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Primary Care Provider Preferences for Steroid Management of Acute Asthma Exacerbations in Children

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Abstract

Objective: Primary care providers (PCP) frequently care for children with acute asthma exacerbations in the outpatient setting. The objective of this study is to **evaluate PCP preferences and perceptions regarding oral corticosteroids prescribed from both outpatient primary care and ED settings for the treatment of children with acute asthma exacerbations.**

Methods: PCPs belonging to the Colorado Chapter of the American Academy of Pediatrics were surveyed between February and May 2019. Survey items were generated by a multidisciplinary team and underwent content and criteria validation and pilot testing. Survey items evaluated PCP preferred oral steroid and dosing regimen for children with acute asthma exacerbations, provider- and patient-level factors contributing to steroid preferences, and perception of steroid regimens in terms of treatment failure, resolution of symptoms and adherence.

Results: A total of 109 of 600 (18.2%) PCPs responded. Equal proportions of PCPs reported preferring oral prednisone/prednisolone (50.5%) and oral dexamethasone (49.5%) for children with acute asthma exacerbations. Forty-four percent of PCPs reported no preference in type of steroid utilized by surrounding emergency departments (EDs). However, for children receiving dexamethasone in the ED but with persistent symptoms on PCP follow-up, 50.5% of PCPs would switch patients to prednisone/prednisolone. **PCPs did not perceive more treatment failure or rapid resolution of symptoms with dexamethasone but reported better adherence with dexamethasone.**

Conclusion: There is variability in PCP steroid management of pediatric acute asthma exacerbations. **There is a need for further investigations to evaluate for differences in clinical outcomes based on PCP steroid treatment choices.**

What's New:

Wide variability exists in PCP steroid management of pediatric asthma exacerbations treated in the **primary care setting. There is a need for further investigations to evaluate for differences in clinical outcomes based on PCP steroid treatment choices.**

Background

Asthma is a leading cause of morbidity in the pediatric population. **Acute exacerbations account for 750,000 emergency department (ED) visits, 200,000 hospitalizations and \$5.2 billion in excess healthcare costs each year.**¹⁻³ The mainstay of treatment for children with acute asthma exacerbations includes inhaled beta-agonists and systemic corticosteroids. Early administration of corticosteroids has proven beneficial in reducing acute asthma symptoms, hospitalization rates and relapse.⁴⁻⁸ Thus, the National Heart, Lung and Blood Institute (NHLBI) guidelines recommend a short course of systemic corticosteroids for initial management of acute asthma exacerbations.⁵ However, there is no consensus on preferred steroid or dosing regimen.

Previously, the most commonly used steroid for acute asthma exacerbations was oral prednisone/prednisolone prescribed for a 3- to 5-day course. Prednisone/prednisolone has poor palatability and compliance, with reported adherence rates of only 64% in children discharged from the emergency department (ED).^{9,10} As a result, alternative steroid regimens have been considered for the treatment of pediatric asthma exacerbations. Most recently, oral dexamethasone, a steroid with prolonged duration of action, and shorter dosing regimen has been utilized as an effective substitute. Several ED studies have demonstrated similar symptom improvement, quality of life scores, need for hospitalization and relapse rates between prednisone/prednisolone and dexamethasone.^{9,11-15} Thus, numerous EDs have switched to oral dexamethasone as the preferred steroid for the initial management of pediatric asthma exacerbations.^{14,16-19}

While many ED providers have adopted oral dexamethasone as first-line treatment for pediatric asthma exacerbations, primary care provider (PCP) practices and steroid preferences in the **outpatient clinic setting are unknown. Comparative effectiveness of prednisone/prednisolone and dexamethasone in outpatient primary care clinics has not been well studied and evidence-**

based guidelines do not provide consensus for the preferred steroid in this setting. Evaluation of PCP treatment decisions is important: a substantial portion of pediatric asthma exacerbations are managed in the office setting.³ PCPs also follow patients post-ED discharge and may have a better understanding of the effectiveness of different steroid regimens in terms of treatment failure and resolution of acute asthma symptoms. **In this study, we sought to evaluate PCP preferences and perceptions regarding oral steroids prescribed from both outpatient primary care and ED settings for the treatment of children with acute asthma exacerbations. Specifically, the objectives of this study were to 1) describe PCP steroid preference between prednisone/prednisolone and dexamethasone for children presenting to the primary care clinic at initial presentation for an acute asthma exacerbation and at 72-hour follow-up for persistent symptoms after receiving treatment at an ED, 2) assess patient- and provider- level factors that influence PCP steroid preferences, 3) evaluate PCP perceptions regarding treatment failure, efficacy and adherence for dexamethasone versus prednisone/prednisolone, and 4) to compare the association between PCP steroid preferences and PCP years of practice and academic affiliation. We hypothesized that variability would exist in PCP steroid preferences for management of acute asthma exacerbations and that steroid preference would be influenced by PCP years of practice and academic affiliation.**

Methods

Study Setting

This survey was administered between February and May 2019 to PCPs who care for children in the **outpatient clinic** setting. This study was approved by the Colorado Multiple Institutional Review Board as exempt research not requiring written consent.

Study Population

The survey was distributed to PCPs including physicians, nurse practitioners, and physician assistants in the state of Colorado who care for pediatric patients. The survey was distributed through the Colorado Chapter of the American Academy of Pediatrics (AAP), which is composed of approximately 600 board certified general pediatricians. A survey reminder was also sent through the Colorado Pediatric Care Network, which is composed of 275 pediatric providers who collaborate with Children's Hospital Colorado. All members of the Pediatric Care Network are also members of the Colorado Chapter of the AAP. The survey was distributed via both organizations to increase response rates and study participants were asked to respond to the survey only once. Although the networks include pediatric sub-specialists, these providers were excluded.

Survey Design

The survey was designed to evaluate PCP preferences and perceptions regarding oral corticosteroids **prescribed from both outpatient primary care and ED settings** for the treatment of children with acute asthma exacerbations. PCP preferred oral steroid and dosing regimen **for children presenting to a primary care clinic at initial presentation for an acute asthma exacerbation and at 72-hour follow-up for persistent symptoms after receiving treatment at an ED** were evaluated utilizing 4 case-based questions. Survey items were formatted as multiple-choice with free-text entry to allow PCPs to describe preferred dosing regimens. Multiple responses ("check all that apply") were allowed when selecting patient- and provider-level factors contributing to steroid preferences. PCP perceptions regarding treatment failure, efficacy and adherence of **dexamethasone versus prednisone/prednisolone** were assessed using a 4-point Likert scale (strongly disagree to strongly agree). The survey also contained questions regarding PCP and practice demographics (see **Appendix for survey**).

Survey items were generated by study investigators. **After several revisions, a modified Delphi method was used to assess content and criterion validity, as well as item utility. A multidisciplinary panel of experts in pediatric emergency medicine, general pediatrics and pediatric pulmonary medicine participated in the modified Delphi review. Expert panelists were asked to rate survey items in terms of utility in evaluating study objectives using a 4-point Likert scale (1-Strongly agree, 2-Agree, 3-Disagree, 4-Strongly disagree). Survey items were accepted if 80% or more of panelists “Strongly agreed” or “Agreed” that survey items were appropriate to evaluate study objectives.** Survey literacy and comprehensibility were then assessed during a pilot test phase, which confirmed that questions and formatting utilized were best able to elicit precise responses.

Survey administration

The survey was administered electronically utilizing REDCap. The survey was distributed via the Colorado Chapter of the AAP listserv with an initial e-mail and subsequent follow-up email 2 weeks later. A survey reminder was also sent via the Colorado Pediatric Care Network in a monthly newsletter with a link to the REDCap survey. All study participants were informed at the beginning of the survey that completion of the survey implied consent for participation.

Data analysis

Descriptive statistics were utilized to describe PCP demographics and summarize survey responses. **Continuous variables were described according to means ($\pm$ SD) and medians (IQR) and categorical data were described using frequencies and proportions. The association between PCP steroid preference and PCP years of practice and academic affiliation were compared using Pearson’s chi-squared and Fisher’s exact tests.** The significance level was set at $p < 0.05$ for all analyses and 95% confidence intervals were reported when indicated. All survey responses were transferred directly into a secure REDCap database. Statistical analysis was performed using the Statistical Package for the Social Sciences version 25 (IBM SPSS, College Station, TX).

Results

Survey Response and Respondent Characteristics

The overall response rate was 18.2% (109/600). The majority of survey respondents were female (72.2%), physicians (91.7%) practicing at a private (37.6%) or hospital-affiliated (31.2%) practice with 14.1 ($\pm$ 10.0) mean years of experience since completion of training. Fifty-nine percent of respondents had a university or academic affiliation. The majority of PCPs estimated that 50% or less of their patients are Hispanic and 29% or less have Medicaid insurance.

PCP Steroid Management of Pediatric Asthma Exacerbations

About half of PCPs (50.5%) reported prescribing oral prednisone/prednisolone for children with acute asthma exacerbations that can be managed on an outpatient basis (**Figure 1**). “Very important” reasons identified for choosing prednisone/prednisolone included effectiveness (96.4%) and feeling that this was best practice based on current evidence (72.7%). For PCPs who prescribe dexamethasone (49.5%), “very important” reasons for choosing dexamethasone included effectiveness (88.9%), patient adherence (81.5%) and ease of dosing (77.8%). Palatability was considered a “very important” reason for choosing dexamethasone for only 35.2%. Typical dosing regimens prescribed by PCPs for oral prednisone/prednisolone and oral dexamethasone are reported

in Table 1. Dosing was fairly consistent among providers, though number of doses and length of treatment varied for both steroids.

For children who **initially** present to their PCP for an **acute** asthma exacerbation but require transfer to an ED due to the severity of symptoms, the majority of PCPs (63.3%) reported administering oral dexamethasone prior to transfer. Ninety-three percent of PCPs identified increased effectiveness as a “very important” reason for choosing dexamethasone in this scenario and only 27.5% identified presumed preference of the ED to which the child was being referred as a “very important” reason.

For children **who follow-up with their PCP for persistent asthma symptoms 72 hours after** being treated an ED for an exacerbation with oral prednisone/prednisolone, the majority (78.9%) of PCPs reported prescribing no additional steroids, and would have patients complete the 5-day course of prednisone/prednisolone as prescribed by the ED. However, in children **who follow-up with their PCP for persistent asthma symptoms 72 hours after being treated at** an ED with oral dexamethasone and an additional dose 36 hours later, half (50.5%) of PCPs stated they would switch children to oral prednisone/prednisolone, while only 22% would prescribe a third dose of oral dexamethasone (**Figure 2**).

PCPs Steroid Preferences and Perceptions

PCPs preferred that surrounding EDs who treat their patients for asthma exacerbations use dexamethasone (44.0%) or had no preference (41.3%). Only 14.7% of PCPs preferred prednisone/prednisolone. There was no significant association between PCP steroid preference and PCP years of practice ($p=0.4$) or academic affiliation ($p=0.06$). **PCPs did not perceive more treatment failure or more rapid resolution of symptoms with dexamethasone compared to prednisone/prednisolone, but reported better perceived adherence with dexamethasone (Table 2).**

Discussion

In this study, we describe PCP practice patterns and preferences between oral prednisone/prednisolone and oral dexamethasone for the treatment of pediatric asthma exacerbations in the **primary care clinic setting**. To our knowledge, this is the first study to evaluate provider- and patient-level factors contributing to PCP steroid preferences and management decisions since oral dexamethasone became a common therapeutic option for outpatients. Our study found PCP steroid preferences are variable, with equal proportions of PCPs prescribing prednisone/prednisolone and dexamethasone. Interestingly, many PCPs consider use of prednisone/prednisolone as “best practice.” However, there is limited evidence to support a specific steroid as “best practice” in the **primary care setting**. **Our study supports the need for further investigations to evaluate for differences in clinical outcomes related to PCP steroid treatment choices.**

The findings in our study are consistent with studies evaluating inpatient steroid management after ED initiation of dexamethasone.^{20,21} The majority of PCPs continue oral prednisone/prednisolone if patients are prescribed prednisone/prednisolone in the ED, and even switch to oral prednisone/prednisolone if prescribed dexamethasone in the ED. This approach is similar to inpatient steroid management, where there is variability in ongoing steroid choice when dexamethasone is administered in the ED. **In the inpatient setting, the variability in steroid preference amongst providers has been associated with errors in medication dosing with almost a third of providers selecting incorrect dosing intervals.²⁰ Thus, variability in steroid preference has potential to impact clinical care through dosing irregularities and inadequate or excessive steroid administration.²⁰**

Our study elicited **substantial variability** in PCP preferences regarding steroid use for asthma. While most PCPs continue or switch to oral prednisone/prednisolone for continued symptoms in the **primary care setting**, a minority of PCPs actually preferred that surrounding EDs utilize prednisone/prednisolone for their patients with asthma exacerbations. In addition, prednisone/prednisolone is typically used for more severe exacerbations.²⁰ However, the majority of PCPs in our study preferred dexamethasone for children with more severe exacerbations requiring transfer to an ED. The assumed preference of the ED to which the PCP referred the patient did not contribute to their steroid choice. The switch to dexamethasone as steroid of choice for asthma exacerbations occurred over the past 5 years, mainly in EDs associated with academic centers. Interestingly, steroid preference among surveyed PCPs was not associated with years in practice, or academic affiliation.^{15,22}

PCP perceptions of oral prednisone/prednisolone and oral dexamethasone are consistent with existing literature. **Most PCPs did not perceive more treatment failure or more rapid resolution of symptoms with dexamethasone compared to prednisone/prednisolone, but reported better perceived adherence with dexamethasone.** This is consistent with ED studies demonstrating no difference between steroids in symptom improvement, need for hospitalization and relapse rates and better adherence with dexamethasone.^{15,22,23} Interestingly, PCPs did not report palatability or side effect profile as important reasons for choosing dexamethasone, though several studies report less vomiting and better palatability.^{9,11}

Although, PCP perceptions of oral dexamethasone are positive, approximately half continue to use prednisone/prednisolone as first-line steroid for asthma exacerbations treated in the **primary care setting**. **Interestingly, family preference was not a “very important” reason for choosing either prednisone/prednisolone or dexamethasone, though numerous studies demonstrate that caregivers prefer dexamethasone due to the shorter course.**^{24,25} **Patient and caregiver preferences are likely to impact adherence and aligns with an approach that incorporates shared decision making in asthma treatment. In addition, cost was not considered a “very important” reason for choosing either steroid; however, in the state of Colorado, insurance providers cover dexamethasone, prednisone and prednisolone at similar rates.** The continued use of prednisone/prednisolone is likely associated with PCP comfort levels with prednisone/prednisolone and insufficient evidence to support first-line use of dexamethasone in the **primary care setting**.

To our knowledge, there is one prior study comparing prednisone/prednisolone and dexamethasone for the treatment of pediatric asthma exacerbations in the **primary care clinic setting**. In this retrospective study, 63% of patients received oral prednisone/prednisolone and 37% received oral dexamethasone.²⁶ There was no difference in clinic length of stay, or cumulative hospitalizations, ED visits or follow-up visits. Treatment of pediatric asthma exacerbations in the primary care setting was associated with US\$3000 cost savings per exacerbation, as compared to treatment in an ED.²⁶ **This study also supports the need for a comparative effectiveness trial evaluating differences in clinical outcomes and cost-effectiveness related to PCP steroid treatment choices. Appropriate treatment of acute asthma exacerbations in the primary care clinic setting has potential to limit ED visits and contribute to substantial cost savings.**

Our study has several limitations. First, we are limited by poor response rates, which may introduce sampling bias and not represent the true PCP population. Second, this is a survey-based study leaving our data prone to subjectivity and response bias. The study relied solely on PCP report of clinical practice and may not reflect actual clinical decisions. **In addition, the AAP is mainly comprised of physicians, which may explain the low response rate by nurse practitioners and physician assistants.** Lastly, this study surveyed PCPs in a single state and may not be generalizable across other settings.

Conclusion

PCPs vary in their treatment decisions and preferences regarding oral steroids for pediatric asthma exacerbations. It is unclear if these inconsistencies impact clinical outcomes in **primary care clinics**. Further investigation of PCP steroid management including an evaluation of clinical outcomes is needed to provide high quality, cost-effective care in the **primary care setting**.

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Tables

Table 1. PCP Dosing Regimen for Treatment of Acute Asthma Exacerbation by Preferred Oral Corticosteroid

Dose	Prednisone/Prednisolone (n=55)	Dexamethasone (n=54)
Typical dose (mg/kg)	1 (1, 2)	0.6 (0.6, 0.6)
Max dose (mg)	60 (40, 60)	16 (16, 16)
Length of treatment (doses)	10 (5, 10)	2 (2, 2)
Frequency (times per day), n (%)	38 (69.1) Twice a day 17 (30.9) Once a day	1 (1.9) Three times a day 40 (74.1) Once a day 13 (24.1) Every 36 hours

*PCP refers to primary care provider.

*Median (interquartile range) unless otherwise reported.

Table 2. PCP Perceptions Regarding Oral Dexamethasone Compared to Oral Prednisone/Prednisolone n=109; n (%)

	Strongly agree	Agree	Disagree	Strongly disagree
Dexamethasone has more frequent treatment failure compared to prednisone/prednisolone.	6 (5.5)	24 (22.0)	54 (49.5)	25 (22.9)
Dexamethasone has better adherence compared to prednisone/prednisolone.	32 (29.4)	56 (51.4)	20 (18.3)	1 (0.9)
Dexamethasone has more rapid resolution of symptoms compared to prednisone/prednisolone.	6 (5.5)	26 (23.9)	68 (62.4)	9 (8.3)

*PCP refers to primary care provider.

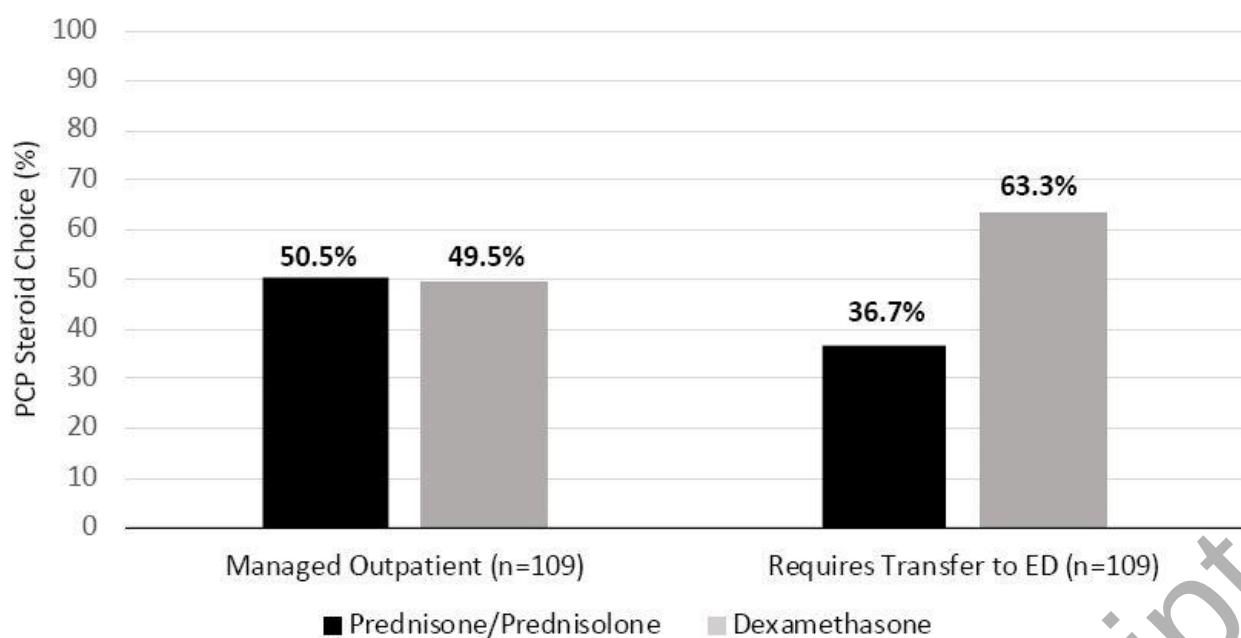


Figure1. PCP steroid choice for an acute asthma exacerbation that can be managed outpatient versus an exacerbation that requires transfer to an ED.

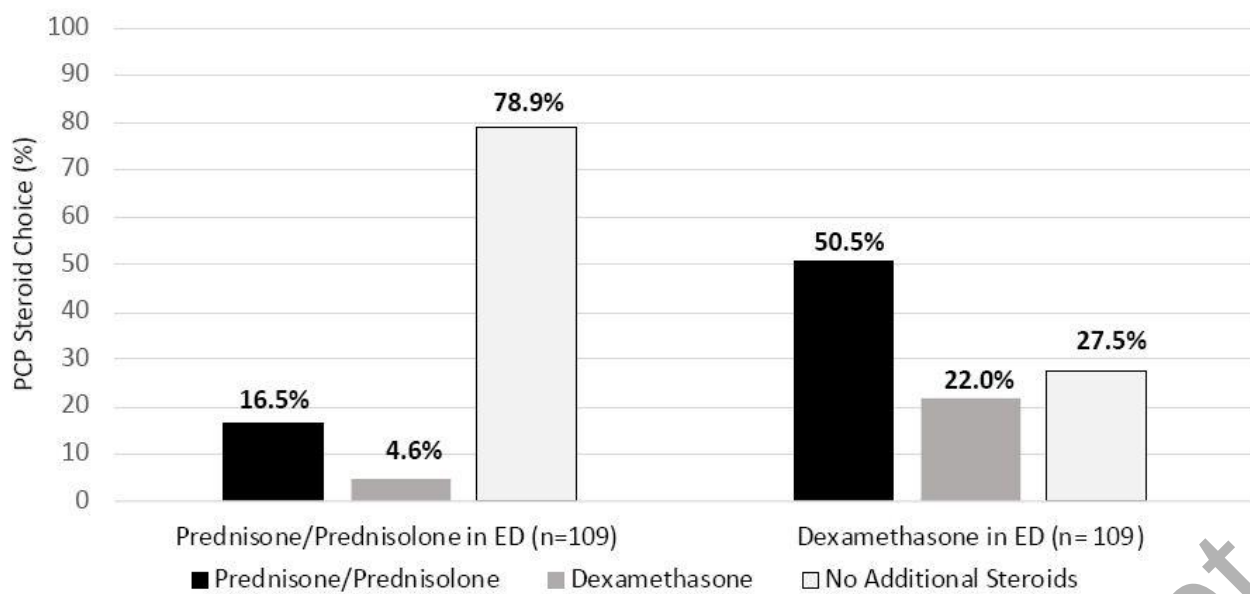


Figure 2. PCP steroid choice for treatment of persistent symptoms 72 hours after being treated with prednisone/prednisolone or dexamethasone for an acute asthma exacerbation in the ED.