Pathways to Improve Pediatric Asthma Care: A Multisite, National Study of Emergency Department Asthma Pathway Implementation

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Objective To determine the effects of pediatric asthma pathway implementation in a diverse, national sample of emergency departments (EDs).

Study design In this quality improvement study, a national sample of EDs were provided pathways to tailor to local needs. Implementation strategies included local champions, external facilitators/mentors, educational seminars, and audit and feedback. Outcomes included systemic corticosteroid administration within 60 minutes (primary), assessment of severity at ED triage, chest radiograph use, hospital admission or transfer for higher level of care, and ED length of stay (balancing). Each month, EDs reviewed all charts (to a maximum of 20) of children ages 2-17 years with a primary diagnosis of asthma. Analyses were done using multilevel regression models with an interrupted time-series approach, adjusting for patient characteristics.

Results We enrolled 83 EDs (37 in children's hospitals, 46 in community hospitals) and 61 (73%) completed the study (n = 22 963 visits). Pathway implementation was associated with significantly increased odds of systemic corticosteroid administration within 60 minutes of arrival (aOR, 1.26; 95% CI, 1.02-1.55), increased odds of severity assessment at triage (aOR, 1.88; 95% CI, 1.22-2.90), and decreased rate of change in odds of hospital admission/transfer (aOR, 0.97; 95% CI, 0.95-0.99). Pathway implementation was not associated with chest radiograph use or ED length of stay.

Conclusions Pathway implementation was associated with improved quality of care for children with asthma in a diverse, national group of EDs. *(J Pediatr 2020;223:100-7)*.

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Childhood asthma is a leading cause of emergency department (ED) visits, hospitalizations, missed school days, and missed work days for caregivers, with total estimated direct costs of approximately $6 billion annually in the US.[1-3] Evidence-based clinical practice guidelines for management of asthma exacerbations are widely available.[4,5] However, clinicians face many challenges adhering to guidelines (eg, lack of awareness, low confidence in ability to adhere).[6,7] Poor guideline adherence contributes to poor health outcomes for children with asthma cared for in ED settings, including longer length of ED stay and higher risk of hospital admission.[8,9]

Clinical pathways are a potential tool for improving guideline adherence and quality of care. They are succinct versions of evidence-based guidelines that visually guide clinicians step-by-step through the timing, indications, and details of recommended tests and treatments for managing a specific illness. Pathways have been shown to improve quality of care for children with asthma in the ED setting by increasing the use and timely administration of recommended medications (bronchodilators and systemic corticosteroids), increasing asthma management teaching, decreasing length of ED stay, and decreasing risk of hospital admission.[10-19] This research has consisted of single-center studies, mainly from EDs within large, tertiary children's hospitals.[13-19] However, more than 30% of children in the US are cared for in these settings.[20] In 2018, the Value in Inpatient Pediatrics Network, the hospital-based pediatric quality improvement (QI) network at the American Academy of Pediatrics (AAP), launched a national quality collaborative to support pathway implementation with the global aim of "improving the value of care delivered to children with asthma."[21] The purpose of our study was to

AAP	American Academy of Pediatrics
CXR	Chest radiography
ED	Emergency department
EHR	Electronic health record
ITS	Interrupted time-series
LOS	Length of stay
QI	Quality improvement

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determine the effects of pediatric asthma pathway implementation in the diverse, national sample of EDs that participated in this collaborative.

Methods

Recruitment of sites occurred via 3 e-mails to Value in Inpatient Pediatrics electronic mailing lists (listservs). These listservs include clinicians from more than 250 EDs and hospitals in the US that range widely in size, type (eg, children's, community), ownership model (eg, private, nonprofit), and location (eg, rural, urban). The study took place from January 2018 to March 2019 and was approved by the AAP Institutional Review Board.

Study Planning

A panel of experts was assembled by the AAP to determine the study design and intervention. Members of this panel worked in diverse hospital and ED settings and had expertise in pediatric hospital medicine, pediatric emergency medicine, asthma, QI, and health services research. The panel met monthly from January to December 2017, including an in-person meeting in March 2017. This panel defined the over-arching goal of the collaborative, selected a set of SMART aims/outcomes (Specific, Measurable, Achievable, Relevant, and Time-Bound) that reflected this goal (Table I), and selected core pathway interventions (Table II, column 1) that had been demonstrated to improve those outcome measures.

Intervention

Participating hospitals were provided a pediatric ED asthma pathway implementation toolkit, which included sample evidence-based pathways and sample order sets based on pathway content.[22] Core pathway interventions included asthma severity assessment tools, order sets for triggering the process for administering systemic corticosteroids, and criteria for ordering chest radiography (CXR). The toolkit was piloted at 2 EDs in late 2017 to assess feasibility. Each ED designated a local physician implementation leader. These leaders recruited and then worked with local multidisciplinary teams to tailor and implement the core pathway interventions to fit local needs and context. To support pathway implementation, we used a learning collaborative model, and each ED's physician implementation leader was provided a physician mentor with QI expertise to guide them in the learning collaborative.[23] These mentors met with local implementation leaders monthly just before and during pathway implementation to provide support in engaging hospital leadership, garnering local clinician buy-in, planning improvement cycles, and addressing institutional barriers.[23] Site leaders also met together every other month to share lessons learned during the implementation process. EDs were provided several additional resources for implementation support, including QI training, a free mobile application with pathway content, monthly audit and feedback, and a total of 6 educational seminars (eg, evidence-based asthma care). To successfully support implementation efforts, EDs launched implementation efforts in 2 waves, with one-half starting pathway implementation in January 2018 and one-half starting pathway implementation in April 2018.

Outcomes

Study aims and outcomes (Table I) were selected through a consensus process among the national expert panel assembled by the AAP for the purpose of this study. The expert panel selected study outcomes/measures based on (1) recommendations of evidence-based guidelines, (2) potential to improve health outcomes, (3) variability and room for improvements in performance, and (4) feasibility of measurement.[4,5] Increasing the administration of systemic steroids within 60 minutes was selected as the primary aim because it has been associated with decreased length of ED stay and risk of hospital admission.[24,25] Additional aims included documentation of asthma severity at triage (a key process within pathways to direct appropriate treatment), CXR use (identified as a benchmark for high quality of asthma care), and hospital admission or transfer for a higher level of care.[26-28] ED length of stay (LOS) was selected as a balancing measure to ensure it did not increase with implementation of new clinical workflows.

Data Collection

Data on ED characteristics and consistency of implementation of core pathway components (fidelity) were collected via survey of implementation leaders. Data on the pathway outcomes outlined in Table I were collected via chart review of children ages 2-17 years with a primary diagnosis of asthma. Charts were excluded if children had chronic medical conditions that precluded pathway use (eg, cystic fibrosis, restrictive lung disease, bronchopulmonary dysplasia, congenital or acquired heart disease, airway issues, immune disorders, sickle cell anemia, or neuromuscular disorders). Charts from January to December 2017 were reviewed retrospectively, and then charts from January 2018 to March 2019 were reviewed prospectively (during the pathway intervention period). Each participating site entered all eligible charts in chronological order each month, to a maximum of 20 charts per month per site. Chart reviewers were trained by the central research team based on the Medical Record Abstraction Quality Assurance and Control Framework.[29] Principles of the framework include (1) quality assurance—prospective actions taken such as abstractor training, standard procedures, and job aids to ensure adequate accuracy, and (2) quality control—measurement of error or discrepancy rates and use of the measurements to guide adjustments to controllable inputs to the abstraction process such as abstraction tools, procedures, and training. Data quality was audited monthly by the central research team and by quality audit functions within REDCap 8.5 (Nashville, Tennessee).

Statistical Analyses

Implementation fidelity, ED characteristics, and patient characteristics were summarized using descriptive statistics. Characteristics of EDs that dropped out vs completed the study

Table I. Study aims and outcomes

Aims	Outcome definition: Numerator/denominator	Type
Primary: increase the proportion of children who receive systemic corticosteroids within 60 minutes of ED arrival to 70% within 12 months	Children in the study population administered systemic corticosteroids within 60 minutes of ED arrival/children administered systemic corticosteroids	Process
Increase the proportion of children with assessment of asthma severity at triage to 90% within 12 months	Children with assessment of severity of asthma exacerbation at ED triage/all children	Process
Decrease the proportion of children who receive CXR to 15% within 12 months	Children with CXR ordered during ED visit/all children	Process
Decrease the proportion of children with hospital admission or transfer for higher level of care by 1% within 12 months	Children with ED disposition either hospital admission or transfer for a higher level of care/all children	Outcome
Do not change ED LOS (no target)	Mean LOS (minutes)	Balancing

were compared using Chi-square tests for categorical variables and Mann-Whitney *U* tests for interval variables.

Analyses of primary and secondary study outcomes (Table I) were done using multilevel regression models with an interrupted time-series (ITS) approach (levels: ED, visit; random effects). ITS accounts for secular trends and evaluates (1) changes in the outcome at the time of implementation, and (2) changes in the rate of change in an outcome after vs before implementation.[30] Models were adjusted for patient characteristics, including age, sex, insurance type (proxy for socioeconomic status), and prior prescription of inhaled corticosteroids (proxy for chronic asthma severity). Models also adjusted for ED type (eg, children's hospital based). ED LOS was modeled using gamma regression, and a quadratic term was included to correct for seasonal trends. All other outcomes were modeled using logistic regression. Data from the first 2 months of the intervention/implementation period were washed out to allow for pathway implementation. All data from all EDs were analyzed, regardless of whether the ED completed the study. Random ED intervention effects were added to the model to calculate ED-level changes in outcomes.

Sensitivity Analysis: Effects of Core Pathway Interventions

Implementation leaders from each ED reported if they had implemented core pathway interventions (Table II, column 1). We conducted a sensitivity analysis to determine if there were associations between leader-reported implementation of these core pathway interventions (at the ED level) and study outcomes. This analysis was done using a multilevel regression model with an ITS approach. The model corrected for the same patient and ED characteristics described above for the primary analysis.

All analyses were performed with SAS 9.4 (SAS Institute, Cary, North Carolina). *P* values of less than .05 were considered statistically significant.

Results

EDs and Study Population

A total of 83 EDs enrolled in the study and 61 (73%) completed the study (participated in the learning collaborative and associated outcome monitoring for the full 15-month study duration). EDs that joined were diverse in terms of size, type, location, and ownership model (Table III;

Table II. Effects of core pathway interventions (n = 54 EDs)

Core pathway interventions	Implemented*	Integrated into EHR*	Effects of implementation†	Effects of EHR integration†
Scoring tool for assessing asthma severity at ED triage	51 (94)	47 (87)	Effects on Severity Assessment at Triage: **1.97 (1.08-3.57)** **1.12 (1.04-1.21)**	Effects on Severity Assessment at Triage: **1.87 (1.12-3.11)** 1.05 (0.99-1.12)
Order set or pathway at ED triage that triggers the process for administering systemic corticosteroids	27 (50)	18 (33)	Effects on Administration of Corticosteroids within 60 minutes: 1.06 (0.77-1.47) 1.02 (0.98-1.06)	Effects on Administration of Corticosteroids within 60 minutes: 0.88 (0.6-1.3) 0.98 (0.94-1.03)
Criteria for ordering CXR	36 (67)	15 (28)	Effects on CXR use: **0.73 (0.57-0.93)** 1.02 (0.99-1.05)	Effects on CXR use: 1.2 (0.82-1.75) **0.95 (0.91-0.99)**

Values are number (%) or OR (95% CI).
Bolded values are those that are statistically significant
*Results describe the number and percent of hospitals that reported implementation or EHR integration of the core pathway intervention.
†First OR describes effects at the time of implementation and second OR describes changes in the rate of change of the outcome after vs before implementation.

available at www.jpeds.com). Most (73 EDs [88%]) were within teaching hospitals. EDs that dropped (n = 22) did not statistically significantly differ from those who completed the study in any of the characteristics described in Table III.

Characteristics of children with asthma cared for before and after pathway implementation are presented in Table IV (available at www.jpeds.com) (n = 22 963). Children cared for after pathway implementation were clinically similar, and all of these characteristics were included in our multivariable regression models.

Effects of Pediatric Asthma Pathway Implementation: Aggregate Analysis of all EDs

Participating EDs were provided pathways to tailor to local needs and implement. In aggregate, pathway implementation was associated with significantly increased odds of systemic corticosteroid administration within 60 minutes of arrival (projected vs actual rates of 49% vs 53%, respectively), increased odds of assessment of severity of asthma exacerbation at ED triage (projected vs actual rates of 83% vs 95%, respectively), and decreased rate of change in hospital admission or transfer for higher level of care (projected vs actual rates of 21% vs 20%, respectively). Pathways were not associated with statistically significant changes in CXR use or ED LOS (balancing measure). All study outcomes are summarized in Figure 1.

Effects of Pediatric Asthma Pathway Implementation: ED-level Analysis

Figure 2 details all study outcomes at the ED level. A total of 26 EDs (43% of those that completed the study) had statistically significant improvements in at least 1 study outcome, and 7 EDs (11% of those that completed the study) had significant improvements in 2 or more outcomes. The most common outcomes improved were hospital admission or transfer to higher level of care (14 EDs) and assessment of severity of asthma exacerbation at ED triage (9 EDs).

Sensitivity Analysis: Effects of Core Pathway Interventions

Implementation leaders from all EDs that completed the study (n = 61) were surveyed to ask about fidelity or consistency of pathway implementation, and 54 (89%) responded. There was wide variability in the implementation of core pathway components and electronic health record (EHR) integration of these components. Both implementation (OR, 1.97; 95% CI, 1.08-3.57) and EHR integration (OR, 1.87; 95% CI, 1.12-3.11) of scoring tools for assessing asthma severity were significantly associated with increases in assessment of severity of asthma exacerbation at ED triage. In addition, both implementation (OR, 0.73; 95% CI, 0.57-0.93) and EHR integration (OR, 0.95; 95% CI, 0.91-0.99) of criteria for ordering CXRs were associated with decreases in CXR use (Table II).

Discussion

This multisite study of ED pediatric asthma pathway implementation included a sample of EDs that varied widely in size, type, location, and structure. Pathways were tailored and implemented at participating EDs and, overall, pathway implementation was associated with significant increases in timely systemic corticosteroid administration, increases in assessment of asthma severity at ED triage, and decreases in hospital admission or transfer for higher level of care. These improvements were significant in our aggregate analysis of all participating EDs, and we also found that 43% of the EDs in this diverse sample had statistically significant improvements in at least 1 outcome or quality measure. Thus, the pathways' effects on quality of care were generalizable across this diverse sample of EDs.

Our findings align with prior studies in demonstrating that clinical pathways can improve guideline adherence and quality of care. We found that pathway use was associated with a 4% increase (from 49% to 53%) in the proportion of children administered systemic corticosteroids within 60 minutes. A prior single-center study by Bekmezian et al found an increase of 27% (from 18% to 45%) in the proportion of children administered systemic corticosteroids within 60 minutes, and another by Walls et al found a decrease in mean time to corticosteroid administration from 196 to 105 minutes.[10,12] We also found that use of a pathway was associated with a 1% decrease (from 21% to 20%) in the proportion of children admitted or transferred for higher level of care. Prior studies of pathway implementation have reported decreases from 14% to 10%, from 21% to 13%, and from 28% to 14%.[10,12,17] Our smaller effect sizes may be due to the fact that the fidelity (consistency with which the core pathway components were implemented) likely varied more widely in our large sample of hospitals than in these prior single-center studies.

We selected assessment of asthma severity at ED triage as a process measure in this study because this assessment was deemed critical to our primary outcome, namely, timely systemic corticosteroid administration. We provided EDs with several options of severity assessment tools to select from (eg, Emergency Severity Index, Clinical Asthma Score) because these assessment tools are comparable in their ability to predict risk of hospital admission.[31] To better understand what specific pathway interventions may have affected our outcomes, we performed a sensitivity analysis to determine associations between implementation of core pathway interventions and study outcomes. We found that both implementation and EHR integration of severity assessment tools were associated with increases in assessment of severity at ED triage. Thus, ED leaders seeking to promote timely clinical assessment at ED triage should consider implementing such scoring tools.

Prior literature indicated that potential interventions for increasing timely systemic corticosteroid administration

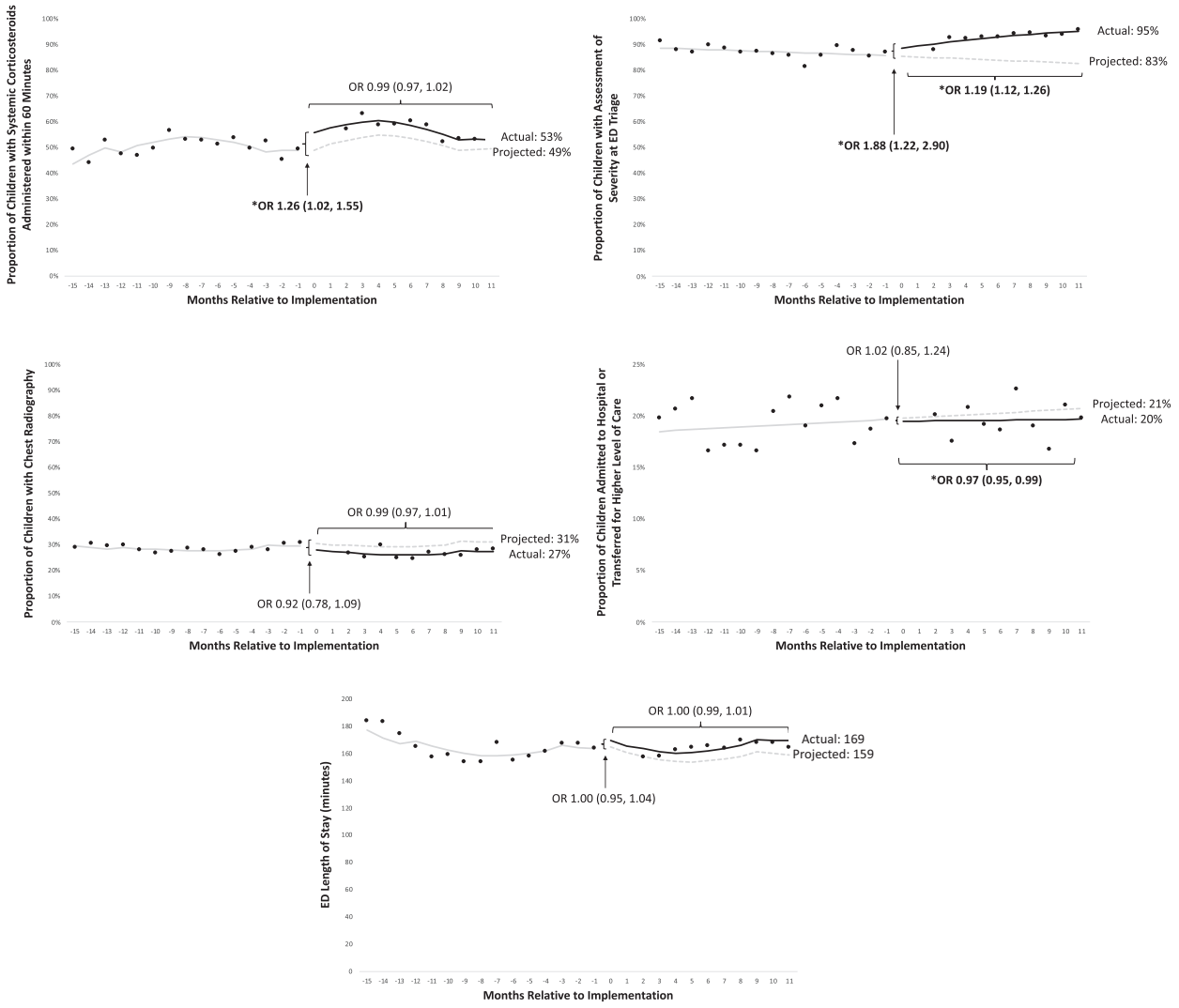

Figure 1. Effects of ED pediatric asthma pathways: aggregate analysis (all EDs). An ITS models analyzed (1) changes in the outcome at the time of pathway implementation, and (2) changes in the rate of change in an outcome after vs before pathway implementation. Figures for each outcome specify the actual and ITS projected values for each outcome. *RR*, Rate Ratio (adjusted). *Statistically significant.

may include clinician education on the benefits of timely systemic corticosteroid administration, posting of visual pathways/algorithms that reinforce time targets (eg, 60 minutes), development of electronic order sets that trigger administration, and shifting the responsibility of clinical assessment and corticosteroid order placement from physicians to nurses.[10,12,17,19,25] In our sensitivity analysis of the effects of core pathway interventions, we did not find significant associations between paper or electronic order set implementation and administration of systemic corticosteroids within 60 minutes. Thus, our overall finding of increases in timely systemic corticosteroid administration with pathway implementation may have been driven by one of these other interventions. EDs might consider prioritizing these other interventions (eg, clinician education, posting of visual pathways/algorithms, shifting responsibility of ordering medications to nurses) to achieve improvements in timely administration of recommended medications for children with asthma, and possibly other patient populations that require highly time-sensitive medications as well.

Routine CXR is not recommended for children with asthma because CXRs involve exposure to ionizing radiation and increase healthcare costs, but they only rarely reveal concomitant bacterial pneumonia.[5,32] The baseline rate of CXR use in our sample of EDs was 29%, and prior national studies have defined achievable benchmarks for CXR use in children with asthma at 17.0%-24.5%.[27,33] We found that pathway implementation was not associated with significant changes in CXR use overall, but we did find significant declines in CXR use in EDs that implemented or integrated CXR criteria into the EHR. Criteria for when to order CXRs (eg, The 4 *Fs*: fever, focal examination findings, concern for foreign body, or failure to improve) have been

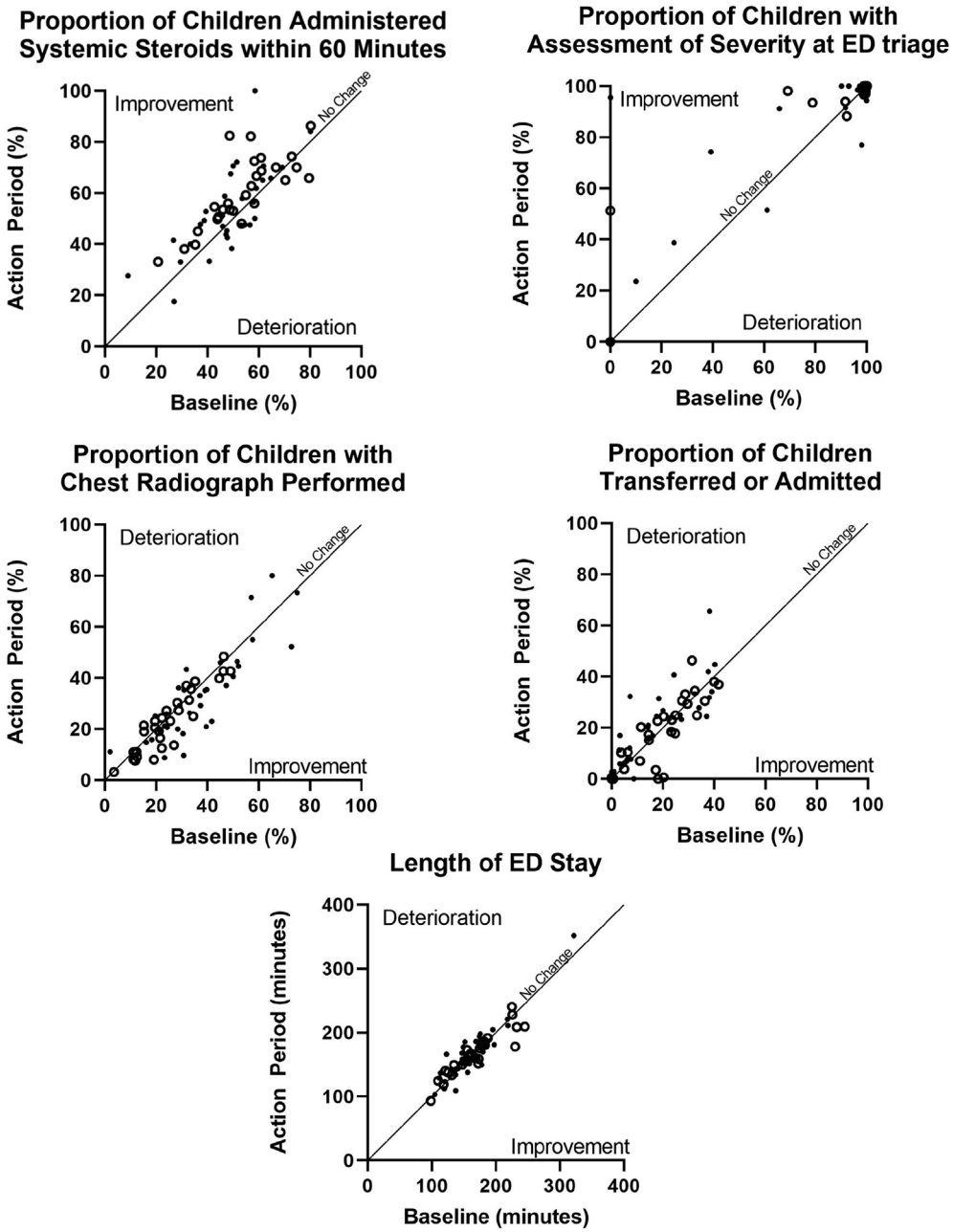

Figure 2. Effects of ED pediatric asthma pathways: ED-level analysis. Open circles represent hospitals with annual volume ≥200 of asthma patients and closed circles represent hospitals with annual volume of more than 200 asthma patients. Each circle is positioned based on baseline performance and intervention/action period performance.

shown to decrease CXR use in other prior studies as well.[10,15,34] Our findings indicate EHR integration of such criteria may have particular benefit, possibly by making the criteria more readily available within clinical workflows. Our overall analysis of the effects of pathway implementation did not show decreases closer to previously defined benchmarks for CXR use.[27,33] This finding may have been driven by two factors. First, the proportion of EDs that implemented or integrated CXR criteria into the EHR was low (**Table II**). Second, these prior studies defining benchmarks were based on data from children's hospital-based EDs, and our study included many EDs without pediatric-trained clinicians. These clinicians may have been less confident in excluding other causes of respiratory distress in children based on clinical examination alone.

This study had several limitations. First, although we used an ITS approach to account for secular trends, our observational study findings may still be affected by this confounder. However, ITS designs have been shown to perform similarly to cluster-randomized trials in accounting for the potential influence of secular trends.[35,36] Second, our results may be in part due to the effects of

beginning to observe and measure provider behavior (Hawthorne effect).[37] In addition, the EDs participating in this study had inpatient pediatric physicians that were part of the AAP's Value in Inpatient Pediatrics Network, and these physicians were motivated to find ED leaders and participate in this national quality collaborative. Thus, our findings may only be most directly applicable to settings with similarly motivated physicians, but the wide-ranging diversity in the characteristics of participating of EDs promotes broader generalizability. Last, there was variation in the fidelity, or consistency, with which pathways were implemented, in terms of what core pathway components were implemented, how they were tailored to fit local needs and context, and how they were integrated into the EHR. This variation may have decreased the effect sizes we observed in comparison with prior single-center studies. However, allowing EDs to tailor the pathway and its implementation to best fit their needs and resources represents a more pragmatic approach, which increases the generalizability of our results to diverse ED settings.

This multisite study of ED pediatric asthma pathway implementation included a sample of EDs that varied widely in size, type, location, and structure. We found that pathway implementation was associated with improvements in multiple measures of quality of care for children with asthma. Important areas of future inquiry include identifying strategies for promoting sustainability and better understanding how to tailor pathways to varying settings. ■

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Data Statement

Data sharing statement available at www.jpeds.com.

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50 Years Ago in *The Journal of Pediatrics*

Clinical and Genetic Delineation of Saethre–Chotzen Syndrome

Bartsocas CS, Weber AL, Crawford JD Acrocephalosyndactyly type III: Chotzen's syndrome. J Pediatr 1970; 77:267-72.

Bartsocas et al described a 3-generation family in which affected individuals had craniofacial abnormalities including acrocephaly, craniosynostosis, shallow orbits, ptosis, hypertelorism, nasal septal deviation, and minor ear anomalies. Some affected individuals had seizures, cognitive impairment, and short stature. Limb anomalies included partial syndactyly of the second and third fingers and toes, radioulnar synostosis, and transverse palmar creases. This pattern of clinical features was similar to a family described by Chotzen in 1932 with acrocephaly, hypertelorism, downslanting palpebral fissures, and syndactyly. McKusick referred to this condition as "acrocephalosyndactyly, type III"[1] and included patients reported by Saethre. These patients had acrocephaly with minimal ptosis, incurving of the second and fifth fingers and syndactyly. An autosomal-dominant mode of inheritance with variable expression was observed in affected families.

Further delineation of Saethre–Chotzen syndrome included features of brachycephaly with coronal craniosynostosis, limb anomalies, facial asymmetry, and maxillary hypoplasia. A low frontal hairline, ptosis, strabismus, prominent ear crus, low set posteriorly rotated small ears, cleft palate, conductive deafness, enlarged parietal foramina, malocclusion, and enamel hypoplasia are observed less frequently. Most affected individuals have normal intellect.

Subsequent molecular studies identified missense, nonsense, insertions, and whole gene deletion mutations in the phylogenetically conserved *TWIST* gene, which encodes a transcription factor localized to chromosome 7p21 in patients with Saethre–Chotzen syndrome.[2] The *TWIST* gene has a DNA binding and helix-loop-helix motif and likely exerts its action through induction of tissues and cytokine expression through the nuclear factor-$\kappa\beta$ signaling pathway. Haploinsufficiency of *TWIST* is a likely genetic mechanism for Saethre-Chotzen syndrome.

A similar but genetically distinct condition, Muenke coronal synostosis syndrome, characterized by unilateral or bilateral coronal synostosis, sensorineural hearing loss, brachydactyly, and cognitive impairment, is associated with a single recurrent Pro250Arg mutation in exon 7 of the *FGFR3* gene.

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References

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2. Kress W, Schropp C, Lieb G, Peterson B, Büsse-Ratzka M, Kunz J, et al. Saethre–Chotzen syndrome caused by TWIST 1 gene mutations: functional differentiation from Muenke coronal synostosis syndrome. Eur J Hum Genet 2006;14:39-48.

Table III. Characteristics of EDs that completed vs dropped out of the Pathways for Improving Pediatric Asthma Care Study

ED characteristic	All EDs (n = 83)	EDs that completed PIPA (n = 61)	EDs that dropped out (n = 22)	*P* value
Type				.37
Children's hospital-based ED	37 (45)	29 (48)	8 (36)	
Community hospital-based ED	46 (55)	32 (52)	14 (64)	
Teaching hospital-based ED	74 (89)	54 (89)	20 (91)	.79
Hospital size				.66
Small (<100 total beds)	8 (10)	7 (11)	1 (5)	
Medium (100-249 total beds)	25 (31)	18 (30)	7 (32)	
Large (≥250 total beds)	48 (59)	35 (57)	13 (59)	
Total inpatient pediatric ward beds (non-ICU/neonatal)	37 ± 51	42 ± 57	25 ± 25	.12
Geographic region				.83
West	17 (20)	13 (21)	4 (18)	
South	26 (31)	18 (30)	8 (36)	
Northeast	16 (19)	11 (18)	5 (23)	
Midwest	24 (29)	19 (31)	5 (23)	
Location				.29
Urban	37 (45)	28 (46)	9 (41)	
Suburban	38 (46)	29 (48)	9 (41)	
Rural	8 (10)	4 (7)	4 (18)	
Presence of pediatric intensive care unit	49 (59)	38 (62)	11 (50)	.32
Ownership model				.09
Government	10 (13)	5 (8)	5 (23)	
Private, nonprofit	63 (79)	50 (82)	13 (59)	
Private, investor owned	7 (9)	4 (7)	3 (14)	
Presence of EHR	81 (98)	59 (97)	22 (100)	.39

Values are number (%) or mean ± SD.

Table IV. Characteristics of asthma ED visits before and after pathway implementation

Characteristics	Total (n = 22 963)	Before pathway (n = 12 870)	After pathway (n = 10 093)
Age, years	7 (4-11)	7 (4-11)	7 (4-11)
Male	13 856 (60)	7709 (60)	6147 (61)
Prior prescription of inhaled steroid	9929 (43)	5481 (43)	4448 (44)
Insurance type			
Public	13 245 (58)	7162 (56)	6083 (60)
Private	5959 (26)	3398 (26)	2561 (25)
Tri-Care	204 (1)	120 (1)	84 (1)
Other, self-pay, or unknown	1893 (8)	1064 (8)	829 (8)
Missing	1662 (7)	1126 (9)	536 (5)

Values are median (IQR) or number (%).