

Oral Corticosteroid Prescribing for Children With Asthma in a Medicaid Managed Care Program

Harold J. Farber, MD, MSPH, FAAP,^{a,b,c} Edwin A. Silveira, BS,^d Douglas R. Vicere,^d
Viral D. Kothari, MD,^b Angelo P. Giardino, MD, PhD, FAAP^b

abstract

BACKGROUND AND OBJECTIVE: Short courses of oral corticosteroid (OCS) medication are recommended for treatment of moderate to severe asthma exacerbations. Concern has been raised about OCS overuse. Our objective is to describe rates of OCS dispensing among children with asthma and factors associated with variation in OCS dispensing.

METHODS: Claims data for children 1 to <18 years of age with an asthma diagnosis between January 2011 and January 2016 were extracted from the computerized databases of Texas Children's Health Plan.

RESULTS: In the years 2011 to 2015, 17.1% to 21.8% of children had an asthma diagnosis. In each of these years 42.1% to 44.2% of these children had ≥ 1 OCS dispensing. OCS dispensing rates were higher for the children 1 to 4 years of age compared with older children. Repeated OCS dispensing was common, and was most common for children 1 to 4 years of age. Most children with an OCS dispensing (81%–83%) did not have other utilization suggesting poor asthma control (excessive β -agonist refills, emergency department visit, or hospitalization for asthma). OCSs were less commonly prescribed to patients whose primary care provider was a board-certified pediatrician compared with other types of primary care providers. There was large variation in OCS prescribing rates among pediatricians (15%–86%). There were minimal differences in asthma emergency department visits and no differences in hospitalization rates by the pediatrician's OCS dispensing rate quartile.

CONCLUSIONS: The patterns of dispensing observed suggest substantial overprescribing of OCS for children with an asthma diagnosis.



^aSection of Pulmonology and ^bDepartment of Pediatrics, Baylor College of Medicine and Texas Children's Hospital, Houston, Texas; and ^cMedical Affairs and ^dInformation Services, Texas Children's Health Plan, Bellaire, Texas

Analyses restricted to members with a primary care provider who is a pediatrician and who had ≥ 50 TCHP members with asthma. The member's primary care provider is not necessarily the prescribing provider. Members who had a clinic (rather than an individual provider) identified as their primary care provider were excluded from this analysis.

Dr Farber conceptualized and designed the study, performed the data analyses, and wrote the manuscript; Drs Kothari and Giardino contributed to study design and critically reviewed the manuscript; and Mr Silveria and Mr Vicere designed and maintained the Texas Children's Health Plan asthma registry, extracted the data from the health plan's computerized data files, and reviewed the manuscript; and all authors approved the final manuscript as submitted.

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WHAT'S KNOWN ON THIS SUBJECT: Oral corticosteroids are recommended for the treatment of moderate to severe asthma exacerbations. Overuse of oral corticosteroids can have important adverse effects.

WHAT THIS STUDY ADDS: In this Medicaid- and Children's Health Insurance Program-insured population, oral corticosteroids appear to be substantially overprescribed for children with a health care provider's diagnosis of asthma. The youngest children have the highest oral corticosteroid prescription rates.

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Short-course oral corticosteroid (OCS) medication is recommended by current asthma guidelines for the treatment of moderate to severe asthma exacerbations.¹ A recent meta-analysis on the efficacy of OCS in preschool wheezing found that, in the emergency department, OCS decreased the risk for hospital admission, whereas pooled data from outpatient studies suggested an increase in hospitalizations among those receiving OCS.² A study in children 2 to 14 years of age of parent-initiated OCS for an asthma attack that did not improve after the child's usual quick-relief medication found an increase in emergency department visits in the treatment group, with no difference in hospitalizations.³

Short bursts of OCS medication have adverse behavioral effects, including anxiety, mania, irritability, and/or aggressive behavior.^{4,5} Studies in adults demonstrate that frequent short courses of oral steroids decrease bone mineral density.⁶ A retrospective case control study in Rochester, Minnesota of patients with asthma onset at <35 years of age found a history of OCS use to be associated with an increased fracture risk.⁷ Genetic polymorphisms have been identified that predispose children to the adverse impact of short bursts of OCS on bone mineral density.⁸ Concerns have begun to be raised about high rates of OCS prescribing among children with asthma.⁹

Texas Children's Health Plan (TCHP) is a large, not-for-profit Medicaid and Children's Health Insurance Program (CHIP) managed care organization serving the greater Harris and Jefferson county areas in East Texas, including the cities of Houston and Beaumont/Port Arthur. The specific aim of this study is to describe the rates of OCS dispensing among children with asthma who were enrolled in TCHP and to determine patient and provider

factors associated with variation in OCS dispensing.

METHODS

TCHP claims data were extracted from the computerized databases of TCHP. A claim is a request for payment for a health care service. For a provider to be paid for a patient encounter, a claim with relevant diagnosis codes must be submitted to the health plan. For a pharmacy to be paid for medication dispensing to a health plan member, a claim must be submitted to the health plan with the National Drug Code and amount of the medication dispensed.

In each of the years from 2011 to 2015, health plan members with asthma were identified by having a claim with a code for asthma (International Classification of Diseases, Ninth Revision, code 493.XX or International Classification of Diseases, Tenth Revision, code J45.XXX). Assessment years were determined as January 15 of the assessment year to January 14 of the next calendar year. The year 2012 was an exception, with data extracted from February 15, 2012 to February 14, 2013. To be included, patients needed to be a health plan member in the month concluding the data pull period. The age range was restricted to ages ≥ 1 to <18 years as of the last date of the analysis year (ie, January 14 of the next year for 2011, 2013, 2014, and 2015 and February 14 of the next year for 2012). Patients with a diagnosis of cystic fibrosis were excluded. Primary care provider characteristics were determined from either health plan credentialing files or publically available Texas Medical Board records.¹⁰ We excluded subjects from analyses by provider type if the primary care provider was identified as a clinic, rather than a specific, provider (5.0% of members with asthma in 2012, 6.1% in 2013, 7.3% in 2014, and 8.8% in 2015).

OCS dispensing was determined as a pharmacy claim for the dispensing of an OCS medication, including prednisone, prednisolone, methylprednisolone, and dexamethasone. Inhaled corticosteroid dispensing events were determined from pharmacy dispensing claims for either a single-agent inhaled corticosteroid or a combination long-acting β -agonist/inhaled corticosteroid product. Hospitalizations and emergency department visits for asthma were determined from claims submitted with either a primary diagnosis of asthma or a secondary diagnosis of asthma if the primary diagnosis was a respiratory illness. A short acting β -agonist canister-equivalent was defined as a 200 puff, short-acting β -agonist inhaler or 50 unit doses of a short-acting β -agonist for inhalation via a nebulizer. Poor asthma control was defined as ≥ 4 short-acting β -agonist canister equivalents dispensed in the previous 12 months and/or a hospitalization or emergency department visit for asthma in the previous 12 months.

We used χ^2 tests for comparisons of categorical data. One-way analysis of variance was used to determine differences in hospitalization and emergency department visit rates by primary care pediatrician OCS dispensing rate quartile. The Scheffé test was used as a postanalysis of variance test to determine the significance of between-group differences. Statistical significance was accepted as two-tailed $P < .05$.

The study protocols were reviewed and approved by the Baylor College of Medicine Institutional Review Board.

RESULTS

We identified 69 056 children <18 years of age who had a health care provider's diagnosis of asthma in the 2015 measurement year, representing 19.9% of the total

TABLE 1 OCS Dispensing for TCHP Members With Asthma Diagnosis and <18 Years of Age

Year	Health Plan Members <18 y, n	Asthma Diagnosis, n (% of Members)	1 OCS Dispensing, n (% of Asthma)	2 OCS Dispensings, n (% of Asthma)	≥3 OCS Dispensings, n (% of Asthma)
2015	346 191	69 056 (19.9)	22 227 (32.2)	4584 (6.6)	2265 (3.3)
2014	347 960	71 640 (20.6)	22 940 (32.0)	5001 (7.0)	2552 (3.6)
2013	309 424	66 119 (21.4)	21 123 (31.9)	4605 (7.0)	2385 (3.6)
2012	311 303	67 810 (21.8)	22 551 (33.3)	5007 (7.4)	2449 (3.6)
2011	308 202	52 678 (17.1)	17 313 (32.9)	3972 (7.5)	1994 (3.8)

TABLE 2 OCS Dispensing by Age Group

Year/Age Group, y	Asthma Diagnosis, n	1 OCS Dispensing, n (% of Asthma)	2 OCS Dispensings, n (% of Asthma)	≥3 OCS dispensings, n (% of Asthma)	OR (95% CI) for Any OCS Dispensing (Compared With Older Children)
2015/1–4	22 553	8147 (36.1)	1948 (8.6)	959 (4.3)	1.5 (1.47–1.57)
2014/1–4	23 782	8549 (36.0)	2065 (8.7)	1103 (4.6)	1.5 (1.46–1.55)
2013/1–4	23 274	8197 (35.2)	2057 (8.8)	1098 (4.7)	1.48 (1.43–1.53)
2012/1–4	23 957	8768 (36.6)	2239 (9.4)	1159 (4.8)	1.50 (1.46–1.55)
2011/1–4	20 828	7629 (36.6)	1901 (9.1)	989 (4.7)	1.53 (1.47–1.58)
2015/5–8	20 645	6580 (31.9)	1371 (6.6)	720 (3.5)	—
2014/5–8	22 176	7009 (31.6)	1637 (7.4)	852 (3.8)	—
2013/5–8	19 641	6300 (32.1)	1390 (7.1)	739 (3.8)	—
2012/5–8	20 620	6793 (32.9)	1529 (7.4)	748 (3.6)	—
2011/5–8	15 425	4960 (32.2)	1234 (8.0)	609 (6.4)	—
2015/9–12	14 716	4143 (28.2)	781 (5.3)	317 (2.2)	—
2014/9–12	11 835	3378 (28.5)	655 (5.5)	288 (2.4)	—
2013/9–12	13 410	3741 (27.9)	735 (5.5)	336 (2.5)	—
2012/9–12	13 527	4035 (29.8)	793 (5.9)	329 (2.4)	—
2011/9–12	9487	2675 (27.7)	502 (5.3)	259 (2.7)	—
2015/13–17	11 142	3357 (30.1)	484 (4.3)	269 (2.4)	—
2014/13–17	13 847	4004 (28.9)	644 (4.7)	309 (2.2)	—
2013/13–17	9794	2885 (29.5)	423 (4.3)	212 (2.2)	—
2012/13–17	9706	2955 (30.5)	446 (4.6)	213 (2.2)	—
2011/13–17	6938	2049 (29.5)	335 (4.8)	137 (2.0)	—

CI, confidence interval; OR, odds ratio.

health plan membership in this age group. The proportion of the health plan pediatric membership with an asthma diagnosis was similar in the years 2011 to 2014 at 17.1% to 21.8%. In the 2015 measurement year, 29 076 children (42.1% of children with an asthma diagnosis) had ≥1 OCS dispensing, 6849 (9.9%) had ≥2 OCS dispensings, and 2265 (3.3%) had ≥3 OCS dispensings during that year. Similar rates of OCS dispensing were found in each of the preceding 4 years (Table 1).

When stratified by age group, OCS dispensing rates were highest for the children <5 years of age. In 2015, there were 22 553 children <5 years of age with a diagnosis of asthma, of

whom 11 054 (49.0%) had ≥1 OCS dispensing event compared to 18 022 of 46 503 (38.8%) children ≥5 years of age with an asthma diagnosis (odds ratio, 1.5; 95% confidence interval, 1.47–1.57). Similar results were seen in each of the previous 4 years (Table 2).

When stratified by ethnicity, OCS dispensing rates were lowest for children identified as African American. In the years 2012 to 2015, 35% to 36% of African American children with an asthma diagnosis had ≥1 OCS dispensing event. In comparison, 40% to 44% of white children and 43% to 49% of Hispanic children had ≥1 OCS dispensing event ($P < .001$).

Among the 17 313 members with an asthma diagnosis who had an OCS dispensing in 2011, 14 458 (83.5%) had ≥36 months of health plan membership in the measurement years 2012 to 2015. Repeated OCS dispensing was common among these members: 8014 (55.4%) had ≥1 additional OCS dispensing in the 2012–2015 measurement years, 4212 (29.1%) had ≥1 OCS dispensing in ≥2 of the 2012–2015 measurement years, and 1863 (12.9%) had ≥1 OCS dispensing in 3 or 4 of the years 2012 to 2015. Younger age groups had greater rates of repeated OCS dispensing than older age groups (Table 3).

TABLE 3 Repeated OCS Dispensing

Age Group in 2011, y	≥1 OCS Dispensing in 2011, n	≥1 OCS Dispensing in 2012, n (%)	≥1 OCS Dispensing in 2013, n (%)	≥1 OCS Dispensing in 2014, n (%) ^a	≥1 OCS Dispensing in 2015, n (%)
1–4	6736	2507 (37.2) ^{a,b}	1939 (28.8) ^a	1734 (25.7) ^a	1282 (19.0) ^a
5–8	4261	1445 (33.9)	1167 (27.4)	1076 (25.3)	783 (18.4)
9–12	2051	633 (30.9)	475 (23.2)	425 (20.7)	329 (16.0)
13–17	811	209 (25.8)	169 (20.8)	98 (12.1)	55 (6.8)
All (1–17)	13 859	4794 (34.6)	3750 (27.1)	3333 (24.1)	2449 (17.7)

The table shows OCS dispensing for health plan members who had (1) a diagnosis of asthma in 2011, (2) an OCS dispensing in 2011, (3) ≥36 months of health plan membership in the measurement years 2012–2015, and (4) health plan membership on the date of data pull for at least 3 of the 4 years from 2012 to 2015.

^a The 1- to 4-year age group is different from age groups 9-12 and 13-17, $P < .0001$.

^b The 1- to 4-year age group is different from 5- to 8-year age group, $P = .002$.

Of the members who had an OCS dispensing in 2015, only 18.6% had ≥1 risk factors for poorly controlled asthma; 7.3% had an emergency department visit for asthma, 0.73% had an asthma hospitalization, and 14.3% had ≥4 short-acting β-agonist canister equivalents dispensed. These rates are greater than for those who did not have an OCS dispensing, (18.6% vs 12.8% for any risk factor, $P < .001$). Similar results were found for the years 2011 through 2014. The presence of an inhaled corticosteroid dispensing event (≥1) was low overall (20%–28%), but it was slightly more common among those with an OCS dispensing event. The difference was not statistically significant in 2015 (22.0% vs 21.4%, $P = .06$), but the small difference (2%–3.5% absolute difference) was statistically significant in the years 2011 to 2014 ($P < .001$) (Supplemental Table 7).

Analysis of utilization in the previous year among patients who had TCHP membership in both years demonstrated that the prevalence of a risk factor for poor asthma control in the previous year was similar (<1% difference) between the groups that had and those that did not have an OCS dispensing in the measurement year. The prevalence of an inhaled corticosteroid dispensing event in the previous year was slightly greater among those who did not have an OCS dispensing in the measurement year (1.7%–3.5% difference, $P < .001$) (Supplemental Table 8).

TABLE 4 Rates of OCS Dispensing to TCHP Members by Pediatrician Primary Care Provider

	2015	2014	2013	2012
Maximum, %	85.8	82.4	86.3	87.3
Quartile 3, %	50.3	48.7	48.3	48.8
Median, %	37.7	38.9	38.5	37.9
Quartile 1, %	29.4	30.4	30.3	31.3
Minimum, %	15.2	16.6	15.2	4.8

Analyses restricted to members with primary care provider who is a pediatrician and who has ≥50 TCHP members with asthma. The primary care provider is not necessarily the prescribing provider.

TABLE 5 Asthma Hospitalization Rate by Provider's OCS Prescribing Quartile

	2015	2014	2013	2012
Quartile 1 (lowest)	0.28 (0.47)	0.43 (0.55)	0.47 (0.62)	0.62 (0.76)
Quartile 2	0.42 (6.1)	0.45 (7.4)	0.50 (0.54)	0.89 (0.92)
Quartile 3	0.56 (0.68)	0.77 (1.3)	0.51 (0.64)	0.75 (0.85)
Quartile 4 (highest)	0.54 (0.88)	0.40 (0.68)	0.54 (0.94)	0.58 (0.80)
<i>P</i>	.08	.06	.95	.18

Data are presented as mean (SD) %, unless otherwise noted. Analysis restricted to pediatricians with ≥50 TCHP members with asthma in their practice.

Rates of OCS dispensing for patients with asthma were lowest when the primary care provider was a board-certified pediatrician, compared with non-board-certified pediatricians (41%–42% vs 44%–51%, $P < .001$) and compared with those with an internal medicine, family practice, or general practitioner as their primary care provider (41%–42% vs 46%–47%, $P < .001$). When a nurse practitioner or physician was listed as the primary care provider, rates of OCS dispensing were similar to or slightly lower than that of board-certified pediatricians (40%–36%, $P = .4$ in 2015, $P ≤ .01$ in other years) (Supplemental Table 9)

There was large variation in rates of OCS dispensing by pediatrician primary care provider. With analyses restricted to pediatricians

(regardless of board certification status) who served as primary care provider for ≥50 TCHP members with a current asthma diagnosis, we found rates of OCS dispensing ranging from 15% to 86% in 2015, with an interquartile range of 29% to 50%. Similar variation was observed in the years 2012 to 2014 (Table 4). We additionally looked to see if there was variation in hospitalization or emergency department visit rates by these pediatricians' OCS dispensing rates. We found no statistically significant differences in asthma hospitalization rates by OCS dispensing rate quartile (Table 5). We found only inconsistent, small differences by OCS dispensing quartile for emergency department visits rates (Table 6).

DISCUSSION

In this population of Medicaid- and CHIP-insured children, we found both high rates of asthma diagnosis, high rates of OCS dispensing among children with an asthma diagnosis, and a large amount of variation in OCS prescribing rates. Taken together, these results suggest a substantial amount of OCS overprescribing among Medicaid-insured children with a health care provider's diagnosis of asthma.

There is good evidence from randomized controlled clinical trials that systemic corticosteroids reduce risk of relapse and speed improvement in patients who present with a moderate to severe asthma exacerbation¹¹⁻¹⁴ and for children with a history of moderate to severe, poorly controlled asthma.^{15,16} Given the large scale of OCS use in our population, one must assume that a substantial portion of the use is for children who present with mild wheezing and/or coughing. There is no evidence for benefit of systemic corticosteroid prescription for children <5 years of age who present with coughing or mild wheezing in the outpatient setting,² yet this is the population where the medication is most commonly prescribed.

Close to one-quarter of children with asthma who had an OCS dispensing in 1 year had additional OCS dispensing events in subsequent years. Repeated OCS dispensing events within the same year is not uncommon. We observed that the high OCS dispensing rates were consistent from year to year from 2011 to 2015. If we assume that a large part of this oral steroid dispensing was for mild asthma, or perhaps respiratory symptoms that were not asthma, then one must conclude that a large number of children are being put at risk for adverse effects of systemic corticosteroids with little to no likelihood of benefit.

TABLE 6 Asthma Emergency Department Visits by Provider's OCS Prescribing Quartile

	2015	2014	2013	2012
Quartile 1 (lowest)	5.3 (2.5)	5.8 (2.8)	4.8 (2.8)	5.7 (3.3)
Quartile 2	5.9 (3.1)	6.8 (4.3) ^a	5.6 (3.2)	6.5 (3.8) ^b
Quartile 3	5.5 (3.2)	5.9 (3.1)	5.4 (3.0)	6.5 (3.1) ^b
Quartile 4 (highest)	4.8 (3.0)	4.6 (3.0) ^a	4.4 (2.9)	4.6 (3.1) ^b
<i>P</i>	.18	.005	.0953	.005

Data are presented as mean (SD) %, unless otherwise noted. Analysis restricted to pediatricians with ≥50 TCHP members with asthma in their practice.

^a Quartile 2 different from quartile 4, *P* = .005 (Scheffé test).

^b Quartiles 2 and 3 different from quartile 4, *P* < .02 (Scheffé test).

Although the level of risk factors for poorly controlled asthma, such as excessive short-acting β-agonist medication dispensing, emergency department visits, or hospitalizations, were somewhat greater among those with an OCS dispensing event in the same year, there were only minimal differences (<1%) for these risk factors in the previous year. It is possible that some of the current-year risk events were associated with treatment of the exacerbation that led to the OCS dispensing event rather than preceded it. Most children with an OCS dispensing event did not have any of these risk factors, additionally supporting the assumption that most of the OCS prescribing was for children with mild respiratory symptoms.

Inhaled corticosteroid dispensing rates were low and minimally different for those with and those without an OCS dispensing. For those with an OCS dispensing in the current year, rates of inhaled corticosteroid dispensing were slightly greater in the current year (1%–4% absolute difference), but slightly lower in the previous year (1%–4% absolute difference). Although these differences were statistically significant, these small differences may not be clinically important.

We found large variation in rates of OCS dispensing to patients by primary care provider type. There was a lower rate of OCS dispensing to patients whose primary care provider was a board-certified pediatrician. Among the pediatricians, there was also large variation in rates

of OCS dispensing. There were no differences in asthma hospitalization rate by OCS dispensing quartile, and the differences in emergency department visit rates were small and not consistent year to year. This substantial variation in practice without associated variation in outcomes supports the hypothesis that a large portion of the OCS dispensing is inappropriate.

These results additionally suggest that quality improvement and continuing education activities for pediatric health care providers need to address the appropriate use of OCS, neither too much nor too little, for children with asthma. Asthma guidelines need to provide clear guidance for providers on when the use of OCS for asthma is not supported by evidence and when its use is not indicated in clinical practice.

In our population, we found that OCS dispensing rates were substantially greater than reported elsewhere. In the Netherlands, a longitudinal follow-up study of 2272 children 4 to 12 years of age who were regular users of asthma medication found that 25.7% of their sample was prescribed an OCS.⁹ Pooled data from 85 US health plans from 1995 to 2008 found OCS dispensing in only 23% of children 6 to 18 years of age with nonsevere asthma.¹⁷ A study of primary care practices in Scotland found, among children 0 to 18 years of age who had an asthma medication dispensed, an escalation in the prevalence of OCS dispensing from 9% in 2001 to 2002 to 16% in 2005

to 2006.¹⁸ Our rates were similar to the 48.7% observed among infants with wheezing in the first year of life in the city of Belo Horizonte, Brazil.¹⁹

We also found that the 17.1% to 21.8% prevalence of asthma diagnosis in our Medicaid- and CHIP-insured population was much greater than the 8.3% to 9.5% prevalence of current asthma reported in the 2011–2014 US National Health Interview Surveys. It is possible that our high asthma prevalence rates reflect health disparities in a low-income population, adverse impacts of air pollution in the greater Houston and Beaumont/Port Arthur area, adverse selection, with asthma patients selecting our health plan at greater rates than patients without asthma, and/or overdiagnosis of asthma among the providers in our health plan.

Our study was an analysis of health plan computerized claims data. Medical records were not reviewed. TCHP covers patients with Medicaid and CHIP health coverage. Eligibility for these programs defines a low-income population, and findings may not be applicable to more affluent communities. Our member-patient sample is from 1 portion of East Texas, and it is possible that practice patterns of providers in other geographic areas are

different. Additional research is needed to replicate these findings in different health plans and different communities. OCS dispensing was assessed, and it is possible that all or part of a medication course dispensed to the patient was not taken by the patient. The specific indication for the OCS dispensing was not determined, and it is possible that some of the OCS was not dispensed for asthma. Given the large sample size, even small differences may be statistically significant even though the differences could be judged as clinically unimportant. For purposes of these analyses, we assigned all asthma medication dispensing to the patient to their primary care provider. It is possible that the primary care provider was not the prescribing provider. Although every effort is made to keep records up-to-date, it is possible that the primary care provider that the patient is assigned to in the health plan's computerized databases is not the primary care provider that the patient uses.

CONCLUSIONS

Among Medicaid- and CHIP-insured children with a health care provider's diagnosis of asthma, there is a high rate of OCS dispensing, with the highest rates in the youngest

children. That there is substantial variation in prescribing rates by primary care provider type, substantial variation in prescribing rates among pediatrician providers, minimal to no significant differences in emergency department visits and hospitalizations associated with this variation, and that most of the OCS dispensing is for children who do not have other risk factors for poorly controlled or high-risk asthma suggests that there is substantial overprescribing of OCS in this population. Over the past 30 years, OCS prescribing for children with asthma has gone from underuse to what now appears to be substantial overprescribing. Like Goldilocks and the Three Bears, our challenge now is to get it just right.²⁰

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ABBREVIATIONS

CHIP: Children's Health Insurance Program
OCS: oral corticosteroid
TCHP: Texas Children's Health Plan

Address correspondence to Harold J. Farber, MD, MSPH, FAAP, Section of Pulmonology, Department of Pediatrics, Texas Children's Hospital, 6701 Fannin St, Suite 1040, Houston, TX 77030. E-mail: hjfarber@texaschildrens.org

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