Corticosteroid Prescription Filling for Children Covered by Medicaid Following an Emergency Department Visit or a Hospitalization for Asthma

William O. Cooper, MD, MPH; Gerald B. Hickson, MD

Objective: To identify predictors of corticosteroid prescription filling following an emergency department (ED) visit or a hospitalization for asthma.

Design: A retrospective cohort study.

Patients: Tennessee children (defined as those aged 2-17 years in this study) covered by Medicaid were included in the cohort if they had an ED visit or a hospitalization for asthma between July 1, 1995, and December 31, 1997.

Main Outcome Measures: Prescriptions filled in the child’s name for an oral corticosteroid within 7 days of the latest ED visit or hospitalization for asthma.

Results: Of 6035 Tennessee children covered by Medicaid with an ED visit for asthma and of 2102 covered by Medicaid with a hospitalization for asthma during the study period, less than half (44.8% following an ED visit and 55.5% following a hospitalization) had prescriptions filled for oral corticosteroids within 7 days. Factors independently predicting a child’s not having an oral corticosteroid prescription filled included older age, black race, and residence in rural regions of the state. Conversely, children with oral corticosteroid prescriptions in the previous 6 months were more likely to have oral corticosteroid prescriptions filled following an ED visit for asthma, and children with more than 3 β-agonist prescriptions in the previous 6 months were more likely to have oral corticosteroid prescriptions filled following a hospitalization for asthma.

Conclusions: Overall, fewer than half of Tennessee children covered by Medicaid had an oral corticosteroid prescription filled following an ED visit or a hospitalization for asthma. Age, race, and county of residence predicted failure to have a prescription filled. Further study is needed to determine whether variations in corticosteroid prescription filling relate to physician practice, family behavior, or both.


Despite specific guidelines for optimizing asthma management,1 many children do not receive recommended care. Certain groups of children are less likely to receive appropriate care than others, including disadvantaged and minority children2,3 and children receiving treatment in certain settings such as neighborhood health clinics and hospital-based clinics.2

One potential point for improving care delivery is the provision of systemic corticosteroids for asthma exacerbations. Systemic corticosteroids are a mainstay of treatment for children with acute asthma exacerbations.1 Because asthma exacerbations are relatively well-defined events, the intervention is short-term, and the filling of prescriptions is relatively easy to track, optimizing corticosteroid prescription filling for children with acute asthma exacerbations is an attractive point for intervention. Interventions targeted at corticosteroid filling could serve as models for interventions at other points in asthma therapy.

This study identifies children (defined as those aged 2-17 years in this study) who do not have corticosteroid prescriptions filled following an asthma emergency department (ED) visit or hospitalization. Identification of groups less likely to receive recommended care would allow for focused education for physicians and families, and might allow for the identification and reduction of barriers to prescription filling.

RESULTS

STUDY COHORT

There were 6035 children enrolled in Medicaid during the study period who had an ED visit for asthma; 2102 children had a hospitalization for asthma. Of chil-
PATIENTS AND METHODS

STUDY COHORT AND SELECTION OF COVARIATES

The cohort included 2- to 17-year-old children enrolled in Tennessee Medicaid between July 1, 1995, and December 31, 1997, who had a hospital discharge diagnosis of asthma or an ED visit with a primary diagnosis of asthma (International Classification of Diseases, Ninth Revision, Clinical Modification, code 493) or a primary diagnosis of a respiratory illness and a secondary diagnosis of asthma. These criteria were chosen to have a high sensitivity for identifying a child with an asthma exacerbation, although it is possible that these criteria also included children with an asthma exacerbation not severe enough to warrant a course of oral corticosteroids.

To be included in the study, children were required to have complete sociodemographic information in the enrollment file (age, race, sex, and county of residency at the index date). The National Institutes of Health guidelines for the care of asthma include age as a determining factor for initiating certain asthma medications. Race was included as a covariate based on previously described disparities in access to asthma care for minority children and on sociocultural beliefs leading to differences in use of asthma medications in minority families. Regional differences in asthma care have also been described; therefore, county of residence was identified for each child in the cohort.

The use of asthma health care services and the filling of prescriptions for asthma medications in the previous 6 months has been shown to predict subsequent use of asthma services. Thus, the use of asthma health care services and the filling of prescriptions for asthma medications serve as markers of asthma severity. Asthma severity measures used in the present study included the number of ED visits for asthma, hospitalizations for asthma, oral corticosteroid prescriptions, and β-agonist prescriptions in the 6 months before the index ED visit or hospitalization for asthma. To allow for complete ascertainment of study outcomes, cohort members were required to be continuously enrolled in Medicaid for the 6 months before the index ED visit or hospitalization and for the 12 months after the index event. Cohort members were required to have 12 months of continuous follow-up to adequately define health services use following the index event as part of a larger study.

ORAL CORTICOSTEROID USE

Pharmacy files were searched to identify oral corticosteroid prescriptions (matching national drug codes from the Food and Drug Administration’s National Drug Codes Classification to pharmacy claims data) filled in the name of cohort members within 7 days of the index visit. Oral corticosteroid dosage forms included prednisone, prednisolone, and methylprednisolone. For hospitalizations, the discharge date was considered as the start of the follow-up period. The primary study outcome was a child having a prescription for an oral corticosteroid filled within 7 days following the index visit.

ANALYSIS

Strata were defined by study covariates, including sociodemographic variables (age, race, sex, and county of residence) and asthma severity variables. Univariate comparisons of oral corticosteroid prescription filling were performed by comparing proportions of children having the primary study outcome across strata. Comparisons of study outcomes were performed, with P < .05 considered to represent statistical significance.

Multivariate logistic regression was used to compare the occurrence of corticosteroid filling across strata, with adjustments made for sociodemographic variables thought to influence prescription filling and asthma severity variables. The category of 5 to 9 years served as the reference for age, white as the reference for race, urban as the reference for county, and west Tennessee as the reference for region of the state. For the asthma severity variables, having no prior ED visits or hospitalizations for asthma, having less than 3 β-agonist prescriptions, and having no corticosteroid prescriptions served as the references.

All analyses were performed using SAS statistical software, version 6.12 (SAS Institute Inc, Cary, NC), running under an operating system (Windows NT 4.0; Microsoft Corp, Redmond, Wash) on a personal computer (Pentium P6; Intel Corp, Santa Clara, Calif).

This study was approved by the Vanderbilt University institutional review board.

dren with an ED visit for asthma, most (67.8%) were younger than 10 years, 45.0% were black, and 55.6% resided in an urban county (Table 1). More children hospitalized with an asthma diagnosis were younger than 10 years (75.2%), while a similar proportion of hospitalized children were black or resided in an urban county.

UNIVARIATE COMPARISONS OF CORTICOSTEROID USE

Overall, only 44.8% of children with an ED visit for asthma and 55.5% of children with a hospitalization for asthma had an oral corticosteroid prescription filled within 7 days of the index event (Table 2). In univariate comparisons for ED visits and hospitalizations, older children (aged 14-17 years) were less likely to have oral corticosteroid prescriptions filled than were younger children. In addition, black children were less likely to have an oral corticosteroid prescription filled than were white children and children of other races. There was much variation in corticosteroid prescription filling according to the child’s county of residence, with fewer children having prescriptions filled in the predominantly rural east and northeast regions of the state and more having prescriptions filled in the other regions. For asthma severity in the 6 months before the index event, prior ED visits for asthma, prior hospitalizations for asthma, having an additional oral corticosteroid prescription, and having 3 or more β-agonist prescriptions were related to corticosteroid prescription filling following an ED visit. Only having 3 or more β-agonist prescriptions was related to corticosteroid
Despite consensus guidelines supporting the use of systemic corticosteroids for asthma exacerbations, it is important to identify potential explanations for the variation from recommended asthma care seen among Tennessee children covered by Medicaid. Several characteristics, including race, age, county of residence, and asthma severity, are unique aspects of the present study. In this study, children were defined as those aged 2 to 17 years, and the emergency department (ED) visit or hospitalization occurred between July 1, 1995, and December 31, 1997.

### Table 1. Characteristics of Tennessee Children Covered by Medicaid With an ED Visit or a Hospitalization for Asthma*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>With an ED Visit for Asthma</th>
<th>With a Hospitalization for Asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>33.9</td>
<td>41.0</td>
</tr>
<tr>
<td>5-9</td>
<td>33.9</td>
<td>34.2</td>
</tr>
<tr>
<td>10-13</td>
<td>17.7</td>
<td>14.4</td>
</tr>
<tr>
<td>14-17</td>
<td>14.5</td>
<td>10.4</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>45.0</td>
<td>47.9</td>
</tr>
<tr>
<td>White or other</td>
<td>55.0</td>
<td>52.1</td>
</tr>
<tr>
<td>County of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>44.4</td>
<td>48.8</td>
</tr>
<tr>
<td>Urban</td>
<td>55.6</td>
<td>51.2</td>
</tr>
</tbody>
</table>

*In this study, children were defined as those aged 2 to 17 years, and the emergency department (ED) visit or hospitalization occurred between July 1, 1995, and December 31, 1997.

### Table 2. Corticosteroid Prescriptions Filled for Tennessee Children Covered by Medicaid Following an ED Visit or a Hospitalization for Asthma*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>After an ED Visit for Asthma (n = 6035)</th>
<th>After a Hospitalization for Asthma (n = 2102)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-4</td>
<td>48.2†</td>
<td>57.8†</td>
</tr>
<tr>
<td>5-9</td>
<td>44.5</td>
<td>57.4</td>
</tr>
<tr>
<td>10-13</td>
<td>45.3</td>
<td>56.3</td>
</tr>
<tr>
<td>14-17</td>
<td>37.1</td>
<td>39.5</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>33.9†</td>
<td>46.8†</td>
</tr>
<tr>
<td>White or other</td>
<td>53.7</td>
<td>63.6</td>
</tr>
<tr>
<td>County of residence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td>39.0†</td>
<td>50.5†</td>
</tr>
<tr>
<td>Urban</td>
<td>49.4</td>
<td>60.3</td>
</tr>
<tr>
<td>Region of the state</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>33.2†</td>
<td>39.4†</td>
</tr>
<tr>
<td>East</td>
<td>32.5</td>
<td>46.9</td>
</tr>
<tr>
<td>Southeast</td>
<td>46.5</td>
<td>55.8</td>
</tr>
<tr>
<td>Middle</td>
<td>40.5</td>
<td>52.0</td>
</tr>
<tr>
<td>West</td>
<td>56.7</td>
<td>66.1</td>
</tr>
<tr>
<td>In the past 6 mo</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED visit for asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60.3†</td>
<td>64.8</td>
</tr>
<tr>
<td>No</td>
<td>44.3</td>
<td>55.3</td>
</tr>
<tr>
<td>Hospitalization for asthma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>60.4‡</td>
<td>65.2</td>
</tr>
<tr>
<td>No</td>
<td>44.7</td>
<td>55.3</td>
</tr>
<tr>
<td>β2-Agonist prescriptions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>≥3</td>
<td>50.4‡</td>
<td>61.2‡</td>
</tr>
<tr>
<td>&lt;3</td>
<td>44.0</td>
<td>54.3</td>
</tr>
<tr>
<td>Oral corticosteroid use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any</td>
<td>52.9‡</td>
<td>58.1</td>
</tr>
<tr>
<td>No</td>
<td>43.1‡</td>
<td>54.6</td>
</tr>
</tbody>
</table>

*In this study, children were defined as those aged 2 to 17 years. Percentages are based on the number of children within each subgroup. ED indicates emergency department. §P<.001, ¥2 analysis. †P<.001, ¥2 analysis. ‡P<.05, ¥2 analysis.

Fewer than half of Tennessee children covered by Medicaid had an oral corticosteroid prescription filled following an ED visit or a hospitalization for an asthma exacerbation. The results of the present study are troubling, but consistent with findings in studies of adults covered by Medicaid. Even though patients covered by Medicaid seek health care for asthma, fewer have corticosteroid prescriptions filled during an asthma exacerbation despite consensus guidelines supporting the use of systemic corticosteroids for asthma exacerbations. It is important to identify potential explanations for the variation from recommended asthma care seen among Tennessee children covered by Medicaid. Several characteristics, including race, age, county of residence, and asthma severity, are unique aspects of the present study. In this study, children were defined as those aged 2 to 17 years, and the emergency department (ED) visit or hospitalization occurred between July 1, 1995, and December 31, 1997.

### MULTIVARIATE COMPARISONS OF ORAL CORTICOSTEROID USE

When controlling for age, race, county, region, and asthma severity characteristics in multivariate analysis, factors related to a child having an oral corticosteroid prescription filled within 7 days of the index visit included age, race, county of residence, and asthma medication prescription filling before the index visit (Table 3). Older age, black race, and residence in rural regions of the state independently predicted failure to have prescriptions filled following both types of encounters. Neither previous ED visits nor previous hospitalizations for asthma predicted the filing of corticosteroid prescriptions after the index visit in multivariate analyses. Corticosteroid use in the previous 6 months positively predicted subsequent corticosteroid prescription filling following an ED visit for asthma, while having 3 or more β2-agonist prescriptions filled positively predicted corticosteroid prescription filling following a hospitalization for asthma.

### COMMENT

The finding that black children were significantly less likely to have corticosteroid prescriptions filled than were white children or children of other races was consistent with findings in other studies describing disparities in asthma care according to race. Bosco et al identified that black children with asthma enrolled in Michigan Medicaid had more frequent health care encounters, but filled prescriptions for all asthma drugs less frequently. In the study by Bosco et al, black children were less than half as likely to have a corticosteroid prescription filled. The study by Bosco et al did not link prescriptions to asthma exacerbations, so it was not possible to determine the asthma severity of children in that study. In a study of quality of care for children with asthma, Finkelstein et al identified marked differences in the prescribing of β2-agonists after hospital discharge for black and Hispanic patients compared with white patients. The inclusion of asthma severity indicators and the focus on corticosteroid use are unique aspects of the present study.
ticosteroid prescriptions. Studies documenting an over-
tionship between adolescence and the filling of oral corti-
warrant careful examination.

During this time, adolescents are driven by the need for
child health care; this period is a time of transition from a
s dependence to the independence of adulthood.

Several factors may contribute to the differences in pre-
scribed by race identified in the present study. There may
have been differences in the writing of prescriptions for cer-
tain groups of children, a notion supported by the find-
ings of Finkelstein et al, who found that children of racial
minorities were less likely to have received maximal effec-
tive prevention therapy before hospital admission. It is also
possible that differences in family adherence with physi-
can recommendations, resulting in some families not
filling prescriptions, even though they were written. Other
studies have suggested that lack of adherence among fami-
ies of children with asthma stems from health beliefs rela-
tive to the effectiveness and safety of asthma medications.

Given evidence from previous studies that asthma is more severe in black children, the disparities in prescrip-
tion filling in the present study are even more striking and
warrant careful examination.

The present study also identified a negative relation-
ship between adolescence and the filling of oral corti-
coerteroids. Studies documenting over-
use of β-agonists among adolescents dying from asthma
support differences in treatment adherence among older
children. Adolescence is a period of transition from a
child’s dependence to the independence of adulthood.

<table>
<thead>
<tr>
<th>Table 3. Factors Related to a Child Having a Corticosteroid Prescription Filled Following an ED Visit or a Hospitalization for Asthma Among Tennessee Children Covered by Medicaid*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Adjusted Odds Ratio (95% Confidence Interval)</strong></td>
</tr>
<tr>
<td><strong>Factor</strong></td>
</tr>
<tr>
<td>Age, y</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Black race</td>
</tr>
<tr>
<td>Rural county</td>
</tr>
<tr>
<td>Region of the state</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>In the past 6 mo</td>
</tr>
<tr>
<td>Hospitalization</td>
</tr>
<tr>
<td>for asthma</td>
</tr>
<tr>
<td>Any corticosteroid prescription</td>
</tr>
</tbody>
</table>

*In this study, children were defined as those aged 2 to 17 years. ED indicates emergency department.

†The reference category for age is 5 to 9 years; for race, white or other; for county, urban; for region of the state, west; for ED visit or hospitalization for asthma in the past 6 months, none; for β-agonist prescriptions in the past 6 months, less than 3; and for corticosteroid prescriptions in the past 6 months, none.

‡The odds ratios were adjusted for age, race, county of residence, region of the state, and asthma severity using multiple logistic regression.

§P<.05.

¶P<.01.

Parents may be more likely to assert influence on an ado-
lescent, particularly if an older child is viewed as less vulner-
able than a younger child or if continued conflicts over
taking medication have negative effects on family dy-
namics. Family dynamics might thus lead to a family’s
reluctance to fill corticosteroid prescriptions that they do
not believe to be likely taken by their child.

County of residence predicted a child’s having a corti-
coerteroid prescription filled, with children residing in ru-
rural counties being less likely to have corticosteroid
prescriptions filled. In addition, children in predominantly
rural regions of the state were less likely to have cortico-
steroid prescriptions filled. Regional differences in asthma
have been documented previously and are thought to rela-
te to differences in prehospitalization asthma care.6 It is
possible that slower diffusion of knowledge into ru-
rural areas with subsequent less knowledge of state-of-the-
art asthma care might relate to less physician adherence
to asthma guidelines.21 The delivery of continuing medi-
cal education to rural physicians may be different from that
delivered to urban physicians, resulting in differences in
awareness of treatment guidelines.21

An additional finding of the present study was that
corticosteroid and β-agonist prescription filling in the pre-
vious 6 months predicted subsequent corticosteroid pre-
scription filling. This was similar to results seen in a study
by Diaz et al of medication use among children with asthma in East Harlem, NY. In the study by Diaz et al, children with more severe asthma who had a recent phy-
sician visit were greater than 3 times more likely to use
anti-inflammatory medications. Families may be more
likely to accept corticosteroid therapy as being effective
in exacerbations if they have experienced benefit previ-
ously or if they have an appreciation for the severity of
their child’s asthma based on prior experience.

Limitations of our study include the inability to de-
termine whether a prescription was written and not filled
by the family or was never written. In addition, even if a
prescription was filled, we were unable to determine if a
child took the medication as prescribed.

It is not likely that medication delivery was missed in
the study because of children receiving corticosteroids or
“sample packs” directly from a physician without a pre-
scription, which would not be captured in the pharmacy
databases. Tennessee’s Medicaid program is administered
through several managed care companies, with strict for-
mary guidelines. In a survey of the institutions in the state
that provide the bulk of children’s services, it was not rou-
tine practice among Tennessee health care facilities to dis-
pense entire courses of a medication without a prescrip-
tion. In addition, for hospitalizations for asthma, it is not
likely that children received a complete course of cortico-
steroids while in the hospital. More than 95% of the chil-
dren with a hospitalization for asthma were discharged
within 5 days of admission, and 98% were discharged by
7 days, so that few children were hospitalized long enough
to complete a typical 5- to 7-day course of corticosteroids.

An additional limitation of the study relates to the
asthma definition used. While it can be argued that any
asthma exacerbation severe enough to warrant hospital-
Despite specific guidelines for optimizing asthma management, many children do not receive recommended care, including disadvantaged and minority children and children receiving treatment in certain health care settings. One point for improving care for children with asthma is the provision of systemic corticosteroids for children with acute asthma exacerbations. Assessing whether children with an asthma exacerbation have a pharmacy claim for systemic corticosteroids would provide a means to assess adherence to asthma guidelines and would provide opportunities for targeted interventions for certain health care settings and populations.

Less than half of the children in the study with an emergency department visit for asthma and just slightly more than half of those with a hospitalization for asthma had prescriptions filled for systemic corticosteroids following the encounter. Characteristics of the child (age, race, and county of residence) and previously validated asthma severity measures (use of asthma medications in the past 6 months) independently predicted whether a child had a corticosteroid prescription filled for emergency department visits and hospitalizations. Interventions are, thus, needed on multiple levels to optimize the care of children with asthma.

What This Study Adds

- The findings of this study that less than 50% of children had an oral corticosteroid prescription filled following an asthma exacerbation severe enough to warrant ED care or a hospitalization, it is likely that interventions will need to be implemented on multiple levels to warrant ED care or a hospitalization, it is likely that interventions will need to be implemented on multiple levels to warrant ED care or a hospitalization.

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REFERENCES


