16,17}

Limitations

This study was conducted in relatively well-established, integrated managed care plans. Because the provider groups in these settings received capitated payment for all care including hospitalization, they may have tended to emphasize preventive care more than other programs. The rates we observed in this study may not be representative of other Medicaid managed care programs with less mature or less integrated systems. However, the fact that we conducted the study in well-established health maintenance organizations makes the low influenza vaccination rates we observed in these settings even more striking.

The children with asthma in our study were enrolled in managed care plans and actively seeking care. Therefore, they should have better indicators of asthma care, including influenza vaccination rates, than poor children not accessing the health care system. It is likely that rates are even lower among the larger population of children in poverty.

This study did not have information about whether parents had received a physician recommendation for the influenza vaccine. Past studies have shown that a physician recommendation is a significant positive predictor of influenza vaccination among children with asthma.^{15,36,37} Although we cannot comment on the frequency and effect of physician recommendations on vaccination status, it is clear that more widespread attention to promoting influenza vaccination in this population is needed.

Influenza vaccination status was based on computerized medical records. Therefore, we do not have information about influenza vaccination provided outside of a child's primary health care system. However, another study we conducted in the Massachusetts population of this study suggested that receipt of influenza vaccination at sites other than the primary care provider was uncommon.³⁸

Since the collection of this data, there has been more attention paid to influenza vaccination nationally and in

primary care settings. Influenza vaccination has received more attention in the media, particularly serious morbidity among children during the 2003–2004 influenza season,³⁹ and a vaccine shortage⁴⁰ during the 2003–2004 and 2004–2005 influenza seasons. Our study cannot address these potential changes in parents' views of the influenza vaccine and changes in vaccination practices among providers and health care delivery systems.

Implications

Influenza vaccination rates among the children with asthma in this study were low despite insurance coverage for this service and enrollment in well-established health plans. Effective interventions are needed to improve influenza vaccination delivery to this high-risk group.

ACKNOWLEDGMENTS

This study was supported in part by Health Resources and Services Administration grant T32 HP 10018 to the Harvard Pediatric Health Services Research Fellowship Program (Dr Gnanasekaran), and by a Mid-Career Investigator Award in Patient-Oriented Research from the National Institute of Child Health and Human Services (K24 HD047667 to Dr Lieu). The ACQA Project was supported by the Agency for Healthcare Research and Quality (U01 HS09935), the American Association of Health Plans (now America's Health Insurance Plans), and the Maternal and Child Health Bureau, Health Resources and Services Administration. We acknowledge the contributions of the original ACQA Project team, especially Nancy Jensvold, MPH, our project coordinator, and Angela Capra, MA, our senior analyst.

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