
Frequency of Prescription of Inhaled Corticosteroids to Children with Asthma in U.S. Emergency Departments

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Abstract

Objectives: This study examined how frequently inhaled corticosteroids (ICS) are prescribed at discharge in U.S. emergency departments (EDs) for children presenting with asthma exacerbations.

Methods: This was a secondary analysis of the 2005–2007 National Hospital Ambulatory Medical Care Survey (NHAMCS) database for ED visits by children 2 to 21 years old with acute respiratory symptoms and a diagnosis of asthma exacerbation. The authors determined the proportion of visits with an ICS prescription at discharge, and the associations between demographic, clinical factors, and ICS prescriptions were analyzed using logistic regression.

Results: Between 2005 and 2007, there were 2,288,874 estimated visits by children 2 to 21 years old to U.S. EDs with asthma exacerbations, and ICS were prescribed at discharge at 4.0% of these visits (95% confidence interval [CI] = 2.4% to 5.5%). In the logistic regression model, ICS were more likely to be prescribed in the fall (adjusted odds ratio [OR] vs. spring 3.3; 95% CI = 1.0 to 11.0). Otherwise, there were no pertinent demographic or clinical factors associated with ICS prescription.

Conclusions: Inhaled corticosteroids are infrequently prescribed for children with asthma at discharge from U.S. EDs. Other than the fall season, there are no identified demographic or clinical factors associated with the likelihood of ICS prescriptions. ED clinicians should consider interventions to increase ICS prescriptions for children with persistent asthma.

ACADEMIC EMERGENCY MEDICINE 2011; 18:767–770 © 2011 by the Society for Academic Emergency Medicine

The National Heart, Lung, and Blood Institute asthma guidelines recommend that children with persistent asthma should take daily inhaled corticosteroids (ICS).¹ Despite these recommendations, children with persistent asthma often are not using ICS. Given the frequency of emergency department (ED)

visits for asthma, ED clinicians have been called on to increase efforts to reduce the burden of asthma. One intervention suggested by asthma guidelines¹ based on expert consensus is prescribing ICS during an ED visit for children with persistent asthma. Children visiting EDs are at high risk of not using asthma controller medications.²

To the best of our knowledge, the frequency of ICS prescriptions from a representative sample of U.S. EDs is unknown. Our goal was to determine the ICS prescribing frequency at discharge for children with asthma at U.S. EDs. We hypothesized that ICS are prescribed infrequently from EDs. This analysis would establish a baseline for ICS prescriptions in EDs and could be repeated longitudinally to follow trends. In addition, we examined whether available demographic or clinical factors are associated with ICS prescribing.

METHODS

Study Design

This was a secondary analysis using the National Hospital Ambulatory Medical Care Survey (NHAMCS)

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Received October 22, 2010; revisions received December 30, 2010 and January 4, 2011; accepted January 5, 2011.

Presented at the American College of Emergency Physicians Scientific Assembly, Boston, MA, October 2009.

There was no outside financial support for this investigation or manuscript development. There were also no financial arrangements that may represent a conflict of interest.

Supervising Editor: Marc Gorelick, MD.

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database between January 1, 2005, and December 31, 2007, the period when the NHAMCS differentiated discharge medications from medications administered during the visit. The institutional review board exempted this study from full review.

Study Setting and Population

The NHAMCS sampling methods have been documented elsewhere.³ Data collection includes a representative sample of U.S. EDs at noninstitutional and short-stay hospitals. Urgent care centers, facilities not open 24 hours a day, federal, military, and Veterans Administration hospitals are excluded. The NHAMCS uses a four-stage probability design to sample 1) geographic areas in the United States, 2) hospitals in these areas, 3) EDs in these hospitals, and 4) patient visits to these EDs. Data are abstracted from ED medical records with rigorous quality control procedures to minimize errors. From the sampled data, weights are applied to estimate U.S. ED visits.

Selection of Population. To identify ED visits by 2- to 21-year-old patients with acute respiratory symptoms, we selected reason-for-visit terms from 1) studies of ED visit logs to identify asthma cases^{4,5} and 2) terms identified by the study investigators that were commonly associated with the International Classification of Diseases, ninth revision (ICD-9), code 493 for asthma. Selected terms included shortness of breath, labored or difficult breathing, wheezing, breathing problems, cough, congestion in chest, asthma, other respiratory diseases, general ill feeling, chest pain and related symptoms, nasal congestion, other symptoms referable to the respiratory system, other symptoms of nose, head cold, upper respiratory infection, and abnormalities of sputum or phlegm. We used reason-for-visit codes to ensure the presence of acute respiratory illness to exclude cases where asthma was a comorbid diagnosis in addition to the primary diagnosis (for example, an injury with asthma as a secondary diagnosis). We analyzed bronchodilator administration as a predictor variable for ICS prescription and not an inclusion criterion. Conceivably a mild asthma exacerbation may not require treatment in the ED (for example, if a child treated prior to arrival is subsequently asymptomatic).

Study Protocol

We queried the NHAMCS database using these terms to generate our sample. In a preliminary data review we confirmed these reason-for-visit terms were sensitive for asthma, as 84% of visits with ICD-9 code 493 had one of these terms. Exclusion criteria included hospital admission or transfer to another facility. Children younger than 2 years old were excluded to avoid misclassification with bronchiolitis. From the remaining visits, we identified our sample as visits with a discharge ICD-9 code 493. The primary outcome was the proportion of ED visits with ICS medications prescribed.

Data Analysis

Recommended rules for using the NHAMCS for analyses based upon sample size were followed.⁶ Direct

logistic regression was used to analyze the association between ICS prescriptions and demographic and clinical variables including age, sex, ethnicity, race, insurance, geographic region, metropolitan versus non-metropolitan area, ED provider, triage-assigned immediacy to be seen, season, and asthma medications administered in the ED. The categories of medications administered included: 1) short-acting β -agonist (SABA) and oral corticosteroid (OCS), 2) SABA alone, 3) OCS alone, and 4) no SABA or OCS. Pearson's chi-square tests were used to determine the association between ICS prescriptions and demographic/clinical factors. Variables associated with ICS prescriptions at $\alpha \leq 0.10$ level were included in the regression model. Analyses were performed using SAS 9.1.3 (SAS Institute Inc., Cary, NC).

RESULTS

There were 3,678 visits in the NHAMCS from 2005 to 2007 with the selected reason-for-visit terms for study inclusion. This represents an estimated 12,169,808 visits for children 2 to 21 years old with acute respiratory symptoms discharged from the ED. An estimated 2,288,874 (19%) visits had an ICD-9 code of 493. ICS were prescribed at 90,655 (4.0%; 95% confidence interval [CI] = 2.4% to 5.5%) of these visits.

The study sample was 51% female, with 24% of children 2 to 4 years old, 43% 5 to 12 years old, and 33% 13 to 21 years old. Approximately 61% of children had race reported as white and 36% as black or African American. Ethnicity was reported for 24% of children as Hispanic. Insurance coverage included 33% private insurance, 46% public insurance, and 21% self-pay or other. Most visits (87%) occurred in a metropolitan ED.

Demographic and clinical variables with significant associations with ICS prescriptions at $\alpha \leq 0.10$ in univariate analyses included ethnicity (odds ratio [OR] = 0.12 for unknown ethnicity; 95% CI = 0.013 to 1.1), race (OR = 2.4 for black or African American; 95% CI = 1.0 to 5.4; vs. white), ED provider (OR = 2.4 for ED attending physician with mid-level provider/resident; 95% CI = 1.0 to 5.9; vs. ED attending only), and season (OR = 3.6 for fall; 95% CI = 1.1 to 11.6; vs. spring). Clinically important variables not associated with ICS prescription included age, sex, insurance, geographic region, metropolitan area, triage immediacy, and medications administered in the ED.

The results of the multivariable logistic regression for ICS prescription are displayed in Table 1. The area under the receiving operating characteristic curve for this model was 0.71 (fair accuracy). The variables included in the model were functionally distinct and did not show evidence of multicollinearity. Visits in the fall had a greater likelihood of ICS prescription (adjusted OR = 3.3; 95% CI = 1.0 to 11.0; vs. spring). The other factors included in the model were not associated with ICS prescriptions.

DISCUSSION

Inhaled corticosteroids are prescribed at discharge to children with asthma at only 4% of visits to U.S. EDs.

Table 1
Multivariable Logistic Regression

Variable	OR (95% CI)
Ethnicity	
Hispanic	Reference
Non-Hispanic	1.1 (0.4–3.5)
Unknown	0.1 (0.02–1.3)
Race	
White	Reference
Black or African American	2.2 (0.8–5.7)
Other	3.1 (0.4–22.6)
ED provider treating patient	
ED attending only	Reference
ED attending supervising resident or midlevel	1.9 (0.7–4.9)
Midlevel only	1.8 (0.4–9.0)
Other	0.2 (0.03–1.5)
Season	
Spring	Reference
Summer	1.0 (0.3–4.0)
Fall	3.3 (1.0–11.0)
Winter	1.8 (0.5–6.2)

There were over 2.2 million visits in the study period at U.S. EDs for children with asthma, representing a significant opportunity to prescribe ICS in this setting. ED clinicians encounter a unique population of children in whom ICS prescriptions for persistent asthma are important. Children with asthma visiting U.S. EDs are often not using appropriate controller medications.² Use of inner-city EDs for asthma is also more frequent among minorities, who have less access to regular medical care and greater morbidity than other children with asthma.⁷

Data from previous research can be used to determine the number of ED visits per year for which ICS are indicated. Approximately 55% to 65% of children presenting to EDs with asthma exacerbations have persistent asthma,^{8,9} and by one estimate, 36% of these children are not taking an appropriate controller medication.⁹ ICS could therefore be provided at 20% to 23% of ED visits for children with asthma exacerbations, a percentage substantially higher than the 4% identified in this study.

Two variables, asthma severity and medications already being used, are not included in the NHAMCS database. The denominator for this study therefore included children with intermittent asthma and children with persistent asthma already using controller medications. ICS prescriptions would not be indicated for these children, resulting in an underestimate of ICS prescriptions.

ICS prescriptions were more likely in the fall. Peak morbidity for childhood asthma occurs in the fall,¹⁰ and it is possible that frequent visits for children with asthma increase the likelihood of ED clinicians to prescribe ICS. The study did not support other associations between demographic/clinical variables and ICS prescriptions. It is possible that the low frequency of ICS prescriptions made it difficult to detect statistical associations that actually exist. An alternative explanation is that decisions to prescribe ICS are not based on

demographic or clinical variables, but instead depend on ED provider beliefs about the appropriateness of ICS prescriptions in the ED. Previous research supports this hypothesis, finding that ED clinicians often do not prescribe ICS because this is deemed a primary care provider responsibility.¹¹

LIMITATIONS

The limitations of cross-sectional panel survey data include an inability to make causal inferences about results and errors during abstraction. To reduce errors, the NHAMCS uses rigorous quality control procedures.³ Another limitation is the absence of data on asthma severity and if children are already using controller medicines. As discussed, inclusion of children with intermittent asthma or those using controller medications would underestimate appropriate ICS prescription.

CONCLUSIONS

Inhaled corticosteroids are infrequently prescribed by U.S. ED clinicians to children with asthma. In this study, inhaled corticosteroid prescriptions were more frequent in the fall, but were not associated with other demographic or clinical factors. This may suggest that provider beliefs about the utility of ICS prescriptions are the primary drivers of ICS prescribing.

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