Dexamethasone Treatment Regimen and Clinical Outcomes in Children With Asthma Exacerbations

Shivam Dave, MD*; Israel Green-Hopkins, MD; Naomi S. Bardach, MD, MAS; Jacqueline Grupp-Phelan, MD, MPH; Daniel J. Shapiro, MD, MPH

*Corresponding Author. E-mail: shivam.dave@ucsf.edu.

Study objectives: To detail variation in the number of doses of dexamethasone used to treat children with asthma exacerbations discharged from the emergency department (ED) and to assess whether treatment with 1 dose versus 2 doses was associated with different clinical outcomes. We hypothesized that clinical outcomes would not differ between groups.

Methods: We conducted a retrospective cohort study of children aged 2 to 20 years discharged from either of 2 EDs after treatment with dexamethasone for an asthma exacerbation. The primary outcome was an ED revisit, and the secondary outcome was a hospitalization, each measured within 14 days. The primary exposure was prescription of a second dose of dexamethasone at discharge. Propensity score adjustment with inverse probability of treatment weighting was used to mitigate confounding.

Results: Among 2,063 children included, 1,277 (61.9%) were prescribed a second dose of dexamethasone. In the propensity score-weighted cohort, the risk of an ED revisit was 5.2% for children who received 1 dose and 5.7% for children who received 2 doses (risk difference, 0.45%, 95% confidence interval [CI]: −1.4% to 2.3%). The risk of hospitalization was 0.85% in the 1-dose group and 0.83% in the 2-dose group (risk difference 0.02%, 95% CI: −0.93% to 0.89%).

Conclusion: Nearly two-thirds of children with asthma exacerbations were treated with 2 doses of dexamethasone rather than a single dose, even though treatment with 2 doses was not associated with improved outcomes. These results suggest that 1 dose of dexamethasone may be sufficient to treat many children with asthma exacerbations discharged from the ED. [Ann Emerg Med. 2026;88:46-54.]

Please see page 47 for the Editor's Capsule Summary of this article.

Keywords: Asthma, Dexamethasone, Optimal dosing, Evidence-based medicine.

Readers: click on the link to go directly to a survey in which you can provide **feedback** to *Annals* on this particular article.
A **podcast** for this article is available at www.annemergmed.com.

0196-0644/$-see front matter
Copyright © 2025 by the American College of Emergency Physicians.
https://doi.org/10.1016/j.annemergmed.2025.12.010

INTRODUCTION

Background

Acute asthma exacerbations in children account for more than 700,000 emergency department (ED) visits annually in the United States.[1,2] To improve symptoms and prevent adverse health outcomes in children with moderate-to-severe asthma exacerbations, professional guidelines recommend treatment with systemic corticosteroids.[3,4] Whereas prednisone historically was the recommended treatment, randomized trials suggest that 1 to 2 doses of dexamethasone have similar efficacy to 3 to 5 days of prednisone, with fewer adverse effects and improved adherence.[5-12] As a result of this evidence, international guidelines endorse 1- or 2-dose regimens of dexamethasone as alternatives to prednisone, and the overall use of dexamethasone for asthma exacerbations in the United States has increased 5-fold in the last decade.[1,13] Although 2 prior studies have investigated the effectiveness of 1 versus 2 doses of dexamethasone, these studies were not powered to detect clinically important differences in ED revisits, an important measure of treatment response.[14,15]

Importance

Determining whether children with asthma exacerbations treated with 1 versus 2 doses of dexamethasone have different outcomes is critical given the potential harms of corticosteroid treatment. In pediatric trials, corticosteroid treatment in children has been associated with vomiting, behavioral changes, and sleep disturbance.[16] Additionally, population-based observational studies in children have demonstrated that short courses of systemic corticosteroids are associated with osteopenia, sepsis, pneumonia, and gastrointestinal

Editor's Capsule Summary

What is already known on this topic

Dexamethasone is an effective treatment for pediatric asthma exacerbations, but impact of a second dose is unknown.

What question this study addressed

After one dose of dexamethasone administered in the emergency department (ED), is a prescription for a second dose associated with fewer revisits after adjusting for severity?

What this study adds to our knowledge

The risk of revisit was not lower for children given a dexamethasone prescription (5.7% prescription vs 5.4% no prescription; risk difference 0.5%, 95% CI –1.4% to 2.3%).

How this is relevant to clinical practice

For children with an asthma exacerbation discharged from the ED, a second dose of dexamethasone may not be necessary.

bleeding.[17,18] The risks of these potential harms are amplified in children with asthma, who often receive multiple courses of corticosteroids each year.[17] Accordingly, professional societies have emphasized that judicious use of corticosteroids for asthma should be a public health priority.[19,20]

Goals of This Investigation

The objectives of this study were to detail variation in the number of doses of dexamethasone used to treat children with asthma exacerbations discharged from the ED and to determine whether treatment with 1 dose rather than 2 doses is associated with different clinical outcomes. We hypothesized that there would be no differences in clinical outcomes between children treated with 1 dose or 2 doses.

METHODS

Study Design and Setting

This was a retrospective cohort study of visits to either of 2 pediatric EDs affiliated with a tertiary care academic pediatric hospital between January 2017 and August 2024 (the most recent available data). The EDs serve a combined 60,000 visits per year and are staffed by pediatric emergency physicians, residents in pediatrics and in emergency medicine, and respiratory therapists. Medical care for children with asthma exacerbations is supported by a clinical pathway that is similar at both sites, though decisions about disposition and medication prescribing are left to the discretion of the attending physician.

We accessed detailed demographic data and encounter-level clinical data from the electronic health record. We examined continuous variables for outliers visually using histograms and boxplots and numerically using summary statistics. We manually examined all categories and frequencies of categoric variables using frequency tables. We did not identify any extreme or implausible values, so we did not exclude any observations on this basis. The only variable for which some data were missing was the asthma severity score (see *Sensitivity Analyses)*. This study was considered nonhuman subjects research by the Institutional Review Board. We followed the Strengthening the Reporting of Observational Studies in Epidemiology reporting guidelines.

Selection of Participants

We included ED visits resulting in discharge by children aged 2 to 20 years with a discharge diagnosis of asthma (International Classification of Diseases, 10th revision, Clinical Modification code: J45) in any diagnosis field who were treated with a dose of systemic dexamethasone while in the ED. For each patient, we included only the first eligible encounter for asthma during the study period. To distinguish index ED visits from visits that would be classified as revisits in our analysis, we excluded children with an ED visit or hospitalization within the prior 14 days. To avoid inclusion of visits in which other systemic corticosteroids were used, we excluded children who were prescribed or treated with a systemic corticosteroid in any context within 7 days prior to the index visit and those who were treated with or prescribed a systemic other than dexamethasone (ie, prednisone, prednisolone, or methylprednisolone) at the index ED visit. We also excluded children who were treated with dexamethasone doses outside of the therapeutic range (0.3-0.6 mg/kg, maximum 16 mg), as sub- or supratherapeutic dosing could result in different outcomes regardless of the number of treatment doses.[21] Additionally, we excluded children with concomitant discharge diagnoses of anaphylaxis, croup, urticaria, or angioedema, as dexamethasone treatment in these cases is common and may not have been for asthma.[22-24] Finally, we excluded children without a documented asthma severity score (the Modified Pediatric Asthma Severity Score [MPASS]), as this variable was used to adjust for illness severity in the comparative effectiveness analysis.[25,26]

Exposures

The primary exposure was whether a second dose of oral dexamethasone was prescribed at discharge. We considered any oral formulation (eg, tablet, liquid) at a therapeutic dose (0.3-0.6 mg/kg).

Outcomes

The primary outcome was an all-cause ED revisit and the secondary outcome was an all-cause hospitalization, each assessed 1 to 14 days after discharge. We did not include revisits within 24 hours—the typical recommended time between the first and second doses—as these early outcomes would not be attributable to the duration of dexamethasone treatment.[10,12]

We evaluated the occurrence of 2 exploratory outcomes: office visits and new systemic corticosteroid treatments within 14 days. The rationale for studying these outcomes was that some children with persistent symptoms might seek additional care in settings other than the ED. We evaluated these outcomes only in children with established primary or pulmonary care at the hospital or its affiliated clinics, as we did not have access to these data for other children. Established primary or pulmonary care was defined—through manual review by 3 investigators (SD, IGH, and DJS)—as attendance of at least one visit to an affiliated primary care or pulmonary clinic within the prior 18 months. We chose an 18-month period to account for variation in the timing of recommended annual primary care visits.

Statistical Analysis

Demographic and clinical characteristics associated with the treatment regimen. To assess whether clinical and/or sociodemographic characteristics were associated with treatment with 1 versus 2 doses of dexamethasone, we performed multivariable logistic regression accounting for clustering by treating physician. Covariates were chosen for inclusion in the model based on an a priori literature-based assessment of their association with the outcome (1 vs 2 doses of dexamethasone) and included age, sex, parent-reported race and ethnicity, preferred language, insurance status, visit year, season (April to September vs October to March), treating facility, maximum MPASS (0-15, larger numbers indicate a more severe exacerbation), treatment with bronchodilators (albuterol, levalbuterol, ipratropium), treatment with magnesium sulfate, or treatment with or prescription of an antibiotic.[27-29] We included the social constructs of race and ethnicity because of prior associations between these constructs and management of asthma.[29-33] We included the maximum MPASS—rather than the first or last recorded MPASS—because it was found to be most strongly associated with a prescription for a second dose of dexamethasone.

Comparative effectiveness of 1 versus 2 doses of dexamethasone. To adjust for potential confounding by indication—whereby certain children might be more likely both to be prescribed a second dose of dexamethasone and to experience one of the outcomes—we generated propensity scores to estimate the probability of being prescribed a second dose of dexamethasone for each patient. We generated propensity scores using multivariable logistic regression, clustering on the treating physician. Covariates were chosen based on the investigators' assessments of variables that would be associated with dexamethasone treatment, as described above. We assessed the overlap assumption graphically with histograms and kernel density plots of propensity scores by treatment group and numerically using summary statistics. We also calculated the proportion of encounters within the region of common support. Using inverse probability of treatment weights, we generated a weighted cohort to balance anticipated differences in baseline characteristics across exposure groups. We considered baseline characteristics to be balanced in the weighted cohort if the standardized differences were less than 0.1.[34] We reported average treatment effects as risk differences with 95% confidence intervals (CIs). We used inverse probability of treatment weights instead of propensity matching to maximize statistical power by preserving all data in the analysis. Based on an anticipated 6% risk of an ED revisit, a sample size of 1,552 would be required to detect a 3% risk difference between groups with 80% power and α=0.05. We chose this clinically significant risk difference to be slightly smaller than the 4% to 5% difference used in 2 randomized trials of dexamethasone versus prednisone, as the definition of treatment failure in those studies included unscheduled outpatient visits—which may have represented less severe outcomes—in addition to ED revisits.[11,12]

Sensitivity Analyses

Due to missing asthma severity scores at some visits, we performed a sensitivity analysis in which we included the triage acuity score (1-5) instead of the asthma severity score in the model to generate propensity scores. Additionally, we repeated the primary analysis including revisits and hospitalizations within 24 hours. Analyses were conducted using Stata 18 (Stata Corp, College Station, TX).

RESULTS

Cohort Characteristics

After exclusions (Appendix E1, available at http://www.annemergmed.com), a total of 2,063 ED visits for asthma exacerbations were included in the analysis. Overall, the median age was 5 years (interquartile range 3.7 years), and 1,293 (62.7%) identified as male (Table 1). The illness severity was mild (MPASS 0-5) in 977 (47.3%) of visits and moderate (MPASS 6-10) in 958 (46.4%) of visits.

Table 1. Characteristics of the unweighted cohort.

Characteristic	1 Dose	2 Doses
N (%)	**786 (38.1%)**	**1,277 (61.9%)**
Season		
Apr-Sep	381 (48.5%)	643 (50.4%)
Oct-Mar	405 (51.5%)	634 (49.6%)
Facility		
Site 1	195 (24.8%)	581 (45.5%)
Site 2	591 (75.2%)	696 (54.5%)
Age group		
2-3 y	238 (30.3%)	426 (33.4%)
4-6 y	230 (29.3%)	392 (30.7%)
7-11 y	213 (27.1%)	311 (24.4%)
12-20 y	105 (13.4%)	148 (11.6%)
Sex		
Female	307 (39.1%)	463 (36.3%)
Male	479 (60.9%)	814 (63.7%)
Race and ethnicity		
Hispanic	292 (37.2%)	422 (33.0%)
Black, non-Hispanic	218 (27.7%)	289 (22.6%)
White, non-Hispanic	64 (8.1%)	137 (10.7%)
Other, non-Hispanic	162 (20.6%)	318 (24.9%)
Unknown/declined	50 (6.4%)	111 (8.7%)
Language		
Other	170 (21.6%)	214 (16.8%)
English	616 (78.4%)	1,063 (83.2%)
Insurance		
Private	206 (26.2%)	434 (34.0%)
Public	567 (72.1%)	815 (63.8%)
Self-pay	13 (1.7%)	28 (2.2%)
Any ED visit for asthma in the prior year	110 (14.0%)	179 (14.0%)
MPASS score (mean, SD)	5.018 (2.937)	6.231 (2.923)
Albuterol treatment at the index visit	681 (86.6%)	1,214 (95.1%)
Ipratropium treatment at the index visit	626 (79.6%)	1,136 (89.0%)
Magnesium treatment at index visit	29 (3.7%)	99 (7.8%)
Antibiotic treatment/ prescription	33 (4.2%)	41 (3.2%)

Variation in Dexamethasone Treatment Regimen

Overall, 786 (38.1%) received a single dose of dexamethasone, and 1,277 (61.9%) received 2 doses. The proportion treated with 2 doses varied substantially according to the treating attending physician (Figure). In multivariable logistic regression analysis, clinical site (adjusted odds ratio, 0.49, 95% CI: 0.30 to 0.81 for site 2 compared with site 1), MPASS (1.08, 1.05, and 1.11 for each 1-point increase in the score), and concomitant treatment with ipratropium (1.92, 1.50, and 2.47) at the index visit were associated with treatment with 2 doses of dexamethasone (Table 2).

Clinical Outcomes in Children Receiving 1 Versus 2 Doses of Dexamethasone

After propensity score adjustment using inverse probability of treatment weights, the weighted cohort included 1,028 patients (49.8%) who received 1 dose of dexamethasone and 1,035 (50.2%) who received 2 doses. There was substantial overlap in the distribution of propensity scores between groups (Appendix E1). The proportion of encounters within the region of common support was 99.4%.

The weighted cohort was balanced on all baseline characteristics (Appendix E1). In the weighted cohort, the risk of an ED revisit within 14 days was 5.2% (3.4%, 7.1%) for children who received 1 dose of dexamethasone and 5.7% (4.5%, 6.9%) for children who received 2 doses (risk difference, 0.45%, 95% CI: –1.4% to 2.3%) (Table 3). The risk of hospitalization within 14 days was 0.85% (0.14%, 1.6%) in those who received 1 dose of dexamethasone compared with 0.83% (0.33%, 1.3%) in those who received 2 doses (risk difference, 0.02% 95% CI: –0.93% to 0.89%). Among the subgroup of 587 children who received primary or pulmonary care within the health system, there were no differences in the risks of office visits (17.7%) or new corticosteroid treatments (10.4%) during the subsequent 14 days (Table 3). In the sensitivity analyses that (1) included children without MPASS scores and (2) included revisits within 24 hours, there were no differences in the risks of the outcomes across groups (Appendix E1).

LIMITATIONS

This study has limitations. First, due to the retrospective design, the identified associations may not be causal. Although our propensity adjustment methods

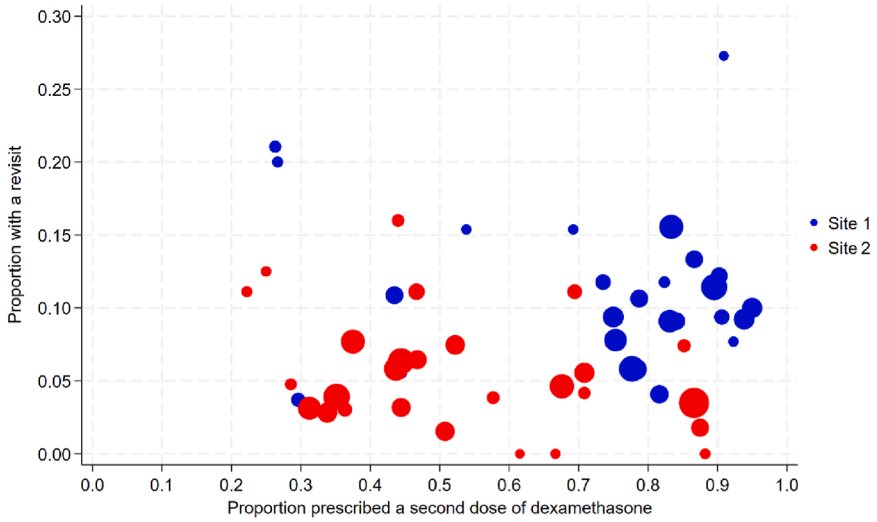

Figure. Physician-level proportions of encounters in which 2-dose regimens were used, plotted against ED revisits. The x-axis shows the proportion of index encounters in which the physician prescribed a second dose of dexamethasone. The y-axis shows the proportion of index encounters for that physician that resulted in an emergency department revisit. Colors correspond to the practice site, and the size of the dot is proportional to the number of visits seen by the physician during the study period. The figure excludes physicians who saw fewer than 10 eligible encounters during the study period.

resulted in a weighted cohort that was balanced across exposure groups on all measured covariates, it is possible that our results were confounded by unmeasured variables. For example, we may not have fully captured differences in asthma severity across groups, and we were unable to measure whether discharge instructions or return precautions differed across groups. Second, although the study's large diverse cohort allowed for the comparison of the primary outcomes across exposure groups with high precision, it is possible that the findings from these 2 pediatric EDs do not generalize to other clinical sites. However, the demographic and clinical characteristics of the included cohort were similar to those in national cohorts of children with asthma discharged from pediatric or general EDs.[1,29,35] Third, because we used data from the electronic health record within a single health system, we lacked complete follow-up data for children who may have sought care at other facilities after discharge from the index visit. Still, the risks of revisits and hospitalizations observed in our study aligned with those seen in previous studies, and we would expect unmeasured outcomes to be balanced across exposure groups.[14,36-40] Additionally, for the subset of children who received primary care within our health system, we observed no differences in the frequency of office visits outside our health system during the follow-up period. Although not directly measurable in our data, we would expect a similar pattern of health care use among the other children included in the study. Fourth, our primary exposure was defined according to a prescription for dexamethasone on discharge. Prior research suggests that parents of children with asthma report filling more than 90% of discharge prescriptions for oral corticosteroids and administering more than 80%, but we could not confirm dispensation of the prescription or whether/when a second dose was consumed.[15,41] Accordingly, our findings should be interpreted as an intention-to-treat analysis.

DISCUSSION

In this cohort study of children with asthma exacerbations discharged from EDs in a large health system, approximately two-thirds of children were treated with 2 doses rather than 1 dose of dexamethasone. We identified substantial variation in the treatment regimen according to nonclinical variables (ie, the treating clinician and clinical site) and markers of clinical illness severity (ie, the asthma severity score and concomitant treatments). After adjusting for baseline differences across exposure groups, there were no differences in the risks of ED revisits, hospitalizations, office visits, or new corticosteroid treatments according to whether a 1- or 2-dose regimen was used.

Previous studies of children hospitalized or treated in the ED for asthma exacerbations have demonstrated large increases over time in the proportion of children treated with dexamethasone rather than prednisone derivatives.[1,42] Our study adds to these findings by demonstrating that nearly two-thirds of children discharged from the included EDs were treated with 2 doses of dexamethasone rather

Table 2. Characteristics associated with treatment with 2 doses of dexamethasone.

Characteristic	Adjusted Odds Ratio (95% CI) for Treatment With 2 Doses
Season	
Apr-Sep	Reference
Oct-Mar	0.96 (0.78-1.18)
Facility	
Site 1	Reference
Site 2	0.49 (0.30-0.81)
Age group	
2-3 y	Reference
4-6 y	1.15 (0.91-1.46)
6-11 y	1.06 (0.82-1.37)
12-20 y	1.14 (0.83-1.56)
Male sex	1.09 (0.91-1.30)
Race and ethnicity	
Hispanic	Reference
Non-Hispanic Black	0.86 (0.69-1.09)
Non-Hispanic White	1.03 (0.76-1.41)
Other non-Hispanic	0.96 (0.71-1.29)
Unknown/declined	0.88 (0.59-1.33)
Insurance	
Private	Reference
Public	1.02 (0.79-1.30)
Self-pay	1.67 (0.80-3.50)
Language	
Other	Reference
English	1.18 (0.90-1.54)
Any ED visit for asthma in the prior year	1.10 (0.81-1.49)
MPASS score (per point)	1.08 (1.05-1.11)
Albuterol treatment at index visit	1.23 (0.92-1.66)
Ipratropium treatment at the index visit	1.92 (1.50-2.47)
Magnesium treatment at index visit	1.64 (0.93-2.91)

Adjusted odds ratios were generated from logistic regression models, accounting for clustering by clinician. In addition to the displayed variables, the model is adjusted for visit year.

than a single dose. The finding that most children were treated with 2 doses may reflect clinicians' reluctance to undertreat symptoms in the absence of definitive evidence to support either regimen, an overestimation of the benefits of a second dose of dexamethasone, or an underestimation of the potential risks of overtreatment.[43]

We identified substantial variation in treatment duration according to the treating clinician and the clinical site. The observed clinician-level variation may reflect learned behaviors from clinical training, subjectivity in the assessment of illness severity, or differences in the perceived risks and benefits of incremental doses of corticosteroids. Similarly, variation by site mirrors hospital-level variation in the management of other common pediatric conditions and likely reflects differences in hospital or ED culture.[22,44-47] Together, these findings suggest an opportunity to develop additional evidence to guide treatment recommendations, with the goal of standardizing care, improving clinical outcomes, and minimizing harms.

In addition to identifying variation in treatment according to certain nonclinical factors, we also observed an association between markers of illness severity (eg, the asthma severity score) and treatment regimen. These findings suggest that some clinicians may prescribe a second dose of dexamethasone for children who they judge to be more severely ill—a practice with intuitive appeal but without an evidence-based standard. Although we lacked the sample size to perform a stratified analysis to determine whether certain children with greater illness severity might benefit from 2 doses of dexamethasone, future studies should seek to determine differences in treatment effects according to illness severity.

After adjusting for baseline differences across exposure groups, we found that there were no differences in the risks of ED revisits or hospitalizations between children who received 1 or 2 doses of dexamethasone. These results build on findings from a small randomized noninferiority trial of 1 versus 2 doses of dexamethasone as well as a single-center observational study, which were underpowered to detect clinically significant differences in ED revisits or hospitalizations across groups.[14,15] We could not evaluate efficacy of a second dose because we only measured prescribing, not medication administration. It is possible that a second dose could be more effective, and future work should explore efficacy, especially in high-risk subpopulations such as those with more severe asthma phenotypes.

Given that nearly two-thirds of children in the cohort were treated with 2 doses, our findings support efforts to safely reduce unnecessary steroid exposure for children treated for asthma exacerbations.[43] In pediatric trials, treatment with short course of systemic corticosteroids has been associated with an approximate 5% risk each of vomiting, behavior change, and sleep disturbance.[16] Similarly, a large population-based cohort study in children showed a 1.4- to 2.2-fold increased risk of gastrointestinal bleeding, sepsis, or pneumonia within 30 days after receiving a short course of systemic corticosteroids.[18] In children with asthma, oral corticosteroid bursts have been shown to reduce bone mineral density in a dosage-dependent fashion, whereby

Table 3. Unadjusted and propensity score-adjusted outcomes among children treated with dexamethasone for asthma exacerbations, stratified by treatment duration.

		Risk (95% CI) of ED Revisit		
Outcome*	**Analysis**	**1 dose**	**2 doses**	**Risk difference (95% CI)**
Emergency department revisits	Unadjusted	5.0% (3.5%-6.7%)	6.1% (4.9%-7.6%)	1.1% (−0.86% to 3.1%)
	Adjusted‡	5.2% (3.4%-7.1%)	5.7% (4.5%-6.9%)	0.45% (−1.4% to 2.3%)
Hospitalizations	Unadjusted	0.76% (0.34%-1.7%)	0.78% (0.42%-1.45%)	−0.01% (−0.66% to 0.79%)
	Adjusted‡	0.85% (0.14%-1.6%)	0.83% (0.33%-1.3%)	−0.02% (−0.93% to 0.89%)
Office visits†	Unadjusted	17.2% (12.5%-23.1%)	18.0% (14.5%-22.1%)	0.82% (−5.7% to 7.3%)
New steroid prescription†	Unadjusted	8.6% (5.4%-13.4%)	11.3% (8.5%-14.9%)	2.7% (−2.3% to 7.7%)

*Outcomes were assessed 1 to 14 days after the index visit.
†Office visits and new steroid prescriptions were assessed in the subgroup of 780 patients who had any visit to a primary care physician or pulmonologist (within the same university health care system as the EDs in the study) in the last 18 months. Given smaller sample size, we report unadjusted proportions for these exploratory outcomes.
‡Propensity scores were generated using logistic regression, clustering by clinician. Inverse probability of treatment weights were applied to create a weighted cohort, in which the adjusted outcomes were measured.

the risk of osteopenia was 10%, 14%, and 21% in children who received 0, 1 to 4, and ≥5 courses, respectively.[17] From a practical perspective, a single dose of dexamethasone ensures adherence and reduces the financial and logistical burdens of filling a prescription or returning to a clinic for a second dose. Given that these potential harms and burdens are compounded for children with asthma, who often receive multiple corticosteroid bursts per year, professional societies have made corticosteroid stewardship in asthma a public health priority.[19,20,43] Although we did not directly measure harms that were attributable to different dexamethasone dosing regimens, using the minimum effective dose of dexamethasone for a single asthma exacerbation has the potential to reduce cumulative exposure over time and, in turn, the potential adverse effects of that cumulative exposure.

In summary, nearly two-thirds of children within this large cohort were treated for asthma exacerbations in the ED with 2 doses of dexamethasone rather than a single dose, but clinical outcomes did not differ according to the number of doses. These findings suggest that treatment with a single dose of dexamethasone is likely sufficient for many patients with asthma exacerbations managed in the ED. Further multicenter evidence could guide potential standardizations of care, thereby decreasing unnecessary exposures to the potential detrimental effects of systemic corticosteroids.

Supervising editors: Kenneth A. Michelson, MD, MPH; Lise E. Nigrovic, MD, MPH. Specific detailed information about possible conflict of interest for individual editors is available at https://www.annemergmed.com/editors.

Author affiliations: From the Department of Pediatrics (Dave, Green-Hopkins, Bardach, Grupp-Phelan, Shapiro), University of California, San Francisco, San Francisco, CA; Department of Emergency Medicine (Green-Hopkins, Grupp-Phelan, Shapiro), University of California, San Francisco, San Francisco, CA; and Philip R. Lee Institute for Health Policy Studies (Bardach), University of California, San Francisco, San Francisco, CA.

Author contributions: SD, IG-H, and DJS conceptualized the study, collected data, conducted statistical analysis, and drafted the initial manuscript. NSB and JG-P provided input on the study design and data analysis, and critically reviewed and revised the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work. SD takes responsibility for the paper as a whole.

Data sharing statement: The data dictionary and analytical code are available on request.

All authors attest to meeting the four ICMJE.org authorship criteria: (1) Substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work; AND (2) Drafting the work or revising it critically for important intellectual content; AND (3) Final approval of the version to be published; AND (4) Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Funding and support: By *Annals'* policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article as per ICMJE conflict of interest guidelines (see www.icmje.org). Dr. Shapiro received funding from the National Foundation of Emergency Medicine's Scholar/Mentor Program. The other authors have stated that no such relationships exist.

Publication dates: Received for publication October 9, 2025. Revisions received November 24, 2025, and December 1, 2025. Accepted for publication December 8, 2025.

REFERENCES

1. Shapiro DJ, Coon ER, Kaiser SV, et al. Trends in dexamethasone treatment for asthma in U.S. emergency departments. *Acad Emerg Med*. 2025;32:91-93.
2. Centers for Disease Control and Prevention. 2. 2019 Healthcare Use Data. January 25, 2023. Accessed September 10, 2024. https://www.cdc.gov/asthma/healthcare-use/2019/table_a.html
3. Expert Panel Working Group of the National Heart, Lung, and Blood Institute (NHLBI) administered and coordinated National Asthma Education and Prevention Program Coordinating Committee (NAEPPCC)Cloutier MM, Baptist AP, et al. 2020 Focused Updates to the Asthma Management Guidelines: A Report from the National Asthma Education and Prevention Program Coordinating Committee Expert Panel Working Group. *J Allergy Clin Immunol*. 2020;146:1217-1270.
4. Bateman ED, Hurd SS, Barnes PJ, et al. Global strategy for asthma management and prevention: GINA executive summary. *Eur Respir J*. 2007;31:143-178.
5. Klig JE, Hodge D 3rd, Rutherford MW. Symptomatic improvement following emergency department management of asthma: a pilot study of intramuscular dexamethasone versus oral prednisone. *J Asthma*. 1997;34:419-425.
6. Altamimi S, Robertson G, Jastaniah W, et al. Single-dose oral dexamethasone in the emergency management of children with exacerbations of mild to moderate asthma. *Pediatr Emerg Care*. 2006;22:786-793.
7. Gries DM, Moffitt DR, Pulos E, et al. A single dose of intramuscularly administered dexamethasone acetate is as effective as oral prednisone to treat asthma exacerbations in young children. *J Pediatr*. 2000;136:298-303.
8. Cronin JJ, McCoy S, Kennedy U, et al. A randomized trial of single-dose oral dexamethasone versus multidose prednisolone for acute exacerbations of asthma in children who attend the emergency department. *Ann Emerg Med*. 2016;67:593-601.e3.
9. Gordon S, Tompkins T, Dayan PS. Randomized trial of single-dose intramuscular dexamethasone compared with prednisolone for children with acute asthma. *Pediatr Emerg Care*. 2007;23:521-527.
10. Paniagua N, Lopez R, Munoz N, et al. Randomized trial of dexamethasone versus prednisone for children with acute asthma exacerbations. *J Pediatr*. 2017;191:190-196.e1.
11. Greenberg RA, Kerby G, Roosevelt GE. A comparison of oral dexamethasone with oral prednisone in pediatric asthma exacerbations treated in the emergency department. *Clin Pediatr (Phila)*. 2008;47:817-823.
12. Qureshi F, Zaritsky A, Poirier MP. Comparative efficacy of oral dexamethasone versus oral prednisone in acute pediatric asthma. *J Pediatr*. 2001;139:20-26.
13. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention. 2024. www.ginasthma.org
14. Martin M, Penque M, Wrotniak BH, et al. Single-dose dexamethasone is not inferior to 2 doses in mild to moderate pediatric asthma exacerbations in the emergency department. *Pediatr Emerg Care*. 2022;38:e1285-e1290.
15. Tanverdi MS, Navanandan N, Brackman S, et al. Impact of a discharge prescription for dexamethasone on outcomes of children treated in the emergency department for acute asthma exacerbations. *J Asthma*. 2024;61:584-593.
16. Aljebab F, Choonara I, Conroy S. Systematic review of the toxicity of short-course oral corticosteroids in children. *Arch Dis Child*. 2016;101:365-370.
17. Kelly HW, Van Natta ML, Covar RA, et al. Effect of long-term corticosteroid use on bone mineral density in children: a prospective longitudinal assessment in the childhood Asthma Management Program (CAMP) study. *Pediatrics*. 2008;122:e53-e61.
18. Yao TC, Wang JY, Chang SM, et al. Association of oral corticosteroid bursts with severe adverse events in children. *JAMA Pediatr*. 2021;175:723-729.
19. Patrawala S, Ramsey A, Mustafa SS. Steroid stewardship in allergy/immunology: an opportunity for improved clinical outcomes. *Ann Allergy Asthma Immunol*. 2025;134:133-134.
20. Blakey J, Chung LP, McDonald VM, et al. Oral corticosteroids stewardship for asthma in adults and adolescents: a position paper from the Thoracic Society of Australia and New Zealand. *Respirology*. 2021;26:1112-1130.
21. Dexamethasone. Lexi-Drugs. UpToDate Lexidrug. UpToDate Inc. Accessed December 1, 2024. https://online.lexi.com
22. Dribin TE, Neuman MI, Schnadower D, et al. Trends and variation in pediatric anaphylaxis care from 2016 to 2022. *J Allergy Clin Immunol Pract*. 2023;11:1184-1189.
23. Bagwell T, Hollingsworth A, Thompson T, et al. Management of croup in the emergency department: The role of multidose nebulized epinephrine. *Pediatr Emerg Care*. 2020;36:e387-e392.
24. Beno SM, Nadel FM, Alessandrini EA. A survey of emergency department management of acute urticaria in children. *Pediatr Emerg Care*. 2007;23:862-868.
25. Johnson MD, Zorc JJ, Nelson DS, et al. Intravenous magnesium in asthma pharmacotherapy: variability in use in the PECARN registry. *J Pediatr*. 2020;220:165-174.e2.
26. Rivera PMP, Park J, Clark T, et al. Implementation of a modified pediatric asthma severity score (mpass) to reduce length of stay for pediatric asthma patients: a quality improvement study. *J Allergy Clin Immunol*. 2019;143:AB211.
27. Tsai C-L, Rowe BH, Sullivan AF, et al. Factors associated with delayed use or nonuse of systemic corticosteroids in emergency department patients with acute asthma. *Ann Allergy Asthma Immunol*. 2009;103:318-324.
28. Bleecker ER, Menzies-Gow AN, Price DB, et al. Systematic literature review of systemic corticosteroid use for asthma management. *Am J Respir Crit Care Med*. 2020;201:276-293.
29. Hudgins JD, Neuman MI, Monuteaux MC, et al. Provision of guideline-based pediatric asthma care in US emergency departments. *Pediatr Emerg Care*. 2021;37:507-512.
30. Sarpong EM, Miller GE. Racial and ethnic differences in childhood asthma treatment in the United States. *Health Serv Res*. 2013;48(6pt1):2014-2036.
31. Boudreaux ED, Emond SD, Clark S, et al. Race/ethnicity and asthma among children presenting to the emergency department: differences in disease severity and management. *Pediatrics*. 2003;111:e615-e621.
32. Crocker D, Brown C, Moolenaar R, et al. Racial and ethnic disparities in asthma medication usage and health-care utilization: data from the National Asthma Survey. *Chest*. 2009;136:1063-1071.
33. Chandra D, Clark S, Camargo CA Jr. Race/ethnicity differences in the inpatient management of acute asthma in the United States. *Chest*. 2009;135:1527-1534.
34. Austin PC. Using the standardized difference to compare the prevalence of a binary variable between two groups in observational research. *Commun Stat Simul Comput*. 2009;38:1228-1234.
35. Ramgopal S, Michelson KA. Adoption of dexamethasone for asthma exacerbations. *Pediatrics*. 2025;156:e2024070153.
36. Bardach NS, Harder VS, McCulloch CE, et al. Follow-up after asthma emergency department visits and its relationship with subsequent asthma-related utilization. *Acad Pediatr*. 2022;22(3S):S125-S132.
37. Aguilar R, Knudsen-Robbins C, Ehwerhemuepha L, et al. Pediatric asthma exacerbations: 14-day emergency department return visit risk factors. *J Emerg Med*. 2024;67:e22-e30.
38. Hall AB, Novotny A, Bhisitkul DM, et al. Association of emergency department albuterol dispensing with pediatric asthma revisits and readmissions. *J Asthma*. 2017;54:498-503.

39. Walsh-Kelly CM, Kelly KJ, Drendel AL, et al. Emergency department revisits for pediatric acute asthma exacerbations: association of factors identified in an emergency department asthma tracking system. *Pediatr Emerg Care*. 2008;24:505-510.
40. Andrews AL, Wong KA, Heine D, et al. A cost-effectiveness analysis of dexamethasone versus prednisone in pediatric acute asthma exacerbations. *Acad Emerg Med*. 2012;19:943-948.
41. Butler K, Cooper WO. Adherence of pediatric asthma patients with oral corticosteroid prescriptions following pediatric emergency department visit or hospitalization. *Pediatr Emerg Care*. 2004;20:730-735.
42. Sellers AR, Roddy MR, Darville KK, et al. Dexamethasone for pediatric critical asthma: a multicenter descriptive study. *J Intensive Care Med*. 2022;37:1520-1527.
43. Bleecker ER, Al-Ahmad M, Bjermer L, et al. Systemic corticosteroids in asthma: a call to action from World Allergy Organization and Respiratory Effectiveness Group. *World Allergy Organ J*. 2022;15:100726.
44. Womer J, Zhong W, Kraemer FW, et al. Variation of opioid use in pediatric inpatients across hospitals in the US. *J Pain Symptom Manage*. 2014;48:903-914.
45. Shapiro DJ, Thurm CW, Hall M, et al. Respiratory virus testing and clinical outcomes among children hospitalized with pneumonia. *J Hosp Med*. 2022;17:693-701.
46. Gerber JS, Newland JG, Coffin SE, et al. Variability in antibiotic use at children's hospitals. *Pediatrics*. 2010;126:1067-1073.
47. Michelson KA, Monuteaux MC, Neuman MI. Variation and trends in anaphylaxis care in United States children's hospitals. *Acad Emerg Med*. 2016;23:623-627.